

Estimate-Related Disclosures and Investors' Reliability Judgments

W. Brooke Elliott*
Kevin E. Jackson
Steven D. Smith
University of Illinois at Urbana-Champaign

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*Corresponding author.
213 Wohlers Hall
1206 South Sixth Street
Champaign, IL 61820
T: 217-333-9247
Email: wbe@uiuc.edu

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ABSTRACT: We investigate how nonprofessional investors' reliability and investment-related judgments are influenced by disclosures that convey information about the reliability of accounting estimates (i.e., estimate disclosures). Specifically, we examine how estimate disclosures (generally and by type) interact with investors' prior reliability perceptions to impact their final reliability and investment-related judgments.

Our experimental results show that accounting estimate disclosures lead to an increase (decrease) in reliability judgments and PE multiple estimates for investors with relatively low (high) initial reliability judgments. We also find that investors presented with a process disclosure (which describes how the estimate was generated) produce higher reliability judgments than investors presented with either a range or sensitivity disclosure. Our results have implications for disclosure requirements given the increasing acceptance of measurement attributes that require estimation (e.g., fair value).

Key Words: *Nonprofessional investors; reliability perceptions; estimate disclosure*

Data Availability: *Contact the authors*

I. INTRODUCTION

The Financial Accounting Standards Board (FASB) issued the Exposure Draft, *Fair Value Measurements* (hereafter the ED) in June 2004. The ED proposes procedural guidance for most fair value estimates, but also proposes that companies provide disclosures to assist investors and other users in assessing the reliability of fair value estimates. In responding to the ED, the AAA Financial Accounting Standards Committee also has called for increased disclosure requirements regarding fair value estimates (AAA FASC 2005), asserting that supplemental disclosures “could provide incremental information that aids investors in assessing the reliability of such estimates” (p. 191).

Underlying calls for expanded disclosure is the acknowledgment that while estimation is a necessary feature of useful financial information, the quality of accounting estimates can vary substantially. Evaluating the reliability of accounting estimates is therefore important for users to make optimal use of financial reports (Henry 2004; Hirst et al. 2003; Lundholm 1999). Yet little is known about how financial statement users perceive or process information regarding the reliability of accounting estimates.

In this study we provide experimental evidence on how nonprofessional investors’ (hereafter, investors) reliability and investment-related judgments are influenced by three common types of disclosure that convey information about the reliability of estimated accounting measures (i.e., estimate disclosures). Specifically, we consider disclosures that describe 1) how the estimate was generated (i.e., a process disclosure), 2) the range of possible values for the estimate (i.e., a range disclosure), or 3) the estimate’s sensitivity to changes in underlying assumptions (i.e., a sensitivity disclosure). We characterize accounting estimates as outcome hypotheses, or “informed guesses.” Given

this perspective, we rely on the hypothesis evaluation literature in psychology and accounting to develop expectations about investors' responses to these disclosures.¹

Prior research shows that a hypothesis is seen as more (less) believable when individuals consider fewer (more) alternative hypotheses (Heiman 1990; Hoch 1985; Mehle et al.1981). Two important propositions emerge when applying this theoretical framework to our estimate setting. First, we propose that estimate disclosures influence investors' reliability judgments via their effect on the number of possible alternative values investors are led to consider for an estimated measure. Second, we propose that the direction of this effect can differ for investors with contrasting *initial* (pre-disclosure) reliability perceptions.

Investors with relatively low initial reliability perceptions are expected to believe that there are many alternative values for the estimate that are also plausible. We hypothesize that estimate disclosures will *increase* these investors' reliability judgments by leading them to consider fewer possible values for the estimate. In contrast, investors with relatively high initial reliability perceptions are expected to initially consider fewer possible values for the estimate to be plausible. We hypothesize that estimate disclosures will *decrease* these investors' reliability judgments by leading them to consider more possible values for the estimate.

We also hypothesize that the effect of estimate disclosures on investors' perceptions of an estimate's reliability will be reflected in their investment-related judgments. Specifically, we argue that estimate disclosures influence investors' estimates of a company's price-earnings multiple in a manner consistent with their reliability

¹ Prior research has applied the hypothesis evaluation literature to accounting and auditing settings. However, to our knowledge our study is the first to apply this literature to the consideration of accounting estimates.

judgments by changing their perceptions of the risk associated with the quality of the company's accounting information.

Finally, we argue that different *types* of estimate disclosures can have different degrees of influence on investors' judgments of reliability. Process disclosures highlight the plausibility of the reported value, while range and sensitivity disclosures highlight the plausibility of values other than the reported value. Thus, we hypothesize that investors who receive a process disclosure will produce higher reliability judgments than investors who receive either a range or sensitivity disclosure.

In our experiment, graduate business students judged the reliability of a company's software development asset and estimated the company's PE multiple before and after viewing a disclosure related to the estimated value of the asset. The disclosure either described the process used to derive the asset's estimated value, indicated the likely range of the asset's true value, or indicated the sensitivity of the asset value to a ten percent change in estimated total future revenues.

The results are consistent with our hypotheses. Estimate disclosures *increased* the reliability judgments and PE multiple estimates of participants with relatively *low* initial reliability perceptions, but *decreased* the reliability judgments and PE multiple estimates of participants with relatively *high* initial reliability perceptions. The results also show that different types of disclosures have different effects on participants' reliability judgments. As predicted, participants who received the process disclosure produced higher reliability judgments than participants who received either the range or sensitivity disclosures. In addition, supplemental analyses are consistent with process disclosures

leading investors to consider fewer possible alternative values for an estimate than either range or sensitivity disclosures.

This study makes three principal contributions. First, by examining the assessment of estimate reliability in light of the hypothesis evaluation literature, we are able to identify an instance in which disclosures interact with prior perceptions to affect investors' reliability judgments. This approach also provides a useful framework for future researchers interested in examining and deriving predictions related to estimation in financial reports.

Second, our paper extends research on hypothesis evaluation by considering a context (i.e., the investment setting) in which heterogeneous prior perceptions about the estimate (i.e., hypothesis) interact with the manipulated variable (in this case, the estimate disclosure), leading to directionally opposite predictions and behaviors. Prior research has only considered contexts in which the effect of alternative hypotheses is independent of participants' prior beliefs about the plausibility of the given hypothesis (e.g., Hoch 1985; Einhorn and Hogarth 1986; Heiman 1990; Koonce 1992; Kennedy 1995).

Third, we extend research on accounting information reliability by examining how different *types* of estimate disclosures can influence investors' reliability judgments.² As such, we inform standard setters about the impact of different types of estimate disclosures at a time when such disclosures are being encouraged as part of issuing fair value measurement guidance (FASB 2004). We also answer the call from Maines and Wahlen (2005) for research that examines how reliability information can be

² Prior research focuses on differences in perceived reliability as a function of only source factors (i.e., the reporting company). For example, Kallapur and Kwan (2004) examine the perceived reliability of brand asset recognition by firms with different levels of contracting incentives to overstate the reported asset.

conveyed and the impact reliability information may have on individuals' reliability perceptions.

The remainder of the paper is organized as follows. Section II discusses relevant background information. Section III presents our theory and hypotheses development. Section IV describes the experiment. Section V discusses the results and additional analyses. Section VI presents discussion, limitations, and conclusions.

II. BACKGROUND

The FASB issued the Exposure Draft, *Fair Value Measurements* in June of 2004 because it recognized the current lack of guidance “for applying the fair value measurement objective in generally accepted accounting principles” (FASB 2004, 7). Importantly, the ED emphasizes the need for expanded disclosures to “assist financial statement users in assessing the reliability of fair value estimates reported in the primary financial statements” (AAA FASC 2005, 187). Understanding how reliability disclosures impact investors' perceptions of an accounting estimate is central to developing effective guidance for expanded disclosures in an accounting environment that increasingly relies on fair value measurement (AAA FASC 2005).

Investors can infer the reliability of an accounting estimate: 1) by observing information about the process used to generate the estimate; and 2) by observing certain characteristics of the estimate (Maines and Wahlen 2005). Investors currently observe process information for a number of typical financial statement items. For example, financial statement footnotes provide process information for depreciation expense, deferred taxes, inventory, and other estimated measures. These disclosures describe the manner in which accounting estimates are derived and are generally regarded as helpful

for users to assess reliability (Maines and Wahlen 2005). Indeed, inclusion of information that may lack reliability in financial reports is often deemed acceptable as long as the process generating the information is also disclosed.³

Other types of disclosures describe characteristics of accounting estimates. For example, Deere and Company's 2004 Annual Report discloses the sensitivities of its calculated pension obligations and its reported retail notes receivables to changes in the assumptions that underlie these items. Similarly, United Refining Company's 2004 10-K presents a range of values for expenditures required to comply with newly promulgated industry regulations. These disclosure types (sensitivity and range) provide information about the statistical properties of estimates that investors may use to infer the reliability of accounting estimates (Maines and Wahlen 2005).

We consider these three disclosure types (i.e., process, range, and sensitivity) in examining how estimate disclosures affect investors' reliability judgments.⁴ Specifically, we develop hypotheses about the impact that estimate disclosures in general have on investors' reliability and investment-related judgments, as well as the varying effects different *types* of estimate disclosures may have on investors' reliability judgments.

³ For example, the SEC agreed to allow companies to report certain pro forma measures as long they disclosed how the measure was derived from a GAAP measure (SEC 2003).

⁴ We acknowledge that there are other disclosure types that could provide information about the reliability of accounting estimates. We examine these three specific types because they are commonly used to provide information about a variety of different financial statement items. For example, the methods companies may use to disclose market risk in accordance with the SEC's Financial Reporting Release No. 48 are analogous to process, range, and sensitivity disclosures (Hodder, et al. 2001).

III. THEORY AND HYPOTHESES DEVELOPMENT

Theoretical Determinants of Perceived Reliability

We characterize accounting estimates as hypotheses about the outcomes of financial measures. Estimates, like hypotheses, represent “informed guesses” about conditions that have not yet been (or cannot be) directly observed. For example, capitalized software development costs depend on informed guesses (i.e., estimates) about the total future revenue to be realized from current software projects. Similarly, bad debt and depreciation expenses reflect informed guesses about the realization of customer accounts receivable and the useful life of an asset.

We therefore consider judgment and decision-making research that examines hypothesis evaluation to inform our expectations about how investors perceive the reliability of accounting estimates. Prior research in psychology and accounting (e.g., Hoch 1984, 1985; Einhorn and Hogarth 1986; Heiman 1990; Koonce 1992; Kennedy 1995) finds that the availability of alternative hypotheses can reduce individuals’ perceptions of the plausibility of a given hypothesis. For example, consistent with the discounting model of Kelley (1973), Heiman (1990) finds that auditors reviewing the hypothesized error explanation in an analytical review task decreased their likelihood judgments as the number of alternative explanations made available increased. Similarly, Hoch (1985) finds that MBA students’ likelihood judgments of a hypothesized starting salary were reduced as reasons supporting alternative salaries were provided.

These findings suggest that individuals judge hypotheses to be more (less) reliable when they observe or consider fewer (more) alternative hypotheses (i.e., values). In our setting, therefore, we expect investors’ assessments of accounting estimate reliability to

be based, at least in part, on the number of alternative values they perceive to be plausible for the estimate.

Estimate Disclosures and Prior Beliefs

Although the hypothesis evaluation literature suggests that investors will perceive an estimate to be more (less) reliable as fewer (more) alternative values for the measure are considered, these studies consider settings in which the effect of alternative hypotheses is *independent* of participants' prior beliefs about the plausibility of the given hypothesis. The auditors in Heiman's (1990) study, for example, were expected to decrease their initial likelihood judgments in the presence of alternative explanations regardless of what those initial judgments were.

Our estimate setting is unique in that, when prior reliability perceptions vary (see Hodge 2003), disclosures may not have one-directional effects. Therefore, our predictions about the impact that estimate disclosures have on investors' judgments depend on their initial perceptions of the estimate's reliability (i.e., their priors). Specifically, we argue that disclosures that convey information about the reliability of an accounting estimate can impact investors' reliability perceptions by influencing (i.e., either expanding or contracting) the set of actual estimate values investors consider to be plausible. Investors with relatively low initial perceptions of an estimate's reliability are likely to consider a relatively large set of values for the measure to be plausible. To these investors, an estimate disclosure likely will reduce the number of plausible alternative values that the estimated measure could take. Thus, we expect investors who initially perceive an estimate's reliability to be relatively low will increase their reliability judgments upon observing the disclosure.

In contrast, we argue that investors with relatively high initial perceptions of an estimate's reliability are likely to consider a relatively small set of values for the measure to be plausible. To these investors, an estimate disclosure likely will increase the number of plausible alternative values that the estimated measure could take. Thus, we expect investors who initially perceive an estimate's reliability to be relatively high will lower their reliability judgments upon observing the disclosure (see Panel A of Figure 1). We summarize our predictions in the following alternative-form hypotheses:

H1a: Estimate disclosures will lead to *increased* reliability judgments of an estimate for investors with relatively *low* initial reliability perceptions of the estimate.

H1b: Estimate disclosures will lead to *decreased* reliability judgments of an estimate for investors with relatively *high* initial reliability perceptions of the estimate.

Estimate Disclosures and Valuation Judgments

We argue that estimate disclosures can also influence investors' valuation-related judgments. Portfolio Theory identifies information risk (or accounting risk) as the risk associated with the perceived quality of accounting information, often related to management's accounting choices (Wild et al., 2001). Because information risk is considered a component of a company's unsystematic risk (for which investors require compensation), it should be priced by equity investors. All else equal, greater perceived information risk is expected to result in a lower price-earnings multiple (Graham et al., 2005).

The FASB's *Statement of Financial Accounting Concepts 2* proposes that the quality of accounting information depends on its relevance and reliability (FASB 1980). It follows, then, that the perceived quality of a company's accounting information is (at least partially) driven by the information's perceived reliability. If estimate disclosures

influence investors' perceptions of the reliability of an estimated measure, investors' price-earnings multiple estimates are expected to be influenced in a similar way (Frederickson, Hodge, and Pratt 2006). Our predictions are summarized in the hypotheses below.

H2a: Estimate disclosures will lead to *increased* price-earnings multiple estimates for investors with relatively *low* initial reliability perceptions of the estimate.

H2b: Estimate disclosures will lead to *decreased* price-earnings multiple estimates for investors with relatively *high* initial reliability perceptions of the estimate.

Estimate Disclosure Type and Investors' Reliability Judgments

As mentioned, the hypothesis-evaluation literature suggests perceptions of an estimate's reliability are linked to the number of plausible alternative values for the measure that an investor considers. Given this theory, we argue that different *types* of estimate disclosures can affect the number of alternative values investors consider to be plausible for the estimated measure, and thus influence their assessments of reliability.

Specifically, we argue that process disclosures will cause investors to consider fewer alternative values than either range or sensitivity disclosures. Process disclosures highlight the plausibility of the estimate by explicitly showing the calculations used to arrive at the reported value, while providing no evidence about the number or plausibility of alternative values. Conversely, range and sensitivity disclosures highlight the existence of a number of alternative values for the estimated measure, without providing any evidence to support the plausibility of the reported value.

Given the anticipated difference in the number of alternative values considered, we expect that investors who receive a process disclosure will produce higher reliability judgments than investors who receive either a range or sensitivity disclosure. Note that

this expectation relates only to levels of post-disclosure reliability judgments. As such, H3 does not distinguish between investors with relatively high vs. low initial reliability perceptions, nor does it consider the change in reliability judgments.

H3: Process disclosures will lead investors to produce higher reliability judgments than range and sensitivity disclosures.

IV. EXPERIMENTAL METHOD

Participants

One hundred fifty-four graduate business students from a large state university participated in the experiment as nonprofessional investors.⁵ On average, participants had completed (or were currently enrolled in) ten accounting and three finance courses. Ninety-seven percent of the participants had previously evaluated a company's performance by analyzing financial statements. Forty-two percent of the participants had experience buying or selling an individual company's common stock or debt securities and 88 percent plan to invest in a company's stock in the next five years. Participants received compensation of \$10 for completing the experiment.

Experimental Design and Task

We used a 1 x 3 between-subjects design analyzed for two levels of a measured variable (investors' high or low initial reliability perceptions) that manipulated the type of estimate disclosure (process, range, and sensitivity) related to a hypothetical company's software development asset (i.e., capitalized software development costs).

Experimental materials in each condition contained background information and an income statement and balance sheet for fiscal year 2005 for a hypothetical firm (EJS,

⁵ Elliott et al. (2007) provide evidence that graduate business students are a good proxy for nonprofessional investors for tasks with similar characteristics to the task in this study.

Incorporated) in the software development industry along with a description of the major features of Statement of Financial Accounting Standard (SFAS) No. 86, *Accounting for the Costs of Computer Software to Be Sold, Leased, or Otherwise Marketed* (FASB 1985).⁶ The background information described the company's software product, its customers, and indicated that the company capitalized its software development costs in accordance with SFAS No. 86. The balance sheet showed a significant balance for the Capitalized Software Development asset.

Participants observed one of three estimate disclosures: PROCESS, RANGE or SENSITIVITY.⁷ Exhibit 1 presents the estimate-related information participants observed in each condition. In the PROCESS condition, the disclosure described the process used to derive the capitalized software development asset's estimated balance of \$300,000. The disclosure explained that the company had one software project currently under development and that "when total costs are expected to exceed the expected total revenue produced by the software product, the company capitalizes costs up to the expected total revenue amount." The process disclosure calculated the expected total revenue for the software product and showed that the company's capitalized costs equaled total expected revenue.

In the RANGE condition, the disclosure indicated the likely range of the capitalized software development asset's true balance was between \$270,000 and \$330,000. Notice that the range of values for the asset have endpoints that equal the recorded asset value minus or plus \$30,000. In the SENSITIVITY condition, the

⁶ Materials for the experiment are based on the instrument used in Hirst et al. (2003).

⁷ The disclosures were modeled after actual disclosures from publicly-traded companies.

disclosure indicated that for a ten percent change in estimated total future revenues, the capitalized software development asset's value would decrease or increase by \$30,000.⁸ The decrease/increase of \$30,000 suggests a dollar-for-dollar relationship between expected total revenues for the product and the value of the software asset recorded in the financial statements.⁹

[Insert Exhibit 1 here]

Procedure

Participants were randomly assigned to one of the three treatment conditions described above and asked to take the role of an investor to analyze a hypothetical company in the software development industry (EJS, Inc.). Participants were given a page of instructions that briefly introduced the hypothetical software development company and generally described the tasks they were to complete. Next, participants worked through the materials in three different envelopes. Envelope #1 contained the background information, financial statements and summary of SFAS No. 86 described above. After analyzing this information, participants assessed the reliability of the

⁸ We used a ten percent change in expected total revenue because ten percent is commonly used within sensitivity disclosures in natural settings. Several footnote disclosures from actual annual reports discuss the change in an estimated value (e.g., financing receivables) related to a ten percent change in an underlying assumption (e.g., discount rate). See examples in the 2004 Annual Reports from John Deere and Clear Channel Communications, Inc.

⁹ Although the disclosure conditions necessarily provide different information, we made design choices to limit meaningful differences across disclosure conditions. For example, the PROCESS disclosure indicates that costs are capitalized up to the expected total revenue. Thus, the PROCESS disclosure is similar to the SENSITIVITY disclosure in that the asset value should change dollar-for-dollar with changes in the product's (estimated) expected total revenue. The RANGE condition (by necessity) does not provide the sensitivity information found in the other two conditions. However, it should be noted that 1) the range endpoint values equal the values of the software asset if the expected total revenue decreased or increased by ten percent and 2) the RANGE disclosure is not predicted to differ from the SENSITIVITY disclosure in its effect on reliability judgments.

reported capitalized software development asset and provided estimates of the company's PE multiple. These judgments represent participants' *pre-treatment* judgments.

Specifically, participants assessed the reliability of the reported capitalized software development asset by responding to the following: "I believe that the Capitalized Software Development Asset reported on EJS's balance sheet as of December 31, 2005 is," using an 11-point scale with endpoints from 1 ("not at all reliable") to 11 ("very reliable"). Participants provided estimates of the company's PE multiple by responding to the following open-ended question: "What price-earnings (PE) multiple would you apply to EJS's reported 2005 Net Income per share?"¹⁰

Next, participants opened Envelope #2 and provided responses to a series of demographic questions. This task was used to collect information to validate our participants as reasonable proxies for nonprofessional investors and as a distracter task between participants' pre- and post-treatment judgments.

Finally, participants opened Envelope #3 which contained the same background information, financial statements and summary of SFAS No. 86 provided in Envelope #1 along with a process, range, or sensitivity disclosure about the company's capitalized software development asset. After observing the additional disclosure, participants provided *post-treatment* judgments identical to the *pre-treatment* judgments described above. Participants also answered supplemental questions related to their beliefs about the reported software development asset, the company's management, their perceptions

¹⁰ Before soliciting participants' PE multiple estimates we provided participants a brief description of PE multiples. We also told participants that in the software development industry, the lowest risk companies are assigned PE multiples of 30, while the highest risk companies are assigned PE multiples of 10. This information was intended to ensure that participants' understood PE multiples and to reduce noise in participants' responses.

of information risk related to EJS's stock, and responded to manipulation check and debriefing questions.

V. RESULTS

Hypotheses Tests

Our hypotheses require that we delineate between participants who initially perceived the reliability of the software development asset to be relatively high versus relatively low. To accomplish this, we first measure participants' reliability judgments of the capitalized software development asset prior to observing the estimate disclosure (i.e., initial reliability judgments). Participants' initial judgments range from one (not at all reliable) to eleven (very reliable), with approximately 90 percent of the observations falling between the values of three and eight on the 11-point scale. We then classify those observations below and including the median (6.00) as relatively low priors and those above the median as relatively high priors.¹¹ Descriptive statistics are presented in Panel A of Table 1.¹²

[Insert Table 1 Here]

Estimate Disclosures and Investors' Reliability Judgments (H1a and H1b)

H1a (H1b) predicts that estimate disclosures will lead to *increased (decreased)* reliability judgments of an estimate for investors with relatively *low (high)* initial reliability perceptions of the estimate. To test H1a and H1b, we conduct paired-sample t-

¹¹ Our results are robust to other classifications of initial reliability judgments as relatively low and high. Specifically, our results are stronger and inferentially identical if we split the data into thirds based on participants' initial reliability perceptions and classify the bottom third as relatively low priors and the top third as relatively high priors.

¹² The results of the hypotheses tests are inferentially identical using non-parametric tests.

tests that compare participants' initial reliability judgments of the estimated measure (i.e., *pre-treatment* judgment) to their reliability judgments after observing the estimate disclosure (i.e., *post-treatment* judgment). Results for both H1a and H1b are reported in Panel B of Table 1. A graphical depiction of the results is provided in Panel A of Figure 1.

[Insert Figure 1 Here]

Consistent with H1a, participants with relatively *low* initial reliability judgments *increased* their reliability judgments (pre = 4.17 versus post = 5.47) after viewing the estimate disclosure ($t = 4.56, p < 0.01$, one-tailed). In contrast, and consistent with H1b, participants with relatively *high* reliability priors *decreased* their reliability judgments (pre = 7.85 versus post = 6.37) after viewing the estimate disclosure ($t = 5.51, p < 0.01$, one-tailed).¹³

Estimate Disclosures and Investors' PE Multiple Estimates (H2a and H2b)

H2a (H2b) predicts that estimate disclosures will lead to *increased* (*decreased*) price-earnings multiple estimates for investors with relatively low (high) initial reliability perceptions of the estimate. To test H2a and H2b, we again conduct paired-sample t-tests that compare participants' initial price-earnings multiple estimates (PE estimates) (i.e., pre-treatment estimates) to their PE estimates after observing the reliability disclosure (i.e., post-treatment estimates). Results for both H2a and H2b are reported in Panel B of Table 1. A graphical depiction of the results is provided in Panel B of Figure 1.

¹³ One might argue that our findings result from a midpoint or mean reversion effect. However, there are two considerations that counter a reversion argument. First, a reversion effect would not presume differences across disclosure type (which we predict in H3a and H3b). Second, while mean reversion would expect participants with high (low) prior PE multiple estimates to change their estimates downward (upward) towards the mean prior PE estimate, participants in our study changed their PE estimates downward (upward) beyond the mean prior PE estimate.

Consistent with H2a, participants with relatively *low* initial reliability judgments increased their PE estimates (pre = 16.91 versus post = 19.17) after viewing the estimate disclosure ($t = 3.74$, $p < 0.01$, one-tailed). In contrast, and consistent with H2b, participants with relatively *high* initial reliability judgments decreased their PE estimates (pre = 20.28 versus post = 17.58) after viewing the disclosure ($t = 4.01$, $p < 0.01$, one-tailed).

Together, these results suggest that disclosures that convey information about the reliability of accounting estimates (i.e., estimate disclosures) influence investors' reliability and investment-related judgments, and that this influence depends on investors' initial reliability perceptions.

Estimate Disclosure Type and Investors' Reliability Judgments (H3)

H3 predicts that process disclosures will lead investors to produce higher reliability judgments than range and sensitivity disclosures. To test H3, we conduct a planned contrast of participants' post reliability judgments in the process disclosure condition versus the pooled reliability judgments of participants in the range and sensitivity disclosure conditions. Descriptive statistics are presented in Panel A of Table 2. Results of the planned contrast are reported in Panel B of Table 2.

[Insert Table 2 Here]

Consistent with H3, participants who viewed the process disclosure judged the reliability of the capitalized software development asset to be higher than participants who viewed the range or sensitivity disclosures (contrast value = 1.26, $t = 1.75$, $p = 0.04$,

one-tailed).¹⁴ This result is consistent with the process disclosure leading investors to consider fewer possible alternative values for the estimate than range and sensitivity disclosures.

Additional Analyses

Process analysis for reliability judgments

To provide further evidence for our theoretical explanation that investors perceive an estimated measure to be more (less) reliable as fewer (more) alternative values for the measure are considered, we examine participants' beliefs about the number of possible values that could represent the actual value of the estimate for which they provided reliability judgments.¹⁵

The results of H3 indicate that participants who viewed the process disclosure judged the reliability of the capitalized software development asset to be higher than participants who viewed the range or sensitivity disclosures. Consistent with this finding, we expect that process disclosures will lead investors to consider fewer possible alternative values for the estimate than range and sensitivity disclosures. To test this expectation, we conduct a planned contrast of participants' judgments of the number of

¹⁴ Results are inferentially similar if we compare participants' post-reliability judgments in the process condition and the range and sensitivity conditions separately. Participants in the process condition provided reliability judgments significantly higher than participants in the range condition ($t = 1.85$, $p = 0.03$, one-tailed) and marginally higher than those in the sensitivity condition ($t = 1.20$, $p = 0.11$, one-tailed).

¹⁵ Specifically, participants responded to the following questions: (1) "Before viewing the additional SFAS No. 86 disclosure provided for EJS, Inc., I believed that the actual value of the Capitalized Software Development Asset could be one of ____ possible values," using an 11-point scale with endpoints from 1 ("very few") to 11 ("very many"), and (2) "After viewing the additional SFAS No. 86 disclosure provided for EJS, Inc., my beliefs about the number of possible values that could represent the actual value of the Capitalized Software Development Asset ____ relative to my beliefs before I viewed the additional disclosure," using an 11-point scale with endpoints from -5 ("decreased by a very large amount") to +5 ("increased by a very large amount"). We create a composite measure of the number of possible values that participants' considered after viewing the estimate disclosure by summing their responses to question (1) and (2) above.

possible values in the process disclosure condition versus the pooled judgments of participants in the range and sensitivity disclosure conditions.

Consistent with our expectation, participants who viewed the process disclosure judged there to be fewer values that could represent the actual value of the asset than participants who viewed the range or sensitivity disclosures (contrast value = 1.53, $t = 1.55$, $p = 0.06$, one-tailed).¹⁶ Together, the results of H3 and this additional analysis are consistent with our theory that investors perceive an estimated measure to be more (less) reliable as they consider fewer (more) alternative values for the measure.

Process analysis for PE multiple estimates

The results of H2a and H2b indicate that estimate disclosures affected investors' PE multiple estimates in a manner consistent with changes in their reliability perceptions. To provide further insight into these results, we examine whether changes in investors' perceptions of information risk are consistent with these findings.¹⁷

Consistent with our expectations, participants with relatively *low* reliability priors judged the information risk of the company's stock to be *lower* (pre = 7.24 versus post = 6.96) after viewing the reliability disclosure ($t = 1.43$, $p = 0.08$, one-tailed). In contrast and consistent with expectations, participants with relatively *high* reliability priors judged the information risk of the company's stock to be *higher* (pre = 5.70 versus post = 6.24) after viewing the reliability disclosure ($t = 2.50$, $p < 0.01$, one-tailed). These results are

¹⁶ Contrast weights for each condition are: Process = -2, Range = 1 and Sensitivity = 1. These weights reflect our expectation that process disclosures will lead participants to consider fewer possible values than range and sensitivity disclosures.

¹⁷ Participants judged the "information risk associated with [the hypothetical company's] common stock" using an 11-point scale (1=Very Low; 11=Very High).

consistent with estimate disclosures influencing investors' PE multiple estimates as they affect investors' perceptions of the information risk of a company's stock.¹⁸

VI. CONCLUSION

This paper investigates how nonprofessional investors' reliability and investment-related judgments are influenced by disclosures that convey information about the reliability of accounting estimates (i.e., estimate disclosures). Specifically, we examine how estimate disclosures, generally and by type, interact with investors' prior reliability perceptions to impact their final reliability and investment-related judgments.

Our results show that accounting estimate disclosures lead to an increase (decrease) in reliability judgments and PE multiple estimates for investors with relatively low (high) initial reliability judgments. We also find that investors presented with a process disclosure (which describes how the estimate was generated) produce higher reliability judgments than investors presented with range or sensitivity disclosures. Supplemental analyses are consistent with process disclosures leading investors to consider fewer possible alternative values for an estimate than either range or sensitivity disclosures.

Our study should be of interest to regulators who consider disclosure requirements given the increasing acceptance of measurement attributes that require estimation (e.g., fair value). The results suggest that estimate disclosures not only affect reliability judgments, but do so differently for investors with different pre-disclosure reliability perceptions. Our experiment is not designed to examine whether estimate

¹⁸ Following the mediation analysis suggested by Baron and Kenny (1986), we find that changes in investors' perceptions of the information risk of the company's stock partially mediates the relationship between changes in their reliability judgments and PE multiple estimates (results not tabulated).

disclosures cause objective *improvement* in reliability judgments. However, the observed increase in agreement (i.e., that investors with relatively high (low) prior reliability judgments decreased (increased) those judgments when given an estimate disclosure) can be seen as an objective benefit of the disclosures.

The results also suggest that disclosures of different types can affect investors' reliability judgments via their effects on the set of values that investors consider to be plausible for the estimated measure. Specifically, the evidence suggests that process disclosures lead to higher reliability judgments because they highlight the plausibility of the reported value, relative to range and sensitivity disclosures, which highlight the plausibility of values other than the reported value.

Future research could examine this result in more natural settings. For example, a natural archival extension of our work would test the prediction that, all else constant, market reactions to process disclosures are greater than market reactions to either range or sensitivity disclosures. Such a result could be explained by differences in reliability judgments across disclosure type, in light of the results we present here.

Other limitations offer additional avenues for future research. For example, our study examines only three types of disclosure. While process, range, and sensitivity are common disclosure formats, other types may induce different effects on investors' reliability judgments. Additionally, reliability judgments are likely to be influenced by a number of disclosure-related factors not considered in this study. Future research could therefore expand on the effects of disclosure type as well as additional mechanisms by which reliability judgments are affected.

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Exhibit 1
Descriptions of Process, Range and Sensitivity Disclosures

ALL CONDITIONS

Consistent with SFAS No. 86, the Company has adopted a policy of capitalizing all software development costs incurred after the software project has reached technological feasibility. The Company determined that the software project had reached technological feasibility prior to the beginning of the current year.

When total costs are expected to exceed the estimated total revenue produced by the software product, the Company capitalizes costs up to the estimated total revenue amount and the remaining costs are expensed.

PROCESS CONDITION

The following analysis describes the process for determining the appropriateness of the asset value for capitalized software development costs recorded as of the end of the current year.

STEP 1: Calculate the estimated total revenue for the software development project

Software Project	Estimated Total Production (in units)	Estimated Price per Unit	Estimated Total Revenue
Project Alpha	1,500	\$200	\$300,000

STEP 2: Summarize the total costs of the software project capitalized.

Software Project	Costs capitalized in prior year	Costs capitalized in current year	Total Capitalized Costs
Project Alpha	\$189,300	109,700	\$300,000

STEP 3: Compare the estimated total revenue to total capitalized costs

Project Alpha	
Estimated Total Revenue	\$300,000
Total Capitalized Costs	(\$300,000)
Difference	0

SENSITIVITY CONDITION

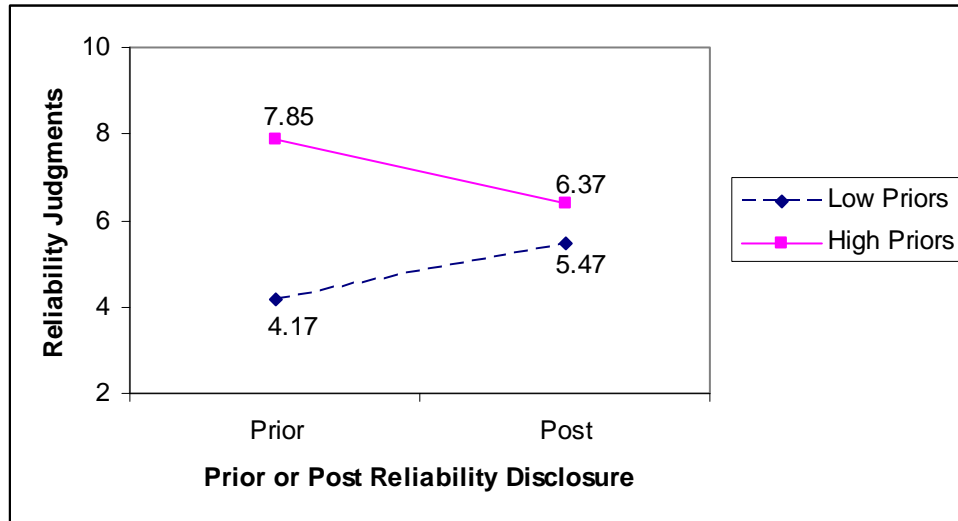
Currently, the company records a software development asset equal to the estimated total revenue from sales of the product, \$300,000. If the estimated total revenue were to decrease or increase by 10%, then the value of the software development asset would decrease or increase by \$30,000.

RANGE CONDITION

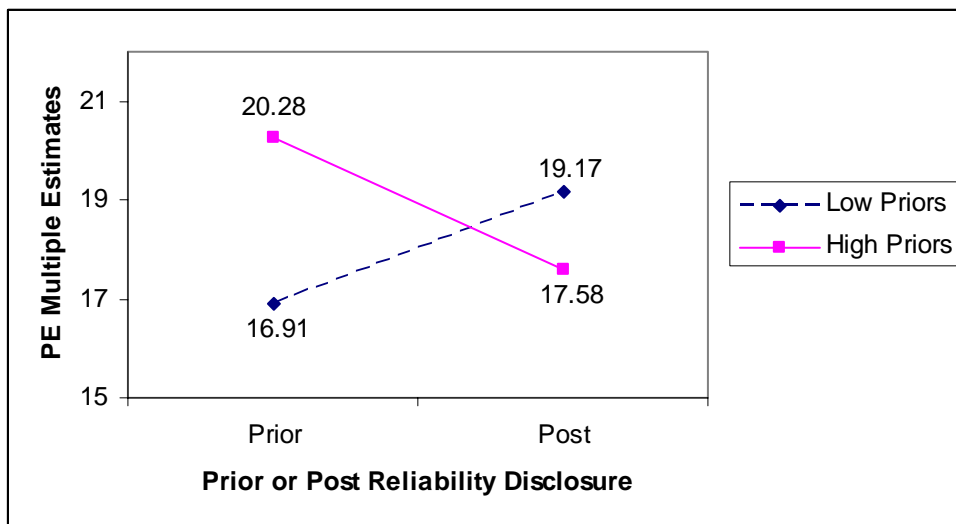
Currently, the company records a software development asset equal to the estimated total revenue from sales of the product, \$300,000. However, the actual total revenue from sales of the product, and the value of the software development asset could range from \$270,000 to \$330,000.

Figure 1
Observed Effects of Estimate Disclosures on Participants' Reliability Judgments and PE Multiple Estimates

Panel A: Dependent Variable – Prior and Post Reliability Judgments (H1a and H1b)



Panel B: Dependent Variable – Prior and Post PE Multiple Estimates (H2a and H2b)



These figures depict the difference in participants' prior and post reliability judgments and PE multiple estimates for those participants' with relatively low reliability priors (i.e., reliability priors at or below the median) and relatively high reliability priors (i.e., reliability priors above the median). We test whether participants' prior judgments (estimates) are significantly different from their post judgments (estimates) in the hypothesized direction using paired-comparisons presented in Panel B of Table 1.

Table 1
Descriptive Statistics and Analysis of Effects of Estimate Disclosures on
Participants' Reliability Judgments and PE Multiple Estimates (H1a, H1b, H2a,
H2b)

Panel A: Descriptive Statistics (mean [standard deviation])

Dependent Variables	Relative Pre-Judgments^c	
	Low n = 83	High n = 71
① Reliability Judgment^a		
Pre	4.17 [1.37]	7.85 [0.82]
Post	5.47 [2.18]	6.37 [2.00]
② Price-Earnings (PE) Multiple Estimate^b		
Pre	16.91 [4.14]	20.28 [7.61]
Post	19.17 [5.39]	17.58 [6.73]

Panel B: Paired Comparisons^d

	Relatively Low Pre-Judgments	Relatively High Pre-Judgments
①	H1a: Post (5.47) > Pre (4.17) t = 4.56, p < 0.01	H1b: Post (6.37) < Pre (7.85) t = 5.51, p < 0.01
②	H2a: Post (19.17) > Pre (16.91) t = 3.74, p < 0.01	H2b: Post (17.58) < Pre (20.28) t = 4.01, p < 0.01

Notes:

^a Participants provided pre (post) reliability judgments of the reported capitalized software development asset before (after) observing an estimate disclosure by responding to the following: "I believe that the Capitalized Software Development Asset reported on EJS's balance sheet as of December 31, 2005 is _____," using an 11-point scale with endpoints from 1 ("very low") to 11 ("very high").

^b Participants provided pre (post) estimates of the company's PE multiple before (after) observing an estimate disclosure by responding to the following open-ended question: "What price-earnings (PE) multiple would you apply to EJS's reported 2005 Net Income per share?".

^c We classified those participants' with initial reliability judgments below and including the median (6.00) as having relatively low pre-judgments and those above the median as having relatively high pre-judgments.

^d P-values are one-tailed.

Table 2
Descriptive Statistics and Analysis of Post-Reliability Judgments by Disclosure Type (H3)

Panel A: Descriptive Statistics (mean [standard deviation])

Dependent Variable	Disclosure Condition ^c		
	Process (P) n = 53	Range (R) n = 53	Sensitivity (S) n = 48
① Post Reliability Judgment ^a	6.30 [2.11]	5.55 [2.09]	5.79 [2.21]

Panel B: Planned Contrast for Process versus Range and Sensitivity^d

	Contrast Value	df	t-statistic	p-value ^d
①	1.26	151	1.75	0.04

Notes:

- ^a Participants provided post reliability judgments of the reported capitalized software development asset after observing an estimate disclosure by responding to the following: “I believe that the Capitalized Software Development Asset reported on EJS’s balance sheet as of December 31, 2005 is _____,” using an 11-point scale with endpoints from 1 (“very low”) to 11 (“very high”).
- ^b Participants observed one of three estimate disclosures: PROCESS, RANGE or SENSITIVITY. In the PROCESS condition, a disclosure described the process used to derive the capitalized software development asset’s estimated balance of \$300,000. In the RANGE condition, a disclosure indicated the likely range of the capitalized software development asset’s true balance was between \$270,000 and \$330,000. In the SENSITIVITY condition, a disclosure indicated that for a ten percent change in estimated total future revenues, the capitalized software development asset’s value would decrease or increase by \$30,000.
- ^c Contrast weights for each condition are: Process = -2, Range = 1 and Sensitivity = 1. These weights reflect our expectation that process disclosures will lead participants to produce higher reliability judgments than either range or sensitivity disclosures.
- ^d P-value is one-tailed.