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The Relevance of Intangibles Disclosure for Market Risk: An Exploratory Study of US Healthcare and Pharmaceutical Industry

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Abstract

The healthcare and pharmaceutical industry in the United States has its primary resources tied up in the form of intangibles. Therefore, the main risk factors of such firms are directly associated with the management of such idiosyncratic resources. Reporting on intangibles has always been controversial because of the persistent conceptual and regulatory challenges, yet voluntary disclosures represent a non-negligible portion of the annual report of such firms. This study explores the reporting environment of intangibles for firms belonging to the healthcare and pharmaceutical industry in the US and analyzes whether these non-financial disclosures on the annual report have an impact on those companies’ market risk. The evidence suggests that disclosure of intangibles vary considerably in the content, and that this type of information does not have an impact on the market risk of healthcare and pharmaceutical firms. However, R&D intensity clearly has a statistically significant effect on the market risk. These results are consistent with the previous findings of Lev and Zarowin (1999), who found that the usefulness of earnings information in annual reports has been deteriorating over the years.

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Keywords: Intangibles, Market Risk, Healthcare, Pharmaceutical, Annual Reports

JEL Classification: C12, G1, M21, M41

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I. INTRODUCTION

In their seminal study Lev and Zarowin (1999) found that the relevance of financial information, such as earnings, cash flow and net assets, for the market value of firms has been on the decline over a period of two decades. To mitigate this risk they categorically proposed “an extended capitalization and amortisation of intangibles investments and a systematic restatement of past financial reports” (p. 383). This argument, however, is not without its challenges (e.g. Francis and Schipper, 1999). Studies such as Collins et al. (1997) also found that incremental value-relevance of 'bottom line' earnings has declined, although the relevance of book value seems to have increased.

In this perspective, the study intends to investigate whether and to what extent the non-financial disclosures about the various categories of intangibles a firm possesses, and as captured by a “disclosure quality” index, show a similar trend vis-à-vis their impact on company market risk.

The focus of this study is on 25 most prominent healthcare and pharmaceutical firms listed in the US capital markets. The choice of this sector for the analysis is related with the fact that the most important resources for these firms in their innovation-seeking efforts are intangible, i.e. human capital as well as the entities’ collective efforts (organizational capital and relational capital), along with the financial resources. These types of critical resources and idiosyncratic competencies (Barney, 1991) get largely ignored in financial statements due to a lacking regulation. However, these firms generally make an effort to disclose voluntarily some information on these resources in their annual reports. The objective of this paper is hence particularly relevant for these firms in order to test whether their non-financial information on intangibles has an effect on market risk, considering that those resources are the fundamental value drivers for the healthcare and pharmaceutical companies and therefore, at the same time, also their principal risk factors. Indeed, it has been shown that today the valuation of a company is based increasingly on the amount of intangible assets they have (Lev, 2003; Lev 2001; Ballow, Burgman, Roos & Molnar, 2004) rather
than their accounting book value or access to critical raw-materials for production or labour capacity.

Exploring the field of non-financial information in the US is complex and delicate, because it is not regulated by the SEC, nor are there any generally accepted standards available in the information marketplace. It is also important to note that this type of information is not disclosed in the annual reports without considering the self-interest of ‘insiders’ otherwise known as ‘managers’, and their incentive to report. We know in fact that the utility of disclosing information should be higher than the cost of the disclosures (Wagenhofer, 1990; Suijs 2007). From the agent-principal perspective, the ‘agents’ who are the managers of the firms may also have their own motives in disclosing non-financial information. This strand of literature has been extensively researched after the seminal work by Verrecchia (1983) and Dye (1985). There have been many empirical studies related to disclosure theory from the perspective of earnings, cash flow, book value, etc. Most of these studies (Lev, 1989; Sougiannis, 1994; Lev and Sougiannis, 1996; Amir and Lev, 1996; Boone and Raman, 2001; Chan, Lakonishok and Sougiannis, 2001; Chambers, Jennings and Thompson, 2001; Guo, Lev and Zhou, 2005; Lev, Sarath, and Sougiannis, 2005; Deng and Lev, 2006) end up by calling for further disclosures and a better regulatory framework that can ensure more quality in the disclosures, both for financial and non-financial information.

Cases and arguments for a reform by the US Financial Accounting Standards Board (FASB) of the current disclosure regime related to investments in R&D and other such value-generating intangibles, have also their opponents. The main arguments used to maintain the status quo invoke ‘self regulation’ and ‘market forces’. Skinner (2008) argued that markets are capable of making fair

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2 Critics of this literature pointed out that the assumption about the ability to ‘understand’ the disclosed information is expected to be equal for both informed and uninformed investors (see Fishman and Hagerty, 2003).

3 According to the U.S. Statement of Financial Accounting Standards No. 2 – Accounting for Research and Development Costs, “all research and development costs encompassed by this Statement shall be charged to expense when incurred” (FASB, 1974, p. 7).
market valuation of the firms who have much of their resources and capital invested in intangible assets. The income statement has been cited as a source of valuable information on intangibles (Penman, 2009). Kanodia, Sapra and Venugopalan (2004) have challenged the entire practice of valuation and measurement of intangibles. Some would argue that there are a large number of financial analysts who keenly follow firms with large numbers of intangibles (Barth, Kasznik and McNichols, 2001), and therefore capital markets already know about all the idiosyncratic resources and risks. Dedman et al. (2009) found evidence from the UK biotech sector that the market does not necessarily misprice firms that are heavily reliant on investments in intangibles.

Considering the nature of the healthcare and pharmaceutical industry that is heavily leveraging on the trilogy of human, organizational and relational capital (Guo, Lev and Zhou, 2004; Guo, Lev and Zhou, 2005; Dedman, Lin, Prakash, and Chang, 2008 for UK biotech industry), there are genuine incentives for managers to disclose non-financial information that are not so costly to record and store (Verrecchia, 1983; Dye, 1985). There is a dearth of research in the non-financial disclosure environment and its effect on the market risk especially after the closure of the ready-to-serve disclosure index that used to be produced by the Association of Investment Management Research (AIMR) (see Botosan, 1997; Sengupta, 1998). The study tries to fill partially this void by using and promoting the disclosure index created by Zambon and Bergamini (2007).

The main evidence from this research is twofold. Firstly, there is a high amount of variability found between various types of non-financial information provided by firms in the US healthcare and pharmaceutical industry. Firms provide much information on strategy, customers and market. On the contrary, the information that constitutes the core for an innovative firm like its human resource capital, organizational capital, innovation and IPR and corporate governance is quite scant. This outcome is surprising considering the nature of the healthcare and pharmaceutical firms. Secondly, the random effect multilevel panel data regression analysis for the period 2004-2006 shows that the non-financial disclosures of intangibles do not have an impact on companies’ market
risk, although R&D intensity does have a statistically significant impact on it. This is a quite
dichotomous result, but not totally unexpected because of what is previously known about the
decreasing relevance of information on financial statements. This result adds to the knowledge
about the value relevance of non-financial information in company annual reports.

This paper is divided into four sections. Next section outlines the theoretical framework and
develops the hypotheses for this research. Section III discusses the methodology, model(s) and the
dataset used for the research, whilst giving justification of each choice. Section IV presents the
analysis based on the model and the commentary on the results. The paper concludes with section
V, where also limitations to the study are provided as well as some suggestions for future research.

II. THEORY AND HYPOTHESES

Literature Review

In this section the various literature threads in the area of market-based research on
intangibles, especially for firms with large R&D investments, will be discussed, including the
existing empirical results. Literature from voluntary disclosure analysis will also be explored to
create the theoretical framework for the current study.

The review paper by Canibano, Garcia-Ayuso and Sanchez (2000) reflects on the various
streams of literature that has been explored in the field of intangibles starting from the economic
nature of intangibles and their definition. In the empirical evidence section on R&D, the authors
found that the field has been researched on the basis of company earnings and profitability and its
effect on the market stock price. The relationship between the investments in R&D and its impact
on the stock prices has also been explored (Grabowski and Mueller, 1978; Hirschey, 1982). Some
researchers have analyzed the market-to-book ratio with R&D investments along with cross-
sectional data, such as Sougiannis (1994) and Lev and Sougiannis (1996). Time series analysis was
used to cover the limitation of cross-sectionality, which implies that the probability of success of R&D does not differ from industry to industry (e.g. Megna and Mueller, 1991; Zarowin, 1999). All these studies found that R&D investments are associated with market value, and firms should have the ability to capitalize and amortize investments in R&D. As for the shortcomings of the existing studies on R&D, Canibano et al. (2000) reported that these studies “do not consider the existence of alternative factors explaining stock prices and returns with respect to which R&D intensity may have little incremental explanatory power” (p. 115).

Empirical examination by Sougiannis (1994) concluded that each dollar invested in R&D leads to a two dollar increase in profit over a seven year period and a five dollar increase in value of the firm. In the paper by Lev and Sougiannis (1996) they explored the value relevance of R&D capitalization in order to address reliability and objectivity concerns. They concluded that “R&D capital is reliably associated with subsequent stock returns” (p. 109), which was a concern for the FASB to allow capitalization of R&D expenditures.

The study by Boone and Raman (2001) provides evidence that immediate expensing of R&D expenditure was causing liquidity challenges for the firms in the market, and therefore additional information about the R&D activities might be useful. Their hypothesis was that with the increase in intangibles in the firms’ portfolios, there is an increase in the bid-ask spread as a result of information asymmetry. This increment in the bid-ask spread results in higher transaction costs for the investors and hence in a higher cost of capital for the firm. This conclusion had been previously reached by Botosan (1997) in a different analysis as discussed later in the section. However, the findings and the resultant conclusion by Boone and Raman (2001) have been challenged by Ronen (2001) on the grounds that the assertions that the empirical association between accounting numbers and market price cannot be a basis for accounting policy change.

In another study by Lev, Sarath, and Sougiannis (2005) with a large sample of data, the authors predicted that there would be a profitability bias when it comes to firms which invest
heavily in R&D; this bias is also significant for ROE and earnings momentum. The authors claim that this creates a systematic mispricing of the securities which is disadvantageous to firms which are conservative in their reporting policies and which are in accordance with GAAP.

In the paper by Amir and Lev (1996) they studied the cellular companies that are highly dependent on intangibles because of their unique business model. Their evidence from the study of the industry suggests that the financial disclosures of these firms were “inadequate”. However, they agreed that the industry is aware of the inadequacies of the GAAP and that the investors do not just rely on the financial information from accounting figures, but also on the non-financial information (non-GAAP) that the company provides voluntarily.

The study by Chambers, Jennings and Thompson (2001) explored the relationship between R&D intensity and excess returns further from Chan, Lakonishok and Sougiannis (2001), and provided some more evidence that there is indeed some form of relationship between them, especially when R&D intensity is measured by the ratio of unrecorded R&D assets to market value of equity.

In general, this thread of literature reflects the view that intangibles are the new value drivers for firms that are in the business of innovation and the information thereon is value relevant to the markets and the investors.

The above arguments and results are not without their rivals. Kanodia, Sapra and Venugopalan (2004) argued in their paper that “intangibles should be measured only when their relative importance in constituting the firm’s capital stock is high and when they can be measured with sufficiently high precision. In all other cases, attempts to separate intangible investments from operating expenses are counterproductive” (p. 116).

Skinner (2008) responded to the latest accounting policy recommendations to capitalize on investments in R&D because of the declining relevance of accounting figures and a possible mispricing of these firms (Lev and Zarowin, 1999; Deng and Lev, 1999; Boone and Raman, 2001;
Lev, Sarath, and Sougiannis, 2005). He asserted that the decline in the relevance of accounting numbers of the firms which invests in R&D does not necessarily reflect a deficiency in the accounting disclosures of intangibles. He associates this deficiency in relevance of accounting figures to the inherently ‘different’ nature of the industry that invests heavily in R&D. He further argues that the information asymmetry as demonstrated by some of these studies is caused by the very complicated nature of the businesses that allows insiders to have more information about the success or failure of investments, which therefore leads to a less liquid market for the firms and to a higher cost of capital (Amihud and Mendelson, 1986). On the “mispricing of the intangibles problem” Skinner’s (2008) response was that markets do not necessarily go by the accounting information and they are sophisticated enough to make their own judgement about the R&D “expenditures” and the future benefits these will produce.

Francis and Schipper (1999) found that the value relevance as explained by the $R^2$ of earnings has been on a decline both for high-technology firms (identified by their spending on R&D, computers, pharmaceuticals, telecommunications, etc) and for low-technology firms (grocery stores, wood and paper products, and railroads) taken alone and combined. However, they did not find any significant reduction in the explanatory power of book value of assets and liabilities (alone or combined). They argued that capital markets do not make a distinction between expensing of future benefits producing investments such as R&D or capitalizing and amortizing them.

Voluntary disclosures have been used quite extensively to understand its role in reducing the information asymmetry. During 1990’s Association for Investment Management and Research (AIMR) created an index for measuring disclosure quality and regularly disseminated a report based on its assessments of the disclosures some of the biggest US firms made on its annual reports and other such publications. In the study based on the AIMR’s disclosure rankings Botosan (1997) found for firms with low analyst following, higher level of disclosures is associated with a lower cost of capital. Again, Sengupta (1998) using the AIMR rankings on disclosures, which was then
published by the Corporate Information Committee Report (CICR), found that firms with high disclosure quality had a lower cost of debt. This finding was in line with the results of Botosan (1997) regarding the cost of capital. Lang and Lundholm (1996) studied the disclosure practices and the analyst following of the firms, along with the properties of earning forecast by analysts, and found that firms with more ‘forthcoming’ disclosures have a greater analyst following. They used the Report of the Financial Analysts Federation Corporate Information Committee (FAF Report 1985-89), which was the predecessor of the AIMR report. They concluded that “firms with more informative disclosure policies have a larger analyst following, more accurate analyst earnings forecasts, less dispersion among individual analyst forecasts and less volatility in forecast revision” (p. 467). Healy, Hutton and Palepu (1999) studied the stock price performance as a response to higher disclosure quality as ranked by the AIMR. The study which was based on 97 firms found that “expanded voluntary disclosure is accompanied by improved stock performance, as well as increased institutional ownership, analyst following, and stock liquidity” (p. 511).

After the AIMR reports were stopped from being published, some research attempted to construct their own disclosure measuring indexes. Francis, Nanda and Olsson (2008) used basic historical information about firms and other financial and non-financial information in their index of disclosure quality. In our view, this disclosure index with all its merits does not fully justice to the different types of intangibles an innovative firm utilises. In another study, Shalev (2009) created a different disclosure quality index that is specific for the business combination scenario, and that used a construction of a numerical disclosure score deflated by the ‘relevant’ disclosures. The weakness of this construction is that it is very situation specific and subject to the judgement of the researcher’s perception of ‘relevance’.

This study will use the Zambon and Bergamini (2007) disclosure quality model that is much more comprehensive and articulated in capturing the various aspects of a firm’s intangible resources and capabilities.
**Hypotheses**

The theoretical framework of information economics as proposed by Milgrom (1981), which draws from the previous literature on the subject by Spence (1973) and Akerlof (1970), comes to the following conclusions: “(1) the arrival of good news about a firm's prospects always causes its share price to rise, (2) more favourable evidence about an agent's effort leads the principal to pay a larger bonus, (3) buyers expect that any product information withheld by a salesman is unfavourable to his product, and (4) bidders figure that low bids by their competitors signal a low value for the object being sold” (p. 380). It is well known that CEOs tend to give out “good news” faster than “bad news” (Verrecchia, 1983; Dye, 1985). Skinner (1994) in his study evidenced that bad news disclosures generate a large stock price reaction, but this reaction is virtually non-existent for good news, and therefore CEOs tend to pre-empt the bad news more frequently than good news in their quarterly earnings announcements. An annual report, which is one of the most prominent forms of investor communication mechanism and which is monitored by SEC and the accounting standards laid down by FASB, should be the place where firms would like to disclose about their intangibles information, both/either of good and/or bad nature.

Drawing from another strand of literature, it is well known that human, organizational and relational intangibles are the main strategic assets for healthcare and pharmaceutical firms (Barney, 1991; Edvinsson and Malone, 1997; Bontis, 1996; Bontis, 1999; Sveiby 1997). The performance of these firms effectively rests on their ability to manage intangible resources in the most productive way.

In light of the above literature and in relation to the annual report in the form of 10-K mandatory filings, that every listed company in the US has to file with the SEC, the hypotheses for this study are the following:
H0: Voluntary disclosures of intangibles on the annual report do not have any effect on the market risk (null hypothesis);

H1: Voluntary disclosures of intangibles on the annual report have a negative effect on the market risk.

III. METHODOLOGY, MODEL AND SAMPLE DATA

Methodology

The scope of the research is limited to the published annual reports of US listed companies that are in the healthcare and pharmaceutical business. As aforementioned, in order to proxy the disclosure quality of intangibles the model developed by Zambon and Bergamini (2007) will be used. In this model, the dependent variable will be the standard deviation of the stock returns for the three-year period 2004-2006, and the independent variable will be industry size, firm size, R&D intensity, capital expenditure, labour intensity, leverage, and disclosure quality (which is a proxy for voluntary non-financial disclosures of intangibles). This has been regressed on a three-year multi-level panel data regression for random effect.

Disclosure Quality

The scoring model for disclosures was first introduced by Zambon and Bergamini in 2001-03 within the EU PRISM Research project, and is the outcome of collaboration between the University of Ferrara and the Italian Association of Financial Analysts (AIAF). Their model, as presented here, has a three dimensional framework, which includes, (i) the nature of information (actual or forecasted), (ii) six communication dimensions: strategy, human resources, customer and markets, innovation and IPR, organization, and corporate governance, and (iii) the level of
communication depth: no information, minimum information, reasonable information, and extensive information.

The model is applicable to different industries because of its wide horizon and various types of indicators that capture the essence of different areas of intangibles generated and utilised by firms. However, it must be noted that not every indicator is applicable to all the industries, and in fact information on several dimensions might be unavailable or it might not be that relevant in some industries. The indicators that will be used to measure the six communication dimensions are directly drawn from the paper of Zambon and Bergamini (2007).
### Table 1. - List of Indicators

**1. Strategy**
- Strategies
- Focus, vision and mission
- Strategic agreements
- Objectives
- Social Responsibility
- Environmental Policy
- Risk Management
- Strategic Position
- Regulatory Environment
- Value Drivers or key competitive advantages
- Targets
- Security program

**2. Human Resources**
- Number of employees
- Employee by category
- Employee by division
- Employee by religion
- Employee by type of contract
- Incentives by category
- Company benifit policy
- Employee policy
- Educational level
- Average age
- Seniority in company
- Training program
- Number of male and female
- Employee target
- Number of apprentices

**3. Customer and Market**
- Total potential market
- Market position
- Competitors
- Active customers
- Customer divided into categories
- Market analysis
- Industry analysis
- Orders backlog
- New customers
- Number of sales outlets
- Distribution network
- Contacts (audience, subscribers, visitors)
- Level of customer satisfaction
- Registered users
- Active users
- Number of page visits on the site
- Market served
- Market penetration index
- Competitive Environment
- Description of brands/licenses/copyrights

**4. Innovation and IPR**
- R&D capabilities
- Projects developed internally
- New product development
- Technology used
- R&D laboratory
- R&D objectives
- R&D partnerships
- Number of researchers

**5. Organization**
- Company Organization Chart
- Indication of legally protected intangible assets
- Company culture
- Information system description
- Description of organization change

**6. Corporate Governance**
- Board members
- Board Activities and responsibilities
- Ethical code
- Committee members
- Committee activities and responsibilities
- Internal control
- Description of other firm bodies
- Investor relations
- Relationship between different board committees
- Combined code

Source: Zambon and Bergamini, 2007
To address the level of information depth this paper makes a distinction from the original model presented by Zambon and Bergamini (2007). Instead of using the five levels of information that included: (1) no information, (2) insufficient information, (3) sufficient information, (4) sufficient and detailed information, and (5) detailed and forecasted information, it is here proposed to reduce these levels to four, as shown below. Considering the subjectivity that involves content analysis which is a known limitation of the method, it is useful to limit the amount of bias through measures that are as clear as possible. The scale for ranking company disclosures on intangibles benefits from this clarity. This simplification of the model, and in turn the decrease in subjectivity by the degree of one, can be considered a contribution of the present study.

**Table 2. Scale for ranking company disclosures on intangibles**

<table>
<thead>
<tr>
<th>Information Quality</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Information</td>
<td>0</td>
</tr>
<tr>
<td>Minimum Information</td>
<td>1</td>
</tr>
<tr>
<td>Reasonable Information</td>
<td>2</td>
</tr>
<tr>
<td>Extensive Information</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: Adapted from Zambon and Bergamini, 2007

**Model**

In this model, annualized standard deviation of daily stock return for a period of three consecutive years (2004-2006) has been used as a measure of market risk (dependent variable). This risk indicator is commonly employed in the event studies and financial modelling literature to measure the volatility of stock return.

In order to understand the effect of the industry on the dependent risk variable, an independent industry variable has been included in the model. Given that the firms in the dataset are the biggest in the sector, but operating in different sub-sectors they are expected to have diversified core competencies and capabilities, then the firm size is also used as an independent variable. The
data on the firm and industry size are in the natural log to control for the size effect. R&D intensity is the reflection of the extent to which a firm invests in this type of activity to produce new products, and thus it is used as an independent variable (Miller and Bromiley, 1990). Every firm makes capital investments, and therefore capital intensity is another independent variable. Labour intensity is a measure of how efficiently the firms are utilizing their employees, and hence it has been used as another independent variable. Debt to Equity ratio is a measure of the capital structure and has been employed in this study as a further independent variable. Disclosure Quality as a proxy for the intangibles reporting on the annual reports of the firms for the period 2004-2006 is the last independent variable that is included in the model.

\[
SDofStkRet_{it} = \alpha + \beta_1 LN_{IndSize_t} + \beta_2 LN_{FirmSize_{it}} + \beta_3 \left( \frac{R&D}{Sales}_{it} \right) + \beta_4 \left( \frac{CapEx}{Tot\,Asst}_{it} \right) \\
+ \beta_5 \left( \frac{Capital}{Tot\,Emp}_{it} \right) + \beta_6 \left( \frac{Debt}{Equity}_{it} \right) + \beta_7 Disc\,Qual_{it} + u_{it} + \varepsilon_{it}
\]

\(SDofStkRet_{it}\) = Annualized standard deviation of daily stock return for firm \(i\) at time \(t\)

\(LN_{IndSize_t}\) = Natural log of Industry Size

\(LN_{FirmSize_{it}}\) = Natural log of Firm Size

\(\frac{R&D}{Sales}_{it}\) = Research and Development Expenses over Sales for a firm \(i\) at time \(t\)

\(\frac{CapEx}{Tot\,Asst}_{it}\) = Capital Expenses over Total Assets for a firm \(i\) at time \(t\)

\(\frac{Capital}{Tot\,Emp}_{it}\) = Labour intensity of firm \(i\) at time \(t\)

\(\frac{Debt}{Equity}_{it}\) = Debt to Equity ratio for a firm \(i\) at time \(t\)

\(Disc\,Qual_{it}\) = A proxy for disclosure of intangibles quality for a firm \(i\) at time \(t\)

\(u_{it}\) = Between-entity error for a firm \(i\) at time \(t\)

\(\varepsilon_{it}\) = Within-entity error for a firm \(i\) at time \(t\)
Sample Data

The data set used for this paper has been influenced by the constituents of the Ocean Tomo 300® Patent Index (OT300). This is the industry’s first index based on the value of the intellectual property, and represents a diversified portfolio of 300 firms that has most of their market value as relative to their book value tied up in intangibles and intellectual capital. The index is priced and published by NYSE Euronext (NYSE Euronext: OTPAT).

The main idea behind evaluating a portfolio of firms that have most of their value in intangibles is that the firms in the portfolio have a proven track record in dealing with intangibles as well as the highest concentration of intangibles in the industry. To be included in the OT300 portfolio the firms must meet some benchmark condition (OT300, 2010).

From this portfolio of 300 firms, about 50 are from the healthcare and pharmaceutical business, and they are the target of this paper’s analysis. However, of this initial portfolio of 50 entities, only those that met the following stringent criteria of selection have been finally considered for the study:

- The firm should be listed in a United States Stock Exchange, preferably NYSE or NASDAQ.
- The firm should publish annual reports for a period of three years from 2004 to 2006.
- Daily stock price data of the firm should be available at the Centre for Research in Security Prices (CRSP) for the entire period under consideration (2004 to 2006).
- Accounting data of the firm should be available in the Compustat database from Standards and Poor’s during the entire period under consideration (2004 to 2006).
From the initial portfolio of OT300 firms that included about 50 healthcare and pharmaceutical firms, only 25 of those have been able to meet all the above criteria for a period of three years. Therefore, the final panel dataset consisted of 75 observations.

IV. ANALYSIS AND COMMENTARY

The random effect panel data regression failed to show any significant relationship between disclosure quality of intangibles and market risk. The results must be put into perspective, since the data collected for this study are for 25 of the largest healthcare and pharmaceutical firms in the industry, which skews the sample towards firms that are much more diversified, and therefore under severe vigilance by regulators, investors and analysts (Barth, Kasznik and McNichols, 2001; Lang and Lundholm, 1996).

The empirical analysis of the multilevel panel dataset for a period of three fiscal years starts with the evaluation of the disclosure content on the annual reports of the 25 firms composing the sample. As mentioned earlier, the coding of the intangibles data present in the annual reports was based on the methodology developed by Zambon and Bergamini (2007), including six sections of intangibles indicators dealing with (i) strategy, (ii) customer and market, (iii) human resources, (iv) organization, (v) innovation and intellectual property resources, and (vi) corporate governance.

The summary statistics of the non-financial disclosures of the intangibles-related indicators for the firms in the healthcare and pharmaceutical industry listed in the US during the fiscal year 2004 to 2006 reveals that the firms report more on indicators such as strategy, customers and market that are more general in nature. The average score of information firms disclose on strategy and customer and market are 18.96 and 20.58 respectively, with an associated standard deviation of 5.92 and 7.72. The average disclosures on human resources and organization is paltry in comparison

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4 All empirical analysis has been performed on Stata/SE 11.0 for Windows.
with the two top reported intangibles categories, and stand at 7.21 and 2.8, respectively, with an associated standard deviation of 5.57 and 1.4.

However, the remaining two categories of intangibles indicators, that are innovation and IPR along with corporate governance, fared slightly better with an average of 9.36 and 10.37, respectively, along with a standard deviation of 3.69 and 3.62. Considering the nature and size of the large US listed healthcare and pharmaceutical firms, the net disclosures about the organization capital, innovation capital and human resource capital are significantly lower than expected (see Appendixes I and II).

From these results it can be inferred that firms in this industry are reluctant to expose non-financial information about their core resources and competencies, which are tied up in human, organizational and relational capital. This outcome can be explained by the theory, where the utility function of disclosing information related to intangibles is not so high for the ‘agents’ as compared to the cost associated with the disclosure process (Suijs, 2007). Another way to explain the information environment of the industry is that the limited disclosure on intangibles creates partial information equilibrium (Wagenhofer, 1990; Verrecchia, 1983; Dye, 1985). In this partial state of equilibrium, the ‘agents’ (i.e. the managers) do not report on intangibles unless market explicitly requires it, or when market participants – such as analysts – know that insiders have a new value relevant information (Suijs, 2007). Drug approval by FDA could give rise to such a situation.

Appendix III provides the summary statistics for the list of dependent and independent variables.

Appendix IV shows the correlation matrix of dependent and independent variables, which shows some insightful results. One is that disclosure quality of non-financial information on intangibles is positively related with the standard deviation of stock returns. Another interesting outcome from the correlation matrix is that firm size is inversely proportional to the disclosure quality. This means that, when the firm’s size increases, the quality of disclosures on intangibles
does not keep up with the growth trend; on the contrary, the disclosure quality decreases as the firm expands in size, thus arguably contributing to the ‘information asymmetry’.

Coming to the regression analysis, in this paper the data used for the analysis is a multilevel nested panel dataset that includes the previously identified portfolio of 25 healthcare and pharmaceutical firms listed in the US. This model of analysis should facilitate to study the effects that vary by entity and/or groups. This method should also assist in estimating the group level averages (Greene, 2003). Other advantages of using nested multilevel panel data regression over regular regression are that individual regressions might face sample data problems and a lack of generalization. Regular regressions ignore the average variation between entities (Greene, 2003). In order to complete a multilevel panel data analysis, a decision needs to be made whether the model is suitable for a fixed effect or a random effect model. To distinguish between these two models, the Hausman test is performed (Hausman, 1978; Greene, 2003) (see Appendix V), where the null hypothesis is that the preferred model is the random effect vs. the alternative (i.e. the fixed effect model). The chi2 value is 0.3424, which is higher than .05. Therefore, the random effect model appears to be the appropriate test to be run for the multilevel panel data analysis of this study.

The rationale behind using the random effect model is that the variations between the entities are assumed to be stochastic and uncorrelated with the independent variables which are included in the model (Greene, 2003). The hypothesis is that disclosure quality of intangibles has a negative impact on the market risk of the firm, and therefore the random effect generalized least square regression is used to test it. The chi2 value for the model to be 0 means that the model is consistent and there are no coefficients in the model that are zero. This phenomenon can also be verified from the correlation matrix as shown in the Appendix IV. The random effect model is particularly suitable for this type of research as the variable of disclosure quality is time invariant.
The Breusch and Pagan Lagrangian multiplier test for random effects or the LM test is used, and it is found that the chi2 value is less than 0.05, which implies that the random effect model is suitable for this research over a simple OLS regression (Greene, 2003) (see Appendix VII).

Appendix VI lists the results from the random effect generalized least square regression or the LM test for our pooled dataset. Interestingly, the p-value test for hypothesis on disclosure quality of intangibles has come to 0.66 which is much greater than 0.05. Our initial null hypothesis was that disclosure quality of intangibles does not have an impact on the standard deviation of stock returns. The result received from the test indicates that disclosure quality of intangibles does not have an effect on the standard deviation of stock returns, i.e. the null hypothesis is accepted.

On the other hand, the p-value of R&D Intensity is 0.025, which is less than 0.05, and means that null hypothesis (H0) is rejected. It also signifies that the R&D intensity of the healthcare and pharmaceutical firms have in fact an impact on the standard deviation of stock returns. This result is consistent with the previous literature for which investments in R&D have an impact on the market risk of the firm (Chan, Lakonishok and Sougiannis, 2001; Chambers, Jennings and Thompson, 2001), even though the value relevance of the financial information presented in annual reports is on a decline slope (Lev and Zarowin, 1999). This result is dichotomous in nature, as it shows that R&D intensity is important for the market, but the information about intangibles that are a result of R&D effort does not have an impact on the standard deviation of stock returns.

The outcome of the disclosure quality analysis clearly demonstrates that US healthcare and pharmaceutical firms provide in their annual reports far more information about their ‘strategy’, ‘customer’ and ‘market’ section which is rather vague in nature, than about any other category of intangibles. Therefore, a first argument that could be put forward is that intangibles-related non-financial information provided in the annual reports is ‘limited’ in its capacity to produce an effect on the market risk.
The second argument that can be made is that analysts in the market might not be capable or sophisticated enough with their financial modelling to incorporate and evaluate the impact of the risk associated with intangibles, being the main set of resources for these firms. Empirical research (Barth, Kasznik and McNichols, 2001; Lang and Lundholm, 1996) has shown that indeed analysts devote many more resources to examining firms that have large portfolios of intangible assets.

The third possible view is from Skinner (2008) who asserted that financial markets are mostly efficient, and therefore whatever little information markets have about a firm’s intangibles, they are able to value the future growth prospects based on the utility of these intangibles, and thus they are able to price the stock fairly and accurately. This view was endorsed by Ross (1979) and a few other opponents of the view that supports change in the current company disclosure regime. However, the vast array of company disclosure literature now demonstrates that the informational relevance of annual reports are on the decline, including this study which reflects on the market risk relevance of intangibles information from the annual reports of firms which are highly invested in intangibles.

v. CONCLUSION, LIMITATIONS AND RECOMMENDATIONS

The paper explores the non-financial disclosure environment related to intangibles in the US healthcare and pharmaceutical industry and modelled it to investigate as to whether these voluntary disclosures have an impact on the market risk as measured by the standard deviation of stock return for the period 2004-2006. Healthcare and pharmaceutical firms have most of their resources tied up in intangibles such as human capital, investments in research and development, patents, copyrights, and know-how, which become part of the organizational and relational intangible capital an innovative firm possesses. Information about these resources should be an important constitutive element of annual reports, especially in the case of the industry in review. The outcome from this study indicates that the firms exercise a lot of subjectivity in their intangibles disclosure policy.
They provide information in general about strategy and customer and market, but do not provide a comparable level of information on human resources, organization, innovation and IPR, and corporate governance. It is known from previous literature that the core competencies of ‘innovative’ firms, such as in healthcare and pharmaceutical sector, come from their human, organization and relational capital, about which, though, information has been found scant and unsatisfactory. Disclosure quality of intangibles also does not have much effect on the market risk of the firms in question.

The above results are subject to some limitations. The number of observations is quite low, because of the manual labour involved in collecting the relevant information and creating an index to rate the voluntary intangibles disclosures in company annual reports. The proxy for disclosure quality is also dependent upon the interpretation of the researcher, which is a well-known limitation when performing content analysis.

Future empirical studies could explore the ‘agent’s’ or managers motives and incentives to voluntarily disclose on intangibles. The disclosure quality model employed can also be customized to specific industries and could be used to investigate the quality of intangibles disclosure in different industries and its effects. Finally, the study conducted can be replicated over a larger sample size of firms throughout a cross-section of industries in order to advance our understanding as to how company-related risk measures react to different content and depth in disclosures on intangible resources.
VI. APPENDIX

Appendix I – Summary of descriptive statistics for the list of indicators employed

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>75</td>
<td>18.96</td>
<td>5.923932</td>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>Customer and Market</td>
<td>75</td>
<td>20.58667</td>
<td>7.728664</td>
<td>4</td>
<td>33</td>
</tr>
<tr>
<td>Human Resources</td>
<td>75</td>
<td>7.213333</td>
<td>5.573328</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>Organization</td>
<td>75</td>
<td>2.8</td>
<td>1.46121</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Innovation and IPR</td>
<td>75</td>
<td>9.36</td>
<td>3.693091</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>Corporate Governance</td>
<td>75</td>
<td>10.37333</td>
<td>3.623397</td>
<td>2</td>
<td>19</td>
</tr>
</tbody>
</table>
Appendix II – Correlation Matrix for the List of Indicators

<table>
<thead>
<tr>
<th>Correlation Matrix of Indicators</th>
<th>Strategy</th>
<th>Customer and Market</th>
<th>Human Resources</th>
<th>Organization</th>
<th>Innovation and IPR</th>
<th>Corporate Governance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer and Market</td>
<td>0.7363</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human Resources</td>
<td>0.3621</td>
<td>0.3619</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organization</td>
<td>0.4206</td>
<td>0.4664</td>
<td>0.3123</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovation and IPR</td>
<td>0.6406</td>
<td>0.6568</td>
<td>0.5136</td>
<td>0.3265</td>
<td>1</td>
<td></td>
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<tr>
<td>Corporate Governance</td>
<td>0.3816</td>
<td>0.4326</td>
<td>0.6986</td>
<td>0.3742</td>
<td>0.4301</td>
<td>1</td>
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</tbody>
</table>

Appendix III – Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD of Stk Ret</td>
<td>75</td>
<td>0.315973</td>
<td>0.227193</td>
<td>0.020626</td>
<td>1.534931</td>
</tr>
<tr>
<td>LN Ind Size</td>
<td>75</td>
<td>19.94567</td>
<td>0.068323</td>
<td>19.85435</td>
<td>20.01691</td>
</tr>
<tr>
<td>LN Firm Size</td>
<td>75</td>
<td>15.62221</td>
<td>1.524672</td>
<td>12.04652</td>
<td>19.07799</td>
</tr>
<tr>
<td>R&amp;D Intensity</td>
<td>75</td>
<td>0.060009</td>
<td>0.15322</td>
<td>0</td>
<td>0.791124</td>
</tr>
<tr>
<td>CapEx/Total Assets</td>
<td>75</td>
<td>0.034114</td>
<td>0.020365</td>
<td>0.002792</td>
<td>0.13406</td>
</tr>
<tr>
<td>Debt/Equity</td>
<td>75</td>
<td>0.616878</td>
<td>1.502131</td>
<td>0</td>
<td>9.452245</td>
</tr>
<tr>
<td>Capital Intensity</td>
<td>75</td>
<td>3.00312</td>
<td>19.84135</td>
<td>0.14283</td>
<td>172.452</td>
</tr>
<tr>
<td>Disclosure Quality</td>
<td>75</td>
<td>0.6</td>
<td>0.493197</td>
<td>0</td>
<td>1</td>
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</tbody>
</table>
### Appendix IV – Correlation Matrix for Dependent and Independent Variables

<table>
<thead>
<tr>
<th>Correlation Matrix</th>
<th>SD of Stk Ret</th>
<th>LN Ind Size</th>
<th>LN Firm Size</th>
<th>R&amp;D Intensity</th>
<th>CapEx/Total Assets</th>
<th>Debt/Equity</th>
<th>Capital Intensity</th>
<th>Disclosure Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD of Stk Ret</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>LN Ind Size</td>
<td>-0.4821</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LN Firm Size</td>
<td>-0.4808</td>
<td>0.1056</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R&amp;D Intensity</td>
<td>0.2291</td>
<td>0.0955</td>
<td>0.0373</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CapEx/Total Assets</td>
<td>-0.136</td>
<td>-0.0727</td>
<td>0.0912</td>
<td>-0.2142</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>Debt/Equity</td>
<td>0.2017</td>
<td>-0.0346</td>
<td>-0.1817</td>
<td>0.0229</td>
<td>-0.1155</td>
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<tr>
<td>Capital Intensity</td>
<td>0.0088</td>
<td>0.0382</td>
<td>0.0762</td>
<td>-0.0431</td>
<td>-0.1317</td>
<td>-0.0426</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Disclosure Quality</td>
<td>0.2292</td>
<td>0</td>
<td>-0.2501</td>
<td>0.169</td>
<td>-0.2678</td>
<td>0.1227</td>
<td>0.1042</td>
<td>1</td>
</tr>
</tbody>
</table>
Appendix V – Hausman Test

<table>
<thead>
<tr>
<th></th>
<th>(b)</th>
<th>(B)</th>
<th>(b-B)</th>
<th>sqrt(diag(V_b-V_B))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>fixed</td>
<td>random</td>
<td>Difference</td>
<td>S.E.</td>
</tr>
<tr>
<td>LN Ind Size</td>
<td>-1.674489</td>
<td>-1.538615</td>
<td>-0.1358737</td>
<td>0.1430351</td>
</tr>
<tr>
<td>LN Firm Size</td>
<td>0.0073581</td>
<td>-0.0631636</td>
<td>0.0705217</td>
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<tr>
<td>R&amp;D Intensity</td>
<td>0.1464202</td>
<td>0.2848611</td>
<td>-0.1384409</td>
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<tr>
<td>CapEx/Total Assets</td>
<td>-0.7903381</td>
<td>-0.8381676</td>
<td>0.0478295</td>
<td>0.7452764</td>
</tr>
<tr>
<td>Debt/Equity</td>
<td>-0.0062474</td>
<td>0.0009725</td>
<td>-0.0072199</td>
<td>0.0075773</td>
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<tr>
<td>Capital Intensity</td>
<td>0.0000783</td>
<td>0.0005406</td>
<td>-0.0004622</td>
<td>0.0004836</td>
</tr>
</tbody>
</table>

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

\[ \text{chi2}(6) = \frac{(b-B)[(V_b-V_B)^{-1}](b-B)}{V_b-V_B \text{ is not positive definite}} \]

<table>
<thead>
<tr>
<th>chi2(6)</th>
<th>(b-B)<a href="b-B">(V_b-V_B)^{-1}</a></th>
<th>=</th>
<th>6.77</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prob&gt;chi2</td>
<td></td>
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<td>0.3424</td>
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</tbody>
</table>

(V_b-V_B is not positive definite)
### Appendix VI – Random Effect Generalized Least Square Model

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<th>Number of Obs: 75</th>
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<tr>
<td>Group variable:</td>
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<tr>
<td>within = 0.5082</td>
</tr>
<tr>
<td>between = 0.5486</td>
</tr>
<tr>
<td>overall = 0.5234</td>
</tr>
<tr>
<td>R-sq:</td>
</tr>
<tr>
<td>within = 0.5082</td>
</tr>
<tr>
<td>between = 0.5486</td>
</tr>
<tr>
<td>overall = 0.5234</td>
</tr>
<tr>
<td>Random Effect GLS</td>
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<tr>
<td>corr(u_i, X)</td>
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<tr>
<td>0 (assumed)</td>
</tr>
<tr>
<td></td>
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<tr>
<td>SD of Stk Ret</td>
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<tr>
<td>LN Ind Size</td>
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<td>R&amp;D Intensity</td>
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<tr>
<td>Debt/Equity</td>
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<tr>
<td>Capital Intensity</td>
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<tr>
<td></td>
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<tr>
<td>sigma_e</td>
</tr>
<tr>
<td>Rho</td>
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</table>
Appendix VII – Breusch and Pagan Lagrangian multiplier test for random effects

<table>
<thead>
<tr>
<th></th>
<th>Var</th>
<th>sd = sqrt(Var)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD of Stk Ret</td>
<td>0.051617</td>
<td>0.227193</td>
</tr>
<tr>
<td>E</td>
<td>0.018389</td>
<td>0.135608</td>
</tr>
<tr>
<td>U</td>
<td>0.00942</td>
<td>0.097057</td>
</tr>
</tbody>
</table>

Test: Var(u) = 0

\[ \chi^2(1) = 4.03 \]

\[ \text{Prob} > \chi^2 = 0.0447 \]
VII. REFERENCES


OT300. (2010). Ocean Tomo 300 Patent Index. Ocean Tomo, LLC.


