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Standardizing the Presentation of Financial Data: Does XBRL's Taxonomy Affect the Investment Performance of Nonprofessional Investors?

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Abstract. Extensible Business Reporting Language (XBRL) is mandated in the United States to make financial information easier to analyze and more useful for investors. When the technology is implemented as intended, it can standardize the information presented in the financial statements. The format is especially beneficial for nonprofessional investors, which represent approximately 41 million investors investing the United States stock exchange. In this study, we conduct an experiment comparing standard and non-standard financial statements, displayed either online or as traditional paper statements. Results suggest that XBRL's ability to standardize financial information facilitates investment performance for nonprofessionals, offering evidence on the value of standardizing the presentation of financial statements and additional benefits of XBRL technology.

Keywords: XBRL, standardization, cognitive fit theory, presentation format, decision making

1. INTRODUCTION

Financial statements provide relevant information for investors and other stakeholders, and regulatory authorities consistently attempt to improve the value of the information through changes to the reporting requirements. In 2009, with the intention of providing users easier, more efficient, accurate, and a more reliable manner of obtaining and analyzing data, the United States (US) began

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requiring public companies and foreign private issuers to submit their financial statements in eXtensible Business Reporting Language (XBRL) format in addition to the regular text format (Securities and Exchange Commission, 2009). While the technology is intended to benefit both professional and nonprofessional investors, this study focuses on the benefits for nonprofessional investors. Research finds the technology improves nonprofessionals' ability to acquire and use information they may have overlooked when searching traditional financial statements (Hodge *et al.*, 2004). The current study explores whether XBRL is useful to nonprofessional investors by standardizing the presentation of financial information and thereby, facilitating the decision-making.

Researchers find that nonprofessional investors have limited investment experience and skillsets and their investment decisions are sometimes affected by the presentation of financial information (Maines & McDaniel, 2000; Koonce *et al.*, 2005). These results are supported by the theory of cognitive fit, which states that performance is negatively affected when a match does not exist between the information presented, the task, and the skill, knowledge, the experience of the individual (Vessey, 1991; Vessey & Galletta, 1991). When a match exists between these factors, individuals are able to generate a consistent and accurate mental representation of the problem, leading to a more effective and efficient task performance. Because nonprofessional investors possess a limited amount of experience and familiarity with financial statements, their cognitive processes are likely to be affected by the presentation of financial information. We posit, however, that XBRL technology's ability to standardize the information benefits nonprofessional investors' investment performance by facilitating this match and making the acquisition and integration of the information less complicated.

Using the theory of cognitive fit as our theoretical background, we conduct a 2 X 2 full factorial between-participants experiment to examine how the standardization (or lack of) and delivery method (paper-based or online display) affects the investment performance of nonprofessional users. Investment performance is measured by the number of ratios correctly calculated, the amount invested in the company considered to be the more profitable, the time required to complete the analysis, and the participants' confidence in their ratio calculations. The delivery method is examined because XBRL is a computer reporting

language and users are expected to view information online. In addition, researchers have found individuals perform at lower levels when information is presented online rather than on paper, an indication that online displays may hinder performance (Dillon, 1992; Galletta, *et al.,* 1996). At XBRL's current stage of diffusion, most investors will only able to view these documents online using SEC's XBRL viewer. Therefore, while the focus of the study is investigating the influence of standardizing the format of financial information, we also examine whether viewing financial statements online affects performance.

As predicted by cognitive fit theory, our results indicate standardizing financial information improves performance. Participants analyzing standardized financial statements were better at calculating ratios, and in less time, when the financial information was standardized than those viewing non-standardized information. Participants viewing the information on paper also spent significantly less time to complete the analysis than those viewing the information online. These results suggest that standardizing financial information is likely to ease the task of acquiring and integrating financial data for nonprofessional investors by reducing the mental processes required for judgments and decision-making while improving efficiency.

In the following sections, we will discuss the background information on XBRL technology and the different types of users of financial data, the theoretical framework used to support the hypotheses, the research method used, and the results of the study. Finally, we will discuss the implications of our results and the study's limitations.

2. BACKGROUND

2.1 Presentation format and XBRL

Users of financial data include professional and nonprofessional investors and each utilize information differently. Professionals possess more experience, technical knowledge, and tend to acquire financial information using a directed-search method, allowing them to be more efficient in the acquisition of financial information and to make more accurate investment decisions than nonprofessionals (Biggs & Mock, 1983; Biggs, 1984; Anderson, 1988). Conversely, nonprofessional investors, such as individuals who buy and sell

securities for their personal investments or retirement accounts, lack the experience and professional judgment than professional analysts, but possess enough investment knowledge and experience to make reasonable and informed investment decisions. Research shows nonprofessionals are influenced by the format of the information, and are less likely to integrate relevant information, which contributes to less than optimal investment decisions (Vessey, 1991; Vessey & Galletta, 1991; Vessey, 1994; Maines & McDaniel, 2000; Shaft & Vessey, 2006). The placement of the information on the financial statements and the labels used to identify financial information can negatively affect nonprofessional investors' decisions (Maines & McDaniel, 2000; Hodge, Kennedy, & Maines, 2004; Koonce *et al*., 2005). They tend to place more weight (value) on information when it is disclosed on the face of the income statement than when the same information is disclosed in the financial statement notes (Hodge, *et al.*, 2004). In addition, a "labeling effect" is shown to lead nonprofessional investors to attribute more risk to some labels than others, even when the risk is exactly the same (Koonce, *et al.*, 2005).

Researchers have proposed that standardizing the presentation of financial information may be beneficial for decision-making. Jensen and Xiao (2001) suggest that standardization and comparability in financial statements are important for investors and regulators because investors will be more effective in comparing and analyzing investment choices and regulators will be better able to monitor the financial reporting of public companies when the information is standardized. Ball (2006) advocates standardized accounting standards, such as International Financial Reporting Standards (IFRS), and reporting formats, believing that it would be particularly advantageous to nonprofessional investors by leveling the playing field between them and professional investors (Ball, 2006, p. 11). According to the Securities Industry Association (SIA), there are "over 41 million nonprofessional investors investing directly in the U.S. stock market" (Elliott *et al*., 2008, p. 473). Many manage their personal retirement accounts, analyze financial statements, as well as make other investment decisions (Elliott *et al.*, 2007). Currently, US companies are not required to employ standardized formats or account labels. However, the Securities and Exchange Commission (SEC) took the first step toward facilitating standardized financial information

when it began requiring all publicly held companies to file and publish their financial statements in e**X**tensible **B**usiness **R**eporting **L**anguage (XBRL) format on their corporate websites. The primary intent was to provide users with an easier, more efficient, more accurate and reliable manner of obtaining and analyzing data from an organization's financial statements. Secondarily, standardizing reporting formats was an additional motive behind the mandate (Securities and Exchange Commission, 2009).

XBRL is an interactive technology that, when utilized as intended by its designers, aids in the acquisition and integration of information from the financial statements (Hodge, *et al.*, 2004). When XBRL-formatted financial statements are prepared, financial information is "tagged" or identified by predefined elements, creating standardized financial statements and increasing comparability between companies. When financial information is not tagged to an element listed in the taxonomy, standardization is diminished. This also occurs when taxonomy extensions, including customized account labels, are created (Boritz & No, 2008, 2009; Zhu & Fu, 2009; Debreceny *et al.*, 2010).

Arguments for standardizing financial information have been reported in the literature by Maines and McDaniel (2000), Hodge *et al.* (2004), Koonce *et al.* (2005), and Ball (2006). In the current study, it is illustrated by income statements of two competitors in the internet information providers industry: Google Inc. and Yahoo Inc. The income statements of Google Inc. and Yahoo Inc. for the first quarter of 2011, shown in Figure 1, demonstrate how firms diminish standardization by presenting similar financial information to investors in alternative manners. Figure 1 presents the revenue and operating expenses for both companies. Both companies customize the account labels and the presentation of stock-based compensation. Yahoo Inc. places stock-based compensation in a separate section at the bottom of the income statement labeled "Stock-based compensation expense by function," where Google includes the same information within each account by modifying the label.

The lack of standardization between the presentation of information in the financial statements of Yahoo Inc. and Google Inc. may diminish comparability and affect investors' judgments, decisions, and overall investment performance because not only are the presentations different from each other, both companies

present stock-based compensation in atypical manners. It is plausible that nonprofessional investors analyzing Yahoo Inc.'s financial statements may not notice the stock-based compensation information listed separately at the bottom of the income statement. Alternatively, Google Inc.'s presentation of stock-based compensation may confuse them regarding what amounts to consider in their calculations and decisions

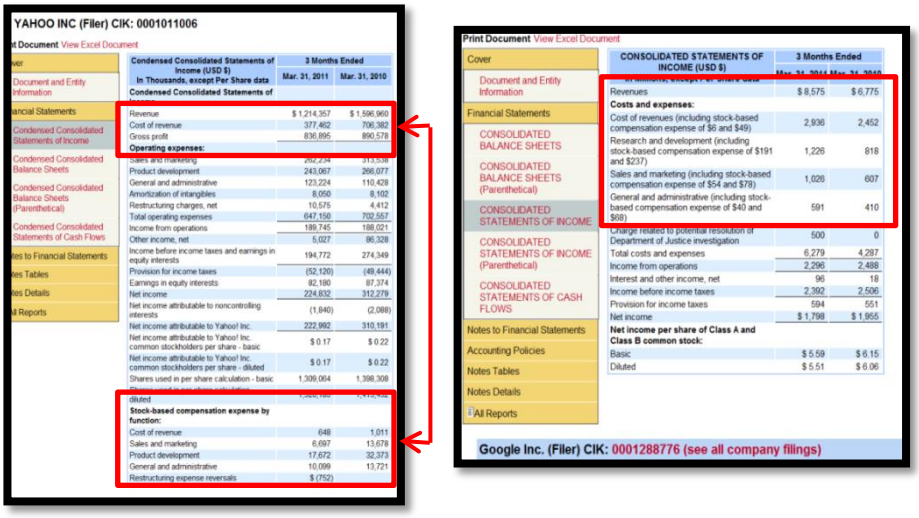

Figure 1. Income statements of Yahoo Inc. and Google Inc.

(Adapted from Yahoo Inc. (2011), Condensed Consolidated Statements of Income and Google Inc. (2011), Consolidated Statements of Income, Retrieved December 21, 2013 from sec.gov)

.Standardizing financial data is achievable with XBRL technology as long as financial information is tagged using predefined elements and labels. We posit that when the technology is used appropriately, standardization of information occurs and is likely to improve the investment performance of nonprofessional investors. Alternatively, when the technology adds taxonomy extensions, or modifies account labels, standardization decreases, negatively affecting investors' performance. Given that XBRL technology is now mandated for all public companies, it is expected that a greater number of nonprofessional investors will analyze financial data in XBRL format. Because nonprofessional investors represent a large portion of investors, they are likely to benefit the most from XBRL technology. Hence, a greater understanding of the potential benefits or

possible ramifications from analyzing XBRL-formatted financial statements warrants examination. The current study seeks to fill this gap by comparing the effect that standardized and non-standardized financial information has on investment decisions.

2.2 Theory and Hypothesis Development

This study investigates the impact of XBRL-formatted financial statements on the investment decisions of nonprofessional investors. We use the theory of cognitive fit as our theoretical background. This is a well-grounded theory that states that the efficiency and effectiveness of problem solving depends on an appropriate fit among the external characteristics of the problem (how information is presented), the current task, and the internal decision-maker characteristics (the individual's problem-solving skills, expertise, and prior experience with task and format). Research on cognitive fit has been examined in the judgment and decision-making literature with results showing that a proper alignment between all three factors improves task performance (Vessey & Galletta, 1991; Vessey, 1991, 1994; Speier *et al.*, 2003; Shaft & Vessey, 2006). We argue that XBRL's standardized presentation of financial information strengthens cognitive fit by aligning the limited skillset of nonprofessional investors, the decision-making task, and the presentation of information. This alignment aids nonprofessional investors in acquiring and integrating information, and improves task performance. The following hypotheses test the effect of a standardized presentation format on investment performance as measured by the number correctly calculated ratios, time to complete the task, and investment decision:

H1a *- Participants analyzing standardized financial statements will calculate more financial ratios correctly than participants analyzing non-standardized financial statements.*

H1b *- Participants analyzing standardized financial statements will spend less time completing the task of financial statement analysis than participants analyzing non-standardized financial statements.*

H1c *- Participants analyzing standardized financial statements will invest more in the optimal company than participants analyzing non-standardized financial statements.*

2.3 Paper versus online display

The complexity of analyzing financial statements may change when the information is viewed online rather than on paper and researchers have found mixed results in this area. Dillon (1992) finds reading comprehension, accuracy, and efficiency are reduced when information is displayed on a computer and Galletta *et al.* (1996) find less experienced users have higher memory recall and greater error detection capability with paper-based displays than with online displays. However, a recent study finds undergraduates taking exams online earned higher test scores than those using traditional paper-based exams (Maguire *et al.*, 2010). Today's advances in and proliferation of technology may explain these conflicting results. According to the U.S. Department of Commerce, over half of all Americans access the internet via computer or smartphones on a daily basis (2010); therefore, it is likely that individuals are now more accustomed to reading, acquiring and integrating information from electronic sources and that their ability to process online information has improved. Because of XBRL's interactive nature, the logical method to display financial statement results is online. Therefore, we examine the effect of viewing information online versus a paper-based display in an effort to rule out other possible explanations for our results. The following three hypotheses examine the effect online and paper-based formats have on investment performance and are measured by the number of correctly calculated ratios, time to complete the task, and investment decision:

H2a *- Participants analyzing paper-based financial statements will calculate more financial ratios correctly than participants analyzing financial statements online.*

H2b *- Participants analyzing paper-based financial statements will spend less time completing the task of financial statement analysis than participants analyzing financial statements online.*

H2c *- Participants analyzing paper-based financial statements will invest more in the optimal company than participants analyzing financial statements online.*

2.4 Confidence in Judgments and Decision Making

Sniezek (1992, p. 124) defines confidence as the "beliefs about the goodness of one's judgments or choices" and states that confidence guides one's course of

action and ultimate decisions. Researchers find a strong correlation between confidence in judgments and task accuracy (Lichtenstein & Fischhoff, 1977; Lichtenstein *et al*., 1977; Budescu *et al.,* 1997a; Budescu, *et al.*, 1997; Harvey, 1997). Hirst, Koonce, and Miller (1999, p. 102) demonstrates "that confidence is a key input into investment decisions" by finding a link between investor confidence, their expectations about prices, and investment decisions.

Changes in presentation format or view can influence participants in the decision-making process, but this effect cannot be examined by only measuring the number of ratios correctly calculated and investment decisions. By solely examining these factors, we are only informed about whether they arrived at the correct or incorrect answer and it is possible for investors to arrive at the correct answer simply by conjecture. Therefore, we include confidence as a measure in this study because nonprofessional investors may be affected by presentation format but still be effective and efficient in task performance. Examining a confidence in decision score as an additional measure of performance provides additional insight on the participants' mental processes (Jarvenpaa, 1989; Amer, 1991; Schulz & Booth, 1995; Lim & Benbasat, 2000). We posit that standardization in the presentation of financial data will result in confidence levels being greater than when the information is not standardized:

H3 - *Participants analyzing standardized financial statements will have greater confidence in the financial ratios they calculate than participants analyzing non-standardized financial statements.*

As discussed previously, research finds mixed results regarding how performance is affected when viewing information on paper or online (Dillon, 1992; Galletta, *et al.,* 1996; Maguire, *et al.,* 2010). To our knowledge, there has been no research showing confidence levels are affected by the manner in which information is viewed. Therefore, there is no directional expectation for confidence levels between the two displays of information. This measure is being included as exploratory and posited as a research question rather than a hypothesis:

RQ1 – *There will be a difference between the confidence levels of participants analyzing paper-based financial statements and online financial statements.*

2.5 Interaction effects

Finally, because we are investigating two factors, the possibility of an interaction between variables is examined to determine whether individual performance may be affected by both the format and the view. To our knowledge, there is no existing research indicating that the two conditions, format and view, should have any influence on the other; therefore, we pose the following interactions as research questions rather than hypotheses.

RQ2 *– Participants analyzing paper-based, standardized financial statements will correctly calculate more ratios than participants analyzing online, standardized financial statements, participants analyzing paper-based, non-standardized financial statements, and participants analyzing online, non-standardized financial statements.*

RQ3 *– Participants analyzing paper-based, standardized financial statements will take less time than participants analyzing online, standardized financial statements, participants analyzing paper-based, non-standardized financial statements, and participants analyzing online, non-standardized financial statements.*

RQ4 *– Participants analyzing paper-based, standardized financial statements will invest more in the optimal company than participants analyzing online, standardized financial statements, participants analyzing paper-based, non-standardized financial statements, and participants analyzing online, non-standardized financial statements.*

RQ5 *– Participants analyzing paper-based, standardized financial statements will have higher confidence levels than participants analyzing online, standardized financial statements, participants analyzing paper-based, non-standardized financial statements, and participants analyzing online, non-standardized financial statements.*

3. RESEARCH METHOD

3.1 Participants

Graduate business students serve as a proxy for nonprofessional investors frequently in the literature (Elliott, *et al.*, 2007; D. E. Hirst, Koonce, & Simko,

1995; E. Hirst, *et al.*, 1999; Hodge, *et al.*, 2004; Koonce, *et al.*, 2005; Maines & McDaniel, 2000). Participants in the current study were 167 graduate business students enrolled at two four-year public universities located in the southwestern region of the US. The majority received extra credit points for their participation; participants not offered extra credit were entered into a raffle for a Kindle Fire tablet. The sample was comprised of 84 (50.3%) females and 83 (49.7%) males with an average age of 30 years and six years of business-related work experience. Most participants had a background in accounting (46%). Others were in finance or business (28%), or sales, engineering, and other professional backgrounds (26%). All participants had completed the core financial accounting courses, where they were required to calculate financial ratios and make investment decisions. Table 1 provides demographic information for all participants.

Variables	N	Mean	SD
Age	167	29.56	7.87
Years of business experience	167	5.14	6.42
Experience calculating ratios	167	4.87	2.22
Experience analyzing financial statements	166	7.27	17.14
Experience making investment decisions	167	3.13	9.40
Manage their own investments	167	.20	.40
Are actively investing	167	.29	.46
Years accessing the internet	167	11.35	4.46

Table 1. Demographic Characteristics of the Sample

3.2 Design and Procedure

The model is a full factorial 2 X 2 between-participants design, where presentation format is manipulated by two independent variables, FORMAT (standardized financial statements / non-standardized financial statements) and VIEW (paper / online display). Standardized financial statements represent information provided in XBRL-formatted financial statements that have been tagged using official elements and account labels from an XBRL taxonomy.

Most of the experimental sessions were conducted in controlled classroom settings; however, not all instructors had available class time so some participants were invited via email to complete the experiment online, at their convenience, in a non-controlled setting. All participants were randomly assigned to a standardized or non-standardized version of the financial statements and acknowledged and accepted an informed consent form. Using the financial statements of two hypothetical publicly held multinational companies, Company A and Company B, each participant analyzed the financial statements for both companies and calculated the same six financial ratios for each company. Subsequent to each ratio calculation, participants were asked to provide a rating from 1 to 7 that represents their confidence in correctly calculating the ratio. After completing all ratio calculations, participants were asked to indicate what percentage of $10,000 they would invest in either Company A or Company B and answered demographic questions.

3.3 Dependent Variables

As it is difficult to accurately measure an individual's mental representation of the decision-making process, the outcome and performance of the task is typically measured instead using the accuracy and efficiency of task completion, the decisions made, and by confidence in decisions made (Amer, 1991; Benbasat & Dexter, 1986; Blocher *et al.,* 1986; Clements & Wolfe, 2000; DeSanctis & Jarvenpaa, 1989; Dickson *et al*. 1986; Frownfelter-Lohrke, 1998; Koonce, *et al.*, 2005; Lim & Benbasat, 2000; Schulz & Booth, 1995; Speier, *et al.*, 2003; Stock & Watson, 1984; Tuttle & Kershaw, 1998; Vessey & Galletta, 1991). We follow this method of measuring task performance to determine whether the FORMAT and VIEW factors affected participants' decisions by assessing similar outcomes. Accuracy of task performance was measured by the number of performance ratios (current ratio, return on equity ratio, gross profit margin ratio, accounts receivable turnover ratio, human capital productivity ratio, and the research and development productivity ratio) calculated correctly for each company and by the investment decision. Correctly calculating all twelve ratios would indicate that Company A was the better investment, and thus, a higher percentage of funds should have been invested in Company A than in Company B. Efficiency was measured by the number of minutes to complete the task. No time constraints were imposed;

participants were allowed as much time as needed as long as the experiment was completed in one setting. Task completion time was measured with starting and ending times verified by the investigator and the survey software. Lastly, perceived level of confidence regarding the correctness of their calculations was measured on a scale of 1 to 7, where 1 indicates the lowest level of confidence and 7 indicates the highest level of confidence. After each ratio calculation, participants reported a level of confidence on the accuracy of their answer. This measure was included to provide additional insight into the effect FORMAT and VIEW had on their investment decision.

4. RESULTS

Violations of the assumptions of normality and/or homogeneity were present in several variables. All attempts to transform the variables were unsuccessful, so non-parametric techniques were used to analyze the data. The means and standard deviations for the number of ratios correctly calculated, the time to complete the task, the investment decision made, and perceived confidence in results are available on request.

The mean scores within the experimental conditions for COMPANY A RATIOS CORRECT and COMPANY B RATIOS CORRECT were examined to determine whether calculations for Company B were affected by calculations for Company A (the practice effect). Results indicated a significant difference in Condition 4 *($p = .013$)*; therefore, the scores for the number of COMPANY A RATIOS CORRECT and COMPANY B RATIOS CORRECT were examined separately. The mean scores within each experimental condition for CONFIDENCE for Companies A and B were also analyzed to determine whether participants became more confident after completing the task for Company A. Results show the scores were not significantly different in any group ($p > .05$). Results of the Wilcoxon signed-rank tests are provided in Table 2.

Seven online participants indicated that they printed the financial statements rather than viewing them online. To ensure that the inclusion of these observations did not affect overall results, the analysis was conducted both with and without their responses. No differences were found and their responses were included in the final sample.

Experimental conditions	*Comparison of dependent variables*			
	Co. A Ratios Correct & Co. B Ratios Correct		Confidence Co. A & Confidence Co. B	
	Z	P-value	Z	P-value
1	-1.000	.317	-.963	.336
2	-1.337	.181	-1.526	.127
3	-.577	.564	-.144	.886
4	-2.496	.013**	-.716	.474

** $p < .05$

Table 2. Wilcoxon Signed-Rank Tests for Related Samples

4.1 Results of Hypotheses Tests

Hypotheses 1a, 1b, 1c, and 3 predicted that non-standardized financial statements would diminish the cognitive fit between task and presentation and negatively affect task performance. Individuals were expected to correctly calculate more financial ratios (H1a), take less time (H1b), make a better investment decision (H1c), and be more confident in their calculations (H3) when analyzing standardized financial information. We find partial support for H1a. Participants analyzing standardized statements correctly calculated more ratios than those analyzing non-standardized statements for Company A ($p = .000$), but not for Company B ($p = .097$). Results provide support for H1b, participants analyzing standardized statements spent less time to complete the analysis than participants analyzing non-standardized statements ($p = .021$). H1c correctly predicted a higher percentage of funds would be invested in the optimal company, Company A, but the difference was not statistically significant ($p = .195$). Lastly, H3 tested whether participants analyzing standardized statements would be more confident in their calculations; results show their overall confidence was higher ($p = .038$).

XBRL is a reporting language intended to be viewed electronically rather than on paper, and thus, we examined any possible effect view had on performance. Hypotheses 2a, 2b, 2c, and RQ1 compared performance between paper and online analysis. We predicted that participants viewing the information on paper would correctly calculate more ratios (H2a), take less time (H2b), make a better investment decision (H2c), and have a different level of confidence in their calculations (RQ1) than those viewing the information online. For H2a, results show no difference in the number of correctly calculated ratios between online

and paper view (*p = .289*). H2b predicted participants would take less time to complete the task when the information was viewed on paper and the results support this hypothesis (*p = .000*). Differences in time are attributed to the change in the view, rather than the format, because the information in the financial statements was identical. H2c expected participants viewing financial information on paper (versus online) would invest more of the hypothetical $10,000 in the better-performing company (Company A), but there was no difference between groups (*p = .069*). Finally, RQ1 examined a possible non-directional difference between participants' confidence in their investment decisions, based on whether they analyzed the financial statements online or on paper. No support was found for this research question (*p = .243*). Results for all hypothesis tests are summarized in Table 3.

Panel A: Mann-Whitney *U* Results				
Source	***U***	***Z***	***Sig***	***Hypothesis***
Correctly Calculated Ratios - Company A				
FORMAT	2484.50	-3.441	.000***	H1a
VIEW	3453.50	-.091	.464	H2a
Correctly Calculated Ratios - Company B				
FORMAT	3109.00	-1.299	.097*	H1a
VIEW	3318.50	-.557	.289	H2a
Time taken to complete task				
FORMAT	4120.00	2.032	.021**	H1b
VIEW	2040.00	-4.619	.000***	H2b
Percent invested in Company A				
FORMAT	3219.00	-.861	.195	H1c
VIEW	3021.00	-1.482	.069*	H2c
Percent invested in Company B				
FORMAT	3219.00	-.861	.195	H1c
VIEW	3021.00	-1.482	.069*	H2c
Average overall confidence in ratio calculations				
FORMAT	2930.00	-1.781	.038**	H1d
VIEW	3262.50	-.697	.243	RQ1

* Significant at .10 level (one-tailed)
** Significant at .05 level (one-tailed)
*** Significant at .01 level (one-tailed)

Table 3. Presentation Effects

4.2 Interaction Effects and Post-hoc Analysis

In addition to non-parametric analysis, ANOVA was conducted on the original data and used to examine possible interactions. ANOVA analysis of H1a and H2b find similar results as in the non-parametric analysis and provides further support to the notion that analyzing standardized financial statements on paper rather than

online improves performance. The analysis also showed the number of correctly calculated ratios was higher for those analyzing standardized financial information *(p = .000)* and that it took less time to analyze the information on paper *(p = .000)*. Results of the interaction analysis showed no statistically significant differences, and we conclude that the manipulations had no effect on each other. Results are summarized in Table 4.

Correctly Calculated Ratios - Company A						
Panel A: Mean (standard deviation) {sample size} across treatment conditions						
Presentation View[a]	*Presentation Format*[b]				*Main effect: view*	
	Standardized		*Non-standardized*			
Paper-based	4.39 (.754) {44}		3.91 (.610) {43}		4.15 (.724) {87}	
Online	4.28 (.793) {39}		3.93 (1.01) {41}		4.10 (.894) {80}	
Main effect: format	4.34 (.769) {83}		3.92 (.824) {84}		4.13 (.823) {167}	
Panel B: ANOVA Results						
Source	*Sum of Squares*	*d.f.*	*Mean Square*	*F*	*p-value*	*Hypothesis*
Format	7.255	1	7.255	11.291	.000***	H1a
View	.074	1	.074	.116	.367	H2a
Format x View	.161	1	.161	.250	.309	RQ2
Error	104.738	163	.643			
Correctly Calculated Ratios - Company B						
Panel A: Mean (standard deviation) {sample size} across treatment conditions						
Presentation View[a]	*Presentation Format*[b]				*Main effect: view*	
	Standardized		*Non-standardized*			
Paper-based	4.43 (.695) {44}		3.91 (.971) {43}		4.26 (.855) {87}	
Online	4.28 (.772) {39}		3.93 (1.00) {41}		4.31 (.894) {80}	
Main effect: format	4.39 (.730) {83}		3.91 (.988) {84}		4.29 (.872) {167}	
Panel B: ANOVA Results						
Source	*Sum of Squares*	*d.f.*	*Mean Square*	*F*	*p-value*	*Hypothesis*
Format	1.500	1	1.500	1.978	.081*	H1a
View	.107	1	.107	.141	.354	H2a
Format x View	.926	1	.926	1.221	.136	RQ2
Error	123.578	163	.758			

Mean (s.d.) {N}

* Significant at .10 level (one-tailed); ** Significant at .05 level (one-tailed); *** Significant at .01 level (one-tailed)

Notes: [a] Presentation view was manipulated by paper-based or online financial statements

[b] Presentation format was manipulated by standardized financial labels or non-standardized financial labels

Table 4. Presentation Effects on the Ability to Correctly Calculate Ratios H1a, H2a, RQ2

4.3 Sensitivity Analyses

We conducted additional analysis to determine whether a confounding factor existed due to online participants completing the experiment in a non-controlled setting and to provide additional support for our findings. Seventy-four percent of the participants completed the experiment in a controlled setting, which consisted of all participants (87) in the paper-based condition and 46 percent (37/80) of the

online participants. T-tests show no differences between controlled or non-controlled setting groups, with the exception of time. Paper-based participants took an average of 30 minutes and the online participants an average of 34 minutes to complete the task ($p = .032$). Because the entire paper-based group completed the experiment in a controlled setting and 64 percent of the online group completed it in a non-controlled setting, a possible confounding factor exists. However, analysis of this information as a control variable showed completing the task in a controlled setting had no effect on task performance ($p > .05$).

To ensure that the format of the financial statements affected performance and to provide additional support for hypotheses 1a, data from ratio calculations were separated into two groups, ratios that *could* be affected by non-standardized information (accounts receivable turnover ratio, human capital productivity ratio, and the research and development productivity ratio) and ratios that *would not* be affected (current ratio, gross profit margin, and return on equity) by non-standardized information. Using this data, we created two additional dependent variables, "could incorporate" non-standardized information ratios (NONSTDRATIOSCORRECT) and "would not incorporate" non-standardized information ratios" (STDRATIOSCORRECT). Results of Mann-Whitney *U* tests show the number of "could incorporate" ratios (NONSTDRATIOSCORRECT) correctly calculated was higher when the information was presented in a standardized format than when presented in a non-standardized format ($p = .004$). For the "would not incorporate" ratios (STDRATIOSCORRECT), results showed no difference between groups ($p = .285$) when the financial information was presented in a standardized format and when it was presented in a non-standardized format. These results provide further support for hypothesis 1a by demonstrating that the format of the information presented affected the participant's ability to correctly calculate the ratios. In summary, participants calculating the three non-standardized ratios, the ratios that *could* be affected by non-standardized information, were less likely to be correct when the financial information was not standardized than when it was standardized. The results of the sensitivity analysis are summarized in Table 5.

Ratios That Could Incorporate Non-Standardized Information Correctly Calculated				
Panel A: Mean (standard deviation) {sample size} across treatment conditions				
Presentation View	*Presentation Format*			*Main effect: presentation view*
	Standardized	*Non-standardized*		
Paper-based	3.09 (1.31) {44}	2.44 (.959) {43}		2.77 (1.19) {87}
Online	3.10 (1.21) {39}	2.95 (1.12) {41}		3.03 (1.16) {80}
Main effect: format	3.10 (1.26) {83}	2.69 (1.06) {84}		2.89 (1.18) {167}
Panel B: Mann-Whitney *U* Results				
Source	*U*	*Z*	*Sig*	*Hypothesis*
FORMAT	2704.00	-2.670	.004***	H1a
VIEW	3947.50	1.597	.055*	H2a
Ratios That Would Not Incorporate Non-Standardized Information Correctly Calculated				
Panel A: Mean (standard deviation) {sample size} across treatment conditions				
Presentation View	*Presentation Format*			*Main effect: presentation view*
	Standardized	*Non-standardized*		
Paper-based	5.66 (.680) {44}	5.56 (.854) {43}		5.61 (.768) {87}
Online	5.51 (.756) {39}	5.27 (1.21) {41}		5.39 (1.01) {80}
Main effect: format	5.59 (.716) {83}	5.42 (1.04) {84}		5.50 (.898) {167}
Panel B: Mann-Whitney *U* Results				
Source	*U*	*Z*	*Sig*	*Hypothesis*
FORMAT	3342.50	-.569	.285	H1a
VIEW	3073.50	-1.614	.054*	H2a

Mean (s.d.) {N}
* Significant at .10 level (one-tailed)
** Significant at .05 level (one-tailed)
*** Significant at .01 level (one-tailed)
Notes:
Presentation view was manipulated by paper-based or online financial statements
Presentation format was manipulated by standardized financial labels or non-standardized financial labels

Table 5. Sensitivity Analysis – H1a, H2a

4.4 Additional Variables Affecting Performance

Other variables were analyzed to determine possible effects on ratio calculations and investment decisions: gender; age; business experience; professional background; and experience calculating ratios, making investment decisions, analyzing financial statements, obtaining information online, and general

computer use; task environment (controlled setting); and type of student (MBA or MAcc). Some of the factors affected the ability to correctly calculate financial ratios, time, and confidence, but none affected the investment decision. All statistically significant results from this analysis are presented in Table 6.

Independent Variable	*Df*	*Sum of Squares*	*Mean Square*	*F-Statistic*	*Sig.*
Dependent Variable: A Ratios Correct					
Business Background	1	7.474	7.474	12.799	.000***
Dependent Variable: B Ratios Correct					
Business Background	1	7.687	7.687	10.888	.001***
Dependent Variable: Time					
Business Background	1	976.980	976.980	8.508	.004***
Ratio Experience	1	578.503	578.503	5.038	.026**
Investment Decision Experience	1	1010.787	1010.787	8.802	.004***
Dependent Variable: Average Overall Confidence					
Gender	1	3.143	3.143	4.546	.035**
Ratio Experience	1	15.498	15.498	22.412	.000***
Owns a Computer	1	3.309	3.309	4.785	.030**

* Significant at .10 level (two-tailed)
** Significant at .05 level (two-tailed)
*** Significant at .01 level (two-tailed)
The abbreviated table is presented in the paper. For the complete table with all significant and non-significant correlations, contact the authors.

Table 6. Analysis of Covariance

5. DISCUSSION

We conducted an experiment that manipulates two factors—format (standard or non-standard) of the information presented and view (paper or online) of the information—to investigate the effect that standardized information has on investment performance. Standardized financial information represents XBRL-formatted financial statements that have been tagged using official elements and account labels from an XBRL taxonomy. Non-standardized financial information represents information that has been customized by extending the XBRL taxonomy or by customizing account labels. Because XBRL-formatted financial

statements are intended to be displayed online rather than on paper, we examined the possibility that the view would affect individuals analyzing financial information and making investment decisions. Investment performance was measured by the number of ratios correctly calculated, investment decision, time, and confidence in ratio calculation correctness. The experimental design was a full factorial 2 X 2 between-participants design.

Results find presentation format and the view of the information has some effect on investment performance. As expected, the number of ratios correctly calculated from participants analyzing financial statements containing standardized information was significantly higher than those analyzing non-standardized information. Individuals viewing standardized financial information were better able to acquire and use the information for decision-making. Additional support for this notion is supported by participants' statements such as they were "unsure of what information to include" in their calculations because the "account titles did not match," and that "each company had differently organized financial statements." The time taken to analyze financial statements and make an investment decision was significantly lower for participants viewing standardized financial information than for those viewing non-standardized information. Confidence in the correctness of ratio calculations was also affected by the format with results showing higher confidence levels for participants analyzing standardized financial information. XBRL-formatted financial statements are more likely to be viewed online than on paper. Thus, investigating whether viewing the information online had any effect on performance was done to rule out possible explanations for finding expected results related to the customization of financial data. Results found the view of the information significantly affected task completion time, but had no effect on the number of ratios correctly calculated, investment decisions, or confidence in the correctness of ratio calculations. Participants analyzing the paper-based version of the financial statements spent less time than those analyzing them online. This is likely because participants analyzing and viewing the information online had to navigate through several screens to acquire the information needed. Participants analyzing and viewing on paper had to navigate through several pages of

information to acquire the same information; however, this task appeared to be more quickly accomplished when provided in paper format.

The results of this study suggest that XBRL technology does have an unintended benefit for nonprofessional investors with its ability to standardize financial information, which may improve investment performance. The technology improves the analysis, shortens the analysis time, and provides a greater sense of confidence to investors. In line with this study, a recent study confirms XBRL's benefits to nonprofessionals and how the technology can "level the playing field" between professionals and nonprofessionals. Arnold, Bedard, Phillips, and Sutton (2012) find that tagging Management Discussion and Analysis (MD&A) information using XBRL technology improves nonprofessionals' search strategies making them more directive than sequential, thereby improving the integration of important information when making investment decisions. These results add to the limited research regarding the benefits to investors as a result of the SEC's 2009 mandate of XBRL technology. Very few studies examine whether the SEC's mandate does indeed have benefits for users and the results of this study suggest that it does. The results also contribute to the theory of cognitive fit by showing that standardizing the presentation of information within the given format (i.e. tabular or graphical) improves performance.

This study is subject to several limitations. First, the amount of information participants received to make investment decisions was limited in order to make the experiment less complex and to reduce completion time. Investors making actual investment decisions would likely take more time and use more information obtained from company websites than what was provided. Second, graduate business students were used as proxies for nonprofessional investors. Research finds MBA students who have completed their first year and completed a course in financial accounting where financial statement analysis was part of the curriculum to be suitable proxies for nonprofessional investors (Elliott, *et al.*, 2007). Participants in this study included MBA and Masters of Accountancy (MAcc) students. The MAcc students included in the study had likely completed more courses that required financial statement analyses and were likely more familiar with the financial statement format and financial ratios than the MBA

students were; however, research has not examined whether they are suitable proxies for nonprofessional investors. Third, all participants did not complete the experiment in a controlled setting. Most online participants completed the experiment on their own time and in their own settings. The task environment cannot be controlled for these participants and interruptions or multitasking may have affected task performance. The scores of participants that had taken an unusual amount of time (longer than two hours) were distinguishable removed; however, it is possible that some scores from participants who did not complete the experiment in one setting were included. Finally, problems in the design of the instrument may explain why significant differences existed between conditions for the number of ratios correctly calculated, but no significant differences existed in the investment decision. This result is likely due to an error in the design of the instrument that was not detected in the pilot study or that another (unknown) factor is influencing their investment decisions. An explanation for this result is currently unclear and should be explored in future research.

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