We thank the auditors who participated in our experiment and the Big 4 firm that provided access to those participants. Thanks also to Rob Bloomfield, Shana Clor-Proell, Emily Griffith, Ryan Guggenmos, Erin Hamilton, Bill Kinney, Lisa Koonce, Patricia O’Brien, Chad Proell, Kristi Rennekamp, Aaron Saiewitz, Jason Smith, Victor van Pelt, Brian White, and workshop participants at Cornell University, University of Amsterdam, University of Graz, HEC-Paris, INSEAD, U Leuven, Maastricht University, University of Nevada Las Vegas, Texas Christian University, Tilburg University, University of Texas at Austin, University of Waterloo, and the Penn State Accounting Research Conference for comments.
Estimates of fair value present a formidable audit challenge. We report an experiment that examines how experienced auditors apply current PCAOB guidance when auditing portfolios of investments that are classified as Level 2 within the fair value hierarchy. We hypothesize and find that, depending on how overstatement is distributed within a portfolio, current PCAOB guidance leads auditors to make adjustments that are predictably too large or small relative to the aggregate overstatement in the portfolio. We also find that auditors sometimes diverge from this guidance in order to correct overstatement that otherwise would remain in the portfolio, particularly when doing so increases their client’s net income. We also predict and find that auditors identify some patterns of overstatement as indicative of management bias, but not others. However, management-bias assessments do not affect auditors’ adjustment decisions, even when auditors are prompted to consider management bias. Together, these results highlight a potential deficiency in current auditing guidance that managers could exploit by strategically locating overstatements within securities with larger book values or by spreading those overstatements across many securities within a portfolio.

**Keywords**: Accounting estimates, audit adjustments, management bias, audit guidance, PCAOB
I. INTRODUCTION

Companies are increasingly measuring assets and liabilities using fair value estimates (Barth 2006; Hodder, Hopkins, and Schipper forthcoming). This trend has raised concerns that the uncertainty and subjectivity inherent in fair values undermines the representational faithfulness of financial reports, and that auditors are ill-equipped to provide assurance on such values (Griffith, Hammersley, and Kadous 2015; Bratten, Gaynor, McDaniel, Montague, and Sierra 2013; Church and Shefchik 2012). In this paper, we focus on the audit of fair values of investment securities that are categorized as Level 2 in the SAS No. 157 hierarchy. Level 2 investments are an increasingly important asset class for companies in general, and totaled $8.65 trillion for the financial institutions included in Compustat’s Bank Fundamentals database in 2015.1

Auditors accumulate identified “misstatements” on a schedule of audit differences, which provides the basis for proposed audit adjustments. For fair value estimates, U.S. auditing standards define a misstatement as the difference between management’s estimate and the nearest endpoint of the range of estimates the auditor considers to be reasonable (the “reasonable range”) (PCAOB Auditing Standard 14.13, hereafter AS 14.13). Regarding securities portfolios, recent PCAOB inspection reports indicate that this requirement should be applied on a security-by-security basis as opposed to a portfolio basis (e.g., PCAOB [2012a], pp. 20-21). We predict that this guidance results in auditors proposing adjustments that are predictably larger or smaller than the aggregate overstatement in a portfolio, depending on two dimensions of the distribution

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1 In supplemental analyses we examined banks’ fair value disclosures as reported on Compustat. Level 2 assets composed approximately 86% of all fair value assets, and that percentage has increased almost monotonically in the past eight years to 92% in 2015. Furthermore, Level 2 assets for these banks sum to a value in excess of $8.65 trillion as of the end of 2014, or about 16% of the banks’ total assets. These statistics suggest that Level 2 fair values are important to financial institutions as well as the US economy.
of overstatement within the portfolio – (1) the extent to which overstatement is spread across many securities or only a few securities in the portfolio (i.e., overstatement frequency) and (2) the extent to which overstatement is concentrated in securities with larger or smaller book values (i.e., overstatement percentage size). Specifically, we predict that, holding constant the aggregate overstatement of a portfolio, auditors propose larger adjustments when overstatements are (a) concentrated in a few individual securities with smaller book values than when overstatements are either (b) concentrated in a few individual securities with larger book values or (c) spread across a larger number of individual securities. Documenting this result is important because it indicates the potential for misleading and non-comparable audited financial statements. Furthermore, it implies the potential for managers to affect the amount of overstatement in post-audit financial statements by strategically locating overstatement in particular securities within a portfolio.

We also test whether another aspect of auditing guidance mitigates this problem. U.S. auditing standards require that auditors assess whether individually-reasonable estimates indicate a pattern of management bias (PCAOB Auditing Standard 14.27). Auditors who identify a pattern indicating management bias might make a larger adjustment than they would otherwise. Yet, standards are largely silent about the specific patterns of evidence that are indicative of bias. Based on psychology research on causal attribution and the frequency heuristic (Alba, Broniarczyk, Shimp, and Urbany 1994; Alba, Mela, Shimp, and Urbany 1999; Koonce and Lipe forthcoming ), we hypothesize and test whether experienced auditors identify a portfolio with (a) large percentage-size overstatements or (c) more frequent overstatements as more indicative of management bias, compared with a portfolio with (b) small percentage-size overstatements, holding aggregate portfolio overstatement constant. We then test whether auditors naturally
consider these management-bias assessments when making adjustment decisions, which would cause a different pattern of adjustments than predicted by purely mechanical application of AS 14.13 on a security-by-security basis. Testing whether auditors naturally identify management bias and apply that information when making adjustment decisions is important because standards and audit firms presume that to be the case.

Given evidence in other contexts that auditors sometimes adopt an “implemental” mindset and mechanically apply auditing standards (Griffith, Hammersley, Kadous, and Young 2015), we also test whether auditors are more likely to incorporate bias assessments into their adjustment decisions when they are prompted to consider bias before making their adjustment decisions (Hoffman and Zimbelman 2009; Bowlin 2011). Testing whether simple prompts are effective in this context is important because they can easily be incorporated in audit programs.

We test our hypotheses in an experiment in which experienced financial-services audit managers and seniors determine for a portfolio of Level 2 investments the total adjustment necessary to receive an unqualified opinion (the required adjustment) and the extent to which the portfolio indicates management bias (the bias assessment). The experiment has a 3 x 2 between-subjects design. We manipulate portfolio at three levels which differ according to the percentage size and frequency of overstated securities within the portfolio, holding aggregate portfolio overstatement constant. We also manipulate the order of the adjustment decision and bias assessments. The condition in which auditors make adjustment decisions before bias assessments allows us to test whether auditors naturally consider bias when making adjustment decisions, while the condition in which auditors make bias assessments before adjustment

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2 These three portfolios represent three cells of a 2x2 factorial design that varies the frequency of overstatements and the percentage size of overstatements in the portfolio. We do not include all four cells of the 2x2 design because the fourth cell in this design (high frequency, high percentage) would not allow us to hold constant the aggregate overstatement in the portfolio, which is a critical feature of our design.
decisions allows us to test whether prompting auditors to consider bias increases the extent to which bias assessments affect adjustment decisions.

Results indicate that, as predicted, current guidance results in auditors requiring adjustments that are predictably larger or smaller than the aggregate overstatement in the portfolio, depending on how the overstatement is distributed across securities within the portfolio. In particular, auditors require an adjustment that is approximately three times larger when overstatements are a larger percentage of security book values than when overstatements either are a smaller percentage or are spread across many securities, holding constant the aggregate pre-audit overstatement in portfolios.

Regarding management-bias assessments, results indicate that, as predicted, auditors assess portfolios to be more biased when overstatements are a large percentage of book value or are spread across many securities than when overstatements are a smaller percentage of book value. Because unprompted adjustment decisions do not follow the same pattern, these results suggest that auditors do not naturally consider bias when making adjustment decisions. Furthermore, prompting auditors to consider management bias before they make adjustment decisions does not affect auditors’ adjustment decisions, even for the frequent-overstatement portfolio that auditors deem to be more biased and for which current guidance otherwise encourages a relatively low adjustment. Additional results indicate that providing simple instructions about bias patterns affects management-bias assessments but not adjustment decisions. Overall, our results suggest that, even when auditors are taught about bias patterns, detect bias patterns, and are prompted to consider them, management-bias assessments do not significantly affect adjustment decisions.
Exploratory analyses indicate that auditors do sometimes diverge from a mechanical application of current guidance in two other respects. First, auditors are more likely to diverge when doing so results in higher post-audit income for the client. Second, auditors diverge from mechanical application of current guidance in the direction necessary to correct the aggregate error in the portfolios.

These results complement prior work on accounting estimates (e.g., Anderson, Brown, Hodder, and Hopkins 2015; Griffin 2014; Griffith et al. 2015a; Griffith et al. 2015b). Whereas prior research has tended to focus on Level 3 fair values, non-financial assets, and single or aggregate account balances, we focus on portfolios of Level 2 fair values of investments, which are critical for financial institutions as well as companies in general. We provide evidence that current guidance causes predictable effects on audit adjustments. We show a lack of relation between bias assessments and audit adjustments despite the presumption in standards and audit programs that such a relation exists. Although our experiment examines auditors’ decisions with respect to portfolios of investment securities, similar results might also be observed for other accounts, such as contingent liabilities and impairments of inventory, fixed assets and goodwill, if auditors produce an independent estimate and consider multiple items simultaneously.

We also contribute to the accounting and psychology literature by providing evidence about intuitive bias assessments. Our results extend prior research (Alba et al. 1994; Alba et al. 1999; Koonce and Lipe forthcoming) suggesting that humans intuitively detect bias via unexpected relative frequencies. We also provide evidence that unexpectedly large misstatements raise concerns about management bias, extending prior research examining attribution (Malle 2011) and perceptions of the size of monetary amounts (Thaler 1980).
These findings have implications for standard setters, auditors, and managers. Our results highlight that current PCAOB guidance places auditors in the difficult position of making the adjustment required by guidance or making the adjustment that corrects aggregate overstatement, and that auditors cope with this challenge by applying guidance somewhat mechanically, but also diverging predictably. Our results also indicate that these effects are unlikely to be mitigated by audit practice aids that include an assessment of management bias as a final check or even that require assessment of management bias prior to proposing audit adjustments. The most direct way to address these concerns is to modify audit standards to require that misstatements be calculated from the auditor’s best estimate (or expected value of a range of estimates), rather than basing misstatements on the nearest endpoint of the range of reasonable estimates. Alternatively, standard setters could require that further adjustments be considered whenever application of current guidance produces adjustment decisions which deviate sufficiently from what would correct for the aggregate error in an account. Finally, companies may want to consider altering control systems to be vigilant for error patterns that might be indicative of management bias, given that managers could exploit the tendency for auditors not to perceive bias in some patterns of evidence.

II. LITERATURE AND HYPOTHESES

Background

Companies are increasingly measuring assets and liabilities with fair-value estimates, sparking regulatory and research interest in the effectiveness of audits of fair values (Church and Shefchik 2012; Martin, Rich, and Wilks 2006). Recent audit research in this area focuses on the process auditors follow when auditing a single estimate for nonfinancial assets that fall in Level 3 of the FAS 157 fair value hierarchy (Backof, Thayer, and Carpenter 2016; Griffin 2014;
Griffith et al. 2015a; Griffith 2016; Rasso 2015). The most important audit issues in these studies typically relate to evaluating the reasonableness of a client’s estimation model, including its inputs and assumptions (Griffith et al. 2015b).

However, in banking and many other financial institutions, the largest fair value estimates are portfolios of investment securities that fall in Level 2 of the FAS 157 fair value hierarchy. Such fair value estimates account for approximately 92% of US banks’ fair value assets, summing to a value in excess of $8.65 trillion, and audits of Level 2 investment securities have resulted in more audit deficiencies in recent PCAOB inspection reports than any other type of fair value estimate (Church and Shefchik 2012, p. 54). Auditing these securities often involves a different audit process than the one investigated in most prior audit research. In particular, it requires an understanding of and attention to the distribution of errors across a portfolio of estimates that are usually valued by clients based on third-party estimates. We examine how experienced auditors apply current PCAOB guidance when auditing such estimates.

Auditing Guidance and Adjustment Decisions

As noted earlier, under AS 14.13, the difference between management’s estimate and the closest endpoint of a range of reasonable estimates (the “reasonable range”) is treated as a misstatement (see Figure 1 for an illustration). Specifically, the standard states:

“If the auditor concludes that the amount of an accounting estimate included in the financial statements is unreasonable … he or she should treat the difference between that estimate and a reasonable estimate … as a misstatement. If a range of reasonable estimates is supported by sufficient appropriate audit evidence and the recorded estimate is outside of the range of reasonable estimates, the auditor should treat the difference between the recorded accounting estimate and the closest reasonable estimate as a misstatement.”

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3 AS 14.13 is consistent with the underlying logic of FIN 14 on contingent liabilities which states that “When no amount within the range is a better estimate than any other amount, however, the minimum amount in the range shall be accrued..(para. 3)”
To make the meaning of the above statement more explicit, the standard goes on to say:

“If … the amount of the estimate is reasonable, a difference between an estimated amount best supported by the audit evidence and the recorded amount of the accounting estimate ordinarily would not be considered to be a misstatement (emphasis added).”

Griffin (2014) provides evidence that auditors follow AS 14.13 in the context of fixed-asset impairment recognition, proposing an adjustment based on the nearest endpoint of the auditors’ reasonable range. Griffin’s focus is on a single impairment, so he does not distinguish between applying AS 14.13 at the account level or at the level of the individual elements that make up the account. However, recent PCAOB inspection reports provide guidance indicating that, at least in the case of investments, the requirements of AS 14.13 should be applied to individual securities and not to the portfolio or account. The clearest indication of this requirement is in PCAOB 2012a, pp. 20-21), which identifies the following audit deficiency:

“In this audit, for certain of the issuer’s investment securities, the Firm obtained estimates of fair values from external pricing services for comparison to the issuer’s fair value measurements. The Firm established a threshold to identify pricing differences for further testing. The threshold, however, was for an aggregate difference at the portfolio level; this threshold caused the Firm not to identify significant differences in prices for individual securities (emphasis added).”

Similar though sometimes vaguer statements are made in other PCAOB inspection reports (e.g., PCAOB 2011a, 2011b, 2013, and 2014).

Our detailed conversations with three of the Big 4 auditing firms confirm that they have responded to this guidance by applying AS 14.13 on a security-by-security basis. To audit a

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4 International auditing standards (ISA 540, A.116) define misstatement in such cases as follows: “Where the auditor has concluded that using the auditor’s range provides sufficient appropriate audit evidence, a management point estimate that lies outside the auditor’s range would not be supported by audit evidence. In such cases, the misstatement is no less than the difference between management’s point estimate and the nearest point of the auditor’s range.” As discussed in Section 5, the slightly different wording of this international standard may lead to different auditor behavior. In this paper, we focus on the consequences of US auditing standards.

5 In these conversations, we were provided with access to relevant firm guidance and typical work paper formats from two of the firms. Our interpretation of the participating firm’s guidance was further confirmed through a detailed video conference with two industry expert partners from the participating firm.
particular security, the auditor first identifies an audit value that reflects the audit firms’ best estimate and then specifies a reasonable range as a percentage of that audit value (typically relying on the firm’s valuation specialists to obtain that information). If the client value of a security falls outside the auditor’s reasonable range, the difference between the client value and the nearest endpoint of the range is treated as a misstatement. The auditor considers all of the misstatements within an account when determining whether (and by how much) the client should adjust the account.

AS 14.13 provides an efficient approach for auditing estimates, and indeed its process of adjusting the client estimate to the nearest reasonable value mirrors intuitive heuristics identified in prior psychology research (Epley and Gilovich 2006). Similarly, specifying reasonable ranges as a percentage of best estimates appears to be a sensible way to size-adjust ranges, and is consistent with general theory in psychology and economics whereby the size of monetary differences is judged as a percentage of the total price (Kahneman and Tversky 1979, Thaler 1980). However, by codifying and applying these intuitive and efficient heuristics, the resulting approaches are vulnerable to predictable errors, similar to judgment rules codified in other professional standards (Hirshleifer and Teoh 2009). We hypothesize that the combination of applying standards on a security-by-security basis and specifying the reasonable range as a percentage of audit value can result in the auditor correcting different amounts of overstatement in portfolios that have the same aggregate overstatement, depending on how overstatement is distributed across securities within the portfolios.

Specifically, holding constant the aggregate overstatement in the portfolio, we focus on two main dimensions over which overstatement can be distributed within a portfolio of

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6 The width of the reasonable range depends on the nature of the security being audited. Auditors take into account a variety of factors when establishing the reasonable range, including the uncertainty of the estimate’s inputs.
estimates. Each of these dimensions increases the amount of overstatement that falls within a reasonable range and so is viewed as *allowable overstatement*, and decreases the amount that falls outside a reasonable range and so is viewed as *misstatement*.

First, overstatements can be concentrated in securities that have larger book values. Assuming auditors base reasonable ranges on a fixed percentage of security book values, larger book values imply larger reasonable ranges. Therefore, concentrating a given amount of overstatement in securities with larger book values results in more overstatement falling within the reasonable range and less overstatement falling outside of it.

Second, overstatements can be spread across many securities rather than concentrated in only a few securities. Given that each security has its own reasonable range, spreading a given amount of overstatement across many securities increases the amount of overstatement that falls within the reasonable range of some security, thereby decreasing the amount of overstatement that falls outside the reasonable range of some security.

These effects are illustrated by three highly simplified example portfolios (A, B, and C) shown in Figure 2. The portfolios differ on the two dimensions described above. Each portfolio contains three securities. For each security, *error* is calculated by comparing the book value recorded by the client (hereafter, the *client value*) with the auditor’s best estimate (hereafter, the *audit value*). For computational simplicity, we set audit value equal to the par value of the security in this example. The reasonable range of estimates is calculated by assuming that reported values should not vary from the audit value by more than 5% for this category of securities, and, following standards, the misstatement for a given security is calculated by computing the difference between the client value and the nearest endpoint of that range. The portfolios contain the same aggregate client value ($306) and aggregate audit value ($300), and
therefore the same aggregate overstatement ($6). But the portfolios differ in the distribution of overstatement across securities within the portfolio. As a consequence, they differ in the aggregate difference outside the reasonable range when misstatements are calculated on a security-by-security basis, which is the amount that the auditing guidance suggests should be included in the schedule of audit differences and considered for audit adjustment.

In Portfolio A, each security has the same audit value, two of the securities are understated (Securities 1 and 2) and one is overstated (Security 3). In this situation, which includes a larger number of small understatements and a smaller number of large overstatements in securities of the same audit value, the security containing the large overstatement also has a large percentage overstatement. As a consequence, the aggregate dollar difference outside the auditor’s reasonable range indicates the need for a large downward adjustment to the client value. In fact, application of current PCAOB guidance produces a surprising overcorrection whereby the downward adjustment ($11) is nearly twice as large as the aggregate overstatement in the portfolio ($6).\(^7\) As a consequence, if the auditor requires that adjustment, the resulting value reported in the financial statements ($306 - $11 = $295) is understated by nearly as large an amount as the initial overstatement in the portfolio. We call this portfolio the “large percent overstatement” portfolio.

In Portfolio B, like Portfolio A, two of the securities are understated (Securities 1 and 2) and one is overstated (Security 3). However, unlike Portfolio A, the overstated security in Portfolio B has a much larger book value compared to the understated securities. As a result of this, application of current PCAOB guidance produces an overcorrection because the total misstatement is calculated as an overstatement that exceeds the total error in the portfolio.

\(^7\) The overcorrection of Portfolio A would occur because correction decisions focus on the amount of error that falls outside the reasonable range of each security value. Given that each of the understatements is relatively small, most of each understatement falls inside the reasonable range, so it is ignored for purposes of calculating misstatements. As a consequence, even though there are more understatements than overstatements, the understatements don’t offset the overstatement in the calculation of total misstatement. Thus, applying AS 14.13 on a security-by-security basis produces the counterintuitive result of encouraging the auditor to require an overcorrection, because the total misstatement is calculated as an overstatement that exceeds the total error in the portfolio.
consequence, the security containing the large overstatement in Portfolio B has a smaller percent overstatement than does the overstated security in Portfolio A, and therefore has a smaller dollar overstatement outside the nearest threshold of the auditor’s reasonable range. If auditors calculate misstatement by focusing on the dollar difference outside their threshold, the distribution of overstatements in Portfolio B would lead to a significantly smaller adjustment than would the distribution in Portfolio A ($1 as opposed to $11), even though the aggregate overstatement ($6) is held constant across portfolios. Note that the small adjustment of Portfolio B still allows some overstatement of the portfolio value ($306 - $1 = $305, which exceeds the $300 audit value), but the amount of that overstatement is within the auditors’ 5% range so would not be considered a misstatement, even though that overstatement could exceed materiality thresholds for the audit. Most of the overstatement is effectively hidden in the large dollar value security. We call this portfolio the “small percent overstatement” portfolio.

In Portfolio C, like Portfolio A, the securities all have the same audit value. However, in Portfolio C one of the securities is understated (Security 1) and two are overstated (Securities 2 and 3). The overstatement is spread across more securities (Securities 2 and 3) so, like Portfolio B, the securities containing the overstatements in Portfolio C have smaller percent overstatements than does the overstated security in Portfolio A, and therefore have smaller dollar overstatements outside of the auditor’s threshold. If auditors calculate misstatement by focusing on the dollar difference outside the threshold, this pattern could lead to a significantly smaller adjustment to management’s estimates than does the pattern in Portfolio A, even though the aggregate overstatement is held constant across portfolios. The overstatement is effectively hidden by spreading it across multiple securities. We call this portfolio the “frequent overstatement” portfolio.
These three portfolios do not differ in aggregate client value, aggregate audit value, or aggregate overstatement, so applying AS 14.13 at the portfolio level would produce the same amount of adjustment in each portfolio. However, if auditors apply AS 14.13 on a security-by-security basis as encouraged in recent PCAOB guidance, they will require a relatively larger adjustment when overstatements occur as a large percentage of securities with small book values (as in Portfolio A) and require smaller adjustments when overstatements occur as a smaller percentage of securities with large book values (as in Portfolio B) or are spread across numerous securities with moderate book values (as in Portfolio C). This reasoning leads to our first hypotheses:

**H1a**: Holding constant the aggregate overstatement in a portfolio, auditors require greater adjustment to a portfolio when overstatements are a large percentage of securities with a small book value (as in Portfolio A) than when overstatements are a small percentage of securities with a large book value (as in Portfolio B).

**H1b**: Holding constant the aggregate overstatement in a portfolio, auditors require greater adjustment to a portfolio when overstatements are concentrated in a few securities (as in Portfolio A) than when overstatements are spread across many securities (as in Portfolio C).

H1a and H1b predict that current guidance drives auditors to make adjustments that are relatively large (in the case of Portfolio A) or small (in the case of Portfolios B and C), relative to the aggregate overstatement present in a portfolio. Thus, the auditor faces a disconcerting choice: should they make the adjustment indicated by current guidance, or make the adjustment that would correct aggregate overstatement? As part of our test of H1a and H1b, we examine how auditors respond to that conflict.

**Management-Bias Assessments**

One reason why auditors could require different adjustments than indicated by AS 14.13 and related guidance is that they identify evidence of management bias. In fact, the portion of AS 14.13 cited above ends with the warning: “Paragraph 27 discusses evaluating accounting
estimates for bias.” Yet, professional standards do not provide a concrete definition of management bias. Rather, they imply that auditors should be concerned about the potential for management bias when qualitative indicators suggest that management has made judgments that cause financial statement amounts to deviate in the direction of management’s incentives and pressures (PCAOB 2012b). Qualitative indicators include patterns of individually reasonable accounting estimates that tend to favor higher or lower income, or swings in estimates from year to year to achieve desired earnings outcomes (AS 14.27). However, specific patterns that are indicative of bias are not identified. As a consequence, it is up to auditors to recognize patterns of evidence that they view as indicative of management bias, and to determine how (if at all) to modify their adjustment decisions in light of that assessment.

Prior research provides evidence that experienced auditors develop sophisticated knowledge that informs their judgments and enhances their skepticism under some circumstances (see Libby and Luft 1993; Solomon and Trotman 2003; Nelson 2009; and Hurtt, Brown-Liburd, Earley, and Krishnamoorthy 2013 for reviews). This knowledge could include patterns of evidence indicative of error (Hammersley 2006) or management bias and trigger auditor skepticism about management estimates. However, while prior research has examined auditors’ judgments and decisions with respect to accounting estimates (e.g., Martin et al. 2006; Christensen, Glover, and Wood 2012; Bell and Griffin 2012; Bratten et al. 2013; Griffin 2014; Griffith et al. 2015a; Wolfe, Fitzgerald, and Newton 2014; Griffith et al. 2015b), no studies have

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8 Specifically, AS 14.27 states: “If each accounting estimate included in the financial statements was individually reasonable but the effect of the difference between each estimate and the estimate best supported by the audit evidence was to increase earnings or loss, the auditor should evaluate whether these circumstances indicate potential management bias in the estimates. Bias also can result from the cumulative effect of changes in multiple accounting estimates. If the estimates in the financial statements are grouped at one end of the range of reasonable estimates in the prior year and are grouped at the other end of the range of reasonable estimates in the current year, the auditor should evaluate whether management is using swings in estimates to achieve an expected or desired outcome, e.g., to offset higher or lower than expected earnings.”
directly examined auditors’ detection of bias patterns within particular accounts. Our examination of firm guidance also provides little insight on this issue.

The closest psychology research is set in the behavioral marketing literature and examines how discount frequency and depth affect the manner in which consumers evaluate the pricing of bundles (portfolios) of goods at either the store or brand level (Alba et al. 1994; Alba et al. 1999). For example, Alba et al. (1994) compare consumer judgments of discounts in the prices within bundles of goods at two stores. The bundles have the same total price, but one store has lower prices on two thirds of the items (similar to Portfolio C above) and the other store has lower prices on one third of the items but by an amount double that of the other store (similar to Portfolio B). Alba et al.’s consumers judge the store with the frequent shallow discounts to have more discounted (or, by analogy in our setting, more biased) prices than the store with less frequent but bigger discounts. Similar results are provided by Koonce and Lipe (forthcoming), who examine how MBA-student investors respond to firms that are inconsistent in meeting earnings benchmarks. Koonce and Lipe provide evidence that these prospective investors are more concerned about the frequency with which firms meet or beat benchmarks than they are about the magnitude by which firms meet or beat benchmarks. When applied to our setting, this prior literature suggests that auditors may rely more on the frequency of price differences than the dollar magnitude of price differences, suggesting the following hypothesis:

**H2a:** Auditors perceive more management bias in a portfolio that has a higher proportion of small-dollar overstatements (as in Portfolio C) than they do in a portfolio that has a smaller proportion of large-dollar overstatements (as in Portfolio B).

Our earlier discussion noted that current standards for determining audit adjustments focus auditors on large percent differences, and that this focus is consistent with literature in psychology and economics providing evidence that the size of monetary differences is judged as a percentage of the total price (Kahneman and Tversky 1979, Thaler 1980). Research in
psychology also provides evidence that people who observe an event seek to attribute that event to some underlying cause, which could be the individual or external circumstances associated with the event (see Malle 2011 for a review). Given that auditors are aware that a large percent overstatement in an estimate falls outside the reasonable range and will be labeled a misstatement, and that management judgment could influence the estimate, we anticipate that they are relatively likely to attribute this event to the individual (management) responsible for it, and assess higher management bias. Thus, we hypothesize that auditors will use percent magnitude to judge management bias, as indicated in the following hypothesis:

\[H2b: \text{Auditors perceive more management bias in a portfolio in which overstatements are a large percentage of securities with a small book value (as in Portfolio A) than they do in a portfolio in which overstatements are a small percentage of securities with a large book value (as in Portfolio B).}\]

We have no basis upon which to predict different perceptions of bias in Portfolio A versus C.

**Relationship Between Management-Bias Assessments and Adjustment Decisions**

As indicated above, AS 14.27 explicitly encourages auditors to consider management bias when auditing estimates, presumably because the PCAOB wants auditors to consider the potential for bias when making adjustment decisions. Yet, AS 14 is silent as to how auditors are supposed to incorporate bias assessments into their adjustment decisions. Also, recent research provides evidence that auditors adopt an “implemental mindset” when auditing estimates, applying procedures somewhat mechanistically rather than engaging in additional judgment that is not specifically required (Griffith et al. 2015a). Thus, it is unclear whether auditors spontaneously incorporate management-bias assessments into their adjustment decisions.

To the extent that auditors do not spontaneously incorporate management-bias assessments into their adjustment decisions, they may be more likely to do so when prompted to consider bias prior to making adjustment decisions. Consistent with this possibility, prior
research provides evidence that auditors are better able to anticipate managers’ strategic bias when prompted to think strategically (Hoffman and Zimbelman 2009; Bowlin 2011), and that auditors adopt a more skeptical mindset when prompted to do so (Griffith et al. 2015a). In light of these findings, we make the following hypothesis:

**H3**: Auditors’ management-bias assessments have a larger effect on auditors’ adjustment decisions when auditors are prompted to assess bias prior to making adjustment decisions.

As discussed further in Sections 3 and 4, we test H3 by varying whether bias is assessed before or after adjustment decisions. We focus our tests on comparisons between Portfolios B and C, because we predict that a mechanistic application of AS 14.13 would yield the same adjustment decision for those portfolios but we also predict higher bias assessments for Portfolio C than for Portfolio B. Thus, if auditors are willing to incorporate bias assessments in their adjustment decisions but do not do so spontaneously, prompting them to consider bias should have a greater effect on adjustment decisions for Portfolio C than for Portfolio B.9

Of course, auditors might not incorporate bias assessments in their adjustment decisions because they lack knowledge of the patterns of overstatement that could indicate bias. Therefore, as discussed more in Section 3, we also explore whether instruction about bias patterns affects auditors’ bias assessments.

### III. METHOD

**Participants**

Experienced auditors were contacted by their firm to participate in an online experiment. 112 auditors participated, all of whom are employed by a single “Big 4” firm. They have, on

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9 Because we predict both large adjustments and large bias assessments for Portfolio A, prompting auditors to consider bias is unlikely to have an effect, so we exclude that setting when testing H3.
average, 7.4 years of audit experience and are partners, managers or experienced seniors within their firm (1% partners, 68% managers, and 31% seniors). 110 have at least some experience in the financial-services industry, and the vast majority primarily audit clients from the financial-services industry.\textsuperscript{10} Participants specialize in a variety of sub-industries within financial services, including real estate, insurance, banking, and asset management.\textsuperscript{11}

**Design and Overview**

We conducted a 3x2 between-subjects experiment in which participants judged the amount of misstatement and bias in a portfolio of trading securities. *Portfolio* varies how overstatement is distributed across securities in the portfolio that participants audited. *Order* varies whether auditors assessed management bias before or after specifying a required adjustment. We modeled our experimental materials after actual audit work papers provided to us by two Big 4 audit firms. Furthermore, we consulted with several Big 4 practice partners from the firm providing participants to ensure the realism of our experimental materials.

**Independent Variables**

**Portfolio Manipulation**

In the experimental task (described in detail below), participants audited a portfolio of trading securities, and we manipulated how overstatement is distributed across the securities in the portfolio. In particular, we created three portfolios of securities that correspond conceptually to the three portfolios depicted in Figure 2 and discussed in Section 2 of the paper. We first created the simplified eight security portfolios in Appendix A and then added small perturbations to the prices of the securities and randomized their order to produce the actual portfolios.

\textsuperscript{10} When asked to indicate what percentage of their audit experience is with financial-services industries, 11 participants indicated 1-20\%, 7 indicated 21-40\%, 6 indicated 41-60\%, 18 indicated 61-80\%, and 68 indicated 81-100\%. Thus, most participants have significant experience auditing clients from the financial services industries.

\textsuperscript{11} When asked to indicate their primary expertise within the financial-services industry, 3 indicated real estate, 22 indicated insurance, 34 indicated banking, and 50 indicated asset management.
included in the experiment and presented in Appendix B. We refer to these three portfolios as A, B, and C, but did not attach those labels to the portfolios in the experiment.

 Across all three portfolios, we held constant the aggregate client value, the aggregate audit value, and therefore the aggregate overstatement in the portfolio. Across the securities in all three portfolios, the auditor sets a reasonable range of 5% around the audit estimate. We chose this range after consulting with multiple participating-firm audit partners from the financial services industry as well as their firm guidance about an appropriate range for this class of securities. Consistent with the three portfolios in Figure 2, to manipulate the distribution of overstatement across securities, we varied whether overstatements were concentrated in securities with larger or smaller book values and whether overstatements were seeded across many securities or only a few securities. The simplified eight security portfolios in Appendix A were created as follows:

*Portfolio A* (see Appendix A) operationalizes the “large percent overstatement” portfolio. Six of the securities are understated (Securities 1 through 6) and two are overstated (Securities 7 and 8). Also, each security has the same audit value. In this situation, which includes a large number of small understatements and a small number of large overstatements in securities of the same book value, the securities containing large overstatements also have large percent overstatements. As a consequence, the total dollar difference outside the auditor’s reasonable range indicates the need for a large downward adjustment to management’s estimates.

*Portfolio B* (see Appendix A) operationalizes the “small percent overstatement” portfolio. Like Portfolio A, six of the securities are understated (Securities 1 through 6) and two are overstated (Securities 7 and 8). However, unlike Portfolio A, the overstated securities have much larger book values compared to the understated securities. As a consequence, the securities
containing the large overstatements have smaller percent overstatements than do the overstated securities in Portfolio A, and therefore have smaller dollar overstatements outside the auditor’s reasonable range.

*Portfolio C* (see Appendix A) operationalizes the “frequent overstatement” portfolio. Like Portfolio A, the securities all have the same audit value. However, in Portfolio C, two of the securities are understated (Securities 1 and 2) and six are overstated (Securities 3 through 8), such that the overstatement is spread out across many securities (Securities 3-8). As a consequence, like Portfolio B, the overstated securities have smaller percent overstatements than do the overstated securities in Portfolio A, and therefore have smaller dollar overstatements outside of the auditor’s reasonable range.

We created the eight-security portfolios in Appendix B that were used in the experiment by modifying the simplified eight-security portfolios in Appendix A. In particular, we (1) created small perturbations in the client price and auditor price and (2) varied the order of the securities. These modifications allowed us to create more realistic portfolios without changing the key features of the portfolios (we still held constant the aggregate client value, the aggregate audit value, and therefore the aggregate overstatement in the portfolio).

**Order Manipulation**

In the experimental task, auditors assessed (1) the total adjustment the client would have to make in order to receive an unqualified opinion and (2) whether the information about securities indicates bias in management’s estimates. We counterbalanced the order of these two questions. Auditors answered each question in order and were not allowed to change their answer to the previous question.
Dependent Variables

Adjustment Decision

We measured participants’ adjustment decisions by asking the following question: “With respect to the securities listed above, what is the total adjustment that the client would have to make in order for the client to receive an unqualified opinion?” Participants indicated their answer by typing a number into a box labeled “A total adjustment to decrease the client’s reported value by:” Participants then were asked to explain their answer in a text box.

Management-Bias Assessment

We measured participants’ bias assessment by asking the following question: “Does the information about securities presented above indicate bias in management’s estimates?” Participants indicated their answer on an 11-point Likert scale, anchored at 1 “Bias to reduce net income by understating market value” on one end, 11 “Bias to increase net income by overstating market value” on the other end, and 6 “No bias” in the middle. Participants then were asked to explain their answer in a text box.

Task

The experimental task consisted of three phases: (1) instructions, (2) assessments, and (3) bias instruction and re-assessments. We describe these phases in greater detail below.

Instructions

Participants were told to assume they were auditing Universal Bank and Trust (UB&T), a fictitious regional bank that provides a full range of banking and trust services in New York and Pennsylvania. Participants learned that they would be auditing the bank’s trading securities
portfolio. UB&T valued these securities after consulting third-party pricing information provided by IDC and several other pricing services. The audit firm obtained an independent estimate of security values after considering independent pricing information from S&P, the third-party pricing service considered most reliable by the audit firm.

Assessment

After reading general instructions, participants proceeded to the assessment screen. On this screen, they were told to assume the following:

1. The audit team has examined the entire trading securities portfolio.
2. The securities in the table below represent only those securities with reported values that differ from the audit firm’s independent estimate by more than the 5% audit pricing threshold.
3. The remaining securities (those not included in the table below) have market value differences that are very small and sum to an amount near zero.
4. The team obtained and analyzed vendor memos and consulted other pricing services as necessary to better understand the audit differences. After performing these additional procedures, the team concluded that the audit price is the most supportable.
5. The client prefers to make no audit adjustment to the value of these securities.
6. Materiality for the financial statements as a whole is $250,000. No qualitative materiality considerations exist.

Participants then viewed one of the portfolios of securities from Appendix B. Participants were first asked to assess bias or to make an adjustment decision, depending on the order manipulation discussed above. They then viewed an identical screen asking them to make the

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12 We focused on an audit of trading securities rather than available-for-sale securities for two main reasons. First, the unrealized gains and losses from trading securities are reflected in net income, and thus are of greater concern to managers and auditors. Second, this design choice allows us to abstract away from the complexity of testing for other-than-temporary-impairments.
13 We stated that UB&T consulted several pricing services in order to create a setting in which management bias is plausible (e.g., by “cherry-picking” the best prices, or by modifying a price provided by a third party).
14 We developed these assumptions in consultation with several practice partners at a Big 4 firm in order to help participants focus on the judgments of interest. Auditors typically do not make adjustment decisions or bias assessments until after performing procedures that help them understand any difference between their estimate and the client’s estimate, so we instructed participants that those procedures had already been performed.
judgment they did not make on the first screen (an adjustment decision or bias assessment). Participants were not allowed to go back and change their previous answer.

**Management-Bias Instruction and Re-Assessment**

After completing the assessment phase of the experiment and an attention check question, participants proceeded to the bias instruction and re-assessment phase of the experiment. In this phase, participants first read a brief tutorial on different patterns that can indicate bias in management’s estimates. That tutorial contained the following text:

“Different patterns of evidence can indicate bias in management’s estimates of the market value of its investments. For example:

- In a portfolio of **equal**-sized investments, management could misstate the market value of a **few** investments by a **large** percentage.
- In a portfolio of **equal**-sized investments, management could misstate the market value of **many** investments by a **small** percentage.
- In a portfolio of **unequal**-sized investments, management could misstate the market value of a **few large** investments by a **small** percentage.”

The instructions thus suggested that bias could be judged by emphasizing the percent magnitude, frequency, or dollar magnitude of price differences, respectively. After reading this information, participants made management-bias assessments and adjustment decisions simultaneously for all three portfolios shown in Appendix B. That is, regardless of the portfolio they viewed in the initial assessment stage of the task, participants viewed all three portfolios on a single screen and made a management-bias assessment and an adjustment decision for each portfolio on that screen. This re-assessment was designed to maximize the chance that

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15 As an attention check, we asked participants to indicate the firm’s reasonable range for the securities they audited in the assessment phase of the task. Three participants answered the question incorrectly. We report analyses throughout the paper that include these participants, but inferences are unchanged when conducting analyses that exclude these participants.

16 We counterbalanced the order in which the portfolios were presented to participants. Participants provided their management-bias assessments first and adjustment decisions second regardless of the order in which they provided
participants could recognize bias patterns and consider management bias when making their adjustment decisions. Participants finished the experiment by answering a question that measured their familiarity with the requirements of AS 14.13\textsuperscript{17} as well as demographic questions.

IV. RESULTS

Attrition

A senior partner at a “Big 4” audit firm provided a web link to our data-collection program to auditors who had clients in the financial-services industry. 170 auditors clicked the link, and of these, 120 answered the first question and 112 finished the entire study. We base our analyses on data from the 112 auditors who finished the study, but inferences are unchanged when analyzing available data from all 120 participants.

Tests of Hypotheses

We test our hypotheses by conducting 3 x 2 ANOVAs with \textit{Portfolio} and \textit{Order} as independent variables. One ANOVA uses adjustment decisions as the dependent variable for our tests of H1 and H3, and another uses management-bias assessments as the dependent variable for our tests of H2.

Tests of \textit{H1a} and \textit{H1b}

\textit{H1a} and \textit{H1b} both make predictions about auditors’ adjustment decisions. We report descriptive statistics for auditors’ adjustment decisions in Table 1, Panel A, and plot mean

\textsuperscript{17} In particular, we provided participants with a simple example of a client’s estimate ($10) that differed from the auditor’s estimate ($5). Participants were told that there was a reasonable range around the audit estimate ($3-$7), and were asked to indicate what current auditing standards would indicate is the minimum amount of misstatement. Throughout the text, we refer to participants who indicated $3 as participants who are more familiar with the requirements of AS 14.13 and those who indicated other amounts as participants who are less familiar with the requirements of AS 14.13.
adjustment decision for our six between-subjects conditions in Figure 3. Table 1, Panel B provides the results of an ANOVA with Portfolio and Order as the independent variables and adjustment decision as the dependent variable. As seen in Table 1, Panel B, Portfolio significantly impacts auditors’ adjustment decision (p < 0.001, one-tailed). Order does not significantly impact auditors’ adjustment decisions, either as a main effect (p = 0.486, two-tailed) or as an interaction with Portfolio (p = 0.235, one-tailed).

We test H1a and H1b with linear contrasts, which are summarized in Table 1, Panel C. H1a predicts that auditors will require greater adjustment to a portfolio of securities when overstatements are a large percentage of securities with a small book value (as in Portfolio A) than when overstatements are a small percentage of securities with a large book value (as in Portfolio B). Table 1, Panel C reveals that auditors required higher adjustments to Portfolio A than to Portfolio B (p < 0.001, one-tailed), supporting H1a. H1b predicts that auditors will require greater adjustment to a portfolio of securities when overstatements are concentrated in a few securities with a small book value (as in Portfolio A) than when overstatements are spread across many securities with a small book value (as in Portfolio C). Table 1, Panel C reveals that auditors required higher adjustments to Portfolio A than to Portfolio C (p < 0.001, one-tailed), supporting H1b. In an untabulated analysis, we compare adjustment decisions for portfolios B and C and find that auditors do not require different adjustment decisions for those portfolios [t(106) = 0.32; p = 0.752, two-tailed].

These results indicate that even though these portfolios do not differ in aggregate overstatement, auditors required smaller adjustments when overstatements were seeded in securities with large book values (as in Portfolio B) or spread among numerous securities (as in Portfolio C) than when overstatements were seeded in securities with small book values (as in
Portfolio A). As a consequence, auditors required adjustments for Portfolio A that are approximately $269,000 higher than the aggregate overstatement in the portfolio, and this difference is marginally significant \([t(34) = 1.82; p = 0.077, \text{two-tailed}]\). For Portfolios B and C, auditors required adjustments that are approximately $1,190,000 and $1,114,000 lower than the aggregate overstatement in the portfolio, and these differences are significant [Portfolio B: \(t(36) = 9.91; p < 0.001, \text{two-tailed} \); Portfolio C: \(t(39) = 9.07; p < 0.001, \text{two-tailed} \)].

Thus, auditors’ adjustments are influenced by the requirements of AS 14.13 as it is applied on a security-by-security basis and based on a reasonable range that is determined as a percentage of the audit value of each security. However, as shown in Figure 3, results also suggest that auditors require adjustments that, on average, diverge from those implied by mechanically applying AS 14.13 on a security-by-security basis in the direction of correcting the aggregate overstatement ($1,860,000) in the portfolios. For portfolio A, auditors’ mean adjustment is approximately $1,280,000 lower than the $3,410,000 adjustment implied by a mechanical application of auditing guidance, and this difference is significant \([t(34) = 8.67; p < 0.001, \text{two-tailed}]\). For portfolios B and C, auditors required an adjustment that is approximately $360,000 and $412,000 higher than the $310,000 minimum adjustment indicated by auditing guidance, and these differences are significant [Portfolio B: \(t(36) = 2.99; p = 0.005, \text{two-tailed} \); Portfolio C: \(t(39) = 3.29; p = 0.002, \text{two-tailed} \)].

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18 A debriefing question assessed participants’ knowledge of auditing standards by asking them to apply AS 14.13 to a simple example. 80% of participants indicated the adjustment required by AS 14.13. A binary AS 14.13 “knowledge” variable (correct/incorrect answer to the debriefing question) does not interact significantly with portfolio or order in any hypothesis test. Results do indicate that participants with lower knowledge of AS 14.13 proposed larger deviations from the adjustment suggested by mechanical application of guidance \([F(1,106) = 7.49; p = 0.007, \text{two-tailed}]\). However, regardless of level of knowledge, participants deviated significantly in the direction of correcting the aggregate error for each of the three portfolios. Thus, results cannot be explained by differences in knowledge of AS 14.13.
A closer look at median responses highlights an asymmetry in this tendency. Table 1, Panel A provides the median required adjustment for each portfolio, and Figure 4 provides histograms of adjustment decisions. The histograms reveal an “all or none” tendency for auditors to choose either to make the adjustment indicated by applying AS 14.13 at the security-by-security level or instead making the adjustment necessary to correct aggregate overstatement in the portfolio. For Portfolio A, auditors’ median required adjustment is equal to the aggregate overstatement in the portfolio ($1,860,000). In fact, most participants assigned to audit Portfolio A required an adjustment equal to the aggregate overstatement in the portfolio, while a smaller proportion of participants required an adjustment equal to the amount implied by a mechanical application of auditing guidance ($3,410,000). A non-parametric sign test (untabulated) confirms that for Portfolio A, auditors adjusted an amount less than the adjustment implied by a mechanical application of auditing guidance in the direction of correcting the aggregate overstatement [$M(34) = 14.5; p < 0.001$, two-tailed]. In contrast, for Portfolios B and C, auditors’ median required adjustment ($310,000) is the adjustment implied by a mechanical application of auditing guidance, and non-parametric sign tests confirm that for these portfolios auditors did not adjust more than the adjustment implied by a mechanical application of auditing guidance [Portfolio B: $M(36) = 1.5; p = 0.701$, two-tailed; Portfolio C: $M(39) = 2; p = 0.597$, two-tailed].

Thus, at least in the context of our three portfolios, auditors appear to be more willing to reduce the adjustment implied by a mechanical application of auditing guidance (as observed for Portfolio A) than they are to increase it (as observed for Portfolios B and C). This asymmetry is consistent with auditors recognizing the fallacy of creating a large aggregate understatement in order to correct an aggregate overstatement. It also is consistent with auditors being more willing
to deviate from mechanical application of auditing guidance when doing so results in higher client income.

Tests of H2a and H2b

H2a and H2b both make predictions about auditors’ assessments of management bias. We report descriptive statistics for auditors’ bias assessments in Table 2, Panel A, and plot mean bias assessment for our six between-subjects conditions in Figure 5. Table 2, Panel B provides the results of an ANOVA with Portfolio and Order as the independent variables and bias assessment as the dependent variable. As seen in Table 2, Panel B, Portfolio significantly impacts auditors’ bias assessment (p = 0.001, one-tailed). Order does not significantly impact auditors’ bias assessments, either as a main effect (p = 0.354, two-tailed) or as an interaction with Portfolio (p = 0.301, two-tailed).

We test H2a and H2b with linear contrasts, which are summarized in Table 2, Panel C. H2a predicts that auditors are more likely to rely on the frequency of price differences than the dollar magnitude of those differences when assessing management bias. Specifically, H2a predicts that auditors will perceive more bias in a portfolio of securities that has a larger proportion of small overstatements (as in Portfolio C) than in a portfolio that has a smaller proportion of large overstatements (as in Portfolio B). Table 2, Panel C reveals that auditors assessed Portfolio C to be more biased than Portfolio B (p = 0.004, one-tailed), supporting H2a.

H2b predicts that auditors are more likely to emphasize the percent magnitude than the dollar magnitude of price differences when assessing management bias. Specifically, H2b predicts that auditors will perceive more bias in a portfolio of securities in which overstatements are a large percentage of securities with a small book value (as in Portfolio A) than they will in a portfolio in which overstatements are a small percentage of securities with a large book value (as
in Portfolio B). Table 2, Panel C reveals that auditors assessed Portfolio A to be more biased than Portfolio B (p < 0.001, one-tailed), supporting H2b.

These results suggest that auditors’ management-bias assessments tend to emphasize the frequency and percent magnitude of price differences, but not the dollar magnitude of price differences.

**Test of H3**

H3 predicts that auditors’ management-bias assessments will have a larger effect on auditors’ adjustment decisions when auditors are prompted to assess bias prior to making adjustment decisions than when auditors are prompted to make adjustment decisions prior to assessing bias. We test this prediction by investigating whether assessing bias prior to making adjustments makes auditors relatively more likely to require higher adjustments for Portfolio C than for Portfolio B. Given that we find support for our prediction in H2a that auditors perceive more bias in Portfolio C than in Portfolio B, but mechanical application of AS 14.13 on a security-by-security basis would lead to the same adjustment decision, prompting auditors to consider bias before making adjustment decisions should lead auditors to require higher adjustments for Portfolio C than for Portfolio B to the extent that auditors (a) believe that bias is relevant to adjustment decisions and (b) do not spontaneously consider bias when making adjustment decisions.

Table 1, Panel B contains the results of an ANOVA with Portfolio and Order as independent variables and adjustment decisions as the dependent variable. As noted previously, Order is not significant as a main effect or as an interaction with Portfolio. We test H3 with a linear contrast, which is summarized in Table 1, Panel C. That contrast reveals that the difference in required adjustments for Portfolios B and C does not depend on the order in which
management-bias assessments and adjustment decisions are elicited, contrary to our prediction in H3 (p = 0.517). This result suggests that auditors either (a) do not incorporate bias assessments into adjustment decisions or (b) spontaneously consider bias when making adjustment decisions. Given that bias judgments were different for Portfolios B and C but adjustment decisions did not differ, the second explanation seems unlikely.19

**Supplemental Analysis**

**Does Instruction About Management-Bias Patterns Influence Auditors’ Bias Assessments?** Results of H2a and H2b support our predictions that auditors are more likely to respond to the *frequency* and *percent magnitude* of price differences than the *dollar magnitude* of price differences when assessing management bias. As a consequence, auditors may be less likely to identify some potential patterns of management bias (e.g., locating misstatements in particularly large securities). Also, any individual auditor might not naturally identify any of the bias patterns we operationalize. Therefore, as an exploratory analysis, we test whether instructing auditors about various patterns of bias makes them more sensitive to patterns of bias that they do not recognize without instruction.

Table 3, Panel A provides descriptive statistics for auditors’ management-bias assessments before and after bias instruction for the portfolio that the participant evaluated in the first (between participants) part of our experiment. Table 3, Panel B provides the results of a mixed model analysis that controls for dependence in participants’ responses across phases of the task20, with *Portfolio* and *Instruction* as independent variables and bias assessment as the dependent variable.

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19 We conduct a similar analysis with bias assessment as the dependent variable and find similar results.
20 Mixed models control for within-subject dependency by specifying a parametric structure for the covariance matrices (Littell, Milliken, Stroup, Wolfinger, Schabenberger 2006). We use this approach, rather than the more conventional “repeated-measures ANOVA” approach, because it allows for more flexibility in testing specific
dependent variable. As seen in Table 3, Panel B, Portfolio continues to significantly impact auditors’ bias assessments (p < 0.001, one-tailed). Further, Instruction increases auditors’ bias assessments (p < 0.001, two-tailed). We also observe a significant interaction between Portfolio and Instruction (p = 0.018, two-tailed). We decompose this interaction in Panel C using linear contrasts.

Table 3, Panel C reports three comparisons of interest. First, the table reveals that instruction about bias patterns increased auditors’ bias assessments for Portfolio B more than it increased bias assessments for Portfolio C (p = 0.019 two-tailed). Second, the table reveals that instruction about bias patterns increased auditors’ bias assessments for Portfolio A more than it increased auditors’ bias assessments for Portfolio C (p = 0.012, two-tailed). Finally, the table reveals that the effect of instruction about bias patterns on auditors’ bias assessments did not differ for Portfolio A and Portfolio B (p = 0.835, two-tailed).

The results in Table 3, Panel C suggest that instruction had a greater effect on management-bias assessments for Portfolios A and B than for Portfolio C. These results are consistent with auditors naturally seeing bias in frequent overstatements, and instruction increasing recognized bias in large percent magnitude and large dollar magnitude portfolios.

**Does Instruction About Management-Bias Patterns Influence Auditors’ Adjustment Decisions?** Given that instruction about management-bias patterns increased auditors’ bias assessments for Portfolios A and B, we now explore whether bias instruction also increases auditors’ adjustment decisions for those portfolios. Table 4, Panel A provides descriptive statistics for auditors’ adjustment decisions before and after bias instruction, and Table 4, Panel

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21 If we Bonferroni adjust for multiple simultaneous comparisons, the p-value for the comparison between Portfolios B and C is 0.054, and between Portfolios A and C is 0.036.
B provides the results of a mixed model analysis that controls for dependence in participants’ responses across phases of the task, with Portfolio and Instruction as the independent variables and adjustment decision as the dependent variable. As seen in Table 4, Panel B, Portfolio continues to significantly impact auditors’ adjustment decisions (p < 0.001, one-tailed), but Instruction does not impact auditors’ adjustment decisions, either as a main effect (p = 0.618, two-tailed) or as an interaction with Portfolio (p = 0.849, two-tailed). Untabulated analyses reveal that Instruction does not impact adjustment decisions for any of the portfolios (all p > 0.50, two-tailed). Together with our results for H3, these results suggest that auditors do not incorporate bias assessments into adjustment decisions, even when they are instructed about bias patterns and detect bias patterns in management’s estimates.

One potential reason why auditors may not have changed their adjustment decisions during the re-assessment phase of the task is that they desired to maintain consistency in their answer from the assessment phase of the experiment. To examine this possibility, we analyzed auditors’ adjustment decisions from the re-assessment phase of the task for only those portfolios that auditors did not view in the initial assessment phase of the experiment. Recall that during the re-assessment phase of the task, auditors provided bias assessments and adjustment decisions for all three portfolios. This allows us to compare auditors’ adjustment decisions before and after management-bias instruction, without the potential biasing effects of auditors’ desire to maintain consistency in their answers across the two phases of the experiment. For example, if a participant was assigned to Portfolio A in the assessment phase of the task, we include in this analysis their adjustment decision for Portfolio A from the assessment phase of the task, and their adjustment decisions for Portfolios B and C from the reassessment phase of the task.
We run a mixed model analysis that controls for dependency in participants’ responses across phases of the task, with Portfolio and Instruction as independent variables and adjustment decision as the dependent variable. This analysis (untabulated) reveals a significant main effect of Portfolio \( F(1,219) = 100.55; p < 0.001, \) one-tailed, a marginally significant main effect of Instruction \( F(1,111) = 3.87; p = 0.052, \) two-tailed, and an insignificant interaction between Portfolio and Instruction \( F(1,219) = 0.37; p = 0.693, \) two-tailed. Further analysis reveals that Instruction produced marginally higher adjustment decisions for Portfolio A \( t(219) = 1.79; p = 0.075, \) two-tailed, but not for Portfolios B and C [Portfolio B: \( t(219) = 0.97; p = 0.332, \) two-tailed; Portfolio C: \( t(219) = 0.65; p = 0.514, \) two-tailed]. Overall, the lack of an effect of Instruction in this analysis suggests that the general lack of effect of Instruction isn’t due to a desire for consistency between assessment and re-assessment.

**V. CONCLUSION**

Our results provide evidence that auditors make different adjustment decisions for investment portfolios with the same amount of aggregate overstatement, depending on the distribution of overstatement within the portfolio. These results indicate that auditors’ adjustment decisions are affected by guidance in AS 14.13 as applied on a security-by-security basis. Results also indicate that auditors exercise their judgment to make adjustment decisions that deviate in the direction of correcting for the aggregate overstatement in the portfolio, particularly when failing to do so would understate their client’s income. This result suggests that auditors recognize that professional audit guidance sometimes suggests an adjustment that is counterintuitive and consider that as well as their clients’ preferences when making adjustment decisions.
Results also indicate that auditors are more likely to spontaneously perceive some management-bias patterns than others. In particular, they are more likely to identify the patterns that we identify as “percentage magnitude” and “frequency” than they are the pattern “dollar magnitude”. As a consequence, the management-bias strategy of “hide the bias in the bigger account balances” is more likely to go undetected by auditors than are strategies of “bias a few accounts by a large percentage” or “bias many accounts by a small amount.” However, our results suggest that even the management-bias patterns that auditors detect do not influence their adjustment decisions, even when auditors are prompted to consider bias before making their adjustment decisions. Further, while our instruction concerning bias patterns affects bias assessments for some patterns, the instruction has no effect on adjustment decisions.

One limitation to this study is that our task necessarily abstracts from actual audit settings, with auditors assessing a small number of securities and lacking access to all of the information they otherwise would have available. We worked with technical partners to ensure that our stimuli reflected key attributes of the setting, but other considerations, like client explanations for audit differences, could potentially affect these decisions. Those additional features could influence the magnitude of our effects, but should not affect their direction.

Another limitation is that we only involved auditors from one Big 4 firm. However, we had preliminary conversations with two other Big 4 firms that suggested that the basic approaches that auditors use to apply AS 14.13 are common among the three firms, so we anticipate that our results would generalize to other auditors at other firms. Third, we focus on the consequences of US auditing guidance and do not consider the consequences of international auditing guidance,
which differs slightly from US guidance in this area.\textsuperscript{22} Future research may wish to investigate whether international audit guidance also leads to the unintended consequences that we document in this study. Finally, it is possible that a more voluminous instruction intervention would have a stronger effect on auditors’ bias assessments than we identify in our re-assessment task. However, our instruction intervention did influence bias assessment for two of the three portfolios we examined, suggesting that it was sufficient to impart information, but it had no effect on adjustment decisions, suggesting that additional instructions likewise would have little effect.

These results contribute to the research literatures in accounting and psychology. Regarding accounting, our results extend prior research examining auditors’ adjustment decisions for ranges specified at the account level (Griffin 2014) by examining decisions at the portfolio and individual-security level. We also extend prior work (Griffith et al. 2015a) investigating whether auditors take an implemental mindset when auditing estimates, focusing on required comparisons rather than more judgmental considerations. On the one hand, we provide evidence that auditors deviate from mechanical application of AS 14.13 on the security-by-security basis in the direction necessary to correct for aggregate overstatement in the portfolio, particularly when doing so increases client income, suggesting auditors incorporate judgment to some extent. However, we also find that auditors don’t incorporate bias assessments in their adjustment decisions, consistent with them focusing primarily on applying the quantitative judgment rule inherent in AS 14.13 rather than the encouragement to consider the potential for management bias indicated in AS 14.27.

\textsuperscript{22} As noted in Section 2, international auditing standards define misstatement as “no less than the difference between management’s point estimate and the nearest endpoint of the auditor’s range.”
From a psychology perspective, we build on prior research to predict and find that auditors spontaneously identify the frequency and percent magnitude patterns as indicative of bias. While prior research has linked inferences about systematic deviations to frequency assessment (e.g., Alba et al. 1994; Alba et al. 1999; Koonce and Lipe forthcoming), no research that we are aware of has linked bias assessment and percent magnitudes, despite prior research highlighting that percent magnitudes are important for assessing size (e.g., Kahneman and Tversky 1979; Thaler 1980) and prior work suggesting that auditors will seek to attribute unexpected amounts to human intervention (Malle 2011).

We believe that these results have important implications for standard setters, auditors, managers, and regulators. We recognize that existing standards are based on long-standing historical precedent in both accounting and auditing, going back at least to FIN 14 (FASB 1976). FIN 14 requires that, when a reasonable estimate of loss contingency is a range, and “no amount within the range is a better estimate than any other amount,” the minimum endpoint of the range should be accrued (FIN 14.3). AS 14.13 likewise argues that the maximum amount that the auditor considers to be a misstatement be the difference between the client book value and the nearest endpoint of a range of reasonable amounts. Such standards may have been crafted this way to address conflicts with clients that can arise in the presence of measurement uncertainty, where an auditor’s independent estimate imprecisely captures underlying economics. However, alternative standard-setting responses are possible. For example, ISA 540 views the difference between the client book value and the nearest endpoint as a minimum adjustment rather than the maximum indicated by PCAOB guidance. The ISA 540 approach could result in adjustments that further reduce aggregate overstatement.
While current standards match the psychology literature on intuitive statistical judgments, common heuristics can produce predictable judgment biases, and codifying such judgment rules can result in error in financial statement numbers (Hirshleifer and Teoh 2009). We believe that the most effective remedy to avoid the effects we demonstrate, as well as to correct systematic deviations of post-audit values in the direction of management’s estimate as permitted by AS 14.13, is to require adjustment to the expected value whenever there is a distribution of reasonable estimates. Alternatively, CPA firms could require that auditors pay special attention to adjustments that deviate significantly from what would be necessary to correct estimated aggregate error. Also, reporting companies could alter control systems to focus on the possibility that managers are strategically producing error patterns that auditors are more likely to allow, and securities regulators could focus more of their investigative efforts on securities valuations in an attempt to detect cases in which management bias went undetected.
REFERENCES


Figure 1 illustrates how auditors calculate misstatement according to Auditing Standard 14.13 as it is typically applied in practice. The auditor determines their best estimate of the value of the security (the *audit value*) and computes a reasonable range around that estimate. The auditor should treat the difference between the recorded accounting estimate (the *client value*) and the closest reasonable estimate as a misstatement. In the example above, the client value is $118, which is outside of the auditor’s reasonable range of $95 to $105. According to Auditing Standard 14.13, the auditor should treat the difference between the client value ($118) and the nearest endpoint of the reasonable range ($105), or $13, as a misstatement.
FIGURE 2  
Simple Example Portfolios

<table>
<thead>
<tr>
<th>Panel A</th>
<th>Portfolio A: Large Percent Overstatement in One Security</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Client Value (A)</td>
</tr>
<tr>
<td>Security 1</td>
<td>$94</td>
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<td>Security 2</td>
<td>$94</td>
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<tr>
<td>Security 3</td>
<td>$118</td>
</tr>
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<td>$306</td>
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<table>
<thead>
<tr>
<th>Panel B</th>
<th>Portfolio B: Small Percent Overstatement in One Security</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Client Value (A)</td>
</tr>
<tr>
<td>Security 1</td>
<td>$47</td>
</tr>
<tr>
<td>Security 2</td>
<td>$47</td>
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<tr>
<td>Security 3</td>
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</table>

<table>
<thead>
<tr>
<th>Panel C</th>
<th>Portfolio C: Frequent Overstatements</th>
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</thead>
<tbody>
<tr>
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<td>Client Value (A)</td>
</tr>
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<tr>
<td>Security 2</td>
<td>$106</td>
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<tr>
<td>Security 3</td>
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</tr>
<tr>
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</table>
Figure 3 presents the means for the adjustment decision measure in our experiment. The red bold lines mark the amount of adjustment that would be made if ASU 14.13 were applied mechanically ($3,410,000 for Portfolio A; $310,000 for Portfolios B and C). The green dashed line marks the amount of adjustment that would exactly correct the overstatement in the portfolio ($1,860,000 for all portfolios). 112 auditors viewed a portfolio of trading securities and judged the total adjustment that the client would have to make in order for the client to receive an unqualified opinion. Auditors viewed one of three portfolios that differ in how overstatement is distributed across securities. Appendix B contains the three portfolios used in the experiment. We also manipulated whether auditors made adjustment decisions before or after assessing management bias, but given an insignificant effect of order we collapse across order conditions.
FIGURE 4
Histogram of Adjustment Decisions, By Portfolio

Panel A: Adjustment Decisions for Portfolio A

Panel B: Adjustment Decisions for Portfolio B
Panel C: Adjustment Decisions for Portfolio C

Figure 4 presents the frequency with which participants made certain adjustment decisions in our experiment. Dotted red lines mark the amount of adjustment that would be made if ASU 14.13 were applied mechanically ($3,410,000 for Portfolio A; $310,000 for Portfolios B and C). Dotted green lines mark the amount of adjustment that would be made if auditors corrected the aggregate overstatement in the portfolios ($1,860,000 for all three portfolios). We created bins around these three critical values because materiality for the audit was $250,000 and some participants subtracted this amount when making adjustments. 112 auditors viewed a portfolio of trading securities and judged the total adjustment that the client would have to make in order for the client to receive an unqualified opinion. Auditors viewed one of three portfolios that differ in how overstatement is distributed across securities. We also manipulated whether auditors made adjustment decisions before or after assessing management bias. Appendix B contains the three portfolios used in the experiment.
Figure 5 presents means for the bias assessment measure in our experiment. 112 auditors viewed a portfolio of trading securities and judged whether the information about securities indicates bias in management’s estimate on an 11-point Likert scale, anchored at 1-“Bias to reduce net income by understating market value” on one end, 11-“Bias to increase net income by overstating market value” on the other end, and 6-“No bias” in the middle. Auditors viewed one of three portfolios that differ in how overstatement is distributed across securities. Appendix B contains the three portfolios used in the experiment. We also manipulated whether auditors made adjustment decisions before or after assessing management bias, but given an insignificant effect of order we collapse across order conditions. Since the scale used to elicit bias assessment is bipolar, we plot values from 6 (no bias) to 11 (bias to increase net income by overstating market value) in the figure.
Table 1 presents descriptive statistics and analyses for the adjustment decision measure in our experiment. 112 auditors viewed a portfolio of trading securities and judged the total adjustment that the client would have to make in order for the client to receive an unqualified opinion. Auditors viewed one of three portfolios that differ in how overstatement is distributed across securities. Appendix B contains the three portfolios used in the experiment. We also manipulated whether auditors made adjustment decisions before or after assessing management bias. Panel A presents the mean, median, and standard deviation of auditors’ required adjustments for each of the six between-subjects conditions in the experiment. Panel B presents an analysis of variance with Portfolio and Order as the independent variable and adjustment decision as the dependent variable. Panel C uses linear contrasts to test specific predictions. Panel C tests whether auditors require higher adjustments for portfolio A than for portfolio B (H1a) or portfolio C (H1b), and whether prompting auditors to consider bias before making adjustment decisions has a greater effect for Portfolio C than for Portfolio B (H3). Bolded p-values indicate a one-tailed equivalent p-value, given our directional predictions.
Table 2 presents descriptive statistics and analyses for the bias assessment measure in our experiment. 112 auditors viewed a portfolio of trading securities and judged whether the information about securities indicates bias in management’s estimate on an 11-point Likert scale, anchored at 1—“Bias to reduce net income by understating market value” on one end, 11—“Bias to increase net income by overstating market value” on the other end, and 6—“No bias” in the middle. Auditors viewed one of three portfolios that differ in how overstatement is distributed across securities. Appendix B contains the three portfolios used in the experiment. We also manipulated whether auditors made adjustment decisions before or after assessing management bias. Panel A presents the mean, median, and standard deviation of auditors’ bias assessments for each of the six between-subjects cells in our experiment. Panel B presents an analysis of variance with Portfolio and Order as the independent variables and bias assessment as the dependent variable. Panels C uses linear contrasts to test specific predictions. Panel C tests whether auditors assess bias to be higher for portfolio C than for portfolio B (H2a), and whether auditors assess bias to be higher for portfolio A than for portfolio B (H2b). Bolded p-values indicate a one-tailed equivalent p-value, given our directional predictions.

### Table 2
**Tests of H2**

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<tr>
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<th>Portfolio A</th>
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<th>Portfolio C</th>
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<tr>
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<td>6.76</td>
<td>7.70</td>
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<td>[6.00]</td>
<td>[8.00]</td>
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<tr>
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<td>(1.44)</td>
<td>(1.45)</td>
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<tr>
<td>n</td>
<td>15</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td><strong>Bias DV elicited first</strong></td>
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<td></td>
</tr>
<tr>
<td>Mean</td>
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<td>7.70</td>
</tr>
<tr>
<td>Median</td>
<td>[9.00]</td>
<td>[7.00]</td>
<td>[7.50]</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>(1.50)</td>
<td>(1.66)</td>
<td>(1.98)</td>
</tr>
<tr>
<td>n</td>
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<td>20</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
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<tr>
<td>Mean</td>
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<td>6.70</td>
<td>7.70</td>
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<tr>
<td>Median</td>
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<td>[7.00]</td>
<td>[8.00]</td>
</tr>
<tr>
<td>Standard Deviation</td>
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<td>(1.71)</td>
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<tr>
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<td>37</td>
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### Panel B: ANOVA Model of Bias Assessment

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<th>p-value</th>
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<td>16.87</td>
<td>6.56</td>
<td><strong>0.001</strong></td>
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<td>Order</td>
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<td>2.23</td>
<td>0.87</td>
<td>0.354</td>
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<tr>
<td>Portfolio*Order</td>
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<td>3.12</td>
<td>1.21</td>
<td>0.301</td>
</tr>
<tr>
<td>Error</td>
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<td>2.57</td>
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### Panel C: Tests of Hypotheses

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<th>Test</th>
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<th>p-value</th>
</tr>
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<tbody>
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<td>H2a: Portfolio C &gt; Portfolio B</td>
<td>2.71</td>
<td><strong>0.004</strong></td>
</tr>
<tr>
<td>H2b: Portfolio A &gt; Portfolio B</td>
<td>3.44</td>
<td>&lt;<strong>0.001</strong></td>
</tr>
</tbody>
</table>
Table 3 presents descriptive statistics and analyses for the bias assessment measure in our experiment. 112 auditors viewed a portfolio of trading securities and judged whether the information about securities indicates bias in management’s estimate on an 11-point Likert scale, anchored at 1-“Bias to reduce net income by understating market value” on one end, 11-“Bias to increase net income by overstating market value” on the other end, and 6-“No bias” in the middle. Auditors initially viewed one of three portfolios that differ in how overstatement is distributed across securities. Appendix B contains the three portfolios used in the experiment. After making an initial bias assessment, auditors read a brief tutorial on different patterns that can indicate bias in management’s estimates. They then re-assessed bias for the portfolio they initially saw, as well as for the other two portfolios. Panel A presents the mean, median, and standard deviation of auditors’ bias assessments, both before and after bias instruction, for the portfolio that auditors initially assessed. Panel B presents a mixed-model analysis of variance that controls for dependency in participants’ responses across bias instruction, with portfolio and bias instruction as the independent variables and bias assessment as the dependent variable. Panel C uses linear contrasts to make specific comparisons. Panel C tests whether auditors increased bias assessments after bias instruction more for portfolio A and for portfolio B than for portfolio C. It also tests whether auditors changed bias assessments after bias instruction more or less for portfolio A than for portfolio B. Bolded p-values indicate a one-tailed equivalent p-value, given our directional predictions.
Table 4 presents descriptive statistics and analyses for the adjustment decision measure in our experiment. 112 auditors viewed a portfolio of trading securities and judged the total adjustment that the client would have to make in order for the client to receive an unqualified opinion. Auditors initially viewed one of three portfolios that differ in how overstatement is distributed across securities. Appendix B contains the three portfolios used in the experiment. After making an initial adjustment decision, auditors read a brief tutorial on different patterns that can indicate bias in management’s estimates. They then re-assessed adjustment decisions for the portfolio they initially saw, as well as for the other two portfolios. Panel A presents the mean, median, and standard deviation of auditors’ adjustment decisions, both before and after bias instruction, for the portfolio that auditors initially assessed. Panel B presents a mixed-model analysis of variance that controls for dependency in participants’ responses across bias instruction, with portfolio and bias instruction as the independent variables and adjustment decision as the dependent variable. Bolded p-values indicate a one-tailed equivalent p-value, given our directional predictions.
### APPENDIX A
**Portfolios Used in Experiment¹ - Simplified**

#### Portfolio A: Large Percentage Overstatements

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Security 1</td>
<td>94.00</td>
<td>100.00</td>
<td>(6.00)</td>
<td>-6.00%</td>
<td>5%</td>
<td>NO</td>
<td>7,285,000</td>
<td>7,750,000</td>
<td>(465,000)</td>
<td>(77,500)</td>
</tr>
<tr>
<td>Security 2</td>
<td>94.00</td>
<td>100.00</td>
<td>(6.00)</td>
<td>-6.00%</td>
<td>5%</td>
<td>NO</td>
<td>7,285,000</td>
<td>7,750,000</td>
<td>(465,000)</td>
<td>(77,500)</td>
</tr>
<tr>
<td>Security 3</td>
<td>94.00</td>
<td>100.00</td>
<td>(6.00)</td>
<td>-6.00%</td>
<td>5%</td>
<td>NO</td>
<td>7,285,000</td>
<td>7,750,000</td>
<td>(465,000)</td>
<td>(77,500)</td>
</tr>
<tr>
<td>Security 4</td>
<td>94.00</td>
<td>100.00</td>
<td>(6.00)</td>
<td>-6.00%</td>
<td>5%</td>
<td>NO</td>
<td>7,285,000</td>
<td>7,750,000</td>
<td>(465,000)</td>
<td>(77,500)</td>
</tr>
<tr>
<td>Security 5</td>
<td>94.00</td>
<td>100.00</td>
<td>(6.00)</td>
<td>-6.00%</td>
<td>5%</td>
<td>NO</td>
<td>7,285,000</td>
<td>7,750,000</td>
<td>(465,000)</td>
<td>(77,500)</td>
</tr>
<tr>
<td>Security 6</td>
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<td>100.00</td>
<td>(6.00)</td>
<td>-6.00%</td>
<td>5%</td>
<td>NO</td>
<td>7,285,000</td>
<td>7,750,000</td>
<td>(465,000)</td>
<td>(77,500)</td>
</tr>
<tr>
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<td>100.00</td>
<td>30.00</td>
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<td>5%</td>
<td>NO</td>
<td>10,075,000</td>
<td>7,750,000</td>
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<tr>
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<td></td>
<td></td>
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<td>1,860,000</td>
<td>3,410,000</td>
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#### Portfolio B: Small Percentage Overstatements

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<td>5%</td>
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<td>2,428,333</td>
<td>2,583,333</td>
<td>(155,000)</td>
<td>(25,833)</td>
</tr>
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<td>100.00</td>
<td>(6.00)</td>
<td>-6.00%</td>
<td>5%</td>
<td>NO</td>
<td>2,428,333</td>
<td>2,583,333</td>
<td>(155,000)</td>
<td>(25,833)</td>
</tr>
<tr>
<td>Security 3</td>
<td>94.00</td>
<td>100.00</td>
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<td>-6.00%</td>
<td>5%</td>
<td>NO</td>
<td>2,428,333</td>
<td>2,583,333</td>
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<td>(25,833)</td>
</tr>
<tr>
<td>Security 4</td>
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<td>100.00</td>
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<td>2,428,333</td>
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<td>NO</td>
<td>2,428,333</td>
<td>2,583,333</td>
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<td><strong>Total</strong></td>
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<td>1,860,000</td>
<td>310,000</td>
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APPENDIX A (continued)
Portfolios Used in Experiment- Simplified

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<td>7,285,000</td>
<td>7,750,000</td>
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<td>-6.00%</td>
<td>5%</td>
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<td>7,285,000</td>
<td>7,750,000</td>
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<td>(77,500)</td>
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<td>5%</td>
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<td>5%</td>
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<td>8,215,000</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>310,000</td>
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</tbody>
</table>

1 Note that the portfolios in this appendix include columns of information not included in the example portfolios in Figure 2, and that the terminology used in this appendix differs from that used in Figure 2. Specifically, the portfolios in this appendix include the Client Price, the Auditor Price, and the Price Difference, which are not included in Figure 2. “Client Value” and “Audit Value” from Figure 2 correspond conceptually to the “Client Market Value” and “Auditor Market Value”, respectively, in this appendix. “Percentage Error” and “Error” in Figure 2 correspond conceptually to “% Difference” and “Market Value” difference, respectively, in this appendix. “Reasonable Range” and “Difference Outside Reasonable Range” in Figure 2 correspond to “Auditor Threshold” and “Dollar Difference Outside Initial Threshold”, respectively, in the appendix. We used terminology in the portfolios included in this appendix (and in the experiment) that would be familiar to auditors from the participating audit firm.

2 The instrument included the participating “Big 4” firm’s name.
APPENDIX B
Portfolios Included in the Experiment

Portfolio A: Large Percentage Overstatements

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Security 1</td>
<td>94.38</td>
<td>99.60</td>
<td>(5.22)</td>
<td>(5.24%)</td>
<td>5%</td>
<td>NO</td>
<td>7,314,140</td>
<td>7,719,000</td>
<td>(404,860)</td>
<td>(18,910)</td>
</tr>
<tr>
<td>Security 2</td>
<td>94.09</td>
<td>99.90</td>
<td>(5.81)</td>
<td>(5.81%)</td>
<td>5%</td>
<td>NO</td>
<td>7,292,285</td>
<td>7,742,250</td>
<td>(449,965)</td>
<td>(62,853)</td>
</tr>
<tr>
<td>Security 3</td>
<td>94.19</td>
<td>99.80</td>
<td>(5.61)</td>
<td>(5.62%)</td>
<td>5%</td>
<td>NO</td>
<td>7,299,570</td>
<td>7,734,500</td>
<td>(434,930)</td>
<td>(48,205)</td>
</tr>
<tr>
<td>Security 4</td>
<td>129.61</td>
<td>100.30</td>
<td>29.31</td>
<td>29.22%</td>
<td>5%</td>
<td>NO</td>
<td>10,044,775</td>
<td>7,773,250</td>
<td>2,271,525</td>
<td>1,882,863</td>
</tr>
<tr>
<td>Security 5</td>
<td>93.91</td>
<td>100.10</td>
<td>(6.19)</td>
<td>(6.19%)</td>
<td>5%</td>
<td>NO</td>
<td>7,277,715</td>
<td>7,757,750</td>
<td>(480,035)</td>
<td>(92,147)</td>
</tr>
<tr>
<td>Security 6</td>
<td>130.39</td>
<td>99.70</td>
<td>30.69</td>
<td>30.78%</td>
<td>5%</td>
<td>NO</td>
<td>10,105,225</td>
<td>7,726,750</td>
<td>2,378,475</td>
<td>1,992,138</td>
</tr>
<tr>
<td>Security 7</td>
<td>93.62</td>
<td>100.40</td>
<td>(6.78)</td>
<td>(6.75%)</td>
<td>5%</td>
<td>NO</td>
<td>7,255,860</td>
<td>7,781,000</td>
<td>(525,140)</td>
<td>(136,090)</td>
</tr>
<tr>
<td>Security 8</td>
<td>93.81</td>
<td>100.20</td>
<td>(6.39)</td>
<td>(6.38%)</td>
<td>5%</td>
<td>NO</td>
<td>7,270,430</td>
<td>7,765,500</td>
<td>(495,070)</td>
<td>(106,795)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,860,000</td>
<td>3,410,000</td>
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Portfolio B: Small Percentage Overstatements

<table>
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<tr>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Security 1</td>
<td>94.38</td>
<td>99.60</td>
<td>(5.22)</td>
<td>(5.24%)</td>
<td>5%</td>
<td>NO</td>
<td>2,438,047</td>
<td>2,573,000</td>
<td>(134,953)</td>
<td>(6,303)</td>
</tr>
<tr>
<td>Security 2</td>
<td>94.09</td>
<td>99.90</td>
<td>(5.81)</td>
<td>(5.81%)</td>
<td>5%</td>
<td>NO</td>
<td>2,430,762</td>
<td>2,580,750</td>
<td>(149,988)</td>
<td>(20,951)</td>
</tr>
<tr>
<td>Security 3</td>
<td>94.19</td>
<td>99.80</td>
<td>(5.61)</td>
<td>(5.62%)</td>
<td>5%</td>
<td>NO</td>
<td>2,433,190</td>
<td>2,578,167</td>
<td>(144,977)</td>
<td>(16,068)</td>
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<tr>
<td>Security 4</td>
<td>105.68</td>
<td>100.30</td>
<td>5.38</td>
<td>5.37%</td>
<td>5%</td>
<td>NO</td>
<td>24,571,065</td>
<td>23,319,750</td>
<td>1,251,315</td>
<td>85,328</td>
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<tr>
<td>Security 5</td>
<td>93.91</td>
<td>100.10</td>
<td>(6.19)</td>
<td>(6.19%)</td>
<td>5%</td>
<td>NO</td>
<td>2,425,905</td>
<td>2,585,917</td>
<td>(160,012)</td>
<td>(30,716)</td>
</tr>
<tr>
<td>Security 6</td>
<td>106.32</td>
<td>99.70</td>
<td>6.62</td>
<td>6.64%</td>
<td>5%</td>
<td>NO</td>
<td>24,718,935</td>
<td>23,180,250</td>
<td>1,538,685</td>
<td>379,672</td>
</tr>
<tr>
<td>Security 7</td>
<td>93.62</td>
<td>100.40</td>
<td>(6.78)</td>
<td>(6.75%)</td>
<td>5%</td>
<td>NO</td>
<td>2,418,620</td>
<td>2,593,667</td>
<td>(175,047)</td>
<td>(45,363)</td>
</tr>
<tr>
<td>Security 8</td>
<td>93.81</td>
<td>100.20</td>
<td>(6.39)</td>
<td>(6.38%)</td>
<td>5%</td>
<td>NO</td>
<td>2,423,477</td>
<td>2,588,500</td>
<td>(165,023)</td>
<td>(35,598)</td>
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<tr>
<td><strong>Total</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,860,000</td>
<td>310,000</td>
</tr>
</tbody>
</table>
## Portfolio C: Frequent Overstatements

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Security 1</td>
<td>106.42</td>
<td>99.60</td>
<td>6.82</td>
<td>6.85%</td>
<td>5%</td>
<td>NO</td>
<td>8,247,860</td>
<td>7,719,000</td>
<td>528,860</td>
<td>142,910</td>
</tr>
<tr>
<td>Security 2</td>
<td>106.11</td>
<td>99.90</td>
<td>6.21</td>
<td>6.21%</td>
<td>5%</td>
<td>NO</td>
<td>8,223,215</td>
<td>7,742,250</td>
<td>480,965</td>
<td>93,852</td>
</tr>
<tr>
<td>Security 3</td>
<td>106.21</td>
<td>99.80</td>
<td>6.41</td>
<td>6.42%</td>
<td>5%</td>
<td>NO</td>
<td>8,231,430</td>
<td>7,734,500</td>
<td>496,930</td>
<td>110,205</td>
</tr>
<tr>
<td>Security 4</td>
<td>93.72</td>
<td>100.30</td>
<td>(6.58)</td>
<td>(6.56%)</td>
<td>5%</td>
<td>NO</td>
<td>7,263,145</td>
<td>7,773,250</td>
<td>(510,105)</td>
<td>(121,442)</td>
</tr>
<tr>
<td>Security 5</td>
<td>105.89</td>
<td>100.10</td>
<td>5.79</td>
<td>5.79%</td>
<td>5%</td>
<td>NO</td>
<td>8,206,785</td>
<td>7,757,750</td>
<td>449,035</td>
<td>61,148</td>
</tr>
<tr>
<td>Security 6</td>
<td>94.28</td>
<td>99.70</td>
<td>(5.42)</td>
<td>(5.43%)</td>
<td>5%</td>
<td>NO</td>
<td>7,306,855</td>
<td>7,726,750</td>
<td>(419,895)</td>
<td>(33,558)</td>
</tr>
<tr>
<td>Security 7</td>
<td>105.58</td>
<td>100.40</td>
<td>5.18</td>
<td>5.16%</td>
<td>5%</td>
<td>NO</td>
<td>8,182,140</td>
<td>7,781,000</td>
<td>401,140</td>
<td>12,090</td>
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<tr>
<td>Security 8</td>
<td>105.79</td>
<td>100.20</td>
<td>5.59</td>
<td>5.58%</td>
<td>5%</td>
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<td>8,198,570</td>
<td>7,765,500</td>
<td>433,070</td>
<td>44,795</td>
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<tr>
<td>Total</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>1,860,000</td>
<td>310,000</td>
</tr>
</tbody>
</table>

1 We created the portfolios in Appendix B by modifying the simplified portfolios in Appendix A. In particular, we (1) created small perturbations in the client price and auditor price and (2) varied the order of the securities. Neither of these procedures impacted the aggregate market value difference or dollar difference outside the auditor’s threshold in the portfolios. We discuss these procedures in greater detail below.

*Creating Small Perturbations in the Client and Auditor Price.* Within each portfolio, we grouped the securities into four pairs of securities that have the same client price and par value. For each of these pairs, we increased (decreased) the client price for the first (second) security in the pair by the adjustment factor and decreased (increased) the auditor price for the first (second) security in the pair by the adjustment factor. To increase realism, we used a different adjustment factor for each of the four pairs (0.20% for first pair, 0.40% for second pair, 0.10% for third pair, and 0.30% for fourth pair). We held these procedures constant across portfolios.

*Varying the Order of Securities.* We determined a random order for the securities and then applied that order to each of the portfolios. This allowed us to hold constant the pattern of overstatements/understatements across portfolios. That is, the two overstatements in portfolios A and B are in the same position as the two understatements in portfolio C.

The instrument included the participating “Big 4” firm’s name. Portfolio titles were not included.