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**Effects on Investor Judgments from Expanded Disclosures of  
Non-Financial Intangibles Information**

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**Effects on Investor Judgments from Expanded Disclosures of  
Non-Financial Intangibles Information**

**by**

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**Dissertation**

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## **Dedication**

To my parents

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# **Effects on Investor Judgments from Expanded Disclosures of Non-Financial Intangibles Information**

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In response to evidence of an increasing disconnect between financial reporting and firm value, a number of commentators have called upon firms to expand their disclosures of intangibles information, particularly disclosures of non-financial measures. In this study, I use an experiment to examine whether and when expanded disclosures of non-financial intangibles information affect investor judgments of financial performance. I propose that, given the complexity of the relationships between today's intangibles activities and future financial results, investors may fail to retain and/or use the information contained in non-financial intangibles disclosures, and performance on non-financial measures may not be reflected in their judgments of future financial performance. Certain investors, those who have high familiarity with the industry setting, should have well-developed causal models that allow them to use the non-financial measures

and relate them to judgments of future financial performance. On the other hand, investors who have low familiarity with the industry setting may not have well-developed causal models, so that expanded disclosure of non-financial information may not be sufficient to influence these investors' judgments. Instead, these investors may need to receive supplemental discussion of how a firm's non-financial measures are causally linked to future financial performance in order to use the non-financial information.

Experimental results for the full sample, combining high familiarity and low familiarity investors, are mixed, and are related to which performance measure is used as the dependent variable. I also examine the results for the subset of investors with relatively low familiarity with the industry setting used in the study. For these investors, disclosure of non-financial measures alone is not sufficient to influence their performance judgments, and non-financial measures are incorporated into performance judgments only when the supplemental causal links discussion is provided. Additional analysis suggests that these results for the low familiarity investors are due to supplemental causal links discussion affecting the *use* of non-financial information in investors' performance judgments, and are not due to causal links discussion affecting *retention* of non-financial information. This study provides evidence on the effects on investor judgments from expanded intangibles disclosures and the necessary conditions for achieving such effects.



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## Chapter 1: Introduction

The ability of accounting and financial reporting data to represent and report information that is useful in assessing firm value and management performance has come under a great deal of scrutiny in recent years. Evidence exists that an increasing number of items that affect valuation are not captured in firms' financial statements. This disconnect is particularly acute for firms with large, unrecognized, investments in intangible assets. Critics suggest that firms should compensate for this by expanding their disclosures of intangibles information, particularly disclosures of non-financial measures<sup>1</sup> (Lev, 2001, and Eccles, Herz, Keegan, and Phillips, 2001, Financial Accounting Standards Board, 2002). Their rationale is that these expanded disclosures will better communicate a company's economics and help unlock additional relevant information about firm value. This will allow investors to distinguish between strong and weak firms, resulting in more differentiated investment-related judgments.

The realization of these benefits relies on the assumption that investors will react to and use the expanded intangibles information in their judgments. Whether and when this happens is unclear. It is possible that simply providing

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<sup>1</sup> Intangible assets are defined by the Financial Accounting Standards Board as assets (not including financial assets) that lack physical substance (FASB, 2001). Although intangible assets are associated with firm value in the financial markets, only certain intangible assets (mostly purchased intangible assets) are recognized for accounting purposes. To mitigate the lack of *recognition* of intangible assets, firms are being encouraged to expand *disclosure* of information about intangible assets. Disclosures of non-financial measures, defined as non-monetized, operational data, provide information about various dimensions of a firm's (recognized and unrecognized) intangible assets and thus are seen as an avenue for providing additional information to investors about a firm's intangible assets and firm value. In this study, I examine investor reactions to disclosures of non-financial measures, with an eye toward the broader discussion of disclosures of information about intangible assets.

non-financial intangibles information will lead to investors incorporating this information in their judgments. On the other hand, the relationships between today's intangibles activity and the related non-financial measures and future financial results can be complex. If complex relations are misunderstood, mischaracterized, or even ignored, expanded disclosures of non-financial intangibles information may not have the effect on investors that their advocates envision. That is, disclosure alone of non-financial information might not affect investors' judgments, because investors lack the knowledge to retain and use the information.

In an experiment set in a research and development investment context, I study *whether* and *when* expanded disclosure of non-financial intangibles information leads to different investor judgments. I use a 2 X 2 plus 1 between subjects research design. The first factor that I manipulate is *causal links discussion*. Participants who receive a report on non-financial measures either receive it with or without a supplemental discussion of how the firm's non-financial intangibles measures are causally linked to future financial performance. The provision of cause-and-effect links is intended to clarify the complex relationships between non-financial measures and future performance, thus leading to increased use of non-financial intangibles disclosures in investor judgments, relative to disclosure of non-financial measures alone. The second manipulated factor is *level of non-financial performance*, where the disclosing firm is identified as having either above or below-average performance on non-financial measures. The performance manipulation is used to examine whether

and when investors differentiate between high and low performing firms by incorporating the content of non-financial intangibles disclosures in their judgments. The “plus 1” is a control condition where participants receive neither the report on non-financial measures nor the links discussion.

I hypothesize that, due to a lack of knowledge about the complex relationships between non-financial measures and future financial performance, disclosure of non-financial intangibles information without causal links discussion is less likely to affect investors’ future financial performance judgments. In other words, in the absence of links discussion, investors’ performance judgments in the above-average and below-average conditions are less differentiated from each other, and less differentiated from judgments in the control (baseline) condition, where non-financial measures are not provided. When the causal links discussion is provided, I hypothesize that investors are more likely to incorporate non-financial measures into their judgments of future performance. This results in the prediction of a causal links discussion by performance level interaction, where investors more strongly differentiate between the above and below-average firms in their judgments when a links discussion is provided.

One complicating factor related to these hypotheses is the presence of high familiarity (high knowledge) investors who may already possess well-developed causal models that allow them to use the non-financial measures when disclosed alone. If the causal models possessed by these high familiarity investors match the causal model implied by the supplemental causal links discussion, then the provision of cause-and-effect links would not affect these investors’ performance

judgments. Accordingly, I partition the data on the basis of industry familiarity, and analyze results for the full sample, for a subset of investors with self-reported high familiarity with the industry setting, and for a subset of investors with self-reported low familiarity with the industry setting.

For the full sample, I find mixed results with respect to my predictions, depending on which performance measure is used as the dependent variable. For next period revenue estimates, investors' estimates for above-average and below-average firms are not significantly different in the absence of the causal links discussion, and they are significantly different when the links discussion is provided, as hypothesized. For judgments of future revenue growth (3 to 5 years out), there is significant differentiation without the causal links discussion, contrary to predictions. Additionally, providing the links discussion does not increase the differentiation between above-average and below-average firms, also contrary to predictions.

I then examine the results for the subset of investors who self-identified as having lower familiarity with the industry setting used in the experimental materials. Unlike high familiarity investors who may be able to process non-financial measures when disclosed alone, low familiarity investors may not have well-developed causal models, so that expanded disclosure alone of non-financial measures may not be sufficient to influence these investors' judgments. Instead, these investors may need to receive the supplemental links discussion. Results for these low familiarity investors indicate that disclosure of non-financial measures alone is not sufficient to influence their performance judgments, as their



assessments of the above-average and below-average firms are not significantly different in the absence of links, as hypothesized. When the links discussion is provided, non-financial measures are incorporated in performance judgments, as hypothesized.

Data for the subset of investors who self-identified as having higher familiarity with the industry setting were also examined. However the small number of investors classified as high familiarity precludes me from making any meaningful conclusions about this group.

Overall, these results suggest that having causal models about non-financial measures and their relationships with future financial performance measures helps investors use non-financial measures. Furthermore, investors who do not already possess these models (from their industry familiarity) can “acquire” a model when cause-and-effect linkages are provided. Additionally, the results show that disclosure alone of non-financial intangibles information may not be sufficient to influence low familiarity investors’ judgments.

This study is of interest to managers of firms (in particular CFOs and investor relations staff of intangibles-heavy firms), accounting researchers, and standard setters. Managers have expressed an interest in increasing the transparency of their disclosures to better communicate information about firm value to investors (Eccles et al, 2001). Information about investors’ reactions to and use of intangibles information can help managers identify when their disclosures are most effective, and help them achieve their goal of better communication.

Additionally, non-financial information is an emerging area of accounting research and I provide evidence on the role of supplemental causal link disclosures and industry familiarity on investors' use of non-financial performance information. The experimental method is well-suited for this study. Conducting my study in a laboratory setting allows me to control for incentives and self-selection of disclosures, which would not be possible using archival data (Libby, Bloomfield, and Nelson, 2002). This study is also in contrast to prior behavioral financial accounting studies that examine historical *financial* information and its influence on judgments of future financial performance, and ultimately on investor valuation judgments (e.g. Hirst and Hopkins (1998), Maines and McDaniel (2000), Krische (2001), Hirst, Jackson, and Koonce (2003), and Frederickson and Miller (2004)). I examine how historical *non-financial* measures influence perceptions of future financial performance. Given that these amounts are non-financial and the relationships to future financial performance are complex, it is not clear ex ante how they will be mapped into judgments of future financial performance by investors. This study examines whether and when disclosure alone is sufficient to influence investor judgments, and whether and when supplemental causal links discussion is necessary.

Finally, the FASB has identified expanded disclosures of information about intangible assets as one of its areas of interest and I provide evidence on the variables that influence investors' use of non-financial intangibles information.

The remainder of this dissertation is organized as follows: Chapter 2 discusses the complexities of forecasting performance in the presence of research

and development investment. Chapter 3 presents a model of investor processing of non-financial intangibles information and develops the hypotheses. Chapter 4 discusses the research method. Chapter 5 presents the results and Chapter 6 summarizes the findings and concludes.

## **Chapter 2: Forecasting in a Research and Development Investment Setting**

### **2.1 DIFFICULTIES IN FORECASTING IN A RESEARCH AND DEVELOPMENT INVESTMENT SETTING**

Evidence exists that a number of items affecting valuation are not captured in firms' financial statements (e.g. Amir and Lev, 1996, Lev and Sougiannis, 1996).<sup>2</sup> This disconnect is particularly acute for firms with large, unrecognized, investments in intangible assets (Lev, 2001). For investors in these firms, this makes the task of forecasting future financial performance much more challenging.

For example, for a pharmaceutical company in the midst of a research and development (R&D) initiative, the company may be reporting significant revenue growth, but it may also report much smaller increases in earnings, due to its R&D expense. Given this scenario, how does an investor forecast future financial performance? First, forecasting earnings may be very difficult, because of the uncertainties surrounding the persistence of discretionary R&D expense.

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<sup>2</sup> Many of these items are related to companies' investments in information and technology. With the evolution of the economy in recent years to a more information-based economy, the magnitude and prominence of these uncaptured items has increased, leading some to claim that the value-relevance of financial statements is declining (Lev, 2000). Other researchers disagree that there has been a decline in the value-relevance of financial statements. Collins, Maydew, and Weiss (1997) and Francis and Schipper (1999) find little evidence that the overall value relevance of financial statements has declined over time. Similarly, Core, Guay, and Van Buskirk (2003) find little evidence of a change in the determinants of equity values over a 25 year period ending in 2000. While the debate on the value relevance of financial statements remains unsettled, the fact remains that standard setters and financial statement preparers have been spurred on to take action. Accordingly, this paper examines the effect on investors from some potential actions to be taken.

Although forecasting revenue may be incrementally easier than forecasting earnings because it is not directly affected by current R&D expense, the timing of future revenue could be significantly affected by the fruits of the current R&D initiative.

Prior archival-empirical research suggests that current required disclosures of R&D expense may be useful to investors in R&D intensive firms. Lev and Sougiannis (1996) find that the valuation of R&D intensive firms is more consistent with “adjusted GAAP” earnings (R&D expenditures added back and amortized) than GAAP earnings (immediate expensing of R&D expenditures). These results suggest that investors in R&D intensive firms make an adjustment for R&D expense in their valuations. However, disclosures of R&D expense, while useful for approximating future benefits from R&D investment, are coarse estimates of those benefits. They reflect inputs into the R&D process, not outputs. For example, two firms with the same amount of R&D spending could have very different future financial prospects due to their different respective returns on R&D investment. Disclosures of R&D expense alone would not be able to help investors differentiate between these two firms.

## **2.2 DISCLOSURE OF NON-FINANCIAL MEASURES**

To supplement the information about intangible assets contained in disclosures of R&D expense, Lev (2001) and Eccles et al (2001) call upon companies to expand and improve the disclosures of intangibles information in financial reports, particularly non-financial information about a company’s activity and progress in the various stages of the intangibles/innovation process.

These disclosures of non-financial measures, especially those that are leading indicators of intangibles process outputs, provide information on additional dimensions of firm performance that are not captured in disclosures of R&D expense. Disclosures of R&D spending with non-financial measures are arguably more useful than disclosures of R&D spending alone because non-financial measures report on the firm's activity and progress in later stages of the innovation process, when the effects on future financial performance are more imminent. In the case of the two firms with equal amounts of R&D investment, any differences in their internal returns on R&D investment would be reflected in their performance on non-financial measures (for example, above-average vs. below-average patent generation). Investors who are provided with non-financial intangibles disclosures would then be able to better differentiate between these firms.

If non-financial measures provide information about the amount and timing of future benefits from the current R&D initiative, investors should be able to differentiate between firms on the basis of the effectiveness of their R&D activities. This differentiation should then be reflected in investors' forecasts of revenue (and revenue growth). However, the effect of disclosing non-financial measures on investors' forecasts of *earnings* (and *earnings* growth) is less straightforward, because of the unknown nature of the future R&D spending strategy of the firm.

This discussion illustrates how expanded disclosures of non-financial measures can facilitate forecasting for R&D intensive firms. However, it is not

clear that simply expanding disclosures of non-financial measures will be sufficient to affect investors' performance judgments and forecasts for R&D intensive firms. The relationships between non-financial measures and future financial results may be sufficiently complex (mostly due to lagged effects), such that investors could observe performance on non-financial measures (in the expanded disclosures), but not reflect that performance in their subsequent investment-related judgments. Indeed, Upton (2001) observes that "Many nonfinancial metrics...are unfamiliar to users of business information," suggesting that expanded disclosures may be too complex for investors to understand. In the next chapter, I introduce a model of investor processing of non-financial intangibles information that predicts whether and when the information contained in non-financial measures is incorporated in investors' performance judgments.

## **Chapter 3: Investor Processing of Non-Financial Intangibles Information**

### **3.1 CHAPTER OVERVIEW**

In Chapter 2, expanded disclosure of non-financial intangibles information was proposed to reduce the information gap for investors in R&D intensive firms. In this chapter, I present a model of investor<sup>3</sup> processing of non-financial intangibles information to predict whether and when investors incorporate the information contained in disclosures of non-financial intangibles information in their performance judgments.

In a study examining investors' processing of comprehensive income information, Maines and McDaniel (2000) propose a framework suggesting that disclosed information moves through three processing stages, information acquisition (which includes information retention), information evaluation, and information weighting, prior to being incorporated into investors' judgments of performance. Furthermore, Maines and McDaniel propose that disclosure-related variables (presentation format in the case of their comprehensive income study) could influence investors' performance judgments, through their effect on any or all of the processing stages that precede the overall performance judgment.

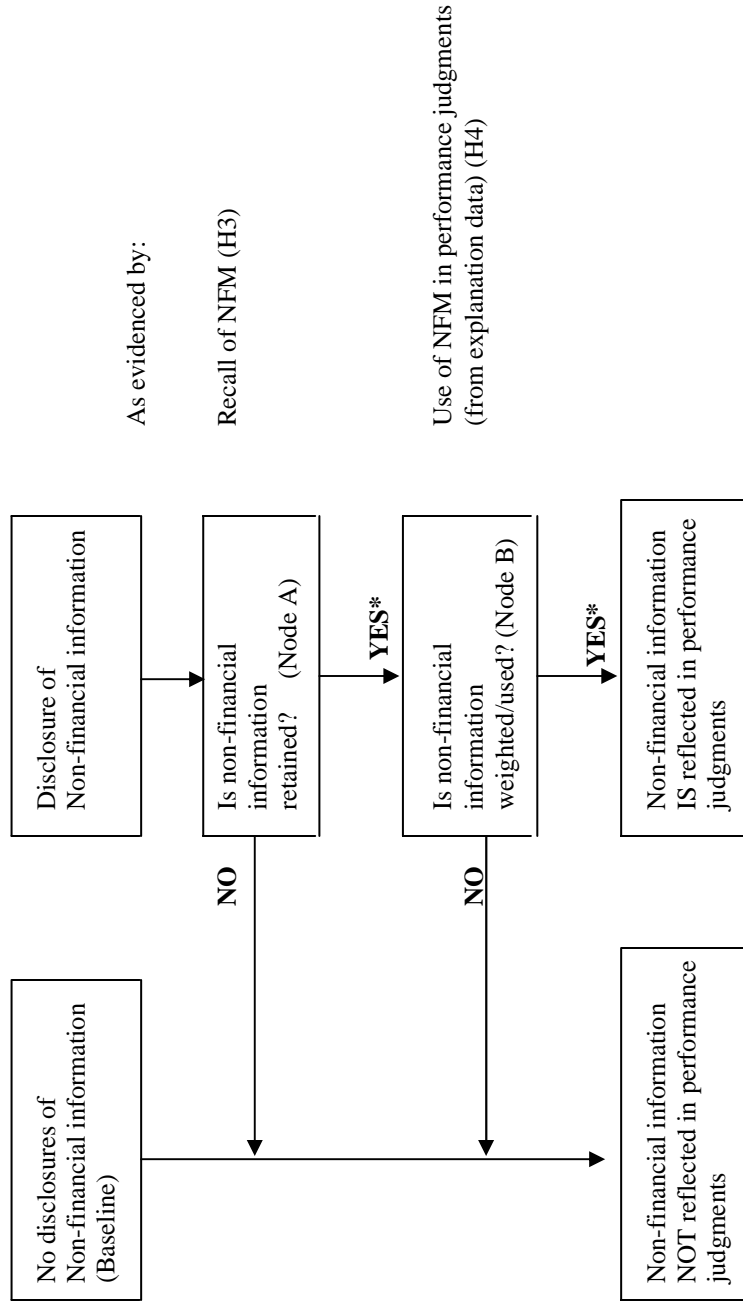
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<sup>3</sup> Because disclosure of non-financial information supports financial analysis, it can be argued that the intended primary recipients for these disclosures are information intermediaries (i.e. financial analysts), and that (individual) investors use this information only after it has been processed by information intermediaries. However, a non-trivial number of firms have no analyst following (Chambers, Jennings, and Thompson, 2004, find that 38% of earnings reports during the period 1984-2002 have zero associated analyst forecasts). For these firms with no analyst following, information about non-financial measures goes directly to the investor, so examination of investor reactions to disclosures of non-financial information is warranted.



In this study, I employ a framework that is similar to the one used by Maines and McDaniel (2000). I propose that investors' processing of non-financial intangibles information moves through the stages of information retention and information weighting prior to being incorporated in performance judgments, and whether the non-financial intangibles information is incorporated in investors' performance judgments is a function of investors' retention and weighting of this information. This framework is summarized in Figure 1.

FIGURE 1 - Proposed Model of Investor Processing of Non-financial Intangibles Information



\*Investors with causal models, from knowledge/familiarity with the pharmaceutical industry or from the causal links discussion, are hypothesized to stay on the path where non-financial information is reflected in performance judgments (i.e. “YES” at Node A and Node B).

As indicated in Figure 1, investors who are presented with expanded disclosures of non-financial measures must retain that information (“YES” at Node A) and must weight/use that information (“YES” at Node B) in order for the performance-relevant information contained in the non-financial measures to be reflected in their performance judgments.

The processing of non-financial measures by investors and their translation into judgments of future financial performance is made more complex by certain key features of non-financial measures. First, because non-financial measures are specific to each particular company’s operations, disclosures thereof vary from company to company, resulting in inconsistent presentation across companies. Non-financial measures are disclosed in different locations in financial reports, and are disclosed in different combinations depending upon the company. Additionally, the labels and definitions for non-financial measures vary from company to company. Second, non-financial measures are not monetized so there will be some effort required to translate performance on non-financial measures to the appropriate magnitude of effect in financial terms. Finally, non-financial measures often have lagged effects on future financial performance (Jackson, 2004), so the magnitude of effect determined earlier would need to be assigned to particular future periods. Because of these unique features, processing of non-financial measures and translating them into judgments of future financial performance is

a complex task, as it requires the integration of multiple inputs and outputs on the part of the investor.<sup>4</sup>

What would positively influence an investor's ability to retain and use non-financial intangibles information and to translate this information into judgments of future financial performance? It would seem that having a well-developed causal model would help investors process non-financial intangibles information. Investors with a well-developed causal model would have a framework for receiving information about non-financial measures, to counteract the lack of standardization of non-financial disclosures. In addition, investors with a well-developed causal model would have a better understanding of how inputs and outputs of the forecasting process are related, to counteract the non-monetized and lagged effect features of non-financial measures.

This leads to the next question—what factors lead to investors having well-developed causal models? Libby and Luft (1993) posit that judgment performance in accounting settings is a function of ability, knowledge, environment, and motivation.<sup>5</sup> Accordingly, characteristics of the decision-maker and characteristics of the task/environment can both potentially influence the outcomes on a task. Applying the Libby and Luft (1993) model to the current study, I propose that a well-developed causal model can be the result of

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<sup>4</sup> Bonner's (1994) model of audit task complexity suggests that task complexity is a function of the complexity (the amount and clarity) of inputs, processing, and outputs related to the task.

<sup>5</sup> Libby and Luft's (1993) model proposes that the four factors above (ability, knowledge, environment, and motivation) affect processing, which in turn affects "judgment performance" (the conceptual dependent variable). In this study, I am not examining judgment performance, per se, because I do not have a normative benchmark against which to measure performance. However, the Libby and Luft (1993) model is still applicable, because I am interested in how the four factors (or a subset of the four factors) affect processing.

characteristics of the investor (investor familiarity<sup>6</sup> with the industry) or characteristics of the environment (a decision aid, such as a causal links discussion). Ultimately, the presence of a well-developed causal model on the part of the investor affects whether they retain (“YES” at Node A) and use (“YES” at Node B) information on non-financial measures in their performance judgments.

### **3.2 THE ROLE OF FAMILIARITY ON INVESTOR PROCESSING OF NON-FINANCIAL INTANGIBLES INFORMATION**

Earlier, I suggested that the complex relationships between non-financial measures and future financial results could lead to NFM performance not being reflected in investors’ judgments of future financial performance. Investors who have familiarity with the industry setting are less likely to be susceptible to this complexity, because they are familiar with the non-financial measures that are the relevant inputs to an investment decision. An investor who is familiar with the industry setting is also more familiar with the value-generating process in the industry, and how non-financial inputs are translated into future financial performance in terms of magnitude and timing (i.e. they are more likely to have well-developed causal models). Accordingly, an investor who is familiar with the industry setting is expected to retain and use information contained in disclosures of non-financial measures if the information is disclosed, even if a supplemental causal links discussion is not

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<sup>6</sup> It is important to note that, in this study, I partition investors on the basis of (self-reported) familiarity with the industry setting, rather than on the basis of knowledge. Although knowledge and familiarity with the industry are not the same concept, the factors that contribute to familiarity with the industry (work experience, exposure through school projects) also contribute to knowledge. Accordingly, the selection of familiarity as the variable of interest in this study is consistent with the Libby and Luft (1993) framework.

provided. That is, a causal links discussion may be redundant with pre-existing high familiarity. Following this, an investor with high familiarity with the industry setting would incorporate more of the performance information contained in the non-financial measures in subsequent performance judgments, with disclosure alone.

### **3.3 THE ROLE OF ENVIRONMENT (CAUSAL LINKS DISCUSSION) ON INVESTOR PROCESSING OF NON-FINANCIAL INTANGIBLES INFORMATION**

Investors with low familiarity with the industry setting bring little to no knowledge of the industry to the forecasting task, so they could have difficulty processing non-financial measures in the face of the complex relationships between non-financial measures and future financial performance. However, there are aspects of the *task environment* that can be modified to provide causal models for these investors and to increase the incorporation of non-financial measures in their performance judgments. One such modification is to provide investors with supplemental information, causally linking non-financial measures to future financial performance (the causal links discussion). A look at firms' financial reports suggests that some firms are attempting to provide such linkages in their communications with investors. In its 1999 annual report Axcan Pharma reported:

“Our aim for the next five years is to have one product or new indication from our research program approved each year in the United States.....Axcan is conducting a double-blind study...in Canada and the United States. Once the study is completed in 2001, we will seek regulatory approval to promote URSO<sup>R</sup> 250 mg as an effective treatment for this disease in the United States. We foresee approval for this treatment by 2004, with potential revenues of US \$150 million.”

The Axcan disclosure links the innovation activity with the expected time to market and the potential future revenues, providing causal linkages of non-financial measures to future financial performance. However, linkage disclosures are not made by all companies on a consistent basis (Upton 2001), suggesting that there is some disagreement over the effectiveness of such disclosures.

Prior research in psychology suggests that information that is causally linked to a judgment variable tends to be attended to and used more. Einhorn and Hogarth (1986), Tversky and Kahneman (1980), and Ajzen (1977) argue that this is the case because individuals tend to organize events in terms of cause-and-effect relations. Indeed, in an early study in accounting that examines causal relations and auditor judgments, Kida (1984) finds that auditors' return on investment (ROI) assessments are more associated with cues that are causally linked to ROI than with cues that are not causally linked.

In Kida's (1984) study, the cues were inherently linked to ROI, and no explicit disclosure was made to enhance the perception of the causal link. However, there is evidence that supplemental explicit disclosure, providing information about causal relationships between variables, leads to a greater perceived relationship between the variables, especially if the inherent causal links are more obscure. In a recent illustration of this concept, Kim and Ahn (2002) provide individuals with symptoms of novel mental illnesses and vary whether symptoms are (1) deeper causes of other symptoms, (2) intermediate effects AND causes of other symptoms, (3) terminal effects, or (4) are causally unrelated to other symptoms. They find that causally unrelated symptoms are

given less weight in category membership (diagnosis) decisions. In other words, the disclosure affected the causal models developed by the individuals, which affected their subsequent judgments.

The examination of links in the present study is related to a number of recent experimental accounting studies that examine the transparency of financial information and its use in investor performance judgments. In these studies, the transparency of financial information is related to the degree to which it is linked to financial performance measures, with variables such as labeling, location, and inclusion in a performance measure affecting the degree of investors' perceived linkage.

Maines and McDaniel (2000) find that presentation format affects non-professional investors' *weighting* of comprehensive income information, which then flows through to subsequent investor judgments. Maines and McDaniel (2000) attribute their results in part to presentation format signaling to investors how relevant comprehensive income is to evaluating the company's performance. When comprehensive income information is presented in the income statement, the link between comprehensive income and firm performance is at the highest level, through the location, labeling, and linkage to net income associated with this format. When comprehensive income information is presented in the footnotes, the link between comprehensive income and firm performance is at the lowest level. Maines and McDaniel (2000) find that weighting of comprehensive income information is highest when the link between comprehensive income and firm performance is the highest.



Hirst et al (2003) find similar results in an experimental study of investors' reactions to disclosures of re-stated capitalized software costs. Specifically, they find that the most effective disclosure, where investors identified and corrected aggressive accounting estimates, explicitly described the implications of misestimation on both the balance sheet and on earnings (performance). Disclosures that only addressed the balance sheet implications of misestimation were not as effective. Similar to Maines and McDaniel (2000), the results of that study are consistent with the idea that linking disclosures to performance implications enhances the likelihood that the disclosed information will be incorporated into investors' performance judgments.

Other results in recent behavioral financial accounting research are consistent with this conjecture as well. In a setting with one-time prior period gains and losses, Krische (2001) finds a difference in investor judgments depending on how the (prior-period) benchmark is computed. Her findings suggest that investors receive a signal about how to treat prior period gains and losses, based on whether the prior period gain or loss is excluded from the benchmark. Similarly, Frederickson and Miller (2004) find that for non-professional investors, whether pro-forma reconciling items are included in a summary performance measure influences subsequent investor judgments. In both of these studies, investors receive a signal about how relevant a particular item is for valuation (in these two cases, linked by their inclusion in a performance measure), which affects how they treat the item in their investment judgments, consistent with the idea that links increase the relevance of a

disclosed measure for performance implications, which in turn increases the weight placed on that item in judgments of performance.

Note that most prior research in accounting that looks at the salience of links between a disclosed item and firm performance has focused on disclosures of *financial* items (comprehensive income, aggressive software capitalization, one-time gains/losses, pro-forma reconciling items). In this study, I examine the effect of providing a links discussion that makes the connection between a *non-financial* disclosure and future financial performance more salient. In the next section, I provide additional background information about causal links discussion and non-financial measures.

### **3.4 CAUSAL LINKS DISCUSSION AND NON-FINANCIAL MEASURES**

In recent years, a popular topic in the managerial accounting literature has been the importance of incorporating non-financial measures into performance measurement (Kaplan and Norton, 1992, 1993, 1996a, 1996b). One of the most discussed tools is the Balanced Scorecard, introduced by Kaplan and Norton (1992). The Balanced Scorecard specifies cause-and-effect paths linking financial and non-financial measures to the company's overall goal. It is hypothesized to be more effective than previous systems in facilitating managers' decisions (Kaplan and Norton, 2001) because providing linkages leads to managers internalizing non-financial measures more appropriately (Rucci, Kirn, and Quinn, 1998). In this study, I examine whether providing cause-and-effect linkages could also affect *investors'* incorporation of intangibles-related non-financial measures in their *investment* judgments.

While there are a number of studies suggesting that linking *financial* variables to performance indicators leads to those financial variables being incorporated in investor judgments, there is much less research involving causal links, *non-financial* information, and investor judgments. One exception to this is a study by Sedor (2002), who posits that financial analysts organize and reason using cause-and-effect relations. She varies the salience of the links between current period management initiatives (non-financial) and future financial outcomes, and finds that management's initiatives are more heavily weighted in analysts' judgments of future financial performance (leading to more optimistic judgments) when the links are more salient. Another exception examining financial and non-financial cues and auditor judgments is Earley (2001). In a real estate valuation task, she finds that novice auditors who are provided with explanation feedback when learning, consisting of patterns of information used and relations among cues (similar to the causal links discussion in this study) make more accurate judgments in subsequent post-tests.<sup>7</sup>

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<sup>7</sup> In another part of her study, Earley (2001) looks at the interplay between knowledge and explanatory feedback. She finds that explanatory feedback does not improve the judgments of auditors who have a "high reasoning" level (i.e. those auditors who made links between items of information and/or related the items to each other in terms of an overall pattern or story). For those auditors who made links already, receiving information about cue relationships does not improve their judgments, suggesting that having knowledge *ex ante* and receiving causal links discussion are substitutes. Earley's (2001) observations about auditors with a high reasoning level are consistent with findings in psychology that individuals with extensive domain experience are more likely to reason using causal models (Lopez et al, 1997).

### ***Primary (Performance-Related) Hypotheses related to Causal Links Discussion***

Figure 1 indicates that even if non-financial information is disclosed, there are pitfalls at nodes along the way, where investors who lack well-developed causal models about non-financial measures and their relationships with financial measures could diverge from the path, and end up with a performance judgment that does not reflect performance on non-financial measures.

This could be due to problems with information retention, where investors lack a framework to effectively encode non-financial information in memory (“NO” at Node A). Separately, investors may encounter non-financial intangibles information and retain that information in memory, but because the implications for earnings are not clear (the framework is poorly developed), investors do not use/weight this information, so that it is not reflected in their performance judgments (“NO” at Node B). Either of these scenarios could lead to newly disclosed non-financial information (if disclosed alone) not being incorporated in investors’ performance judgments.

On the other hand, when investors have well-developed causal models (from either pre-existing familiarity or causal links discussion), causal reasoning is aided, and they are able to retain and use the information contained in non-financial measures and reflect it in subsequent investment judgments.

Based on the discussion in the preceding sections, I hypothesize that non-financial measures will not be incorporated into low familiarity investors’ performance judgments when there is no causal links discussion and will be

incorporated into investors' performance judgments when there is links discussion or high familiarity. As discussed earlier, disclosures of non-financial intangibles information will reveal firms to either be performing above or below-average on their non-financial measures. I hypothesize that low familiarity investors' judgments will reflect less differentiation between the above and below-average firms when causal links discussion is not provided and will reflect more differentiation when causal links discussion is provided.

These hypotheses are formalized as follows:

H1: Low familiarity investors' performance judgments will not reflect information contained in disclosures of non-financial intangibles information, and will not differentiate between above-average, below-average, and non-disclosing (control/baseline condition) firms, with disclosure alone.

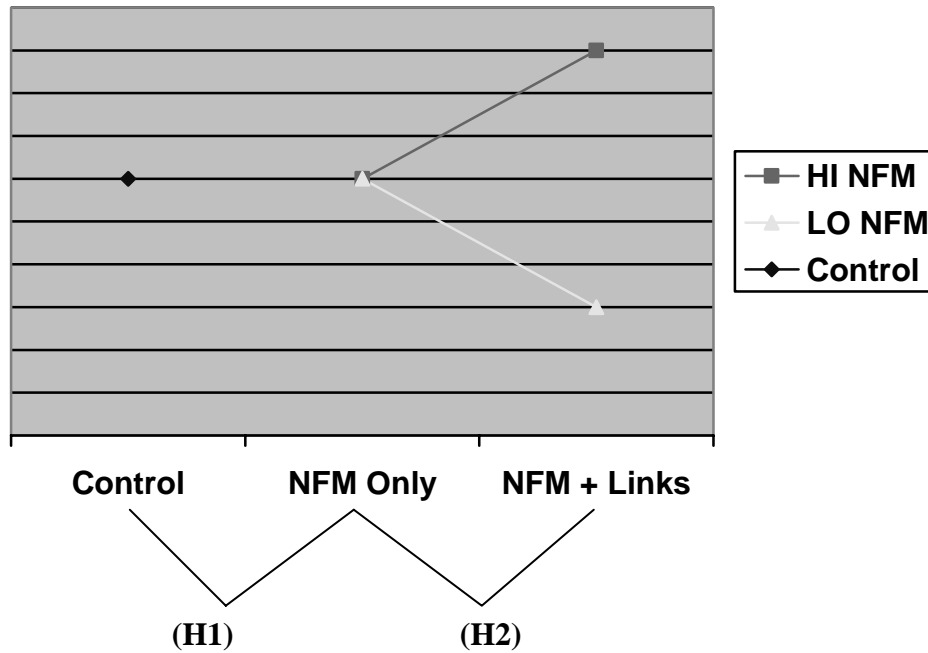
H2: The information contained in disclosures of non-financial intangibles information will affect low familiarity investors' performance judgments more when causal links discussion is provided than when it is not provided.

Although hypotheses 1 and 2 are directed toward low familiarity investors, these hypotheses will also be tested using the full sample of high and low familiarity investors.

See Figure 2 for a pictorial summary of the primary hypotheses.

FIGURE 2 - Pictorial Summary of Hypotheses 1 and 2

DV= Revenue/Revenue Growth



Hypothesis 2 predicts a difference between above-average and below-average firms when causal links are provided. I do not make a formal prediction about how judgments in these two links conditions compare to judgments in the control/baseline (no disclosure) condition. Verrecchia (1983) observes that in the absence of proprietary costs of voluntary disclosure, rational expectations traders will infer bad news as soon as it becomes apparent that information is being withheld. Thus, in this study, if there is no disclosure,

investors may infer low performance. On the other hand, investors may have no ex ante expectation of disclosure (i.e. no belief that something is being withheld), as I believe is the case in this study. I believe this because disclosures are not standardized and vary from company to company, so expectations are not formed. Thus investors would not infer low performance from non-disclosure, but would instead infer an average level of performance. If this is the case, then judgments would be lower for the below-average links discussion firm, as compared to the non-disclosing (perceived to be average) firm. Similarly, for hypothesis 1, I assume that investors have no ex ante expectation of disclosure, so their performance judgments are based on the content (if provided) of the NFM disclosures.

### ***Hypotheses Related to Process and Intermediate Stage Cognitions***

I am also interested in identifying the process/path through which any observed effect of causal links discussion on investors' performance judgments occurs. The supplemental links discussion is hypothesized to assist investors in developing a causal model related to non-financial measures. The existence of a causal model is hypothesized to have two effects. One is to provide a framework for the investor, similar to that of an advance organizer, initially researched by Ausubel (1968). Ausubel (1968) defines advance organizers as "appropriately relevant and inclusive introductory materials...introduced in advance of learning and presented at a higher level of abstraction, generality, and inclusiveness" (p.148).

In other advance organizer research, Mayer, Dyck, and Cook (1984) examine whether other advance organizer techniques assist in the development

of frameworks and mental models and enhance recall. Mayer et al (1984) examine the effect of providing definitions of key terms of a cause-and-effect system. They find that providing definitions enhances recall and enhances problem-solving performance. More related to the present study, Mayer et al (1984) also examine whether signaling the key causal links of the cause-and-effect system affects recall. They find that signaling the key causal links also enhances recall and enhances problem-solving performance.

The insights gained from prior psychology research on advance organizers are applicable to the present study of causal links discussion and non-financial intangibles disclosures. The causal links discussion illustrates how the firm's non-financial measures are linked to future financial performance. If investors are provided with cause-and-effect links, they have an existing structure with which to receive new non-financial intangibles information. With this structure in place, more associations between non-financial measures and the existing structure are made, and the associations that are made are more salient and are retained better, because the future financial effects of today's non-financial measures can be envisioned. If causal links discussion affects information retention as hypothesized, differences in investors' retention of non-financial intangibles information should be reflected their recall of non-financial information. Accordingly, I propose the following process hypothesis:

H3: Recall of performance on non-financial measures will be higher for investors who receive the causal links discussion than for investors who do not receive it.



Links are also hypothesized to make the outcomes/implications on future financial performance of non-financial measures more transparent. If causal links discussion affects information weighting and use, as hypothesized, then providing a links discussion about how non-financial measures are linked to future financial performance will lead to an increased belief that non-financial measures are relevant for valuation. Accordingly, I propose the following hypothesis:

H4: The frequency of references to performance on non-financial measures in investors' written explanations for their judgments will be higher for investors who receive the causal links discussion than for investors who do not receive it.

## Chapter 4: Description of Method

To test the hypotheses, I conducted an experiment in which 87 MBA students at a large state university participated. Participants were recruited by way of an e-mail notice and were paid a flat wage of \$10 plus the chance of winning a random cash drawing. On average, study participants had 5.7 years of work experience and had completed 2.5 accounting classes and 3.1 finance classes. Eighty-three percent indicated that they had invested in common stock or in a common stock mutual fund; 100 percent indicated that they had invested or planned to invest in common stock.

Participants were asked to assume the role of an investor evaluating the common stock of a pharmaceutical firm. The hypothetical firm was profitable, with products already in the market and products in the pipeline. This context is the prototypical inter-temporal intangibles situation, with R&D expenditures incurred up front, and cash and earnings payoffs in subsequent years. The hypothetical firm was developed based on a composite of profitable publicly-traded pharmaceutical firms with less than \$500 million in annual revenues.

Two factors were manipulated and fully crossed. When combined with a control condition, this results in a 2 X 2 plus 1 between-subjects design. The first manipulated factor was *causal links discussion*, where participants who received a report on non-financial measures, either received it with or without a supplemental discussion of how the firm's non-financial intangibles measures were linked to future financial performance. The second manipulated factor was

*level of non-financial performance*, where the disclosing firm was identified as having either above-average performance (HI NFM) or below-average performance (LO NFM) on non-financial measures. This performance manipulation was used to examine whether and when investors incorporate the content of non-financial intangibles disclosures in their judgments. The “plus 1” was a control condition where participants received neither the report on non-financial measures nor the links discussion. The specific non-financial measures that were manipulated to be above-average and below-average were based on key factors identified in pharmaceutical companies’ Form 10K filings and annual reports. The specific levels chosen to be HI, LO, and Industry Average were based on disclosures in pharmaceutical companies’ Form 10K filings and annual reports. All materials were pre-tested with Ph.D. students, including some with professional financial analysis experience, and some with experience in the pharmaceutical industry. Results from pre-testing indicated that the non-financial measures that were manipulated and the selected levels of performance were considered reasonable and realistic by the participants.

In Part A of the experiment, participants were provided with background information about the pharmaceutical company. At this time, participants in the causal links discussion condition also received a supplemental discussion of how the firm’s non-financial intangibles measures were linked to future financial performance. The supplemental discussion contained a narrative, graphical, and matrix description of the links (see Appendix A).

In Part B, participants were provided with a stylized press release reporting current year results. The press release discussed financial results for the year just ended, and included comparative income statements, condensed balance sheets, and a report on the company's non-financial measures.

The level of non-financial performance was manipulated in this stage of the experiment. The non-financials report for participants in the HI NFM (LO NFM) condition showed the company to be performing above (below) the industry average on its key linked non-financial measures (see Appendix A). The HI/LO NFM manipulation was intended to reflect the variation in firms' values that investors would need to differentiate (even when R&D spending is held constant between firms). Participants in the control condition did not receive a report on the company's non-financial measures. Otherwise, the discussion of financial results, income statements, and condensed balance sheets were identical in all conditions.

After reviewing the background information and the earnings announcement package, participants were instructed to make predictions of the company's future financial performance (next year's net income, next year's revenue, net income growth, and revenue growth). The next year net income and revenue questions were open-ended questions with no response scale provided. Participants also answered an open-ended question on how they arrived at their net income judgment. Participants were also asked for second order judgments, including the level of confidence in the accuracy of their next year net income and revenue judgments, and an optimistic and pessimistic prediction for next year net

income and next year revenue, representing the upper and lower bounds, respectively, of a 95% confidence interval.

The session concluded with participants responding to a series of post-experimental questions about the case, including manipulation checks and demographic questions, including a question asking participants to rate their familiarity level with the pharmaceutical industry.

I use next year's revenue and revenue growth (3 to 5 years out) as the primary dependent variables for this study. As discussed earlier, because of the discretionary nature surrounding R&D spending and the assumptions that investors must make about the future R&D spending strategy of the firm, earnings-related dependent variables are noisier. At the same time, revenue is an input into valuation (as it is an input into earnings), so there is validity to using it as a dependent variable, without it being confounded by expectations of R&D expense. Also, although I use next year's revenue and revenue growth (3 to 5 years out) interchangeably as operationalizations of future financial performance, different investor perceptions of the *timing* of the benefits from R&D (brought on by disclosure of non-financial measures and/or familiarity and cause-and-effect links) could lead to different results for these two dependent variables.

## Chapter 5: Results

### 5.1 MANIPULATION AND OTHER CHECKS

The results from the manipulation check questions reveal that participants saw the two manipulated variables as intended. For the causal links discussion variable, I reasoned that the usefulness of non-financial measures would be higher for participants who received the links discussion than for those who did not. As expected, participants who received the causal links discussion rated the usefulness of non-financial measures (in predicting net income) higher (mean of 11.00 on a 15-point scale with 1 as “not at all useful” and 15 as “extremely useful”) than those who did not receive the links discussion (mean of 9.77) ( $F=2.369$ ,  $p=.06$ , one-tailed).

For the non-financial measures performance manipulation, I reasoned that the performance on non-financial measures should affect participants’ evaluations of management’s competence and the quality of the job that management was doing in its stewardship of the company. As expected, participants receiving HI NFM performance rated management’s competence higher (mean of 9.83 on a 15-point scale with 1 as “not at all competent” and 15 as “very competent”) than participants receiving LO NFM performance (mean of 8.63) ( $F=5.900$ ,  $p=.01$ , one-tailed). Similarly, participants receiving HI NFM performance rated management’s stewardship of the company higher (mean of 9.49 on a 15-point scale with 1 as “very poor job” and 15 as “outstanding/excellent job”) than

participants receiving LO NFM performance (mean of 8.24) ( $F=6.290$ ,  $p=.01$ , one-tailed). Overall, these results indicate that the manipulations were successful.

The data analysis in the following sections is organized as follows: In Section 5.2, I provide evidence of noise in the net income and net income growth measures, which leads to these measures being dropped from subsequent analysis. In Section 5.3, I analyze the data for the full sample on the primary hypotheses (Hypotheses 1 and 2). The results are mixed, so I do not perform the analysis of the mediating processes. In Section 5.4, I analyze the data for the high familiarity subset. In Sections 5.5 and 5.6, I analyze the data for the low familiarity subset, the investors who were most likely to be affected by the provision of supplemental links. In Section 5.5, I analyze the data for the primary hypotheses and in Section 5.6, I analyze the data for the intermediate stage judgments. In Section 5.7, I analyze the causal models elicited from participants during the experiment, which may provide information on the causal models used by investors. Finally, in Section 5.8, I analyze the data for second-order judgments. A summary of the results organized by hypotheses is as follows:

Table 1 - Summary of Results

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	<u>Full Sample</u>	<u>Low Familiarity</u>
Hypothesis 1 (No effect of expanded NFM disclosure alone)	Partially supported	Supported
Hypothesis 2 (Effect of causal links discussion)	Partially supported	Supported
Hypothesis 3 (Recall of non-financial performance)	N/A	Not supported
Hypothesis 4 (References to NFM in explanations)	N/A	Partially supported

## **5.2 NOISE IN THE NET INCOME AND NET INCOME GROWTH MEASURES**

Earlier, I provided a rationale for my choice of revenue and revenue growth as the primary dependent variables for this study. Because of the discretionary nature surrounding R&D spending, investors would have to make assumptions about the future R&D spending levels of the firm, leading to increased noise in the net income and net income growth measures.

As discussed earlier, participants were asked to explain how they arrived at their net income judgments. Analysis of participants' explanations for their net income judgments indicates that these judgments were strongly influenced by participants' expectations and assumptions about R&D expense. Seventy-seven percent of participants referred to R&D expense in their explanations of how they



arrived at their net income judgment, and 56% of participants indicated that they adjusted R&D expense from the current year to arrive at their next year net income estimate. Some participants believed that R&D in 2002 was unusually high, so R&D expense would be lower in the next year. Some participants believed that R&D expense would be higher next year, either to sustain the many products in the company's research and development pipeline (those in the HI NFM condition) or to catch up to their competitors who had more products in their pipeline (those in the LO NFM condition). These idiosyncratic adjustments for R&D made by participants contributed to the noise in the net income and net income growth dependent measures. Accordingly, these net income measures are dropped from the analysis, and I focus on next year revenue and revenue growth in the analysis and discussion that follows.

### **5.3 PRIMARY HYPOTHESES - FULL SAMPLE**

Descriptive statistics for the main dependent variables are reported in Table 2 and are presented in a graph in Figure 3.

Table 2 - Descriptive Statistics (Full Sample)

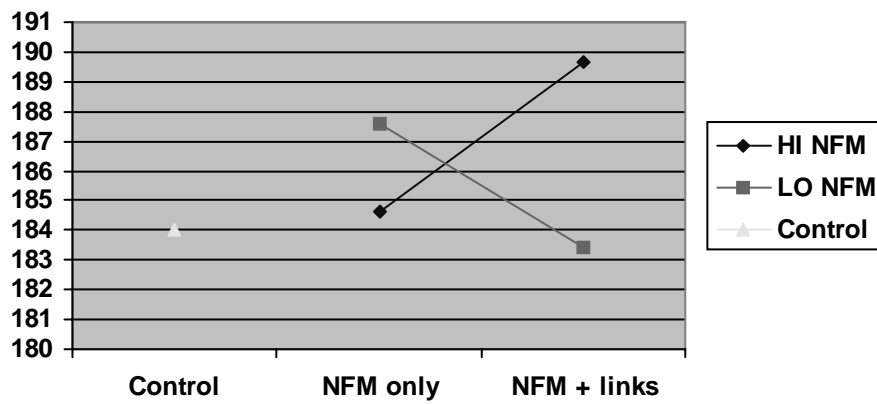
Mean Next Year Revenue Judgments (Standard Deviation)			
		<u>No Links</u>	<u>Links</u>
	HI NFM	184.66 (14.82) N=18	189.64 (11.71) N=18
Control	184.01 (7.21) N=17		
	LO NFM	187.57 (13.26) N=17	183.43 (14.27) N=17
Mean Revenue Growth Judgments (Standard Deviation)			
		<u>No Links</u>	<u>Links</u>
	HI NFM	11.47 (1.83) N=18	11.68 (1.78) N=18
Control	10.54 (2.15) N=17		
	LO NFM	9.12 (3.16) N=17	9.40 (3.45) N=17

This table shows the descriptive statistics for next year revenue and revenue growth judgments for the full sample. Study participants were randomly assigned to one of five conditions, in a 2 X 2 plus 1 between-subjects design. In these conditions, they were provided with no disclosures of non-financial measures (control condition), disclosures of non-financial measures with no supplemental links information (no links), or disclosures of non-financial measures with supplemental links information (links). For the no links and links conditions, the disclosures of non-financial measures revealed the company to be performing above-average (HI NFM) or below-average (LO NFM) on key non-financial measures. As part of the experimental task, participants were asked to provide judgments of next year revenue and revenue growth (3 to 5 years out). The next year estimate was elicited as an open-ended question (no response scale was used). Participants provided the growth judgment on a 15-point Likert Scale, with the end points labeled 1=“very weak” and 15 = “very strong”).

FIGURE 3 - Full Sample Results

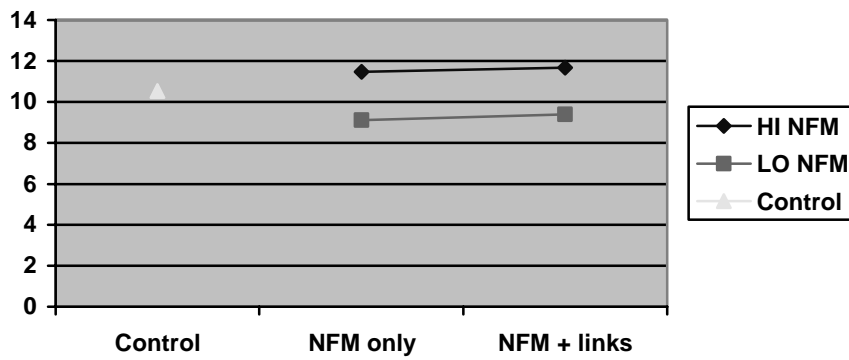
Panel A (Full Sample-Next Year Revenue)

DV = Next Year Revenue



Panel B (Full Sample-Revenue Growth)

DV = Revenue Growth



***Effect of Disclosing Non-Financial Measures Alone (Hypothesis 1)***

Recall that hypothesis 1 predicts that investors will not differentiate between HI NFM, LO NFM, and no NFM firms if non-financial measures are disclosed alone. To test this, a series of 1 X 3 ANOVA's was performed, with condition (no NFM vs. HI NFM-No links vs. LO NFM-No links) as the between-subjects variable.<sup>8</sup> Results are reported in Table 3.

Table 3 - Tests of Hypothesis One (Full Sample)

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**Panel A: Analysis of Variance with next year revenue as the dependent variable**

Source	d.f.	F-statistic	Probability
Between group	2	.408	.667
Within group	49		

**Panel B: Analysis of Variance with revenue growth as the dependent variable**

Source	d.f.	F-statistic	Probability
Between group	2	4.131	.022
Within group	49		
Contrasts		t-statistic	
HI NFM vs. LO NFM		2.677	.01
HI NFM vs. No NFM		1.368	.18
LO NFM vs. No NFM		1.541	.13

When next year revenue is used as the dependent variable, the results of the ANOVA indicate no significant effect for condition ( $F=.408$ ,  $p=.67$ ) (Table 3,

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<sup>8</sup> A MANOVA with 2 dependent variables (revenue and revenue growth) was performed before running the ANOVA analyses (Wilks' Lambda,  $F=2.375$ ,  $p=.06$ ).

Panel A). This “no effect” result suggests that investors do not distinguish between HI NFM, LO NFM, and no NFM firms, consistent with hypothesis 1.

When revenue growth (3 to 5 years out) is used as the dependent variable, the results of the omnibus 1 X 3 ANOVA indicate a significant effect for condition ( $F=4.131$ ,  $p=.02$ )<sup>9</sup> (Table 3, Panel B). Follow-up contrasts indicate that revenue growth estimates were higher for investors in the HI NFM condition than for investors in the LO NFM condition ( $t=2.677$ ,  $p=.01$ , two-tailed), using the separate variance approach outlined by Maxwell and Delaney (1990), to account for heterogeneity of variances in the data. For the revenue growth dependent variable, investors, even without links, were able to differentiate between the above-average and below-average firm. This result is not consistent with hypothesis 1. Other follow-up contrasts indicate that revenue growth estimates for investors in the HI NFM condition were not significantly different than revenue growth estimates for investors in the no NFM condition ( $t=1.368$ ,  $p=.18$ , two-tailed). Additionally, revenue growth estimates for investors in the LO NFM condition were not significantly different than revenue growth estimates for investors in the no NFM condition ( $t=1.541$ ,  $p=.13$ , two-tailed).

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<sup>9</sup> The standard deviations for revenue growth judgments in the 5 conditions are significantly different (Levene statistic = 5.458, thus the null hypothesis of homogenous variances can be rejected at  $p<.01$ ). The implications of this violation of the assumption of homogeneous variances are varied. Hays (1994) and Maxwell and Delaney (1990) conclude that an omnibus ANOVA test is robust to violations of the assumption of homogeneous variances “provided that the *number of cases* in each sample is the *same*” (Hays, 1994, pg. 407). Hays (1994, pg. 407) goes on to define “same” as the ratio of the number of cases in the largest group to the number of cases in the smallest group being less than 1.5, which is the case for this study. Accordingly, the ANOVA reported below is neither liberal nor conservative, despite the violation of homogeneous variances. On the other hand, Maxwell and Delaney (1990) report that “tests of contrasts are not robust to heterogeneity”, even with equal sample sizes, requiring the use of a “separate variance approach” (Maxwell and Delaney, 1990), or the use of nonparametric tests that are distribution free.

In summary, providing non-financial measures alone was effective in helping investors differentiate between HI NFM and LO NFM firms when investors were asked about revenue growth, but not when asked about next period revenue. This suggests that, on average, investors brought enough industry knowledge (familiarity) to the table (i.e. they had their own links) to use NFM, even with disclosure alone (without links). The fact that NFM performance was more readily reflected in the revenue growth dependent variable (3 to 5 years out) than in the next year revenue estimate suggests that the familiarity that some investors already had linked NFM performance to periods beyond, but not including, the immediate next year. This could be the case if investors observe the level of NFM performance and evaluate the historical performance as HI or LO (as they did in the performance manipulation check questions), but have difficulty understanding the timing of benefits and translating historical NFM performance to future financial performance in particular periods. Absent the links, it appears in this case that there is a belief among investors that the financial effects of current period NFM performance would be realized more in the long-term.

***Effect of Disclosing Non-Financial Measures with Causal Links Discussion (Hypothesis 2)***

Recall that hypothesis 2 predicts that investors can better differentiate between HI NFM and LO NFM firms when links are provided. To test this, a

series of 2 x 2 ANOVA's was performed, with causal links discussion and NFM performance as the independent variables.<sup>10</sup> Results are reported in Table 4.

Table 4 - Tests of Hypothesis Two (Full Sample)

**Panel A: Analysis of Variance with next year revenue as the dependent variable**

Source	d.f.	F-statistic	Probability
NFM performance	1	.259	.612
Links	1	.016	.898
NFM performance X Links	1	1.977	.082 (1-tailed)

**Panel B: Analysis of Variance with revenue growth as the dependent variable**

Source	d.f.	F-statistic	Probability
NFM performance	1	13.430	<.01
Links	1	.149	.701
NFM performance X Links	1	.004	.476 (1-tailed)

First, I examine the effect of providing causal links with next year revenue as the dependent variable. As indicated in table 4, panel A, there is a marginally significant links by performance interaction ( $F=1.977$ ,  $p=.08$ , one-tailed<sup>11</sup>), with no main effect for either links or performance. Follow-up simple effects tests indicate that, when NFM are provided without causal links, revenue judgments for HI NFM and LO NFM are not significantly different ( $F=.402$ ,  $p=.53$ ). When

<sup>10</sup> A MANOVA with 2 dependent variables (revenue and revenue growth) was performed before running the ANOVA analyses (for the interaction, Wilks' Lambda,  $F=.970$ ,  $p=.38$ ) (however, as the analysis for hypothesis 1 above indicates, in this instance, next year revenue and revenue growth may be capturing perceptions of the differential timing of future revenues).

<sup>11</sup> McNeil, Newman, and Kelly (1996) advise extending the usual logic of a one-sided hypothesis test to directional tests of single-degree-of-freedom interactions between two factors.

causal links are added, revenue predictions are (marginally) higher for HI NFM vs. LO NFM ( $F=1.834$ ,  $p=.09$ , one-tailed), consistent with hypothesis 2.

When revenue growth is used as the dependent variable (table 4, panel B), there is no significant interaction ( $F=.004$ ,  $p=.48$ , one-tailed), which is not consistent with hypothesis 2. There is a main effect for NFM performance ( $F=13.430$ ,  $p<.01$ ), and no effect for links ( $F=.149$ ,  $p=.70$ ). This is consistent with the earlier result for hypothesis 1 that investors' judgments of revenue growth reflect performance on NFM even when causal links are not provided.

The mixed results for the full sample suggest that the causal links discussion informs investors about the immediacy (but not the direction or magnitude, which they already know about) of future financial effects from current period non-financial performance. Even without causal links, full sample participants link current non-financial performance to revenue growth 3 to 5 years out. But these participants do not reflect non-financial performance in the more immediate "next year revenue" dependent measure, unless they receive the causal links discussion.

The premise underlying hypotheses 1 and 2 is that causal links provide information about cause-and-effect relations, allowing investors to understand non-financial measures and their implications for future financial performance. However, if investors already have familiarity with the industry setting to use non-financial measures, then providing the links may not make a difference. This may explain the mixed results observed above with the full sample.



To better understand the role of industry familiarity in using non-financial measures, I partition my sample and separately analyze the responses for participants having high familiarity and participants having low familiarity. High familiarity participants are expected to have pre-existing causal models, so their “no links” judgments should resemble the “with links” judgments of low familiarity participants. At the same time, providing causal links may be redundant for these participants. Low familiarity participants are expected to benefit the most from having causal links provided, so focusing on low familiarity participants provides for a stronger test of the role of causal links in moderating judgments about non-financial measures.

In the demographic questions in the experimental materials, I asked participants to indicate their level of familiarity with the pharmaceutical industry on a 7-point scale, with the endpoints labeled 1=“not familiar at all” and 7=“very familiar.” To partition the sample, I designated those participants who rated themselves 4 or lower as “low familiarity” participants (n=63), and those participant who rated themselves 5 or higher as “high familiarity” participants (n=24).<sup>12</sup>

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<sup>12</sup> To explicitly test the joint effect of NFM, links, and familiarity, I ran a 2 X 2 X 2 MANOVA (using the 2 dependent variables identified earlier), with NFM performance, links, and a dichotomous familiarity variable, coding participants who rated themselves a 5 or higher on familiarity with the pharmaceutical industry as High and participants who rated themselves a 4 or lower on familiarity as Low (note that this results in unequal cell sizes). The results of the 3-way MANOVA are significant (F=4.706, p=.013). However, this result for this MANOVA is sensitive to the “cut-point” used to determine High and Low familiarity participants. When I code participants who rated themselves a 4 or higher on familiarity as High and participants who rated themselves a 3 or lower on familiarity as Low, the results of the MANOVA are not significant (F=1.651, p=.20). When I code participants who rated themselves a 3 or higher on familiarity as High and participants who rated themselves a 2 or lower on familiarity as Low, the results of the MANOVA are significant (F=2.768, p=.07). Consequently, these ex post analyses should be interpreted with caution.

#### **5.4 HIGH FAMILIARITY SUBSET**

Descriptive statistics for the main dependent variables for the twenty-four high familiarity participants are reported in Table 5.

Table 5 - Descriptive Statistics (High Familiarity Subset)

Mean Next Year Revenue Judgments (Standard Deviation)			
		<u>No Links</u>	<u>Links</u>
	HI NFM	185.77 (16.11) N=5	193.20 (16.08) N=5
Control	183.75 (6.29) N=4		
	LO NFM	185.50 (11.73) N=4	190.83 (10.21) N=6
Mean Revenue Growth Judgments (Standard Deviation)			
		<u>No Links</u>	<u>Links</u>
	HI NFM	13.02 (1.86) N=5	12.00 (0.71) N=5
Control	11.40 (2.70) N=4		
	LO NFM	6.65 (3.30) N=4	11.35 (3.80) N=6

This table shows the descriptive statistics for next year revenue and revenue growth judgments for participants who rated themselves 5 to 7 on “familiarity with the pharmaceutical industry.” Study participants were randomly assigned to one of five conditions, in a 2 X 2 plus 1 between-subjects design. In these conditions, they were provided with no disclosures of non-financial measures (control condition), disclosures of non-financial measures with no supplemental links information (no links), or disclosures of non-financial measures with supplemental links information (links). For the no links and links conditions, the disclosures of non-financial measures revealed the company to be performing above-average (HI NFM) or below-average (LO NFM) on key non-financial measures. As part of the experimental task, participants were asked to provide judgments of next year revenue and revenue growth (3 to 5 years out). The next year estimate was elicited as an open-ended question (no response scale was used). Participants provided the growth judgment on a 15-point Likert Scale, with the end points labeled 1=“very weak” and 15 = “very strong”).

Recall that hypothesis 1 (directed toward low familiarity investors) predicted that investors will not differentiate between HI NFM, LO NFM, and no NFM firms if non-financial measures are disclosed alone. However, for high familiarity investors who have well-developed causal models involving non-financial measures, I expect them to differentiate between the HI NFM, LO NFM, and no NFM firms. To test this, I performed a series of ANOVA's on the high familiarity subset, with condition (no NFM vs. HI NFM-No links vs. LO NFM-No links) as the between-subjects variable. Results are reported in Table 6.

Table 6 - Tests of Hypothesis One (High Familiarity Subset)

**Panel A: Analysis of Variance with next year revenue as the dependent variable**

Source	d.f.	F-statistic	Probability
Between group	2	.032	.97
Within group	10		

**Panel B: Analysis of Variance with revenue growth as the dependent variable**

Source	d.f.	F-statistic	Probability
Between group	2	6.889	.01
Within group	10		

When next year revenue is used as the dependent variable, the results of the ANOVA indicate no significant effect for condition ( $F=.032$ ,  $p=.97$ ) (table 6, panel A). This “no effect” result is consistent with hypothesis 1, but is not consistent with the notion that high familiarity investors bring knowledge about

non-financial measures to the task. When revenue growth (3 to 5 years out) is used as the dependent variable, the results of the omnibus 1 X 3 ANOVA for the high familiarity participants indicate a significant effect for condition ( $F=6.889$ ,  $p=.01$ ) (table 6, panel B), consistent with the notion that high familiarity investors are able to differentiate between above and below-average firms and to reflect these differences in judgments of future financial performance, even when causal links are not provided. Given the especially small sample size and the sensitivity to the cut point used to partition high and low familiarity investors, these results should be interpreted with caution.

***Effect of Disclosing Non-Financial Measures with Causal Links Discussion (Hypothesis 2)***

For high familiarity investors, providing links is expected to be redundant, leading to a prediction of a main effect for performance and no performance by links interaction. To test this prediction, I performed a series of 2 x 2 ANOVA's on the high familiarity subset, with causal links discussion and NFM performance as the independent variables. Results are reported in Table 7.

Table 7 - Tests of Hypothesis Two (High Familiarity Subset)

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**Panel A: Analysis of Variance with next year revenue as the dependent variable**

Source	d.f.	F-statistic	Probability
NFM performance	1	.045	.834
Links	1	1.061	.318
NFM performance X Links	1	.029	.868

**Panel B: Analysis of Variance with revenue growth as the dependent variable**

Source	d.f.	F-statistic	Probability
NFM performance	1	8.006	.012
Links	1	2.200	.157
NFM performance X Links	1	5.316	.035

First, I examine the effect of providing causal links with next year revenue as my dependent variable. As indicated in table 7, panel A, there is no significant links by NFM performance interaction, and no main effect for either links or NFM performance, contrary to expectations.

When revenue growth is used as the dependent variable (table 7, panel B), there is a significant links by NFM performance interaction ( $F=5.316$ ,  $p=.04$ , one-tailed). Follow-up simple effects tests indicate that, when NFM are provided without causal links, revenue growth judgments for HI NFM and LO NFM are significantly different. When causal links are added, revenue growth predictions become *less* differentiated, contrary to expectations. Once again, given the especially small sample size and the sensitivity to the cut point used to partition

high and low familiarity investors, these results should be interpreted with caution.

## **5.5 LOW FAMILIARITY SUBSET - PRIMARY HYPOTHESES**

Descriptive statistics for the main dependent variables for the 63 low familiarity participants are reported in Table 8 and are presented in a graph in Figure 4.

Table 8 - Descriptive Statistics (Low Familiarity Subset)

Mean Next Year Revenue Judgments (Standard Deviation)			
		<u>No Links</u>	<u>Links</u>
	HI NFM	184.23 (14.98) N=13	188.27 (10.04) N=13
Control	184.08 (7.70) N=13		
	LO NFM	188.21 (14.07) N=13	179.38 (14.92) N=11
Mean Revenue Growth Judgments (Standard Deviation)			
		<u>No Links</u>	<u>Links</u>
	HI NFM	10.87 (1.48) N=13	11.55 (2.07) N=13
Control	10.28 (2.00) N=17		
	LO NFM	9.88 (2.82) N=13	8.34 (2.87) N=11

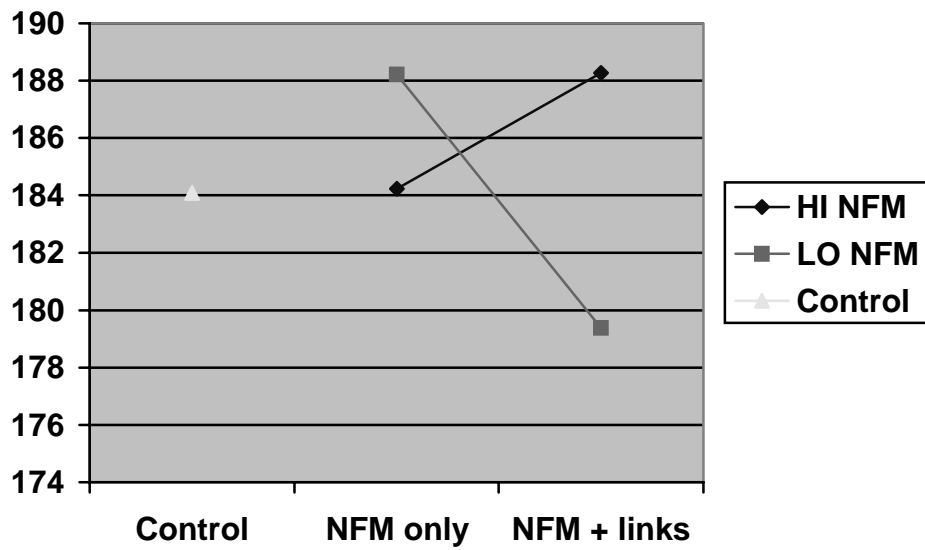
This table shows the descriptive statistics for next year revenue and revenue growth judgments for participants who rated themselves 1 to 4 on “familiarity with the pharmaceutical industry.” Study participants were randomly assigned to one of five conditions, in a 2 X 2 plus 1 between-subjects design. In these conditions, they were provided with no disclosures of non-financial measures (control condition), disclosures of non-financial measures with no supplemental links information (no links), or disclosures of non-financial measures with supplemental links information (links). For the no links and links conditions, the disclosures of non-financial measures revealed the company to be performing above-average (HI NFM) or below-average (LO NFM) on key non-financial measures. As part of the experimental task, participants were asked to provide judgments of next year revenue and revenue growth (3 to 5 years out). The next year estimate was elicited as an open-ended question (no response scale was used). Participants provided the growth judgment on a 15-point Likert Scale, with the end points labeled 1=“very weak” and 15 = “very strong”).



FIGURE 4 - Low Familiarity Subset Results

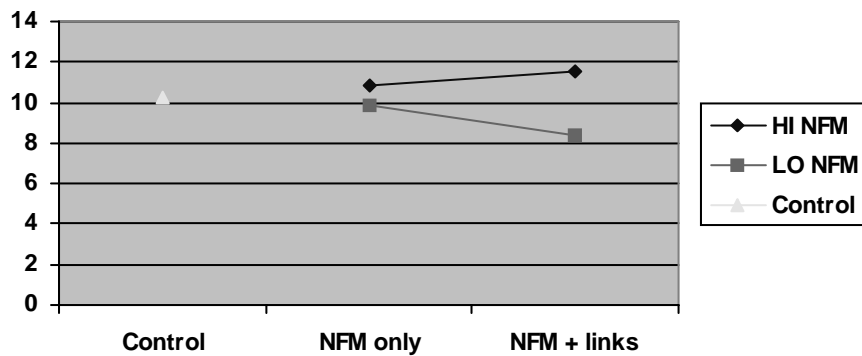
Panel A (Low Familiarity Subset-Next Year Revenue)

DV= Next Year Revenue



Panel B (Low Familiarity Subset-Revenue Growth)

DV= Revenue Growth



***Effect of Disclosing Non-Financial Measures Alone (Hypothesis 1)***

To re-test the hypothesis that investors will not differentiate between HI NFM, LO NFM, and no NFM firms if non-financial measures are disclosed alone, I performed a series of ANOVA's on the low familiarity subset, with condition (no NFM vs. HI NFM-No links vs. LO NFM-No links) as the between-subjects variable.<sup>13</sup> Results are reported in Table 9.

**Table 9 - Tests of Hypothesis One (Low Familiarity Subset)**

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**Panel A: Analysis of Variance with next year revenue as the dependent variable**

Source	d.f.	F-statistic	Probability
Between group	2	.442	.65
Within group	36		

**Panel B: Analysis of Variance with revenue growth as the dependent variable**

Source	d.f.	F-statistic	Probability
Between group	2	.696	.51
Within group	36		

When next year revenue is used as the dependent variable, the results of the ANOVA indicate no significant effect for condition ( $F=.442$ ,  $p=.65$ ) (table 9, panel A). This “no effect” result is consistent with hypothesis 1. When revenue growth (3 to 5 years out) is used as the dependent variable, the results of the

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<sup>13</sup> A MANOVA with 2 dependent variables (revenue and revenue growth) was performed before running the ANOVA analyses (all measures, highest  $F=1.04$ , lowest  $p=.36$ ).

omnibus 1 X 3 ANOVA for the low familiarity participants now indicate no significant effect for condition ( $F=.696$ ,  $p=.51$ ) (table 9, panel B), consistent with hypothesis 1.

Overall, as predicted, for the low familiarity subset, disclosure alone of non-financial measures does not lead to more differentiated investor judgments, even when NFM performance is unambiguously above or below-average.

***Effect of Disclosing Non-Financial Measures with Causal Links Discussion (Hypothesis 2)***

To re-test the prediction that investors can better differentiate between HI NFM and LO NFM firms when causal links are provided, I performed a series of 2 x 2 ANOVA's on the low familiarity subset, with causal links discussion and NFM performance as the independent variables.<sup>14</sup> Results are reported in Table 10.

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<sup>14</sup> A MANOVA with 2 dependent variables (revenue and revenue growth) was performed before running the ANOVA analyses (for the interaction, Wilks' Lambda,  $F=2.773$ ,  $p=.04$ , one-tailed).

Table 10 - Tests of Hypothesis Two (Low Familiarity Subset)

**Panel A: Analysis of Variance with next year revenue as the dependent variable**

Source	d.f.	F-statistic	Probability
NFM performance	1	.405	.528
Links	1	.385	.538
NFM performance X Links	1	2.779	.051 (1-tailed)

**Panel B: Analysis of Variance with revenue growth as the dependent variable**

Source	d.f.	F-statistic	Probability
NFM performance	1	9.936	<.01
Links	1	.417	.522
NFM performance X Links	1	2.747	.052 (1-tailed)

First, I examine the effect of providing links with next year revenue as my dependent variable. As indicated in table 10, panel A, there is a significant links by performance interaction ( $F=2.779$ ,  $p=.05$ , one-tailed), with no main effect for either links or performance. Follow-up simple effects tests indicate that, when NFM are provided without causal links, revenue judgments for HI NFM and LO NFM are not significantly different ( $F=.555$ ,  $p=.46$ ) (means are in the wrong direction as well). When causal links are added, revenue predictions are higher for HI NFM vs. LO NFM ( $F=2.542$ ,  $p=.06$ , one-tailed), consistent with hypothesis 2.

When revenue growth is used as the dependent variable (table 10, panel B), there is a significant links by performance interaction ( $F=2.747$ ,  $p=.05$ , one-tailed). Follow-up simple effects tests indicate that, when NFM are provided

without causal links, revenue growth judgments for HI NFM and LO NFM are not significantly different ( $F=1.168$ ,  $p=.29$ ). When causal links are added, revenue growth predictions are higher for HI NFM vs. LO NFM ( $F=11.084$ ,  $p<.01$ , one-tailed), consistent with hypothesis 2.

Overall these results using the low familiarity subset are more consistent with the hypothesis that providing causal links leads to more differentiated judgments of future financial performance. The stronger results with the low familiarity subset are consistent with the theory that causal links provide investors with the causal models to understand and use non-financial measures. The weaker effects of links with the full sample earlier could be due to some investors in the full sample already having the familiarity (and the causal models) to understand and use non-financial measures in the pharmaceutical industry. For these investors, links did not help to differentiate above and below-average firms because investors could do it on their own. Once the high familiarity investors were eliminated from the analysis, the effects of links are much stronger. Essentially, having a causal model is necessary for investors to process non-financial information, and investors can either possess the model based on industry familiarity from prior work experience and schooling (antecedents of “knowledge” in the Libby and Lift, 1993, model) or can acquire it from supplemental links discussion (“environment” in the Libby and Luft, 1993, model).

## **5.5 LOW FAMILIARITY SUBSET - MEDIATING PROCESSES HYPOTHESES**

Given the overall effect for providing causal links observed above, it is possible to conclude that, without causal links or pre-existing familiarity with the industry, investors do stray from the path outlined in Figure 1 and do not incorporate non-financial intangibles information in their performance judgments. What is yet unknown is when (i.e. at which node in Figure 1) this breakdown occurs. In this section, I provide evidence on the specific investors' processes that are affected by the provision of causal links (i.e. looking at *how* providing cause-and-effect links helps low familiarity investors use non-financial intangibles information).

In Chapter 3, I suggested that providing cause-and-effect links increases investors' incorporation of non-financial information, by affecting the information retention and/or information use/weighting processes. For these processes, I identified testable hypotheses involving intermediate stage cognitions and judgments, to determine if the processes are affected by causal links discussion.

If providing causal links gives investors a structure to receive new non-financial intangibles information, low familiarity investors with causal links would be more likely to retain information about linked non-financial intangibles, relative to low familiarity investors without links. Differences in information retention should be reflected in participants' recall of non-financial information.

As part of the post-experimental questionnaire, participants who received a report on non-financial measures completed a recall task, asking for details about the non-financial measures report that they saw. They were asked (1) for

the number of projects in the hypothetical company’s development pipeline, (2) whether the number of projects currently in the pipeline was higher than, the same as, or lower than the industry average, and (3) the number of years that it takes the hypothetical company to complete the cycle from initial investment to development. Results from the recall task are presented in Table 11.

Table 11 - Recall Data (Low Familiarity Subset)

Percentage of Participants Answering Recall Question Correctly

<u>Question</u>	<u>Links</u>	<u>No Links</u>
Number of Projects in the Development Pipeline	46%	62%
Number of Projects in the Development Pipeline Relative to Industry Average	63%	77%
Time to Completion of New Projects	88%	77%

Recall that hypothesis 3 predicts that recall of performance on non-financial measures will be higher for those investors receiving the causal links discussion than for those investors who do not receive it. The results in Table 11 indicate that the proportion of low familiarity participants correctly recalling the details of performance on key non-financial measures is not significantly higher (chi-square statistic < 2, for all three questions) for participants in the causal links condition vs. participants in the no links condition. This result is not consistent with hypothesis 3, the prediction that providing causal links leads to greater retention of non-financial information. The results of the recall tests suggest that even for investors with low familiarity and no links, they stayed on the right path

(“YES”) at Node A in Figure 1.<sup>15</sup> The results of these recall tests also suggest that the differences in judgments of future financial performance observed earlier are attributable to causal links affecting use or weighting of NFM, and not to links affecting acquisition/retention.

To more directly examine the notion that the causal links discussion affects how NFM are used,<sup>16</sup> I examine the explanation data to see if participants referred to using NFM information when arriving at their (net income) performance judgments. Recall that participants were asked to explain how they arrived at their net income prediction. If causal links affect participants’ use of non-financial measures, non-financial measures should be mentioned more frequently in participants’ explanations, which was formally stated as Hypothesis 4.

I reviewed low familiarity participants’ written explanations for their net income judgments. Compared to participants in the no links condition, those in the links condition refer more often to non-financial measures (67% to 60%),

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<sup>15</sup> Although the differences in recall proportions are not statistically significant, the higher recall level (on two questions) for investors who did not receive causal links discussion is curious. One possible explanation is that the causal links discussion led to investors having an affective reaction to the level of NFM performance, where they retain the gist of the non-financial information in memory, but not the specific details. To examine this possibility, I re-analyzed the data for the first recall question, this time using a standard of “directional correctness,” where responses for participants in the HI (LO) NFM condition that were higher (lower) than the industry average were classified as correct. Using this new standard of directional correctness, 73% of participants in the “no links” condition and 75% of participants in the “with links” condition correctly answered the recall question. This is preliminary evidence that causal links discussion may have induced a stronger affective reaction, which could have had a negative effect on recall of specific NFM details.

<sup>16</sup> Similar to the results for the full sample, low familiarity participants who received the causal links discussion rated the usefulness of non-financial measures (in predicting net income) higher (mean of 10.87) than those who did not receive the links discussion (mean of 9.27) ( $F=3.269$ ,  $p=.04$ , one-tailed).



refer more often to one of the three linked non-financial measures (67% to 57%), and compare NFM performance to industry average more often (50% to 19%). Although the directional pattern of these proportions is consistent with predictions, only the difference in comparison of NFM performance to industry average is statistically significant (chi-square statistic is 5.27,  $p < .025$ ). Overall, these results suggest that low familiarity investors receiving the causal links discussion are more likely to use (and refer to) non-financial measures.

Interestingly, significantly more participants refer to the company's NFM performance relative to industry average in their judgment explanations when they receive causal links than when they do not, but the recall data presented earlier show that recall of NFM performance relative to industry average is not different across conditions. In other words, the overall differences observed earlier for hypotheses 1 and 2 appear to be driven by differences in whether and how non-financial information is used, and not by differences in the retention of that information.

## **5.6 ANALYSIS OF CAUSAL MODELS USED BY INVESTORS**

In this section, I analyze the data collected from participants about the causal models that they used while participating in the study. In the last part of the study, participants were provided with a sheet of paper with eight boxes, representing the eight stages of the company's innovation process (consistent with the innovation process outlined in the links manipulation). The boxes were scrambled on the page, and participants were asked to draw arrows between the boxes to indicate how the company's actions, non-financial measures, and future

financial outcomes were connected. I perform two analyses in this section. First, I examine whether the causal models drawn by participants were affected by whether they received the causal links discussion and whether they had high or low familiarity with the industry setting. Of particular interest are the causal models drawn by participants who did not receive the causal links discussion, because this is an opportunity to see what causal models are held by investors without the influence of a provided causal links discussion. In the second analysis, I examine the connection between the causal models drawn by investors and their judgments of future financial performance.

The causal models drawn by participants fell into 3 primary categories. Sixty-five participants (75%) drew primarily linear models, where boxes were connected in sequential fashion. Most importantly, non-financial measures were part of the sequential chain, where applications would lead to FDA approvals, and FDA approvals would lead to revenues, for example. Sixteen participants (18%) drew a network (spider web) model, where all NFM were connected to each other and to revenues. It is important to note that with linear models and network models, there is a linkage between NFM and revenues, although the distance in terms of nodes/boxes would be greater in a linear model. Six participants (7%) did not have NFM linked to revenues in the models that they drew.

Analysis of “model drawn” by “links condition” indicates that 71% of participants who did not receive a causal links discussion drew a linear causal model, similar to the format illustrated in the links discussion. Meanwhile, 80% of participants who received a causal links discussion drew a linear causal model,

similar to the format illustrated in the links discussion (which they had received previously). Further breakdown by high and low familiarity participants indicates that, in the no links conditions, 77% of high familiarity participants drew a linear causal model, compared to 69% of low familiarity participants. In the links conditions, 82% of high familiarity participants drew a linear causal model, compared to 79% of low familiarity participants. These results suggest that the majority of investors possess a model similar to that provided by the company, and that high familiarity investors are even more likely to possess the linear model. Additionally, it appears that slightly more low familiarity investors adopted a linear causal model after receiving the causal links discussion, although this increase is not statistically significant.

The other analysis in this section involves comparing the causal models drawn to the judgments made by investors. Given that 93% of participants linked a non-financial measure to revenues, there is not enough variation in the “linked or not” condition to analyze subsequent participant judgments. Where there is variation is in the *number* of nodes between FDA approval and revenues. Recall that the majority of participants drew linear causal models where nodes were connected sequentially. Depending on what nodes were used, FDA approvals, while ultimately linked to revenues, could be directly linked to revenues, or could be 2 (or 3 or more) nodes removed. In the case of FDA approvals, forty-seven participants drew a direct link between FDA approval and revenues, while twenty-one participants connected FDA approval and revenues, but through an intermediate node (the most common ones being product formulation or future

financial performance). If the existence of an intermediate node between FDA approval and revenues reflects a perceived lagged effect of FDA approval on revenues, then estimates of next year revenue and revenue growth should be more differentiated (HI NFM vs. LO NFM) when there are fewer intermediate nodes.

I performed a 2X2 ANOVA with number of intermediate nodes and NFM performance as the independent variables. When revenue growth is used as the dependent variable, there is a significant nodes by NFM performance interaction ( $F=3.197$ ,  $p=.04$ , one-tailed), consistent with predictions. There is also a main effect for NFM performance. When next year revenue is used as the dependent variable, there is no significant interaction, and there are no main effects for nodes or NFM performance. There was similar variation on the number of intermediate nodes between FDA application and revenues. I performed a 2x3 ANOVA, with three levels of numbers of nodes and two levels of NFM performance, with no significant interaction or main effects. Overall, there appears to be slight support for the notion that there is an association between the causal model drawn and investor judgments, although this association could depend greatly on the context and setting.

## **5.7 SECOND-ORDER JUDGMENTS**

In a recent study, Botosan (1997) documents a relationship between the quantity of voluntary disclosure and cost of capital. The relationship is consistent with the notion that increased disclosure reduces uncertainty, leading to lower cost of capital. In this section, I provide results of exploratory analysis that examines whether expanded disclosure of non-financial intangibles information

(with and without supplemental links disclosure) affects second-order judgments (confidence, variance), which are presumably tied to cost of capital.

Recall that participants were asked to indicate the level of confidence that they had in their point forecasts of next year net income and next year revenue. Confidence judgments were compared across the three disclosure conditions (No NFM, NFM no links, and NFM links). For the full sample, a one-way ANOVA indicates no significant differences in net income confidence judgments across the three conditions ( $F=.290$ ,  $p=.75$ ) and no significant differences in revenue confidence judgments across the three conditions ( $F=.332$ ,  $p=.72$ ). Confidence judgments were also compared using two-way ANOVA. For the full sample, there are no significant main effects or interactions for links discussion or level of NFM performance (highest  $F=1.088$ , lowest p-value is .30)

For the low familiarity subset, a one-way ANOVA indicates no significant differences in net income confidence judgments ( $F=.172$ ,  $p=.84$ ) or revenue confidence judgments ( $F=.348$ ,  $p=.71$ ) across the three disclosure conditions. Confidence judgments were also compared using a two-way ANOVA. For revenue confidence judgments, there are no significant main effects or interactions for links discussion or level of NFM performance (highest  $F=.485$ , lowest p-value=.49). For net income confidence judgments, there is a significant links by performance interaction ( $F=4.469$ ,  $p=.04$ ), where confidence judgments become more extreme when links are provided (the main effect for links is not significant, however,  $F=.138$ ,  $p=.71$ ). Confidence is highest when causal links are provided and non-financial performance is low (mean=5.90, on an 11-point Likert

scale, ranging from 0 to 10) while confidence is lowest when causal links are provided and non-financial performance is high (mean=4.08). This result was not predicted. Overall, the results looking at confidence judgments do not support the conjecture that increased disclosure with causal links discussion leads to increased investor confidence.

Confidence was also measured by asking participants to provide optimistic and pessimistic predictions for next year net income and next year revenue. Participants were told that these optimistic and pessimistic predictions should correspond to the upper and lower bounds, respectively, of a 95% confidence interval. If expanded disclosures of non-financial measures and causal links discussion lead to reduced uncertainty, this should be reflected in the width of participants' confidence intervals. Results for the full sample indicate that there are no significant differences in net income confidence intervals ( $F=.344$ ,  $p=.71$ ) or revenue confidence intervals ( $F=1.858$ ,  $p=.16$ ) across the three disclosure conditions. Confidence intervals were also compared using two-way ANOVA. For net income confidence intervals, there are no significant main effects or interactions for links discussion or level of NFM performance (highest  $F=.538$ , lowest  $p\text{-value}=.47$ ). For revenue confidence intervals, there is a significant main effect for links ( $F=4.227$ ,  $p=.04$ ). However, confidence intervals are larger when links are provided (mean = \$68.2 million) than when they are not provided (mean = \$53.8 million), contrary to expectations.

For the low familiarity subset, there are no significant differences in net income confidence intervals ( $F=.827$ ,  $p=.44$ ) or revenue confidence intervals

( $F=1.425$ ,  $p=.25$ ) across the three disclosure conditions. Confidence intervals were also compared using two-way ANOVA. For net income and revenue confidence intervals, there are no significant main effects or interactions for links discussion or level of NFM performance (highest  $F=1.966$ , lowest  $p\text{-value}=.17$ ). Overall, the results looking at confidence intervals do not support the conjecture that increased disclosure of non-financial measures with causal links discussion leads to increased investor confidence, through reduced uncertainty.

The variance of investors' next year revenue and revenue growth judgments was also examined. If expanded disclosure reduces uncertainty, this should be reflected in lower variance of investor judgments when causal links are provided. I computed Levene's statistic for these judgments for the full sample, and found no significant differences in the variance of participants' next year revenue judgments across conditions. There is a significant difference in the variance of participants' revenue growth judgments (Levene statistic= $5.458$ ,  $p=.01$ ). However, the higher variance is related to the level of NFM performance (low performance, higher variance), and is not related to the disclosure condition, again contrary to expectations.

Overall the results in this study looking at self-reported confidence, confidence intervals, and variance of judgments do not support the notion that expanded disclosure of non-financial intangibles information increases investor confidence, even when the information is accompanied by supplemental cause-and-effect links information. One possible explanation for these results is the presence of offsetting effects. On one hand, disclosures of NFM performance

should reduce uncertainty on the part of the investor in this setting, leading to increased confidence. On the other hand, these disclosures could also highlight the complexities of forecasting future performance for an R&D intensive company, in terms of the multitude of inputs to be considered and the complex translation of these inputs into judgments of future financial performance. If investors learn from these disclosures that they actually know very little, this will lead to reduced confidence.



## **Chapter 6: Summary and Conclusions**

In this study, I examine in an experimental setting whether and when expanded disclosures of intangibles information influence investor performance evaluations. To this end, I introduce a progression of intangibles disclosures, from disclosures of financial information only to disclosures of non-financial intangibles information to disclosures of non-financial information with a causal links discussion added. The central prediction in this study is that investors are less likely to use non-financial intangibles information and will not differentiate between above-average and below-average firms, in the absence of disclosure of cause-and-effect linkages. Once links are provided, they are hypothesized to facilitate retention and use/weighting of non-financial intangibles information and lead to investors making more differentiated evaluations of firms with above and below-average performance on non-financial measures. Because judgments involving NFM involve lagged effects, a well-developed causal model plays a role in how and whether NFM are used in subsequent investor judgments, because causally linked information is more likely to be reflected in subsequent related judgments. The choice of links discussion as an independent variable in this study is inspired by the managerial accounting literature. Just as the provision of links via the Balanced Scorecard is hypothesized to lead to increased emphasis by managers on linked non-financial measures in a managerial accounting setting and increased understanding, the provision of causal links in this setting is

expected to lead to increased use of non-financial intangibles disclosures in investor judgments, especially those with low familiarity with the industry.

For the full sample of study participants, I find mixed results, depending on whether next year revenue or revenue growth (3 to 5 years out) is used as the dependent variable. Results are stronger and more consistent with hypotheses when data were analyzed for the subset of participants who self-reported low familiarity with the pharmaceutical setting. These results suggest that disclosure alone of non-financial intangibles information may not be sufficient to influence low familiarity investors' performance judgments and that these investors need causal links information to process and incorporate non-financial measures in their judgments. Additionally, the results suggest that having causal models about non-financial measures and their relationships with future financial performance measures helps to counteract the complex relationships between non-financial measures and future financial performance, and investors can either possess models based on prior work experience and schooling (antecedents of "knowledge" in the Libby and Luft, 1993, model) or can acquire it from supplemental links discussion ("environment" in the Libby and Luft, 1993, model).

Financial reporting continues to come under scrutiny for its perceived deficiencies in capturing and communicating firm value. With intangible assets getting the credit (or the blame) for being the biggest source of the disconnect between GAAP financial statements and firm value, firms have been encouraged to close the gap and get their message out to investors by expanding disclosures of

intangibles information. This study weighs in on this issue by providing evidence on the effect on investor judgments from providing expanded intangibles disclosures, and the necessary conditions for any anticipated benefits to be achieved. Consequently, this study is of interest to managers of firms (especially those of intangible-heavy firms), accounting researchers, and standard setters.

One of the limitations of this study is its context. The hypothetical company in the study is a pharmaceutical firm with products already in the market (so it is profitable), while also having products in the pipeline. This context was chosen because it is the prototypical inter-temporal intangibles situation: R&D expenditures are incurred upfront, and cash and earnings payoffs occur in subsequent years. Additionally, intangible assets related to R&D expenditures are the types of intangible assets covered by the FASB's project on disclosures of information about intangible assets. On the other hand, the AAA FASC (AAA FASB, 2003) observes that the R&D context is unique among intangibles, because of existing disclosure rules, which may limit the generalizability of this study to other complex intangibles relationships. Future research could examine expanded disclosures of intangibles information in other intangible asset contexts, such as those related to customer or employee satisfaction or distribution channels. Other areas for future research include examining the specific proposals (historical cost and fair value) being considered by the FASB, examining the effect of expanded intangibles disclosures when the credibility of the discloser is varied, and examining the effect of standardization and increased comparability of intangibles information on investor judgments.

Another area for future research is the examination of investors' causal models and their processing of across-period financial and non-financial information. Because the R&D investment/pharmaceutical company setting in this study was so well-known, a majority of investors already possessed a causal model similar to the one disclosed by the company. Future research could examine settings with more obscure non-financial-financial relationships, where the ex ante causal models held by investors are either more varied/divergent or non-existent. Such research could examine the effect of having a causal model on investors' reactions to disclosed information and could examine whether company-disclosed causal links discussion is effective in altering investors' ex ante causal models.

## Appendix A – Experimental Materials

### GENERAL INSTRUCTIONS

Thank you for participating in this study. The purpose of the study is to investigate how investors make judgments and decisions. Because this study involves decisions in the field of accounting, graduate business students at the University of Texas at Austin were selected to participate in this study. Your participation should take approximately 20 minutes.

For purposes of this study, you are asked to assume the role of an investor evaluating the common stock of a company. Assume that you manage your own investments and you are considering adding the common stock of Panax Pharmaceuticals, Inc. to your investment portfolio.

In this study, you will be provided with the following information about Panax Pharmaceuticals, Inc.: background information about the company (**PART A**), and a press release, containing selected financial and non-financial information about the company (**PART B**).

After reading and reviewing this information, you will be asked to make several judgments (**PARTS C and D**). Your individual responses in this study will remain strictly confidential and will only be analyzed after being combined with the response of other participants.

The case information you will receive is not intended to include all the information that would potentially be available if you were evaluating the common stock of Panax Pharmaceuticals, Inc. However, for purposes of this study, base your judgments on the information provided.

Should you have any questions during this study, please do not hesitate to ask me those questions. Please do not talk to others about the study during your participation in it. Thank you again for your participation.

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University of Texas at Austin  
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E-mail: ayen@mail.utexas.edu

\*Supervising Professor: D. Eric Hirst (471-5565)

## ***Panax Pharmaceuticals, Inc. (PART A)***

### **Company Background**

Panax Pharmaceuticals, Inc. (the Company) is a biopharmaceutical company engaged in the discovery, development, manufacturing, and marketing of prescription pharmaceutical products, principally for the cardiovascular and respiratory markets. Panax currently has two commercially available products, Chol-arrest ® and HDL Builder ®. Chol-arrest ® is marketed as a treatment to reduce elevated low-density, lipoprotein cholesterol, commonly referred to as LDL or “bad cholesterol.” HDL Builder ® is marketed as a treatment to increase high-density, lipoprotein cholesterol, commonly referred to as HDL or “good cholesterol.” Panax also has a number of projects in its research and development pipeline.

**[Links discussion manipulation (this page and the following 2 pages) – depending on the condition to which they are assigned, participants either receive the 3 page links discussion or not]**

## PANAX PHARMACEUTICALS, INC.

### Research and Development Strategy

*(excerpt from Management's Discussion and Analysis filed with the 2002 Form 10-K)*

A key element of the Company's strategy to increase shareholder value is the investment in research and development activities, in order to innovate and bring new products to the marketplace. This process is illustrated in the diagram on the following page.

Through investment in research and development, the Company identifies potential new products and develops them. This is followed by product testing in clinical trials. If successful in the clinical trial stage, the Company files a New Drug Application with the Food and Drug Administration. Once approved by the FDA, the product is moved to commercial production, where it will have a positive impact on the Company's revenues in subsequent years.

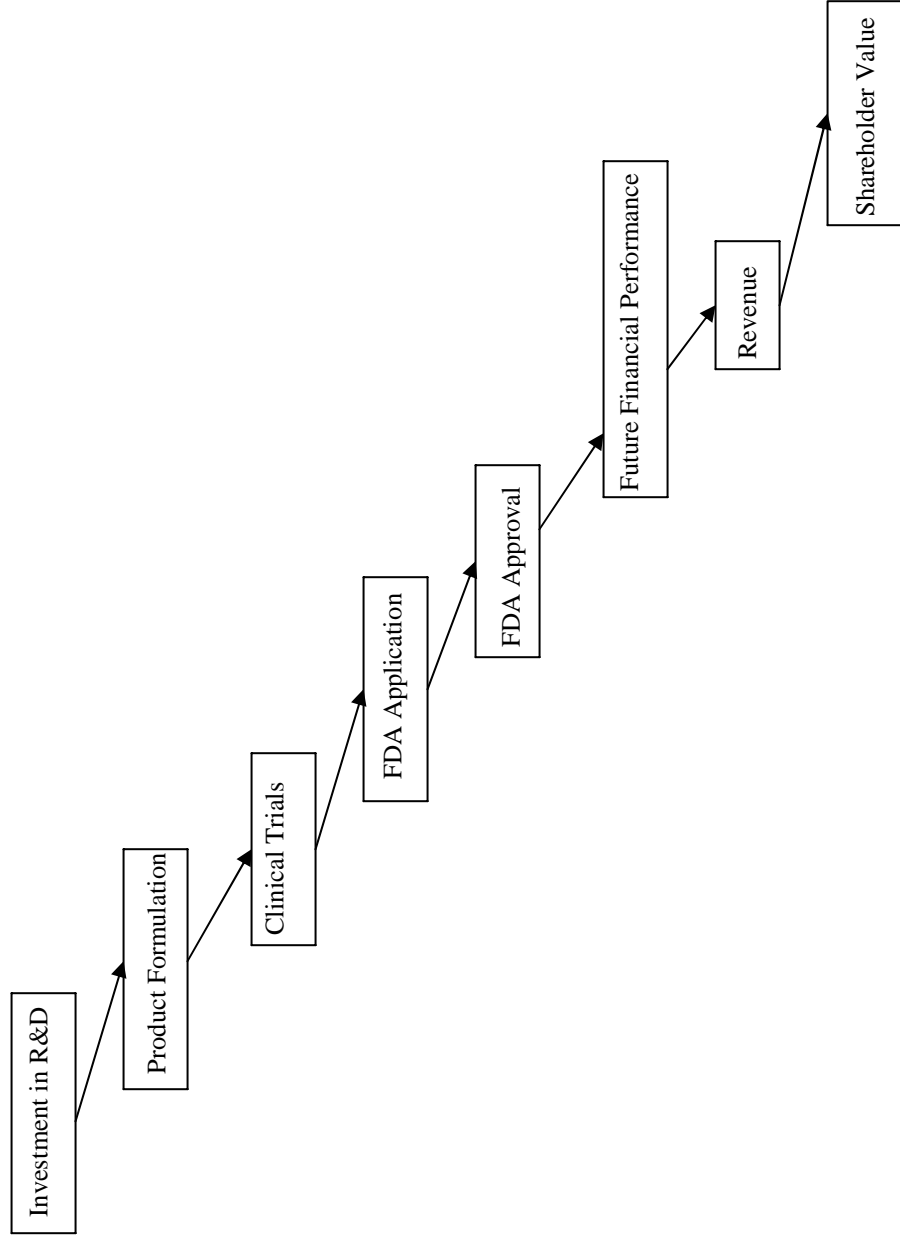
The impact of R&D investment on future financial performance (revenues from product sales) is a function of the amount invested, success at developing products, success at obtaining FDA approvals, and the speed at which products can be pushed through the pipeline.

Accordingly, non-financial measures such as:

- the number of projects in the pipeline
- FDA approvals, and
- time to completion of new products

are important predictors of the Company's future financial performance (i.e. future revenues from product sales and future net income), as products in the pipeline, once approved, can be moved to commercial production, to increase the Company's revenues in subsequent years.

**Panax Pharmaceuticals, Inc. - Research and Development Strategy (Innovation Process)**





**Panax Pharmaceuticals, Inc. - Research and Development Strategy (Innovation Process)  
How We Measure Our Success at Innovation**

<b>PROCESS</b>	<b>WHAT IT MEANS</b>	<b>HOW WE MEASURE IT</b>
Development pipeline (including product formulation, clinical trials, FDA applications)	The projects in the development pipeline are the potential blockbuster drugs of the future, contributing to the Company's future revenue and net income growth.	Number of projects in the development pipeline
FDA approval	FDA approval represents the final regulatory hurdle that must be met before commercial production can begin. Projects nearing FDA approval are expected to positively impact the company's revenue and net income in the near future.	Number of expected FDA approvals in the near future
Product development speed	The speed at which projects can be converted to products contributes to the Company's revenue and net income, by accelerating the payback/return on amounts invested in R&D in earlier periods.	Time to completion of new products

## PRESS RELEASE (PART B)

(Assume that it is February 2003 and the following press release regarding 2002 results was issued earlier today by Panax.)

### PANAX ANNOUNCES ANNUAL RESULTS

## Revenues increase 18% Net Income up 1%

**Dateline:** Philadelphia, PA, February 10, 2003

**Text:** Panax Pharmaceuticals, Inc. today reported results for the year ended December 31, 2002. Revenue for the year ended December 31, 2002 was \$161.2 million, an 18% increase from revenue of \$136.3 million in calendar 2001.

The Company reported net income of \$37.5 million for the year ended December 31, 2002, as compared to net income of \$37.0 million in 2001. Net income was relatively flat in 2002 as compared to 2001, despite the Company's sales growth, due to a significant increase in the Company's Research and development expense, from \$35.5 million in 2001 to \$52.0 million in 2002, an increase of 47%. Research and development expense represents amounts incurred by the Company to develop new products and to expand its product line. Under generally accepted accounting principles, such amounts are required to be expensed in the period incurred, leading to decreased net income in periods of high R&D investment.

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#### SUMMARIZED FINANCIAL HIGHLIGHTS (in thousands):

	Year ended December 31,		
	<u>2002</u>	<u>2001</u>	<u>% Change</u>
Product sales	\$161,210	\$136,338	18%
Research and development expense	\$51,959	\$35,461	47%
Operating income before income taxes	\$58,613	\$57,782	1%
Net income	\$37,512	\$36,980	1%

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## PRESS RELEASE (CONTINUED)

### PANAX PHARMACEUTICALS, INC.

#### CONSOLIDATED STATEMENTS OF OPERATIONS

(In thousands except per share data)

	Years Ended December 31,	
	<u>2002</u>	<u>2001</u>
Revenues:		
Product sales	\$161,210	\$136,338
Operating costs and expenses:		
Cost of sales	14,781	12,770
Research and development expense*	51,959	35,461
Selling, general and administrative expense	35,857	30,325
Total operating costs and expenses	<u>102,597</u>	<u>78,556</u>
Operating income before income taxes	58,613	57,782
Provision for income taxes	<u>21,101</u>	<u>20,802</u>
Net income	<u>\$37,512</u>	<u>\$36,980</u>

\*EXCERPT FROM "Note 1. Summary Of Significant Accounting Policies": Research and Development -- Research and development costs are expensed as incurred.

### PANAX PHARMACEUTICALS, INC.

#### CONDENSED CONSOLIDATED BALANCE SHEETS

(In thousands)

	December 31	
	<u>2002</u>	<u>2001</u>
<b>Assets</b>		
Total current assets	308,954	280,867
Property, plant and equipment, net	144,178	131,071
Other assets	<u>113,283</u>	<u>102,984</u>
Total assets	\$ <u>566,415</u>	\$ <u>514,922</u>
<b>Liabilities and Shareholders' Equity</b>		
Total current liabilities	144,052	128,199
Notes payable	130,157	132,029
Total shareholders' equity	<u>292,206</u>	<u>254,694</u>
Total liabilities and shareholders' equity	\$ <u>566,415</u>	\$ <u>514,922</u>

(Level of Non-Financial Performance Manipulation)

## PRESS RELEASE (CONTINUED)

PANAX PHARMACEUTICALS, INC. - REPORT ON NON-FINANCIAL MEASURES  
AS OF DECEMBER 31, 2002

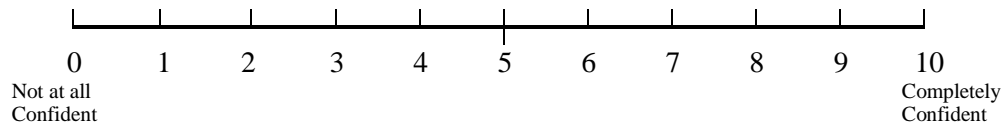
Measure	HI (LO) PANAX	INDUSTRY AVERAGE
Employee training programs offered	8	10
Expected FDA Approvals of New Products in 2003	3 (1)	2
Foreign patent applications as a percentage of total patent applications	50%	40%
Number of awards for family-friendly workplace (2002)	1	2
Number of projects currently in the development pipeline (12/31/02)	6 (2)	4
Social justice rating	85	75
Time to completion of new products	3 (7)yrs	5 yrs

## PART C – QUESTIONS

- PLEASE ANSWER THE FOLLOWING QUESTIONS IN THE ORDER THEY ARE PRESENTED.
- YOU ARE FREE TO LOOK BACK AT PARTS A&B OF THE CASE MATERIALS WHEN ANSWERING THESE QUESTIONS.
- AFTER YOU HAVE ANSWERED A QUESTION, PLEASE DO *NOT* GO BACK AND CHANGE YOUR RESPONSE.

1. Based on all of the information provided to me in the case, I predict Panax's **net income** to be \_\_\_\_\_ (in thousands) for next year (calendar year 2003).  
*Write in a number*

2. I am \_\_\_\_\_ of the **accuracy of my net income forecast** provided above (please indicate your answer by marking an "X" on the scale below).



3. In addition to providing your best estimate of 2003 net income (in question 1), please also provide an **optimistic** prediction and a **pessimistic** prediction for 2003 net income. The optimistic and pessimistic forecast would represent the upper and lower bounds of a 95% confidence interval, respectively.

Based on all of the information provided to me in the case, I am 95% certain that Panax's net income for next year will be BETWEEN:

\_\_\_\_\_ (in thousands) (**Pessimistic prediction/Lower bound**)  
*Write in a number*

AND

\_\_\_\_\_ (in thousands) (**Optimistic prediction/Upper bound**)  
*Write in a number*

4. Please explain how you arrived at your net income prediction (i.e. what information did you consider?).

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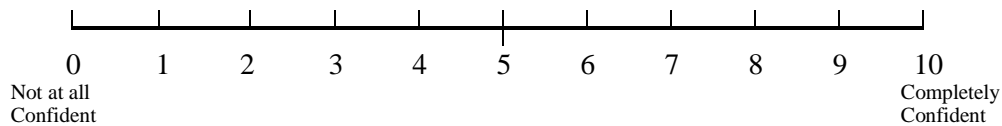
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5. Based on all of the information provided to me in the case, I predict Panax's **revenues from product sales** to be \_\_\_\_\_ (in thousands) for next year (calendar year 2003). *Write in a number*

6. I am \_\_\_\_\_ of the **accuracy of my revenue forecast** provided above (please indicate your answer by marking an "X" on the scale below).



7. In addition to providing your best estimate of 2003 revenues (in question 5), please also provide an **optimistic** prediction and a **pessimistic** prediction for 2003 revenues. The optimistic and pessimistic forecast would represent the upper and lower bounds of a 95% confidence interval, respectively.

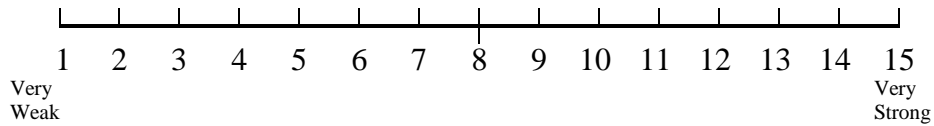
Based on all of the information provided to me in the case, I am 95% certain that Panax's revenues for next year will be BETWEEN:

\_\_\_\_\_ (in thousands) (**Pessimistic prediction/Lower bound**)  
*Write in a number*

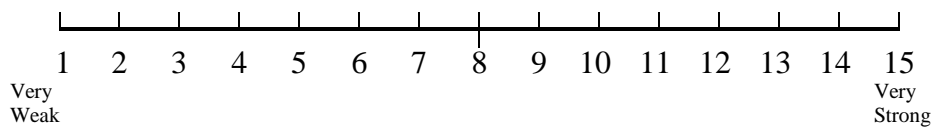
AND

\_\_\_\_\_ (in thousands) (**Optimistic prediction/Upper bound**)  
*Write in a number*

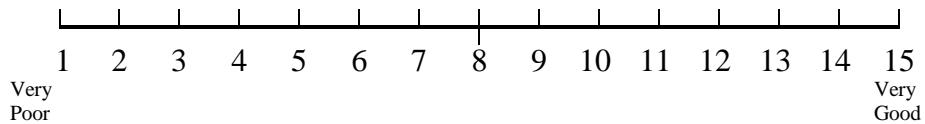
8. I believe that Panax's *potential for future net income growth* (in the next 3 to 5 years) is \_\_\_\_\_.



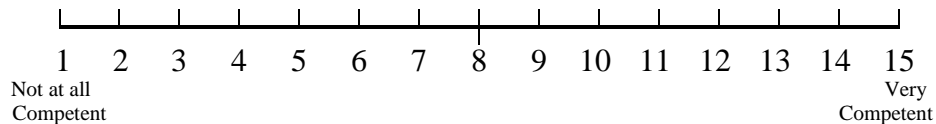
9. I believe that Panax's *potential for future revenue growth* (in the next 3 to 5 years) is \_\_\_\_\_.



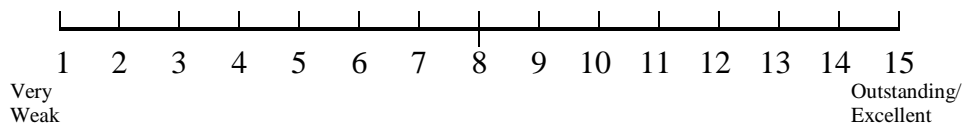
10. I believe that Panax's *overall financial condition* (strength of the balance sheet in terms of liquidity and risk) is \_\_\_\_\_.



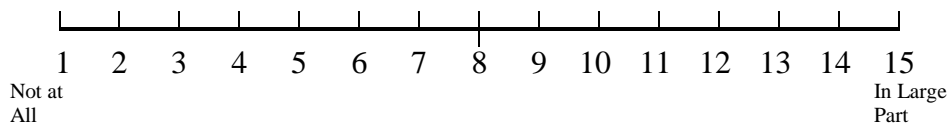
11. I believe that Panax's *management* is \_\_\_\_\_.



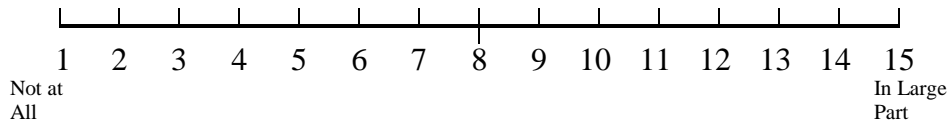
12. I believe that Panax's management is doing a(n) \_\_\_\_\_ job in its *stewardship of the company*.



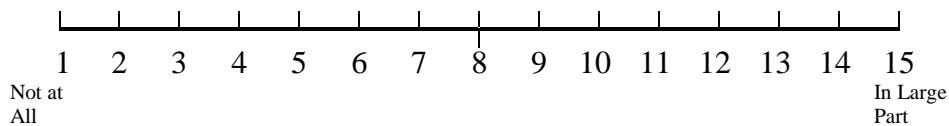
13. I believe that Panax's low growth in net income for 2002 (despite revenue growth) can be attributed \_\_\_\_\_ to the *accounting rules* concerning R&D expenditures.



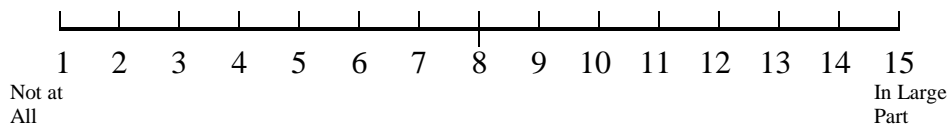
14. I believe that Panax's low growth in net income for 2002 (despite revenue growth) can be attributed \_\_\_\_\_ to **overall economic conditions**.



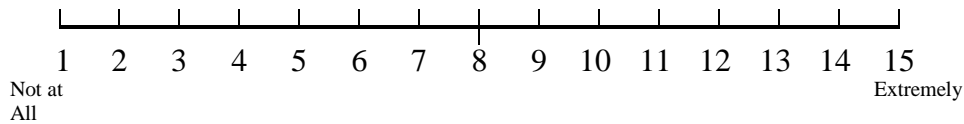
15. I believe that Panax's low growth in net income for 2002 (despite revenue growth) can be attributed \_\_\_\_\_ to the **timing of benefits from its R&D investments**.



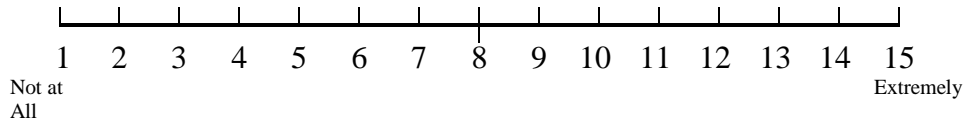
16. I believe that Panax's low growth in net income for 2002 (despite revenue growth) can be attributed \_\_\_\_\_ to the **quality of its management team**.



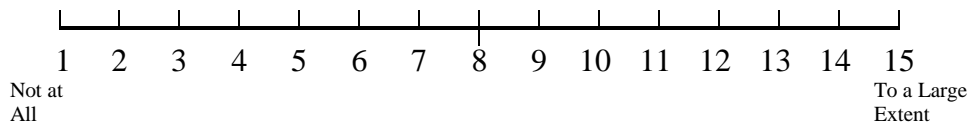
17. I found the **disclosure of R&D expense in the income statement** to be \_\_\_\_\_ **useful** in deriving my net income estimate for 2003.



18. I found the **information in the report on non-financial measures** to be \_\_\_\_\_ **useful** in deriving my net income estimate for 2003.

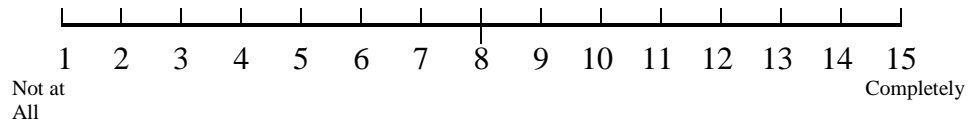


19. I can \_\_\_\_\_ **determine how actions undertaken** by management in the current year were intended to **lead to outcomes** in future periods.

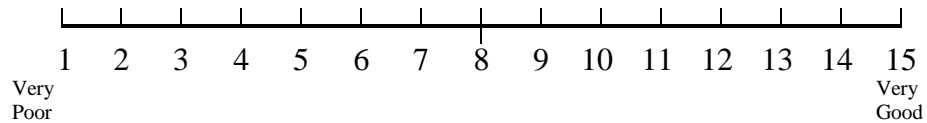




20. I believe that Panax's disclosures of its non-financial measures were \_\_\_\_\_  
*credible.*



21. For Panax, I believe that Net income (under GAAP) is a \_\_\_\_\_ measure  
for *assessing a company's performance.*



**YOU HAVE NOW COMPLETED PART C. PLEASE PLACE THE MATERIALS  
YOU HAVE JUST COMPLETED (PARTS A, B, and C) IN THE MANILA  
ENVELOPE.**

**YOU MAY NOW CONTINUE ON TO PART D.**

**PART D-PLEASE DO NOT LOOK BACK AT THE CASE MATERIALS  
WHEN ANSWERING THE FOLLOWING QUESTIONS.**

1. The number of projects currently in Panax's development pipeline is (circle one answer):

0 1 2 3 4 5 6 7 8 9 10 >10

2. The number of projects currently in Panax's development pipeline is (circle one answer):

(higher than) the industry average

(the same as) the industry average

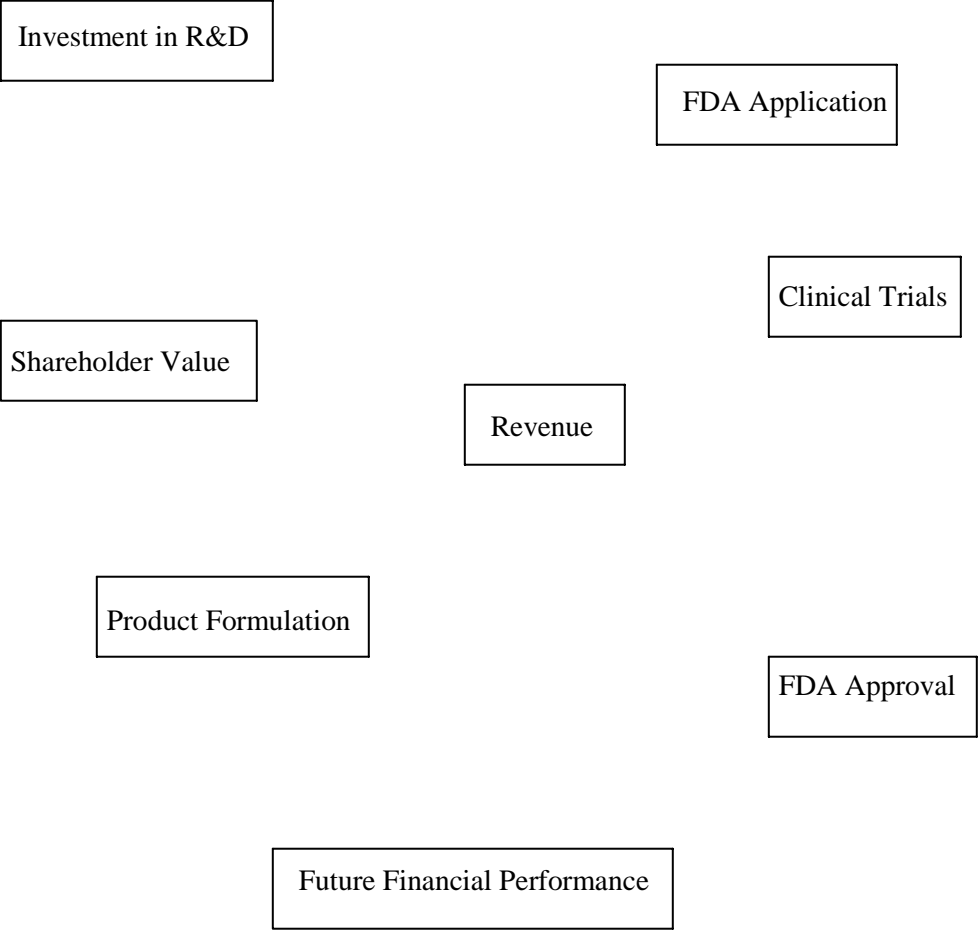
(lower than) the industry average

3. The average number of years that it takes Panax to complete the cycle from initial investment to development is:

0 1 2 3 4 5 6 7 8 9 10 >10

4. Did you receive a discussion of the Company's research and development strategy and procedure, as part of the company background in part A (circle one answer) **YES NO**.

5. Draw arrows between the boxes below to indicate how Panax's actions, non-financial measures, and future financial outcomes are connected (draw as many arrows as necessary).



IN ORDER TO HELP US BETTER UNDERSTAND WHY YOUR RESPONSES MIGHT DIFFER FROM THOSE OF YOUR COLLEAGUES, PLEASE ANSWER THE FOLLOWING QUESTIONS.

1. Have you ever made investments in the common stock of a company? YES NO

If yes, approximately how many times? \_\_\_\_\_ times

2. Do you plan to invest in the common stock of a company at some time in the future?

YES NO

3. Have you ever made investments in a common stock mutual fund? YES NO

4. Prior to this study, had you ever read the financial statements and accompanying footnotes section of an annual report? YES NO

5. What is your gender? F M

6. Please indicate your years of work experience in any of the following fields:

<p>_____ Investment banking</p> <p>_____ Retail</p> <p>_____ Consumer Goods Mftg</p> <p>_____ Commercial Bank/Insurance</p> <p>_____ Medical/Dental</p> <p>_____ Hospitality</p> <p>_____ Natural Sciences</p>	<p>_____ Public Accounting</p> <p>_____ High Tech</p> <p>_____ Education</p> <p>_____ Pharmaceuticals</p> <p>_____ Gov't (incl. Military)</p> <p>_____ Energy</p> <p>_____ Other</p>
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7. Please indicate your level of familiarity with the pharmaceutical industry, based on prior work experience, school projects, etc. (1=not familiar at all, 7=very familiar)

1    2    3    4    5    6    7

8. How many Accounting courses have you taken (including those you are taking this semester)? \_\_\_\_\_ courses
9. How many Finance courses have you taken (including those you are taking this semester)? \_\_\_\_\_ courses

YOU ARE FINISHED WITH THE CASE.

THANK YOU FOR PARTICIPATING IN THIS STUDY

TO ENTER INTO THE DRAWING, PLEASE THE DETACH THE PIECE OF PAPER BELOW AND WRITE YOUR NAME ON IT. THEN, PLACE THIS PART OF THE QUESTIONNAIRE INTO THE MANILA ENVELOPE WITH ALL THE OTHER CASE MATERIALS. WHEN YOU TURN IN THE ENVELOPE, PLACE YOUR NAME INTO THE GLASS BOWL FOR A CHANCE TO WIN THE PARTICIPATION PRIZES.

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## **Vita**

Alex Ching-Chung Yen, the son of David H.Y. and Lorraine C.C. Yen, was born on September 27, 1965 in Lansing, Michigan. Alex was awarded a Bachelor of Arts in Accounting from Michigan State University in 1987, and a Masters of Business Administration in Finance from the Simon School at the University of Rochester in 1989. Following graduation from the University of Rochester, Alex accepted a position with Price Waterhouse as a staff accountant. Alex was promoted to senior accountant at Price Waterhouse in 1992 and to manager in 1995, and held this position until beginning the Ph.D. program at the University of Texas at Austin in 1997. During the 2003-2004 academic year, Alex held an appointment as a visiting lecturer in the Department of Accounting at Indiana University in Bloomington, Indiana.

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