

# **Nonprofessional Investors' Perceptions of the Efficiency and Effectiveness of XBRL-enabled Financial Statement Analysis and of Firms Providing XBRL-formatted Information**

Robert Pinsker  
Associate Professor of Accounting  
Old Dominion University  
2140 Constant Hall  
Norfolk, VA 23529  
Phone: (757) 683-6553  
Fax: (757) 683-3258  
Email: rpinsker@odu.edu

Patrick Wheeler  
Associate Professor  
School of Accountancy  
University of Missouri-Columbia  
441 Cornell Hall  
Columbia, Missouri 65203  
Phone: (573) 882-6056  
Fax: (573) 882-2437  
Email: wheelerp@missouri.edu

**Key Words:** eXtensible Business Reporting Language (XBRL), information technology (IT), financial statements, analysis, perception

**Data Availability:** Please send all data requests to the first author.

**Acknowledgements:** We are grateful for helpful comments on earlier drafts by anonymous reviewers for the Sixth International Research Symposium on Accounting Information Systems (2005), the Third Annual XBRL Conference at Bryant College (2003), the 2009 AAA IS/SET Midyear Meeting, workshop participants at North Carolina State University, Joe Brazel, Jim Hunton, Mark Nelson, Saeed Roohani, Brad Tuttle, Grant Castner, Elaine Mauldin, and Vairam Arunachalam. We would also like to thank Mahmoud Abdul-Jawad for research assistance during this project.

## **EXECUTIVE SUMMARY**

Businesses continually invest in new information technologies (IT) for improved reporting. EXtensible Business Reporting Language (XBRL) is an example of IT that allows financial statements to be transmitted and analyzed electronically. The international business community has shown strong support for XBRL, with several countries mandating financial reporting using XBRL. However, even though organizations may be required to transmit XBRL-formatted financial statements, users of such statements would still need to choose whether or not they wish to analyze them with XBRL-enabled analysis tools. Prior research indicates that the individual user's perceptions of IT tools are frequently negatively biased and that IT tools are commonly underused as a result. If this general finding were to be true for XBRL use, it could seriously impact XBRL's diffusion into the business community.

The authors, both CPAs and accounting professors, investigate the relationship between XBRL use and perception by surveying 61 MBA students as proxies for nonprofessional investors. Results indicate that while perceptions of XBRL are generally positive, increased use of XBRL leads to more positive perceptions. Thus, organizations promoting the spread of XBRL should consider making access to XBRL analysis tools as easy and widely available as possible. Additionally, organizations that issue XBRL-formatted reports are perceived more positively than ones that do not issue such reports (a halo effect).

## I. INTRODUCTION

Firms frequently investigate new processes and technologies for improving business reporting (i.e., reporting including both key financial and nonfinancial information) in order to reduce costs and in response to demands from business information consumers. One such information technology (IT) involves formatting business reports in eXtensible Business Reporting Language (XBRL), allowing them to be transmitted, accessed, and analyzed electronically. XBRL has received strong support from many sectors of the business community.<sup>1</sup> In the U.S., the Securities and Exchange Commission's (SEC) recent proposed rule (33-8496, involving furnishing XBRL-formatted reports for all SEC disclosures) has resulted in the June 15, 2009 mandatory adoption of XBRL-formatted reporting by the 500 largest public firms. Internationally, several stock exchanges have begun to require XBRL-formatted reporting, such as exchanges in Germany, Canada, and China. As a result, the XBRL formatting of business reports is increasing and may soon become dominant on a global scale.

However, even though firms may be required by regulating agencies (e.g., SEC) to issue XBRL-formatted financial statements, individual users of such statements would still need to choose, to varying degrees, their method of analysis.<sup>2</sup> They could, for example, analyze these statements by using electronic technologies dependent on XBRL formatting (e.g., search capabilities; there are several free or relatively inexpensive XBRL analytical tools available, including one on the SEC's website) or by applying traditional paper-based methods (e.g., unguided or nondirected spreadsheet analysis). Hodge et al. (2004) had to eliminate most of their sample, because those individuals chose not to use XBRL as an information search technology. Thus, although XBRL-enabled analysis requires XBRL-formatting, the converse is not true. Furthermore, even when use of an IT is required, the effectiveness and efficiency with which it is applied to a task is affected by user attitudes (Hayes 2004; Davis et al. 1989).<sup>3</sup>

Research indicates that the individual user's perceptions of IT capabilities can significantly influence attitudes toward IT and the degree to which IT is accepted and used, which, in turn, can affect organizations adopting new IT (Agarwal 2000; Bagozzi et al. 1992; Davis et al. 1989). An IT tool's superiority to other tools (or to no tool at all) does *not* guarantee its perception by users as superior; nor does its superiority prevent it from being under-utilized by users with negative perceptions of the tool (Hayes 2004; Mun and Hwang 2003). Accordingly, the perceptions of individual XBRL users can impact XBRL's diffusion into the business community, in addition to affecting the individual's performance of XBRL-formatted tasks. Negative user perceptions of XBRL's capabilities could retard its spread through organizations, increase implementations costs, and cause its inefficient use by individuals. Thus, it is important to complement evidence about the practical advantages of using XBRL (e.g., Hodge et al. 2004) with research on user perceptions of XBRL's capabilities. Because the perceptions of individual investors (our examples of IT users) can affect both individual and organizational IT use, we examine their perceptions of the effects of XBRL on their own financial statement analysis (as an individual-level construct) and their perceptions of firms issuing XBRL-formatted financial statements (as an organization-level construct). Perceptions related to the latter construct (positive or negative) may provide useful information to organizations currently considering whether or not to adopt XBRL for business reporting purposes.

Building on the established relationship between IT perception (as a cause) and IT use (as an effect), we investigate the antecedent causes of perceptions relating to XBRL (i.e., we do not examine how initial user perceptions of XBRL affect subsequent XBRL use, but conversely examine how initial XBRL use affects subsequent XBRL perceptions). It is important to test this

latter relationship in regard to XBRL because, as noted above, it cannot be assumed that user perceptions will accurately reflect IT functionality. Based on the theory of reasoned action (TRA) and the technology acceptance model (TAM) literatures, we predict that investors performing XBRL-enabled financial statement analysis will more positively perceive the efficiency and effectiveness of (a) XBRL-formatted analysis and, indirectly, (b) firms providing XBRL-formatted business information, compared to the same perceptions from those performing nondirected, paper-based analyses. We test these predictions using a between-subjects experiment involving 61 MBA student participants as a proxy for nonprofessional investors.<sup>4</sup> The NASDAQ Demo Excel Investor Analysis Tool is used as our XBRL proxy.

Consistent with our predictions, results show the participants in the XBRL-formatted group perceive XBRL-enabled analysis to be significantly more effective and efficient than the nondirected participants in the paper-based group. Additionally, post hoc analysis reveals that participants in both groups perceive XBRL-formatted information as more accurate (a proxy for effectiveness) than paper-based information. Also as predicted, results indicate that individuals perceive that firms are both more efficient and more effective when they provide XBRL-formatted information compared to providing paper-based information. An interesting finding is that both participant groups believe that XBRL improves the efficiency and effectiveness of financial statement analysis and firms issuing those statements relative to paper-based information (with the XBRL-formatted group being stronger in their perceptions in all cases).

Our results complement prior findings regarding performance advantages derived from analyzing XBRL-formatted information (e.g., Hodge et al. 2004) by showing how XBRL use affects nonprofessional investor perceptions of both their own analysis and of the firms providing this information. Since perception is known to affect behavior and mediate IT use

when use is voluntary (per TRA and TAM), these findings have important implications for the use of XBRL-formatted business information by the consumers of such information (e.g., investors). Such usage will always be affected by user attitudes and involve some degree of user choice, regardless of whether or not firms are required by regulatory agencies to use XBRL formatting when issuing financial statements. Therefore, given the positive user perceptions related to XBRL use and organizations that issue XBRL-formatted reports (a halo effect), interested parties promoting the spread of XBRL should consider making access to XBRL analysis tools as easy and widely available as possible.

Our results also make two contributions to the TAM literature. First, we investigate and find evidence concerning user perceptions of effectiveness and efficiency as they relate to both individual IT use (i.e., financial statement analysis) and organizational constructs (i.e., firms providing financial statements). Existing TAM research and theory focuses primarily on the former. Second, our study adds new details to the TAM framework concerning the antecedent processes and causes to user perceptions. Whereas most prior TAM research investigates the effects of user perceptions on IT use, we examine the effects of IT use on user perceptions.

In the remainder of the paper, we discuss relevant literature and develop hypotheses (section 2), our research method (section 3), results (section 4), and conclusions from the study, including limitations and future research (section 5).

## **II. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT**

### **XBRL Background**

We believe that, because of its extensibility and reusability, XBRL represents a different business reporting format from both paper-based and traditional PDF-based reporting. Mason and Mitroff (1973) suggest that presentation mode is an important variable in information

systems research. Further, “media choice in financial reporting is a new phenomenon brought on by the widespread use of multimedia-capable computers and financial reporting on the Internet,” (Clements and Wolfe 2000, 79). Paper-based and PDF-based reporting may not be efficient or effective enough to satisfy both business information users’ interests (primarily stockholders and creditors) or new legislation and regulation (e.g., Section 409 of the Sarbanes-Oxley Act 2002). For example, these formats are nondirected, to use Silver’s (1990) terminology, in that they provide users with no guidance as to how to proceed with analysis. The major concerns of both business information users and regulators are effectiveness (i.e., ability to successfully complete a task) and efficiency (i.e., using minimal resources while successfully completing a task). Thus, XBRL-formatted reporting should have substantial benefits over paper and PDF-based formats.

Our belief regarding the benefits of XBRL-formatted reporting is supported by the theory of the “best fit” between characteristics of the task, the user/decision-maker, and the environment: including any information systems present (Vessey 1991). Of particular relevance to XBRL’s enhanced search capabilities, Hunton and McEwen’s (1997) results indicate that cognitive search strategies which closely fit the task improve task performance in computerized environments. XBRL provides decision makers a closer fit to the digitalized and electronic environment in which they work than do paper or PDF formats. Furthermore, XBRL’s search capabilities are much greater than those of the other two formats (Hodge et al. 2004). While our focus in this paper is on XBRL versus paper-based formats in this paper, we believe there are also benefits over PDF-based reporting, because it is more difficult to search and there is a tendency to print PDF documents (Nielsen Norman Group 2003).

U.S. academic research on XBRL has been limited. Research focuses on the practical benefits of XBRL to analysts and other users (e.g., Hodge et al. 2004) and the appropriateness of

an XBRL taxonomy (e.g., Bovee et al. 2002). We extend this research by examining the perceptions of XBRL-enabled and non-XBRL-enabled investors, specifically, perceptions of the efficiency and effectiveness of (a) analyzing financial statement analysis with/without XBRL formatting and (b) firms adopting/not adopting XBRL-formatted reporting.

We develop our hypotheses and research propositions from two research literatures. First, we use the theory of reasoned action to establish the importance of perception in determining behavior. Second, since TAM applies TRA to IT, we use TAM to formulate beliefs about the effects of IT use on user perceptions. Figure 1 presents our model of the effects of IT use on user perceptions of IT and the firm providing IT, and is explained in the following sections.

[Insert Figure 1 about here]

### **Theory of Reasoned Action and Importance of Perception**

The theory of reasoned action (TRA) starts with two assumptions about individuals in order to model the relationship among perceptions, attitudes, intentions, and behaviors: (1) individuals are rational with the ability to process and use available information, and (2) they use the information they have processed to arrive at reasonable decisions about behavior (Ajzen and Fishbein 1980; Fishbein and Ajzen 1975).<sup>5</sup> When individuals perceive objects they gather information, which consist of bundles of attributes. An individual's attitude toward an object is determined by an evaluative response toward the object's attributes. Perceptions, as the information source for rational decision-making, strongly influence attitudes. TRA completes its model by asserting that attitudes affect intentions, which in turn affect behavior. Intentions, according to TRA, are the best predictors of behavior. Thus, TRA holds that behavior is made as a rational decision by individuals consistent with their intentions, the content of which is derived



from perceptions.<sup>6</sup> Armitage and Connor (2001), as well as Sheppard et al. (1988) provide empirical support for TRA's predictions.

### **Technology Acceptance Model and XBRL**

The technology acceptance model (TAM) is an adaptation of TRA applied to the acceptance and adoption of new IT (Bagozzi et al. 1992; Davis et al. 1989). TAM is diagrammed in Subfigure A of Figure 1. It postulates that when users are provided new IT to assist them in performing assigned tasks, their perceptions of the IT's potential effectiveness and efficiency relative to task performance significantly influence their attitudes toward adopting or accepting the IT (Agarwal 2000; Bagozzi et al. 1992; Davis et al. 1989). Perceived usefulness is the degree to which a person believes that using a particular system would enhance his or her ability to successfully complete a job (i.e., effectiveness), while perceived ease of use is the degree to which a person believes that using a particular system would minimize the resources (e.g., cognitive effort) required to successfully complete a job (i.e., efficiency; Davis 1989). Thus, consistent with TRA, TAM holds that perceptions about IT affect attitudes about IT, which affect the intentions to accept and actually use IT.

The numerous studies testing TAM have resulted in an accumulation of evidence supporting its modeling of how user perceptions of IT usefulness and ease of use affect user attitudes toward IT adoption or acceptance (e.g., Adams et al. 1992; Al-Gahtani 2001; Davis et al. 1989; Hendrickson et al. 1993; Segars and Grover 1993; Subramanian 1994; and Szajna 1994). Although subsequent research has extended TAM (e.g., Venkatesh and Davis 2000; Venkatesh et al. 2002), the basic TAM framework (shown in Fig. 1, Subfig. A) has not changed and is generally accepted in the Information Systems' literature. Thus, TRA and TAM research have firmly established the critical mediating role user perceptions play in determining IT

acceptance and use. In fact, Davis (1993) states that perceived usefulness is the most influential determinant of IT acceptance.

However, TAM does not postulate that an IT's functional superiority to other ITs will necessarily result in its perception by users as superior. In fact, the literature indicates that this is frequently not the case and that under-utilization of IT due to users' negative misperceptions is a major problem in businesses using IT (Hayes 2004; Mun and Hwang 2003). Accordingly, recent studies have extended TAM to include the antecedent causes of user perceptions (e.g., Chiasson and Lovato 2001, Venkatesh et al. 2002).

These findings have important implications for potential XBRL adoption and diffusion among organizations. Specifically, while Hodge et al.'s (2004) results indicate that XBRL-enabled users (MBA students) are better than non-XBRL users at acquiring and integrating financial statement information, their study does not examine whether their XBRL users have more positive perceptions than did their non-XBRL users about their respective IT. It is *crucial* to investigate the perceptions of XBRL users in order to form expectations about the diffusion of XBRL use in the business community, since TRA and TAM research establishes a strong causal link from user perceptions of IT to IT use. As discussed above, a mandated use of XBRL for issuing business information is unlikely to have much effect on the voluntary use of XBRL-enabled analysis by nonprofessional investors, if these information consumers have negative perceptions of XBRL usage (although it would impact their perceptions of the firms providing this information). If these negative perceptions and the resulting suboptimal use of XBRL-enabled analysis tools become extensive in the business community, the diffusion of XBRL will be impaired and possibly in jeopardy.

In order to investigate user perceptions of XBRL, we extend TAM by including initial IT use among the external factors affecting user perceptions (see Figure 1). Although the primary focus of TAM research has been the effects of internal factors (i.e., perceptions) on acceptance of a new IT, the literature recognizes that some initial use of the new IT (i.e., prior to acceptance) is required for users to form rational perceptions of IT (Davis et al. 1989; Venkatesh and Davis 1996). Several studies have formally extended TAM by including training and pre-training experiences with new IT as user acceptance enablers that can affect user perceptions, especially of perceived ease of use (i.e., efficiency; Venkatesh and Davis 1996; Venkatesh 1999; Venkatesh et al. 2002).

Accordingly, we do not adopt the research design used in prior TAM studies examining the effect of IT user perceptions on IT use, a causal relationship we accept as established in the literature. Instead, following the extensions of TAM in Venkatesh and Davis (1996), Venkatesh (1999), and Venkatesh et al. (2002), we examine causal links antecedent to the effects of perception on IT use, namely, the effects of IT use (i.e., initial use) on user perceptions, which in turn affects long term IT adoption, acceptance, and use. Specifically, we test the effects of XBRL-enabled and non-XBRL-enabled use on user (MBA students as nonprofessional investors) perceptions. By examining the effects of XBRL use in this manner, we complement Hodge et al.'s (2004) results on the practical advantages gained by using XBRL with results on the effects of XBRL use on user perceptions: a critical factor in determining the extent to which the advantages of XBRL usage will be realized in practice.

Thus, we predict in our two hypotheses that XBRL-enabled users will have stronger positive perceptions of their IT's efficiency (H1) and effectiveness (H2) than that of the nondirected users of the paper-based IT, consistent with the superior capabilities of the former.

Based on TRA's and TAM's underlying assumption that individuals rationally process information about an object's attributes, we expect user perceptions to fairly reflect the relative capabilities of the two technologies (i.e., XBRL and paper).

***H1: Perceived User/Investor Efficiency***

Nonprofessional investors using XBRL-formatted information should enjoy efficiency gains since XBRL-formatted tools allow them to gather, integrate, and compare firm data more rapidly, and therefore, at a lower cost, compared to using paper-based data (Hodge et al. 2004). The ability to more quickly and accurately make comparisons should improve individual efficiency when analyzing firm information. Thus, to the extent that actual IT usage (i.e., experiencing IT capabilities first-hand) rationally influences user perceptions, we hypothesize that investors using XBRL-formatted information will form more positive perceptions (compared to non-aided users) of their own XBRL-enabled financial statement analysis efficiency. We assume that all investors have a basic knowledge of XBRL-enabled analysis, sufficient to allow those using other non-XBRL types of analyses (e.g., paper-based) to form an opinion of how the different types of analyses compare.

**H1: Given that all investors have a rudimentary understanding of XBRL-enabled analysis, investors using XBRL-formatted information will form a stronger perception of the efficiency of XBRL-enabled financial statement analysis than will paper-based investors.**

***H2: Perceived User/Investor Effectiveness***

Hodge et al. (2004) show that investors benefit from the ability to easily review, compare, and integrate data from multiple firms. Since XBRL business data is more easily searchable and retrievable, use of an XBRL-enabled tool should lead to greater effectiveness. Consistent with this expectation, Hodge et al.'s study provides experimental support for XBRL improving two aspects of effectiveness (i.e., necessary steps toward completing the financial task

successfully): the ability to better acquire and the ability to better integrate financial information. Parallel to H1, to the degree to which IT usage influences user perceptions, we hypothesize that investors using XBRL-formatted information will form more positive perceptions (compared to non-aided users) of their own XBRL-enabled financial statement analysis effectiveness. As in H1, it is assumed that all investors have a basic knowledge of XBRL-enabled analysis for comparison purposes.

**H2: Given that all investors have a rudimentary understanding of XBRL-enabled analysis, investors using XBRL-formatted information will form a stronger perception of the effectiveness of XBRL-enabled financial statement analysis than will paper-based investors.**

In research propositions (RP) 1 and 2, we extend TRA and TAM in relation to XBRL by investigating the effects of users' perceptions of firms (i.e., preparers) providing their business information in XBRL format (relative to a paper-based format). These expectations are termed 'research propositions' because the literatures provide little theoretical support for them. They are primarily theory building attempts. Nevertheless, we believe them to be consistent with TRA and TAM, and view them as extensions of TRA's and TAM's predictions concerning the user's perceptions of specific IT to the user's perceptions of the firms providing or using said IT.

TRA's assumption that perception influences behavior is not limited to IT (as in TAM). Thus, firms providing investor stakeholders with XBRL-formatted business information should be interested in the impact such information has on stakeholders' perceptions of the firms since such perceptions will influence the investors' behavior toward them. A negative or positive investor reaction could impact the firm's decision to adopt XBRL for business reporting purposes. Even a regulatory requirement to report in the XBRL format is likely to only include a small subset of firm information (e.g., the SEC's required "furnishing" of SEC reports in the

XBRL format). Consistent with this expectation, TRA has been extensively applied to customer behavior (Sheppard et al. 1988). Also, research on “halo effects,” “brand name effects,” projection, and transference suggest that perceptions of a specific IT may carry over to the firm providing the IT (Kernberg 1988; Leuthesser et al. 1995). Accordingly, we expect that the attitudes investors form about XBRL may carry over to the firms providing XBRL-formatted information. Nonetheless, RP1 and RP2 have less theoretical grounding than do H1 and H2 and are therefore more exploratory and theory-building in nature.

***RP1: Perceived Firm Efficiency***

Efficiency refers to the amount of resources required to achieve the desired objective, with fewer required resources equating to greater efficiency (Brenner et al. 2002). We predict that XBRL, or more specifically, a tool based on XBRL, will reduce the resources required to prepare and analyze financial reports. Thus, based on TRA’s assumption that experiences rationally influence perceptions and intentions, we predict that investors using XBRL-formatted information will form larger positive efficiency perceptions (compared to paper-based investors) of firms that provide their business information via XBRL. As in H1 and H2, it is assumed that all investors have a basic knowledge of XBRL-enabled analysis for comparison purposes.

**RP1: Given that all investors have a rudimentary understanding of XBRL-enabled analysis, investors using XBRL-formatted information will form a stronger perception of the efficiency of firms supporting XBRL-enabled financial statement analysis than will paper-based investors.**

***RP2: Perceived Firm Effectiveness***

Effectiveness is the extent to which a technology enables achieving desired objectives (Brenner et al. 2002; Yuthas and Eining 1995). From a firm perspective, the objective of XBRL is to reduce data redundancy, and therefore, improve reporting consistency and reduce errors (Hodge et al. 2004). As mentioned earlier, XBRL allows firms to store financial statement data

in a single location, but use the data for multiple purposes. Not only does this reduce report preparation time, but it also reduces the likelihood of errors and inconsistent data (i.e., it makes the data relatively more accurate). XBRL-enabled users should be able to more strongly perceive this effect, given their own experiences. As in noted above, it is assumed that all investors have a basic knowledge of XBRL-enabled analysis for comparison purposes.

**RP2: Given that all investors have a rudimentary understanding of XBRL-enabled analysis, investors using XBRL-formatted information will form a stronger perception of the effectiveness of firms supporting XBRL-enabled financial statement analysis than will paper-based investors.**

### III. METHOD

#### Participants

Sixty-four MBA students at a medium-sized public university represent our proxies for the nonprofessional investors. There are no significant differences in age, number of accounting courses taken, years of work experience, prior XBRL knowledge and experience, semester of experiment, gender, or undergraduate degree obtained between conditions.<sup>7</sup> Additionally, self-efficacy beliefs are measured in a manner similar to Hunton and Beeler (1997) using three items summed into a single index (Cronbach's alpha = 0.89). However, it too is not significant between conditions ( $p$ -value = 0.83). Three participants are dropped for not completing the instrument.<sup>8</sup> Thus, there are 61 usable responses (41 in the XBRL-formatted condition and 20 in the paper-based condition).<sup>9</sup>

Study participants include 26 females (42.6%), 34 males (55.7%), and 1 unreported (1.7%). Many of the MBA students have a professional work history, as evidenced by the average age of 28 years ( $SD = 4.61$ ) and work experience ( $M = 6.04$  years,  $SD = 4.85$ ) demographics. MBA students have been used in recent investment studies (e.g., Bloomfield and Libby 1996; Bloomfield et al. 1999; Hirst et al. 1999; Maines and McDaniel 2000; Hodge et al.

2004; Koonce et al. 2005) and empirically shown to be appropriate proxies for nonprofessional investors in the literature (Elliott et al. 2007).<sup>10</sup>

Using seven-point Likert scales, two items on the post-test questionnaire inquire as to task difficulty. The first asked, “Overall, how would you rate the difficulty of the company analysis task you had to do?” (1 = not difficult, 7 = extremely difficult). The second item required a response to the statement, “I thought the task was very easy.” (1 = strongly disagree, 7 = strongly agree). We reverse-scored the second item in order to protect against common answer bias such that a low score represents a perceived “easy” task, while a higher score represents a perceived “difficult” task (consistent with the direction of the first item). Since the two items are highly correlated (Cronbach’s alpha (0.80); Pearson Correlation of 0.67,  $p$ -value < 0.001), they are summed into a single index and analyzed. The mean (standard deviation) of the two groups are 9.05 (2.76) for the group using the Excel Investor Tool created in XBRL (henceforth, the XBRL-formatted group) and 9.25 (2.49) for the nondirected group performing the task using all paper-based information (henceforth, the paper-based group), indicating a slight tendency toward the “more difficult” half of the scale (the midpoint of the combined scales would be a score of 8). An ANOVA reveals no difference between groups ( $F$ -statistic = 0.08,  $p$ -value = 0.79). Thus, even though the XBRL-formatted participants are *novice* users and have to essentially learn on their own how to use the NASDAQ Excel Investor Tool, they do *not* perceive the task to be any more difficult than the paper-based group.

## **Procedures**

Study participants come from one of the author’s MBA classes. Although the students were not randomly chosen, the particular classes were randomly assigned (i.e., coin flip) to either the XBRL-formatted or paper-based experimental condition. Earlier in the course, all student



participants completed a group financial statement analysis case using paper-based annual reports. Additionally, prior the experiment, all participants receive instructions to independently read about XBRL (in order to form their own opinions), are given a brief XBRL description, and are given a short (5-10 minute) demonstration regarding some of the capabilities of the Investor's Assistant Tool. As noted in the prior section, some basic knowledge of XBRL-enabled analysis is needed on which to base comparisons to other non-XBRL types of analyses. No attempts at XBRL advocacy, however, are made by the instructor in order to ensure independent opinions of the student participants.

The research instrument is in the form of an anonymous questionnaire, based on a take-home test (participants hand in each separately).<sup>11</sup> Since the test is an important part of the students' course grade, we expect students participating in the study to be motivated and would take the task seriously. Both experimental conditions are assigned to analyze two companies: Applied Micro Circuits Corporation (AMCC) and Maxim Integrated Products, Inc. (MXIM). Specifically, participants are to analyze the two companies over a two year period and choose one company as the "better" investment choice. Participants are told that the companies were to be analyzed similarly to the manner the participants were instructed in class throughout the semester (and like they did on their earlier group projects). That is, "better" companies are so because of various ratio analysis results and footnote disclosures, rather than some subjective criterion (e.g., which company is more ecologically friendly). Participants stated that they had no prior knowledge with either company, eliminating a potential bias in their analysis.

All participants receive identical paper-based information containing background information for each company (obtained from the annual reports) and select segment data, as well as the post-test questionnaire together with the take-home test. Although the test is required,

completing the post-test questionnaire is voluntary. Participants are instructed to answer the questionnaire according to their test experiences.<sup>12</sup> All participants are given a week (i.e., until the next class) to complete the test and optionally fill out the questionnaire.

The XBRL-formatted group is assigned to acquire and analyze the firm performance using the NASDAQ's Excel Investor Analysis tool ([www.NASDAQ.com/xbrl](http://www.NASDAQ.com/xbrl); see Figure 2), developed jointly by NASDAQ, PricewaterhouseCoopers, and Microsoft. It uses point-and-click technology and requires no programming or coding skills. When the participants go to the above URL to download the tool, they are provided an explanation regarding the data being coded in XBRL. This information is necessary so the XBRL-format participants do not think they are doing their analyses in Excel, rather than XBRL (the manipulation check questions confirm this notion). All of the company information is tagged in XBRL, but is brought to a more "user-friendly" state through the use of the Excel format. The tool contains links to both firms' financial statements, selected footnotes, and auditor reports constructed using an XBRL instance document (which is explained to all participants during the instructor's demonstration) and could perform some basic analysis functions such as providing charts and graphs. The participants are responsible for learning how to get the tool to do their desired analyses. The paper-based group is given the identical information provided in the XBRL tool, but on paper, which is consistent with the earlier project.<sup>13</sup>

[Insert Figure 2 about here]

Although using take-home test procedures removes task completion from our direct control, several factors mitigate the impact of this condition of our results. Since our dependent variables are types of perceptions and not performance indicators (e.g., accuracy) we are less concerned with participants influencing each other. Unlike Hodge et al. (2004), we are not

interested in how potential XBRL-enabled analysis affects performance, but only in how it affects perception. In order to achieve this goal, our primary experimental requirements are for XBRL-formatted participants to be exposed to XBRL-formatted environments and for paper-based participants to perform the task (test) in non-XBRL environments. To ensure that XBRL-formatted participants use the XBRL analysis tool, they are not provided paper copies of the test companies' financial statements, but had to find and retrieve them with the XBRL tool. Additionally, all completed tests require supporting documentation (e.g., graphs, ratios, etc.). XBRL-formatted participants need to use the XBRL-formatted tool; whereas, paper-based participants could not use the XBRL tool. The documents submitted by the paper-based group were examined to see if there were any indications of being retrieved from the XBRL tool, of which there were none.<sup>14</sup>

Furthermore, although we have relatively less experimental control over participant responses by using an out-of-lab research design, our design is consistent with a growing trend in psychology-based research (Reips 2000) and accounting research (e.g., Alexander et al. 2006; Kadous et al. 2006), and provides us with advantages over a traditional laboratory experiment.<sup>15</sup> Bryant et al. (2004) note that out-of-lab experiments can improve external validity because participants can complete the task in a more realistic environment, rather than in an artificial laboratory setting. For our purposes, the participants parallel an average "day-trader" in that they are able to analyze the firms whenever and however they wanted over the period of the experiment, and are able to use a "real" investor analysis tool, rather than a researcher-constructed tool. Also, Bryant et al. (2004) observe that out-of-lab experiments can significantly reduce demand effects and other experimenter biases because the task is completed outside of the researcher's view. In a study comparing traditional laboratory experiments and out-of-lab

experiments, Alexander et al. (2006) find no differences with regard to interaction with the independent or dependent variables; thus, providing support for the convergent validity of both designs. In addition to our study, similar investor-based accounting research uses an out-of-lab design (e.g., Kadous et al. 2006).

## **Variables**

Dependent variables are measured in the post-test questionnaire using seven-point Likert scales (1 = strongly agree, 7 = strongly disagree). The dependent variable for H1 (perceived investor efficiency) is phrased, “I believe that using XBRL to analyze a company’s annual report information would be more efficient than using a paper version of the annual report.” The dependent variable for H2 (perceived investor effectiveness) is phrased the same as H1 except for substituting the word “effective” for “efficient.” The dependent variable for RP1 (perceived firm efficiency) is phrased, “I believe that using XBRL to report a company’s financial information would make a company more efficient.” Finally, the dependent variable for RP2 (perceived firm effectiveness) is phrased the same as RP1 except for using “effective” instead of “efficient.”

We choose self-reported single-item measures for the dependent variables for two reasons. First, our “effectiveness” and “efficiency” constructs are understood by participants and participants can observe their attitudes or perceptions regarding them without difficulty. Since the efficiency and effectiveness of firm business reporting is a common discussion topic throughout the course, we feel that by the end of the semester (when the experiment is run) the MBA student participants are able to converge on the meanings of efficiency and effectiveness. Consistent with this expectation, in a pilot of this study, MBA students (not used as participants in the current study) state that the wording in the task instrument is not confusing or ambiguous.

Second, we examine participants' perceptions as the result or outcome of a preceding cause and not as the cause of observed behavior (as in prior TAM studies; see Fig. 1, especially Subfigure A). The literature on single-item versus multiple-item measures suggests that self-reported single-item measures are appropriate when (1) the constructs being measured are understandable per se by participants and (2) the focus of the investigation is on participants' beliefs or attitudes about perceptions of a construct as opposed to how perceptions affect subsequent decisions (Gardner et al. 1998; Ilgen et al. 1981; Wanous and Reichers 1996; Wanous et al. 1997).<sup>16</sup> Our study meets both of these criteria: (1) consistent with the first criteria, feedback from our pilot study, as noted above, indicates that participants have no problems understanding the instrument; and (2) consistent with the second criteria, our study examines perceptions that participants can accurately self-report. Although it might be criticized that the terms "effectiveness" and "efficiency" are too vague or general, especially when left to participants to define for themselves, we would point out that this procedure is accepted by the relevant literatures for other similar terms such as "job satisfaction" and "participation in decision making" (Ilgen et al. 1981; Wanous et al. 1997). The deciding factors for applying this approach are whether the term in question is one of everyday use or from a specialized (i.e., research) vocabulary, and whether or not we are interested in knowing what participants think or perceive about the item being research *in their own terms*. Our study meets these factors also.

The independent variable, "format," consists of two groups: XBRL-formatted and paper-based. Participants are randomly assigned to these groups based on their class attended. Of all covariates tested (see "Participants" section), only the current degree being sought is significant across conditions and, thus, used as a covariate in the analysis.<sup>17</sup> The experiment is conducted incorporating a between-subjects experimental design.

## IV. RESULTS

### Manipulation Check

A manipulation check is used to ensure that the participants understand the source of the information they receive (i.e., either paper-based or by using the XBRL-enabled investment tool). Using a seven-point Likert scale (1 = strongly disagree, 7 = strongly agree), participants respond to the following statement in the post-test questionnaire, “I was asked to analyze companies using XBRL-formatted company information on the computer.” The means (standard deviations) for the XBRL-formatted and paper-based groups are 6.58 (1.11) and 2.93 (2.34), respectively.<sup>18</sup> *T*-tests indicate that the means are significantly higher than the midpoint ( $p$ -value < 0.01) for the XBRL-formatted group and significantly lower than the midpoint ( $p$ -value < 0.05) for the paper-based group. We conclude, therefore, that participants properly understand their information sources.

Table 1 presents descriptive statistics and a summary of the following hypotheses testing.

[Insert Table 1 about here]

### Hypotheses Testing

Hypothesis 1 examines the perceived efficiency of using XBRL in financial statement analysis and predicts that investors using XBRL-formatted information (compared to those using paper-based information) will perceive XBRL-enabled analysis as more efficient. As presented in Table 2 and consistent with H1, the XBRL-formatted group’s mean (1.90;  $SD = 0.94$ ) is significantly less than the nondirected, paper-based group’s mean (3.30;  $SD = 2.25$ ;  $F$ -statistic = 11.39,  $p$ -value < 0.01). Both means are on the “agreeable” side of the scale regarding using XBRL for financial statement analysis.<sup>19</sup> Thus, H1 is supported.

[Insert Table 2 about here]

Hypothesis 2 examines the perceived effectiveness of using XBRL in financial statement analysis and predicts that investors using XBRL-formatted information (compared to nondirected investors using paper-based information) will perceive XBRL-enabled analysis as more effective. As displayed on Table 3, the ANCOVA results support this hypothesis ( $F$ -statistic = 4.33,  $p$ -value = 0.04). Specifically, the XBRL-formatted group's mean (2.20;  $SD$  = 1.21) is statistically lower than the paper-based group's mean (3.15;  $SD$  = 2.25) and both means are again on the lower (agreeable) half of the scale. Thus, H2 is supported.

[Insert Table 3 about here]

Research Proposition 1 compares the perceived efficiency of a firm using XBRL for financial reporting versus the same firm providing only paper-based information. RP1 predicts that firms providing XBRL-enabled information will be perceived by XBRL-formatted investors as more efficient (relative to investors using paper-based information). The results of the ANCOVA are presented in Table 4 and are consistent with RP1. Specifically, the XBRL-formatted group's mean (1.98;  $SD$  = 1.13) is significantly lower than the paper-based group's mean (2.98;  $SD$  = 2.00;  $F$ -statistic = 5.69,  $p$ -value = 0.02). An interesting finding, to be discussed later in the paper, is that both groups' means are on the "agreeable" side of the scale. Thus, RP1 is supported.

[Insert Table 4 about here]

Research Proposition 2 compares the perceived effectiveness of a firm using XBRL for financial reporting versus the same firm providing only paper-based information. RP2 predicts that firms providing XBRL-enabled information will be perceived by XBRL-formatted investors as more effective (compared to investors using paper-based information). As displayed in Table 5 and consistent with RP2, the XBRL-formatted group's mean (2.32;  $SD$  = 1.31) is significantly

lower than the paper-based group's mean (3.20;  $SD = 1.47$ ;  $F$ -statistic = 4.84,  $p$ -value = 0.03). Once again, both means favor XBRL-formatted reporting. Thus, RP2 is supported.

[Insert Table 5 about here]

### **Sensitivity Analysis**

We ask participants to respond using a seven-point Likert scale (1 = strongly agree, 4 = not sure, 7 = strongly disagree) to two statements in order to improve construct validity and provide further evidence that XBRL usage results in perceived effectiveness gains. Specifically, we want to find out if XBRL usage would result in increased perceived accuracy both in firm-preparers' information and in nonprofessional investor analysis, where increased accuracy (i.e., successful task completion) is one of the objectives of XBRL use and therefore another indicator of effectiveness (Yuthas and Eining 1995).

The first statement is, "I believe that using XBRL to report a company's financial information would result in more accurate information than using the current technology." The ANOVA is significant ( $F$ -statistic = 23.96,  $p$ -value < 0.01), with the XBRL-formatted group having a significantly smaller mean (2.17;  $SD = 1.09$ ) than the paper-based group ( $M = 4.20$ ;  $SD = 2.07$ ). Thus, the participants who use the NASDAQ Investor Tool are strongly in agreement with firms being more accurate in reporting if they use XBRL (consistent with one of XBRL's intended benefits); whereas, participants who did their analysis solely using paper-based information are unsure.

The second statement is phrased, "I believe that using XBRL to analyze a company's annual report would provide more accurate results than using a paper version of the annual report." The ANOVA indicates that the mean for the XBRL-formatted group (2.54;  $SD = 1.31$ ) is statistically lower ( $F$ -statistic = 7.59;  $p$ -value < 0.01) than the mean for the paper-based group



(3.55;  $SD = 1.50$ ). The mean for the paper-based group is not statistically less than the midpoint of the scale ( $p$ -value  $> 0.05$ ), indicating this group is unsure of this XBRL intended benefit.

To provide further support for our contention linking accuracy and effectiveness, we ran a Pearson Correlation analysis for each measure. Results indicate both effectiveness measures are significantly correlated with the accuracy measures (Corr. = 0.57,  $p$ -value  $< 0.001$  for the company reporting accuracy/effectiveness measure; Corr. = 0.36,  $p$ -value  $< 0.01$  for the individual analysis accuracy/effectiveness measure). Thus, the results from sensitivity analysis are consistent with XBRL's intended accuracy (perhaps due to decreased data entry errors) for both preparers and users of business information and with H2's and RP2's predictions involving perceived effectiveness.

## V. CONCLUSIONS

We investigate the perceived efficiency and effectiveness of XBRL-formatted reporting compared to paper-based reporting in relation to financial statement analysis and firms providing financial statements. While prior academic financial reporting studies and anecdotal reports in accounting practice indicate that XBRL has practical benefits (e.g., Hodge et al. 2004), research on the effects of XBRL use on user perceptions has been lacking, although theory indicates that perceptions strongly influences behavior, including IT use. This study fills that gap.

Both of our hypotheses and research propositions are supported by testing and sensitivity analysis. These results indicate that nonprofessional investors who use XBRL-formatted information have higher perceptions of analytical effectiveness and efficiency through the use of XBRL-enabled information (compared to paper-based investors performing nondirected analysis). Further, XBRL-formatted investors have higher efficiency and effectiveness

perceptions (relative to nondirected paper-based investors) regarding firms that provide XBRL-enabled information.

An interesting non-hypothesized finding is that both groups are agreeable to XBRL's perceived efficiency and effectiveness advantages for both preparers and users of financial information.<sup>20</sup> Thus, the sample in general appears receptive (i.e., had positive attitudes) to XBRL in terms of perceived efficiency and effectiveness gains. We believe that when the XBRL tool was demonstrated in class for all to see, students could see its advantages, having performed similar analyses on paper earlier in the semester. This result suggests that educating an organization's management and external stakeholders about XBRL and providing an example of its use could bring about positive perceptions of the firm (i.e., a halo effect). Hands-on use of an XBRL tool appears to enhance favorable perceptions of efficiency and effectiveness. In aggregate, our findings support the SEC's initiative, as well as others similar to it around the globe, to require more XBRL-formatted reporting.

One implication of our results is that experience using XBRL-enabled analysis tools increases perceptions of the value of these tools *beyond what can be gained from reading about them or seeing others demonstrate their use*. Thus, to the extent possible, investors should be enticed into using XBRL tools for themselves. Online websites with free-to-try XBRL tools, such as what can currently be found on the SEC's website, are periodically available and a good step in achieving this objective. However, it should be noted that the third-party demonstration provided to participants in this study was very basic. Future research might examine whether more thorough instructions and demonstrations not involving use, as well as an option for allowing investor choice can substitute for actual hands-on experience.

Our study is subject to a number of limitations. First, the use of MBA students may limit the external validity of the experiment, because they may not adequately substitute for actual nonprofessional investors. This threat is mitigated, however, by the past business-related experience of most MBA students used in the study. The threat to external validity is also mitigated because the task was administered as a take-home test (i.e., an out-of-lab experiment). While out-of-lab experiments involve some loss of control, they also have compensating advantages (Alexander et al. 2006; Bryant et al. 2004). A take-home test can more accurately reflect real world conditions by allowing participants an unrestricted amount of time to analyze the data and make the investment decision. Our participants likely took advantage of this option to varying degrees, as do actual nonprofessional investors. However, since we had no way to monitor the amount of time participants actually expended on the test, we cannot offer data in this regard.

The use of a dichotomous variable to measure XBRL usage is another potential limitation of the study. As with any innovation, XBRL can be adopted and used to different degrees by firms and individuals. This limitation is minimized however, by the fact that many firms and individuals use standard tools when viewing and using XBRL data, reducing the potential level of actual XBRL adoption variance.

Comparing paper-based analysis to XBRL-enabled analysis might be seen as an uninformative comparison. However, our paper-based condition refers primarily to how the materials for analysis are provided to participants, who are free to then use (or not use) spreadsheets for further analysis. Thus, our study covers one common scenario with nonprofessional investors (e.g., working from paper documents received in the mail as required by the SEC or performing copy-and-paste functions from online documents). However, our

results do not generalize to situations in which data is directly downloadable into spreadsheets. Accordingly, our paper-based condition is a proxy for nondirected analysis potentially involving computerized tools (e.g., spreadsheets), and our results are generalizable beyond the paper-based condition, strictly construed. Future research could exert more control on this aspect of the experiment than was possible with our take-home test method and could also examine scenarios involving data easily downloadable into spreadsheets.

We acknowledge that having participants perform the task as a take-home test and the use of self-reported single-item measures of dependent variables are frequently viewed as limitations to research. However, as discussed above in the “Method” section, we believe that these procedures are appropriate and in agreement with the research literature for the type of data we collect (i.e., perceptions), and that potential limitations resulting from these procedures are adequately controlled for and mitigated by other factors in the experiment.

Finally, we did not ask our participants if they were professional investors. If several participants were professional investors, our results could be distorted. Even though no discussion of “professional analysts” came up in or out of class, this possibility cannot be ruled out entirely. However, the instructor (one of the researchers) did have a good idea of the types of jobs most of the students had.

The limitations discussed above suggest several areas for future research. Further research on XBRL could survey actual investors (professional and nonprofessional), financial institutions, auditors, and financial statement preparers to assess any differences in their perceptions of efficiency and effectiveness. Another interesting area is the development of more comprehensive measures of XBRL efficiency and effectiveness. In addition, we presume that the investors subsist in an environment where they have a choice in using or not using an XBRL-

enabled analysis tool. Given the SEC mandate of XBRL-formatted reporting, future research should consider if investors perceptions change if they are required to analyze XBRL-formatted information or are given a choice. Finally, future research should investigate what level of adoption and usage across firms is required before investors perceive a benefit to adopting the technology.

## FOOTNOTES

- 1 XBRL supporters include a consortium of over 450 CPA firms, companies (e.g., Microsoft), regulators (e.g., Securities and Exchange Commission (SEC)), and standard setters and accounting bodies (e.g., the Financial Accounting Standards Board (FASB), the International Accounting Standards Committee and Canadian Institute of Chartered Accountants (Debreceeny and Gray 2001; FASB 2000; Trites 1999)).
- 2 This freedom of choice would probably vary by user. Choice by institutional investors might be constrained by organizational policies promoting the use of XBRL-enabled analysis tools, while nonprofessional investors would be completely free to choose among available methods.
- 3 *Effectiveness* refers to the ability to successfully accomplish a task, whereas *efficiency* refers to successfully accomplishing a task with minimal waste of resources. Effectiveness is frequently measured in terms of accuracy; efficiency, in terms of task time with accuracy as a covariate. In this study, we were interested in participants' perceptions of the effectiveness and efficiency of certain aspects of XBRL, and not with objective measures of the effectiveness and efficiency of these aspects of XBRL. The literature on single-item measures, such as effectiveness and efficiency, recommends not explicitly defining them for participants when investigating participants' perceptions of the constructs (Ilgen et al. 1981; Wanous et al. 1997), provided that the terms are in common use. Instead, participants should use their own working definitions. For additional discussion, see the "Method" section.
- 4 Consistent with Pinsker (2007), we define nonprofessional investors as those who do not invest as a profession (i.e., not analysts, pension plans, etc.).

- 5 Theory of Planned Behavior extends TRA to include control beliefs and perceptions of control beliefs (Ajzen 1991). Since these variables do not apply to the situation we are investigating, we use TRA as the more parsimonious of the two models and because TAM is developed from TRA.
- 6 According to TRA, intentions consist of attitudes and subjective norms (i.e., beliefs that others think one should or should not perform a certain behavior). Since behavior is not a dependent variable in our study, we do not discuss subjective norms.
- 7 Using seven-point Likert scales where 1 is 'low' and 7 is 'high,' mean (standard deviation) participants' perceived XBRL knowledge and experience before the course are 1.49 (1.22) and 1.44 (1.20), respectively. Thus, it can be inferred that the participants are novice users of XBRL and do not bring preconceived biases (regarding XBRL) into the experiment.
- 8 There is no significant change in the results when the three participants who did not complete the instrument are included in the analysis.
- 9 The large discrepancy in cell sizes is due to the splitting of entire classes into experimental conditions. We chose this design in order to prevent hypothesis guessing. Specifically, if those in the same class were split into either condition, given our out-of-lab design, if they chose to "cheat" and see what others were doing, they would see the different technology and be more likely to engage in hypothesis guessing. The disparity in sample size between conditions is taken into account by using general linear models (GLM) procedures.
- 10 The MBA students used are completing a graduate financial accounting class. Elliott et al. (2007) indicate that MBA students are appropriate proxies for investors if they have

sufficient knowledge of the task materials. Under this condition, we believe that the MBA students who participated in our study are appropriate experimental participants, given their classroom instruction completed at the time of the study (the experiment is conducted at the end of the course) and the fact that most were scheduled to graduate later in the year. Further support for our use of MBA students is provided by Hodge et al.'s (2004) use of MBA students in their similar XBRL study.

- 11 There are no significant differences in the test scores of the various groups. To ensure that student course grades were not unfairly affected by the experiment condition to which a student was assigned, overall test grades were based on other criteria in addition to performance of the experimental task part of the test (e.g., writing, organization, reasonableness of arguments for conclusion, etc.). Further, the experimental task portion of the test was assigned a relatively low weight. Thus, the test grades were too noisy to accurately reflect task performance and were therefore not used as performance measures. Also, the study was approved by the university's Institutional Review Board (IRB), which ensures the students involved in research are not treated unfairly.
- 12 We ask participants about their perceived relationship between the questionnaire and the task (i.e., exam). All participants indicate that since the exam is being graded and the questionnaire is not, they did not even look at the questionnaire until after completing the exam.
- 13 Although the students are not required to perform their analyses using every ratio learned, the same opportunity to calculate them exists in both groups. Consequent examination of the analysis task (i.e., final exam) does not yield many differences in the number or type of ratios used between conditions.



- 14 As additional assurance that the test/task would be performed as required for research purposes, all participants are required to sign an honor pledge indicating they would not discuss the exam and questionnaire (i.e., the research instrument) with anyone other than the instructor. All participants are made aware that first time violators of the honor pledge typically receive suspensions, while second time offenders are expelled from the University.
- 15 “Out-of-lab” terminology is consistent with Alexander et al.’s (2006) description of an experiment being conducted outside of the researcher’s presence.
- 16 These studies provide “personality factors” and “cognitive abilities” as examples of constructs too complex for single-item measures. These constructs are multi-dimensional, participants are uncertain of their meaning, and they involve processes of which participants are not completely aware. Examples of constructs for which single-item measures have been empirically verified to be appropriate include “job satisfaction,” “amount of participation in decision making,” and “probability that an effort affects performance of a task.” The meaning of these constructs is unambiguous to participants and participants are fully aware of their beliefs and perceptions regarding them.
- 17 Although all participants are graduate students, four participants are not pursuing an MBA. Their demographics, however, are quite similar to the MBA student participants.
- 18 We looked through the paper-based group’s responses to the manipulation check question to see if we could identify any outliers that would cause the mean and standard deviation to be relatively high. We found responses from two individuals whose responses were on the opposite end of the scale (i.e., 7’s when they should have been 1’s). We dropped these two participants from the sample and re-ran the hypothesis testing analyses. Revised

results indicate both effectiveness dependent variables change significance from the .025 to the .05 level (1-tailed tests). The revised analysis does not affect the significance of either efficiency dependent variable. Since all four dependent variables remain significant even after dropping the two individuals, our contentions and inferences do not materially change. Therefore, we keep the two individuals in the hypothesis testing analyses to preserve statistical power and degrees of freedom.

19 Unless otherwise indicated, results of *t*-tests confirm the mean is statistically lower than the midpoint of the scale.

20 We differentiate our results from Hodge et al.'s (2004) through usage. Specifically, they operationalize XBRL as an optional search engine to find data. We operationalize XBRL as an analysis tool. Thus, we infer from the differences in the results that when investors use XBRL as an analysis tool, they generally have favorable perceptions, and would want to use it again (consistent with the TAM model). We understand that for Hodge et al.'s users who actually used XBRL, they had similar, favorable opinions of the technology.

## REFERENCES

- Adams, D. A., R. R. Nelson, and P. A. Todd. 1992. Perceived usefulness, ease of use, and usage of information technology: A replication. *MIS Quarterly* 16 (2): 227-247.
- Agarwal, R. 2000. Individual acceptance of information technologies. In R. W. Zmud (Ed.) *Framing the Domains of IT Management: Projecting the Future...Through the Past*. Cincinnati, OH: Pinnaflex Education Resources: 85-104.
- Ajzen, I. 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 50: 179-211.
- , and M. Fishbein. 1980. *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall, Inc.
- Alexander, R. M., A. D. Blay, and R. K. Hurtt. 2006. An examination of convergent validity between in-lab and out-of-lab Internet-based experimental accounting research. *Behavioral Research in Accounting* 18: 207-217.
- Al-Gahtani, S. 2001. The applicability of TAM outside North America: An empirical test in the United Kingdom. *Information Resources Management Journal* 14 (3): 37-46.
- Armitage, C. J., and M. Conner. 2001. Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology* 40: 471 - 499.
- Bagozzi, R. P., F. D. Davis, and P. R. Warshaw. 1992. Development and test of a theory of technological learning and usage. *Human Relations* 45 (7): 660-686.
- Bloomfield, R., and R. Libby. 1996. Market reactions to differentially available information in the laboratory. *Journal of Accounting Research* 34 (2): 183-207.
- , R. Libby, and M. W. Nelson. 1999. Confidence and the welfare of less-informed investors. *Accounting, Organizations, and Society* 24 (8): 623-647.
- Bovee, M., M. L. Ettredge, R. P. Srivastava, and M. A. Vasarhelyi. 2002. Does the Year 2000 XBRL Taxonomy Accommodate Current Business Financial-Reporting Practice? *Journal of Information Systems* 16 (2): 165-182.
- Brenner, M., I. Radisic, and M. Schollmeyer. 2002. A criteria catalog based methodology for analyzing service management processes. *13th IFIP/IEEE International Workshop on Distributed Systems: Operations and Management*, Montreal, Canada.
- Bryant, S. M., J. E. Hunton, and D. N. Stone. 2004. Internet-based experiments: Prospects and possibilities for behavioral accounting research. *Behavioral Research in Accounting* 16: 107-129.

- Chiasson, M., and C. Lovato. 2001. Factors influencing the formation of a user's perceptions and use of a DSS software innovation. *The Data Base for Advances in Information Systems* 32(3): 16-35.
- Clements, C. E., and C. J. Wolfe. 2000. Reporting financial results with the video medium: An experimental analysis. *Journal of Information Systems* 14 (2): 79-94.
- Davis, F. D. 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly* 13 (3): 319-340.
- , 1993. User Acceptance of Information Technology: System Characteristics, User Perceptions and Behavioral Impacts. *International Journal of Man-Machine Studies* 38: 475-487.
- , R. P. Bagozzi, and P. R. Warshaw. 1989. User acceptance of computer technology: A comparison of two theoretical models. *Management Science* 35: 982-1003.
- Debreceeny, R., and G. L. Gray. 2001. The production and use of semantically rich accounting reports on the Internet XML and XBRL. *International Journal of Accounting Information Systems* 2 (1): 47-74.
- Elliott, W. B., F. Hodge, J. J. Kennedy, and M. Pronk. 2007. Are graduate students a reasonable proxy for nonprofessional investors? *The Accounting Review* 82 (1): 139-168.
- Financial Accounting Standards Board. 2000. Business reporting research project: Electronic distribution of business information. *Financial Accounting Standards Board*, Norwalk, CT.
- Fishbein, M., and I. Ajzen. 1975. *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley.
- Gardner, D., L. Cummings, R. Dunham, and J. Pierce. 1998. Single-item versus multiple-item measurement scales: An empirical comparison. *Educational and Psychological Measurement* 58 (6): 898-915.
- Hayes, F. 2004. Chaos is back. *ComputerWorld* November 8.
- Hendrickson, A. R., P. D. Massey, and T. P. Cronan. 1993. On the test-retest reliability of perceived usefulness and perceived ease of use scales. *MIS Quarterly* 17: 227-230.
- Hirst, D. E., L. Koonce, and J. Miller. 1999. The joint effect of management's prior forecast accuracy and the form of its financial forecasts on investor judgment. *Journal of Accounting Research* 37 (Supplement): 101-124.
- Hodge, F. D., J. J. Kennedy, and L. A. Maines. 2004. Does search-facilitating technology improve the transparency of financial reporting? *The Accounting Review* 79 (3): 687-703.

- Hunton, J. E., and J. D. Beeler. 1997. Effects of user participation in systems development: A longitudinal field experiment. *MIS Quarterly* 21 (4): 359-388.
- , and R. A. McEwen. 1997. An assessment of the relation between analysts' earnings forecasts, motivational incentives, and cognitive information search strategy. *The Accounting Review* 72 (4): 497-516.
- Ilgen, D., D. Nebeker, and R. Pritchard. 1981. Expectancy theory measures: An empirical comparison in an experimental simulation. *Organizational Behavior and Human Performance* 28: 189-223.
- Kadous, K., S. D. Krische, and L. M. Sedor. 2006. Using counter-explanation to limit analysts' forecast optimism. *The Accounting Review* 81 (2): 377-397.
- Kernberg, O. 1988. Psychic structure and structural change: An ego psychology-object relations theory viewpoint. *Journal of the American Psychoanalytic Association* 36: 315-337.
- Koonce, L., M. L. McAnally, and M. Mercer. 2005. How do investors judge the risk of financial items? *The Accounting Review* 80 (1): 221-242.
- Leuthesser, L., C. Kohli, and K. Harich. 1995. Brand equity: the halo effect measure. *European Journal of Marketing* 29 (4): 57-66.
- Maines, L. A., and L. S. McDaniel. 2000. Effects of comprehensive income characteristics on nonprofessional investors' judgments: The role of financial- statement presentation format. *The Accounting Review* 75 (2): 179-207.
- Mason, R. I., and I. Mitroff. 1973. A program for research on management information systems. *Management Science* 19 (5): 475-487.
- Mun, Y., and Y. Hwang. 2003. Predicting the use of web-based information systems: Self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model. *International Journal of Human-Computer Studies* 59(4): 431 – 449.
- Nielsen Norman Group. 2003. Usability of the Investor Relations Area of Corporate Websites: Guidelines from Usability Studies with Individual Investors, Institutional Investors, Financial Analysts, and Business Journalists, <http://www.useit.com/alertbox/20030218.html> 2003; Last accessed July 1, 2005.
- Pinsker, R. 2007. Long series of information and non-professional investors' belief revision. *Behavioral Research in Accounting* 19: 197-214.
- Reips, U. 2000. The web experiment method: Advantages, disadvantages, and solutions. In M. H. Birnbaum (Ed.) *Psychological Experiments on the Internet*. San Diego, CA: Academic Press: 89-117.

- Segars, A. H., and V. Grover. 1993. Re-examining perceived ease of use and usefulness: A confirmatory factor analysis. *MIS Quarterly* 17: 517-525.
- Sheppard, B. H., J. Hartwick, and P. R. Warshaw. 1988. The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. *Journal of Consumer Research* 15 (December): 325-343.
- Silver, M. S. 1990. Decision support systems: Directed and nondirected change. *Information Systems Research* 1: 47-70.
- Subramanian, G. H. 1994. A replication of perceived usefulness and perceived ease of use measurement. *Decision Sciences* 25 (5/6): 863-873.
- Szajna, B. 1994. Software evaluation and choice: predictive evaluation of the Technology Acceptance Instrument. *MIS Quarterly* 18 (3): 319-324.
- Trites, G. 1999. The impact of technology on financial and business reporting. Canadian Institute of Chartered Accountants, Toronto, Canada.
- United States Congress. 2002. Sarbanes-Oxley Act of 2002. Pub.L. 107-204, 116 Stat.
- Venkatesh, V. 1999. Creation of favorable user perceptions: Exploring the role of intrinsic motivation. *MIS Quarterly* 23: 239-260.
- , and F. Davis. 1996. A model of the antecedents of perceived ease of use: Development and test. *Decision Sciences* 27: 451-481.
- , and -----, 2000. A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science* 46: 186-204.
- , C. Speier, and M. Morris. 2002. User acceptance enablers in individual decision making about technology: Toward an integrated model. *Decision Sciences* 33 (2): 297-316.
- Vessey, I. 1991. Cognitive fit: a theory-based analysis of the graphs versus tables literature. *Decision Sciences* 22 (2): 219-241.
- [www.NASDAQ.com/XBRL](http://www.NASDAQ.com/XBRL). Last accessed March 25, 2003.
- Wanous, J., and A. Reichers. 1996. Estimating the reliability of a single-item measure. *Psychological Reports* 78: 631-634.
- , -----, and M. Hudy. 1997. Overall job satisfaction: How good are single-item measures? *Journal of Applied Psychology* 82 (2): 247-252.

Yuthas, K., and M. Eining. 1995. An experimental evaluation of measurements of information system effectiveness. *Journal of Information Systems* 9 (2): 69-84.

**Table 1**  
**Descriptive Statistics and Summary of Hypotheses and Research Propositions**

<b><u>Prediction</u></b>	<b><u>Mean X<sup>a</sup></u></b>	<b><u>Mean P<sup>b</sup></u></b>	<b><u>Support</u></b>
H1 (The XBRL-formatted group perceives an investor as being more efficient using XBRL)	1.90*	3.30	Yes
H2 (The XBRL-formatted group perceives an investor as being more effective using XBRL)	2.20*	3.15	Yes
RP1 (The XBRL-formatted group perceives a firm as being more efficient using XBRL)	1.98*	2.98	Yes
RP2 (The XBRL-formatted group perceives a firm as being more effective using XBRL)	2.32*	3.20	Yes

<sup>a</sup> Means for the XBRL-formatted group

<sup>b</sup> Means for the paper-based group

\* Indicates significant differences between Mean X and Mean P at an alpha of 0.05.



**Table 2**  
**ANCOVA Table for H1 – Perceived Investor Analysis Efficiency**

<u>Source of Variation</u>	<u>DF</u>	<u>SS</u>	<u>MS</u>	<u>F-stat</u>	<u>p-value</u>
Main Effect:					
Format	1	25.88	25.88	11.39	< 0.01
Covariate:					
Degree	1	3.08	3.08	0.01	0.91
Model	2	26.29	13.14	5.79	< 0.01

*Format* refers to XBRL-formatted or non-XBRL/paper-based formatted financial statements.

*Degree* refers to the undergraduate degree being sought by the participant as reported in the post-test questionnaire.

**Table 3**  
**ANCOVA Table for H2 – Perceived Investor Analysis Effectiveness**

<u>Source of Variation</u>	<u>DF</u>	<u>SS</u>	<u>MS</u>	<u>F-stat</u>	<u>p-value</u>
Main Effect:					
Format	1	11.57	11.57	4.33	0.04
Covariate:					
Degree	1	0.12	0.12	0.05	0.83
Model	2	12.38	6.19	2.32	0.10

*Format* refers to XBRL-formatted or non-XBRL/paper-based formatted financial statements.

*Degree* refers to the undergraduate degree being sought by the participant as reported in the post-test questionnaire.

**Table 4**  
**ANCOVA Table for RP1 – Perceived Firm Efficiency**

<u>Source of Variation</u>	<u>DF</u>	<u>SS</u>	<u>MS</u>	<u>F-stat</u>	<u>p-value</u>
Main Effect:					
Format	1	12.46	12.46	5.69	0.02
Covariate:					
Degree	1	0.31	0.31	0.14	0.71
Model	2	13.74	6.87	3.14	0.05

*Format* refers to XBRL-formatted or non-XBRL/paper-based formatted financial statements.

*Degree* refers to the undergraduate degree being sought by the participant as reported in the post-test questionnaire.

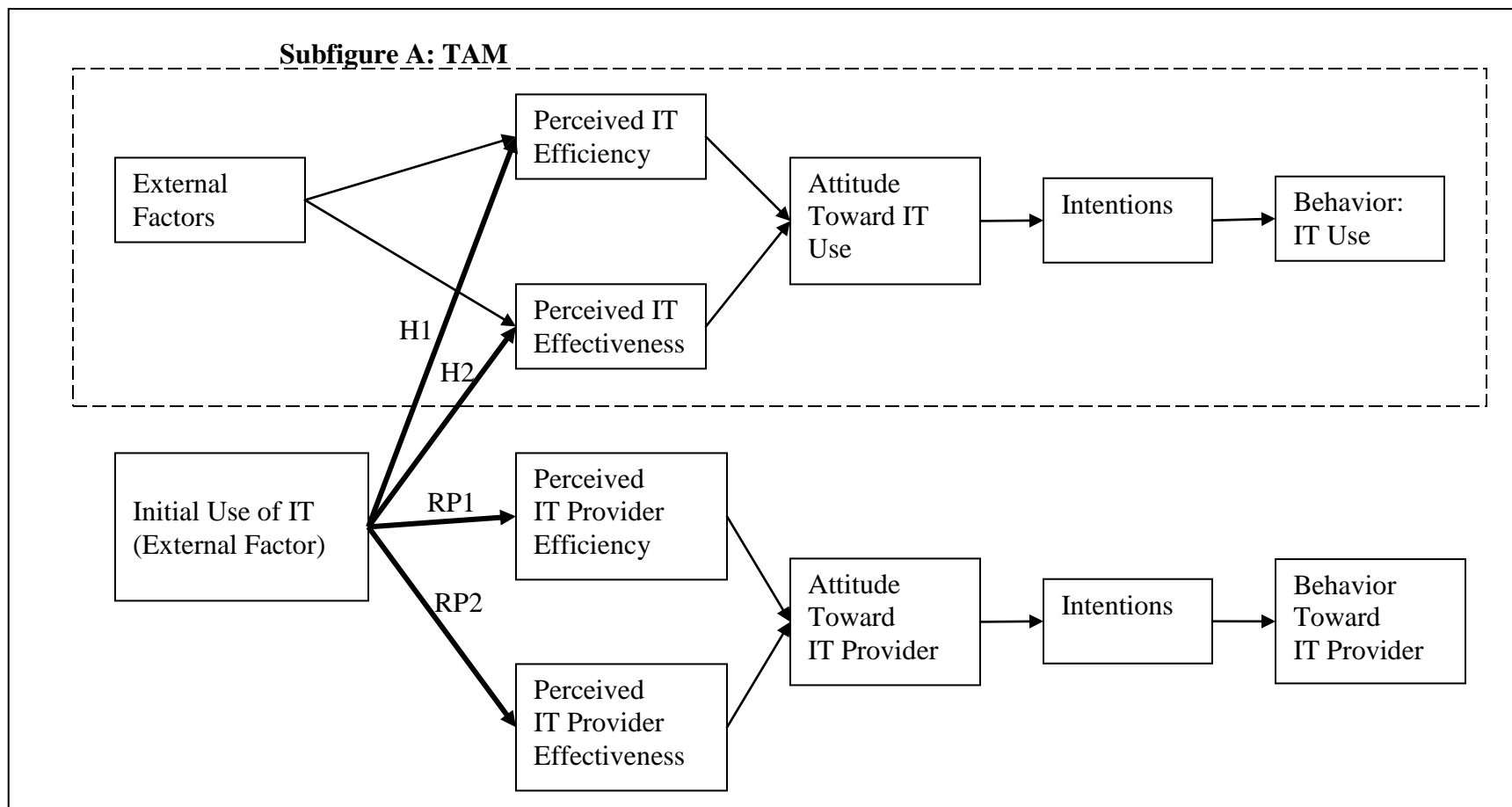
**Table 5**  
**ANCOVA Table for RP2 – Perceived Firm Effectiveness**

<u>Source of Variation</u>	<u>DF</u>	<u>SS</u>	<u>MS</u>	<u>F-stat</u>	<u>p-value</u>
Main Effect:					
Format	1	9.06	9.06	4.84	0.03
Covariate:					
Degree	1	1.37	1.37	0.73	0.40
Model	2	11.85	5.92	3.16	0.05

*Format* refers to XBRL-formatted or non-XBRL/paper-based formatted financial statements.

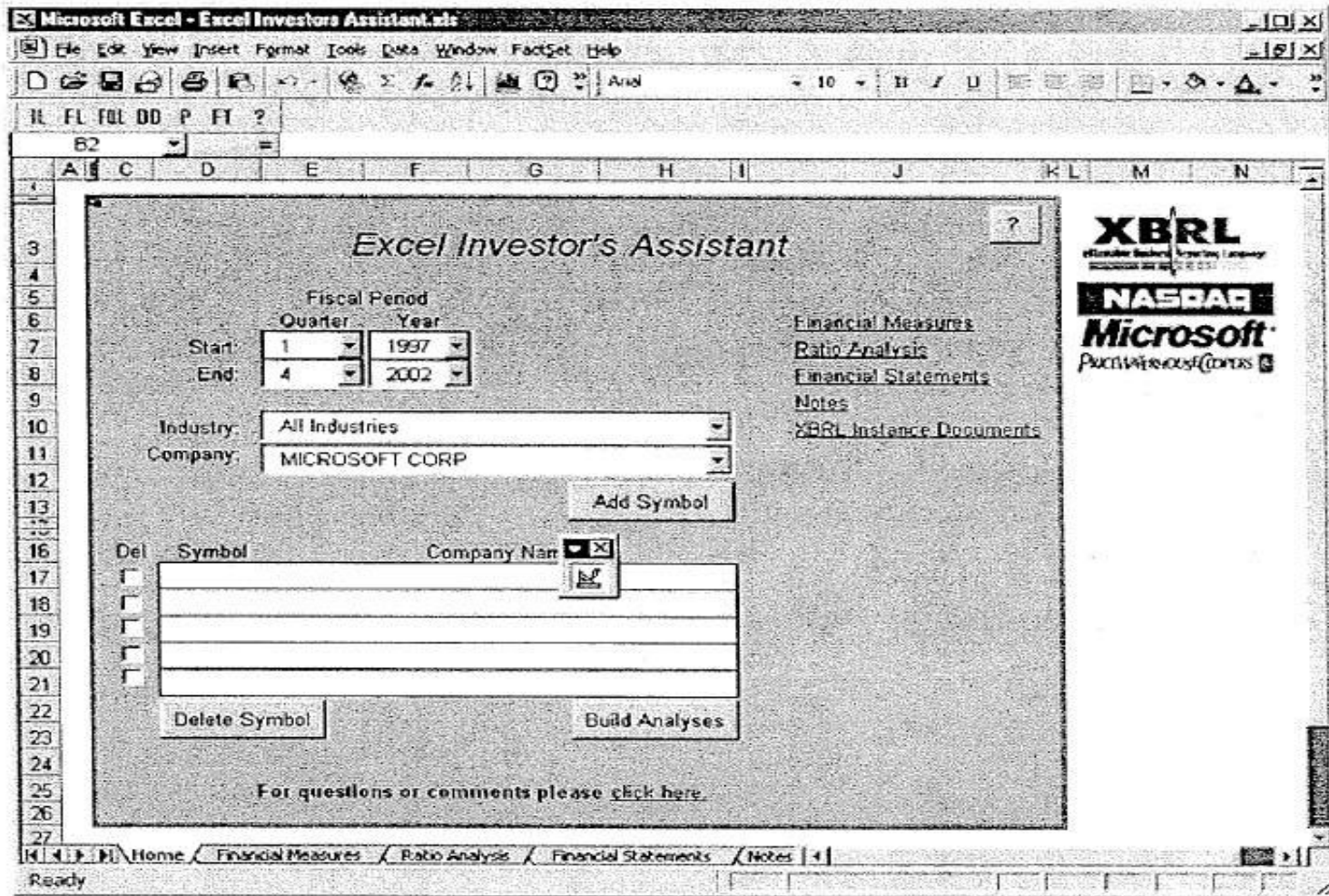
*Degree* refers to the undergraduate degree being sought by the participant as reported in the post-test questionnaire.

**Figure 1**  
**Model of the Effects of IT Use on User Perceptions of IT and IT Provider**



*IT* refers to XBRL-enabled or paper-based analysis of financial statements.  
*IT Provider* refers to the firm provider of either XBRL-formatted or paper financial statements.  
*TAM* in Subfigure A refers to the technology acceptance model and is based on Davis et al. (1989).  
*H1* and *H2* refer to hypotheses 1 and 2; *RP1* and *RP2* refer to research propositions 1 and 2.

**Figure 2**  
**NASDAQ Excel Investor Tool Analysis Start Page**



### **Author Bios**

**Robert Pinsker** PhD (University of South Florida, 2002) CPA, is an associate professor at Old Dominion University, where he teaches Financial Accounting courses. Professor Pinsker's research focuses on behavioral issues related to continuous reporting and XBRL. He has published in *The Journal of Accounting and Public Policy*, *Behavioral Research in Accounting*, *Advances in Accounting Behavioral Research*, *Journal of Information Systems*, and *The International Journal of Accounting Information Systems*.

**Patrick Wheeler** PhD (Georgia State University, 1999) CPA, CITP, is an associate professor at the University of Missouri, where he teaches Accounting Information Systems. Professor Wheeler's research focuses on behavioral issues in the business uses of information technologies. He has published in *The Accounting Review*, *Journal of Information Systems*, *Behavioral Research in Accounting*, *Advances in Accounting Behavioral Research*, *Issues in Accounting Education*, and *The International Journal of Accounting Information Systems*.