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Does Search-Facilitating Technology Improve the Transparency of Financial Reporting?

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ABSTRACT: XBRL (eXtensible Business Reporting Language) is an emerging technology that facilitates directed searches and simultaneous presentation of related financial statement and footnote information. We investigate whether using an XBRL-enhanced search engine helps nonprofessional financial statement users acquire and integrate related financial information when making an investment decision. We conduct our investigation in the context of recognition versus disclosure of stock option compensation. Our results reveal that many users do not access the technology, but those who do use it are better able to acquire and integrate information. Specifically, we find that when stock option accounting varies between firms, the use of an XBRL-enhanced search engine increases the likelihood that individuals acquire information about stock option compensation disclosed in the footnotes. We also find that XBRL helps individuals integrate the implications of this information, resulting in different investment decisions between individuals who use and do not use the search engine. Our results suggest that search-facilitating technologies, such as XBRL, aid financial statement users by improving the transparency of firms' financial statement information and managers' choices for reporting that information. Our results also reveal that wide publicity about the benefits of using search-facilitating technology may be needed to induce financial statement users to access the technology.

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I. INTRODUCTION

An emerging technology, XBRL (eXtensible Business Reporting Language), is a computer language promulgated by XBRL International, a global consortium of over 200 financial services, technology, and accounting organizations. Within XBRL, each piece of financial data is assigned a unique, predefined data tag. These data tags act like barcodes identifying the information's content and structure. Proponents of XBRL claim it has the potential to influence users' acquisition and processing of financial information and, thus, their judgments and decisions based on this information (Eccles et al. 2001, 310-311; Hannon 2002; Leibs and Goff 2003).[1]

While XBRL has implications for many aspects of financial reporting, we believe a key benefit is its ability to facilitate the acquisition and integration of *related* financial information from within a firm's financial reports. XBRL-coded financial statements allow individuals using software applications (e.g., search engines, parsers) to extract and simultaneously exhibit all identically coded information from the financial statements and footnotes. For example, a search on ''employee compensation'' would retrieve not only salary/wage expense from the income statement, but also information related to stock option compensation disclosed in the footnotes.

We propose that search-facilitating technology, such as XBRL, will influence financial statement users' ability to acquire and integrate related financial information in several important ways. First, when a firm's managers assign similar data tags to related financial information items, search-facilitating technology can easily retrieve these items, regardless of their location within the firm's financial report. Second, similarly tagged items signal to users that knowledgeable individuals, such as financial experts who developed XBRL and the firm's managers, believe these items are related. Third, by acquiring and presenting related financial information together, search-facilitating technology directs users' attention toward evaluating items in relation to one another, and reduces the costs of such processing. Fourth, by facilitating comparisons across companies, search-facilitating technology makes managers' financial reporting choices (e.g., recognition versus disclosure) more transparent to users and highlights differences in these choices. For these reasons, search-facilitating technology has the potential to enable financial statement users to make more informed decisions based on the information contained in financial reports, regardless of where the information is located in the reports.

To investigate these issues, we examine whether individuals who use search-facilitating technology are more likely to acquire information and integrate the information when making investment decisions than individuals who do not use such technology. In a 2×2 between-subjects experiment, we manipulate the *Presentation* of financial information (non-searchable or searchable format) and the *Placement* of stock option compensation information (recognition or disclosure). We manipulate *Presentation* by presenting the materials

[1] The NASDAQ has engaged in a pilot program to allow users to experience the financial analysis benefits of XBRL. This pilot program, undertaken in conjunction with Microsoft and PricewaterhouseCoopers, provides investors with access to five years of XBRL-formatted financial data for 21 NASDAQ-listed companies. EDGAR, Inc. also has launched a public repository for 79 company financial statements tagged in XBRL, called XBRL Express.

in a nonsearchable (PDF) format versus a searchable (XBRL) format.[2] We manipulate *Placement* by either recognizing stock option compensation expense on the face of the income statement or disclosing stock option compensation in the firm's footnotes.

In our experiment participants analyze information about two firms (Firm A and Firm B) for the purpose of making an investment decision; participants must decide what portion of $10,000 to invest in each firm's stock. Firm B represents the *Placement* manipulation and either recognizes stock option compensation on the face of the income statement (recognition condition) or discloses stock option compensation in the footnotes (disclosure condition). Firm A discloses stock option compensation in the footnotes in both conditions. When both firms disclose stock option compensation (disclosure condition), Firm B exhibits better economic performance by outperforming Firm A on four key income statement ratios. In the recognition condition, where Firm A discloses and Firm B recognizes stock option compensation, Firm A *appears* to outperform Firm B simply due to the difference in financial reporting choices.

Since our predictions are predicated on the *use* of search-facilitating technology, we programmed the experimental materials to track which participants used the search engine to examine the footnotes in the searchable condition. This information allows us to divide our sample into those who used the search-facilitating technology and those who did not. Our results show that when stock option accounting varies among firms, users' ability to acquire information and integrate that information improves when they use search-facilitating technology relative to when they do not use the technology. Participants who used search-facilitating technology were more likely to recall footnote information indicating Firm A's and Firm B's different approaches for accounting for stock option compensation than were participants who did not use the search engine. This result indicates that when analyzing complex financial reports, using search-facilitating technology aids users in acquiring information.

Our results also reveal that the investment decisions of participants who used search-facilitating technology more strongly reflect information disclosed in the footnotes than the investment decisions of individuals who did not use search-facilitating technology. This result suggests that using search-facilitating technology helps users integrate footnote information, i.e., better evaluate implications of acquired footnote information and combine those implications with related information placed elsewhere in the financial statements.

These results provide empirical evidence of the effects of XBRL on financial statement users. The importance of this evidence is highlighted by the expectation that XBRL will become the global standard for financial reporting in the near future. Our findings indicate that XBRL will improve computer-literate, nonprofessional investors' use of financial information. Additionally, we document the specific cognitive processes that benefit from the use of an XBRL-enhanced search engine, i.e., the acquisition and integration of information located in various places of the financial statements (e.g., financial statements and footnotes).

We find, however, that nonprofessional users may not automatically use XBRL-enhanced technology. Approximately half of our experimental participants who had access to XBRL technology did not use the technology. This finding suggests that wide publicity

[2] We recognize that PDF documents have limited search capabilities using Adobe Acrobat's search command. However, these search capabilities are not based on data tags, which are a prerequisite to software programs being able to extract, organize, and present user-specified information. For ease of exposition, we refer to our experimental conditions that contained an XBRL-enabled search engine as "searchable" and those that did not as "nonsearchable."

about the benefits of using search-facilitating technology may be needed to induce financial statement users to access, and thereby benefit from, the technology.

Our findings have implications for several financial reporting issues. Our results suggest that search-facilitating technology improves the transparency of managers' financial reporting choices and the financial statement effects of those choices.[3] In doing so, search-facilitating technology supports the goal promulgated by former SEC chairman Harvey Pitt (2001) that financial information be "useful to and utilizable by ordinary investors."

While our study focuses on recognition versus disclosure of stock option compensation, the transparency benefits of using search-facilitating technology likely extend to other financial reporting issues, such as managers' choice of estimates/assumptions and the structuring of transactions to achieve desired financial results. The increased transparency associated with XBRL processing may encourage managers to be more neutral in their choice of estimates and assumptions. Additionally, widespread implementation of this technology may alter some of the incentives that managers have to structure transactions to receive a preferred financial reporting treatment (e.g., operating leases) or to lobby for flexibility in financial reporting (e.g., recognition versus disclosure of stock option compensation).

This paper is organized as follows. Section II explains how using a search-facilitating technology can influence users' ability to acquire and integrate related information. Section III describes our experiment and Section IV provides results. Section V summarizes and concludes.

II. THEORY AND HYPOTHESES

XBRL and Performance in Financial Analysis Tasks

Maines and McDaniel (2000, 183–184) rely on a judgment model proposed by Hogarth (1980) to describe how users of financial reports acquire and use data when conducting financial analysis. They break down the process into three tasks: information acquisition, information evaluation, and information combination. Information acquisition occurs when financial statement users find and read specific pieces of financial information, while information evaluation entails users assessing implications of the information for a firm's financial condition and performance. Information combination involves assimilating the implications of various pieces of information and weighting these implications to arrive at an overall judgment about the financial condition or performance of a company, or a related decision such as investing in the company's stock. In subsequent discussion we refer to information evaluation and information combination as a single task: information "integration." In the following sections, we argue that XBRL will impact users' ability to both acquire and integrate information.

XBRL and the Acquisition of Information

XBRL assists users in acquiring information by labeling each piece of financial data with a unique identification tag that defines the information's content and structure. For example, the tag contains information about the data itself (e.g., the amount of research

[3] Financial statements are transparent if they make apparent the underlying economics of the business and its transactions, as well as managements' financial reporting choices and assumptions. To be transparent, financial statements must be representationally faithful and neutral, i.e., the financial statements must accurately represent the underlying economics in an unbiased manner (Statement of Financial Accounting Concepts [SFAC] No. 2, FASB 1980, para. 63). Additionally, transparency is associated with the idea that financial statements should be presented in a manner that is easily understood by individuals "who have a reasonable understanding of business and economic activities and are willing to study the information with reasonable diligence" (SFAC No. 1, FASB 1978, para. 34).

and development expense for fiscal year 2003), as well as information about where in the overall structure of the financial report the data reside (e.g., 2003 annual report/financial statements/income statement/operating expenses). Thus, as long as users know the type of information they would like to analyze, an XBRL-enhanced search engine will automatically acquire that information by searching for the appropriate tag, regardless of where the information resides in the financial report.[4] By quickly extracting all data related to a specified topic, an XBRL-enhanced search engine assists users in acquiring related information dispersed throughout a firm's financial statements and footnotes.

Once the XBRL-enhanced search engine retrieves all related information, management's financial reporting choices about placement and other issues become more transparent (assuming that the information's place of origin is identified, as it is in XBRL). This transparency facilitates users recognizing when two firms have made different financial reporting choices for similar transactions; for example when one firm recognizes stock option expense in its income statement and one firm discloses stock option expense in its footnotes. When this is the case, using an XBRL-enhanced search engine facilitates individuals acquiring information about the firm's reporting choice in the footnotes.

H1: Individuals who use search-facilitating technology are more likely to acquire information from various places in the financial statements and footnotes than are individuals who do not use search-facilitating technology.

XBRL and Integrating Information

A key attribute of XBRL-enhanced search engines is that they facilitate users simultaneously viewing similarly tagged financial information. This simultaneous presentation helps users to evaluate items in relation to each other and to integrate the related information when making decisions (Russo 1977). This feature of search-facilitating technology facilitates users integrating dispersed, but related, information in ways they may not have considered in a more traditional, non-searchable, environment.

We expect that XBRL search-facilitating technology will affect users' integration of information in at least three ways. First, the data tags utilized by this technology provide expert guidance about the relations among financial information items. The fact that a number of items are coded with the same data tag suggests that someone with knowledge of these items (e.g., management) classified them in a related manner. Users likely will interpret the data tag ''signal'' as indicating that items with the same data tag should be evaluated together and integrated in some manner. Thus, data tags can act as substitutes for direct links among related items that may be absent in the financial statements (Maines and McDaniel 2000).

Second, simultaneous presentation of related information directs users' attention toward examining relations among the information items (Russo 1977). Simultaneous presentation also reduces the cognitive costs of integrating the information. As a result, users likely will more thoroughly evaluate related information that might otherwise be ignored due to its dispersed placement within a larger body of information.

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[4] XBRL International is responsible for developing the taxonomy that will define all of the data tags required to comply with U.S. GAAP. Software programs under development will automatically do much of the tagging, once management decides how an item should be classified. XBRL-enhanced search engines will use the taxonomy to search for information. A user does not need to know any of the technical aspects of XBRL to use an XBRL-enhanced search engine. Search engines, such as the one we used in our experiment, will likely provide drop-down menus, or something similar, containing terms defined in the taxonomy.

Third, as previously discussed, once the XBRL-enhanced search engine simultaneously presents all related information, management's financial reporting choices are clearly observable. The clear delineation of reporting choices can raise questions in users' minds about managements' motives for their choices (Hodge 2001). This questioning likely is greater when financial statements of two or more companies are compared and the managers have made different financial reporting choices for similar transactions.

The three arguments above indicate that search-facilitating technology should improve financial statement users' ability to integrate related information in financial reports.

H2: Individuals who use search-facilitating technology will better integrate related information from various places in the financial statements and footnotes than will individuals who do not use search-facilitating technology.

Participants and Context for Examining the Effects of XBRL

Effects of XBRL on Professional versus Nonprofessional Users

We focus our examination of the benefits of using an XBRL-enhanced search engine on nonprofessional users of financial reports because research suggests that nonprofessional investors, rather than professional financial analysts, are most likely to benefit from the technology. Research documents that experienced professional analysts follow specific valuation approaches (Frederickson and Miller 2004), and skip around in the financial statements and footnotes in order to collect related information required for these approaches (Bouwman et al. 1987; Hunton and McEwen 1997). In effect, experienced professional analysts possess the knowledge about the nature of financial items and the relations among these items implied by the XBRL tagging system. Thus, while XBRL may reduce professionals' cognitive costs, it is less likely to significantly change their analysis processes.

In contrast, nonprofessional investors use less-defined valuation models and assimilate financial information in a relatively unstructured manner (SRI International 1987; Frederickson and Miller 2004). Nonprofessional investors (and less experienced analysts) read the financial statements sequentially, reflecting their lack of a well-developed framework for the importance of and relations among various financial statement items (Bouwman 1982; Hunton and McEwen 1997). The tagging system in XBRL provides a framework for nonprofessional investors and likely will affect how they process financial statement and footnote information.

XBRL and Recognition versus Disclosure of Stock Option Compensation

We study the implications of search-facilitating technology in the context of recognition versus disclosure of stock option compensation. Statement of Financial Accounting Standard (SFAS) No. 123, *Accounting for Stock-Based Compensation* (FASB 1995), allows managers either to recognize the fair value of stock option compensation in the income statement or disclose this information in the footnotes. Until 2002, only two firms in the *Fortune* 500 recognized stock option compensation; however, a number of firms have subsequently switched from disclosure to recognition, increasing the diversity in reporting for stock option compensation. The FASB has indicated it will require that stock option compensation be recognized as an expense in the income statement starting in 2005 (FASB 2003).

In general, research indicates that financial statement users react less to disclosed information than to recognized information. Experimental research typically manipulates recognition versus disclosure in individual judgment settings, and finds individuals' judgments and decisions reflect information less when it is disclosed than when it is recognized (Sami

and Schwartz 1992; Harper et al. 1987, 1991; Hirst and Hopkins 1998; Wilkins and Zimmer 1983). Empirical-archival studies find that stock prices reflect footnote information (Landsman 1986; Harris and Ohlson 1987; Barth 1994; Aboody et al. 2001), though to a lesser degree than expectation models specify (Harris and Ohlson 1987; Landsman and Ohlson 1990; Imhoff et al. 1995).[5]

Reported net income is higher when a firm chooses disclosure rather than recognition of stock option compensation. If users fail to integrate footnote information, the higher net income associated with disclosure will lead them to view a firm that discloses stock option compensation more favorably, *ceteris paribus*, than a firm that recognizes such compensation. However, if users integrate the stock option compensation information disclosed in the footnotes with other employee compensation recognized as an expense, then the effect of recognition versus disclosure on users' investment decisions should be mitigated. As indicated in the discussion preceding H2, we expect that individuals who use search technology are more likely to evaluate stock option compensation as similar to other employee compensation and to combine together all forms of employee compensation when conducting their analysis. Thus, we expect that artificial differences in net income created by disclosure versus recognition of stock option compensation are less likely to affect the investment decisions of individuals who use search technology than those who do not use search technology.

Moreover, the use of search technology highlights differences in financial reporting choices for stock option compensation across companies. Given that the FASB has consistently stated that recognition is the conceptually appropriate accounting method for stock option compensation, a decision by a firm's manager to disclose this information may raise questions about the reliability of the firm's financial reporting. Additionally, research indicates that firms that lobbied against recognition of stock option compensation grant a larger percentage of their stock options to top executives (Dechow et al. 1996). Accordingly, investors may view a firm's choice to disclose stock option compensation as trying to downplay potentially negative information about the firm's compensation policy. If search technology highlights firms' financial reporting choices, then individuals who use search technology may react more negatively to a firm that chooses disclosure than will individuals who do not use search technology.

In summary, we test the effects of search technology on users' acquisition and integration of information in the context of recognition versus disclosure of stock option compensation. We believe that, when stock option accounting varies across two firms, search technology will enable users to better acquire stock option footnote information that reveals the difference in stock option accounting between firms, as indicated in H1. We also expect that search technology will help users better integrate footnote information on stock option compensation with other types of employee compensation expensed in the income statement, as indicated in H2. Moreover, the implications of a firm's choice to recognize or disclose stock option compensation should be more apparent to individuals who use search technology than those who do not use the technology.

[5] Archival tests of recognition versus disclosure are rare since most accounting standards mandate recognition or disclosure. Examining disclosure versus recognition for the same firm over time also is problematic since changes in accounting policy either are self-selected or result from mandated changes in accounting, which may reflect changes in the information's characteristics (Bernard and Schipper 1994).

III. EXPERIMENT

Participants

Ninety-six second-year M.B.A. students enrolled in financial statement analysis courses at two large state universities served as surrogates for nonprofessional financial statement users in our experiment.[6] As discussed, we use nonprofessional financial statement users as participants since they are more likely to benefit from using search-facilitating technology than experienced professional users. Moreover, nonprofessionals play an important role in the capital markets, as indicated by the fact that 34 million nonprofessional investors invest directly in the stock market (New York Stock Exchange [NYSE] 2001). Since XBRL is an online tool, we also wanted participants who had experience using the Web to retrieve financial information. Finally, graduate business students possess many of the characteristics of online traders, such as being more open to new technologies, more self-directed and aggressive, younger, and more highly educated than investors who do not trade online (Fidelity Investments 2000).

On average, participants had completed three accounting and four finance courses. Ninety-six percent of the participants had previously evaluated a company's performance by analyzing financial statements. Sixty-three percent of the participants had experience buying or selling an individual company's common stock or debt securities (not through a mutual or pension fund) and 94 percent plan to invest in a company's stock in the next five years. Each participant earned a flat wage of $10 for completing the experiment.

Design and Materials

We randomly assigned participants to one of four conditions in a 2 × 2 between-subjects design. The two independent variables are presentation format (*nonsearchable/searchable*) and placement of data (*recognition/disclosure*). The searchable condition contained an XBRL-enabled search engine at the bottom of the computer screen that allowed participants to retrieve all information on the site related to a specific account. For example, if participants were analyzing salary expense on a firm's income statement and wanted to see related note information, then they could retrieve the footnote information and simultaneously view it with the income statement information by using the search engine. The Appendix provides an example of what the search engine retrieval screen would look like if a participant had searched for information on salary expense.[7] The nonsearchable condition contained the same information (financial statements and notes) in a PDF-formatted document, which did not have the search engine at the bottom of the screen.

We manipulated recognition versus disclosure by having one of the two firms (Firm B) in the medical supply industry recognize stock option compensation expense on the face

[6] We recruited participants over two quarters. The materials used each quarter were identical except for one alteration. In the first quarter participants could view each firm's footnote information by using the search engine, or by clicking on a "notes" hyperlink on the menu bar located on the left side of the screen (see the Appendix). During the second quarter we deactivated the footnote hyperlink on the menu bar. There are no quarter or school differences in our subsequent hypotheses tests.

[7] In the experimental materials one firm was named "Mediready" and the other firm was named "Supplymed." We refer to Mediready as "Firm A" and Supplymed as "Firm B" in our discussion of the two firms. The two experimental firms are based on actual firms in the medical supplies industry. We chose this industry because it is one of only four industries in which earnings adjusted for stock option compensation is at least 10 percent less than reported earnings from 1997–1999 (Bear, Stearns & Company, Inc. 2000). Additionally, relative to other industries that meet this first criterion (e.g., high-tech firms), we believed that participants would not have strong beliefs about the performance of the medical supplies industry. Indeed, 95 percent of participants reported that they had not analyzed a firm in this industry.

of the income statement (recognition condition) or disclose it in the notes (disclosure condition). The other firm (Firm A) always disclosed stock option compensation expense in the notes. In the disclosure condition, where both firms disclosed stock compensation, Firm B outperformed Firm A on four key income statement ratios. Given identical financial reporting, the difference in key ratios reflected economic differences between the two firms. In the recognition condition, where Firm A disclosed and Firm B recognized stock option compensation, Firm A outperformed Firm B on the four key income statement ratios *unless* participants adjusted Firm A's income statement to reflect stock option compensation, i.e., put the two firms on equal footing.

Procedure

Participants began the case by typing in the Web address listed on their instructions sheet: each of the four conditions had a unique Web address. Participants then reviewed an instructions page, a page containing general information about the medical supplies industry, and a preview of questionnaire #1, which elicited the primary dependent variables. Participants began their analysis by going to either firm's home page. From each firm's home page, participants could view the financial statements or footnotes for that firm or they could click on a hyperlink to go to the other firm's financial statements and notes. After examining each firm's financial information, participants completed questionnaire #1, which asked them to compute the four key ratios and to make their investment decisions and several judgments for each firm. After submitting this questionnaire, participants completed a second questionnaire that contained manipulation check questions and gathered demographic information. On average, participants completed the case in 27 minutes.[8]

Dependent Measures

We examine two primary dependent measures: acquisition and investment decisions. We capture acquisition by asking participants in the post-experiment questionnaire to identify whether Firm A and Firm B disclosed or recognized stock option compensation information. Our acquisition dependent measure is the percentage of participants who correctly identify how each firm reported stock option compensation information. We capture participants' investment decisions by asking them to allocate an investment of $10,000 between Firm A and Firm B. Our investment decision dependent measure is the percentage of $10,000 participants invested in Firm B.

IV. RESULTS

Hypotheses Tests

In discussing our results, it is important to recall that in the disclosure condition Firm A and Firm B both disclosed information about the cost of stock options, whereas in the recognition condition Firm A disclosed and Firm B recognized this information. It is only in our recognition condition, therefore, that the stock option compensation reporting choices of Firm A and Firm B differ.

Testing H1 and H2 requires identifying those participants who used the search-facilitating technology and those who did not. To assist in this task, we programmed the experimental materials to track which participants used the search engine to examine the

[8] One participant submitted the first questionnaire over four hours after beginning the case. We assume this participant did not complete the case in one sitting and therefore eliminate this participant's responses from our data set. Our results do not differ if we include this participant's responses in our analysis.

footnotes. Of the 60 participants who viewed the materials in the searchable (XBRL) conditions, 31 used the search engine to view footnote information. These 31 participants constitute our ''search'' group.[9] Our ''nonsearch'' group combines participants who were exposed to the search-facilitating technology but elected not to use it (29 participants), and participants who were not exposed to the search engine (34 participants).

XBRL and the Acquisition of Information

Hypothesis 1 predicts that individuals who use search-facilitating technology to analyze firms' financial statements and footnotes will more likely acquire footnote information than individuals who do not use search-facilitating technology. Panel A of Table 1 presents descriptive statistics for our acquisition dependent measure: the percentage of participants who correctly identified whether Firm A and Firm B recognized or disclosed stock option compensation information. Panel B presents the related ANOVA, with *Presentation, Placement,* and the interaction of these two variables as independent factors. Panel C reports our hypothesized contrast. We use the following contrast weights (Rosnow and Rosenthal 1995):

Search/Disclosure condition	+1
Nonsearch/Disclosure condition	+1
Search/Recognition condition	+1
Nonsearch/Recognition condition	−3

The first two +1 weights reflect our expectation that when Firm A and Firm B both disclose stock option compensation information, using an XBRL-enhanced search engine will not significantly help users identify each firm's reporting choice. Given that nearly all firms disclosed stock option compensation information at the time of our experiment and that both Firm A and Firm B reported in this manner, we expect most participants in our disclosure conditions to correctly identify Firm A's and Firm B's reporting choices. The third +1 weight reflects our expectation that using an XBRL-enhanced search engine facilitates users correctly identifying each firm's reporting choice, even when the firms report differently. The –3 weight reflects our expectation that when the two firms report differently, not using an XBRL-enhanced search engine hampers users' ability to correctly identify each firm's reporting choice.

The descriptive statistics in Panel A of Table 1 show that in the search (nonsearch) group 87 percent (94 percent) of participants in the disclosure condition correctly identified that both firms disclosed information about stock options in their footnotes, and 69 percent (43 percent) of participants in the recognition condition correctly identified that Firm A disclosed and Firm B recognized the cost of stock options. Fisher's exact tests reveal that the difference in the disclosure condition is not significant ($p = 0.58$), whereas the difference in the recognition condition is significant ($p = 0.09$).[10] The hypothesized contrast in Panel C supports H1 ($p < 0.01$) and suggests that, when stock option accounting varies among firms, using search-facilitating technology increases the likelihood that users will acquire footnote information.

[9] That approximately half of these participants did not use the search engine is an interesting result in itself. We discuss the implications of this result for XBRL in the concluding section. We elected not to force participants to use the search engine due to concerns about experimental demand effects. Forcing participants to use a search engine that retrieved footnote information might have signaled to participants that the researchers viewed footnote information as important to participants' investment decisions. However, our approach raises self-selection concerns about our acquisition tests. We discuss this issue in a later section.

[10] Throughout the paper, we report one-tailed p-values for directional tests, and two-tailed p-values for nondirectional tests.

TABLE 1
The Effect of Search-Facilitating Technology on Users' Acquisition[a]

Panel A: Percentage [Proportion] of Participants Who Correctly Identified whether Firm A and Firm B Recognized or Disclosed Stock Option Compensation Information

	Placement of Information[b]		
Participants[c]	**Disclosure condition**	**Recognition Condition**	**Difference (Disclosure – Recognition)**
Search group	87% [13/15]	69% [11/16]	−18%
Nonsearch group	94% [31/33]	43% [13/30]	−51%

Panel B: Categorical Analysis of Variance

Source of Variance	**df**	**χ^2-statistic**	**p-value**
Intercept	1	17.16	0.00
Presentation	1	0.02	0.88
Placement	1	10.91	0.00
Presentation × Placement	1	2.42	0.12

Panel C: Hypothesized Contrast—H1

Dependent Variable	**df**	**χ^2-statistic**	**p-value[d]**
Proportion of participants who correctly identified where Firm A and Firm B reported stock option compensation information	1	14.69	0.00

[a] User acquisition is measured by the percentage of participants in each cell who correctly identified whether Firm A and Firm B disclosed or recognized stock option compensation information.
[b] Participants received summary financial statements and other general information for Firm A and Firm B. Firm A always disclosed the cost of stock options in the footnotes; Firm B disclosed the cost of stock options in the footnotes in the disclosure condition and recognized the cost of stock options in the income statement in the recognition condition.
[c] Participants in the search (nonsearch) group used (did not use) an XBRL-enhanced search engine while viewing the materials.
[d] Contrast weights for each group are: Search/Disclosure = 1, Search/Recognition = 1, Nonsearch/Disclosure = 1, Nonsearch/Recognition = –3.

XBRL and Integrating Information

Hypothesis 2 predicts that individuals who use search-facilitating technology will better integrate information presented in various places in the financial statements than individuals who do not use search-facilitating technology. The layout of Table 2 is identical to that of Table 1: Panel A presents descriptive statistics for our investment decision dependent variable, Panel B presents the related ANOVA, and Panel C reports our hypothesized contrast. In testing H2, we use the same contrast weights we used in testing H1, though for slightly different reasons as described below.

In interpreting the descriptive statistics reported in Panel A, it is important to recall that Firm B outperforms Firm A on four key income statement ratios if participants put the two firms on equal footing with respect to recognition or disclosure of stock option compensation. Descriptive statistics indicate that in the disclosure condition where the two firms are on equal footing, participants in the search (nonsearch) group elected to invest 57 percent (67 percent) of their $10,000 in Firm B. A simple t-test reveals that these percentages do not significantly differ ($p = 0.19$).

TABLE 2
The Effect of Search-Facilitating Technology on Users' Investment Decisions[a]

Panel A: Percentage Invested in Firm B (mean [standard deviation])

	Placement of Information[b]		
Participants[c]	**Disclosure Condition**	**Recognition Condition**	**Difference (Disclosure – Recognition)**
Search group	n = 15	n = 16	
Firm B	57% [23%]	55% [33%]	−2%
Nonsearch group	n = 32	n = 32	
Firm B	67% [22%]	34% [32%]	−33%

Panel B: Percentage Invested in Firm B Analysis of Variance

Source of Variance	df	F-statistic	p-value
Intercept	1	309.61	0.00
Presentation	1	0.90	0.34
Placement	1	8.46	0.01
Presentation × Placement	1	6.26	0.01
Error	91		
Total	95		

Panel C: Hypothesized Contrast—H2

Dependent Variable	Standard Error	df	t-statistic	p-value[d,e,f]
Percentage invested in Firm B	18%	91	4.19	0.00

[a] Participants made a decision about the percentage of $10,000 to invest in Firm A and Firm B. The Investment Decision dependent measure is the percentage of $10,000 invested in Firm B. The percentage invested in Firm A is 100 less the percentage invested in Firm B.
[b] Participants received summary financial statements and other general information for Firm A and Firm B. Firm A always disclosed the cost of stock options in the footnotes; Firm B disclosed the cost of stock options in the footnotes in the disclosure condition and recognized the cost of stock options in the income statement in the recognition condition.
[c] Participants in the search (nonsearch) group used (did not use) an XBRL-enhanced search engine while viewing the materials.
[d] Consistent with a directional prediction, p-value is one-tailed.
[e] An F-test for unequal variances is significant for the contrast reported in Panel C. A planned contrast that does not assume equal variances yields inferentially identical results ($p < 0.01$).
[f] Contrast weights for each group are: Search/Disclosure = 1, Search/Recognition = 1, Nonsearch/Disclosure = 1, Nonsearch/Recognition = −3.

In our recognition condition, where Firm A disclosed and Firm B recognized stock option compensation information, we expect that participants who do not fully integrate footnote information on stock option compensation for Firm A will invest less in Firm B than participants in the disclosure condition. In contrast, we expect that participants who integrate footnote information on stock option compensation will invest relatively the same amount in Firm B as participants in the disclosure condition for two reasons. First, if participants integrate the cost of stock option compensation with other compensation expensed on the income statement, the relation between Firm A and Firm B on the four income statement ratios should be the same as in the disclosure condition (Firm B outperforms Firm A). Second, the fact that Firm A chose to disclose stock option compensation instead of recognizing stock option expense in the income statement like Firm B may raise participants' concerns about the financial reporting reliability of Firm A.

These arguments suggest that the percentage of $10,000 that participants elect to invest in Firm B relative to Firm A should not significantly differ between our Search/Disclosure, Nonsearch/Disclosure, and Search/Recognition groups. They also suggest that participants in the Nonsearch/Recognition group are less likely to favor Firm B when making their investment decision. For these reasons, we test H2 using the same +1, +1, +1, –3 contrast weights.

Descriptive statistics in Panel A of Table 2 indicate that in the recognition condition where the two firms report stock option compensation information differently, participants in the search (nonsearch) group elected to invest 55 percent (34 percent) of their $10,000 in Firm B. A simple t-test reveals that these percentages significantly differ ($p = 0.02$). The hypothesized contrast in Panel C supports H2 ($p < 0.01$).[11]

To gain further insight into participants' investment decisions, we examine several investment-related judgments made by participants, including their assessments of the two firms' financial performance and reliability of the financial statements. We asked participants to evaluate each firm's financial performance using 11-point scales with "very weak" and "very strong" as endpoints, and to evaluate the reliability of each firm's financial statements on 11-point scales with "not reliable" and "very reliable" as endpoints. Participants' assessments for these two measures were significantly correlated with their investment decisions ($r = 0.76$, $p < 0.01$ for financial performance judgments and $r = 0.28$, $p < 0.01$ for financial statement reliability judgments). We analyze how the use of search-facilitating technology affects participants' assessments of these two measures.

We expect that individuals who use search technology will be more likely to acquire and integrate disclosed stock option costs with other forms of employee compensation to determine a firm's financial performance. Thus, the relative financial performance judgments for Firm A and Firm B of participants in the recognition condition who use search technology should more closely mirror those of individuals in the disclosure condition (where the two firms are on equal footing) than the judgments of participants in the recognition condition who did not use the search engine. Using the same contrast weights that we previously used, we find significant results (not tabulated) for this comparison ($p < 0.01$), further collaborating our investment decision results.[12]

Since search-facilitating technology makes differences in recognition/disclosure choices between companies more transparent, it draws attention to a firm trying to downplay stock option compensation by choosing disclosure rather than recognition. We expect that individuals who use search-facilitating technology will have greater disparity in their financial statement reliability judgments between firms that choose disclosure and those that choose recognition than will individuals who do not use the technology. Results support this contention; the difference in participants' assessment of financial statement reliability between disclosure and recognition is greater in the search than the nonsearch group

[11] Results using standard contrast weights (+1, −1, −1, +1) produce inferentially identical results ($p < 0.01$).

[12] To obtain additional insight into participants' financial performance judgments, we examine their calculations of one of the four key ratios participants computed. We labeled this ratio the "human capital productivity ratio." The materials described this ratio as "total sales/total employee compensation." Results indicate that significantly more participants in the search/recognition group adjusted the denominator of the human productivity ratio upward for Firm A than did participants in the nonsearch/recognition group (56 percent versus 25 percent; $p = 0.02$). This result provides additional evidence that search-facilitating technology facilitated the integration of the footnote information with information reported in the income statement.

($p = 0.02$).[13] This result is consistent with our investment decision results.[14] In sum, analyses using several related dependent measures provide additional evidence that using search-facilitating technology helps users integrate (evaluate and combine) footnote information with information reported on the face of the financial statements.

Examining Self-Selection Bias Issues

Since we *ex post* combined subjects who had access to the search engine but chose not to use it with subjects who did not have access to the search engine, it is important to show that other extraneous variables do not explain our results. We conduct this analysis to rule out alternative explanations for our findings, such as the possibility that participants who used the search engine were more knowledgeable or more highly motivated than participants who did not use the search engine.

We address this concern by testing whether differences exist across our four groups with respect to nine different demographic/performance variables.[15] We find that only two of the nine variables differ across the four groups: the number of participants who had previously evaluated a firm in the medical supply industry and the number of accounting classes taken. Including these variables as covariates in our hypotheses tests does not alter our conclusions (all significant p-values remain < 0.01). Overall, our sensitivity analysis provides additional evidence that our manipulations are responsible for our results, rather than differences in participants' intelligence, motivation, personal background characteristics, or other extraneous variables.

V. SUMMARY AND CONCLUSIONS

This paper investigates the potential for search-facilitating technology to improve nonprofessional investors' use of financial information in investment decisions, using the context of recognition versus disclosure of stock option compensation. We find that when stock option accounting varies among firms, search technology helps users both acquire information and integrate that information. Participants who use search-facilitating technology are more likely to acquire footnote information, and are more likely to integrate the footnote information with related information on the face of the income statement when making judgments and decisions than participants who do not use search-facilitating technology.

Our results further suggest that the presence of search-facilitating technology is not an automatic remedy for eliminating differences between recognition versus disclosure created by cognitive processing. Approximately 50 percent of participants in our experiment did

[13] We also asked participants to assess the relative risk of financial distress for the two firms on an 11-point scale. Results are consistent with those for financial statement reliability. The difference in participants' perceived risk between disclosure and recognition is greater in the search group than in the nonsearch group ($p < 0.01$).

[14] By including participants in each condition who did not correctly identify how each firm reported stock option compensation information, the analyses in this section jointly tests acquisition and integration. In an attempt to isolate the effects of search-facilitating technology on integration, we reran our investment decision, financial performance, and reliability tests using only those participants in each group who correctly identified where Firm A and Firm B reported stock option compensation information. Using this substantially reduced sample, the p-values for these three dependent variables are: investment decision ($p = 0.12$), financial performance ($p = 0.06$), and reliability ($p = .03$).

[15] The nine variables are: (1) grades, (2) time to complete the case, (3) identification of whether either firm disclosed or recognized goodwill, (4) familiarity with using a price/earnings valuation approach, (5) familiarity with using financial statements to value a firm, (6) number of participants who have bought or sold an individual firm's common stock or debt securities, (7) number of participants who have previously evaluated a firm in the medical supply industry, (8) the number of accounting classes taken, and (9) the number of finance classes taken. Participants provided responses to variables (3)–(9) in questionnaire #2. The computer automatically recorded participants' time to complete the case, and we collected information on participants' grades after they completed the financial analysis class from which they were recruited.

not use the available technology. This suggests that wide publicity about the benefits of using search-facilitating technology may be needed to induce financial statement users to access the technology. Though XBRL-enhanced search engines will likely be easy to use, training investors on how to most effectively use this technology may also be necessary. Future research could help in this endeavor by pinpointing the factors that lead investors to adopt, versus avoid, new technologies.

There are several implications of this study. First, our findings provide further support that at least some of the recognition versus disclosure differences noted in the archival and experimental literature are due in part to cognitive processing difficulties. These difficulties are likely more prevalent in nonprofessional investors. Our results suggest that technology can potentially mitigate these cognitive processing difficulties by bringing together pieces of related information. This, in part, substitutes for knowledge nonprofessional investors lack, or highlights relations they may not automatically consider when making investment-related judgments and decisions.

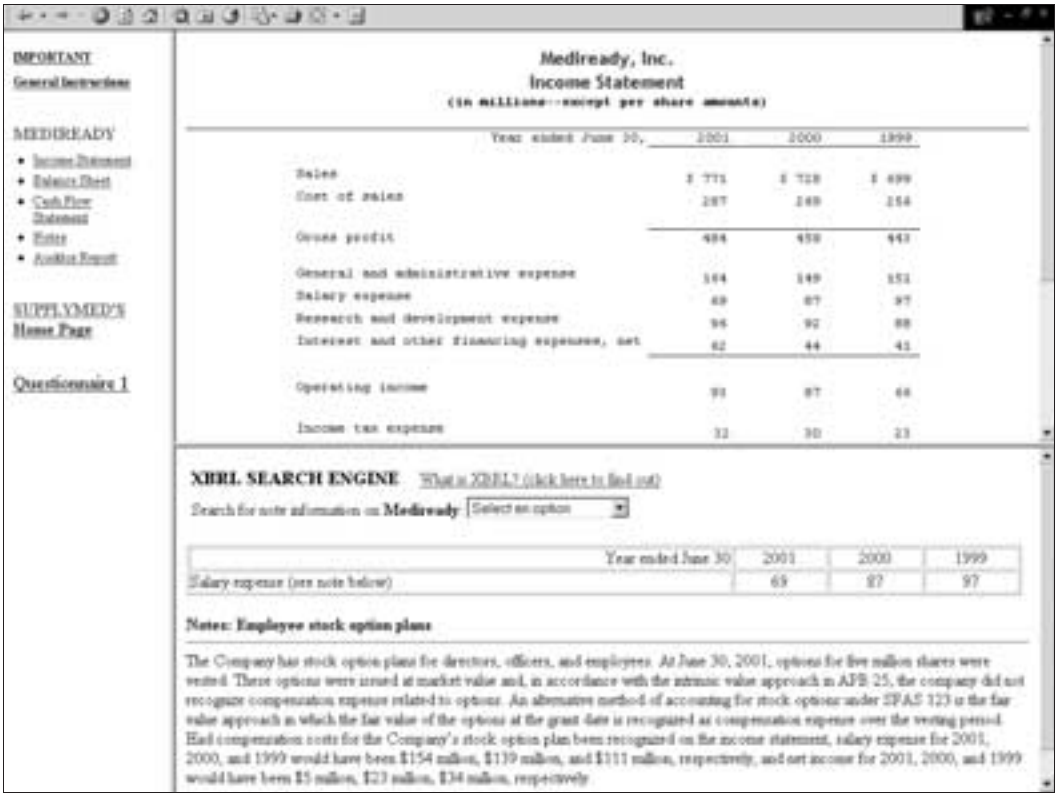
Second, widespread implementation of search-facilitating technology might affect managers' decisions with respect to financial reporting. Specifically, the effect of search-facilitating technology on users' decisions may mitigate the benefits of managers lobbying for and choosing financial reporting approaches that ''artificially'' enhance the financial performance or condition of the firm. These effects likely would extend to issues other than recognition versus disclosure, such as choice of pension assumptions and transaction structuring to obtain operating lease status.

Interestingly, our results raise the issue that what constitutes ''appropriately'' tagged information may in the future be as hotly debated as recognition versus disclosure of stock options is today. Auditors' roles likely would expand to include auditing their clients' use of data tags. Examining the implications of this expanded role for auditors is an interesting issue for future research on XBRL.

This study is subject to several limitations. First, we limit the amount of information participants receive to a subset of that available on most corporate websites so that participants can complete the task in a reasonable amount of time. Most firms' financial reports are more complex than our experimental setting. This reduced complexity biases against our predictions, and suggests that search-facilitating technology may have a greater impact on both users' acquisition and processing of actual financial statement information than demonstrated in this study. Future research could examine how investor judgments are affected by search-facilitating technology in more complex environments.

Second, we use graduate business students as surrogates for online nonprofessional investors. Although graduate business students exhibit demographic characteristics similar to online investors, some have limited investment experience and therefore may not reflect the beliefs or investment approaches of actual investors. Our participants likely have greater formal training in accounting and finance than the average nonprofessional investor and may be more sophisticated on that dimension. Given the heterogeneity in individual investors, the use of any one group likely will not generalize to all individual investors. Despite these limitations, this study provides descriptive *ex ante* evidence to regulators, financial information providers, and financial information users that issuing financial reports in a format that is easily searchable, like XBRL, assists nonprofessional users in the acquisition and integration of decision-relevant information.

APPENDIX
Example of Search Engine Output



IMPORTANT
General Instructions

MEDIREADY
- Income Statement
- Balance Sheet
- Cash Flow Statement
- Notes
- Auditor Report

SUPPLYMED'S
Home Page

Questionnaire 1

Mediready, Inc.
Income Statement
(in millions--except per share amounts)

Year ended June 30,	2001	2000	1999
Sales	$ 771	$ 728	$ 699
Cost of sales	287	269	254
Gross profit	484	459	445
General and administrative expense	164	149	151
Salary expense	69	87	97
Research and development expense	96	92	88
Interest and other financing expenses, net	62	44	41
Operating income	93	87	68
Income tax expense	32	30	23

XBRL SEARCH ENGINE What is XBRL? (click here to find out)

Search for note information on **Mediready** Select an option

Year ended June 30	2001	2000	1999
Salary expense (see note below)	69	87	97

Notes: Employee stock option plans

The Company has stock option plans for directors, officers, and employees. At June 30, 2001, options for five million shares were vested. These options were issued at market value and, in accordance with the intrinsic value approach in APB 25, the company did not recognize compensation expense related to options. An alternative method of accounting for stock options under SFAS 123 is the fair value approach in which the fair value of the options at the grant date is recognized as compensation expense over the vesting period. Had compensation costs for the Company's stock option plan been recognized on the income statement, salary expense for 2001, 2000, and 1999 would have been $154 million, $139 million, and $111 million, respectively, and net income for 2001, 2000, and 1999 would have been $5 million, $23 million, $34 million, respectively.

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