Does Audit Effort Impede the Willingness to Impose Audit Adjustments?

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ABSTRACT: In an abstract, incentivized experiment patterned after the investigation and adjustment decisions that characterize auditing, we find that participants who adjust for information obtained from their willful investigation specify lower adjustments than participants who get the same information without having to take investigative action. Our theory draws on mental accounting and information choice effects, which in combination predict that unfavorable outcomes from costly investigative actions can impede the willingness to incur additional costs in the adjustment process. Separating investigative and adjustment decisions in a paired variant of the task removes the effect of investigative effort on adjustments, but introduces a systematic negative effect on adjustments from sharing costs with paired participants. Overall, our study provides potential insight into the puzzle of why auditors willingly exert costly effort to uncover material misstatements, only to subsequently waive the adjustments that would fully correct these misstatements.

KEYWORDS: audit effort; waived audit adjustments; auditor independence; mental accounting; information choice effects
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I. INTRODUCTION

During the course of an audit, auditors engage in two costly activities. First, they obtain audit evidence, which can be suggestive of material misstatements in reported amounts. Second, to the extent that material misstatements are evident, auditors follow up with client personnel to request the adjustments necessary to justify a clean audit opinion. Although investigative effort from the first activity is arguably a sunk cost when auditors contemplate adjustments, we design an abstract experiment to investigate the premise that investigation itself can impede auditors’ willingness to incur further costs in the adjustment process. That is, we ask whether auditors are less willing to impose costly adjustments when those adjustments follow from costly investigative outcomes than when the same adjustments are considered independently of the investigative process.

Our research question is important because audit failures can arise from insufficient effort or from insufficient adjustment (DeAngelo 1981). Evidence of heavy audit workloads (e.g., Fogarty, Singh, Rhoads, and Moore 2000) suggests that audit failures do not necessarily arise from insufficient investigative effort alone. Rather, anecdotes abound of auditors who knew of a material misstatement, but did not insist on the requisite corrective adjustments (e.g., Moore, Tetlock, Tanlu, and Bazerman 2006). More generally, a recent examination of PCAOB audit inspection data by Choudhary, Merkley, and Schipper (2019) finds that waived audit adjustments are associated with future restatements, suggesting that reliable financial reporting could be enhanced if auditors simply acted on the evidence revealed by their investigative efforts.

The phenomenon of auditors exerting investigative effort only to back off on material adjustments presents a logical puzzle. The reason is that auditors presumably exert effort to
substantiate the basis for adjustment, such that it would seem to make little sense to willingly investigate but not act on the product of that investigation. A popular explanation points to impairment of auditor independence from conflicts of interest (e.g., Moore et al. 2006; Bazerman and Moore 2011), but this explanation seems incomplete to the extent that auditors should be able to anticipate conflicts of interest. Put differently, if an auditor is willing to acquiesce to a client’s challenge on a problematic adjustment, the auditor would arguably be better off exerting less investigative effort in the first place in order to avoid prompting the challenge. Accordingly, we propose a more primal explanation of the puzzle: perhaps well-intended auditors would otherwise be willing to insist on adjustments, except that the investigative process itself impedes the auditor’s willingness to incur additional adjustment costs. This explanation draws on the psychology of mental accounting and information choice effects, which in combination lead to the prediction that costly outcomes from willful investigative actions can impede the willingness to incur the additional costs necessary to address those outcomes.

We design an abstract experiment in the tradition of experimental economics to investigate this premise. In our experiment, participants in an auditor-like role face a risk of loss that is analogous to the penalty associated with an audit failure. Participants in our Solo-Effort treatment condition make two decisions. First, in a decision analogous to investigative effort, they decide how much they are willing to spend to reveal the true percentage probability of loss that they face. Second, in a decision analogous to audit adjustments, they decide how much additional cost they are willing to spend to reduce the loss percentage revealed from the first decision. Conversely, in a control condition that we label Solo-No Effort, participants make only the adjustment decision, given the risk of loss. We yoke the risk information and monetary positions of participants in the Solo-No Effort condition to the same information and after-effort
wealth of participants in the Solo-Effort condition, thus ensuring economically equivalent bases for making the adjustment decision. However, only Solo-Effort participants take explicit actions to uncover this information.

Findings from these two conditions indicate that Solo-Effort participants who make both effort and adjustment decisions choose significantly lower (i.e., less costly) adjustments than participants in the Solo-No Effort condition who have the same information but only make adjustment decisions. We find this effect despite experimental parameters that incentivize risk-neutral or risk-averse decision makers to adjust by the maximum amount possible, such that lower adjustments reflect risk-seeking behavior. The difference cannot be attributed to wealth effects, as we subtract the cost of Solo-Effort participants’ investigative decisions from the starting endowments of Solo-No Effort participants, ensuring the same ex ante monetary positions. Rather, we attribute the difference to a more psychological phenomenon: relative to Solo-No Effort participants, costly investigation leads Solo-Effort participants to experience more of a sense of loss from the risks thereby revealed, impeding their willingness to incur additional costs from adjustment decisions.

Given that the observed difference in adjustment between the Solo-Effort and Solo-No Effort conditions appears to arise from the fact that participants in the Solo-Effort condition make both effort and adjustment decisions, our second manipulation addresses a potential remedy by splitting these responsibilities in a paired task. That is, in our Paired-Effort condition, one participant makes the investigative effort decision and another participant independently makes the adjustment decision after learning the outcome of the investigation. To ensure that pairing isolates the incremental effect of making investigative decisions rather than paying for these decisions, both paired participants share the same investigative and adjustment
costs and the same probabilistic outcomes. As a control, we also operationalize a *Paired-No Effort* condition in which there are no effort decisions, but one participant makes an adjustment decision that impacts both him/herself and another participant.

Results from the paired conditions have mixed implications. On one hand, we no longer observe an adjustment difference between the *Paired-Effort* and *Paired-No Effort* conditions, suggesting that separating the investigative and adjustment decisions in the *Paired-Effort* condition removes the psychological linkage between effort and adjustment that appears to impede adjustments in the *Solo-Effort* condition. On the other hand, adjustments in both the *Paired-Effort* and *Paired-No Effort* conditions are lower than in the *Solo-No Effort* condition. While unanticipated, we interpret the apparent systematic lowering of adjustments in our paired conditions as likely reflecting the reluctance of participants to incur adjustment costs that also affect their paired counterparts. Thus, while the pairing remedy to the effort-adjustment linkage is encouraging, it too presents tradeoffs that could be of importance in audit settings.

Overall, our study contributes to the literature by examining a source of reluctance to audit adjustments that goes beyond the usual focus on client pressure and conflicts of interest *per se*. That is, we find that costly investigation itself can influence subsequent adjustments in ways that would not be present if investigative effort decisions could be detached from subsequent adjustment decisions, as in our *Solo-No Effort* condition. Dividing investigative and adjustment decisions in a paired setting appears to achieve this separation, but at the cost of a systematic negative effect on adjustments from sharing costs with paired participants. Thus, to the extent that investors and regulators desire more stringent audit adjustments to follow up on audit evidence, environments closer to the *Solo-No Effort* condition would appear to be best. Such environments would be difficult to establish in real-world audit settings, as investigative
effort and follow-up adjustments are and should be integral to the audit process. Nevertheless, our research suggests that any actions that help to detach mental associations between costly investigations and costly adjustments could be worthy of consideration. For example, to the extent that data analytics innovations in auditing can help to make the investigation stage of the audit less onerous (e.g., see commentaries by Earley [2015] and by Appelbaum, Kogan, and Vasarhelyi [2017]), a byproduct could potentially be more a greater willingness of auditors to act on the information thereby revealed.

II. BACKGROUND, THEORY, AND HYPOTHESES

Background

Although much of an audit is comprised of gathering substantive evidence, the auditor’s decisions do not end at this stage. Rather, auditors must act on the evidence they collect by proposing adjustments to correct any detected material misstatements. Strictly speaking, adjustments are made by clients, not by auditors (Choudhary et al. 2019), but auditors have the leverage of reserving a clean audit opinion, and hence can insist on any adjustments necessary to justify such an opinion. To the extent that material adjustments go unrecorded, financial reporting (and auditing) failures can arise even for problems revealed by audit evidence.

Audits can certainly fail for lack of evidence, such as in cases in which additional procedures could arguably have detected a material misstatement that the auditor missed (e.g., Erickson, Mayhew, and Felix 2000). Nevertheless, in general, auditors clearly put in long hours to gather evidence (Fogarty et al. 2000). Given this reality, it is noteworthy how many financial reporting failures occur despite auditor awareness of the problems leading to these failures (Moore et al. 2006). Indeed, recent evidence using PCAOB inspection data finds that waived audit adjustments are commonplace, and are material enough to be significantly
associated with future restatements (Choudhary et al. 2019), suggesting that financial reporting
could be improved if auditors simply acted on the misstatements they detect.

As reviewed by Tepalagul and Lin (2015) and by Church, Jenkins, and Stanley (2018),
the literature on auditor independence identifies several factors that can impair the auditor’s
willingness to insist on corrective adjustments. In particular, auditors can be hesitant to displease
a client in view of economic bonds (e.g., Wright and Wright 1997; Bazerman and Moore 2011;
Schmidt 2012; Hurley, Mayhew, and Obermire 2019) and/or social bonds (e.g., Bamber and Iyer
2007; Bauer 2015; Kachelmeier and Van Landuyt 2017). While we do not deny the importance
of these factors, it remains puzzling why an auditor would willingly exert costly effort to uncover
problems, only to bow to client pressure and overlook the problems discovered. Less effort could
arguably lead to the same outcome at lower cost, such that underadjustment appears to logically
contradict the reason for investigating in the first place. Indeed, auditing applications of
experimental economics sometimes remove the adjustment decision altogether, given that the
only reason to investigate is to determine the adjustment needed (e.g., Kowaleski, Mayhew, and
Tegeler 2018). In the current study, we set aside the nuances of client pressure to examine more
fundamental behavioral reasons why investigative effort itself could impede the auditor’s
willingness to incur additional costs from corrective adjustments.

An abstract experiment is ideal for testing our premise, as it enables us to isolate the
theoretical constructs of interest in a ceteris paribus setting. Indeed, a previous abstract
experiment from the early years of experimental economic applications in the accounting
literature helps to illustrate our premise. Specifically, Beck, Davis, and Jung (1996) conduct an
abstract tax experiment in which student participants face risk from an uncertain tax position that
can result in a penalty from an unfavorable tax audit. At their discretion, participants can pay for
advice that reveals whether an aggressive tax position would indeed lead to an unfavorable outcome if audited. Participants then decide whether to take a conservative or aggressive tax position. One of the more interesting, albeit unexpected, findings from Beck et al. (1996) is that participants frequently pay for advice, find that advice to be unfavorable, and then take an aggressive position anyway. As Kachelmeier (1996) observes in his discussion of Beck et al. (1996), such a strategy is strictly dominated in an economic sense, insofar as participants could have taken the same risky position at strictly lower cost by foregoing the advice.

While Beck et al. (1996) cast their experiment in a tax setting, it exhibits some parallels with our auditing motivation. Namely, investigative effort in an audit setting is somewhat like Beck et al.’s (1996) tax advice, potentially revealing bad news. Also like Beck et al. (1996), there would seem to be little reason to investigate unless one is willing to act on the news revealed. Yet, as discussed below, theory derived from mental accounting in combination with information choice effects supports the prediction that bad news from costly investigation can make decision makers less willing to incur additional costs from the adjustments necessary to remove the risk revealed by the investigation. Our study goes beyond Beck et al.’s (1996) unexpected finding by (1) developing theory, (2) enriching the choice set available to participants in a manner more analogous to an audit setting, (3) examining other treatments (i.e., pairing), and most importantly (4) including a control condition as a basis for comparison in which participants have the same information and monetary positions without having to take investigative actions to acquire this information.

**Theory and Hypotheses**

At a fundamental level, audit adjustment decisions are in the form of a risky loss prospect, meaning that the auditor faces a choice between incurring the certain cost of forcing an
adjustment now or facing the possibility of a larger but uncertain loss if an audit failure arises later. We know from decades of research on prospect theory (Kahneman and Tversky 1979; Tversky and Kahneman 1992; Barberis 2013) that “loss-loss” prospects of this nature can prompt risk-seeking behavior when the probability of loss is moderate to large, as we capture in our experiment by assuming a risky account that already exposes participants to a 50 percent chance of loss even before investigation. Thus, prospect theory suggests that the sense of immediate loss from adjustment costs could tempt auditors to waive such adjustments, riding on the hope of avoiding a larger loss later.

Mental accounting can exacerbate this phenomenon to the extent that the costs of investigation become commingled with the costs of adjustment. That is, people tend to combine seemingly related actions into common mental accounts, even if economic logic suggests that such actions should be evaluated separately (Thaler 1985). Tversky and Kahneman (1981) provide the classic example in which experimental participants are asked to imagine that they had lost a $10 theater ticket. Only 46% of participants indicate that they would pay another $10 for a replacement ticket, even though 86% indicate that they would pay $10 for a theater ticket if they had previously lost $10 in cash instead of losing an identical theater ticket. Apparently, the mental account of “going to the theater” is sufficient to justify one $10 ticket, but not two, despite the sunk and hence economically irrelevant cost of a lost ticket.

In auditing, it is reasonable to assume that all costs associated with an audit client accumulate in the same mental (and likely firm) account. Thus, even though investigative costs become sunk costs after they are incurred, to the extent that investigation reveals the auditor’s exposure to possible material misstatement(s), the auditor is faced with the prospect of additional costs associated with confronting client personnel on top of the costs already incurred. Just as
one show may not seem worth the price of two theater tickets, mental accounting suggests that adjustment costs could seem excessive when added to the investigative costs that have already accumulated in the same mental account, exacerbating any tendency to engage in risk-seeking behavior in the adjustment process.

In our experiment, we yoke participants in the treatment (Effort) and control (No Effort) conditions to have the same information about the known risk of loss and the same monetary positions, with the only difference being whether participants generate this information from their own investigative decisions. In this manner, our design ensures that any observed treatment effects arise from how information is discovered, not what information is discovered. Given this setting, one could reason that even the No Effort control participants could become risk seeking in their adjustment decisions. The literature on information choice effects, however, suggests that identical information does not necessarily lead to identical perceptions. Specifically, Bastardi and Shafir (1998) find that the mere act of choosing to acquire information places greater mental weight on that information. Smith, Tayler, and Prawitt (2016) test this phenomenon in an auditing context in which participants interpret the diagnosticity of audit evidence involving possible inventory obsolescence. They find that auditors choosing to acquire information are more confident in their judgments than auditors who are simply given the same information.

Unlike Smith et al.’s (2016) contextually rich experiment, participants in our experiment do not have to interpret the evidence they receive, as we inform participants of the exact percentage loss of risk each piece of “bad news” evidence implies. Nevertheless, information choice effects are likely to influence the extent to which costly evidence and costly adjustments accumulate in the same mental account. Recall from the original Tversky and Kahneman (1981) example involving the purchase of a $10 theater ticket that a mental accounting bias did not
result from the previous loss of a $10 bill rather than the loss of an identical $10 theater ticket. That is, participants were able to mentally detach the prior loss of $10 in currency from the purchase decision currently at hand. Similarly, if simply providing participants with information enables them to make a more detached adjustment decision, we predict that they will be less averse to the costs of adjustment. In contrast, willfully acquired information is more likely to accumulate in the same mental account as the costs of subsequent adjustment decisions, leading to greater aversion to incurring further adjustment costs and hence a greater willingness to gamble on the possibility of a future penalty that might or might not materialize.

Together, mental accounting and information choice effects lead to our first hypothesized prediction:

**H1:** Participants who willfully acquire costly information analogous to audit evidence (i.e., *Solo-Effort* condition) will choose lower additional costs analogous to audit adjustments than participants who are endowed with the same information (i.e., *Solo-No Effort* condition).

*Pairing as a Possible Way to Detach Investigation from Adjustment*

If the mental association of audit investigation with audit adjustment is the conceptual driver underlying H1, a potential remedy is to separate the parties responsible for these decisions. In a literal sense, these tasks are naturally separated to the extent that staff auditors collect much of the evidence while partners confront clients with needed adjustments. Still, even a team of auditors could behave like participants in our *Solo-Effort* condition if audit partners and managers internalize the evidence collection costs incurred by the seniors and staff they supervise. That is, partners and managers approve and direct the audit tests that give rise to investigation costs. Supervisory and subordinate auditors also integrate through the audit review process (e.g., Rich, Solomon, and Trotman 1997). Even within the audit staff, junior auditors bear some responsibility for audit adjustments to the extent that they exercise discretion in
calling attention to the unfavorable audit findings they detect. Accordingly, it is not our intent to suggest that our theory would not apply to real-world audit teams in which different levels of the audit hierarchy have different responsibilities. Still, it is possible for audit firms to vary the degree of separation between evidence collection and adjustment decisions, such as by asking concurring partners or national-office personnel to make the final call on whether or not to insist on a material adjustment as a condition for an unqualified audit opinion.

Accordingly, we test two additional conditions, *Paired-Effort* and *Paired-No Effort*, in which pairs of participants are linked to common costs and outcomes, but with only one of the pair making adjustment decisions. In the *Paired-Effort* condition, the other participant in the pair makes the investigative effort decisions, whereas in the *Paired-No Effort* control condition, the other participant is simply the passive recipient of the outcomes resulting from the decisions of the participant making the adjustment decisions. In this manner, we test the incremental effect of separating investigative and adjustment decisions while holding constant the presence of two participants sharing a common outcome. Our second hypothesis H2 below predicts that separating the investigating and adjusting decisions in our *Paired* conditions will mitigate the *Solo-Effort vs. Solo-No Effort* difference that we predict in H1 above.

**H2:** The extent to which costly investigation leads to lower adjustments will be less pronounced when a separate participant makes adjustment decisions on behalf of a linked pair (i.e., *Paired-Effort* versus *Paired-No Effort*) than when decisions are individual (i.e., *Solo-Effort* versus *Solo-No Effort*).

Overall, as Figure 1 depicts, we predict lower adjustments in the *Solo-Effort* condition than in the other three conditions in which we either remove the investigative decision (*Solo-No Effort* condition), separate the two decisions in a paired task (*Paired-Effort* condition), or pair participants and remove investigation (*Paired-No Effort* condition).
III. EXPERIMENTAL METHOD AND DESIGN

In the tradition of experimental economics, we conduct an abstract incentivized laboratory experiment with student participants to test our hypotheses. To focus our participants on their incentives rather than on role playing, we describe the task using generic rather than contextually rich terminology (Haynes and Kachelmeier 1998). That is, we do not refer to participants as “auditors,” we use “X cards” (explained shortly) instead of “audit evidence,” and we ask participants to decide how much they wish to reduce their “known risk of loss” instead of asking for the amounts of required audit adjustments. An abstract experiment is advantageous for our research question, as we are interested in the primal effect of how the collection of costly evidence can influence subsequent costly decisions that act on that evidence, independently of how auditors interpret evidence.

Participants are 135 undergraduate student volunteers who opt-in to a participant pool maintained by the Behavioral Research Laboratory of a large public university’s business school.¹ Of the 135 participants, 91 make the adjustment decisions that comprise our primary dependent variable, with the other 44 necessary to operationalize pairings in the Paired-Effort and Paired-No Effort conditions. On average, participants are 20 years old, and 62% are women. As explained below, participants earn compensation based upon their results from the experiment, in addition to a $5 show up fee. Participation is not tied to any class.

Experimental Task

We use z-Tree (Fischbacher 2007) to program an experiment in which participants face a risk of loss from an initial endowment, as described below, but are uncertain of how much risk they face. Investigation refines the known risk of loss with greater precision, whereas adjustment

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¹ We obtained approval from the University’s Institutional Review Board for experiments with human participants.
can reduce the risk of loss. Our experiment is broadly consistent with any framework of audit risk assessment, including the audit-risk model in which auditors assess inherent and control risks followed by substantive tests to reduce overall audit risk. That being said, we interpret our setting in the framework of costly investigative effort that reveals risks of exposure from likely material misstatements, followed by decisions to force or waive the requisite adjustments. In this sense, our setting is conceptually similar to other auditing experiments in which participants adjust for the risk from an estimated misstatement (e.g., Griffin 2014; Kachelmeier and Van Landuyt 2017), except that participants in the current study both collect evidence to determine the magnitude of risk and then adjust based on the evidence revealed.

Participants begin the task by reading instructions and answering comprehension questions, with incorrect answers leading to remedial instructions and a prompt to retry the question. After completing this training, participants begin the task. Figure 2 shows the timeline under all four experimental conditions.

**Solo-Effort Condition**

Participants in the Solo-Effort condition begin with a random starting endowment ranging from $29 to $31 and a 50% baseline risk of an $18 loss from this endowment, analogous to the probability of an audit failure from exposure to an uncorrected material misstatement.² The 50% baseline risk captures the essence of an account for which preliminary assessments indicate a relatively high risk of a material difference between the auditor’s estimate and the client’s estimate, with further substantive testing possible to refine the magnitude and hence the degree of exposure to this difference. The instructions for participants in the Solo-Effort condition

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² The reason for slightly different starting endowments is that participants in the Solo-No Effort condition have different starting endowments to reflect the yoked cost of effort, such that participants in the Solo-Effort condition also start with different initial amounts to hold constant the presence of variable endowments across conditions.
explain that the actual risk of the $18 loss is 50% plus the result of four (virtual) cards that are initially placed face down on the z-Tree interface. Specifically, if a card has an “X” on the back, it increases the risk of loss by 10%. Thus, the total risk in each round can range from 50% if no card is marked with an “X” to 90% if all four cards have an “X.” The known risk of loss is the portion of the total risk that is revealed from investigative effort, as explained shortly. Participants are truthfully informed that each card has an equal chance of being an X card or a blank card. Consistent with this representation, we determined card outcomes before the experiment, and hold these outcomes constant across sessions to ensure that all participants face the same underlying risk in each round. Figure 3 shows the distribution of X cards across the seven rounds. In total, 15 of the 28 total cards across the seven rounds have an “X.”

Appendix A reproduces the decision interface for Solo-Effort participants. The first decision is investigation, in which these participants can pay to reveal zero, one, two, three, or all four cards. As shown in Table 1, Panel A, the marginal cost to reveal each card increases from $0.25 for the first card, $0.35 for the second, $0.60 for the third, and $0.80 for the fourth, such that a participant revealing all four cards would pay $2.00 up front. Effort costs are deducted from the starting endowment irrespective of the adjustment decisions and loss realizations that follow. These costs proxy for the costly effort necessary to gather additional substantive evidence to refine the risk of auditor exposure to an estimated misstatement and any corresponding need for audit adjustments. Conceptually, these costs can come from a number of sources, including the economic costs of time, the complexities of dealing with client personnel (e.g., Guénin-Paracini, Malsch, and Trembley 2015), and fatigue (e.g., Hurley 2015; 2019).³ We

³ Although fatigue is clearly a cost of investigation, our study does not address the specific possibility that fatigued auditors might make more compromised decisions as the result of ego depletion (e.g., see Hurley 2015; 2019). Participants in our study simply elect a level of investigation at an increasing marginal cost, and hence do not exert literal effort that could lead to fatigue.
abstract away from differentiating the effects of different kinds of costly effort in order to investigate the more primal effects of simply engaging in costly investigation.

In the adjustment stage, participants can lower their known risk of an $18 loss by paying an additional cost, analogous to the cost of requiring an audit adjustment. Specifically, participants can reduce risk in increments of 10%, down to a minimum of 10%. Larger adjustments represent successively more conservative positions taken by an auditor, analogous to stances taken in auditor-client negotiations. Importantly, the *known* risk of loss that participants can reduce is not necessarily the *actual* risk, as it does not reflect any additional “X” cards the participant chose *not* to reveal. The restriction that participants can only reduce known risk reflects the reality that auditors cannot realistically require an adjustment larger than what the audit evidence indicates. Like the marginal cost of effort, the marginal cost of adjustment is increasing in each 10% increment, as shown in Panel B of Table 1 and in the interface reproduced in Appendix A. Adjustment costs range from $0 if choosing no adjustment, $1.20 if reducing risk by 10%, $2.50 if reducing risk by 20%, and up to $12.40 if reducing the 90% highest possible known risk to the minimum possible risk of 10%. Participants cannot lower risk to zero, capturing the real-world auditing limitation that even the best audits can only provide reasonable assurance, not absolute assurance.

Like effort costs, adjustment costs in our experiment are an abstract proxy for the costs auditors incur in practice from a number of sources. These costs include the economic and emotional costs of dealing with client resistance to proposed adjustments (e.g., Guénin-Paracini, Malsch, and Paillé 2014). There are no “clients” in our experiment, but our setting captures the reality that audit adjustments are costly, with larger adjustments associated with larger costs.
**Solo-No Effort Condition**

Participants in the *Solo-No Effort* condition do not complete the investigation stage. Instead, these participants go straight to the adjustment stage after being informed of a starting endowment and known risk of loss. We obtain this information by yoking each *Solo-No Effort* participant to the investigation decisions and revelations of a previous participant in the *Solo-Effort* condition. Yoking ensures that, on average, participants across conditions have the same known risk of loss and the same monetary positions. We do not inform participants that their information has been yoked to a different participant, but providing the same information achieves *ceteris paribus* matching. Importantly, we present participants in the *Solo-No Effort* condition with the same z-Tree interface of four virtual cards that might or might not have an “X” on the back, with zero to four of these cards revealed and the others not revealed. Thus, both *Solo-Effort* and *Solo-No Effort* participants are aware of the potential for additional risk corresponding to any cards left unrevealed. The only difference is that *Solo-No Effort* participants do not take any action to reveal cards, but rather are simply provided with the same information and the same after-effort monetary position as that determined by a yoked participant in the *Solo-Effort* condition.⁴

**Paired Conditions**

The *Paired-Effort* condition duplicates the *Solo-Effort* condition, with the sole exception that two participants are linked, with one completing the investigation stage and the other completing the adjustment stage. Although the instructions truthfully inform participants that

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⁴For example, assume that a *Solo-Effort* participant begins with an endowment of $30 and a 50% risk of loss. The participant pays $1.20 to reveal three of the four cards, leaving a $28.80 endowment net of this cost. Assume that two of the three revealed cards have an X, such that the known risk of loss is now 70%, with the possibility of 10% additional risk depending on the outcome of the fourth card. These parameters would then be yoked to a *Solo-No Effort* participant, who would start with an endowment of $28.80, and would be informed at the start of the round that the known risk of loss is 70%, with a hidden card that could increase this risk by an additional 10%.
they “will be paired with another person,” paired participants do not interact or even see each other, nor are they aware of each other’s identity, thus separating investigative and adjustment decisions without collaboration or consultation. The two participants in each pair begin with the same monetary endowment, are made aware of each other’s decisions, and incur the same evidence and adjustment costs, such that all decisions and revelations impact each participant in a pair identically. In this manner, we separate the parties who make investigative and adjustment decisions while holding constant the consequences of these decisions.

Similarly, the Paired-No Effort condition duplicates the Solo-No Effort control condition, but with two linked participants instead of one. Because there are no investigative decisions in this control condition, one of the two participants in each pair of Paired-No Effort participants takes no actions and makes no decisions, while the other completes the adjustment stage. Accordingly, we hold constant the presence of two linked participants in the Paired-Effort and Paired-No Effort conditions, while manipulating whether information on the risk of loss comes from the decisions of one of these participants (Paired-Effort) or is simply provided without any actions taken by either participant (Paired-No Effort). Similar to the yoking process in the Solo-No Effort condition, we yoke each Paired-No Effort pair to the same investigative information and costs as determined by a yoked pair in the Paired-Effort condition. The inclusion of the Paired-No Effort condition in the experimental design enables us to separate out any main effect of pairing that is independent of effort.

Wealth-Maximizing Strategies

As a benchmark for interpreting our hypotheses, we comment in this subsection on the strategies we would observe if all participants were fully wealth maximizing and risk neutral. Starting with investigative effort, given our experimental parameters (Table 1), the optimal
wealth-maximizing strategy for risk-neutral participants is to incur no investigation costs (i.e., revealing zero cards). See Appendix B for proof. While we would certainly not argue that real-world auditors have no incentive to exert effort, these parameters ensure that participants who choose to incur investigative costs are willfully invested in that decision. The literature on curiosity, as reviewed by Loewenstein (1994), finds that the demand for diagnostic information often exceeds what would be predicted by models of rational choice, helping to explain, for example, the arguably excessive demand for diagnostic tests in medicine. To the extent that this phenomenon applies in our study, participants will pay to reveal their true risk of loss because they want to know, not because they are economically induced to do so.

Appendix B also explains that our parameters incentivize wealth-maximizing, risk-neutral participants to reduce risk in the adjustment stage by the maximum amount possible, irrespective of the amount of investigation and risk thereby revealed. That is, under our parameters, participants should always reduce the risk of an $18 loss to the lowest permissible risk of 10%. Overall, the monetary incentive structure we implement enables a strong test of theory that cannot be explained by economic incentives alone. That is, we expect participants to willingly pay for investigative information in the Effort conditions but to adjust by less in the Solo-Effort condition than in the other conditions, despite equivalent information and economic incentives across conditions to adjust as much as possible.

Experimental Rounds, Outcome Realizations, and Payments

We repeat the experimental task for seven rounds to facilitate participant learning and adaptation. Each round starts with a new endowment and new risk information. Participants are unaware of the number of rounds beforehand and do not learn whether they incur or do not incur an $18 loss in any particular round until all rounds are completed and all data are collected, thus
minimizing any outcome or end-game effects. Participants are aware from the instructions that two of the experimental rounds will be selected randomly for cash payments equal to the average amount earned in these two rounds. At the end of the experiment, participants answer several post-experimental questions before the two payment rounds are randomly selected. For these rounds, the z-Tree interface truthfully reveals the actual risk of loss, including any X cards that were not previously revealed in the investigation stage. Participants then draw a card from a (real) deck with shuffled cards prenumbered from 1 to 100 to credibly operationalize the percentage risk of incurring an $18 loss for any particular round. If the number drawn from the deck is less than the number corresponding to the percentage risk of loss, the loss is realized, deducting $18 from the participant’s monetary endowment.\footnote{In contrast to the fixed penalty of $18 that we operationalize, Burton, Wilks, and Zimbelman (2011) assert that a skewed probabilistic audit penalty may prompt more audit effort. We acknowledge that a more complex penalty structure might influence participants' adjustment choices, but we have no reason to believe that any such effect would interact with our manipulated factors.} Thus, the final result for each round is as follows:

\[
\text{Starting endowment} - \text{investigation cost (determined by participant in \textit{Effort} conditions or netted against the starting endowment in \textit{No Effort} conditions)} - \text{adjustment cost} - \$18 \text{ loss (if incurred)} = \text{final cash outcome for round.}
\]

We average the two payment rounds and add the $5 show-up to determine compensation, which we pay discreetly to participants in cash. Payments average to $22.75 and range from $10.00 to $34.00, indicating meaningful variation in final monetary outcomes. We operationalize all experimental steps as indicated in the instructions, with no deception.

**IV. RESULTS**

**Manipulation Checks**

The post-experimental questionnaire asks participants to assess on a seven-point Likert scale how responsible they felt for the known risk of loss and for lowering that risk. Participants in the \textit{Effort} conditions who made investigation choices express more responsibility for the
known risk of loss than other participants ($F_{1,133} = 78.18; p < 0.01$), and participants making the adjustment decision across conditions feel more responsible for lowering risk than participants in the Paired-Effort and Paired-No Effort conditions who did not make adjustment decisions ($F_{1,133} = 148.20; p < 0.01$). We conclude that are our manipulations are effective and salient.

Focus of Analysis

As explained by Hertwig and Ortmann (2001, 387), a primary reason for using multiple trials in an incentivized economic experiment is to capture behavior after participants have learned and adapted to the task. As the authors observe, this is why experimental economists generally focus on the last periods of data in their analyses. Consistent with this advice, although we observe a mostly consistent pattern of behavior across rounds, as we revisit later, our data exhibit the least volatility and hence the greatest statistical power in the final period, round seven. The seventh round has the added advantage that the last three cards of the four available for investigation are all “X” cards (see Figure 3), providing a meaningful addition to the known risk of loss after investigative effort. Accordingly, all of our primary analyses are based on data from round seven. We comment on other rounds as part of our supplemental analyses.

Investigative Effort Decisions

Although our hypothesized predictions focus on adjustment decisions, we begin by describing investigative effort decisions to ensure that our setting exhibits a meaningful level of investigative effort in spite of monetary incentives to exert zero effort (see Appendix B). As explained above, we report choices from the final round (i.e., round seven), although we observe similar effort choices in other rounds. As shown in Table 2, participants in the Solo-Effort and Paired-Effort conditions choose to reveal 2.63 of the four available cards, on average. More specifically, 30 of the 48 participants (62.5 percent) in these conditions choose to reveal three or
all four cards, and 38 of 48 (79.1 percent) reveal at least two cards. We therefore conclude that our setting exhibits meaningful investigative effort. We note further that, by construction, yoking ensures that No Effort participants have the same risk information as the Effort participants to whom they are yoked.\footnote{Because there are slightly more Effort participants (n = 48) than No Effort participants (n = 43), not all Effort participants are yoked to a No Effort participant. The five extra Effort participants are otherwise legitimate observations, so we include all data in our reported analyses. A reduced-sample analysis of adjustments that omits unyoked observations in the Effort conditions (untabulated) reaches the same statistical inferences.} We control for this information as a covariate in our analysis of adjustment decisions.

Investigative effort decisions do not significantly differ between the Solo-Effort and Paired-Effort conditions, with averages of 2.72 and 2.52 cards revealed, respectively ($F_{1,44} = 0.251; p = 0.62$). Accordingly, we are comfortable that the only substantive difference between the Solo and Paired conditions is the pairing of participants.

**Primary Analysis of Adjustment Decisions**

We test our hypotheses using the following ANCOVA model:

$$ AAAA = \beta_0 + \beta_1 EE + \beta_2 PPPE + \beta_3 PPPEE \times PPPE + \beta_4 SAEAS + \beta_5 SAEAS + \beta_6 GAAA + \epsilon, $$  

\begin{equation}
(1)
\end{equation}

*Adjustment* is the percentage of adjustment chosen by the participant. *Effort* (Effort vs. No Effort) and *Pairing* (Solo vs. Paired) are categorical variables. The model includes three covariates: *StartRisk*, *RiskPref*, and *Gender*.\footnote{*StartRisk* and *RiskPref* are continuous control variables, whereas *Gender* is categorical. Results from separate tests indicate that these covariates are not significantly associated at conventional levels with the manipulated treatment factors *Effort* or *Pairing* (all $p > 0.14$).} *StartRisk* is the known risk of loss the participant faces when making his/her adjustment decision, controlling for the fact that higher known risks allow larger adjustments. *RiskPref* is a measure of participants’ risk preferences from a post-experimental questionnaire, and is included along with *Gender* because both measures could be associated with variance in risky adjustment decisions that is independent of the manipulated factors.
Table 3, Panel A reports and Figure 4 depicts marginal mean adjustments by condition. As Figure 4 shows, adjustments are lower in the Solo-Effort condition than in the Solo-No Effort condition, consistent with H1. Figure 4 also shows that the Paired-Effort and Paired-No Effort conditions do not exhibit this difference. While the absence of lower adjustments in the Paired-Effort condition than in the Paired-No Effort condition is technically consistent with H2, the interactive pattern in Figure 4 does not mirror our prediction in Figure 1. Rather, adjustments in both the Paired-Effort and Paired-No Effort conditions are closer in magnitude to the relatively low adjustments in the Solo-Effort condition than to the higher adjustments in the Solo-No Effort condition. We return to this observation when discussing our findings for H2.

Table 3, Panel B reports the results from testing the ANCOVA model. All reported \(p\)-values are two-tailed. The Effort \(\times\) Pairing interaction apparent in Figure 4 is statistically significant (\(F_{1,84} = 5.24; p = 0.02\)). Supporting H1, the follow-up analysis of simple effects in Table 2, Panel C shows that adjustments are significantly lower in the Solo-Effort condition than in the Solo-No Effort condition (\(F_{1,84} = 5.61; p = 0.02\)), despite the equivalence of known risk information and monetary positions ensured by our yoking procedure. Thus, the mere action of choosing to acquire costly information appears to make participants more risk seeking, given that our parameters are set such that risk-neutral or risk-averse participants should reduce the known risk of loss to the maximum extent possible.

In contrast, we find mixed evidence for H2 regarding the effect of pairing to separate the investigative and adjustment decisions. The significant Effort \(\times\) Pairing interaction in Panel B of Table 3 indicates that the effect of Effort is less pronounced for Paired participants than for Solo

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8 The ANCOVA model treats the dependent variable Adjustment as a continuous variable. Strictly speaking, however, adjustments can only be in increments of 10%. Accordingly, we also conduct an alternative model with Adjustment as a multinomial variable (untabulated), obtaining the same inferences.
participants. Moreover, the difference between the Paired-Effort and Paired-No Effort conditions is not statistically significant, as shown in the simple-effect test reported in Panel C ($F_{1,84} = 0.823; p = 0.37$). These findings are consistent with H2. However, as noted above in our discussion of Figure 4, both the Paired-Effort and Paired-No Effort conditions are closer to the lower, Solo-Effort adjustment levels than to the higher, Solo-No Effort adjustment levels. Thus, while separating participants’ investigation and adjustment responsibilities appears to eliminate any effort-based adjustment effect from H1, it also appears to lead to systematically lower adjustments, irrespective of effort, below those observed in the Solo-No Effort control condition.

While post hoc, a plausible explanation for this unexpected finding is that participants are hesitant to incur adjustment costs that apply to themselves and their paired counterparts. By way of analogy, Atanasov and Kunreuther (2016) report an experiment in which participants are less willing to pay a protective investment cost in a game styled after the prisoner’s dilemma when acting on behalf of a group than when acting individually. The two experiments present different strategic incentives, but a common thread could be that participants are reluctant to force others to bear protective costs. Even in our control conditions without investigative effort choices, participants adjust by significantly less in the Paired-No Effort condition than in the Solo-No Effort condition ($F_{1,84} = 5.54; p = 0.02$), with the only difference between these conditions being that Paired-No Effort adjustments also impact a second person. Auditors in practice could face the same dilemma, as any negative impact associated with audit adjustments would be felt not only by, say, a national-office partner charged with the making the final adjustment decision, but also by the local partner in charge of the audit.

Overall, our primary analysis supports our core theoretical premise in H1 that the act of undertaking costly investigation can impede the willingness to adjust for the news revealed in the
investigation, relative to a setting in which the same news is simply provided without explicit investigation decisions. To the extent that this phenomenon can lead to underadjustment, separating the investigative and adjustment decisions in a paired task solves the problem in part, insofar as we no longer observe less adjustment among paired participants with investigative effort than without such effort. That being said, pairing also appears to introduce an unexpected new problem, insofar as the adjustments made by both Paired-Effort and Paired-No Effort participants are closer to Solo-Effort adjustments than to Solo-No Effort adjustments, possibly reflecting an incremental behavioral aversion to sharing protective costs with others. Thus, we cannot claim full support for H2. We return to the practical implications of these findings in our concluding comments.

Supplemental Analyses

Sensitivity to Different Levels of Risk Information

Although we provide an investigative option to participants in the Effort conditions, we do not tell these participants how much to investigate. Yoking each No Effort participant to the information revealed by an Effort participant ensures that these participants have the same information when contemplating adjustments, and we also control for the known risk of loss that embeds this information (i.e., StartRisk) as a covariate in our primary analysis. The statistical significance of StartRisk in Table 3 (F_{1,84} = 26.89; p < 0.01) is as expected, given that larger levels of StartRisk leave more room for adjustment. To provide additional assurance of the robustness of our findings to different levels of risk, below we report results after excluding participants at the extremes of risk information.

Table 4 reports marginal means in Panel A and simple effect tests from an ANCOVA model in Panel B for adjustment decisions after (1) excluding participants with no revealed cards
or just one revealed card, (2) excluding participants with all four revealed cards, and (3) applying both exclusions, thus retaining only those participants with two or three of the four possible revealed cards. Notwithstanding the smaller sample sizes of these tests, we observe consistent findings. Namely, adjustments are significantly lower in the Solo-Effort condition than in the Solo-No Effort condition at \( p = 0.02 \) or better (see Table 4, Panel B), supporting H1. Also consistent with our primary analysis, the Paired-Effort and Paired-No Effort conditions do not significantly differ (lowest \( p = 0.23 \)). The latter result only partially supports H2, as Paired adjustments continue to be lower than in the Solo-No Effort condition, suggesting that pairing itself exerts a downward effect on the level of adjustment. On balance, we conclude that our primary findings are not driven by high or low extremes of available risk information.\(^9\)

**Risk Preferences and Gender**

In addition to controlling for participants’ known risk of loss (i.e., \( \text{StartRisk} \)), our analyses also control for risk preferences and gender. We obtain a measure of risk preferences by averaging participants’ responses to two questions in the post-experimental questionnaire that elicit preferences between a safe option and a risky option.\(^{10}\) The resulting \( \text{RiskPref} \) measure that we include as a covariate in Table 3 is not statistically significant (\( F_{1,84} = 0.54; \ p = 0.47 \)). Accordingly, although participants’ adjustments are in response to risk information, our findings appear to be more consistent with the perspective taken in prospect theory that risk preferences

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\(^9\) Given our theory, one could argue that we should observe no treatment effect for participants with zero or one revealed cards. However, we are unable to meaningfully test this supposition, as participants’ effort choices (see Table 2) leave us with only 20 observations (five per cell) that meet this condition. The average difference between Solo-Effort and Solo-No Effort adjustments for participants with zero or one revealed cards is about half the magnitude as the difference for other participants, and is not statistically significant (\( p = 0.62 \)).

\(^{10}\) The first question asks participants to rate on a seven-point scale the extent to which they would prefer a certain $5 to a 50% chance at $10, with 1 = “Extremely prefer $5 for sure” and 7 = “Extremely prefer a 50% chance at $10.” The second question asks participants whether they would prefer to invest $100 in a small startup’s stock with high price variance or an established company’s stock with low price variance, with 1 = “Extremely prefer the small company stock” and 7 = “Extremely prefer the large company stock.” We reverse-code the second question before averaging responses to obtain the covariate \( \text{RiskPref} \).
are context-specific and cannot easily be captured as an overall personality trait, meaning that otherwise risk-averse decision makers can become risk seeking when placed in a loss domain.

Regarding gender, the ANCOVA in Table 3 indicates a significant association \((F_{1,84} = 7.58; p < 0.01)\) between Adjustment and the Gender indicator that we obtain from the post-experimental questionnaire. Specifically, women adjust by less than men, implying that women are more risk seeking than men in this setting. Although this finding appears to contrast against the general sense from the literature that women are more risk averse than men (see review by Croson and Gneezy 2009),\(^{11}\) adjustment decisions in our experiment are in the context of a loss prospect (i.e., losing a certain amount now to avoid the risk of a larger loss later). In challenging the conventional wisdom that women are more risk averse than men, Schubert, Brown, Gysler, and Brachinger (1999) find that, while women do indeed tend to be more risk averse than men when evaluating potential gains, the opposite is true when losses are at stake. In any event, controlling for Gender in our primary analysis extracts the incremental effect of our treatment manipulations independently of any gender effect.\(^{12}\)

**Results across Rounds**

As explained earlier, we use observations from the seventh and final round for our primary analysis, under the rationale that the final round has the advantages of maximizing participant learning (Hertwig and Ortmann 2001) and also the fact that round seven has three X cards among the four that could be revealed, thus presenting meaningful consequences from investigative effort. Accordingly, we believe that our primary analysis in Table 3 uses our most reliable data. Nevertheless, in this subsection we report adjustment decisions across other rounds,

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\(^{11}\) Even within our experiment, our post-experimental RiskPref measure indicates greater risk aversion for women than for men \((F_{1,80} = 4.20; p = 0.04, \text{untabulated}).\)

\(^{12}\) Our primary inferences remain at least marginally significant even if we omit the covariates for risk preferences and gender (i.e., two-tailed \(p = 0.07\) for the Effort × Pairing interaction and \(p = 0.05\) for the simple effect of Effort for Solo participants).
with marginal means by condition depicted in Figure 5, for the last four rounds in Panel A and for all rounds in Panel B.

As Figure 5 shows, we observe the same general pattern across the last four rounds and in all rounds as we find in Figure 4 from round seven. Namely, adjustments in the Solo-Effort condition are lower than in the Solo-No Effort condition, whereas we do not observe this difference when comparing the Paired-Effort and Paired-No Effort conditions. Statistically, an untabulated two-tailed ANCOVA using average adjustments across the last four rounds as the dependent variable finds a significant simple effect for the difference between the Solo-Effort and Solo-No Effort conditions in support of H1 ($F_{1,84} = 3.89; p = 0.05$) and at least a marginally significant Effort $\times$ Pairing interaction in support of H2 ($F_{1,84} = 3.16; p = 0.08$). Using averages across all rounds, an untabulated ANCOVA finds a marginally significant simple effect for the Solo-Effort versus Solo-No Effort difference ($F_{1,84} = 3.38; p = 0.08$) but no significant Effort $\times$ Pairing interaction ($F_{1,84} = 1.60; p = 0.21$). In both cases, the Paired-Effort versus Paired-No Effort simple effect is not statistically significant ($p = 0.57$ and $p = 0.97$ for the last four rounds and for all rounds, respectively). Thus, while support for our hypothesized predictions is somewhat statistically weaker, our reported primary findings are mostly consistent across rounds.

V. CONCLUSIONS

Why do auditors sometimes waive material adjustments (e.g., Wright and Wright 1997; Choudhary et al. 2019) if they willingly exert the costly effort to detect the need for such adjustments? There is no simple answer to this question, but our study suggests that one contributor could be the investigative process itself. That is, finding unfavorable audit evidence from costly investigation could make auditors less willing to incur additional costs to carry out an adjustment. We test this premise in an abstract experimental setting that maximizes our ability
to isolate the theoretical constructs of interest. We find that participants who undertake costly investigation to uncover the risk of a penalty are less willing to pay additional adjustment costs to reduce this risk than are yoked participants in a control condition who have the same risk information and the same monetary position, but without explicit investigative decisions. Consistent with the theory of mental accounting in combination with information choice effects, we interpret this finding as evidence of the difficulty people have separating the costs and outcomes of investigation from the costly adjustments that follow. Experimental participants who do not make investigation decisions do not face this difficulty.

If detaching investigation decisions from adjustment decisions is the key to removing the effect of the former on the latter, an intuitive solution to the problem could be to separate the responsibility for audit adjustments from the responsibility for audit evidence. Indeed, in a variant of our experimental conditions in which we pair participants and ask only one member of each pair to make adjustment decisions, we find that adjustments are no longer lower with investigative effort than without. However, in an unexpected twist on this finding, adjustments made in pairs are systematically lower than those made by individual participants without investigative effort. A plausible, albeit post hoc, explanation is that paired participants are hesitant to incur adjustment costs that their paired counterparts must share, offsetting the relative immunity of such participants to the effects of investigative effort.

If one would want auditors to adopt a risk-averse or at most a risk-neutral stance with respect to audit adjustments, we are thus left with the conclusion that the optimal condition we test is the Solo-No Effort condition in which participants make adjustment decisions independently of investigative decisions, but not in a paired setting. Unfortunately, the Solo-No Effort condition would be particularly difficult to implement in practice, given that both
investigation and adjustment are integral to the audit process. Still, we leave for future research the consideration of possible ways to approach our Solo-No Effort condition. We offer two potential examples in this regard. First, to the extent that data analytics can make the investigation stage of an audit less onerous (e.g., see commentaries by Earley [2015] and Appelbaum et al. [2017]), a byproduct could be that auditors might be more willing to act on the information revealed. As a second example, López and Peters (2012) find that audits completed during “busy season” are associated with greater abnormal accruals and more evidence of earnings management than audits completed during less stressful times of the year. While the authors attribute their findings to workload pressure, our study suggests the possibility of a subtly different (or additional) interpretation. Namely, like our Solo-No Effort participants, auditors who have the luxury of taking more time to complete the audit could be better able to detach themselves from the perceived losses already incurred from a problematic audit investigation when contemplating the additional costs of audit adjustments.

Our findings are subject to the usual limitations of an abstract laboratory experiment (Kachelmeier and King 2002). Student participants are not audit professionals and the laboratory is not a client site. Similarly, paying a small sum to flip over a virtual card is far removed from the effort of logging a 100-hour audit work week during busy season. However, if flipping over some digital cards is enough to cause information choice effects, a 100-hour work week would likely to do the same. Finally, our experiment omits a human reporter. This design choice is intentional because our research objective is to examine the primal effects of the presence of investigative and adjustment costs, not the sources of these costs. That being said, it is possible that human reporters could exacerbate the influence of auditor effort on auditor-imposed
adjustments to the extent that reporters impose additional costs on auditors during evidence collection through uncooperative behavior (e.g., Guénin-Paracini et al. 2015).

We encourage further research that goes beyond the traditional appeal to client pressure from economic and social bonds as the root cause of impaired auditor independence. Client pressure is surely important and worthy of investigation, but at the same time, it is somewhat of an enigma as to why auditors would willingly exert investigative effort, discover material misstatements, and yet bow to client pressure rather than insist on the requisite adjustments. While abstract, our attempt to integrate investigation decisions and adjustment decisions within the same study is a step towards a more holistic consideration of the auditor’s environment.
APPENDIX A

Screenshots from Decision Interface

Panel A: Screenshot for the first decision of the investigation stage:

You will now begin the experiment.

Your starting endowment is: $30.00

Your starting risk of loss is: 50%

Below are your 4 cards (they are all dark blue). Each one is facedown.

Do you want to flip over the first card for: $0.25?

- [ ] Yes, flip over the first card
- [ ] No, I don't want to flip any cards

[Continue]
Appendix A, continued

Panel B: Screenshot from the investigation stage after a participant has flipped three cards:

Your new endowment is $29.80

Your known risk of loss is now 70%

Below are your 4 cards. You have flipped over the first three cards.

Do you want to flip over the fourth card for an additional $0.80?

- Yes, flip over the fourth card
- No, I don't want to flip over any more cards

Continue
Appendix A, continued

Panel C: Representative screenshot from the adjustment stage:

Your new endowment is: $28.80

Your known risk of loss is now: 70%

You still have 1 card covered up which may or may not have an "X" under them (unflipped cards are shown below).

You may now choose to reduce your Known Risk of Loss. Please reference the table on Page 6 of your instructions for the price of reducing your Known Risk of Loss.

- I do not want to reduce my Known Risk of Loss
- Reduce by 10% for $1.20
- Reduce by 20% for $2.50
- Reduce by 30% for $3.90
- Reduce by 40% for $5.40
- Reduce by 50% for $7.00
- Reduce by 60% for $9.70

OK
APPENDIX B

Optimal Investigation and Adjustment Strategies
Assuming Wealth Maximization and Risk Neutrality

We solve the game by backward induction. At the adjustment stage, regardless of how many cards the auditor has flipped and the risks revealed by those cards, the participant’s expected loss is minimized by paying to reduce risk to 10%, the minimum possible amount. The total expected loss is the sum of the costs of investigation and adjustment plus the expected value of the residual risk of an $18 penalty that remains after the adjustment decision.

The left column indicates the possible known risks of loss that could be revealed for each possible investigation decision. The second through last columns indicate the expected losses for each adjustment strategy. As shown in **boldface**, expected losses are lowest when the participant adjusts by the maximum amount allowed, leaving a 10% residual risk of an $18 penalty.

<table>
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<tr>
<th>4 cards flipped</th>
<th>Reduce by 0</th>
<th>Reduce by 10</th>
<th>Reduce by 20</th>
<th>Reduce by 30</th>
<th>Reduce by 40</th>
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<td>16.4</td>
<td>16.2</td>
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<td>16.1</td>
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</tr>
<tr>
<td>80%</td>
<td>16.4</td>
<td>15.8</td>
<td>15.3</td>
<td>14.9</td>
<td>14.6</td>
<td>14.4</td>
<td>14.3</td>
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</tr>
<tr>
<td>70%</td>
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<td>14</td>
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<td>12.6</td>
<td>12.6</td>
<td>12.6</td>
<td>12.6</td>
</tr>
<tr>
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<td>12.2</td>
<td>11.7</td>
<td>11.3</td>
<td>11</td>
<td>10.8</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>50%</td>
<td>11</td>
<td>10.4</td>
<td>9.9</td>
<td>9.5</td>
<td>9.2</td>
<td>N/A</td>
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<th>Reduce by 10</th>
<th>Reduce by 20</th>
<th>Reduce by 30</th>
<th>Reduce by 40</th>
<th>Reduce by 50</th>
<th>Reduce by 60</th>
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<td>15.9</td>
<td>15.4</td>
<td>15</td>
<td>14.7</td>
<td>14.5</td>
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<td>13.6</td>
<td>13.2</td>
<td>12.9</td>
<td>12.7</td>
<td>12.6</td>
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<tr>
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<tr>
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<td>10.5</td>
<td>10</td>
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<td>9.3</td>
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<th>Reduce by 20</th>
<th>Reduce by 30</th>
<th>Reduce by 40</th>
<th>Reduce by 50</th>
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<td>12.6</td>
<td>12.1</td>
<td>11.7</td>
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</tr>
<tr>
<td>50%</td>
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<td>10.8</td>
<td>10.3</td>
<td>9.9</td>
<td>9.6</td>
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<th>Reduce by 30</th>
<th>Reduce by 40</th>
<th>Reduce by 50</th>
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<td>60%</td>
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<td>13.2</td>
<td>12.7</td>
<td>12.3</td>
<td>12.0</td>
<td>11.8</td>
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<tr>
<td>50%</td>
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<td>11.4</td>
<td>10.9</td>
<td>10.5</td>
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<table>
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<th>Reduce by 0</th>
<th>Reduce by 10</th>
<th>Reduce by 20</th>
<th>Reduce by 30</th>
<th>Reduce by 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>50%</td>
<td>12.6</td>
<td>12</td>
<td>11.5</td>
<td>11.1</td>
<td>10.8</td>
</tr>
</tbody>
</table>

Continued on next page
Appendix B, continued

The above outcomes also demonstrate that, when deciding how much investigative effort to exert (i.e., how many cards to flip), the expected loss from flipping zero cards can only be beaten if every card flipped does not have an X. Because participants know that each card has a 50% chance of an X, the strategy of flipping zero cards cannot be beaten in expectation. Accordingly, the strategy of flipping zero cards and reducing known risk by the maximum amount allowed minimizes the expected loss and hence maximizes expected final payoffs.
REFERENCES


FIGURE 1

Predicted Results for Audit Adjustments

<table>
<thead>
<tr>
<th>Amount of Adjustment</th>
<th>Effort</th>
<th>No Effort</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Solo</td>
<td>Paired</td>
</tr>
</tbody>
</table>

Condition
# FIGURE 2
Experimental Timeline

<table>
<thead>
<tr>
<th>Solo-Effort Condition</th>
<th>Solo-No Effort Condition</th>
<th>Paired-Effort Condition</th>
<th>Paired-No Effort Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Participants review instructions</td>
<td>1. Participants review instructions</td>
<td>1. Participants review instructions and are assigned as the investigator or adjuster.</td>
<td>1. Participants review instructions and half of participants are assigned as adjusters.</td>
</tr>
<tr>
<td>2. Participants review a starting endowment ($29-$31) and an initial known account risk (50%).</td>
<td>2. Participants review a starting endowment and an initial known account risk (from the Investigation Stage in the Effort condition).</td>
<td>2. Investigators review a starting endowment ($29-$31) and an initial known account risk (50%).</td>
<td>2. Adjusters review a starting endowment and an initial known account risk (from the Investigation Stage in the Effort condition).</td>
</tr>
<tr>
<td>3. <strong>Investigation Stage</strong> - participants choose how many of 4 cards to flip over to receive more risk information.</td>
<td>3. <strong>Investigation Stage</strong> - The investigator chooses how many of 4 cards to flip over to receive more risk information.</td>
<td>3. <strong>Investigation Stage</strong> - The investigator chooses how many of 4 cards to flip over to receive more risk information.</td>
<td>3. <strong>Investigation Stage</strong> - Adjusters choose how much to reduce account risk</td>
</tr>
<tr>
<td>4. <strong>Adjustment Stage</strong> - Participants choose how much to reduce account risk.</td>
<td>4. <strong>Adjustment Stage</strong> - Participants choose how much to reduce account risk.</td>
<td>4. <strong>Adjustment Stage</strong> - The adjuster chooses how much to reduce account risk.</td>
<td>4. Game repeats seven times.</td>
</tr>
<tr>
<td>5. Game repeats seven times.</td>
<td>5. Game repeats seven times.</td>
<td>5. Game repeats seven times.</td>
<td>6. Participants fill out survey.</td>
</tr>
<tr>
<td>7. Two rounds are randomly selected, unflipped cards are revealed, final results and compensation is calculated.</td>
<td>6. Two rounds are randomly selected, unflipped cards are revealed, final results and compensation is calculated.</td>
<td>7. Two rounds are randomly selected, unflipped cards are revealed, final results and compensation is calculated.</td>
<td>6. Two rounds are randomly selected, unflipped cards are revealed, final results and compensation is calculated.</td>
</tr>
</tbody>
</table>

---

40
This figure shows the distribution of cards that participants could reveal each round. Boxes marked with an “X” increase the participant’s risk of a $18 loss by 10%. Only by paying a cost can participants uncover whether each card, revealed from left to right, is an X card or a blank card. We hold the distribution constant across conditions and across participants to ensure comparability.
FIGURE 4

Estimated Marginal Means of Audit Adjustments in Round Seven

Amount of Adjustment

Condition

Solo
Paired

Effort
No Effort
FIGURE 5
Estimated Marginal Means of Audit Adjustments in Other Rounds

Panel A: Last Four Experimental Rounds

\[ \text{Amount of Adjustment} \]

Panel B: All Experimental Rounds

\[ \text{Amount of Adjustment} \]
TABLE 1

Experimental Parameters

Panel A: Investigation Costs

<table>
<thead>
<tr>
<th>Number of Cards Drawn</th>
<th>Marginal Cost of Card</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N/A</td>
<td>$0.00</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>$0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>2</td>
<td>0.35</td>
<td>0.60</td>
</tr>
<tr>
<td>3</td>
<td>0.60</td>
<td>1.20</td>
</tr>
<tr>
<td>4</td>
<td>0.80</td>
<td>2.00</td>
</tr>
</tbody>
</table>

Panel B: Adjustment Costs

<table>
<thead>
<tr>
<th>Reduction of Known Account Risk</th>
<th>Marginal Cost of Adjustment</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>N/A</td>
<td>$0.00</td>
</tr>
<tr>
<td>10%</td>
<td>$1.20</td>
<td>1.20</td>
</tr>
<tr>
<td>20%</td>
<td>1.30</td>
<td>2.50</td>
</tr>
<tr>
<td>30%</td>
<td>1.40</td>
<td>3.90</td>
</tr>
<tr>
<td>40%</td>
<td>1.50</td>
<td>5.40</td>
</tr>
<tr>
<td>50%</td>
<td>1.60</td>
<td>7.00</td>
</tr>
<tr>
<td>60%</td>
<td>1.70</td>
<td>8.70</td>
</tr>
<tr>
<td>70%</td>
<td>1.80</td>
<td>10.50</td>
</tr>
<tr>
<td>80%</td>
<td>1.90</td>
<td>12.40</td>
</tr>
</tbody>
</table>
TABLE 2

Investigative Effort Choices in Round Seven

<table>
<thead>
<tr>
<th></th>
<th>Solo-Effort</th>
<th>Paired-Effort</th>
<th>All conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (standard</td>
<td>2.72</td>
<td>2.52</td>
<td>2.63</td>
</tr>
<tr>
<td>deviation) cards</td>
<td>(1.37)</td>
<td>(1.38)</td>
<td>(1.36)</td>
</tr>
<tr>
<td>flipped</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency counts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 cards flipped</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>1 card flipped</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2 cards flipped</td>
<td>3</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>3 cards flipped</td>
<td>10</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>4 cards flipped</td>
<td>8</td>
<td>8</td>
<td>16</td>
</tr>
</tbody>
</table>

This table indicates means, standard deviations, and frequency counts for the number of cards flipped in the investigative stage of the experiment by participants in the Solo-Effort and Paired-Effort conditions. We yoke each participant in the Solo-No Effort and Paired-No Effort conditions to a randomly selected participant in the Solo-Effort or Paired-Effort condition, respectively, to ensure equivalent risk information across conditions.
Table 3: Adjustment Decisions in Round Seven

Panel A: Estimated Marginal Means (Standard Errors)

<table>
<thead>
<tr>
<th></th>
<th>Effort</th>
<th>No Effort</th>
<th>Row means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solo</td>
<td>35.07</td>
<td>45.66</td>
<td>40.36</td>
</tr>
<tr>
<td></td>
<td>(3.06)</td>
<td>(3.31)</td>
<td>(2.28)</td>
</tr>
<tr>
<td>n = 25</td>
<td>n = 22</td>
<td>n = 47</td>
<td></td>
</tr>
<tr>
<td>Paired</td>
<td>38.80</td>
<td>34.59</td>
<td>36.70</td>
</tr>
<tr>
<td></td>
<td>(3.25)</td>
<td>(3.34)</td>
<td>(2.33)</td>
</tr>
<tr>
<td>n = 23</td>
<td>n = 21</td>
<td>n = 44</td>
<td></td>
</tr>
</tbody>
</table>

Column means

<table>
<thead>
<tr>
<th></th>
<th>Effort</th>
<th>No Effort</th>
<th>Row means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>36.94</td>
<td>40.12</td>
<td>38.53</td>
</tr>
<tr>
<td></td>
<td>(2.25)</td>
<td>(2.35)</td>
<td>(1.65)</td>
</tr>
<tr>
<td>n = 48</td>
<td>n = 43</td>
<td>n = 91</td>
<td></td>
</tr>
</tbody>
</table>

Panel B: ANCOVA Results

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>M.S.</th>
<th>F-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effort</td>
<td>1</td>
<td>225.39</td>
<td>0.97</td>
<td>0.33</td>
</tr>
<tr>
<td>Pairing</td>
<td>1</td>
<td>298.54</td>
<td>1.29</td>
<td>0.26</td>
</tr>
<tr>
<td>Effort × Pairing</td>
<td>1</td>
<td>1212.60</td>
<td>5.24</td>
<td>0.02</td>
</tr>
<tr>
<td>StartRisk</td>
<td>1</td>
<td>6219.19</td>
<td>26.89</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>RiskPref</td>
<td>1</td>
<td>123.82</td>
<td>0.54</td>
<td>0.47</td>
</tr>
<tr>
<td>Gender</td>
<td>1</td>
<td>1753.53</td>
<td>7.58</td>
<td>0.01</td>
</tr>
<tr>
<td>Error</td>
<td>84</td>
<td>231.31</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Panel C: Simple Effects

<table>
<thead>
<tr>
<th>Source</th>
<th>F-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effort vs. No Effort</td>
<td>Solo</td>
<td>5.61</td>
</tr>
<tr>
<td>Effort vs. No Effort</td>
<td>Paired</td>
<td>0.82</td>
</tr>
<tr>
<td>Solo vs. Paired</td>
<td>Effort</td>
<td>0.71</td>
</tr>
<tr>
<td>Solo vs. Paired</td>
<td>No Effort</td>
<td>5.54</td>
</tr>
</tbody>
</table>

All reported p-values are two-tailed.
Dependent variable: Adjustment: The percentage adjustment the participant elects to reduce the known risk of loss.
Independent variables and covariates:
Effort: A categorical variable to indicate whether the known risk of loss results from the participant’s decisions (Effort) or if the same information is provided to a yoked participant to does not make effort decisions (No Effort).
Paired: A categorical variable to indicate whether participants make adjustment decisions on behalf of themselves only (Solo) or also on behalf of a second, paired participant (Paired).
StartRisk: Covariate for the participant’s known risk of loss immediately before the adjustment decision.
RiskPref: A covariate risk preference measure obtained by averaging two post-experimental survey questions.
Gender: Categorical covariate for the participants’ self-reported gender from the post-experimental questionnaire.
The estimated marginal means in Panel A are adjusted for the effects of the covariates.
### TABLE 4

**Supplemental Tests on Audit Adjustments**

<table>
<thead>
<tr>
<th>Panel A: Estimated Marginal Means</th>
<th>Solo-Effort</th>
<th>Solo-No Effort</th>
<th>Paired-Effort</th>
<th>Paired-No Effort</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excluding 0 and 1 cards flipped (no bad news)</td>
<td>37.03 ( (3.36) )</td>
<td>48.82 ( (3.73) )</td>
<td>44.27 ( (3.99) )</td>
<td>37.31 ( (4.01) )</td>
</tr>
<tr>
<td>Excluding 4 cards flipped (maximum effort costs)</td>
<td>29.48 ( (3.45) )</td>
<td>44.83 ( (3.78) )</td>
<td>28.40 ( (3.64) )</td>
<td>31.65 ( (3.78) )</td>
</tr>
<tr>
<td>Excluding 0, 1, and 4 cards flipped</td>
<td>29.75 ( (3.81) )</td>
<td>48.11 ( (4.38) )</td>
<td>31.25 ( (4.75) )</td>
<td>37.43 ( (4.97) )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: Statistical Tests</th>
<th>Solo-Effort vs. Solo-No Effort</th>
<th>Paired-Effort vs. Paired-No Effort</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excluding 0 and 1 cards flipped</td>
<td>( F )-statistic</td>
<td>( p )-value</td>
</tr>
<tr>
<td>Excluding 4 cards flipped</td>
<td>5.64</td>
<td>0.02</td>
</tr>
<tr>
<td>Excluding 0, 1, and 4 cards flipped</td>
<td>9.17</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

All reported \( p \)-values are two-tailed.

Dependent variable: *Adjustment*: The percentage adjustment the participant elects to reduce the known risk of loss.

Independent variables and covariates:

*Effort*: A categorical variable to indicate whether the known risk of loss results from the participant’s decisions (*Effort*) or if the same information is provided to a yoked participant to does not make effort decisions (*No Effort*).

*Paired*: A categorical variable to indicate whether participants make adjustment decisions on behalf of themselves only (Solo) or also on behalf of a second, paired participant (Paired).

The estimated marginal means in Panel A are adjusted for the effects of the covariates.