NOTE TO USERS

DETERMINANTS OF ERROR ATTRIBUTION IN ACCOUNTING ESTIMATES

BY

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ABSTRACT

Accounting researchers (e.g., Lundholm 1999) and standard-setters (e.g., AICPA 2002 and SEC 2002) have suggested that *ex post* reporting and examination of the accuracy of prior-period accounting estimates may increase investor welfare by increasing the perceived reliability of current-period accounting estimates. In this dissertation, I experimentally examine two main research questions related to decision makers' interpretations of prior-period accounting estimate accuracy disclosures: (1) Are decision makers' interpretations of such *ex post* reports on prior-period accounting estimate accuracy affected by the properties of the time series observed, and (2) Are decision makers' interpretations of such *ex post* reports susceptible to biases resulting from directionally motivated reasoning? I hypothesize that directionally motivated reasoning moderates decision makers' misconceptions of the properties of bias and noise in the observed sequences of accounting estimate errors, such that potential stockholders are more likely than other decision makers to attribute misestimations to bias, while current stockholders are more likely than other decision makers to attribute misestimations to noise, and that these differences will decrease as reasonableness constraints increase. Also, results suggest that when reasonableness constraints are low, potential stockholders are more likely than current stockholders to attribute misestimations to bias, while current stockholders are more likely than potential stockholders to attribute misestimations to noise, consistent with directionally motivated reasoning. Results from a second experiment show that increasing the number of observations to the maximum likely to be seen in a financial reporting context does not mitigate the effects observed in the first experiment.

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CHAPTER 1 – INTRODUCTION

This dissertation examines one potential drawback to a mechanism for reporting on prior accounting estimate accuracy that has been suggested by accounting researchers and standard setters (Lundholm 1999). Specifically, I examine whether proposals for *ex post* reporting of accounting estimate accuracy are undermined by people's often incorrect intuitions about statistical properties such as systematic and non-systematic error (i.e., bias and noise) in a time series of accounting estimates.

Accounting estimates generally emerge from a combination of objective and subjective factors. Accounting and auditing standards recognize the potential problem that subjectivity creates for financial statement users, namely that managers could manipulate financial results through misestimation. To mitigate the potential for deliberate misestimation, a recurring proposal in the accounting literature and audit standards calls for heightened *ex post* examination of the accuracy of management's accounting estimates (Powers and Revsine 1989, Anthony and Petroni 1997, Ryan 1997, Beaver and McNichols 1998, Lundholm 1999, Hirst, Jackson, and Koonce 2003). Lundholm (1999) recommends that current reporting requirements be augmented by disclosures of the *ex post* realizations of prior accounting estimates. Reporting the realized values for prior period accounting estimates purportedly would (at least partially) reveal any systematic overstatement or understatement, and thereby warn financial statement users of potential managerial bias.

The recently issued SAS No. 99 incorporates elements of Lundholm's recommendation into auditing standards, requiring auditors to "perform a retrospective review of significant accounting estimates reflected in the financial statements of the prior year to determine whether management judgments and assumptions relating to the estimates

indicate a possible bias on the part of management" (AICPA 2002). SAS No. 99 states that this review is not meant to question the auditor's judgment in the prior year, but instead provides the auditor with information regarding potential bias in current year estimates. While I do not examine auditor judgments specifically in this dissertation, a similar recommendation is made for financial reporting in the SEC's Proposed Rule No. 33-8098, "Disclosure in Management's Discussion and Analysis about the Application of Critical Accounting Policies" (SEC 2002). Although the proposal put forth by the SEC has yet to be implemented, pronouncements such as these demonstrate that the issue of *ex post* review of accounting estimates is both timely and consequential.

However, the Lundholm recommendation, SAS No. 99, and the SEC's proposed rule are virtually silent about how accurately financial statement users can detect bias and noise in a time series of estimates and realizations. This silence is disconcerting because research in psychology and forecasting has shown that people's (including auditors' and investors') intuition about statistical properties such as bias and noise are often incorrect (e.g., Tversky and Kahneman 1974, Budescu, Erev, and Wallsten 1997, Soll 1999, Budescu and Rantilla 2000, Peecher, Rich, and Tubbs 2003), and we know little about financial statement users' tendency to attribute misestimations to noise or bias. I hypothesize that directionally motivated reasoning moderates users' misconceptions of the properties of bias and noise. This causes potential stockholders to be more likely than current stockholders to attribute differences between *ex ante* estimates and *ex post* realizations to bias, while current stockholders will be more likely than potential stockholders to attribute the differences to noise.

In my first experiment, participants viewed a series of *ex ante* estimates and *ex post* realizations, and judged the extent to which errors in prior years' estimates are attributable to bias or noise. I manipulated two attributes of the series of estimate/realization pairs between subjects: The frequency of reversals in the sequence of directional misestimations at two levels (higher or lower)[1] and participants' goal state at three levels (potential stockholder, current stockholder, and neutral verifier). The latter manipulation reflects directionally motivated reasoning theory finding that decision makers employ different criteria for evaluation of preference-consistent versus preference-inconsistent evidence (e.g., Ditto and Lopez 1992, Doosje, Spears, and Koomen 1995, Kunda 1999, Hales 2003). The former manipulation, frequency of reversals, is based on psychology research which implies that participants will misunderstand the diagnosticity of short sequences of estimate/realization pairs, and overinfer the number of runs in the underlying population based upon the number of runs in the observed short sequence (e.g., Tversky and Kahneman 1974, Kunda 1999; see Barberis, Shleifer, and Vishny 1998, Bloomfield and Hales 2002, and Rabin 2002 for recent behavioral finance and economics research with similar implications).

I hypothesize that goal state and reversals will yield an ordinal interaction such that the influence of the reversal effect on judged noise and bias is moderated by the goal state effect. Specifically, I expect all participants' noise likelihood judgments to be higher in the high reversal condition than in the low reversal condition. Additionally, due to directionally motivated reasoning, I expect current stockholders' noise likelihood judgments to be greater than those of participants in the other two conditions. However, reasonableness constraints

[1] In this dissertation, I focus only on directional misestimations (i.e., whether the original estimate was under- or over-estimated). Thus, I define "misestimations" by the sign of the estimation error and hold the magnitude of errors constant. While understanding the effect that misestimations of varying magnitudes has on investor judgments is an important topic, it is beyond the scope of this dissertation.

will cause an ordinal interaction between participants' goal states and the frequency of reversals, such that the difference in noise likelihood judgments across goal states decreases when reasonableness constraints are relatively stronger (i.e., when reversals are high and, thus, naïvely representative of noisy time series). Similarly, I expect all participants' bias likelihood judgments to be higher in the low reversal condition than in the high reversal condition, and I expect potential stockholders' bias likelihood judgments to be higher than those of participants in the other two conditions. Again, though, reasonableness constraints will decrease the magnitude of the difference in bias likelihood judgments across goal states when the sequence is naïvely representative of bias (i.e., when reversals are low).

The experimental results provide evidence supportive of these predictions. Participants' noise likelihood judgments were highest in the high reversals condition, and their bias likelihood judgments were highest in the low reversals condition. On average, current stockholders' noise likelihood judgments were significantly greater than those of other participants, and potential stockholders' bias likelihood judgments were significantly greater than those of other participants. Additionally, for both noise and bias likelihood judgments, differences between goal state conditions were smaller when reasonableness constraints were stronger. An important implication here is that participants' inappropriate reliance on the law of small numbers quickly leads to perceived reasonableness constraints that may be no different from those that would obtain if a longer time series of misestimations were observed.

A second experiment was conducted to explore whether increasing the length of the time series (but keeping it within the length likely to be observed in financial reporting) would mitigate the effects seen in experiment one. Normatively, increasing the length of the

time series should allow decision makers to form better mental models of error propagation, and should increase decision makers' reasonableness constraints, thus mitigating the effects seen in experiment one. Thus, I hypothesize that for shorter time series, potential (current) stockholders will be more likely than current (potential) stockholders to attribute misestimations to bias (noise), but for longer time series the difference will decrease. The results of experiment two, though interesting, do not fully support my hypotheses. In fact, the interaction that obtains for judged bias is the opposite of the one I predicted. This seems to be driven by the fact that potential stockholders' bias likelihood judgments were constant across time series lengths, while current stockholders' bias likelihood judgments decreased as the time series length increased. This unexpected result is explored in more detail in a later section.

This study contributes to the accounting literature in at least two ways. First, it identifies a potential drawback to the outstanding proposals for *ex post* estimate-accuracy review made by academics and by standard-setters (the AICPA in SAS No. 99 and the SEC in their proposed rule on critical accounting policies). Specifically, even when estimate/realization sequences are short, the combined effects of directionally motivated reasoning and misperceptions of noise and bias may lead potential stockholders to over-attribute estimate errors to bias, and may lead current stockholders to over-attribute estimate errors to noise. Thus, potential stockholders may pass up otherwise sound (and potentially profitable) investments, and current stockholders may be too slow to sell poor performing stocks (also observed empirically by Odean (1998)).

Second, this study also examines particular cognitive mechanisms that likely operate when decision makers attempt to interpret preference-consistent or preference-inconsistent

information pertaining to the *ex post* accuracy of accounting estimates. I show that a decision-maker's tendency towards directionally motivated reasoning moderates the effect that misperceptions of randomness have on judgments in accounting error attribution tasks. In other words, I examine conditions under which potential stockholders' preference for caution (i.e., occasionally passing over an otherwise sound investment in order to minimize the risk of out-of-pocket losses) and current stockholders' preference that misestimations were due to noise (due to the decline in the value of their holdings if the company in question is accused of biased reporting) moderate the extent to which financial statement users confound beliefs and preferences when analyzing financial information.

This study contributes to the psychology literature by identifying and examining a situation in which previously identified cognitive biases likely are moderated by accounting contextual factors. Specifically, the multi-period nature of accounting reports facilitates an integrative examination of factors identified separately in social psychology, judgment and decision-making research, and economics (i.e., directionally motivated reasoning (Kunda 1999), the representativeness heuristic (Tversky and Kahneman 1974), and the "law of small numbers" (Tversky and Kahneman 1971, Rabin 2002)). Additionally, this study extends previous theory on directionally motivated reasoning by experimentally demonstrating that the effects noted in Doosje, Spears, and Koomen (1995)—namely that decision-makers' willingness to make inferences from relatively smaller samples (i.e., $n = 10$) increases when those inferences are preference-consistent—holds when the samples are extremely small (i.e., $n < 10$).

The remainder of this dissertation is organized as follows. The following chapter reviews the relevant literature and explains the theory and hypotheses. Chapter III describes

the method, and Chapter IV provides the results of my study. Chapter V discusses a second experiment that was designed to follow up on issues identified in the first experiment, and Chapter VI concludes with the implications and limitations of this dissertation, and previews some ideas for future research.

CHAPTER 2 – LITERATURE REVIEW AND HYPOTHESES

This chapter contains three major sections. The first section reviews prior research on accounting estimates, including recent research claiming that additional disclosure about accounting estimates would be helpful to investors. The second and third sections provide discussions of research from cognitive and social psychology relevant to the judgments made by users of accounting estimates.

2.1 Research on Accounting Estimates

When compiling financial statements, management makes numerous significant accounting estimates. Examples include the allowance for uncollectible receivables, the net realizable value of certain inventory items, the valuation of financial securities, the useful lives and residual values of assets, warranty claims, pension costs, losses due to litigation, etc. These estimates generally are based on both objective and subjective factors; subjectivity makes it difficult for management to design and implement perfect controls over the estimates. Even in best-case scenarios (i.e., estimates made by competent and diligent managers with access to high quality data), the potential for misestimation (bias or noise) exists in the selection and interpretation of data (AICPA 1988).[2]

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[2] Recent regulatory proceedings also have focused attention on management estimates. For example, Statement on Auditing Standards No. 99 ("Consideration of Fraud in a Financial Statement Audit") emphasizes ex post review and evaluation of management's significant prior year accounting estimates. The express purpose of the review is to determine whether differences between the *ex ante* estimated amounts and the *ex post* realized amounts indicate potential bias on the part of management (AICPA 2002; see paragraphs 63-65). However, no guidance is provided regarding how auditors should treat an estimate from the prior year that has not been resolved by the end of the current year; the standard is also silent with respect to how auditors should interpret any misestimations that they discover. Misestimations can be the result of either bias or random error (or some combination of the two), and little empirical evidence exists regarding how auditors might decide which type of error is responsible for a given misestimation (Peecher, Rich, and Tubbs 2003). Also, a recently issued SEC proposal echoes the AICPA's concern for appropriate treatment of accounting estimates. Proposed rule #33-8098, "Disclosure in Management's Discussion and Analysis about the Application of Critical Accounting Policies," attempts to improve financial reporting by better informing financial statement users about the properties (statistical and otherwise) of estimates that are related to critical accounting policies. Under the

Accounting researchers suggest that disclosure about the accuracy of prior-period accounting estimates would improve investor welfare (see Petroni (2003) for a history of this proposal). For example, in a study of how financial statement users interpret lessors' estimated residual values, Powers and Revsine (1989, p. 367) suggest that financial statement users would benefit from knowing lessors' track records of residual value estimates and realizations: "Lessors who have demonstrated a history for choosing attainable residual values would presumably be more likely to be measuring current income using similarly attainable residual values."[3] Anthony and Petroni (1997) investigate disclosures on past estimation errors in the unpaid claim loss liability for property-casualty insurers.[4] Based on their results (i.e., a negative association between variance in prior estimation errors and earnings response coefficients), Anthony and Petroni (1997), along with Ryan (1997), suggest that reporting on the *ex post* variation in major accrual estimates would be helpful in assessing risk and determining value. Consistent with the decision usefulness of such disclosures, Beaver and McNichols (1998) find that investors incorporate prior period estimate accuracy in their pricing decisions (i.e., investors appear to discount book values for insurers that have underreserved in the past). Although Beaver and McNichols show that

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proposed rule, additional disclosure about significant accounting estimates would be required in the MD&A section of the annual report (SEC 2002). The additional disclosure seeks to help investors better understand the sensitivity of the financial statements to changes in the accounting estimate. Specifically, the proposed rule requires: "For each critical accounting estimate, a company would discuss changes that would result either from: (i) making reasonably possible, near-term changes in the most material assumption(s) underlying the estimate; or (ii) using in place of the recorded estimate the ends of the range of reasonably possible amounts which the company likely determined when formulating its recorded estimate. . . . *In addition, the proposals would require a quantitative and qualitative discussion of management's history of changing its critical accounting estimates in recent years.*" (SEC 2002, emphasis added) Although it appears unlikely that this proposal will be implemented in its current form, its introduction indicates that the SEC is interested in—and examining mechanisms for—improving management's accounting estimates.

[3] In January 2003, the SEC alleged that Xerox's residual values were inappropriately estimated and brought suit against KPMG and four of its partners (Hecht 2003, SEC 2003).

[4] Property and casualty insurers are required to accrue a liability for policy claim losses (i.e., future cash payments to settle claims related to policies outstanding as of the balance sheet date). The SEC currently requires property and casualty insurers to disclose revisions to their claim loss liability estimates for each of the ten past years.

investors appear to impound prior accuracy into their pricing decisions, mispricing could persist despite changes in prices if price adjustments reflect some investors' flawed understanding of bias and noise.

While much of this prior research suggests that *ex post* disclosure of estimate accuracy would be useful for investors and decision makers, none of these papers explore in detail the form that such disclosure might take. Lundholm (1999) examines the issue in some depth and proposes a financial reporting mechanism wherein companies would be free to use any reasonable procedure for calculating accounting estimates, but would also be required to disclose the *ex post* accuracy of those estimates. Financial statement users armed with this information could perform a retrospective analysis of estimate accuracy similar to that recently required of auditors in SAS No. 99.[5] Lundholm contends that anticipation of investors' retrospective review would provide companies with incentives to make accurate estimates, as differences between the estimated *ex ante* and actual *ex post* numbers would indicate potential bias on the part of management. Of course, some differences would not be due only to bias—differences could also arise from random error. Lundholm (1999, p.321) recognizes this, stating that the proposed *ex post* report "will have less impact if there is a large amount of residual uncertainty. . . . It may not be that management is attempting to mislead investors, they may simply not have very good information themselves about the uncertain variable being estimated." In instances such as these, however, financial statement users may still be able to detect biased reporting if they have access to a time series of estimate realizations and a good understanding of the indicators of noisy/biased time series.

[5] See footnote 2 for a brief description of SAS No. 99.

In Lundholm's words (p. 321), "Repeated outcomes with the same-signed forecast error can still reveal bias."[6]

Hirst, Jackson, and Koonce (2003) experimentally examine Lundholm's proposal and find that the effect of *ex post* reporting depends on the relative transparency of the *ex post* report, and is (unexpectedly) asymmetric in terms of investor reward versus punishment. Specifically, participants rewarded "accurate" disclosure when it was relatively transparent (i.e., when it explicitly noted the income effect of any misestimation), but did not punish equally transparent, but opportunistically biased, disclosures. Relatively less transparent disclosures (i.e., those showing only the balance sheet effects, and not the income statement effects) did not lead participants to differentiate between accurate and opportunistically biased behavior.[7]

One issue that Hirst et al. (2003) address only indirectly is the effect of random error. Similar to the general tone of Lundholm (1999), Hirst et al. believe that consistent (i.e., same-signed) differences between estimated and realized numbers will be perceived as indicating management's opportunistic behavior (i.e., bias). However, prior research is

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[6] In the financial reporting arena, *ex post* realizations are likely to be subject to some degree of bias and noise as well. Noise and bias in *ex post* realizations will affect the magnitude and direction of any misestimations; however, to facilitate my investigation into judgments about *ex ante* estimates, I assume that the *ex post* realizations are relatively accurate and unbiased.

[7] Although the findings with respect to "reward" are consistent with a long line of prior research in both psychology and consumer behavior showing that effort-averse people tend to use information naïvely and in the manner in which it is given to them (see Payne, Bettman, and Johnson 1993 and Higgins and Bargh 1987 for good reviews of this research), the lack of punishment was unexpected. One possible explanation is that the experimental materials may confound perceived bias and perceived economic performance. Specifically, reported earnings remained constant across all conditions, but underlying economic performance varied. Thus, it is difficult to determine whether participants reacted to the perceived level of opportunistic bias or to the underlying economics of the company (i.e., if participants correctly adjusted for the "seeded" opportunistic bias, then the "low bias" company would appear to have better underlying economic performance). Hirst et al. (2003) address this issue by conducting a separate experiment in which the underlying economics were held constant across conditions, but the reported financial statements were misstated only in the "opportunistic bias" condition. Results from this experiment still fail to support the "punishment" hypothesis, but the reason for this is unclear. Because participants were providing judgments that are several steps removed from their perceptions of bias and noise in the reported numbers (i.e., these perceptions are inputs to judgments about future earnings and expected P/E multiples, but they are certainly not the only inputs), we cannot say for sure whether the results were due specifically to these perceptions.

unclear on the "threshold" at which consistent differences should be and are considered indicative of bias instead of random error. If, for example, financial statement users see two misestimations in the same direction, they may attribute the differences to random error; if they see thirty misestimations in the same direction, they are likely to believe that the differences are due to bias. What factors affect the point at which their judgment changes? The determinants of the degree to which financial statement users attribute differences between estimated and realized accounting numbers to various types of error remains an open question.

One potential concern with implementing the proposals for *ex post* review of accounting estimates put forth by the AICPA, SEC, and researchers is that people's intuitive judgments of statistical properties such as bias and noise are often incorrect (Tversky and Kahneman 1971, 1974, Lopes and Oden 1987, Rapoport and Budescu 1992). In addition, although the decision maker's goal state is normatively irrelevant to statistical analyses, it is central to many cognitive analyses, and will moderate the extent to which a cue of dubious normative relevance is used. For example, from a normative perspective, a sample containing three observations is unlikely to have high diagnosticity due to the large sample variance. However, if the sample evidence is consistent with decision makers' preferences, decision makers may treat small samples as relevant (Doosje, Spears, and Koomen 1995).

Next, I develop hypotheses related to the frequency of reversals in a time series of accounting estimates and realizations, decision makers' goal states, and the interaction of these two factors.

2.2 Misappreciation of the Properties of Noise

Very little research exists that jointly examines how people account for different levels of bias and noise when making judgments or decisions. Some guidance can be found in the medical decision-making literature that discusses clinical versus statistical approaches to decision making. Einhorn (1986) notes that while the clinical approach is essentially deterministic (it all but ignores non-systematic, or random, error), the statistical approach accepts random error as a part of nature. In many situations, the acceptance of random error leads to better predictions, on average. For example, Edwards (1956) showed that while participants in a probability-learning exercise were able to learn the (unknown) probability with which one of two lights was lit, they kept trying to predict a non-existent pattern in the series of lights. In part because the costs of prediction error were not asymmetric, participants would have been better off by simply predicting the alternative known to occur with higher frequency on each and every trial, even though this alternative would often be incorrect. Thus, accepting a degree of random error would have led participants to make more accurate predictions, on average.[8]

The debate over clinical versus statistical decision making, though, is generally limited to a consideration of different levels of random error, and whether that random error can (or even should) be eliminated. Most decision makers face situations with varying levels

[8] Subjects in these experiments typically had to predict which of two lights (red or green) would be lit next. The lights were programmed to light according to a binomial process wherein the proportion of red to green lights was 60:40. While the proportion of red to green in subjects' predictions was roughly correct (i.e., subjects predicted red 60% of the time and green 40% of the time), the subjects kept trying to see non-existent patterns in the data, and thus (erroneously) tried to make perfect predictions based on past series of lights. The expected percent of correct predictions for such a strategy (as noted in Einhorn 1986) is only 52%. However, by predicting the most likely alternative (red) on all trials, subjects would be correct 60% of the time. Einhorn (1986) concludes that this indicates the superiority (at least in certain situations) of decision strategies that accept some error on particular trials (i.e., abandon the attempt to eliminate all prediction error) in order to reduce the average (or overall) level of error across all trials.

of both noise and bias. Indeed, as noted in Ravinder, Kleinmuntz, and Dyer (1988), control of random error is not a sufficient condition for accurate assessment of subjective probabilities.

More recent research by Soll (1999) shows that while people are generally sophisticated enough (in a statistical sense) to recognize two main types of error (noise and bias), their beliefs about these types of error are sometimes systematically wrong. While most people correctly believe that taking multiple measurements from the same source will reduce concerns about random error, some people erroneously believe that taking multiple measures from different sources reduces only concerns about bias (Soll 1999). From a normative perspective, random error on individual measurements should be uncorrelated both within and between sources (i.e., the random error from any two measurements should be uncorrelated, regardless of whether those two measurements are from the same or from different sources), so averaging the measurements from different sources should reduce concerns about both types of error (assuming that the magnitude of potential random error is constant across all sources). However, the theory developed in Soll (1999) applies more to situations in which the level of potential random error is constant across measurement sources than to the more realistic situation where the level of random error varies across measurement sources.

In an investment decision-making context, previous theory suggests, but does not empirically demonstrate, that potential stockholders viewing a time series of accounting estimate/realization pairs are likely to infer bias even when no patterns or weak patterns indicative of bias exist. The potential for such false inferences likely manifests at least in part due to a misappreciation of the properties of noise and bias (Tversky and Kahneman

1974, Bloomfield and Hales 2002). One cause of this tendency is use of the representativeness heuristic (Tversky and Kahneman 1974, Gilovich, Vallone, and Tversky 1985, Kunda 1999) or, more specifically, belief in the law of small numbers (Rabin 2002). Accounting research on *ex post* estimate-accuracy reporting generally has not examined factors that affect the extent to which decision makers interpret consistent (i.e., same-signed) misestimations as suggestive of opportunistic, or biased, reporting (Lundholm 1999, Hirst, Jackson, and Koonce 2003). If unbiased misestimations are as likely to be positive as negative, a time series of the direction of past misestimations should be indistinguishable from any other binomial random series (e.g., flipping a fair coin).

However, people's intuitive beliefs about such random series are generally inaccurate. Specifically, research on the representativeness heuristic concludes that people tend to overestimate the extent to which small samples should be representative of the population from which they are drawn (i.e., they underestimate the effect of sampling error in small samples). Consequently, people expect short segments of a random sequence to reflect the true population parameters; if a sequence deviates from the population parameters, a corrective bias is expected.[9] Tversky and Kahneman (1971) also refer to this time series tendency as the *gambler's fallacy*. For example, a decision maker employing the representativeness heuristic expects that a flip of 'heads' from a fair coin is more likely to be followed by 'tails' than by another 'heads'. Griffin and Tversky (1992) note that confidence in judgments is determined primarily by the strength (or extremeness) of an observation, and not by its weight (or predictive validity). In a time series of dichotomous observations, the

[9] The representativeness heuristic is a cognitive or perceptual bias (Tversky and Kahneman 1974). As such, its effects on investor decision making are unlikely to be eliminated by motivations to be accurate, which are often claimed to eliminate individual biases in a market setting (Barberis, Shleifer, and Vishny 1998).

sample proportion and sample size arguably represent measures of strength and weight, respectively.

Barberis, Shleifer, and Vishny (1998) develop a model of investor sentiment that incorporates the representativeness heuristic to help predict simultaneous investor overreaction to a series of good news disclosures and investor underreaction to individual earnings surprises. They note that although consistent growth may reflect nothing more than a random draw for a few lucky firms, "investors see 'order among chaos' and infer from the in-sample growth path that the firm belongs to a small and distinct population of firms whose earnings just keep growing" (p. 316). Bloomfield and Hales (2002) experimentally examine the assumption in the Barberis et al. model that investors use the number of recent trend reversals to judge the probability of future reversals, as predicted by the representativeness heuristic.[10,11] Their results show a strong negative correlation between the number of

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[10] Participants in Bloomfield and Hales (2002) traded securities whose value was dependent on a random walk (i.e., future changes in value were uncorrelated with past observations). A sequence of past changes in value was shown to participants, along with an explanation of "random walk" processes, including the statement that "statistical models are unable to predict future outcomes from past ones and, on average, there is no upward or downward trend." The value of the securities depended solely on the next change (i.e., the value was 100 if the next change was upward, and 0 if the next change was downward; each possibility had a 50% probability of occurrence). From a normative perspective, participants could maximize their wealth by setting the price they were willing to pay for the securities equal to 50 in each and every period. The results, however, show a strong negative correlation between the number of reversals in a series and investor reaction. Specifically, participants overreacted (set prices above 50) to the most recent change in a sequence containing few reversals, and underreacted (set prices below 50) to the most recent change in a sequence containing many reversals. Thus, the tendency for investors to infer non-random patterns in data that is essentially random has been shown to affect investor judgment in some situations. Similar to Einhorn's recommendation that physicians should occasionally be willing to accept some degree of error on individual trials in order to reduce the overall level of error across all trials, participants in Bloomfield and Hales (2002) would have been better off by setting prices equal to 50 (the expected value of the security) on all trials, rather than trying to predict non-existent patterns in the random series.

[11] Consistent with the model derived in Barberis, Shleifer, and Vishny (1998), Bloomfield and Hales (2002) assume that investors erroneously rely on the frequency of reversals in earnings surprises when determining whether a particular company is in a "trending regime" or a "mean-reverting regime". (Informally describing their model, Barberis et al. state: "When a positive earnings surprise is followed by another positive surprise, the investor raises the likelihood that he is in the trending regime, whereas when a positive surprise is followed by a negative surprise, the investor raises the likelihood that he is in the mean-reverting regime.") Thus, although one could argue that some investors use the *proportion* of misestimations in each direction when making inferences about the estimation process, I remain consistent with previous researchers, and focus on the *frequency of reversals* in the time series of misestimations.

reversals in a series and investor reaction. The tendency for investors to infer non-random patterns in earnings sequences that are essentially random causes investors to value securities at levels above or below their true expected value, depending on the specific earnings sequence viewed. The finding that the frequency of reversals in a series affects investors' perceptions of the randomness in the series is consistent with Gilovich, Vallone, and Tversky (1985), who note that "people not only perceive random sequences as positively correlated, they also perceive negatively correlated sequences as random" (p. 311). In the present study, this theory implies that if the direction of misestimation is consistent from one year to the next, investors are likely to believe that the misestimations are non-random; however, if the direction of misestimation changes frequently, investors are likely to believe that the misestimations are random.

A derivative psychological effect—belief in the law of small numbers—stems from the representativeness heuristic, and assumes that random processes contain some sort of active self-correcting tendency.[12] Rabin (2002) descriptively models investor belief in the "law of small numbers" by assuming that (otherwise Bayesian) decision makers erroneously exaggerate the likelihood that a short sequence of signals resembles the population from which those signals were drawn (i.e., decision makers underestimate the variability that naturally occurs in short random sequences). This belief in the law of small numbers leads decision makers who are uncertain about the rate at which signals are generated to overinfer population rates from short sequences of signals. In Rabin's words:

[12] Tversky and Kahneman (1971) describe the law of small numbers as follows: "The law of large numbers guarantees that very large samples will indeed be highly representative of the population from which they are drawn. If, in addition, a self-corrective tendency is at work, then small samples should also be highly representative and similar to one another. People's intuitions about random sampling appear to satisfy the law of small numbers, which asserts that the law of large numbers applies to small numbers as well."

> Exaggerating the likelihood that a short sequence of signals will closely resemble the underlying rate leads to exaggerating the likelihood that the underlying rate resembles a short sequence of signals. If a person believes that every pair of flips of a fair coin generates one head and one tail, then he believes that two heads in a row indicates a biased coin. (Rabin 2002, p. 776)

In a financial statement disclosure setting, a tendency towards belief in the law of small numbers implies that if a company's estimates contain only random error, misestimations in one direction should be quickly offset by misestimations in the opposite direction. Even short sequences of misestimations in the same direction are not expected if the misestimation is driven purely by random error, and thus would be viewed as indicative of bias.

Based on the research discussed above, I propose the following hypotheses:

HYPOTHESIS 1A: Participants will judge the likelihood that misestimations are caused by noise to be greater when the series of estimate/realization pairs contains more reversals.

HYPOTHESIS 1B: Participants will judge the likelihood that misestimations are caused by bias to be greater when the series of estimate/realization pairs contains fewer reversals.

2.3 Goal State

Features of the financial reporting/investing context—such as the decision maker's implicit and explicit goals—likely moderate the tendencies to infer non-random patterns in otherwise random series and to infer randomness in negatively correlated series. In an examination of directionally motivated reasoning,[13] Ditto and Lopez (1992) posit that people

[13] *Directionally motivated reasoning* posits that cognitive processes—and the judgments and decisions that result from those processes—can be colored by the decision-maker's motivation. Specifically, directional motivation has been shown to affect the memories, beliefs and inferential rules accessed by decision-makers (see, e.g.: Klayman and Ha 1987; Kunda 1987; Dunning, Meyerowitz, and Holzberg 1989; Sanitioso, Kunda, and Fong 1990; Dunning, Perie, and Story 1991; Schaller 1992; Doosje, Spears, and Koomen 1995; Dunning, Leuenberger, and Sherman 1995; McDonald and Hirt 1997) and the amount of effort expended by decision-makers (see, e.g.: Lord, Ross, and Lepper 1979; Kruglanski 1980; Ditto and Lopez 1992; Edwards and Smith 1996, Boiney, Kennedy, and Nye 1997). The decision-maker's *preferred position* refers to the directional goal that the decision-maker is motivated to achieve. Directionally motivated reasoning is constrained, however, by

examine information more critically when it is interpreted as inconsistent with a preferred position. Additionally, less information is required to reach preferred conclusions than non-preferred conclusions. As the strength of a decision maker's commitment to a particular goal increases, the effects of directionally motivated reasoning also increase (Kadous, Kennedy, and Peecher 2003). Directionally motivated reasoning has been shown to affect the inferential rules that decision makers select and use, including rules about the sufficiency of small samples. For example, participants in Doosje, Spears, and Koomen (1995) were willing to generalize from a relatively smaller sample only when the sample reinforced to the preferred position; these same participants dismissed the smaller sample when its implications were preference-inconsistent. When the sample was larger, participants accepted its inferences regardless of their preferred position, consistent with the reasonableness constraints on directionally motivated reasoning (Kunda 1999). However, the experimental setting in Doosje et al. differs from the financial reporting arena in at least one important way: the sample sizes used were much larger than would likely be seen in financial reports (n = 10 and 20 for "small" and "large" samples, respectively). It is highly unlikely that companies would be willing to include twenty years of financial information in their reports.[14]

When conducting an *ex post* review of the accuracy of accounting estimates, belief in the law of small numbers will cause reasonableness constraints to be relatively stronger if the sample at hand is naïvely "representative" of the type of error about which a judgment is

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the decision-maker's need to justify the feasibility of his or her conclusions in light of his or her understanding of reality (Boiney, Kennedy, and Nye 1997, Kunda 1999 (p. 227)), commonly referred to as "reasonableness" constraints.

[14] Although analysts and investors could, over time, accumulate enough information to build their own "long term" track record of financial information, any disclosures about accounting estimates would be new information, unavailable for prior time periods. Thus, decision makers would not have a 20-year track record of accounting estimate information for quite some time.

being made. For example, if the direction of misestimation changes each year (is constant each year), concluding that misestimations were caused by noise (bias) becomes more tenable for decision makers. Thus, the frequency of reversals in a time series of directional misestimations impacts the degree of reasonableness constraints implied by that time series. When reasonableness constraints are relatively high (e.g., high reversals for noise likelihood judgments and low reversals for bias likelihood judgments), judgments are not expected to differ as much based on decision makers' implicit and explicit goals.

In financial reporting contexts, allegations and discoveries of biased reporting generally lead to poor investor outcomes (e.g., accounting "scandals" and steep declines in stock prices), especially in the present (post-Enron, post-WorldCom) reporting environment; misestimations and accounting errors of similar magnitudes that are caused by random error are less likely to result in extreme market reactions. (In other words, it stands to reason that companies are often held responsible for biased reporting, but are less often pointedly punished for "honest" mistakes.) This is consistent with theory developed in Mendenhall and Nichols (1988), which shows that market reactions to bad news are greater in quarters where management has greater discretion over reported numbers. Thus, empirical evidence supports the idea that managers are punished less for reporting bad news that they had little control over (e.g., random events).

I expect that whether an investor will consider a short sequence of misestimations to be a sufficient basis for inference is influenced by the investor's stake in the company, as well as by specific properties of the sequence. Because their risk of financial loss significantly increases when allegations of biased reporting are made, investors who already own a particular stock likely would prefer not to receive information indicative of bias in that

company's reporting. Their preferred position would be for misestimations to be caused by noise, rather than bias. In contrast, investors who do not yet own, but are considering purchasing, that same stock likely are more concerned about out-of-pocket losses resulting from reliance on biased financial reports than the relatively smaller opportunity costs that might result from passing up an otherwise sound investment. Directionally motivated reasoning is likely to cause potential stockholders to attribute misestimations more to bias than would other stakeholders. (Note that from a normative perspective, the decision-maker's stake in the company is irrelevant—judgments about noise and bias should not vary across goal states. Thus, observed differences across goal states imply some degree of non-normativeness, though it is difficult to say which goal state is closer to the normatively correct answer.)[15]

Specifically, the research discussed above leads me to hypothesize that current stockholders will be more likely, on average, than potential stockholders and neutral verifiers to attribute misestimations to noise (see H2a below). Furthermore, when reasonableness constraints for noise are higher, I expect no differences in likelihood judgments for noise across goal states; however, when reasonableness constraints for noise are lower, likelihood judgments for noise will decrease for all decision makers, but will decrease less for current stockholders than for other decision makers (see H3a below). Similarly for bias, I hypothesize that potential stockholders will be more likely, on average, than current stockholders and neutral verifiers to attribute misestimations to bias (H2b). When

[15] In this context, computing the normatively correct expectation is difficult, as decision makers are essentially viewing observations sampled from different underlying distributions (i.e., the estimate itself has one particular distribution, and the reported realization potentially has a different distribution). Both of these distributions are unknown to the decision maker, and the decision maker is attempting to make inferences about reported numbers based on observations from both distributions. In any case, quantifying the extent of non-normativeness is not the focus of this study, but the normative answer will not differ according to the decision maker's goal state. Thus, observed differences across goal states imply some degree of non-normative judgment.

reasonableness constraints for bias are higher, I expect no differences in likelihood judgments for bias across goal states; however, when reasonableness constraints for bias are lower, likelihood judgments for bias will decrease for all decision makers, but will decrease less for potential stockholders than for other decision makers (H3b). The interactions predicted by Hypotheses 3a and 3b, as well as the predictions from the other hypotheses, are shown graphically in Figure 1.

> HYPOTHESIS 2A: Current stockholders will judge the likelihood that misestimations are caused by noise to be higher than potential stockholders and neutral verifiers.
>
> HYPOTHESIS 2B: Potential stockholders will judge the likelihood that misestimations are caused by bias to be higher than current stockholders and neutral verifiers.
>
> HYPOTHESIS 3A: Likelihood judgments for noise will be: *highest* when reasonableness constraints for noise are relatively high (i.e., when the frequency of reversals is high), regardless of the decision-maker's goal state, *lower* for current stockholders with low reasonableness constraints for noise (i.e., low frequency of reversals), and *lowest* for potential stockholders and neutral verifiers with low reasonableness constraints for noise (i.e., low frequency of reversals).
>
> HYPOTHESIS 3B: Likelihood judgments for bias will be: *highest* when reasonableness constraints for bias are relatively high (i.e., when the frequency of reversals is low), regardless of the decision-maker's goal state, *lower* for potential stockholders with low reasonableness constraints for bias (i.e., high frequency of reversals), and *lowest* for current stockholders and neutral verifiers with low reasonableness constraints for bias (i.e., high frequency of reversals).

CHAPTER 3 – EXPERIMENTAL METHOD AND DESIGN

This chapter is organized as follows: The first section provides a discussion of the experimental design, including a description of the operationalization of the dependent and independent variables. Next, the second section describes the development of the case study used in the experiment. Finally, the third section discusses the participants in the experiment.

3.1 Experimental Design and Operationalization of Variables

The experiment employs a 3 x 2 between-subjects design to test whether misperceptions of noise and bias affect judgments about a time series of errors in accounting estimates, and whether factors in an accounting context moderate the tendency for investor judgment to be affected. The independent variables are *goal state* and *frequency of reversals*. The *goal state* of participants is manipulated at three levels. In each goal state condition, participants are told that the accounting estimates are from a given company's financial statements, and asked to assume one of three roles: Potential Stockholder, Current Stockholder, or Neutral Verifier. *Potential Stockholders* are told that they are evaluating accounting estimates made by a company in which they are considering investing, *Current Stockholders* are told that they are evaluating accounting estimates made by a company whose stock they already own, and *Neutral Verifiers* are told that they have been hired by management to verify the accuracy of accounting estimates that have been prepared for management's internal use only.

In addition to the goal state manipulation, *frequency of reversals* is varied at two levels. Participants view a three-year sequence of prior period estimate/realization pairs, so the number of reversals has to be between 0 and 2. Thus, the *lower reversal* condition will

have 0 reversals (i.e., all three misestimations will be in the same direction), and the *higher reversal* condition will have 2 reversals (i.e., the direction of the misestimations will change every year). For likelihood judgments regarding noise (bias), the higher (lower) reversal condition implies relatively higher reasonableness constraints.

The dependent measures for all hypotheses are participants' judgments of the likelihood that the current year's allowance for sales returns is subject to bias or noise. Separate scales are used to measure judgments about bias and noise because pilot testing and prior research (e.g., Peecher, Rich, and Tubbs 2003) indicate that people tend to believe that bias and noise are positively correlated. Thus, measuring likelihood judgments on a single scale would preclude replicating this phenomenon.

3.2 Experimental Task

Participants first completed a voluntary consent form, then viewed a one-page explanation of bias and noise (adapted from Peecher, Rich, and Tubbs 2003, and shown in Appendix D). After completing four questions designed to test their understanding of the meaning of bias and noise, participants were asked to read a short case. The case revolves around a realistic but fictitious automotive testing equipment manufacturer, ModernMotors, Inc.[16] Information in the case was limited to a short description of the company and its products, and a paragraph describing ModernMotors's sales return policy (which stated that any item could be returned within one year, with no questions asked). More detailed information that may have signaled incentives for management bias was intentionally

[16] Although the company in the case is fictitious, most of the case information comes from two actual manufacturers of automotive testing equipment.

excluded, as this may have constrained the extent to which participants could engage in directionally motivated reasoning.

Next, participants viewed a worksheet containing the current year's allowance for sales returns and a sequence of the preceding three years' estimated allowance for sales returns, along with the subsequent realized sales returns for each of those prior years. Similar to Hirst et al. (2003), I chose three years' of prior estimate/realization data in order to incorporate the multi-period reporting aspect of most companies' accounting systems. Lundholm (1999) notes that the multi-period nature of these disclosures may enable financial statement users to discriminate between "accurate and unbiased" and "inaccurate and biased" reporting.[17]

The number of reversals in the three-year sequence of estimate/realization pairs was either higher (i.e., the direction of misestimation changed each year) or lower (i.e., the direction of misestimation was the same in each of the three years). In the "lower reversals" condition, ModernMotors underestimated the allowance for sales returns in each of the three preceding years, leading to overstatements of net income in each year. In the "higher reversals" condition, the sequence of misestimation was under-, over-, under-estimated. Pilot-testing of the experimental materials indicated that participants' judgments were qualitatively similar for sequences with the opposite effects on net income, so the opposing sequences (e.g., overestimations of the allowance in each year for the low reversals condition and over-, under-, over-estimated for the high reversals condition) were not included in this

[17] Longer time series provide more data for decision makers, but it is not clear how long of a time series is reasonable in this setting. For example, property and casualty insurers recently went from providing five years of prior loan loss reserve reconciliations to ten years. However, SAS No. 99 requires auditors to examine only estimates from the prior year. Thus, in current practice, decision makers observe anywhere from 1-10 years of data. In a second experiment, I examine how the length of the time series affects the results observed in experiment one.

examination. Additionally, other permutations of over- and under-estimations were not examined, because I wanted a strong manipulation of the number of reversals. (Note that all other permutations, such as "over-, over-, under-estimate" or "under-, over-, over-estimate" have only one reversal, while the permutation examined has two reversals. The theory proposed in Barberis et al. (1998) and tested in Bloomfield and Hales (2002) is built on the *rate* of recent reversals, so the rate of reversals is manipulated here as well.[18])

3.3 Participants

Accounting students (n = 211) at the University of Illinois at Urbana-Champaign completed the experimental materials as part of one of their accounting courses. Undergraduate accounting students were recruited for this experiment, since nothing in the current theory indicates that the use of professional participants would be necessary (Peecher and Solomon 2001). Specifically, undergraduate students' statistical knowledge (and thus, their tendency to believe in the law of small numbers) is likely to be similar to that of non-professional investors, a large section of the investing public. For example, from 1995 to 1998, the number of U.S. households investing directly in equity securities grew by more than 30% (Kennickell, Starr-McCluer, and Surette 2000); as of 1998, 37% of all retail trading volume in equities and options could be attributed to online trading (US GAO 2000). According to Forrester Research, Inc. (Punishill 1999), non-professional online investors will manage over $3 trillion on-line—nearly 19% of total retail investment assets—in 20.4 million on-line accounts.

[18] An argument could be made that participants base their judgments on the number of misestimations in each direction rather than the rate of reversals, such that a sequence of "over-, over-, under-estimate" is treated the same as a sequence of "over-, under-, over-estimate," since both sequences contain two overestimations and one underestimation. Future research may examine this question in more depth.

Participants completing all of the materials were entered in a lottery for cash prizes, and all participants received a small gift for their participation.[19] Participants self-reported effort on a 7-point scale, with endpoints labeled "-3: Did not try very hard" and "3: Tried very hard" and midpoint labeled "0: Average"; the mean response of 1.42 was significantly greater than the midpoint ($p < 0.001$), indicating above average self-reported effort. Self-reported effort did not significantly differ across treatment conditions ($p = 0.704$).[20] The task took approximately 25-40 minutes to complete.

[19] Prizes included one $50 cash award, two $25 cash awards, and ten $10 cash awards. Winners were determined randomly, and all participants entered in the lottery had an equal chance of winning. All participants (regardless of whether they completed the materials) also received a gift certificate for a free drink at a local coffee shop.

[20] All reported p-values are two-tailed, unless otherwise noted.

CHAPTER 4 – RESULTS

This chapter has five main sections. The first section reviews all of the manipulation checks that were run on the data. The next three sections describe and discuss tests of H1, H2, and H3, respectively. The last section provides further detail about additional analyses that were run on the data.

4.1 Manipulation Checks

4.1.1 Frequency of Reversals Manipulation

Recall that the two manipulated variables were *frequency of reversals* and *goal state*. Before providing experimental responses, participants examined and answered questions on a worksheet containing details about prior years' estimated and actual allowances for sales returns. Participants were asked whether ModernMotors' original estimates (in years 2002, 2001, and 2000) were too small or too large. The percentage of participants with the correct answer for each year was 97.6%, 95.2%, and 97.1%. These results indicate that participants correctly identified the direction of misestimation in each year and, consequently, correctly identified the frequency of reversals over the 3-year time period.[21]

4.1.2 Goal State Manipulation

I tested the effectiveness of the *goal state* manipulation in two ways. First, in a post-experimental questionnaire, 92.4% of participants responded consistent with the instructions they were given as to the role they were asked to play in the study. Second, participants were asked a series of questions designed to measure the strength of their goal state commitment

[21] All tests of hypotheses were re-run excluding those participants who did not pass all of the manipulation checks. Although not reported separately, these results are not qualitatively different from those reported.

(where the goals in question were: choosing or keeping particularly good stocks, avoiding or selling particularly bad stocks, and determining the accuracy of ModernMotors' accounting estimates). Responses were given on a 7-point scale, with endpoints of –3 ("Strongly disagree") and 3 ("Strongly agree"). Table 1 shows mean responses (standard deviation) by "goal state" condition. I expected "neutral verifier" participants to be most concerned with determining the accuracy of the accounting estimates, and more relative concern with respect to keeping good stocks than selling bad stocks for "current stockholders" than for "potential stockholders."

In all three goal state conditions, the primary concern is for the accuracy of ModernMotors' accounting estimates. Reported commitment to this goal is, however, higher for "neutral verifier" participants than for participants in the other two conditions ($t = 2.69$, $p = 0.004$, one-tailed). In addition, the extent to which participants are more concerned with keeping good stocks than selling bad stocks is significantly greater for current stockholders than for potential stockholders ($t = 1.73$, $p = 0.043$, one-tailed).

4.2 Tests of H1

Table 2 provides descriptive statistics for participants' noise and bias likelihood judgments in each of the experimental treatments. Hypotheses 1a and 1b predict a main effect for the frequency of reversals in the direction of prior years' misestimations on participants' judgments of the noise and bias in the current year's estimate. As seen in Table 2, participants in the "Higher reversals" conditions judged the likelihood of noise to be significantly higher ($F(1, 204) = 162.07$, $p < 0.001$) than participants in the "Lower reversals" conditions. Thus, H1a is supported. Further, participants in the "Lower reversals"

conditions judged the likelihood of bias to be significantly higher ($F(1, 204) = 84.13, p < 0.001$) than participants in the "Higher reversals" conditions, providing support for H1b.

4.3 Tests of H2

Hypotheses 2a and 2b predict a main effect for goal state on participants' noise and bias likelihood judgments. H2a predicts that current stockholders' noise likelihood judgments will be greater than those made by potential stockholders and neutral verifiers. Current stockholders did, in fact, judge the likelihood of noise to be higher than both potential stockholders ($F(1, 136) = 8.717, p = 0.004$) and neutral verifiers ($F(1, 137) = 16.45, p < 0.001$). The theory being tested does not provide a reason to predict differences between potential stockholders and neutral verifiers with respect to noise likelihood judgments, and no difference is observed ($F(1, 135) = 0.681, p = 0.411$). (See Table 2 for summary data of participants' noise likelihood judgments.) In this experiment, current stockholders are more likely than other decision makers to attribute misestimations to noise, providing support for H2a.

H2b predicts that potential stockholders' bias likelihood judgments will be greater than the bias likelihood judgments made by current stockholders and neutral verifiers. Again, the observed means support the hypothesis: Potential stockholders' bias likelihood judgments were greater than those of current stockholders ($F(1, 136) = 25.28, p < 0.001$) and neutral verifiers ($F(1, 135) = 15.55, p < 0.001$). There is no reason to expect current stockholders and neutral verifiers to provide differing bias likelihood judgments, and no difference in their judgments is observed ($F(1, 137) = 1.01, p = 0.317$). (See Table 2 for summary data of participants' bias likelihood judgments.) Thus, potential stockholders are

more likely than other decision makers to attribute misestimations to bias, providing support for H2b.

4.4 Tests of H3

A major focus of this experiment, however, is the ordinal interaction between frequency of reversals and the decision maker's goal state. Hypothesis 3a predicts that when reasonableness constraints for noise are lower (i.e., the frequency of reversals is lower), current stockholders will judge the likelihood of noise to be significantly greater than other decision makers do, but when reasonableness constraints for noise are higher (i.e., reversals are highly frequent), likelihood judgments for noise will increase for all decision makers and will not differ across goal states. Note that because the theory provides no reason to expect neutral verifiers and potential stockholders to provide different noise likelihood judgments (and no differences were found), these two conditions are combined when testing H3a.[22] Hypothesis 3b predicts a specific interaction wherein potential stockholders judge the likelihood of bias to be significantly greater than other decision makers do when reasonableness constraints for bias are lower (i.e., the frequency of reversals is higher), but likelihood judgments for bias will increase for all decision makers and will not differ across goal states when reasonableness constraints for bias are higher (i.e., when the frequency of reversals is lower). Again, because there is no reason to expect bias likelihood judgments to be different for neutral verifiers and current stockholders, and no differences were observed, these two conditions are combined when testing H3b. As shown in Figure 1, these hypotheses define specific patterns of judged noise and bias likelihoods across the

[22] All analyses for H3a and H3b were re-run with the neutral verifier group excluded, and all results were qualitatively similar to those reported.

experimental conditions. Accordingly, I test these hypotheses with a linear contrast of cell means (Buckless and Ravenscroft 1990, Rosnow and Rosenthal 1995, Rosenthal, Rosnow, and Rubin 2000).[23] The specific contrast weights used are also shown in Figure 1.

The planned linear contrasts are reported in Table 3, Panel A. For completeness, I report traditional ANOVA models for judged noise and bias likelihoods in Panel B. Hypothesis 3a predicts an interaction wherein the difference in noise likelihood judgments between current stockholders and other decision makers decreases when reasonableness constraints are relatively high (i.e., the high reversal condition). The results in Table 3, Panel A, show that this interaction is significant ($F(1,206) = 174.29, p < 0.001$).[24] Thus, H3a is supported.[25] Hypothesis 3b predicts that the difference in bias likelihood judgments between potential stockholders and other decision makers will decrease when reasonableness constraints are relatively high (i.e., the low reversal condition). Again, the results of the planned contrast show that this interaction is significant ($F(1,206) = 101.25, p < 0.001$). Thus, H3b is supported.[26]

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[23] Traditional ANOVA tests for differences between cell means, but does not specify the pattern of relationships that will or should obtain. Instead, ANOVA tests for *all* possible patterns, and thus alters the likelihood of finding any *specific* pattern (Buckless and Ravenscroft 1990).

[24] Sensitivity analyses were conducted on both of the contrast coding tests. Reported results are not dependent on the specific contrast weights employed, and my conclusions do not change if other qualitatively similar weighting schemes are used.

[25] Post-hoc tests were also conducted to ensure that the predicted orderings of cell means are, in fact, supported by the data. These post-hoc tests are complementary, but more conservative, tests of H3a and H3b. Specifically, Table 4 shows the differences in means across cells, along with the predicted and observed relations between those means (significance levels in Table 4 are from Tukey-Kramer HSD tests). As shown in Table 4, Panel A, the predicted differences between cell means for noise likelihood judgments are statistically significant, and the observed ordering of cell means matches the prediction in H3a. Noise likelihood judgments under higher reversals (i.e., high reasonableness constraints for noise judgments) are not significantly different across goal states, as predicted ($p = 0.428$). For lower reversals (i.e., low reasonableness constraints for noise), noise likelihood judgments decrease for all goal states, but decrease less for current stockholders than for other goal states (all other differences are statistically significant at $p = 0.01$ or less). Thus, the data provide clear support for H3a.

[26] The Tukey-Kramer HSD post-hoc tests provide moderate support for H3b (see Table 4, Panel B). Bias likelihood judgments under lower reversals (i.e., high reasonableness constraints for bias judgments) are significantly different, though no difference was predicted ($p = 0.022$). For higher reversals (i.e., low reasonableness constraints for bias judgments), bias likelihood judgments decrease for all goal states, but

4.5 Additional analysis

Additional analysis was conducted to determine whether participants' noise and bias likelihood judgments would affect their investment decisions. Although my experimental conditions did not significantly affect participants' judgments of the attractiveness of the stock, participants should consider the stock less attractive as their judged likelihood of either bias or noise increases.[27] A variable titled "Neg_Appeal" was constructed by creating a scatterplot with bias likelihood judgments on one axis and noise likelihood judgments on the other axis, then computing the Euclidean distance from the origin of this scatterplot to each point. Increasing likelihood judgments for either bias or noise will increase the value of Neg_Appeal. I expect that Neg_Appeal will be negatively correlated with participants' judgments of the attractiveness of the stock. The computed correlation is -0.42 ($p < 0.001$). This evidence is consistent with the notion that participants' judgments of the attractiveness of the stock decrease as their judgments of the likelihood of either bias or noise in the accounting estimates increases. The significantly negative correlation affirms that the absence of an effect of the manipulated variables on judgments of stock attractiveness is more likely a function of the levels chosen, not an indication that the manipulated variables have no effect on stock price judgments.

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decrease less for potential stockholders than for other goal states (one of the pairwise differences is only marginally significant, $p = 0.094$, all other differences are statistically significant at $p = 0.01$ or less).

[27] In the post-experimental questionnaire, participants were asked whether they believed the company in the case that they completed "would be a good stock to have in a person's portfolio." Participants responded on 7-point scale, with endpoints labeled "-3: Definitely not a good stock" and "3: Definitely a good stock," and midpoint labeled "0: Average stock." Mean responses did not differ across goal states ($F(2,207) = 0.167$, $p = 0.846$). Participants' judgments of the attractiveness of the stock were moderately significantly negatively correlated with their bias likelihood judgments ($p = 0.093$), but were not significantly correlated with their noise likelihood judgments ($p = 0.180$).

CHAPTER 5 – EXPERIMENT 2

This chapter describes a second experiment that was designed to follow-up on issues raised by the first experiment. The chapter has three main sections, and is organized as follows: Section 5.1 provides a review of the relevant issues from the first experiment, and a discussion of related research. Section 5.2 explicates the method and design for experiment 2. Section 5.3 provides a discussion of the results from experiment 2, including tests of H4 and H5.

5.1 Literature Review and Hypotheses

Theory and findings related to experiment 1 suggest that (1) when reasonableness constraints are relatively lower, current stockholders are more likely than potential stockholders to attribute misestimations to noise, and potential stockholders are more likely than current stockholders to attribute misestimations to bias, and (2) consistent with directionally motivated reasoning, this effect decreases when reasonableness constraints are relatively higher. However, in experiment 1 (and previous research on *ex post* review of accounting estimates), the length of the time series of estimate/realization pairs was held constant, and was relatively short (i.e., 3 observations). As noted earlier (see footnote 17), the length of time series most likely to be seen in financial reporting contexts ranges from one to ten years. Accordingly, experiment 2 is designed to examine whether the effects noted in experiment 1 persist when reasonableness constraints are increased by lengthening the time series of estimate/realization pairs observed by decision makers. In other words, do the observed differences in noise and bias likelihood judgments across goal states decrease as the sample size increases?

Investors' judgments may vary according to the time series length for several reasons. First, with a longer time series (i.e., more sample observations), participants can develop better mental models of error in the population. Normatively, longer time series have higher diagnosticity, so participants should be more confident in judgments that are based upon longer versus shorter time series, *ceteris paribus* (Budescu and Rantilla 2000). For time series with extreme sample proportions (e.g., estimation errors that are always or nearly always in the same direction), the higher diagnosticity implies a higher degree of reasonableness constraints (for bias), which in turn would imply fewer differences in attribution due to goal state by decision makers who otherwise would fall prey to directionally motivated reasoning.

However, recent research suggests that decision makers react primarily to the signals they observe, and neglect the environment that produced those signals (Massey and Wu 2003).[28] Similarly, as noted earlier, Griffin and Tversky (1992) show that likelihood judgments are determined primarily by evidence strength (or extremeness), and not by evidence weight (or predictive validity). In a time series of dichotomous observations, the sample proportion and sample size arguably represent strength and weight, respectively. This would imply that noise and bias likelihood judgments would be expected to change little as sample size increases (assuming the sample proportion is constant across sample sizes).

From a normative perspective, though, longer time series have higher diagnosticity, so participants should be able to form better mental models of error propagation when

[28] Results from an earlier pilot study for this project (unreported), in which participants reacted very strongly to the *observed sequence* of misestimations and completely ignored the *method* by which the original estimates were made, supports this *system-neglect hypothesis*. The estimation method was manipulated at two levels: one in which the estimation method was largely subjective (e.g., based on a single manager's judgment, and thus highly susceptible to bias and noise) and another in which the estimation method was less subjective (e.g., the average of a number of independent experts' opinions). In this pilot study, participants' judged bias and judged noise significantly differed according to the specific sequence of estimate/realization pairs that they observed, but did not significantly differ according to the estimation method.

viewing longer versus shorter time series (holding the rate of reversals constant). Furthermore, in settings where decision makers may exhibit directionally motivated reasoning, larger sample sizes are likely to imply greater reasonableness constraints—and theory and findings from experiment 1 suggest that the influence of directional goals decreases as reasonableness constraints increase. Results from a study on generalization and stereotyping (Doosje, Spears, and Koomen 1995) also support the idea that larger sample sizes imply greater reasonableness constraints: participants' willingness to generalize from a sample of observations differed (across "preferred positions") only when the sample size was small. When the sample was large, participants accepted its inferences regardless of their preferred position.[29] Thus, a longer time series may help mitigate investors' tendency to fall prey to directionally motivated reasoning.

This discussion leads to the following hypotheses for experiment 2:

HYPOTHESIS 4: For shorter time series lengths, current stockholders will be more likely than potential stockholders to attribute misestimations to noise. For longer time series lengths, this difference decreases.

HYPOTHESIS 5: For shorter time series lengths, potential stockholders will be more likely than current stockholders to attribute misestimations to bias. For longer time series lengths, this difference decreases.

[29] Doosje et al.'s results would not necessarily be expected to replicate here for two reasons. First, both their smaller and larger sample sizes (10 and 20 items, respectively) are at or above the maximum number of observations one could reasonably expect to see in a financial reporting context. Whether participants rely on statistical versus non-statistical heuristics when sample sizes are smaller yet (i.e., 10 or fewer, as is the case in financial reporting contexts) remains an open question. Second, participants in Doosje et al. were making judgments related to social stereotypes, where the use of statistical heuristics is much less likely (Kunda 1995, p80). Participants in my experiments are in a domain where the role of chance is somewhat more salient (especially to accountants), and so may be more likely to rely on statistical reasoning—even when sample sizes are relatively small.

5.2 Experimental Method and Design

Hypotheses 4 and 5 were examined in a 2 x 2 x 2, full factorial experiment, in which *goal state* was manipulated between subjects and *time series length* and *frequency of reversals* were manipulated within subjects. To manipulate goal state, participants were instructed to evaluate accounting estimates made either by companies *in which they are considering investing*, or by companies *in which they already own stock* (essentially identical to the goal state manipulation in experiment 1). Given the within-subjects manipulations, though, participants in experiment 2 evaluated multiple time series rather than a single case (as in experiment 1).

Both of the within-subjects variables were manipulated at two levels, resulting in four cases. Cases A and B had longer time series (10 observations); Cases C and D had shorter time series (3 observations); Cases A and C had low rate of reversal; and Cases B and D had high rate of reversal.[30] Participants viewed all four cases in a counter-balanced order (i.e., a Latin-square design). The dependent measures include participants' judgments about the likelihood that misestimations are due to bias and to noise.

At the beginning of the experiment, participants completed a short primer on bias and noise (also used in experiment 1) and provided their prior (i.e., baseline) judgments for the likelihood of bias and noise in accounting estimates. (Company specific information was limited in this experiment, so a given participant's priors should be the same for all observed misestimation sequences.) Participants then completed the four cases described in the preceding paragraph.

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[30] See Appendix A for a discussion of how the estimate/realization sequences were developed.

Accounting students at the University of Montana-Missoula and Washington State University (n = 172) participated in the second experiment. Participants completing all of the materials were entered in a lottery for cash prizes, and all participants received a small gift for their participation.[31] Participants self-reported effort on a 7-point scale, with endpoints labeled "-3: Did not try very hard" and "3: Tried very hard" and midpoint labeled "0: Average"; the mean response of 1.48 was significantly greater than the midpoint ($p < 0.001$), indicating a high level of self-reported effort. Self-reported effort did not significantly differ across treatment conditions ($p = 0.169$). The task took approximately 15-30 minutes to complete.

5.3 Results

Table 5 presents descriptive statistics for experiment 2. Hypotheses 4 and 5 predict that lengthening the time series of estimate/realization pairs will decrease differences in judged noise and judged bias, respectively, across goal states. However, experiment 1 showed that judged noise and judged bias differed across goal states only when reasonableness constraints were low. When reasonableness constraints are already relatively high, no differences in judged noise and judged bias would be expected to begin with, so further increasing reasonableness constraints by lengthening the observed time series would not be expected to have any effect. Accordingly, I test hypotheses 4 and 5 using cases using lower reasonableness constraints cases. As discussed previously (in section 2.3), reasonableness constraints for judged noise (judged bias) are lower when the proportion of reversals is lower (higher). Thus, I test hypothesis 4 (which relates to judged noise) using

[31] Prizes included one $50 cash award, two $25 cash awards, and ten $10 cash awards at each campus. Winners were determined randomly, and all participants entered in the lottery had an equal chance of winning.

"low reversal" sequences of different lengths, and I test hypothesis 5 using "high reversal" sequences of different lengths.

A post-experimental questionnaire included manipulation checks for participants' goal states. In the manipulation check, 99.4% of participants correctly identified the goal state that was indicated by their experimental materials. This percentage is significantly different from what would be expected by chance ($p < 0.001$), and does not significantly differ across experimental treatments ($p = 0.325$).

5.3.1 Tests of H4

Hypothesis 4 predicts an interaction between goal state and time series length, such that the difference between potential stockholders' and current stockholders' judged noise will decrease as the time series length increases (but still within the limited number of observations likely to be seen in this context). This hypothesis is first tested using a repeated measures ANOVA, shown in Table 7, Panel A. Though the interaction between goal state and time series length has the predicted shape (see Figure 3, Panel A), it is not statistically significant ($F(1,171) = 0.35$, $p = 0.555$). Thus, H4 is not supported.[32]

5.3.2 Tests of H5

Hypothesis 5 predicts an interaction between goal state and time series length, such that the difference between potential stockholders' and current stockholders' judged bias will

[32] In experiment 1, I relied on random assignment of participants to experimental conditions to control for possible differences in participants' priors. While random assignment alone is a powerful control for participants' priors, as an added measure in experiment 2, participants provided their prior noise and bias likelihood judgments. These prior judgments were collected before participants saw any of the four experimental cases. My conclusions regarding H4 and H5 do not change if these prior are included in the analyses as a covariate; the interaction predicted by H4 remains statistically insignificant ($F(1,170) = 0.42$, $p = 0.518$), and the interaction predicted by H5 remains statistically significant ($F(1,170) = 7.60$, $p = 0.006$).

decrease as the time series length increases (but remains within the limited number of observations likely to be seen in this context, i.e., from one to ten observations). This hypothesis is first tested using a repeated measures ANOVA, shown in Table 7, Panel B.[33] The interaction between goal state and time series length is statistically significant ($F(1,171) = 7.47, p = 0.007$). While consistent with directionally motivated reasoning, the interaction that obtained is not the one that was predicted. Rather than *decreasing* as the time series lengthens, the difference between potential stockholders' and current stockholders' judged bias *increases* as the time series lengthens. In particular, potential stockholders' judgments stay relatively constant across time series lengths, but current stockholders' judged bias decreases as the time series gets longer (see Figure 3, Panel B).

Upon further reflection, the observed interaction, though not predicted in advance, is consistent with directionally motivated reasoning theory as well as the results of experiment 1. Recall that in experiment 1, participants who displayed directionally motivated reasoning made judgments that were consistent with their preferred position when reasonableness constraints were low. Previous estimate/realization sequences with higher rates of reversal imply low reasonableness constraints for judged bias (see section 2.3 for a discussion of this point). Because participants' judgments were not expected to differ as much when reasonableness constraints were higher rather than lower, H5 was tested using "higher reversal" cases. Thus, reasonableness constraints were relatively low for judged bias. It would seem that current stockholders in these cases actually relied on the longer time series to *decrease* their judged bias, consistent with judgments that are subject to directionally

[33] The tabulated results from the full repeated measures ANOVAs for judged noise and judged bias appear in Table 6, Panels A and B, respectively.

motivated reasoning.[34] Further research may be necessary to determine whether this is, in fact, what happened.

One other potential explanation for this result is that potential stockholders are simply always more sensitive to bias than current stockholders. To examine whether this is the case, the relative salience of bias (as compared to noise) was computed for each participant. This was done in two steps: (1) For each case, determine the participant's change in judged bias and judged noise from the baseline judgments elicited just before any cases were viewed, then (2) subtract the change in judged noise from the change in judged bias. (Though a ratio measure may seem better here, it is computationally difficult, since some judgments did not change at all from the baseline, leading to a zero value for the denominator in many cases.) The resulting measure indicates, for each case, the relative salience of bias versus noise: positive values indicate that, for a given case, the change in judged bias (from the baseline) was greater than the change in judged noise; negative values indicate that, for a given case, the change in judged noise was greater than the change in judged bias. Overall (across all four cases), this variable is not significantly different for the two goal state conditions (means (standard deviations) are 3.66 (12.20) and 5.01 (11.81) for potential owners and current owners, respectively, $t = -0.74$, $p = 0.461$). (The measure was not statistically significantly different across goal states for any of the four individual cases either.) Thus, the results do not support this alternative explanation.

[34] Interestingly, although data from the "low reversal" cases was not used in tests of H5, participants in those cases reacted in almost the same fashion. Specifically, potential stockholders' judged likelihood of bias increased slightly as the length of the time series increased, while current stockholders' judged likelihood of bias decreased. The interaction between goal state and time series length in the low reversal cases was significant ($p = 0.002$), though there were no other significant effects.

5.3.4 Additional Analysis—Portfolio Allocations

Experiment 2 also included exploratory questions about how participants would allocate a given endowment among the four separate companies whose estimate/realization pairs they were evaluating. Although formal hypotheses are not derived, participants were expected to allocate more money to companies with more observations and to companies with more reversals. In fact, that is exactly the result that obtained. Across the two goal state groups, participants allocated an average of $57.19 (out of $100) to companies where longer sequence lengths were observed, and $42.99 to companies where shorter sequence lengths were observed. This difference ($14.20) is statistically significant ($t = 5.72$, $p < 0.001$, one-tailed). The difference in allocations between high reversal and low reversal cases is also in the expected direction, and is marginally significant. On average, participants allocated $52.53 to the high reversal cases and $47.64 to the low reversal cases, for a difference of $4.89 ($t = 1.41$, $p = 0.080$, one-tailed).

CHAPTER 6 – DISCUSSION AND CONCLUDING REMARKS

6.1 Summary

Proposals for *ex post* review of accounting estimate accuracy have the important goal of increasing the reliability of accounting estimates for financial statement users. Proponents of such reviews argue that decision makers armed with information about the accuracy of prior period accounting estimates should be able to infer the accuracy of current period accounting estimates. This dissertation presents a model of decision processes that likely underlie such inferences; specifically, it melds theory about directionally motivated reasoning with theory about impoverished mental models of error propagation. This model is then tested in a behavioral experiment, and evidence supporting the model is presented. When reasonableness constraints are relatively weak, the judged likelihood of noise is greater for current stockholders than for other decision makers and the judged likelihood of bias is greater for potential stockholders than for other decision makers. When reasonableness constraints are relatively strong, the differences in judgments across goal states decrease.

From a practical perspective, my results suggest that the effectiveness of an *ex post* review of accounting estimate accuracy may be mitigated by the decision maker's implicit and explicit goals. Proposals for *ex post* review of accounting estimate accuracy may need to take into account these factors, realizing that different decision makers are likely to evaluate the same information differently. For example, owners of a particular stock are more likely to attribute a given misestimation to noise, while potential investors in the same stock are more likely to attribute the misestimation to bias. This is likely to lead owners of the stock to value that stock more highly than potential owners do.

Having demonstrated that a financial statement user's goal state moderates the influence of the frequency of reversals on the judged likelihood of noise and bias, a second experiment was conducted to examine whether increasing the length of time series (while remaining within the length likely to be seen in this context, i.e., 1-10 years) would decrease the effects noted in experiment 1. The results of experiment 2 imply that increasing the time series length would not decrease, and in some cases might exacerbate, the effects of directionally motivated reasoning on decision-makers' bias and noise attributions.

6.2 Limitations and Future Research

"Goal state" is a difficult construct to manipulate in an experimental setting. Though the participants in this experiment passed the various manipulation checks (and their responses were systematically different across the levels of goal state), future research on this topic could involve a stronger manipulation of goal state. One concern is that participants might not have fully internalized the intended consequences of the role that they were asked to assume. The theory developed in this dissertation is based on the assumption that participants in the experimental laboratory behave in a manner similar to investors outside of the laboratory. A stronger manipulation of goal state would mitigate concerns about this assumption. However, the data from the experiments is consistent with the hypotheses proposed in this dissertation, and incentives for directionally motivated reasoning may be even stronger for investors outside of the experimental laboratory than for those in it.

Also, the results for Hypothesis 5, while statistically significant, were not entirely consistent with the hypothesis. Specifically, I hypothesized that increasing the number of observations in the time series would increase the perceived reasonableness constraints for all

participants, and thus decrease the differences in bias likelihood judgments across goal states. The results that obtained, however, suggest that increasing the number of observations in the time series from three to ten may not have increased participants' perceived reasonableness constraints, and may, in fact, have reduced the reasonableness constraints for some participants. The drivers of these unexpected results are, at this point, undetermined. How decision makers in this setting treat relatively small samples is an issue that deserves further exploration.

Finally, I did not vary management's strategic role or the potential for bias and noise in *ex post* realizations, limiting the implications that can be drawn from my experiment. In the real world, managers may manipulate both *ex ante* estimates and *ex post* realizations in order to manage perceptions and expectations. Future research could examine the degree to which financial statement users consider estimates *and* realizations to be subject to bias and noise.

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APPENDIX A – DEVELOPMENT OF TIME SERIES FOR EXPERIMENT 2

LOW REVERSALS (p = probability of reversal)

In Bloomfield and Hales (2002), "low" reversals was 0 or 1 out of 7 possible reversals. To be consistent with their research and with my first experiment, the "low reversal" sequence for experiment 2 will have p = 1/7 = 0.14. (Note that in experiment 1, p = 0. While p = 0.14 is different from p = 0, I still consider this "consistent" in the sense that the rate of reversal is quite low. I do not use p = 0 in experiment 2 because that may make the manipulation too transparent.)

For n = 10

Observation	Random#	Over/Under *
1	0.683791896	Under
2	0.999853054	Under
3	0.082354493	Over
4	0.435951125	Over
5	0.01613133	Under
6	0.999276979	Under
7	0.444024045	Under
8	0.548511196	Under
9	0.665028123	Under
10	0.699195322	Under

* If the random draw is less than 0.14, a reversal takes place (i.e, the directional misestimation is the opposite of the preceding misestimation). If the random draw is greater than 0.14, no reversal takes place.

For n = 3

Observation	Random#	Over/Under *
1	0.55476392	Under
2	0.721172311	Under
3	0.594249698	Under

* If the random draw is less than 0.14, a reversal takes place (i.e, the directional misestimation is the opposite of the preceding misestimation). If the random draw is greater than 0.14, no reversal takes place.

HIGH REVERSALS (p = probability of reversal)

In Bloomfield and Hales (2002), "high" reversals was 6 or 7 out of 7 possible reversals. To be consistent with their research and with my first experiment, the "high reversal" sequence for experiment 2 will have p = 6/7 = 0.86. (Note that in experiment 1, p = 1. While p = 0.86 is different from p = 0, I still consider this "consistent" in the sense that the rate of reversal is quite high. I do not use p = 1 in experiment 2 because that may make the manipulation too transparent.)

For n = 10

Observation	Random#	Over/Under *
1	0.695396538	Under
2	0.491754522	Over
3	0.047054682	Under
4	0.903591772	Under
5	0.082139214	Over
6	0.26554349	Under
7	0.544808762	Over
8	0.596271597	Under
9	0.00949735	Over
10	0.359162355	Under

* If the random draw is less than 0.86, a reversal takes place (i.e, the directional misestimation is the opposite of the preceding misestimation). If the random draw is greater than 0.86, no reversal takes place.

For n = 3

Observation	Random#	Over/Under *
1	0.790382619	Under
2	0.143023773	Over
3	0.591347631	Under

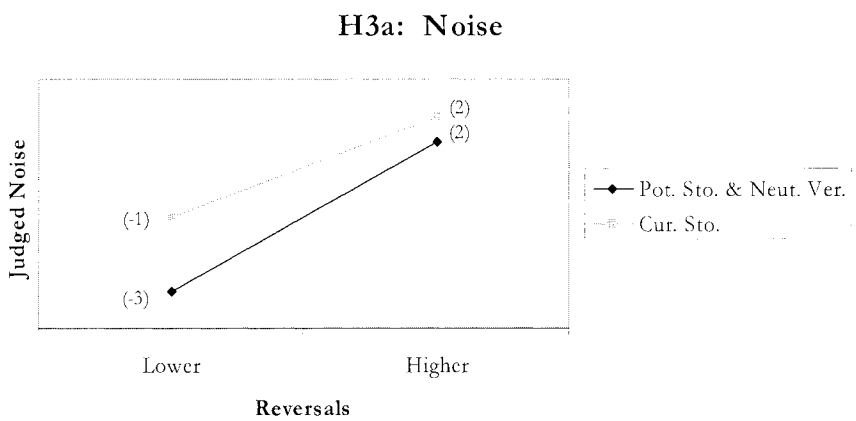
* If the random draw is less than 0.86, a reversal takes place (i.e, the directional misestimation is the opposite of the preceding misestimation). If the random draw is greater than 0.86, no reversal takes place.

APPENDIX B – FIGURES

Figure 1

Predicted Ordinal Interactions for Experiment 1

Panel A: Hypothesis 3a (Contrast weights for hypothesis tests are shown in parentheses)



Panel B: Hypothesis 3b (Contrast weights for hypothesis tests are shown in parentheses)

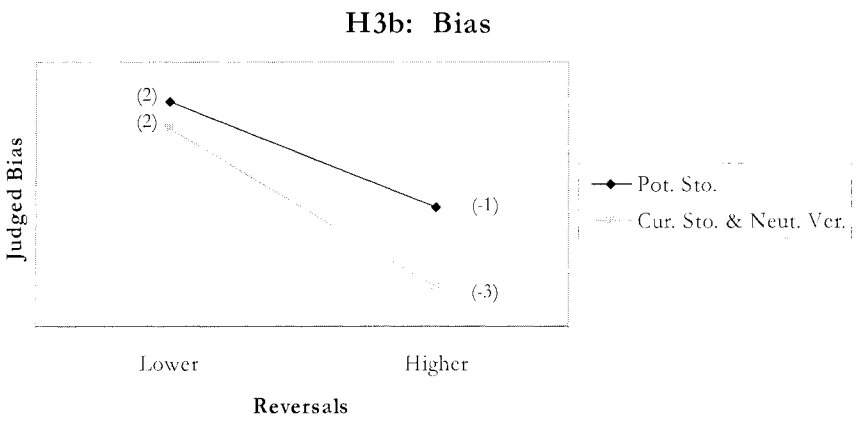
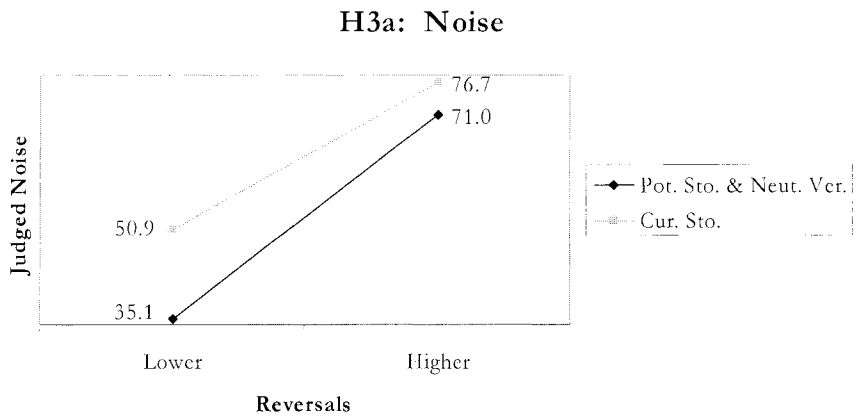


Figure 2

Observed Results for Experiment 1

Panel A: Hypothesis 3a



Panel B: Hypothesis 3b

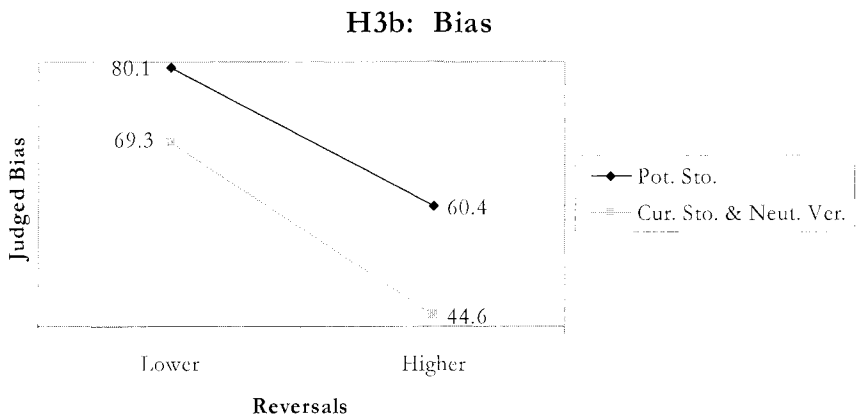
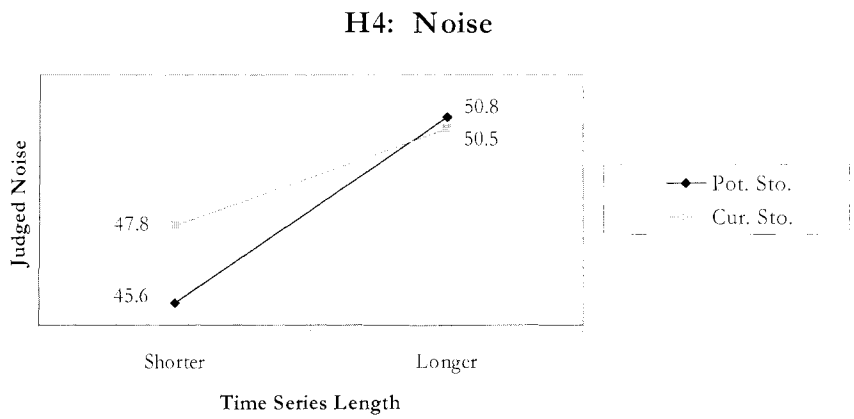


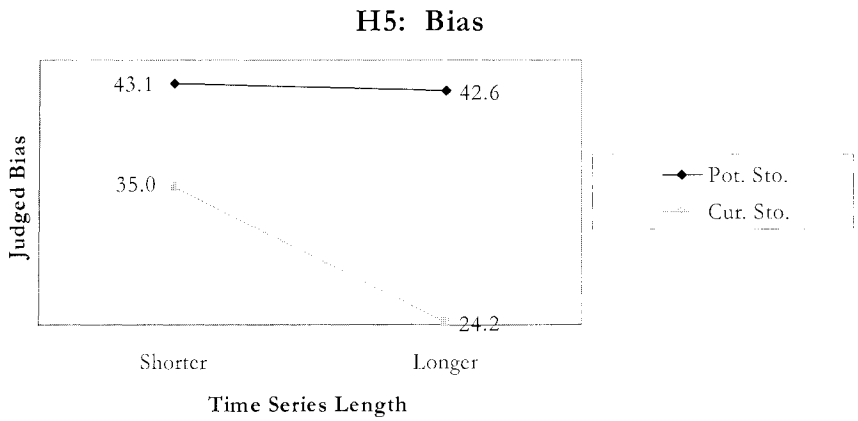
Figure 3

Observed Results for Experiment 2

Panel A: Hypothesis 4



Panel B: Hypothesis 5



APPENDIX C – TABLES

Table 1

Mean Responses (Standard Deviation) to "Goal State" Manipulation Check Questions

Goal [a]	Current Stockholder [b]	Neutral Verifier [c]	Potential Stockholder [d]
a. "While completing this case, my primary concern was to avoid keeping or choosing a bad stock."	0.54 (1.64)	-1.45 (1.60)	0.40 (1.63)
b. "While completing this case, my primary concern was to make sure I kept or chose a good stock."	0.88 (1.35)	1.48 (1.56)	0.35 (1.68)
c. "While completing the case materials, I wanted to determine the "true" accuracy of ModernMotors' accounting estimates."	1.34 (1.51)	1.97 (1.01)	1.58 (1.32)

a. Responses for all three goal commitment questions were measured on a seven-point scale, with endpoints labeled "-3: Strongly disagree" and "3: Strongly agree."
b. Current stockholders were expected to be most committed to keeping good stocks.
c. Neutral verifiers were expected to be most committed to determining the accuracy of ModernMotors accounting estimates.
d. Potential stockholders were expected to be most committed to avoiding bad stocks.

Table 2

Judged Noise and Judged Bias
Mean Responses (Standard Deviation)

	Judged Noise [a]			Judged Bias [b]		
	Reversals			Reversals		
Goal state:	Lower	Higher	Overall	Lower	Higher	Overall
Current	50.93	76.74	64.01	66.57	44.10	55.18
Stockholder	(20.36)	(14.70)	(21.87)	(18.29)	(20.49)	(22.37)
	n = 35	n = 36	n = 71	n = 35	n = 36	n = 71
Neutral	34.14	69.36	51.75	72.00	45.21	58.61
Verifier	(20.70)	(13.96)	(24.94)	(17.37)	(20.92)	(23.37)
	n = 35	n = 35	n = 70	n = 35	n = 35	n = 70
Potential	36.14	72.65	54.13	80.14	60.44	70.44
Stockholder	(22.53)	(17.16)	(27.10)	(11.60)	(18.64)	(18.29)
	n = 35	n = 34	n = 69	n = 35	n = 34	n = 69
Overall	40.41	72.95		72.91	49.76	
	(22.32)	(15.47)		(16.84)	(21.21)	
	n = 105	n = 105		n = 105	n = 105	

a. Participants were asked to judge the likelihood that the current year's estimated allowance for sales returns was subject to bias. Responses were marked on a 101-point scale, with endpoints labeled "0: Extremely unlikely" and "100: Extremely likely," and midpoint labeled "50: Not sure."
b. Participants were asked to judge the likelihood that the current year's estimated allowance for sales returns was subject to noise. Responses were marked on a 101-point scale, with endpoints labeled "0: Extremely unlikely" and "100: Extremely likely," and midpoint labeled "50: Not sure."

Table 3

Tests of Hypotheses 3a and 3b

Panel A: Planned Contrasts

	F-Statistic	*p*-value
H3a: Likelihood judgments for noise will be: *highest* when reasonableness constraints for noise are relatively high (i.e., when the frequency of reversals is higher), regardless of the decision-maker's goal state, *lower* for current stockholders with low reasonableness constraints for noise (i.e., lower frequency of reversals), and *lowest* for potential stockholders and neutral verifiers with low reasonableness constraints for noise (i.e., lower frequency of reversals). (Contrast weights are -3, -1, 2, and 2 for the LR/PS&NV, LR/CS, HR/CS, and HR/PS&NV conditions, respectively.)	174.29	< 0.001
H3b: Likelihood judgments for bias will be: *highest* when reasonableness constraints for bias are relatively high (i.e., when the frequency of reversals is lower), regardless of the decision-maker's goal state, *lower* for potential stockholders with low reasonableness constraints for bias (i.e., higher frequency of reversals), and *lowest* for current stockholders and neutral verifiers with low reasonableness constraints for bias (i.e., higher frequency of reversals). (Contrast weights are -3, -1, 2, and 2 for the HR/CS&NV, HR/PS, LR/PS, and LR/CS&NV conditions, respectively.)	101.25	< 0.001

Note: LR = Lower Reversals
HR = Higher Reversals
CS = Current Stockholder
PS = Potential Stockholder
NV = Neutral Verifier

Panel B: ANOVA Models of Judged Noise and Judged Bias

	Judged Noise				Judged Bias			
	df	Mean Square	F-Statistic	*p*-value	df	Mean Square	F-Statistic	*p*-value
Goal state [a]	1	5452.11	16.03	< 0.001	1	8224.87	25.00	< 0.001
Reversal [b]	1	44637.10	131.22	< 0.001	1	22766.19	69.19	< 0.001
Goal state by Reversal	1	1191.26	3.47	0.064	1	282.16	0.86	0.356
Error	206	340.17			206	329.06		

a. For tests of judged noise likelihood, the goal state is classified as either current stockholder or other decision maker (i.e., neutral verifier and potential stockholder). For tests of judged bias likelihood, the goal state is classified as either potential stockholder or other decision maker (i.e., neutral verifier and current stockholder).
b. The frequency of reversals was either higher or lower.

Table 4

Post-hoc Tests for Hypotheses 3a and 3b

Panel A: Mean Differences in Noise Likelihood Judgments Across Cells[a,b]

Cells:

	HR/CS	HR/PS&NV	LR/CS	LR/PS&NV
HR/CS	-	Difference = 5.76 Predicted diff.: None ($p = 0.428$)	Difference = 25.81 Predicted diff.: > ($p < 0.001$)	Difference = 41.59 Predicted diff.: > ($p < 0.001$)
HR/PS&NV		-	Difference = 20.05 Predicted diff.: > ($p < 0.001$)	Difference = 35.84 Predicted diff.: > ($p < 0.001$)
LR/CS			-	Difference = 15.78 Predicted diff.: > ($p < 0.001$)
LR/PS&NV				-

a. The cells are coded as follows: LR = Lower Reversals, HR = Higher Reversals, CS = Current Stockholder, PS = Potential Stockholder, NV = Neutral Verifier.
b. Table shows the difference between cell means, the predicted difference between cell means, and the statistical significance from the Tukey-Kramer HSD test.

Panel B: Mean Differences in Bias Likelihood Judgments Across Cells[a,b]

Cells:

	LR/PS	LR/CS&NV	HR/PS	HR/CS&NV
LR/PS	-	Difference = 10.86 Predicted diff.: None ($p = 0.022$)	Difference = 19.70 Predicted diff.: >
($p < 0.001$)	Difference = 35.50 Predicted diff.: >
($p < 0.001$)
LR/CS&NV		-	Difference = 8.84 Predicted diff.: >
($p = 0.094$)	Difference = 24.64 Predicted diff.: >
($p < 0.001$)
HR/PS			-	Difference = 15.79 Predicted diff.: >
($p < 0.001$)
HR/CS&NV				-

a. The cells are coded as follows: LR = Lower Reversals, HR = Higher Reversals, CS = Current Stockholder, PS = Potential Stockholder, NV = Neutral Verifier.
b. Table shows the difference between cell means, the predicted difference between cell means, and the statistical significance from the Tukey-Kramer HSD test.

Table 5

Judged Noise and Judged Bias in Experiment 2
Mean Responses (Standard Deviation)

Panel A: Judged Noise [a, b]

	Small Sample Size		Large Sample Size		
Goal state:	Low Reversal	High Reversal	Low Reversal	High Reversal	Overall
Current Stockholder	47.77 (26.49) n = 84	72.83 (21.16) n = 84	50.54 (27.13) n = 84	78.69 (22.92) n = 84	62.46 (14.66) n = 84
Potential Stockholder	45.56 (27.41) n = 89	69.05 (17.04) n = 89	50.79 (25.50) n = 89	72.39 (23.28) n = 89	59.45 (16.17) n = 89
Overall	46.63 (26.91) n = 173	70.88 (19.19) n = 173	50.67 (26.23) n = 173	75.45 (23.25) n = 173	60.91 (15.49) n = 173

a. Participants were asked to judge the likelihood that the current year's estimated allowance for sales returns was subject to noise. Responses were marked on a 101-point scale, with endpoints labeled "0: Extremely unlikely" and "100: Extremely likely," and midpoint labeled "50: Not sure."

b. Time series length and the rate of reversals were manipulated within subjects in the following manner: Cases A and B had longer time series; Cases C and D had shorter time series; Cases A and C had low rate of reversal; and Cases B and D had high rate of reversal. Participants viewed all four cases in a counter-balanced order.

Panel B: Judged Bias [a, b]

	Small Sample Size		Large Sample Size		
	Low	High	Low	High	
Goal state:	Reversal	Reversal	Reversal	Reversal	Overall
Current	65.77	34.97	56.67	24.23	45.41
Stockholder	(25.63)	(22.48)	(28.16)	(24.13)	(16.09)
	n = 84	n = 84	n = 84	n = 84	n = 84
	c	d	a	b	
Potential	64.83	43.06	68.15	42.61	54.66
Stockholder	(26.47)	(21.87)	(20.18)	(28.08)	(15.18)
	n = 89	n = 89	n = 89	n = 89	n = 89
Overall	65.29	39.13	62.57	33.69	50.17
	(26.00)	(22.47)	(24.98)	(27.73)	(16.26)
	n = 173	n = 173	n = 173	n = 173	n = 173

a. Participants were asked to judge the likelihood that the current year's estimated allowance for sales returns was subject to bias. Responses were marked on a 101-point scale, with endpoints labeled "0: Extremely unlikely" and "100: Extremely likely," and midpoint labeled "50: Not sure."

b. Time series length and the rate of reversals were manipulated within subjects in the following manner: Cases A and B had longer time series; Cases C and D had shorter time series; Cases A and C had low rate of reversal; and Cases B and D had high rate of reversal. Participants viewed all four cases in a counter-balanced order.

Table 6

Full Repeated Measures ANOVA Models for Judged Noise and Judged Bias in Experiment 2

Panel A: Judged Noise

		Judged Noise		
Source	df	Mean Square	F-Statistic	*p*-value
		Between subjects		
Goal state (GS)[a]	1	1566.23	1.64	0.202
Error	171	955.63		
		Within subjects		
Reversal (R)[b]	1	104389.66	140.35	< 0.001
R x GS	1	714.08	0.96	0.329
Error (R)	171	743.79		
Time series length (TSL)[c]	1	3195.49	10.60	0.001
TSL x GS	1	0.04	0.00	0.990
Error (TSL)	171	301.54		
R x TSL	1	15.90	0.05	0.824
R x TSL x GS	1	267.64	0.84	0.361
Error (R x TSL)	171	318.71		

a. Goal state was either "potential stockholder" or "current stockholder", manipulated between-subjects.
b. Frequency of reversals was manipulated within-subjects at two levels, low or high (see Appendix C for more details).
c. Time series length was manipulated within-subjects at two levels, low (3 observations) or high (10 observations).

Panel B: Judged Bias

Source	df	Judged Bias Mean Square	F-Statistic	*p*-value
		Between subjects		
Goal state (GS)[a]	1	14801.77	15.15	< 0.001
Error	171	977.02		
		Within subjects		
Reversal (R)[b]	1	132026.29	159.21	< 0.001
R x GS	1	2745.22	3.31	0.071
Error (R)	171	829.26		
Time series length (TSL)[c]	1	3117.07	11.74	0.001
TSL x GS	1	5574.95	20.99	< 0.001
Error (TSL)	171	265.62		
R x TSL	1	315.14	0.826	0.365
R x TSL x GS	1	48.88	0.13	0.721
Error (R x TSL)	171	381.59		

a. Goal state was either "potential stockholder" or "current stockholder", manipulated between-subjects.
b. Frequency of reversals was manipulated within-subjects at two levels, low or high (see Appendix C for more details).
c. Time series length was manipulated within-subjects at two levels, low (3 observations) or high (10 observations).

Table 7

Tests of Hypotheses 4 and 5

Panel A: Repeated Measures ANOVA Model of Judged Noise[a]

		Judged Bias		
Source	df	Mean Square	F-Statistic	*p*-value
		Between subjects		
Goal state (GS)[b]	1	82.60	0.08	0.779
Error	171	1045.55		
		Within subjects		
Time series length (TSL)[c]	1	1380.28	3.70	0.056
GS x TSL	1	130.42	0.35	0.555
Error	171	373.49		

a. Data from low reversal cases only.
b. Goal state was either "potential stockholder" or "current stockholder".
c. Time series length was manipulated within-subjects at two levels, low (3 observations) or high (10 observations).

Panel B: Repeated Measures ANOVA Model of Judged Bias[a]

		Judged Bias		
Source	df	Mean Square	F-Statistic	*p*-value
		Between subjects		
Goal state (GS)[b]	1	15147.98	17.36	< 0.001
Error	171	872.80		
		Within subjects		
Time series length (TSL)[c]	1	2707.22	8.83	0.003
GS x TSL	1	2289.88	7.47	0.007
Error	171	306.74		

a. Data from high reversal cases only.
b. Goal state was either "potential stockholder" or "current stockholder".
c. Time series length was manipulated within-subjects at two levels, low (3 observations) or high (10 observations).

APPENDIX D – EXPERIMENT 1 MATERIALS

The experimental materials in this appendix are divided into the following sections:

- *Consent and overview (all conditions)*
- *General instructions (all conditions)*
- *Bias/noise primer (all conditions)*
- *Case studies:*
    - *Current stockholder/high reversal condition*
    - *Current stockholder/low reversal condition*
    - *Neutral verifier/high reversal condition*
    - *Neutral verifier/low reversal condition*
    - *Potential stockholder/high reversal condition*
    - *Potential stockholder/low reversal condition*
- *Post-experimental questionnaire (all conditions)*

Consent and Overview

ILLINOIS

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

INTRODUCTION

Purpose: This study is about how people evaluate and draw inferences from financial information. I invite you to participate. In deciding whether to participate, please keep the following in mind:

Procedure: You will be asked read a case and form judgments based on case information that is simplified and abbreviated relative to information in the real-world. The case has four parts. Parts 1-3 entail reading a short case study featuring a hypothetical company and answering several questions that require thoughtful judgment (e.g., rating scales, short answers). Part 4 entails demographic questions, follow-up questions to Part 1, and other questions that require judgment. You would complete each phase without consulting any colleagues (we are interested in your own individual judgment). I estimate that completing the study will take 25-35 minutes.

Risks/Benefits: Your participation would help us better understand and potentially suggest ways to improve accounting and finance theory, practice, and education (at the University of Illinois at Urbana-Champaign (UIUC) and other universities). Your participation would pose no risks to you beyond those encountered in everyday life, but it likely would stimulate your thinking and provide a basis for future class discussions and activities.

Confidentiality: Your responses would be strictly anonymous. The only place we ask for your name is on this consent form. You will subsequently separate this form from your case materials by returning it to a separate box than the one that contains completed case materials.

Your Choice: As with nearly all academic research involving human participants, your participation in this study is completely voluntary. You may decline to participate or withdraw at any time. Your decision to participate, decline, or withdraw will have no effect on any future relations with the UIUC.

Contact Information: If you have questions about the nature or results of this study, please contact me at the telephone number or e-mail listed below. If you have any questions about your rights as a participant, please contact the UIUC's Institutional Review Board at (217) 333-2670 or irb@uiuc.edu.

I have read the above and agree to participate in this study. I have been offered a copy of this consent form.

Printed Name _____ Signature _____ Date _____

Joshua Herbold
University of Illinois -- College of Business
Department of Accountancy
217.377.9848, herbo@uiuc.edu

University of Illinois
Approved Consent Form
Valid Until
10 September 2004

GENERAL INSTRUCTIONS

Thank you for participating in this case study. Your participation today should take approximately 25-35 minutes. Participants who complete all of the materials will be entered into a lottery for cash prizes (one $50 prize, two $25 prizes, and ten $10 prizes will be awarded).

Please feel free to ask any questions you might have during the study. However, any questions that may impact the results of the study will be deferred to the end of today's session.

The case materials contain other sets of instructions detailing how to proceed. These instructions will be shaded. Please read and follow these instructions carefully.

Your input is very important to this study. Thanks again for your participation.

Joshua Herbold
Ph. D. Student
Department of Accounting
College of Business
University of Illinois at Urbana-Champaign

Bias/Noise Primer

This study examines how judgments may be affected by two types of error in estimates—bias and noise. To clarify the difference between **bias** and **noise**, please consider the following scenario:

Suppose you are working in a chemistry lab, and your job is to determine the weight of different samples of material. The lab has two scales that you could use, Scale 1 and Scale 2.

Scale 1 is never subject to noise, but is always subject to **bias**. Scale 1 systematically shows a weight that is 10 grams more than the true weight of a sample. In other words, Scale 1 will display a weight of 210 grams for a sample that actually weighs 200 grams; a weight of 335 grams for a sample that actually weighs 325 grams; and so on. If Scale 1 is used to measure the same sample repeatedly, it will always display the same weight (though that weight will always be 10 grams over the true weight of the sample). In other words, if a sample that actually weighs 100 grams is weighed five times on Scale 1, the readings will be: 110, 110, 110, 110, 110. If you knew the amount of bias in scale 1, you could obtain the true weight of a sample after just one measurement by simply subtracting 10 grams from the reading on the scale.

Scale 2 is never subject to bias, but is always subject to **noise** (also called random error). The readings from Scale 2 are, on average, correct; however, any individual reading may be off by as much as 5 grams on either side of the true weight. In other words, the weights displayed by Scale 2 are randomly distributed around but centered on the true weight. If a sample that actually weighs 100 grams is weighed five times on Scale 2, the readings might be: 98, 100, 105, 96, 101. Even if you knew the amount of noise (or random error) in Scale 2, you could not determine the true weight of a sample after only one measurement. However, the average of a number of readings should converge to the true weight.

Before continuing, please answer the following questions. You may refer back to the explanations if necessary. (Circle or fill in the appropriate answer.)

1. A bathroom scale that consistently displays 10 pounds below a person's true weight is subject to _____.

   a. bias

   b. noise

2. A bathroom scale that randomly displays up to 10 pounds below or above a person's true weight is subject to _____.

   a. bias

   b. noise

3. Imagine a car driving a constant speed. The speedometer readings, however, are known to contain noise. If a random sample of these speedometer readings at different points in time shows 54, 60, 58, 50, and 53, what is your best guess as to the car's actual speed?

   _____ mph

4. Imagine a car driving a constant speed. The speedometer, however, is known to read 5mph higher than the car's actual speed. If the speedometer shows a reading of 70, what is your best guess as to the car's actual speed?

   _____ mph

SPECIFIC INSTRUCTIONS

For purposes of this study, please assume that **you currently hold a significant portion of common stock in ModernMotors, Inc.**, an automotive diagnostics supplier. You are currently re-evaluating your investment in ModernMotors, Inc. As you work your way through the case materials, please keep in mind that you already own the stock, and are currently considering whether to hold on to it or sell it.

You will be provided with background information and selected financial information about ModernMotors. Based on this information, you will be asked to provide several judgments about ModernMotors and its estimates related to sales returns. The case information is not intended to include all of the information that would normally be available if you were evaluating the common stock of ModernMotors. However, for the purposes of this study, base your judgments on the information provided.

BACKGROUND INFORMATION

Prior to your investment in ModernMotors, Inc., you reviewed the company's most recent annual report. Some background information from that annual report is shown on the next two pages. Please review this information before moving on to the next part of the case. Again, you will be asked to provide judgments about bias and noise in ModernMotors' estimates of future sales returns.

ModernMotors, Inc.—Company Background

ModernMotors, Inc. ("the Company") develops and manufactures diagnostic testing equipment used by automobile, motorcycle, ATV and watercraft manufacturers and technicians. The Company's primary products include hand-held diagnostic testers and custom on-board vehicle and engine diagnostic systems. The Company markets its products to factory-affiliated and independent repair technicians worldwide through a network of independent automotive tool distributors, as well as to most major automobile manufacturers through its in-house sales team. Products are sold in all key international markets, including North America, South America, Europe, and the Pacific Rim.

Products

The current ModernMotors Product Portfolio includes:

- Handheld tool range
- Programmable scan tool / system tester
- Vehicle data software for specific test and diagnosis
- CDROM vehicle service information for fault finding and general vehicle service
- Emission test modules
- $CO/HC/CO_2/O_2$ and NOX measurement modules for use in legislative emission testing
- PC-based tester range for basic fault finding
- IT workstation range with comprehensive faultfinding and diagnostic tools

Sales return policy

The driving force behind the ModernMotors marketing plan is the Company's long-standing *Customer Satisfaction Policy* (CSP). According to the CSP, purchasers of ModernMotors equipment (including custom-designed equipment) can return their purchase for a *full* refund *within one year* of the purchase for *any* reason. Although this policy occasionally results in unexpected returns and is far more liberal than competitors' return policies (which usually require prior authorization for any returns), ModernMotors believes that this is the best way to accomplish the twin goals of (1) providing the customer with assurance that ModernMotors products are the right choice, and (2) gaining timely feedback whenever products fail to live up to customer expectations.

PART 2

As you may remember, companies must report sales net of an estimated allowance for sales returns. While examining ModernMotors' estimated allowance for sales returns, you obtained the information at the top of the following worksheet. To familiarize yourself with the numbers, please complete the worksheet according to the instructions provided. In the next part, you will be asked to use your calculations to make judgments about bias and noise in ModernMotors' estimates of future sales returns.

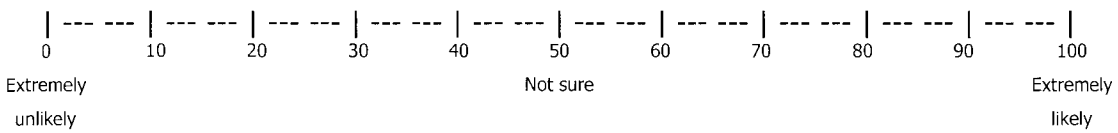
ModernMotors, Inc: Selected Financial Information

Line		2003	2002	2001	2000
a.	Reported net income	$7,152,700	$6,998,500	$7,544,700	$7,293,200
b.	Estimated allowance for sales returns (used when compiling the *Reported net income* above)	1,094,350	1,100,850	1,143,700	1,077,990
c.	Actual sales returns (compiled subsequent to year end, thus not used for determining *Reported net income*)	Not yet available	1,182,560	1,054,080	1,160,340
d.	Dollar error in ModernMotors' estimated allowance for sales returns (obtained by subtracting *Line c* from *Line b*)	N/A	-81,710	89,620	-82,350
e.	"Perfect foresight" net income (i.e., the net income that ModernMotors would have reported if its estimates had been perfectly accurate)	N/A	6,916,790	7,634,320	7,210,850
f.	Calculate the *Estimated allowance for sales returns* as a percentage of the actual sales returns by dividing *Line b* by *Line c*. Note that if ModernMotors underestimated sales returns, this will be less than 100%; if ModernMotors overestimated sales returns, this will be greater than 100%. (In other words, *Line b* ÷ *Line c* = ?)	N/A	_____%	_____%	_____%
g.	Was ModernMotors original estimate too small or too large? (Circle one.)	N/A	Too small or Too large	Too small or Too large	Too small or Too large
h.	Was ModernMotors originally reported net income (*Line a*, which used the *estimated* allowance for sales returns) **understated** or **overstated** when compared to the "perfect foresight" net income in *Line e*? (Circle one.)	N/A	Understated or Overstated	Understated or Overstated	Understated or Overstated

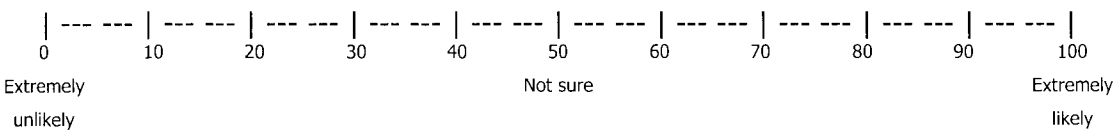
PART 3

Keeping in mind that **you already own stock in ModernMotors**, and using the information on previous pages, please answer the following questions about ModernMotors' sales returns. Feel free to look back at previous pages if necessary.

1. Based on the sequence of past estimated and actual sales returns, how likely do you think it is that the current year's *Estimated allowance for sales returns* is subject to intentional **bias** on the part of management? (Mark your answer on the scale below.)



2. Based on the sequence of past estimated and actual sales returns, how likely do you think it is that the current year's *Estimated allowance for sales returns* is subject to **noise** on the part of management? (Mark your answer on the scale below.)



3. Now that you've considered the potential for bias and noise in ModernMotors' *Estimated allowance for sales returns*, please write down your best guess of the most likely *Actual sales returns* for 2003, along with pessimistic and optimistic figures.

   The pessimistic and optimistic values should provide a range that you feel certain will include the *Actual sales returns* for 2003. (In probability terms there should be a chance of less than 5 in 100 that the actual sales return value lies outside your range.)

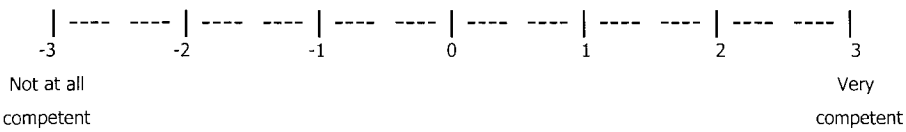
   Optimistic (i.e., lower bound of range) _____

   Most likely _____

   Pessimistic (i.e., upper bound of range) _____

4. **Management credibility:** Based on the sequence of past estimated and actual sales returns, **how credible/trustworthy** do you think the current year's estimate is? (Mark your answer on the scale below.)

5. **Management competence:** Based on the sequence of past estimated and actual sales returns, **how competent** do you think the management of this company is at making estimates? (Mark your answer on the scale below.)



6. Imagine for a moment that you are able to view a very large sample of estimates made by ModernMotors, along with the actual outcomes for each of those estimates. What do you think the **average** "estimate as a percent of outcome" would be (similar to the "estimate as a percent of outcome" that you calculated on *Line f* of the earlier worksheet)? Please write down this average, along with lower and upper bounds that you feel certain would contain the true average.

   (If, for example, you think that ModernMotors' estimates are always absolutely correct, then you would write down 100% for the average—i.e., the estimate is 100% of the actual outcome. A number above 100% would indicate that you think ModernMotors estimates are, on average, *greater than* the actual outcomes. Conversely, a number below 100% would indicate that you think ModernMotors estimates are, on average, *less than* the actual outcomes.)

   The lower and upper bounds should provide a range that you feel certain would include the true average. In probability terms, there should be a chance of less than 5 in 100 that the true average lies outside your range.

   Lower bound of range _____ %

   Average "estimate as a percent of outcome" _____ %

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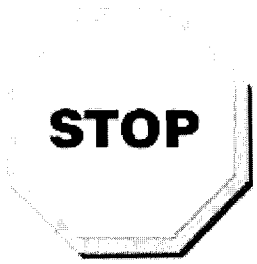
7. Based on your assessments of bias, noise, management credibility, and management competence, to what extent do you believe that this would be a good stock to have in a person's portfolio? (Mark your answer on the scale below.)

| ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- |

-3 -2 -1 0 1 2 3

Definitely not a good stock — Average stock — Definitely a good stock



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SPECIFIC INSTRUCTIONS

For purposes of this study, please assume that **you currently hold a significant portion of common stock in ModernMotors, Inc.**, an automotive diagnostics supplier. You are currently re-evaluating your investment in ModernMotors, Inc. As you work your way through the case materials, please keep in mind that you already own the stock, and are currently considering whether to hold on to it or sell it.

You will be provided with background information and selected financial information about ModernMotors. Based on this information, you will be asked to provide several judgments about ModernMotors and its estimates related to sales returns. The case information is not intended to include all of the information that would normally be available if you were evaluating the common stock of ModernMotors. However, for the purposes of this study, base your judgments on the information provided.

BACKGROUND INFORMATION

Prior to your investment in ModernMotors, Inc., you reviewed the company's most recent annual report. Some background information from that annual report is shown on the next two pages. Please review this information before moving on to the next part of the case. Again, you will be asked to provide judgments about bias and noise in ModernMotors' estimates of future sales returns.

ModernMotors, Inc.—Company Background

ModernMotors, Inc. ("the Company") develops and manufactures diagnostic testing equipment used by automobile, motorcycle, ATV and watercraft manufacturers and technicians. The Company's primary products include hand-held diagnostic testers and custom on-board vehicle and engine diagnostic systems. The Company markets its products to factory-affiliated and independent repair technicians worldwide through a network of independent automotive tool distributors, as well as to most major automobile manufacturers through its in-house sales team. Products are sold in all key international markets, including North America, South America, Europe, and the Pacific Rim.

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The current ModernMotors Product Portfolio includes:

- Handheld tool range
- Programmable scan tool / system tester
- Vehicle data software for specific test and diagnosis
- CDROM vehicle service information for fault finding and general vehicle service
- Emission test modules
- CO/HC/CO_2/O_2 and NOX measurement modules for use in legislative emission testing
- PC-based tester range for basic fault finding
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Sales return policy

The driving force behind the ModernMotors marketing plan is the Company's long-standing *Customer Satisfaction Policy* (CSP). According to the CSP, purchasers of ModernMotors equipment (including custom-designed equipment) can return their purchase for a *full* refund *within one year* of the purchase for *any* reason. Although this policy occasionally results in unexpected returns and is far more liberal than competitors' return policies (which usually require prior authorization for any returns), ModernMotors believes that this is the best way to accomplish the twin goals of (1) providing the customer with assurance that ModernMotors products are the right choice, and (2) gaining timely feedback whenever products fail to live up to customer expectations.

PART 2

As you may remember, companies must report sales net of an estimated allowance for sales returns. While examining ModernMotors' estimated allowance for sales returns, you obtained the information at the top of the following worksheet. To familiarize yourself with the numbers, please complete the worksheet according to the instructions provided. In the next part, you will be asked to use your calculations to make judgments about bias and noise in ModernMotors' estimates of future sales returns.

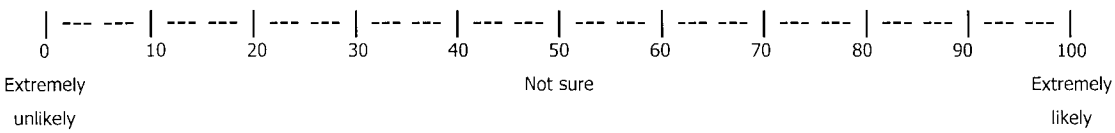
ModernMotors, Inc: Selected Financial Information

Line		2003	2002	2001	2000
a.	Reported net income	$7,152,700	$6,998,500	$7,544,700	$7,293,200
b.	Estimated allowance for sales returns (used when compiling the *Reported net income* above)	1,094,350	1,100,850	1,143,700	1,077,990
c.	Actual sales returns (compiled subsequent to year end, thus not used for determining *Reported net income*)	Not yet available	1,182,560	1,219,080	1,160,340
d.	Dollar error in ModernMotors' estimated allowance for sales returns (obtained by subtracting *Line c* from *Line b*)	N/A	-81,710	-75,380	-82,350
e.	"Perfect foresight" net income (i.e., the net income that ModernMotors would have reported if its estimates had been perfectly accurate)	N/A	6,916,790	7,469,320	7,210,850
f.	Calculate the *Estimated allowance for sales returns* as a percentage of the actual sales returns by dividing *Line b* by *Line c*. Note that if ModernMotors underestimated sales returns, this will be less than 100%; if ModernMotors overestimated sales returns, this will be greater than 100%. (In other words, *Line b* ÷ *Line c* = ?)	N/A	_____%	_____%	_____%
g.	Was ModernMotors original estimate too small or too large? (Circle one.)	N/A	Too small or Too large	Too small or Too large	Too small or Too large
h.	Was ModernMotors originally reported net income (*Line a*, which used the *estimated* allowance for sales returns) **understated** or **overstated** when compared to the "perfect foresight" net income in *Line e*? (Circle one.)	N/A	Understated or Overstated	Understated or Overstated	Understated or Overstated

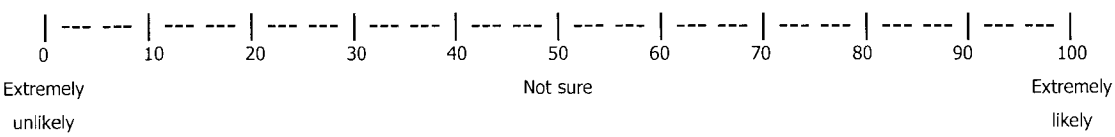
PART 3

Keeping in mind that **you already own stock in ModernMotors**, and using the information on previous pages, please answer the following questions about ModernMotors' sales returns. Feel free to look back at previous pages if necessary.

1. Based on the sequence of past estimated and actual sales returns, how likely do you think it is that the current year's *Estimated allowance for sales returns* is subject to intentional **bias** on the part of management? (Mark your answer on the scale below.)



2. Based on the sequence of past estimated and actual sales returns, how likely do you think it is that the current year's *Estimated allowance for sales returns* is subject to **noise** on the part of management? (Mark your answer on the scale below.)



3. Now that you've considered the potential for bias and noise in ModernMotors' *Estimated allowance for sales returns*, please write down your best guess of the most likely *Actual sales returns* for 2003, along with pessimistic and optimistic figures.

   The pessimistic and optimistic values should provide a range that you feel certain will include the *Actual sales returns* for 2003. (In probability terms there should be a chance of less than 5 in 100 that the actual sales return value lies outside your range.)

   Optimistic (i.e., lower bound of range) _____

   Most likely _____

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4. **Management credibility:** Based on the sequence of past estimated and actual sales returns, **how credible/trustworthy** do you think the current year's estimate is? (Mark your answer on the scale below.)

5. **Management competence:** Based on the sequence of past estimated and actual sales returns, **how competent** do you think the management of this company is at making estimates? (Mark your answer on the scale below.)

6. Imagine for a moment that you are able to view a very large sample of estimates made by ModernMotors, along with the actual outcomes for each of those estimates. What do you think the **average** "estimate as a percent of outcome" would be (similar to the "estimate as a percent of outcome" that you calculated on *Line f* of the earlier worksheet)? Please write down this average, along with lower and upper bounds that you feel certain would contain the true average.

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7. Based on your assessments of bias, noise, management credibility, and management competence, to what extent do you believe that this would be a good stock to have in a person's portfolio? (Mark your answer on the scale below.)

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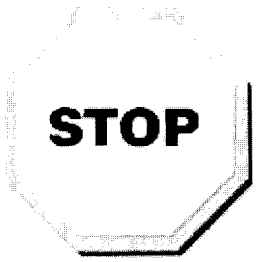

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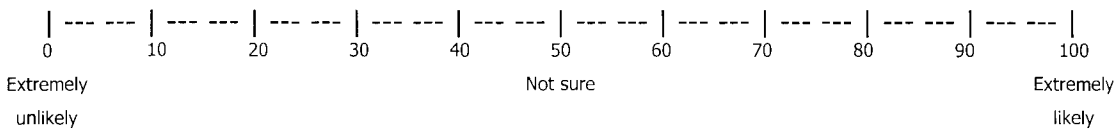
c.	Actual sales returns (compiled subsequent to year end, thus not used for determining *Reported net income*)	Not yet available	1,182,560	1,054,080	1,160,340
d.	Dollar error in ModernMotors' estimated allowance for sales returns (obtained by subtracting *Line c* from *Line b*)	N/A	-81,710	89,620	-82,350
e.	"Perfect foresight" net income (i.e., the net income that ModernMotors would have reported if its estimates had been perfectly accurate)	N/A	6,916,790	7,634,320	7,210,850
f.	Calculate the *Estimated allowance for sales returns* as a percentage of the actual sales returns by dividing *Line b* by *Line c*. Note that if ModernMotors underestimated sales returns, this will be less than 100%; if ModernMotors overestimated sales returns, this will be greater than 100%. (In other words, *Line b* ÷ *Line c* = ?)	N/A	_____%	_____%	_____%
g.	Was ModernMotors original estimate too small or too large? (Circle one.)	N/A	Too small or Too large	Too small or Too large	Too small or Too large
h.	Was ModernMotors originally reported net income (*Line a*, which used the *estimated* allowance for sales returns) **understated** or **overstated** when compared to the "perfect foresight" net income in *Line e*? (Circle one.)	N/A	Understated or Overstated	Understated or Overstated	Understated or Overstated

PART 3

Keeping in mind that **you have been hired to evaluate the accuracy of ModernMotors estimated allowance for sales returns**, and using the information on previous pages, please answer the following questions about ModernMotors' sales returns. Feel free to look back at previous pages if necessary.

1. Based on the sequence of past estimated and actual sales returns, how likely do you think it is that the current year's *Estimated allowance for sales returns* is subject to intentional **bias** on the part of management? (Mark your answer on the scale below.)



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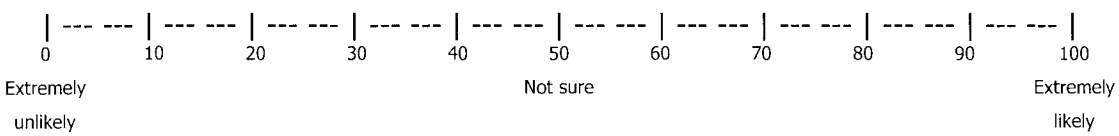

3. Now that you've considered the potential for bias and noise in ModernMotors' *Estimated allowance for sales returns*, please write down your best guess of the most likely *Actual sales returns* for 2003, along with pessimistic and optimistic figures.

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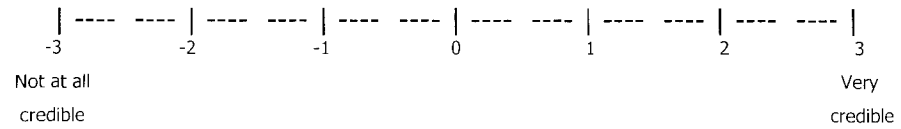

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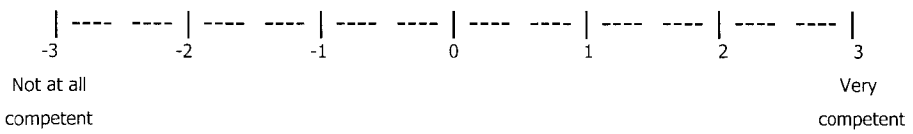

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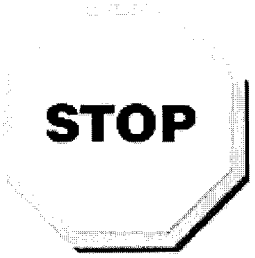

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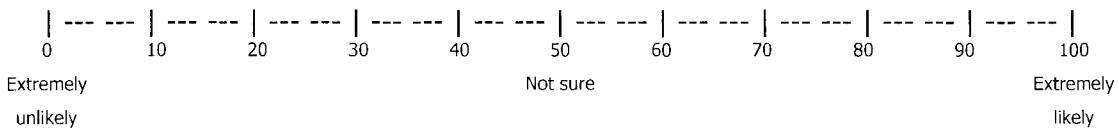

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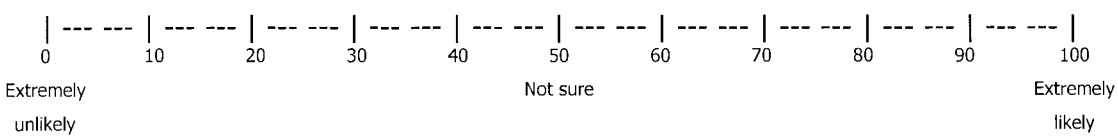

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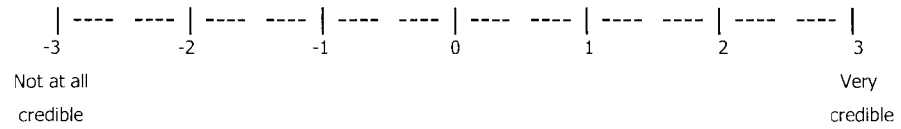

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7. Based on your assessments of bias, noise, management credibility, and management competence, to what extent do you believe that this would be a good stock to have in a person's portfolio? (Mark your answer on the scale below.)

| ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- |

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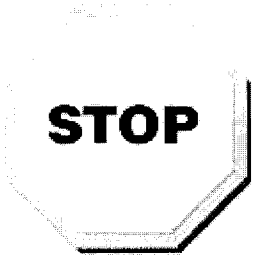

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The current ModernMotors Product Portfolio includes:

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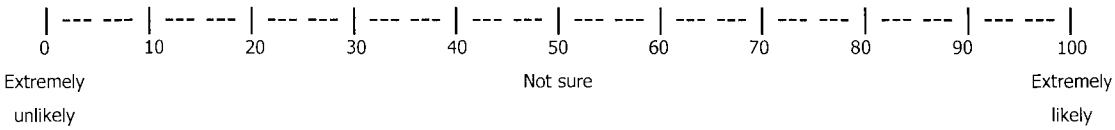
ModernMotors, Inc: Selected Financial Information

Line		2003	2002	2001	2000
a.	Reported net income	$7,152,700	$6,998,500	$7,544,700	$7,293,200
b.	Estimated allowance for sales returns (used when compiling the *Reported net income* above)	1,094,350	1,100,850	1,143,700	1,077,990
c.	Actual sales returns (compiled subsequent to year end, thus not used for determining *Reported net income*)	Not yet available	1,182,560	1,054,080	1,160,340
d.	Dollar error in ModernMotors' estimated allowance for sales returns (obtained by subtracting *Line c* from *Line b*)	N/A	-81,710	89,620	-82,350
e.	"Perfect foresight" net income (i.e., the net income that ModernMotors would have reported if its estimates had been perfectly accurate)	N/A	6,916,790	7,634,320	7,210,850
f.	Calculate the *Estimated allowance for sales returns* as a percentage of the actual sales returns by dividing *Line b* by *Line c*. Note that if ModernMotors underestimated sales returns, this will be less than 100%; if ModernMotors overestimated sales returns, this will be greater than 100%. (In other words, *Line b* ÷ *Line c* = ?)	N/A	_____%	_____%	_____%
g.	Was ModernMotors original estimate too small or too large? (Circle one.)	N/A	Too small or Too large	Too small or Too large	Too small or Too large
h.	Was ModernMotors originally reported net income (*Line a*, which used the *estimated* allowance for sales returns) **understated** or **overstated** when compared to the "perfect foresight" net income in *Line e*? (Circle one.)	N/A	Understated or Overstated	Understated or Overstated	Understated or Overstated

PART 3

Keeping in mind that **you do not yet own, but are considering purchasing stock in ModernMotors**, and using the information on previous pages, please answer the following questions about ModernMotors' sales returns. Feel free to look back at previous pages if necessary.

1. Based on the sequence of past estimated and actual sales returns, how likely do you think it is that the current year's *Estimated allowance for sales returns* is subject to intentional **bias** on the part of management? (Mark your answer on the scale below.)



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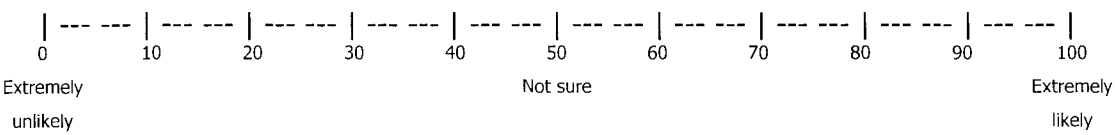

3. Now that you've considered the potential for bias and noise in ModernMotors' *Estimated allowance for sales returns*, please write down your best guess of the most likely *Actual sales returns* for 2003, along with pessimistic and optimistic figures.

   The pessimistic and optimistic values should provide a range that you feel certain will include the *Actual sales returns* for 2003. (In probability terms there should be a chance of less than 5 in 100 that the actual sales return value lies outside your range.)

   Optimistic (i.e., lower bound of range) _____

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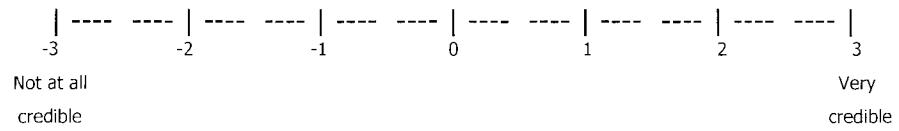

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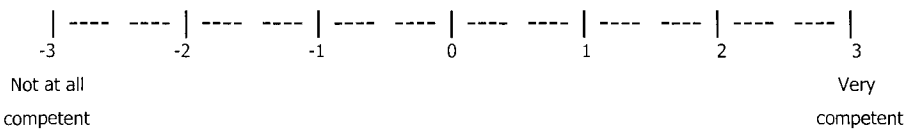

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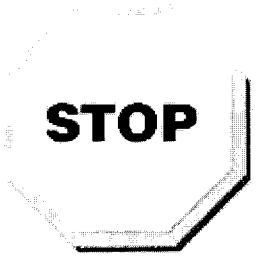

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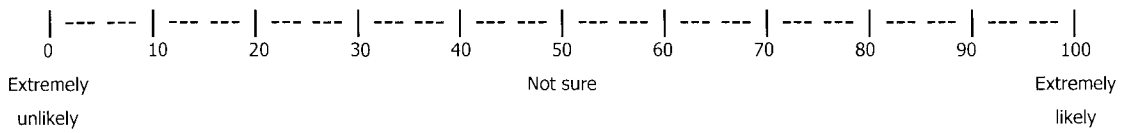

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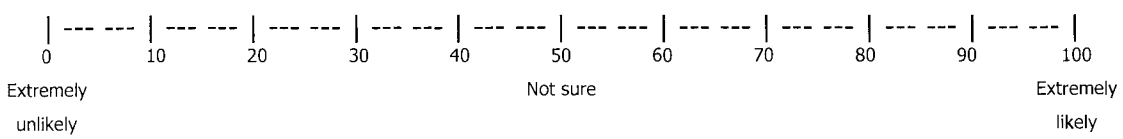

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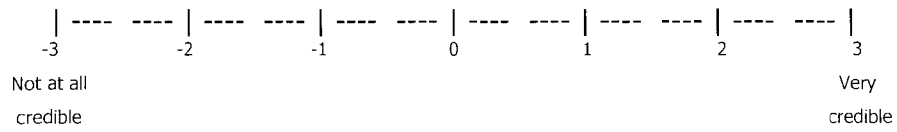

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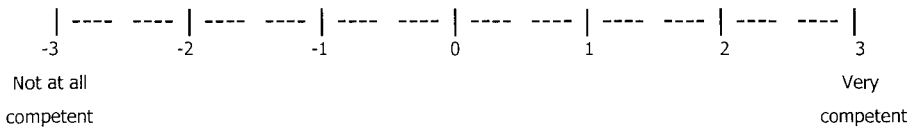

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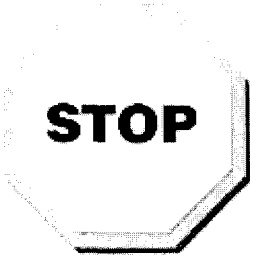

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Post-experimental Questionnaire
PART 4

Please answer the following questions about yourself. As stated earlier, your name will not be attached to this sheet, and all of your answers will remain confidential. Furthermore, this data will not be analyzed individually; rather, it will only be analyzed in the aggregate.

1. What is your year in school? (Circle one.)

   Junior Senior Fifth-year Senior Graduate Student

2. What is your current grade point average? _____ /4.0

3. What is your current accounting grade point average? _____ /4.0

4. Have you ever invested directly in the common stock of a publicly traded corporation? (Circle one.)

   Yes **No**

5. Have you had any experience in the automotive industry? (Circle one.)

   Yes **No**

   If yes, please explain: _____

   _____

6. What role were you asked to play in this case study? (Circle one.)

   a. I was asked to assume that I was an owner of ModernMotors' common stock.

   b. I was asked to assume that I was considering purchasing common stock in ModernMotors, Inc.

   c. I was asked to assume that I had been hired to provide assurance to ModernMotors management about the accuracy of their accounting estimates.

7. How hard did you try to do well on this study? (Mark your answer on the scale below.)

| ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- |
-3 -2 -1 0 1 2 3

Did not try hard at all Average Tried very hard

8. How well do you think you did in this study? (Mark your answer on the scale below.)

| ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- |
-3 -2 -1 0 1 2 3

Much worse than average Average Much better than average

9. How well do you think you understand the concepts of bias and noise? (Mark your answer on the scale below.)

| ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- |
-3 -2 -1 0 1 2 3

Much worse than average — Average — Much better than average

10. Earlier in the case, you were asked for your impressions about ModernMotors' *estimated allowance for sales returns.* With respect to the accuracy of the ***actual*** *sales returns*:

    a. How much intentional **bias** do you think exists in ModernMotors' measurement of ***actual*** *sales returns*? (Mark your answer on the scale below.)

| ----- ----- | ----- ----- | ----- ----- | ----- ----- | ----- ----- | ----- ----- | ----- ----- |
-3 -2 -1 0 1 2 3

Measurement of actual sales returns tends to be too low — Measurement of actual sales returns is not biased — Measurement of actual sales returns tends to be too high

    b. How much **noise** do you think exists in ModernMotors' measurement of ***actual*** *sales returns*? (Mark your answer on the scale below.)

| ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- |
-3 -2 -1 0 1 2 3

Very low levels of noise — Very high levels of noise

11. Although bias is generally thought of as intentional, and noise is generally thought of as unintentional, *in theory* both bias and noise can be either intentional or unintentional. Please **assign 100 points to the relative importance** of intentional bias, unintentional bias, intentional noise, and unintentional noise in the ModernMotors case. (In other words, if you think they were all equally important, you would assign 25 points to each. If you think that one was very important and the rest were not important, you would assign 100/0/0/0, etc.)

Intentional bias _____ points

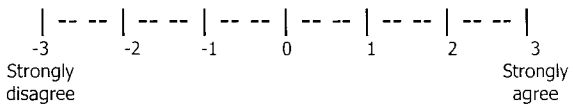
Unintentional bias _____ points

Intentional noise _____ points

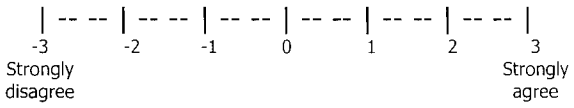
Unintentional noise _____ points

12. To what extent do you agree with each of the following statements? (Mark your answers on the scales provided.)

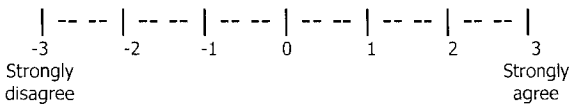
a. While completing this case, my primary concern was to avoid keeping or choosing a bad stock.



b. While completing this case, my primary concern was to make sure I kept or chose a good stock.



c. While completing the case materials, I wanted to determine the "true" accuracy of ModernMotors' accounting estimates.



APPENDIX E – EXPERIMENT 2 MATERIALS

The experimental materials in this appendix are divided into the following sections:

- *Consent and overview (all conditions)*
- *General instructions (all conditions)*
- *Bias/noise primer (all conditions)*
- *Case studies:*
    - *Current stockholder condition*
    - *Potential stockholder condition*
- *Post-experimental questionnaire (all conditions)*

Consent and Overview

INTRODUCTION

Purpose: This study is about how people evaluate and draw inferences from financial information. I invite you to participate. In deciding whether to participate, please keep the following in mind:

Procedure: You will be asked to read a case and form judgments based on case information that is simplified and abbreviated relative to information in the real-world. The case has three parts. Parts 1 and 2 entail reading information about hypothetical companies and answering several questions that require thoughtful judgment (e.g., rating scales, short answers). Part 3 entails demographic questions, follow-up questions to Parts 1 and 2, and other questions that require judgment. You would complete each phase without consulting any colleagues (we are interested in your own individual judgment). I estimate that completing the study will take 20-30 minutes.

Risks/Benefits: Your participation would help us better understand and potentially suggest ways to improve accounting and finance theory, practice, and education (at Washington State University and other universities). Your participation would pose no risks to you beyond those encountered in everyday life, but it likely would stimulate your thinking and provide a basis for future class discussions and activities.

Confidentiality: Your responses will be strictly anonymous. We do not ask for your name, nor should you put your name on any of the materials.

Your Choice: As with nearly all academic research involving human participants, your participation in this study is completely voluntary. You may decline to participate or withdraw at any time. Your decision to participate, decline, or withdraw will have no effect on any future relations with WSU.

Contact Information: If you have questions about the nature or results of this study, please contact me at the telephone number or e-mail listed below. If you have any questions about your rights as a participant, please contact the WSU's Institutional Review Board at (509) 324-7248 or irb@wsu.edu.

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GENERAL INSTRUCTIONS

Thank you for participating in this case study. Your participation today should take approximately 20-30 minutes.

Please feel free to ask any questions you might have during the study. However, any questions that may impact the results of the study will be deferred to the end of today's session.

The case materials contain other sets of instructions detailing how to proceed. These instructions will be shaded. Please read and follow these instructions carefully.

Your input is very important to this study. Thanks again for your participation.

Joshua Herbold, CPA
Visiting Professor of Accounting
Department of Accounting and Finance
School of Business Administration
University of Montana-Missoula

Bias/Noise Primer

This study examines how judgments may be affected by two types of error in estimates—bias and noise. To clarify the difference between **bias** and **noise**, please consider the following scenario:

Suppose you are working in a chemistry lab, and your job is to determine the weight of different samples of material. The lab has two scales that you could use, Scale 1 and Scale 2.

Scale 1 is never subject to noise, but is always subject to **bias**. Scale 1 systematically shows a weight that is 10 grams more than the true weight of a sample. In other words, Scale 1 will display a weight of 210 grams for a sample that actually weighs 200 grams; a weight of 335 grams for a sample that actually weighs 325 grams; and so on. If Scale 1 is used to measure the same sample repeatedly, it will always display the same weight (though that weight will always be 10 grams over the true weight of the sample). In other words, if a sample that actually weighs 100 grams is weighed five times on Scale 1, the readings will be: 110, 110, 110, 110, 110. If you knew the amount of bias in scale 1, you could obtain the true weight of a sample after just one measurement by simply subtracting 10 grams from the reading on the scale.

Scale 2 is never subject to bias, but is always subject to **noise** (also called random error). The readings from Scale 2 are, on average, correct; however, any individual reading may be off by as much as 5 grams on either side of the true weight. In other words, the weights displayed by Scale 2 are randomly distributed around but centered on the true weight. If a sample that actually weighs 100 grams is weighed five times on Scale 2, the readings might be: 98, 100, 105, 96, 101. Even if you knew the amount of noise (or random error) in Scale 2, you could not determine the true weight of a sample after only one measurement. However, the average of a number of readings should converge to the true weight.

Before continuing, please answer the following questions. You may refer back to the explanations if necessary. (Circle or fill in the appropriate answer.)

1. A bathroom scale that consistently displays 10 pounds below a person's true weight is subject to _____.

   a. bias

   b. noise

2. A bathroom scale that randomly displays up to 10 pounds below or above a person's true weight is subject to _____.

   a. bias

   b. noise

3. Imagine a car driving a constant speed. The speedometer readings, however, are known to contain noise. If a random sample of these speedometer readings at different points in time shows 54, 60, 58, 50, and 53, what is your best guess as to the car's actual speed?

   _____ mph

4. Imagine a car driving a constant speed. The speedometer, however, is known to read 5mph higher than the car's actual speed. If the speedometer shows a reading of 70, what is your best guess as to the car's actual speed?

   _____ mph

PART 2

For purposes of this study, please assume that **you currently hold a significant portion of common stock** of a number of companies in the computer hardware manufacturing industry. (You will read more information about these companies in a moment.)

As part of your investigation into these companies, you have gathered information about each company's accounting estimates related to future warranty expenditures. As you work your way through the case materials, please keep in mind that **you already own** these stocks, and are currently re-evaluating your holdings of these companies.

As you may recall, generally accepted accounting principles require companies to recognize an expense and accrue a liability for estimated warranty claims. Companies must recognize an amount equivalent to their best estimate. This accrual represents estimated future expenditures for warranty repairs on items sold during the current fiscal period. **If a company's warranty expense estimate is too high, current period net income will be understated, but if a company's warranty expense estimate is too low, current period net income will be inflated (overstated).**

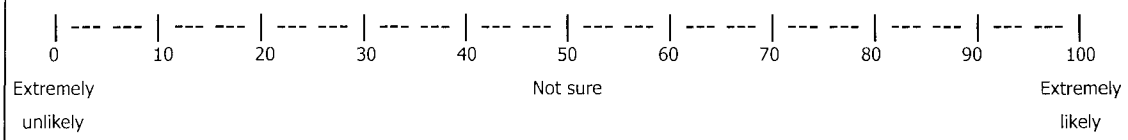
Because companies do not have *perfect* foresight into future expenditures, their estimates may differ from actual future expenditures. A recently proposed rule for financial reporting would require companies to report (on an "after the fact" basis) on the actual outcomes for their original estimates. In other words, companies would be required to disclose their original estimates from previous periods, and the actual outcomes.

In accordance with this new rule, you have gathered information about the estimated and actual warranty expense (as a percentage of sales) for four companies in which you are have invested. For each company, you will be provided with a sequence of estimated and actual warranty expenses for previous years. You will also be given estimated warranty expense for the current year. Each company's numbers are stated as a percentage of net sales. Based on this information, you will be asked to provide several judgments about each company and its estimates related to warranty expenditures. After evaluating all four companies, you will be asked to rank the four companies in terms of their relative investment potential. The quality of your comparison of the four companies will determine the number of lottery tickets that you earn, and thus your chance of winning an additional cash prize.

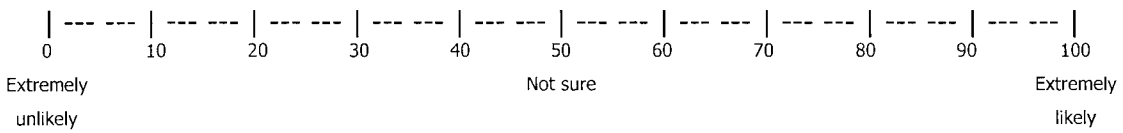
The case information is not intended to include all of the information that would normally be available if you were evaluating the common stock of a company. For this study, please base your judgments on the information provided.

Before continuing, please answer the following questions:

1. Many accounting numbers are based on estimates. In general, how likely do you think it is that accounting estimates are subject to bias? (Mark your answer on the scale below.)



2. In general, how likely do you think it is that accounting estimates are subject to noise? (Mark your answer on the scale below.)



Keeping in mind that **you already own stock in the following companies**, please answer the questions on the following pages about each company's warranty expense estimates.

Each company is completely separate and independent from the others, so please evaluate each company without prejudice to your responses about the other companies.

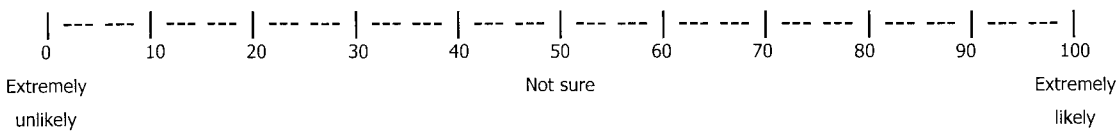
Company A

(Remember, this company is independent of the other companies that you will see. Think about the information in this part and the questions that follow independently from the other companies. After evaluating all four companies independently, you will compare their relative investment attractiveness.)

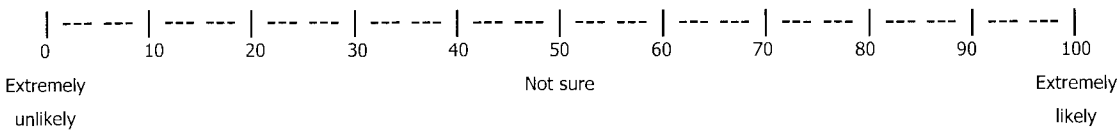
Company A's reported (i.e., originally estimated) and actual warranty expenses for prior years, and the current year's reported warranty expense, are as follows:

	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994
Original estimate (percentage of net sales):	3.7 %	3.5 %	3.9 %	4.1 %	3.9 %	3.6 %	3.7 %	3.5 %	4.1 %	4.3 %	3.5 %
Actual realization (percentage of net sales):	N/A	3.6 %	4.6 %	4.9 %	4.8 %	3.7 %	4.0 %	2.8 %	3.6 %	4.7 %	3.9 %
Original estimate was:		**Too Low**	**Too Low**	**Too Low**	**Too Low**	**Too Low**	**Too Low**	**Too High**	**Too High**	**Too Low**	**Too Low**

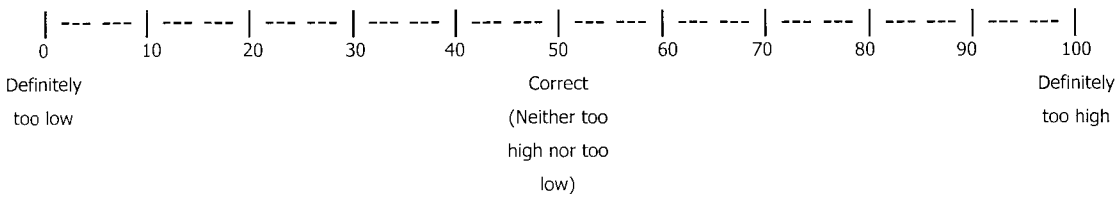
1. Based on the sequence of past estimated and actual warranty expense, how likely do you think it is that the current year's warranty expense is subject to **bias**? (Mark your answer on the scale below.)



2. Based on the sequence of past estimated and actual warranty expense, how likely do you think it is that the current year's warranty expense is subject to **noise**? (Mark your answer on the scale below.)



3. Based on the sequence of past estimated and actual warranty expense, would you expect <u>this year's</u> warranty expense estimate to be too high, correct, or too low? (Mark your answer on the scale below.)



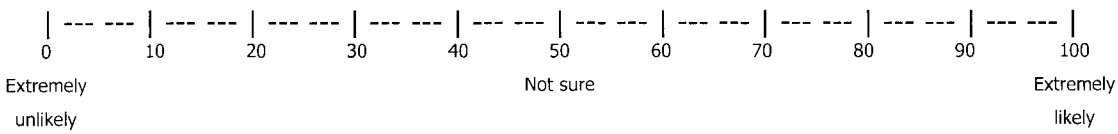
Company B

(Remember, this company is independent of the other companies that you will see. Think about the information in this part and the questions that follow independently from the other companies. After evaluating all four companies independently, you will compare their relative investment attractiveness.)

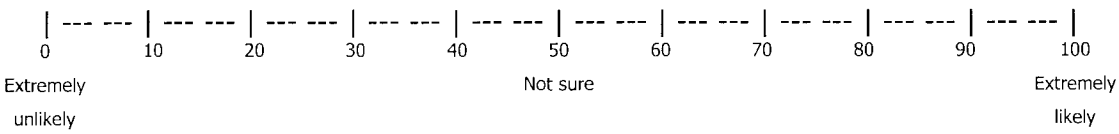
Company B's reported (i.e., originally estimated) and actual warranty expenses for prior years, and the current year's reported warranty expense, are as follows:

	2004	**2003**	**2002**	**2001**	**2000**	**1999**	**1998**	**1997**	**1996**	**1995**	**1994**
Original estimate (percentage of net sales):	3.7	3.2	3.7	4.0	3.0	3.7	3.4	3.8	4.0	3.5	3.5
Actual realization (percentage of net sales):	N/A	3.9	3.3	4.7	2.8	4.0	3.0	3.9	4.7	3.4	4.0
Original estimate was:		**Too Low**	**Too High**	**Too Low**	**Too High**	**Too Low**	**Too High**	**Too Low**	**Too Low**	**Too High**	**Too Low**

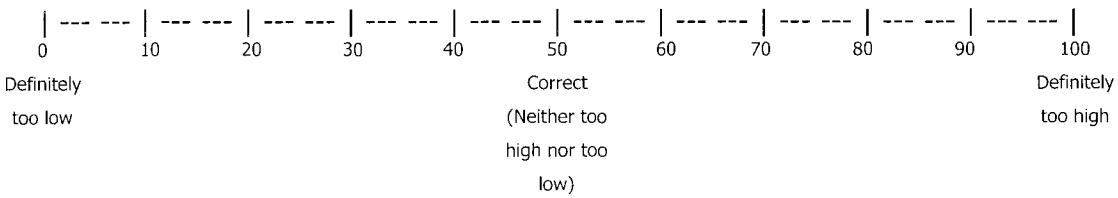
1. Based on the sequence of past estimated and actual warranty expense, how likely do you think it is that the current year's warranty expense is subject to **bias**? (Mark your answer on the scale below.)



2. Based on the sequence of past estimated and actual warranty expense, how likely do you think it is that the current year's warranty expense is subject to **noise**? (Mark your answer on the scale below.)



3. Based on the sequence of past estimated and actual warranty expense, would you expect <u>this year's</u> warranty expense estimate to be too high, correct, or too low? (Mark your answer on the scale below.)



Company C

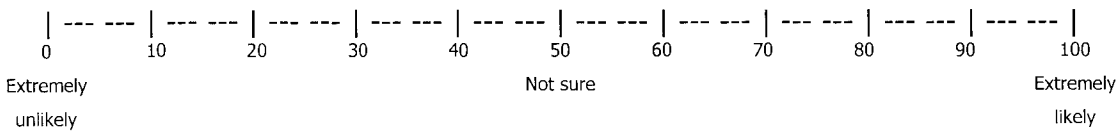
(Remember, this company is independent of the other companies that you will see. Think about the information in this part and the questions that follow independently from the other companies. After evaluating all four companies independently, you will compare their relative investment attractiveness.)

Company C's reported (i.e., originally estimated) and actual warranty expenses for prior years, and the current year's reported warranty expense, are as follows:

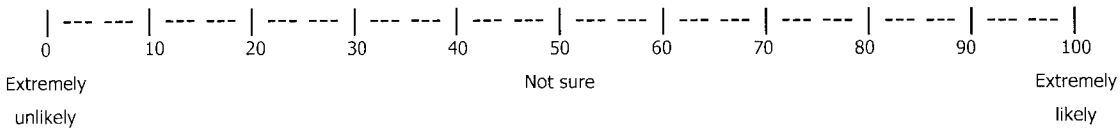
	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994
Original estimate (percentage of net sales):	5.3	5.0	4.2	4.6							
Actual realization (percentage of net sales):	N/A	5.4	4.3	4.9							
Original estimate was:		**Too Low**	**Too Low**	**Too Low**							

** Data for this company were not available prior to 2001.*

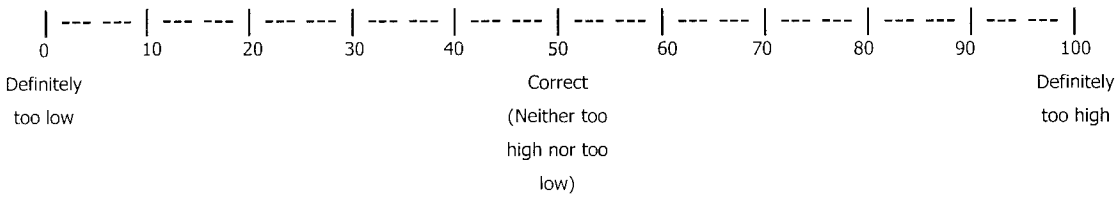
1. Based on the sequence of past estimated and actual warranty expense, how likely do you think it is that the current year's warranty expense is subject to **bias**? (Mark your answer on the scale below.)



2. Based on the sequence of past estimated and actual warranty expense, how likely do you think it is that the current year's warranty expense is subject to **noise**? (Mark your answer on the scale below.)



3. Based on the sequence of past estimated and actual warranty expense, would you expect <u>this year's</u> warranty expense estimate to be too high, correct, or too low? (Mark your answer on the scale below.)



Company D

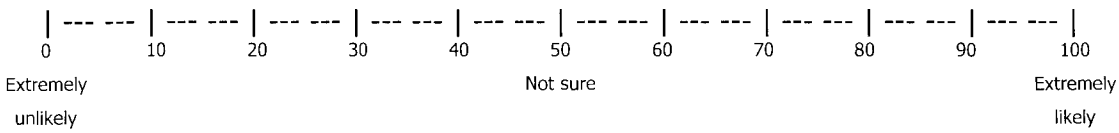
(Remember, this company is independent of the other companies that you will see. Think about the information in this part and the questions that follow independently from the other companies. After evaluating all four companies independently, you will compare their relative investment attractiveness.)

Company D's reported (i.e., originally estimated) and actual warranty expenses for prior years, and the current year's reported warranty expense, are as follows:

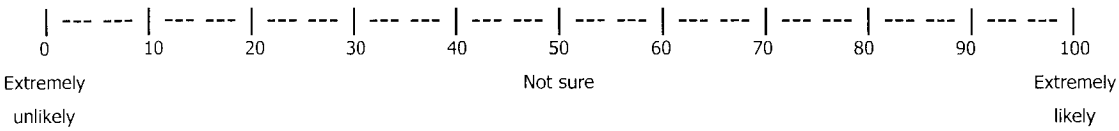
	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994
Original estimate (percentage of net sales):	4.4 %	4.1 %	3.7 %	3.8 %							
Actual realization (percentage of net sales):	N/A	4.7 %	3.3 %	4.5 %							
Original estimate was:		**Too Low**	**Too High**	**Too Low**							

** Data for this company were not available prior to 2001.*

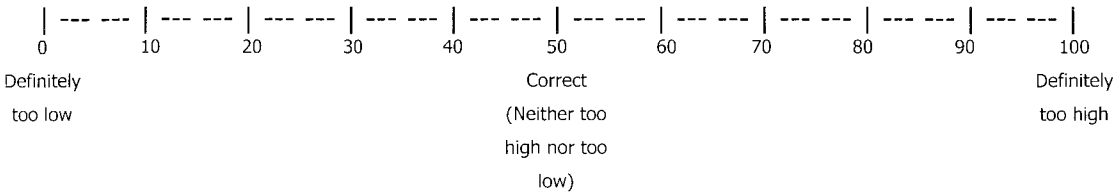
1. Based on the sequence of past estimated and actual warranty expense, how likely do you think it is that the current year's warranty expense is subject to **bias**? (Mark your answer on the scale below.)



2. Based on the sequence of past estimated and actual warranty expense, how likely do you think it is that the current year's warranty expense is subject to **noise**? (Mark your answer on the scale below.)



3. Based on the sequence of past estimated and actual warranty expense, would you expect <u>this year's</u> warranty expense estimate to be too high, correct, or too low? (Mark your answer on the scale below.)



Investment Allocation

Some accounting researchers believe investors' judgments of bias and noise in accounting estimates affect real-world companies' stock prices, though there is not much research on whether this is true or on how it works.

To help accounting researchers begin to address this issue, please review your judgments of bias and noise in each company's accounting estimates to help answer the following question: **If you had $100 to invest, how much would you invest in each of the four companies?**

By way of incentive, you will earn more lottery tickets to the degree that the difference between your allocation and the average allocation across all participants is smaller. Specifically:

- If your allocation matches the average allocation across all participants for a given company, you will receive 1,000 tickets (i.e., 4,000 is the maximum lottery tickets; it requires a perfect match on all four companies).
- If your allocation differs from the average allocation for a given company, you will lose one ticket for each unit of squared error. For example, if the average allocation for a given company was $45 but your allocation was $25, you would earn $1{,}000 - (45 - 25)^2 = 600$ tickets for that company.
- If your squared error is greater than 1,000 on a given company, you will still earn a minimum of one ticket for that company.

Overall, the more lottery tickets you earn, the better your chances of winning one of the cash prizes.

Before making your allocations, you may find it quite helpful to review the information and your prior judgments of bias and noise in each company's accounting estimates.

In the spaces below, provide your allocation for each company.

If I had $100 to invest in these four companies, I would allocate my investment as follows:

Company A:	**$**_____
Company B:	**$**_____
Company C:	**$**_____
Company D:	**$**_____
Total:	**$ 100**

(Note that you may allocate the entire $100 to one company or you can divide it amongst the companies in any way you choose.)

Potential Stockholder Condition

PART 2

For purposes of this study, please assume that **you are considering purchasing a significant portion of common stock** of a number of companies in the computer hardware manufacturing industry. (You will read more information about these companies in a moment.)

As part of your investigation into these companies, you have gathered information about each company's accounting estimates related to future warranty expenditures. As you work your way through the case materials, please keep in mind that **you do not yet own** these stocks. **At this point, you are considering whether to purchase any of them or invest your money elsewhere.**

As you may recall, generally accepted accounting principles require companies to recognize an expense and accrue a liability for estimated warranty claims. Companies must recognize an amount equivalent to their best estimate. This accrual represents estimated future expenditures for warranty repairs on items sold during the current fiscal period. **If a company's warranty expense estimate is too high, current period net income will be understated, but if a company's warranty expense estimate is too low, current period net income will be inflated (overstated).**

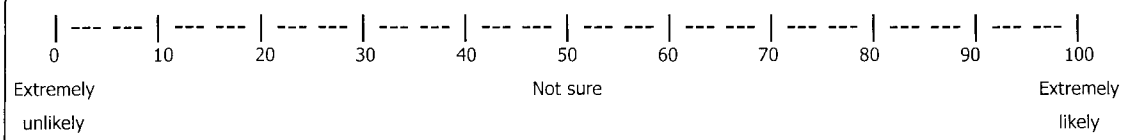
Because companies do not have *perfect* foresight into future expenditures, their estimates may differ from actual future expenditures. A recently proposed rule for financial reporting would require companies to report (on an "after the fact" basis) on the actual outcomes for their original estimates. In other words, companies would be required to disclose their original estimates from previous periods, and the actual outcomes.

In accordance with this new rule, you have gathered information about the estimated and actual warranty expense (as a percentage of sales) for four companies in which you are considering investing. For each company, you will be provided with a sequence of estimated and actual warranty expenses for previous years. You will also be given estimated warranty expense for the current year. Each company's numbers are stated as a percentage of net sales. Based on this information, you will be asked to provide several judgments about each company and its estimates related to warranty expenditures. After evaluating all four companies, you will be asked to rank the four companies in terms of their relative investment potential. The quality of your comparison of the four companies will determine the number of lottery tickets that you earn, and thus your chance of winning an additional cash prize.

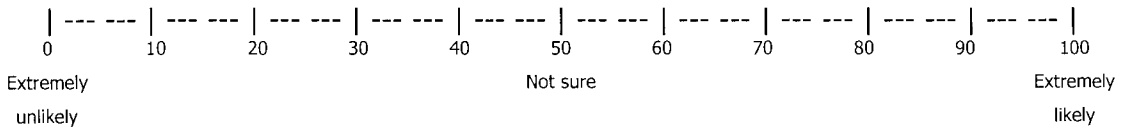
The case information is not intended to include all of the information that would normally be available if you were evaluating the common stock of a company. For this study, please base your judgments on the information provided.

Before continuing, please answer the following questions:

1. Many accounting numbers are based on estimates. In general, how likely do you think it is that accounting estimates are subject to bias? (Mark your answer on the scale below.)



2. In general, how likely do you think it is that accounting estimates are subject to noise? (Mark your answer on the scale below.)



Keeping in mind that **you do not yet own, but are considering purchasing stock in the following companies**, please answer the questions on the following pages about each company's warranty expense estimates.

Each company is completely separate and independent from the others, so please evaluate each company without prejudice to your responses about the other companies.

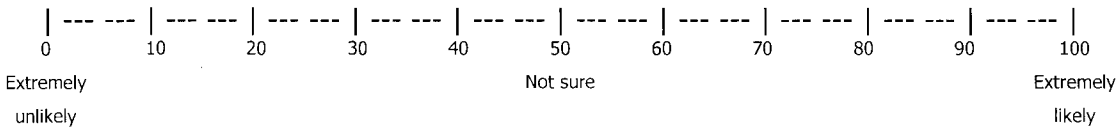
Company A

(Remember, this company is independent of the other companies that you will see. Think about the information in this part and the questions that follow independently from the other companies. After evaluating all four companies independently, you will compare their relative investment attractiveness.)

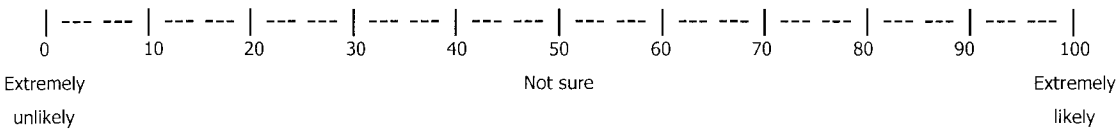
Company A's reported (i.e., originally estimated) and actual warranty expenses for prior years, and the current year's reported warranty expense, are as follows:

	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994
Original estimate (percentage of net sales):	3.7 %	3.5 %	3.9 %	4.1 %	3.9 %	3.6 %	3.7 %	3.5 %	4.1 %	4.3 %	3.5 %
Actual realization (percentage of net sales):	N/A	3.6 %	4.6 %	4.9 %	4.8 %	3.7 %	4.0 %	2.8 %	3.6 %	4.7 %	3.9 %
Original estimate was:		**Too Low**	**Too Low**	**Too Low**	**Too Low**	**Too Low**	**Too Low**	**Too High**	**Too High**	**Too Low**	**Too Low**

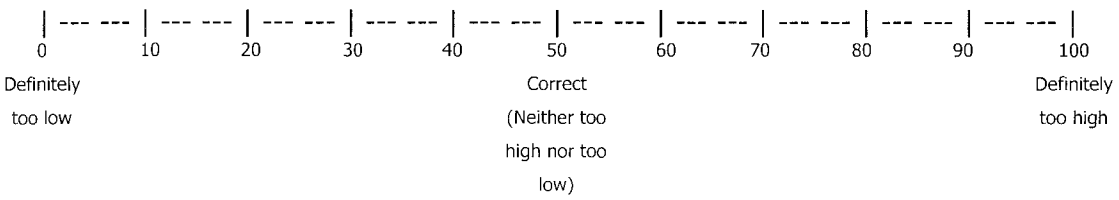
1. Based on the sequence of past estimated and actual warranty expense, how likely do you think it is that the current year's warranty expense is subject to **bias**? (Mark your answer on the scale below.)



2. Based on the sequence of past estimated and actual warranty expense, how likely do you think it is that the current year's warranty expense is subject to **noise**? (Mark your answer on the scale below.)



3. Based on the sequence of past estimated and actual warranty expense, would you expect this year's warranty expense estimate to be too high, correct, or too low? (Mark your answer on the scale below.)



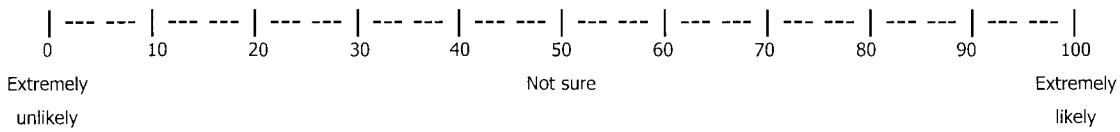
Company B

(Remember, this company is independent of the other companies that you will see. Think about the information in this part and the questions that follow independently from the other companies. After evaluating all four companies independently, you will compare their relative investment attractiveness.)

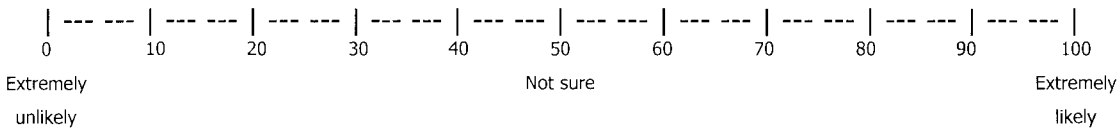
Company B's reported (i.e., originally estimated) and actual warranty expenses for prior years, and the current year's reported warranty expense, are as follows:

	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994
Original estimate (percentage of net sales):	3.7	3.2	3.7	4.0	3.0	3.7	3.4	3.8	4.0	3.5	3.5
Actual realization (percentage of net sales):	N/A	3.9	3.3	4.7	2.8	4.0	3.0	3.9	4.7	3.4	4.0
Original estimate was:		**Too Low**	**Too High**	**Too Low**	**Too High**	**Too Low**	**Too High**	**Too Low**	**Too Low**	**Too High**	**Too Low**

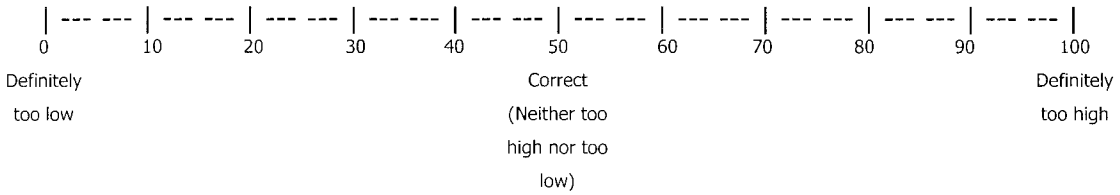
1. Based on the sequence of past estimated and actual warranty expense, how likely do you think it is that the current year's warranty expense is subject to **bias**? (Mark your answer on the scale below.)



2. Based on the sequence of past estimated and actual warranty expense, how likely do you think it is that the current year's warranty expense is subject to **noise**? (Mark your answer on the scale below.)



3. Based on the sequence of past estimated and actual warranty expense, would you expect this year's warranty expense estimate to be too high, correct, or too low? (Mark your answer on the scale below.)



Company C

(Remember, this company is independent of the other companies that you will see. Think about the information in this part and the questions that follow independently from the other companies. After evaluating all four companies independently, you will compare their relative investment attractiveness.)

Company C's reported (i.e., originally estimated) and actual warranty expenses for prior years, and the current year's reported warranty expense, are as follows:

	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994
Original estimate (percentage of net sales):	5.3	5.0	4.2	4.6							
Actual realization (percentage of net sales):	N/A	5.4	4.3	4.9							
Original estimate was:		**Too Low**	**Too Low**	**Too Low**							

** Data for this company were not available prior to 2001.*

1. Based on the sequence of past estimated and actual warranty expense, how likely do you think it is that the current year's warranty expense is subject to **bias**? (Mark your answer on the scale below.)

| --- --- | --- --- | --- --- | --- --- | --- --- | --- --- | --- --- | --- --- | --- --- | --- --- |
0 10 20 30 40 50 60 70 80 90 100

Extremely unlikely — Not sure — Extremely likely

2. Based on the sequence of past estimated and actual warranty expense, how likely do you think it is that the current year's warranty expense is subject to **noise**? (Mark your answer on the scale below.)

| --- --- | --- --- | --- --- | --- --- | --- --- | --- --- | --- --- | --- --- | --- --- | --- --- |
0 10 20 30 40 50 60 70 80 90 100

Extremely unlikely — Not sure — Extremely likely

3. Based on the sequence of past estimated and actual warranty expense, would you expect this year's warranty expense estimate to be too high, correct, or too low? (Mark your answer on the scale below.)

| --- --- | --- --- | --- --- | --- --- | --- --- | --- --- | --- --- | --- --- | --- --- | --- --- |
0 10 20 30 40 50 60 70 80 90 100

Definitely too low — Correct (Neither too high nor too low) — Definitely too high

Company D

(Remember, this company is independent of the other companies that you will see. Think about the information in this part and the questions that follow independently from the other companies. After evaluating all four companies independently, you will compare their relative investment attractiveness.)

Company D's reported (i.e., originally estimated) and actual warranty expenses for prior years, and the current year's reported warranty expense, are as follows:

	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994
Original estimate (percentage of net sales):	4.4 %	4.1 %	3.7 %	3.8 %							
Actual realization (percentage of net sales):	N/A	4.7 %	3.3 %	4.5 %							
Original estimate was:		**Too Low**	**Too High**	**Too Low**							

** Data for this company were not available prior to 2001.*

1. Based on the sequence of past estimated and actual warranty expense, how likely do you think it is that the current year's warranty expense is subject to **bias**? (Mark your answer on the scale below.)

--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	---
0	10	20	30	40	50	60	70	80	90	100
Extremely unlikely					Not sure					Extremely likely

2. Based on the sequence of past estimated and actual warranty expense, how likely do you think it is that the current year's warranty expense is subject to **noise**? (Mark your answer on the scale below.)

--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	---
0	10	20	30	40	50	60	70	80	90	100
Extremely unlikely					Not sure					Extremely likely

3. Based on the sequence of past estimated and actual warranty expense, would you expect this year's warranty expense estimate to be too high, correct, or too low? (Mark your answer on the scale below.)

--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	---
0	10	20	30	40	50	60	70	80	90	100
Definitely too low					Correct (Neither too high nor too low)					Definitely too high

Investment Allocation

Some accounting researchers believe investors' judgments of bias and noise in accounting estimates affect real-world companies' stock prices, though there is not much research on whether this is true or on how it works.

To help accounting researchers begin to address this issue, please review your judgments of bias and noise in each company's accounting estimates to help answer the following question: **If you had $100 to invest, how much would you invest in each of the four companies?**

By way of incentive, you will earn more lottery tickets to the degree that the difference between your allocation and the average allocation across all participants is smaller. Specifically:

- If your allocation matches the average allocation across all participants for a given company, you will receive 1,000 tickets (i.e., 4,000 is the maximum lottery tickets; it requires a perfect match on all four companies).
- If your allocation differs from the average allocation for a given company, you will lose one ticket for each unit of squared error. For example, if the average allocation for a given company was $45 but your allocation was $25, you would earn $1{,}000 - (45 - 25)^2 = 600$ tickets for that company.
- If your squared error is greater than 1,000 on a given company, you will still earn a minimum of one ticket for that company.

Overall, the more lottery tickets you earn, the better your chances of winning one of the cash prizes.

Before making your allocations, you may find it quite helpful to review the information and your prior judgments of bias and noise in each company's accounting estimates.

In the spaces below, provide your allocation for each company.

If I had $100 to invest in these four companies, I would allocate my investment as follows:

Company A: **$**_____

Company B: **$**_____

Company C: **$**_____

Company D: **$**_____

Total: **$ 100**

(Note that you may allocate the entire $100 to one company or you can divide it amongst the companies in any way you choose.)

Post-experimental Questionnaire

PART 3

Please answer the following questions about yourself. As stated earlier, your name will not be collected, and all of your answers will remain anonymous and confidential. Furthermore, this data will not be analyzed individually; rather, it will only be analyzed in the aggregate.

1. What is your year in school? (Circle one.)

   Junior Senior Fifth-year Senior Graduate Student

2. What is your current grade point average? _____ /4.0

3. What is your current accounting grade point average? _____ /4.0

4. Have you ever invested directly in the common stock of a publicly traded corporation? (Circle one.)

   Yes **No**

5. What role were you asked to play in this case study? (Circle one.)

   a. I was asked to assume that I already owned stock in the companies presented.

   b. I was asked to assume that I was considering purchasing common stock in the companies presented.

6. How hard did you try to do well on this study? (Mark your answer on the scale below.)

| ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- |
-3 -2 -1 0 1 2 3

Did not try hard at all — Average — Tried very hard

7. How well do you think you did in this study? (Mark your answer on the scale below.)

| ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- |
-3 -2 -1 0 1 2 3

Much worse than average — Average — Much better than average

8. How well do you think you understand the concepts of bias and noise? (Mark your answer on the scale below.)

| ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- | ---- ---- |
-3 -2 -1 0 1 2 3

Much worse than average — Average — Much better than average

Curriculum Vitae

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Education

Ph. D. (expected May 2005)
University of Illinois at Urbana-Champaign
Dissertation Chair: Mark Peecher

B.S. in Accountancy, May 1995
University of Illinois at Urbana-Champaign

Research and Teaching Interests

Research: Behavioral financial accounting and auditing.
Teaching: Auditing and attestation, all levels of financial accounting.

Working Papers

"Determinants of Error Attribution in Accounting Estimates"

> This study examines whether decision makers' interpretation of *ex post* reports on accounting estimate accuracy are affected by the properties of the time series and by directionally motivated reasoning. Specifically, participants attributed misestimations more to bias (noise) when the sequence of misestimations contained no (high) reversals. I present evidence supporting my hypotheses that *potential stockholders* are more likely than *current stockholders* to attribute misestimations to bias, while *current stockholders* are more likely than *potential stockholders* to attribute misestimations to noise. Finally—and importantly—I show that this key effect moderates participants' use of the representativeness heuristic.

"An Experimental Examination of Assurer Reputation within a Multi-Assurance Service Context," with Mark Peecher and Ananda Ganguly. Resubmitted September 2004 for second round at *Contemporary Accounting Research.*

> This paper examines the dynamics of an assurer's reputation for competence within a multi-assurance-service laboratory market setting. We focus on how an assurer's flagship-service reputation affects the initial reputation in two new assurance markets and also on how initial performance in such markets affects the previously established flagship and overall reputations. The two new markets differ in the degree to which the knowhow (i.e., knowledge and skills) required to provide assurance therein overlaps with that required to perform the flagship assurance service. We expect relative knowhow overlap to moderate market participants' evolving perceptions of the assurer's competence, and present results for various measures of reputation, including attitudinal assessments, probability estimates of future assurer success, and bids to procure the assurer's report.

Presentations

"An Experimental Examination of Assurer Reputation within a Multi-Assurance Service Context," 2002 AAA Auditing Section Midyear Conference

Work Experience

University of Montana

Instructor for *Financial Accounting*
Fall 2004 (student ratings not yet received)

University of Illinois at Urbana-Champaign

Instructor for *Assurance and Attestation*

Semester	Average Student "Instructor Effectiveness" Rating
Fall 2003	4.0/5.0
Summer 2002	4.4/5.0
Summer 2001	4.5/5.0
Fall 2000	4.1/5.0
Summer 2000	4.2/5.0
Summer 1999	3.8/5.0
Spring 1999	4.1/5.0

University of Illinois at Urbana-Champaign

Research Assistant for Mark Peecher.
Fall 1999

University of Illinois at Urbana-Champaign

Teaching Assistant for various accounting courses, including *Accounting Measurement and Disclosure*, *Decision Making for Accountancy*, and *Accounting Control Systems*.
1997 to present.

Academic Honors

Fellowships & Awards

University of Illinois Fellow, 1997-2003
Lillian and Morrie Moss Fellow, 2000-2003
Victor L. Bernard Memorial Award, 2001-2002

Teaching Awards

Fred H. Figge Distinguished Teaching Award, 2001
College of Commerce Alumni Association Excellence in Teaching Award, 2001
Incomplete List of Teachers Ranked as Excellent by Their Students, 2001 and 2002

Service

Ad Hoc Reviewer, AAA Annual Meeting, 2005
Discussant, AAA Audit Section Midyear Meeting, 2005
Discussant, AAA Annual Meeting, 2004
Ad Hoc Reviewer, 16th Audit Research Symposium (Univ. of Illinois/KPMG Foundation)
Ad Hoc Reviewer, *Issues in Accounting Education*
Ad Hoc Reviewer, AAA Audit Section Midyear Meeting, 2004
Student Representative, Department of Accountancy Ph. D. Committee, 1999-2001

Selected Conferences Attended

Auditing Research Symposium, University of Illinois at Urbana-Champaign, 1998-2004
American Accounting Association Doctoral Consortium, Tahoe City, California, 1999
Big Ten Doctoral Consortium, University of Illinois at Urbana-Champaign, 1999
Business Measurement and Assurance Services Conference, University of Texas, 1999

Dissertation Committee Members

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David V. Budescu	Psychology Dept.	217.333.6758	dbudescu@uiuc.edu
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Marjorie K. Shelley	Accounting Dept.	217.333.1066	shelley1@uiuc.edu