

The Association between PCAOB Revenue-Deficient Audit Engagements and Revenue Quality

Lawrence J. Abbott
Colleen M. Boland
Sean M. McCarthy
Laura A. Swenson

University of Wisconsin–Milwaukee

ABSTRACT: The Big 4 auditors are inspected annually by the Public Company Accounting Oversight Board (PCAOB), with the summarized findings (labeled “audit deficiencies”) being publicly available on its website. Although the PCAOB claims that its inspection findings and process are designed to increase audit quality, there is limited empirical evidence to support this claim. We examine whether changes in revenue-deficient audit engagements are associated with subsequent year changes in client revenue quality. A revenue-deficient audit engagement is an inspected engagement that has at least one revenue-related audit deficiency. To infer audit quality, we link year-over-year changes in revenue-deficient audit engagements to the subsequent year’s change in engagement-level revenue quality—a common financial reporting quality proxy. We predict that audit firms will react asymmetrically to changes in revenue-deficient audit engagements: increases will prompt audit quality improving actions, but decreases will not. Our results support our prediction.

JEL Classifications: M42.

Keywords: PCAOB; audit quality; audit effort; revenue quality.

I. INTRODUCTION

The Public Company Accounting Oversight Board (PCAOB) is charged with furthering the public interest by overseeing the preparation of informative, independent audit reports, claiming it “contributes directly to audit quality through its...inspections” (PCAOB 2017). PCAOB inspection information is summarized in publicly available reports describing findings, referred to as deficiencies, that suggest relatively poorer audit quality (Franzel 2016). However, research examining the contemporaneous association between deficiency information and broad-based audit quality measures inferred through financial reporting quality generates mixed evidence (Aobdia 2019; Gunny and Zhang 2013).¹ Moreover, research investigating audit firm responses to deficiency information finds little evidence of subsequent improvements in financial reporting-based measures of audit quality (Hendricks, Landsman, and Peña-

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This research study was conducted by Colleen Boland solely in her capacity as a faculty member at the University of Wisconsin–Milwaukee; it does not reflect the views of PCAOB or any other entity with which she has been or currently is affiliated. For the avoidance of doubt, it has not been authorized by—and, absent express exceptions, should be understood to be fully disclaimed by—PCAOB.

Lawrence J. Abbott, Colleen M. Boland, Sean M. McCarthy, and Laura A. Swenson, University of Wisconsin–Milwaukee, Lubar College of Business, Accounting Area, Milwaukee, WI, USA.

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¹ Because audit quality is inherently unobservable, we use financial reporting outcomes to infer audit quality—a practice consistent with extant archival, audit quality research (DeFond and Zhang 2014).

Romera 2022) or documents an increase in audit firm conservatism (Stuber and Hogan 2021). We test the PCAOB's audit quality claim by examining whether annual *changes* in revenue-related deficiency information are asymmetrically associated with subsequent year improvements in audit and revenue quality for clients of Big 4 auditors.²

To illustrate our research question, assume an audit firm's 2011 PCAOB inspection report contained ten revenue-deficient engagements (i.e., ten inspected engagements have at least one revenue-related audit deficiency). The 2012 inspection report contained 15 revenue-deficient engagements, an increase of five revenue-deficient engagements. We posit that the audit firm will recognize that the increase in revenue-deficient engagements indicates the 2012 revenue auditing approach is relatively less effective. The firm's national office would need to recalibrate its firm-wide approach to auditing revenue to reduce the likelihood that an engagement-level audit partner would experience a revenue-deficient engagement.³ The national office would communicate the recalibrated revenue-related audit approach to its audit personnel, who would execute it during the 2013 audit season, resulting in improved 2013 revenue quality.⁴ Conversely, the firm would not need to recalibrate in cases with an annual decrease in revenue-deficient engagements, as the current inspection trend is favorable.

Our research question is predicated upon three linkages. First, annual increases in revenue-deficient engagements reflect relatively poorer year-over-year revenue auditing and provide "noisy" feedback about the quality of a firm's approach to auditing revenue. This linkage is not a foregone conclusion, as questions persist about the PCAOB inspection process "audit quality informativeness" (Boland, Brown, and Dickins 2020; Church and Shefchik 2012; Glover, Prawitt, and Taylor 2009). Second, national offices respond asymmetrically to annual increases in revenue-deficient engagements and use inspection findings to recalibrate their firm's auditing revenue approach. An annual increase serves as a publicly available, adverse signal about performance that may impair the national office's legitimacy and spur recalibration (Johnstone, Li, and Rupley 2011; Pinnuck and Lillis 2007). Third, the recalibrated revenue audit approach is communicated to firm personnel in time for the subsequent audit season, which, upon execution, results in increased client revenue quality (PCAOB 2022).

We posit there are three reasons why annual changes in revenue-deficient engagements are likely to be a performance measure that most closely aligns the goals of both engagement-level audit partners and the national office. First, engagement-level audit partners and the national office recognize that—due to revenue's importance and complexity—revenue auditing is highly likely to be an inspection focus. Second, this measure recognizes the inherent desire of engagement-level audit partners to achieve a deficiency-free engagement (Johnson, Keune, and Winchel 2019; Westermann, Cohen, and Trompeter 2019). As such, an increase in the number of revenue-deficient engagements increases the assessed likelihood that subsequent year audit engagements would be found deficient, compelling a national office recalibration to the firm's revenue auditing approach. Third, this measure is an objective, publicly available, easily understood heuristic about the efficacy of the firm's approach to auditing revenue.

To address our research question, we first examine the PCAOB inspection reports for Big 4 auditors from 2003 through 2017 to identify audit engagements with revenue-related deficiencies.⁵ Next, we calculate the annual change in the number of revenue-deficient engagements. We regress this annual change against the subsequent year's change in revenue quality (Stubben 2010). Since we predict an asymmetric response to increases compared with decreases in revenue-deficient audit engagements, we split our sample into increase and decrease subsamples.⁶ We predict and find that increases in revenue-deficient engagements lead to improvements in subsequent year revenue quality and decreases in revenue-deficient engagements are not related to changes in subsequent year revenue quality. Moreover, we document that the revenue quality improvement is associated with the magnitude of the increase.

² Since Big 4 audit firms audit over 95 percent of the recorded revenue of the Fortune 500 firms (tabulated from the 2017 Compustat database), we limit our main analysis to issuers audited by Big 4 audit firms. A sensitivity analysis expands our sample to include BDO and Grant Thornton. Together, these six audit firms are known as the "Globally Networked Firms" (GNFs) and audit over 98 percent of the recorded revenue of the U.S. Fortune 500 firms. A review of the PCAOB inspection reports of all annually inspected firms suggests there are differences between GNFs and non-GNFs. Specifically, the PCAOB reviews fewer non-GNF engagements and non-GNFs appear to have more specialized portfolios (e.g., prerevenue/developmental stage firms, local banks). Due to these differences, we exclude non-GNFs from our analyses. However, inferences are unchanged if our sample includes non-GNF firms.

³ "National office" describes the audit firm's centralized function that standardizes the firm's audit methodology and disseminates guidance on auditing issues, including those related to PCAOB inspections. Engagement-level audit partners refer to audit partners who sign off on the audit report for publicly held clients.

⁴ Although the 2012 inspection report may not be publicly available before the 2013 inspection begins, the inspection team alerts the firm to potential audit deficiencies during the inspection process (PCAOB 2022; Aobdia 2018; Center for Audit Quality (CAQ) 2012). Such discussions occur before the next audit "busy season" and allow the firms to evaluate deficiencies and recalibrate their audit approaches before the next round of inspections.

⁵ ASC 605, *Revenue Recognition*, was effective throughout our sample period. ASC 606, *Revenue from Contracts with Customers*, was effective for audits after 2019 (i.e., after our sample period).

⁶ An annual increase in revenue-deficient engagements is a publicly available adverse signal. Such signals often trigger organizational changes (Johnstone et al. 2011; Pinnuck and Lillis 2007). Due to their adverse nature, we predict the national office will recalibrate its firm-wide revenue auditing approach for increases in revenue-deficient engagements, but not for decreases. See Section III for further details.

To further our insights, we test whether audit firms effectuate their recalibrated audit approaches via audit effort. We use mediation analysis to investigate the potential relation between audit effort (proxied using audit fees) and revenue quality. We fail to document a mediating effect of audit effort on the relation between our test variable and revenue quality. This nonresult may indicate that the national office improved the effectiveness of their firm's approach to auditing revenue without resorting to increases in audit effort.⁷

In an additional analysis, we investigate whether our evidence is sensitive to specific periods within the PCAOB era. Prior research documents that Big 4 audit firms initially contested PCAOB deficiency information (Ege, Knechel, Lamoreaux, and Maksymov 2020). Our evidence is consistent with a growing acknowledgment of the PCAOB's legitimacy after 2009 (Ege et al. 2020).

We also examine whether there are differential effects of two categories of revenue deficiencies: type (controls versus substantive based) and severity. We find that year-over-year changes in substantive (controls) deficiencies are (not) associated with subsequent increases in revenue quality. We use the Church and Shefchik (2012) severity of audit deficiency taxonomy, which categorizes deficiencies as (1) failure to test an account and/or an assertion, (2) failure to adequately or properly evaluate an accounting issue and/or whether the accounting treatment was appropriate, and (3) failure to perform or document sufficient procedures/analyses when testing (insufficiency of testing). We find that increases in revenue-deficient audit engagements relating to the insufficiency of testing (failure to test; failure to evaluate) are (not) related to subsequent year improvements in revenue quality.

We contribute to the literature in three ways. First, we provide large sample evidence linking changes in specific deficiency information to a specific measure of subsequent improvements in financial reporting quality. Our evidence indicates that, in certain contexts, revenue-related inspection deficiencies can provide an "actionable" path toward higher quality financial reporting. These results support the PCAOB's stated public interest objectives of improved audit quality. This is not a foregone conclusion, as researchers have questioned the motivations, qualifications, and/or focuses of PCAOB inspectors and inspection results (Boland et al. 2020; Westermann et al. 2019; DeFond and Lennox 2017; Church and Shefchik 2012; Glover et al. 2009).

Second, we provide insights into how large audit firms respond to inspection report information as one of many levers to improve audit quality. Specifically, many prior studies have utilized tests of contemporaneous association between inspection information, broad-based financial reporting measures, and/or audit quality evidence and have generated mixed results (Aobdia 2018; Gunny and Zhang 2013). Other studies that examine audit firms' reactions to inspection report information either find little evidence of subsequent audit quality improvements (Hendricks et al. 2022) or document an increase in audit firm conservatism (Stuber and Hogan 2021). Our paper helps to reconcile some of these inconsistent findings by demonstrating that audit firms react asymmetrically to year-over-year changes in inspection findings. Our test variable, the number of revenue-deficient engagements, is novel in that it simultaneously encompasses the incentives of engagement-level audit partners and national offices. These research design innovations can help inform future research that examines the potential linkage between inspection information and audit quality.

Third, our account-level analysis allows for a more targeted and potentially more powerful research design while still enabling us to examine multiple industries and a far broader sample of companies (e.g., Dee, Gunny, and Strawser 2019; Stuber and Hogan 2021). Our focus on revenue auditing is particularly germane given the (1) complexity of revenue auditing, (2) pervasive importance of revenue for firm valuation, and (3) consistent PCAOB inspection emphasis on revenue auditing.

II. REGULATORY ENVIRONMENT AND PRIOR RESEARCH

The PCAOB and the PCAOB Inspection Process

PCAOB inspections involve (1) evaluating the quality of the audit work performed in a specific audit engagement and (2) reviewing the auditor's quality control system. For Big 4 firms, inspection teams do not review every engagement due to the costs of inspections (Swanquist 2014; PCAOB 2014b; Abbott, Gunny, and Zhang 2013). Instead, the PCAOB selects inspection engagements on a sample basis. Although the engagement selection process is risk based, the process retains some randomness. Thus, audit firms cannot accurately predict which audit clients will be selected for inspection. Moreover, for large audit firms with over 100 publicly held clients, the PCAOB performs its inspections annually.

⁷ In an additional analysis, we also examine another possible consequence of revenue-deficient engagement increases, whether the client-auditor relationship is severed. We find no relation between changes in revenue-deficient engagements and the likelihood of subsequently changing auditors, suggesting that the client-auditor relationship is not severed in response to changes in revenue-deficient engagements.

FIGURE 1
Inspection Timeline

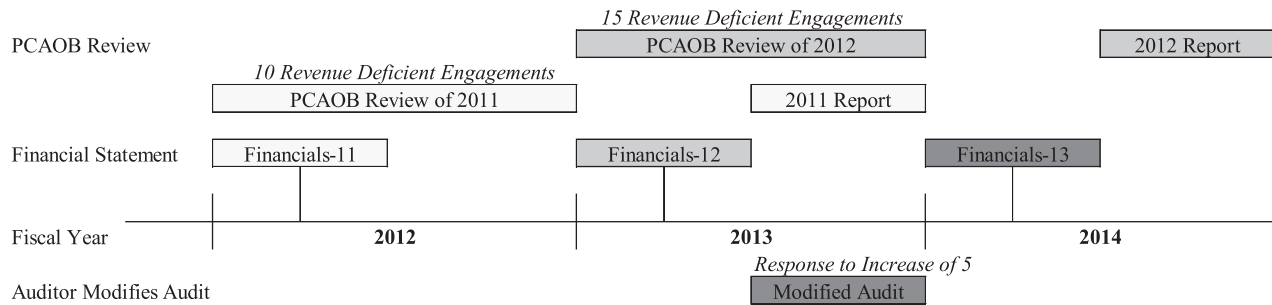


Figure 1 illustrates the linkage of PCAOB inspection work to auditor response and, in turn, to client financial statements (derived from Aobdia 2018, Figure 1). For this example, we show EY's pattern of deficient engagements in 2012 and 2013. Based on inspection fieldwork, EY expects the PCAOB to identify 15 issuers with at least one revenue-related deficiency in its review of 2012 fiscal year audits (i.e., reviews conducted in 2013). It will recognize this is an increase of five from the 2011 PCAOB inspection report, which signals to EY that the auditing of revenue needs to be recalibrated. Although fiscal year 2013 will have started before the 2012 inspection report is made public, the dialogue throughout fieldwork allows the firms to quickly address issues in the new audit year. Therefore, we expect audits of fiscal year 2013 to reflect better quality of revenue in EY's client base.

Within an inspection, the team generally focuses on high-risk audit areas, such as revenue recognition, and inspectors typically have extensive auditing work experience (Aobdia 2018).

Figure 1 summarizes the timing of the PCAOB's inspection process and illustrates the multiyear, iterative process of the engagement selection, inspections, inspection reporting, and audit firm reaction. Initially, the PCAOB informs the audit firms of the engagements it intends to inspect. The audit firm grants PCAOB inspectors access to the audit workpapers. The inspection team alerts the audit firm personnel to potential audit deficiencies during the inspection process (PCAOB 2022; Aobdia 2018; CAQ 2012). Such discussions occur before the next audit busy season and allow the firms to evaluate deficiencies and recalibrate their audit approaches prior to the next round of inspections.⁸ Deficiencies not resolved in the engagement inspection are summarized in a publicly available inspection report on the PCAOB website (although client identity remains confidential). Inspection reports detail the number of inspected engagements and describe audit deficiencies on an engagement basis. Thus, capital market participants can determine whether an inspected engagement has a deficiency (although not the identity of the engagement) and the type of audit deficiencies on the engagement.

Several properties of PCAOB inspection reports suggest their use as internal performance measures by audit firms. First, the reports are compiled annually, allowing for benchmarking and evaluating audit performance trends. Second, the reports' deficiency information is public knowledge, allowing audit firm personnel at all levels to react to inspection report information. Third, to the extent that the PCAOB's sampling methodology remains unknown to audit partners, audit firms are expected to tailor any audit approach changes at the firm rather than the office level (Acito, Hogan, and Mergenthaler 2018).

Audit Firm and Audit Partner Reaction to PCAOB Inspection Reports

Because inspection reports have consequences (Christensen, Lundstrom, and Newton 2021; Acito et al. 2018), it is unsurprising that audit firms try to improve their inspection outcomes. However, research on *how* audit firms do so is limited. The firm's national office is tasked with improving audit firm inspection performance, employing a centralized group of high-profile firm personnel, including audit partners and, in some cases, former PCAOB inspectors (Hendricks et al. 2022). Using the KPMG "Steal the Exam" scandal for background, Abbott, Barber, Buslepp, and Sapkota (2023) describe how Big 4 audit firms use the firms' national offices to process inspection report information and communicate firm-wide audit approach changes. Abbott et al. (2023) also detail how the KPMG national office's prominence created within-firm expectations to improve inspection outcomes and describe how it recognized that adverse inspection outcomes would impair its within-firm standing.

⁸ Christensen, Newton, and Wilkins (2022) observe that an audit firm shifts a significant portion of the current-year audit effort to later in the engagement (i.e., the fourth quarter or after year-end) to address inspection disruptions.

Johnson et al. (2019) interview audit personnel about their perceptions of, and preparations for, PCAOB inspections. They document that auditors place great importance on inspection findings since they can influence performance evaluations, compensation, and promotions. Westermann et al. (2019) survey experienced auditors from the six largest audit firms and note that auditors adopt defensive documentation approaches to mitigate inspection deficiencies rather than improving audit quality. Notably, the evidence of Johnson et al. (2019) and Westermann et al. (2019) indicates that engagement-level partners view *any* inspection deficiency as detrimental to their career and aspire to a deficiency-free audit engagement.

Prior Research on the Association between Inspection Deficiencies and Audit Outcomes

Given the inextricable link between audit and financial reporting quality (Gaynor, Kelton, Mercer, and Yohn 2016), prior research has examined the association between PCAOB inspection report information and financial reporting-based measures of audit quality. Research designs use both broad-based financial reporting outcomes (e.g., accruals, restatements) and more targeted, account-based financial reporting outcomes.

Gunny and Zhang (2013) document an association between inspection report findings and abnormal accruals and restatements—but only for triennially inspected auditors with severely deficient inspection findings. Using proprietary inspection data, Aobdia (2019) documents a contemporaneous association between engagement-level inspection findings and restatements of the inspected period and an increase in the propensity to meet or beat the zero earnings threshold. However, the predictive power of financial reporting-based measures of audit quality on the likelihood of inspection findings is quite low. Hendricks et al. (2022) provide evidence that the number of PCAOB employees hired by large audit firms is positively (negatively) related to the number of deficiencies reported in their prior (subsequent) inspection reports. However, they do not find consistent evidence linking the number of former PCAOB employees that a firm hires and improvements in future client restatements or several other broad-based financial reporting-based audit quality measures.⁹

Two recent studies investigate the potential relation between account-level inspection deficiencies and account-level reporting outcomes. Stuber and Hogan (2021) find that allowance for loan loss estimates (ALL) becomes *less* accurate and more conservative with higher levels of ALL-related inspection findings. Dee et al. (2019) document a negative association between the intensity of fair value deficiencies and information uncertainty of Level 2 financial assets. Both studies limit their sample to financial services firms and do not examine whether intertemporal trends in deficiency information influence their results.

In sum, prior research generally does not demonstrate a strong association between inspection report deficiencies and broad-based financial reporting-based audit quality measures. Studies linking specific deficiency information to account-based measures of audit quality lack generalizability and either find only an increase in auditor conservatism (Stuber and Hogan 2021) or are limited to a specialized type of financial asset (Dee et al. 2019). Moreover, prior research does not investigate whether (1) time-series trends in deficiency information and (2) the *pervasiveness* of account-based deficiency information across inspected engagements are associated with financial reporting-based audit quality. These differences motivate our research questions.

III. HYPOTHESES DEVELOPMENT

Revenue is a critically important, constantly evolving, and potentially complex account that affects large, publicly traded firms.¹⁰ As such, revenue recognition and revenue auditing consistently receive disproportionate regulatory attention. We posit that Big 4 national offices will focus on the annual changes in (rather than the number of) revenue-deficient audit engagements when annually evaluating its revenue auditing approach.

We argue that engagement-level audit partners focus on year-over-year changes in revenue-deficient engagements for several nonmutually exclusive reasons. First, revenue auditing is a likely inspection target, as it is an area that has consistently exhibited audit deficiencies. Second, the focus on revenue auditing creates a singularly dynamic process of adjusting potential audit approaches because of revenue auditing's inherent complexity and evolving nature. Third, the persistence of revenue-deficient engagements suggests that annual changes in revenue-deficient engagements serve as a salient, publicly available, easily understood, and benchmarked signal of the efficacy of the firm's revenue auditing approach.

⁹ Hendricks et al. (2022) demonstrate that improved PCAOB inspection outcomes are not antecedents to improved financial reporting. There are several potential reasons for this disconnect, including the qualifications and incentives of inspectors (Johnson et al. 2019; Westermann et al. 2019), inspectors' overemphasis on workpaper documentation (Glover et al. 2009), and lack of sampling representativeness (DeFond and Lennox 2017).

¹⁰ The importance of revenue to capital markets for valuation (Barth, Li, and McClure 2023; Callen, Robb, and Segal 2008) and CEO contracting purposes (Drake and Martin 2020) is well established.

Prior literature documents that publicly available adverse signals often trigger organizational changes that otherwise may not have been undertaken. For example, [Johnstone et al. \(2011\)](#) find that a material weakness (MW) disclosure prompts the board of directors to alter their structure, as the MW indicates the board was ineffective. [Pinnuck and Lillis \(2007\)](#) demonstrate that using decision cues to compel organizational changes is often rooted in a reference point. These reference points can be either a net loss or a negative performance *vis-à-vis* a prior year reference point. Applied to our setting, an annual increase in revenue-deficient engagements increases the engagement-level audit partners' assessed likelihood of having a subsequent year deficient engagement while simultaneously reducing the national office's within-firm standing. Furthermore, larger increases are further from the reference point and considered more adverse. These factors would compel the national office to recalibrate its firm-wide revenue auditing approach, with larger increases spurring greater recalibration. An annual decrease in revenue-deficient engagements would have no such effect.

The recalibration reaction to increases in revenue-deficient engagements assumes that an increase provides actionable information about a firm's approach to auditing revenue. If so, we predict that the recalibrated revenue audit approach leads to higher subsequent levels of revenue-related audit quality. In turn, this corresponds to higher subsequent levels of client revenue quality, leading to our first hypothesis (in alternative form):

H1: Year-over-year changes in revenue-deficient audit engagements will have an asymmetric effect on client revenue quality, with increases positively associated with subsequent improvements in revenue quality and decreases having no association.

H1 is asymmetric. Specifically, we argue that firm-level *decreases* in revenue-related deficiencies are unlikely to spur recalibrations in the firm's revenue audit approach for at least three reasons. First, the firm's national office and audit engagement partners are, by nature, risk averse ([Lennox and Kausar 2017](#); [Davidson and Dalby 1993](#)) and thus less likely to want changes to a demonstrably successful revenue auditing approach. Further, there may be complacency-related resistance to changes in the firm's revenue audit approach that has most recently generated improved inspection performance. Finally, national office resources are likely to be fixed; allocating the national office's team effort has an opportunity cost of attention to other inspection areas.

We do not believe that decreases in firm-level, revenue-related deficiencies will negatively affect engagement-level revenue quality for two reasons. First, audit engagement partners are continually aware that revenue is almost assured to be an inspection focus, and there are career consequences for engagement-level inspection deficiencies ([Westermann et al. 2019](#); [Johnson et al. 2019](#)). Second, revenue restatements arising from poor-quality auditing entail omnipresent reputation and career consequences for audit engagement partners ([Chi, Lisic, Myers, Pevzner, and Siedel 2019](#)). Because of these two sets of factors, we posit that there is unlikely any relation between decreases in revenue-related deficiencies and subsequent revenue quality. Consequently, our hypothesis is asymmetric in orientation.

An audit firm can recalibrate its revenue audit approach to improve revenue quality in several ways. One channel to achieve this is to increase audit effort. Using proprietary inspection data, [Aobdia \(2018\)](#) finds that auditors react to inspection findings with increases in audit effort via audit hours, but not audit fees. He documents that the increases in audit hours are associated with a reduction in the subsequent year's inspection findings. Similarly, [Acito et al. \(2018\)](#) conclude that audit firms charge higher fees to defray the costs associated with addressing PCAOB deficiencies; however, this relation is moderated by client bargaining power.¹¹ Relatedly, [Johnson et al. \(2019\)](#) note that, although audit firms respond to PCAOB inspection findings, clients resist paying for additional inspection-related procedures.¹² As such, client resistance to audit fee increases may bias against finding a mediating effect of audit effort on revenue quality. However, it is unlikely that an increase in revenue-deficient engagements would lead to a decrease in audit effort. Thus, we use a directional hypothesis to test whether the relation between our test variable and revenue quality is mediated via increases in audit effort and present our second hypothesis (stated in the alternative form):

H2: Conditional upon increases in revenue-deficient engagements, subsequent improvement in revenue quality is mediated by increases in audit effort.

We use audit fees to measure auditor effort, a common proxy used in the auditing literature ([Hay, Knechel, and Wong 2006](#); [Simunic 1980](#)).

¹¹ Although [Acito et al. \(2018\)](#) focus on GAAP-related inspection deficiencies, our paper focuses on revenue-related deficiencies. These authors use changes in an adjusted audit exposure relative to other audit firms as their primary test variable. Our focus is on asymmetric responses to within-firm, annual changes in revenue-deficient audit engagements. They examine the implication of the deficiency information on the demand for auditing whereas we focus on changes in engagement-level revenue quality.

¹² Audit firms may have already negotiated the audit engagement fee before becoming informed of PCAOB inspection results and therefore cannot adjust fees. We thank an anonymous reviewer for this insight.

IV. RESEARCH DESIGN, DATA, AND DESCRIPTIVE STATISTICS

Research Design

Recall that our first hypothesis centers upon the audit firm's reaction to the trend in revenue-deficient engagements and how it potentially impacts subsequent-year revenue quality. Linking when the audit firm receives information to when it responds is nontrivial to our design and thus merits further discussion.

To illustrate (see Figure 1), consider the example of EY's 2012 inspection report released in calendar year 2014 (PCAOB 2014a).¹³ The PCAOB performed its fieldwork at various EY offices from December 2012 to October 2013, reviewing 52 engagements. At the end of each engagement's inspection, PCAOB and EY personnel would have discussed preliminary results at an "exit meeting" (PCAOB 2022; CAQ 2012). The PCAOB accumulated the results and, after approval of the PCAOB board, publicly issued its report in August of 2014 (PCAOB 2014a), noting 15 engagements with at least one revenue deficiency, five engagements more than the prior year (PCAOB 2013). EY's National Office would have monitored the status of PCAOB fieldwork and, upon identifying trends, communicated proposed audit methodology recalibrations to active audit engagements to reduce future inspection findings. The recalibrated methodology is likely disseminated to audit personnel through formal (e.g., "alert" emails, training, webcasts) and informal networks within the firms. Therefore, we predict that the fiscal year corresponding to the timing of PCAOB fieldwork will have financial statements reflecting improved financial reporting quality. In this example, EY clients will have improved revenue quality for fiscal year 2013.¹⁴ Thus, although our dependent variable (i.e., the change in revenue quality) is measured in changes from $t-1$ to t , our test variable of interest is measured as the changes in the number of revenue-deficient engagements from $t-2$ to $t-1$.

Our proxy for revenue quality is a discretionary revenue measure (Stubben 2010). Stubben (2010) calculates discretionary revenue using the residual from the regression of the annual change in accounts receivable at time t on the annual change in revenue at time t , both scaled by average total assets. This regression is run by industry and year, allowing the parameter estimates to vary across 15 industries and over time.¹⁵ Thus, our audit quality proxy is a relative measure of revenue quality that compares each firm i against its industry peers each year.¹⁶ Because abnormally high or low residual values suggest revenue management, we use the absolute value of the residual as our measure of discretionary revenue.¹⁷ We then determine the change from period $t-1$ to t as the difference between the absolute residuals. Next, we multiply the change in revenue quality by -1 so more positive (negative) values reflect an increase (decrease) in revenue quality from time $t-1$ to time t .

Our dependent variable possesses three desirable properties relevant to our research question. First, the measure focuses on revenue quality, which allows us to investigate the potential linkage between specific PCAOB findings and a specific financial statement outcome (Stubben 2010). Second, revenue quality is generally considered a measure of financial reporting quality rather than conservatism (Hope, Thomas, and Vyas 2013; Watts 2003).¹⁸ Thus, consistent with extant archival studies (Hendricks et al. 2022; Gaynor et al. 2016; DeFond and Zhang 2014), we use financial reporting outcomes to infer audit quality (Gaynor et al. 2016; Carver, Hollingsworth, and Stanley 2011). Finally, our dependent variable utilizes the Stubben (2010) measure's absolute value; it does not distinguish between income-increasing and

¹³ The PCAOB names its inspection reports by the year it performs the inspection fieldwork and the date the report is issued. For this example, the PCAOB titles this report as the 2013 Inspection of Ernst & Young, LLP and labels it PCAOB Release No 104-2014-143. For ease of exposition, we reference these reports by the year the audit work was conducted. Thus, the 2013 Inspection of Ernst & Young, LLP is labeled the 2012 PCAOB report, as it summarizes fiscal year 2012 financial statements inspections.

¹⁴ In mapping inspection reports to subsequent fiscal years, we assume that the engagement team and national office conduct real-time discussions throughout fieldwork. We perform two untabulated robustness analyses to test the sensitivity of this assumption. First, we identify observations with reactive fiscal years ending before fieldwork end dates. For these observations, we replace our test variable with the inspection report in which the fieldwork end date is closest to but before the reactive fiscal year-end. Results are similar to our main findings. Second, we split our sample into observations with fieldwork ending before and after the reactive fiscal year-end. We find results consistent with our main findings in both subsamples.

¹⁵ Industry is defined consistent with Barth, Beaver, Hand, and Landsman (2005) and requires at least 15 observations for each industry-year regression.

¹⁶ Many industries have different accounting guidance for revenue recognition, which results in inherent differences in revenue quality across industries. Our research design addresses this in two ways. First, the Stubben (2010) measure determines revenue quality relative to industry peers within each year, which alleviates some concerns regarding interindustry variation in revenue quality. Second, using changes in the Stubben (2010) measure, each issuer acts as its own control, reducing concerns about time-variant, industry shocks to revenue quality.

¹⁷ We recognize that other forms of discretionary revenue may exist that may not be identified in our measure (e.g., incorrect application of GAAP). We choose Stubben's (2010) measure because other measures (e.g., Caylor 2010) require multiple years of data to compute discretionary revenues. The Stubben measure avoids timing and measurement issues with respect to the relation between changes in revenue auditing and revenue quality.

¹⁸ Similarly, Altamuro, Beatty, and Weber (2005) investigate the impact of Staff Accounting Bulletin (SAB) 101, which mandated a more conservative approach to recording revenues. Altamuro et al. (2005) document a negative relation between the mandated adoption of SAB 101 and the association between earnings and future cash flows, suggesting that an increase in revenue recognition conservatism reduces revenue informativeness/quality.

decreasing values. Deviations from zero—positive or negative—are considered more discretionary and of lower quality. Larger deviations are of relatively lower quality than smaller ones.

ChRevDefEngagements is our test variable and is the change in the number of revenue-deficient engagements reported in a firm's PCAOB inspection report.¹⁹ This variable is assigned to all issuers based on their respective audit firm. We include several control variables to capture client and audit firm characteristics likely to influence revenue quality and/or the likelihood of PCAOB inspection (Doyle, Ge, and McVay 2007; Stubben 2010; Hope et al. 2013; Bills, Cobabe, Pittman, and Stein 2020). For brevity, these variables are defined in Appendix A. Standard errors are clustered by firm to address concerns related to serial correlation in error terms. As discussed above, we expect revenue quality improvements in year t relative to year $t-1$ due to PCAOB-inspected revenue-deficient engagement increases in year $t-1$ relative to year $t-2$. Accordingly, we test our first hypothesis with the model below:

$$\begin{aligned} ChRevQuality_t = & \alpha + \beta_1 ChRevDefEngagements_{t-1} + \beta_2 LogAssets_t + \beta_3 ROE_t \\ & + \beta_4 StdROA_t + \beta_5 Leverage_t + \beta_6 Growth_t + \beta_7 OpCycle_t + \beta_8 CapitalNeeds_t \\ & + \beta_9 Inventory_t + \beta_{10} PercLoss_t + \beta_{11} Specialist_t + \beta_{12} LogTenure_t + \beta_{13} Importance_t \\ & + \beta_{14} HighImportance_t + \beta_{15} NAS\%_t + \beta_{16} MW_t + \beta_{17} ACQ_t + \varepsilon_t \end{aligned} \quad (1)$$

H1 predicts that changes in the number of revenue-deficient engagements will be asymmetrically related to subsequent changes in revenue quality. Specifically, we expect that the coefficient on *ChRevDefEngagements* will be significant only when there are increases in engagements with revenue-related PCAOB inspection findings. For completeness, we first run Equation (1) on the entire sample and again on those firms where engagements with revenue deficiencies increased (decreased) in engagements with revenue deficiencies. We test the difference in *ChRevDefEngagements* across these two subsamples. H1 predicts that, for the subsample of firms with increases (decreases) in revenue-deficient engagements, the coefficient on *ChRevDefEngagements* will be positive and significant (insignificant), suggesting a (no) recalibration of revenue auditing approaches by audit firms.

Our second hypothesis explores whether increases in revenue-deficient engagements influence client revenue quality through increased audit effort. We use audit fees to measure auditor effort (Hay et al. 2006; Simunic 1980). Since we are interested in whether audit effort changes in response to increases in revenue-deficient engagements, we use changes in audit fees (*ChLogFees*). To test our second hypothesis, we use mediation analysis (Zhao, Lynch, and Chen 2010; Iacobucci, Saldanha, and Deng 2007), testing for an indirect effect of increases in revenue-deficient engagements on client revenue quality that is driven by audit fees. We use structural equation modeling to estimate the direct and indirect paths by regressing the mediator (*ChLogFees*) on the independent variable (*ChRevDefEngagements*) and a set of controls commonly found in the auditing literature (e.g., Hay et al. 2006) (Equation (2) below). We simultaneously regress the dependent variable (*ChRevQuality*) on both the mediator (*ChLogFees*) and independent variable (*ChRevDefEngagements*).²⁰ To test for the indirect effect of increases in revenue-deficient engagements on client revenue quality via audit fees, we examine the significance of the product of the coefficients on *ChLogFees* (from Equation (1)) and *ChRevDefEngagements* (from Equation (2)) (Zhao et al. 2010; Sobel 1982).

$$\begin{aligned} ChLogFees_t = & \alpha + \beta_1 ChRevDeficiencies_{t-1} + \beta_2 ARInv_t + \beta_3 LogAssets_t + \beta_4 ROA_t \\ & + \beta_5 Leverage_t + \beta_6 Loss_t + \beta_7 Quick_t + \beta_8 Foreign_t + \beta_9 LogSegments_t \\ & + \beta_{10} GoingConcern_t + YearFixedEffects_t + IndustryFixedEffects_t + \varepsilon_t \end{aligned} \quad (2)$$

Sample

As presented in Table 1, Panel A, our sample begins in 2005 (i.e., to calculate the first year with potential subsequent changes in revenue quality) and ends in 2016 due to data availability. Our initial sample consists of 72,332 issuer-year observations in both Compustat and Audit Analytics. To isolate specific auditors' influence on issuers' revenue quality, we remove observations corresponding to years with an auditor change (7,509). We remove 14,410 observations that do not have December 31 year-ends to provide a more direct linkage of inspection reports to annual engagement years. We further restrict our sample to Big 4 audit engagements (16,865). We also remove 5,470 observations with missing data

¹⁹ Notably, our test variable captures the change in revenue-deficient engagements, not the percentage of inspected issuers with a revenue-related engagement. In an untabulated analysis, we control for the number of offices visited/inspected, and results are qualitatively similar.

²⁰ This model is Equation (1) from the test of our first hypothesis, modified to include *ChLogFees*. We use the natural log of audit fees consistent with prior research (Hay et al. 2006).

TABLE 1
Sample

Panel A: Attrition

Observations in Compustat and Audit Analytics from 2005-2016	72,332
Less: Change in auditors during the year or from the prior year	-7,509
Less: Fiscal year-ends not falling on 12/31	-14,410
Less: Non-Big 4 Auditor	-16,865
Less: Missing data needed for Stubben measure	-5,470
Less: Firms in financial industries	-5,017
Less: Data needed for regression analysis	-8,924
Total Observations	14,137
Unique Companies	2,579

Panel B: PCAOB Revenue Inspection Findings by Audit Firm by Fiscal Year

Audit Firm	Fiscal Year Under Review	Reactive Fiscal Year	Report Number	Fieldwork Begin Date	Fieldwork End Date	Date of Report	# Revenue-Deficient Engagements	Change in Revenue-Deficient Engagements
EY	2004	2005	104-2007-001	Aug-05	Dec-05	1/11/2007	1	0
EY	2005	2006	104-2007-064	May-06	Nov-06	5/2/2007	2	1
EY	2006	2007	104-2008-067	Apr-07	Dec-07	4/29/2008	0	-2
EY	2007	2008	104-2009-069	Apr-08	Sep-08	5/19/2009	4	4
EY	2008	2009	104-2010-091	Oct-08	Oct-09	7/2/2010	1	-3
EY	2009	2010	104-2011-319	Mar-10	Dec-10	11/30/2011	5	4
EY	2010	2011	104-2012-272	Apr-11	Dec-11	12/6/2012	5	0
EY	2011	2012	104-2013-146	Nov-11	Nov-12	6/28/2013	10	5
EY	2012	2013	104-2014-143	Dec-12	Oct-13	8/14/2014	15	5
EY	2013	2014	104-2015-121	Nov-13	Oct-14	6/16/2015	10	-5
EY	2014	2015	104-2016-142	Nov-14	Jun-16	10/25/2016	5	-5
EY	2015	2016	104-2018-018	Nov-15	Jun-17	12/19/2017	8	3
Deloitte	2004	2005	104-2006-202	May-05	Oct-05	11/30/2006	5	5
Deloitte	2005	2006	104-2007-086	May-06	Nov-06	6/14/2007	2	-3
Deloitte	2006	2007	104-2008-070	Mar-07	Nov-07	5/19/2008	1	-1
Deloitte	2007	2008	104-2009-051	Mar-08	Nov-08	4/16/2009	2	1
Deloitte	2008	2009	104-2010-050	Oct-08	Oct-09	5/4/2010	2	0
Deloitte	2009	2010	104-2011-290	Oct-09	Mar-11	12/7/2011	6	4
Deloitte	2010	2011	104-2012-271	Oct-10	Mar-12	11/28/2012	10	4
Deloitte	2011	2012	104-2013-088	Oct-11	Feb-13	5/7/2013	2	-8
Deloitte	2012	2013	104-2014-099	Apr-13	Jan-14	5/6/2014	6	4
Deloitte	2013	2014	104-2015-095	Oct-13	Jan-15	5/12/2015	4	-2
Deloitte	2014	2015	104-2016-141	Oct-14	Apr-16	8/10/2016	4	0
Deloitte	2015	2016	104-2017-198	Nov-15	Feb-17	11/28/2017	3	-1
KPMG	2004	2005	104-2007-002	Jun-05	Feb-06	1/11/2007	4	-2
KPMG	2005	2006	104-2007-106	May-06	Dec-06	7/26/2007	1	-3
KPMG	2006	2007	104-2008-146	Apr-07	Jan-08	8/12/2008	4	3
KPMG	2007	2008	104-2009-096	Apr-08	Oct-08	6/16/2009	1	-3
KPMG	2008	2009	104-2010-132	Oct-08	Sep-09	10/5/2010	0	-1
KPMG	2009	2010	104-2011-288	Sep-09	Feb-11	11/8/2011	1	1
KPMG	2010	2011	104-2012-199	Nov-10	Oct-11	8/15/2012	2	1
KPMG	2011	2012	104-2013-147	Oct-11	Feb-13	7/30/2013	6	4
KPMG	2012	2013	104-2014-167	Dec-12	Feb-14	9/24/2014	6	0

(continued on next page)

TABLE 1 (continued)

Audit Firm	Fiscal Year Under Review	Reactive Fiscal Year	Report Number	Fieldwork Begin Date	Fieldwork End Date	Date of Report	# Revenue-Deficient Engagements	Change in Revenue-Deficient Engagements
KPMG	2013	2014	104-2015-189	Oct-13	Feb-15	10/15/2015	9	3
KPMG	2014	2015	104-2016-175	Nov-14	Jul-16	11/9/2016	10	1
KPMG	2015	2016	104-2019-001	Oct-16	Apr-18	1/15/2019	7	-3
PwC	2004	2005	104-2006-205	Jul-05	Mar-06	12/14/2006	4	3
PwC	2005	2006	104-2007-129	May-06	Jan-07	10/18/2007	2	-2
PwC	2006	2007	104-2008-125	Apr-07	Jan-08	6/27/2008	4	2
PwC	2007	2008	104-2009-038	Apr-08	Oct-08	3/25/2009	3	-1
PwC	2008	2009	104-2010-131	Oct-08	Oct-09	8/12/2010	3	0
PwC	2009	2010	104-2011-289	Mar-10	Nov-10	11/8/2011	15	12
PwC	2010	2011	104-2012-235	Apr-11	Jan-12	9/27/2012	13	-2
PwC	2011	2012	104-2013-148	Nov-11	Feb-13	8/20/2013	8	-5
PwC	2012	2013	104-2014-102	Dec-12	Nov-13	6/19/2014	5	-3
PwC	2013	2014	104-2015-122	Nov-13	Jan-15	6/30/2015	3	-2
PwC	2014	2015	104-2016-140	Mar-15	Mar-16	8/10/2016	4	1
PwC	2015	2016	104-2018-001	Nov-15	Mar-17	12/19/2017	4	0

Table 1 presents sample attrition (Panel A) and the number and changes in engagements with PCAOB-inspected, revenue-related deficiencies distribution and by audit firm and fiscal year (Panel B).

needed to calculate our dependent variable from Equation (1) (*ChRevQuality*), 5,017 observations in financial industries with different financial reporting requirements, and 8,924 observations missing data necessary to calculate our independent variables from Equation (1), resulting in a final sample of 14,137 issuer-year audits representing 2,579 unique issuers.

Table 1, Panel B summarizes each PCAOB inspection report in our sample and presents the month and year fieldwork began and ended, the date the report was made available to the public, and revenue-related inspection findings by audit firm and year. The “reactive” year identifies the fiscal period in which we expect to observe a change in revenue quality. Figure 2 displays the number of revenue-deficient engagements by audit firm by fiscal year. We note variation across audit firms and years in revenue-deficient engagements. EY and PwC have the most revenue-deficient engagements (August 14, 2014 and November 8, 2011, respectively). EY and KPMG are the only firms with zero revenue-deficient engagements (April 29, 2008 and October 5, 2010, respectively).

Descriptive Statistics

Table 2, Panel A reports descriptive statistics on the variables used in our analyses. Although the average issuer reports no material change in revenue quality (*ChRevQuality*), auditors experienced an increase in revenue-deficient engagements (*ChRevDefEngagements*) (mean 0.172). The mean (median) issuer paid its auditor approximately \$3.0 million (\$2.5 million) (untabulated). The average firm experiences relatively small increases (mean 1.8 percent, median 1.1 percent) in audit fees from year to year (untabulated).²¹ The mean (median) leverage is 57 percent (56 percent). Twenty-nine percent of our sample report losses, and approximately, 4 percent have material weaknesses. Descriptive statistics for other control variables are consistent with control variables from prior literature employing revenue quality in their analyses (Bills et al. 2020; Hope et al. 2013; Stubben 2010; Doyle et al. 2007).

As reported in the final three columns of Panel A, we separate the sample on whether *ChRevDefEngagements* is greater than 0 or less than 0. We find no significant difference in the average change in revenue quality across the subsamples. Recall H1 predicts asymmetric responses to the *magnitude* of increases and decreases in revenue-deficient engagements. Because the magnitude of *ChRevDefEngagements* is not captured by bifurcating into these subsamples and revenue quality is measured and centered at 0 for the industry-year level, we do not expect systematic differences in *ChRevQuality* across the two subsamples. For the increase subsample, we find that the engagements are smaller in asset

²¹ We note a loss of 12 observations in analyses using audit fee data due to data availability needed to calculate a change in the natural log of audit fees.

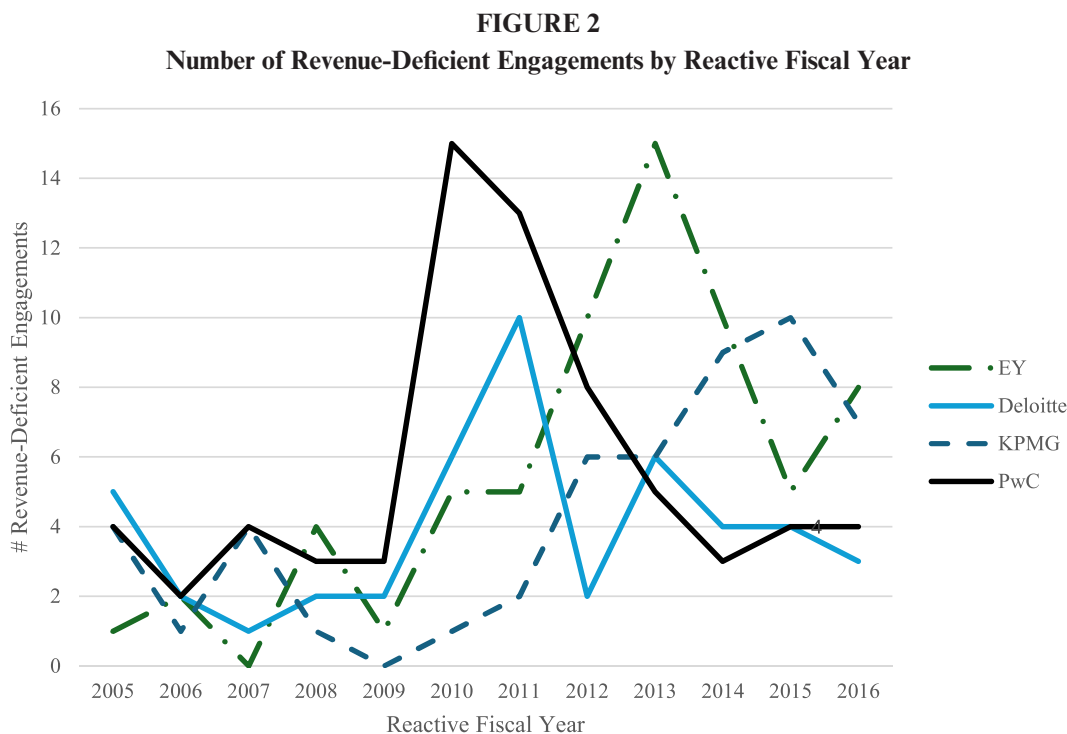


Figure 2 displays the number of inspected engagements with revenue deficiencies in the PCAOB inspection report by audit firm and by reactive fiscal year.

(The full-color version is available online.)

size and leverage, are less likely to be audited by a national industry specialist, and experience smaller increases in audit fees than the decrease subsample. These observations also have more volatile income and losses over five years. These differences highlight the importance of including them as controls. The remaining differences are insignificant.

Table 2, Panel B contains the Pearson correlations for the variables used in the regression analyses. Panel B reports a positive and significant relation between the lagged change in the number of revenue-deficient engagements and the issuer's change in revenue quality and provides initial univariate evidence suggesting auditors respond to trends in revenue-deficient engagements. Several control variables exhibit significant correlations with *ChRevQuality*. Specifically, an improvement in revenue quality is associated with characteristics consistent with less risky issuers, such as less volatile income, less leverage, high growth, and higher capital needs. Unlike *LogAssets* with *StdROA* and *PercLoss*, *StdROA* with *PercLoss*, and *Growth* with *CapitalNeeds*, none of the main independent variables appear highly correlated. Variance inflation factors (VIFs) for Equation (1) indicate that multicollinearity is not an issue; the mean VIF for our independent variables is 1.45 and ranges from 1.00 to 2.62.

V. RESULTS

Change in Revenue Quality

Table 3 presents the results of estimating Equation (1). Recall, *ChRevQuality* (our dependent variable) is the change in revenue quality in the year after a change in revenue-deficient engagements. We present the pooled regression results in column (1). Several control variables exhibit associations consistent with univariate results reported in Table 2, Panel B. For example, we find increases in revenue quality to be negatively related to leverage and acquisitions and positively related to higher capital needs and client importance. The only statistically significant difference in control variables across our two subsamples is client importance, which is marginally significant.

To test H1, we bifurcate our sample into those firm-year observations whose auditors experienced an annual increase in revenue-deficient engagements in column (2) and those with an annual decrease in revenue-deficient

TABLE 2
Descriptive Statistics and Correlations

Panel A: Descriptive Statistics

Variable Name	All Observations (n = 14,137)			ChRevDefEngagements > 0 (n = 6,040)	ChRevDefEngagements < 0 (n = 6,191)	Difference
	Std. Dev.	Mean	Median	Mean		
<i>ChRevQuality</i>	0.023	0.000	0.000	0.001	0.000	0.001
<i>ChRevDefEngagements</i>	3.561	0.172	0.000	3.414	-2.937	6.351***
<i>ChLogFees</i>	0.160	0.021	0.013	0.020	0.028	-0.011**
<i>LogAssets</i>	1.984	7.332	7.344	7.238	7.370	-0.132***
<i>ROE</i>	0.680	0.004	0.090	0.000	0.009	-0.009
<i>StdROA</i>	0.133	0.086	0.038	0.089	0.083	0.007***
<i>Leverage</i>	0.279	0.570	0.561	0.564	0.573	-0.009*
<i>Growth</i>	0.302	0.093	0.043	0.097	0.095	0.002
<i>OpCycle</i>	96.163	117.682	93.660	117.053	117.558	-0.505
<i>CapitalNeeds</i>	0.429	0.095	0.042	0.102	0.096	0.006
<i>Inventory</i>	0.090	0.071	0.031	0.072	0.071	0.001
<i>PercLoss</i>	0.356	0.289	0.200	0.300	0.282	0.017***
<i>Specialist</i>	0.343	0.137	0.000	0.127	0.138	-0.011*
<i>LogTenure</i>	0.570	2.496	2.485	2.488	2.489	-0.002
<i>Importance</i>	0.021	0.064	0.021	0.063	0.065	-0.002
<i>HighImportance</i>	0.499	0.476	0.000	0.462	0.486	-0.024***
<i>NAS%</i>	0.133	0.146	0.113	0.145	0.147	-0.002
<i>MW</i>	0.193	0.039	0.000	0.034	0.044	-0.010***
<i>ACQ</i>	0.498	0.450	0.000	0.452	0.453	0.001

Panel B: Pearson Correlations (n = 14,137)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) <i>ChRevQuality</i>									
(2) <i>ChRevDefEngagements</i>	0.02								
(3) <i>ChLogFees</i>	-0.03	-0.03							
(4) <i>LogAssets</i>	0.01	-0.02	0.04						
(5) <i>ROE</i>	0.02	0.01	0.02	0.20					
(6) <i>StdROA</i>	-0.02	0.02	-0.03	-0.46	-0.23				
(7) <i>Leverage</i>	-0.02	-0.02	-0.03	0.20	0.02	0.08			
(8) <i>Growth</i>	0.02	0.00	0.31	0.06	0.07	-0.01	-0.12		
(9) <i>OpCycle</i>	-0.01	0.00	0.03	-0.07	-0.03	0.07	-0.14	0.09	
(10) <i>CapitalNeeds</i>	0.04	0.00	0.22	0.06	0.09	-0.06	-0.15	0.78	0.06
(11) <i>Inventory</i>	0.00	0.01	0.00	-0.08	0.05	-0.07	-0.05	-0.07	0.35
(12) <i>PercLoss</i>	-0.02	0.01	-0.05	-0.49	-0.31	0.54	0.13	-0.06	0.06
(13) <i>Specialist</i>	0.00	-0.01	0.02	0.20	0.04	-0.12	0.14	-0.02	-0.09
(14) <i>LogTenure</i>	0.00	0.00	-0.01	0.27	0.10	-0.21	0.05	-0.07	0.03
(15) <i>Importance</i>	0.00	-0.01	0.03	0.27	0.06	-0.11	0.14	-0.01	-0.04
(16) <i>HighImportance</i>	0.00	0.00	0.03	0.36	0.09	-0.19	0.15	-0.03	-0.03
(17) <i>NAS%</i>	0.00	0.01	-0.01	0.17	0.06	-0.08	0.05	0.08	0.04
(18) <i>MW</i>	0.00	0.00	0.08	-0.05	-0.03	0.04	0.02	0.00	0.05
(19) <i>ACQ</i>	-0.01	0.00	0.12	0.24	0.10	-0.19	-0.03	0.15	0.04

(continued on next page)

TABLE 2 (continued)

	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(1) <i>ChRevQuality</i>									
(2) <i>ChRevDefEngagements</i>									
(3) <i>ChLogFees</i>									
(4) <i>LogAssets</i>									
(5) <i>ROE</i>									
(6) <i>StdROA</i>									
(7) <i>Leverage</i>									
(8) <i>Growth</i>									
(9) <i>OpCycle</i>									
(10) <i>CapitalNeeds</i>									
(11) <i>Inventory</i>	-0.06								
(12) <i>PercLoss</i>	-0.08	-0.10							
(13) <i>Specialist</i>	-0.01	-0.03	-0.12						
(14) <i>LogTenure</i>	-0.04	0.11	-0.22	0.12					
(15) <i>Importance</i>	0.00	0.04	-0.13	0.10	0.19				
(16) <i>HighImportance</i>	-0.01	0.09	-0.22	0.16	0.22	0.49			
(17) <i>NAS%</i>	0.07	0.01	-0.13	-0.04	0.11	0.05	0.07		
(18) <i>MW</i>	-0.01	0.03	0.06	-0.01	-0.04	0.00	0.01	-0.02	
(19) <i>ACQ</i>	0.12	0.05	-0.25	-0.07	0.08	0.09	0.16	0.15	0.01

***, **, * Indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

Table 2 presents descriptive statistics and Pearson correlations for variables of interest and control variables. All untransformed continuous variables are Winsorized at the 1st and 99th percentile of their distributions. Panel A presents descriptive statistics on the full sample and subsamples when *ChRevDefEngagements* > 0 and *ChRevDefEngagements* < 0. Mean tests of differences across the two subsamples are presented in the last column. Panel B presents Pearson correlations among variables in Panel A; correlations with significance levels <0.05 are in bold.

All variable definitions appear in [Appendix A](#).

engagements in column (3).²² Differences in coefficients between these two subsamples are reported in column (4). Consistent with H1, we find asymmetric responses to changes in revenue-deficient engagements. Specifically, we find that the subsample of firms with increases in revenue-deficient engagements (increases subsample) drives the positive relation between *ChRevQuality* and *ChRevDefEngagements*. We fail to find significance on *ChRevDefEngagements* in the subsample of firms with decreases in revenue-deficient engagements (decreases subsample). Column (4) shows that the difference in the coefficient on *ChRevDefEngagements* across the two subsamples is statistically significant. Collectively, the results of columns (2)–(4) support H1.²³

Audit Fees

Figure 3 and Table 4 report the results of H2, whether auditors’ responses to increases in revenue-deficient engagements improve client revenue quality via increased audit effort. Given our findings for H1, we focus this analysis on the increases subsample.

Table 4 presents our results. Panel A presents the simultaneous equations used in this analysis. Panel B presents the results for both the direct and indirect path. The coefficient $\alpha_1 * \beta_2$ represents the indirect path, testing the extent to which auditors increase audit effort in response to increases in revenue-deficient engagements, which in turn increases the quality of client revenue. Although $\alpha_1 * \beta_2$ is not significant (z-statistic = 0.474), there is a significant direct path (coefficient 0.000338, z-statistic = 2.75), indicating direct-only nonmediation (Zhao et al. 2010). Although we fail to find evidence that the relation between increases in deficient engagements and revenue quality is mediated by increased audit

²² Note that, because we exclude observations with a 0 value for *ChRevDefEngagements*, our sample sizes in columns (2) and (3) do not add to the sample size in column (1).

²³ In an untabulated sensitivity test, we replace the control variables measured at time *t* with changes in the same control variables from time *t*–1 to time *t*. Using the changes rather than the levels of the control variables, the coefficient (t-statistic) on *ChRevDefEngagements* is 0.00015 (2.43) in the pooled regression, 0.000363 (3.03) in the increases subsample, and –0.000079 (–0.52) in the decreases subsample. The difference between the coefficients in the increases versus decreases subsamples is significant in the predicted direction with a t-statistic equal to 2.37. Importantly, we continue to find asymmetric responses to year-over-year trends in PCAOB revenue-related deficient engagements as predicted.

TABLE 3
Regression Results—Change in Revenue Quality

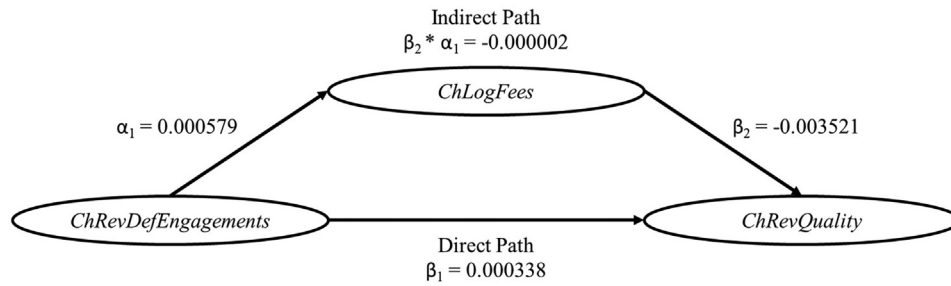
Variables	(1)	(2)	(3)	(4)
	All Observations Coefficient (t-stat)	Increase in Revenue- Deficient Engagements Coefficient (t-stat)	Decrease in Revenue- Deficient Engagements Coefficient (t-stat)	Difference (2) – (3) Coefficient (t-stat)
<i>ChRevDefEngagements</i>	0.000111** (1.92)	0.000338*** (2.98)	−0.000091 (−0.61)	0.000429** (−2.39)
<i>LogAssets</i>	0.000103 (1.13)	−0.000074 (−0.37)	0.000182 (1.02)	−0.000256 (−0.82)
<i>ROE</i>	0.000313 (0.85)	0.000467 (0.87)	0.000065 (0.12)	0.000402 (−0.53)
<i>StdROA</i>	−0.002221 (−1.16)	−0.002708 (−0.71)	−0.005499 (−1.64)	0.002791 (−0.50)
<i>Leverage</i>	−0.001016 (−1.54)	−0.002499** (−2.04)	−0.000660 (−0.58)	−0.001839 (−1.00)
<i>Growth</i>	−0.002041 (−1.49)	−0.001213 (−0.60)	−0.003603 (−1.60)	0.002390 (−0.79)
<i>OpCycle</i>	−0.000004* (−1.72)	−0.000003 (−0.82)	−0.000002 (−0.49)	−0.000001 (−0.14)
<i>CapitalNeeds</i>	0.003372*** (3.38)	0.003824** (2.52)	0.003361** (2.08)	0.000463 (−0.21)
<i>Inventory</i>	0.002156 (1.22)	0.003837 (1.00)	−0.001061 (−0.28)	0.004898 (−0.78)
<i>PercLoss</i>	−0.000107 (−0.19)	−0.000523 (−0.46)	−0.000504 (−0.48)	−0.000019 (−0.01)
<i>Specialist</i>	−0.000045 (−0.13)	−0.000168 (−0.21)	−0.000734 (−1.22)	0.000566 (−0.49)
<i>LogTenure</i>	−0.000129 (−0.61)	−0.000481 (−0.95)	0.000008 (0.02)	−0.000489 (−0.60)
<i>Importance</i>	0.000869 (0.79)	0.004550* (1.80)	−0.001608 (−0.78)	0.006158* (−1.66)
<i>HighImportance</i>	−0.000357 (−1.25)	−0.001122 (−1.62)	−0.000156 (−0.25)	−0.000966 (−0.89)
<i>NAS%</i>	−0.000241 (−0.20)	0.000171 (0.08)	0.000839 (0.38)	−0.000668 (−0.20)
<i>MW</i>	0.000024 (0.02)	0.000518 (0.25)	−0.000352 (−0.21)	0.000870 (−0.31)
<i>ACQ</i>	−0.000801** (−2.34)	−0.001869*** (−3.07)	−0.000381 (−0.66)	−0.001488 (−1.64)
Observations	14,137	6,040	6,191	
Adjusted R ²	0.004	0.009	0.004	

***, **, * Indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

Table 3 presents the regression results of the change in revenue quality on the change in revenue-deficient engagements and controls for all firm year observations in column (1), a subsample of observations that had an increase in revenue-deficient engagements from the prior year in column (2), a subsample of observations that had a decrease in revenue-deficient engagements from the prior year in column (3), and tests of differences between columns (2) and (3) in column (4). All untransformed continuous variables are Winsorized at the 1st and 99th percentile of their distributions. Standard errors are robust to heteroskedasticity and clustering at the firm level. Tests of significance are reported as two-tailed tests except for our variables of interest, which are one-tailed tests as predicted by the hypotheses.

Variable definitions appear in [Appendix A](#).

FIGURE 3
Mediation Analysis Research Model



This figure shows the linkages between our variable of interest and the dependent variable and the predicted indirect effect through the mediator. Specifically, increases in revenue-deficient engagements are positively related to increases in revenue quality, as shown in our test of H1. We predict in H2 that the mechanism for this association is audit effort, and therefore our mediating variable is the change in logged audit fees. The coefficients from Table 4 are also presented in the diagram. For reference, the equations used to test H2 are

$$ChRevQuality_t = \beta_0 + \beta_1 ChRevDefEngagements_{t-1} + \beta_2 ChLogFees_t + \beta Controls_t + \varepsilon_t \tag{1a}$$

$$ChLogFees_t = \alpha_0 + \alpha_1 ChRevDefEngagements_{t-1} + \alpha Controls_t + \varepsilon_t \tag{1b}$$

TABLE 4
Mediation Analysis

Panel A: Models

$$ChRevQuality_t = \beta_0 + \beta_1 ChRevDefEngagements_{t-1} + \beta_2 ChLogFees_t + \beta Controls_t + \varepsilon_t \tag{1a}$$

$$ChLogFees_t = \alpha_0 + \alpha_1 ChRevDefEngagements_{t-1} + \alpha Controls_t + \varepsilon_t \tag{1b}$$

Panel B: Mediation Analysis

	<u>Coefficient</u>	<u>z-stat</u>
Direct Path		
p(<i>ChRevDefEngagements</i> , <i>ChRevQuality</i>) β_1	0.000338***	(2.75)
Indirect Path		
p(<i>ChRevDefEngagements</i> , <i>ChLogFees</i>) α_1	0.000579	(0.59)
p(<i>ChLogFees</i> , <i>ChRevQuality</i>) β_2	-0.003521	(-1.66)
Total Mediated Path $\alpha_1 * \beta_2$	-0.000002	(0.47)
Controls	Included	
Observations	6,028	

*** Indicates significance at the 0.01 level.

Table 4 presents the mediation analysis to test for an indirect effect of increases in revenue-deficient engagements on client revenue quality driven by audit fees for the subsample of observations that have an increase in revenue-deficient engagements. The mediator is measured as the changes in the natural log of audit fees (*ChLogFees*). Tests of significance are reported as one-tailed tests as predicted by the hypotheses. Variable definitions appear in Appendix A.

effort, this is not surprising for several reasons. First, audit firms may find it difficult to pass on the costs of a recalibrated audit approach to their clients (Johnson et al. 2019).²⁴ Although Acito et al. (2018) find an association between audit

²⁴ PCAOB inspections for Big 4 auditors sample approximately 10 percent of all audit engagements, making it difficult for auditors to justify an increase in audit fees when such a small percentage of engagements are inspected. Moreover, the PCAOB has noted several instances where audit firms have downplayed the importance of PCAOB inspection findings (PCAOB 2010). This further encumbers audit firm requests for increased audit fees arising from inspection results when the same audit firm is simultaneously downplaying inspection results.

fees and a client's exposure to deficient auditing, they also find that deficient auditing is associated with a higher likelihood of auditor turnover. This suggests that audit firms may be reluctant to pass on the costs of incremental audit effort for fear of losing their clients.²⁵ Second, the engagement letters, which include audit fees, are generally negotiated before inspection fieldwork completion. Third, the national office's specialized inspection knowledge may have successfully processed deficiency information into a more effective, recalibrated revenue auditing approach without increasing audit fees. Finally, our lack of results may also be due to the inherent noisiness of audit fees as an audit effort proxy. In an untabulated sensitivity analysis, we use another proxy for audit effort, the change in audit report lag, and find results consistent with our primary analysis of H2.

Additional Analyses

Additional analyses focus on the following issues: (1) whether our evidence is a function of specific periods within the post-SOX PCAOB era, (2) whether differential effects of revenue deficiency information exist based on deficiency categories, (3) whether increases in revenue-deficient engagements impact the client-auditor relation in terms of auditor turnover, and (4) whether our results are similar if we use the scaled change in revenue-deficient engagements.

Sample Period

There are several reasons to believe that, in the early years of PCAOB oversight (2004–2009), audit firms would be less likely to use deficiency information to recalibrate their revenue auditing strategy. First, the PCAOB inspection regime replaced a peer review regime. Many within the auditing industry described the initial relationship between the PCAOB and audit firms as “adversarial” (e.g., [Abbott et al. 2013](#)), culminating in a lawsuit in 2006 challenging the PCAOB's authority. The lawsuit was settled in 2010, mainly favoring the PCAOB ([Ege et al. 2020](#)). In its ruling, the U.S. Supreme Court upheld the constitutionality of the PCAOB and two essential authorities: inspection access to workpapers and publicly disclosing audit deficiencies.

Second, several Part II quality control disclosures during and before 2010 against Big 4 audit firms signaled a shift in the PCAOB's willingness to use its enforcement powers vigorously.²⁶ Third, and potentially due to the first two factors, [Ege et al. \(2020\)](#) measure the tone of the audit firm response letter for each Big 4 audit firm contained within the 2004–2012 inspection reports. They find that firms' public response letters contained “essentially no negative tone in letters from 2010 to 2012” ([Ege et al. 2020](#)).

The above discussion suggests that Big 4 audit firms expended resources in contesting rather than using PCAOB deficiency information during the initial PCAOB regime of 2004–2009. After 2009, there appeared to be a growing acceptance of the PCAOB's authority as the public company audit firms' regulatory body. For example, [Hendricks et al. \(2022\)](#) document a steep acceleration in the Big 4 audit firms' practice of hiring PCAOB officials commencing in 2009 and doubling in rate from 2009 to 2011, indicating the Big 4 audit firms' acceptance of the PCAOB and its inspection process.²⁷ To test this conjecture, in an untabulated analysis, we split our sample into two periods, pre-2010 and 2010 and after. The coefficient on *ChRevDefEngagements* is positive and significant (coefficient = 0.000294; t-statistic = 2.49) in the 2010 and after subsample, and the difference in coefficients on *ChRevDefEngagements* between the two subsamples is significant (t-statistics = -1.44). This indicates that our results are sensitive to the period under consideration and suggests that Big 4 audit firms began using deficiency information for recalibration purposes after 2009. We also perform tests of H2 using the 2010 and after subsample. Like the results reported on the expanded sample in [Table 4](#), we find that, although $\alpha_1 * \beta_2$ is not significant (z-statistic = -0.379), there continues to be a significant direct path (coefficient 0.000288, z-statistic = 2.23), indicating direct-only non-mediation ([Zhao et al. 2010](#)). As such, we continue to fail to find evidence that the relation between increases in deficient engagements and revenue quality is mediated by increased audit effort.

Nature of Deficiencies

In this section, we examine whether differential effects of revenue deficiency information exist based on two distinct deficiency categories: type and severity. Deficiency type refers to whether the disclosed deficiency corresponds to

²⁵ There is a key distinction between the deficiency exposure in [Acito et al. \(2018\)](#) and our deficiency measure. [Acito et al. \(2018\)](#) develop a measure of exposure based on client mentions of various accounting standards and the corresponding auditor deficiencies aligned to these standards. Our measure is internally focused, incorporates time trends in performance, and is more salient and easily understood by firm personnel at all levels.

²⁶ The initial Part II quality control disclosure involved Deloitte in 2008. The PCAOB issued two more in 2009 (Deloitte and PwC) and another two in 2010 (PwC and EY). Since 2011, there have been only three additional quality control disclosures (KPMG in 2012, 2015, and 2016).

²⁷ For the initial 2004–2009 period, there may not have been enough time and/or within-firm resources for audit firms to use inspection report information to materially affect the subsequent audit season's audit approaches. As audit firms experienced several inspection cycles, their ability to enact timely changes to their audit approaches likely improved. We thank an anonymous reviewer for insights into this phenomenon.

controls or substantive testing. Deficiency severity is based upon the Church and Shefchik (2012) taxonomy: *No-Test*, *No-Eval*, and *No-Suff*.²⁸ They classify PCAOB inspection deficiencies into three groups of decreasing severity: (1) *No-Test*, in which case the audit firm failed to test an account and/or assertion; (2) *No-Eval*, in which case the firm failed to adequately evaluate whether an accounting issue or accounting treatment was appropriate; and (3) *No-Suff*, in which case the firm performed procedures that were insufficient to test the account or assertion.²⁹

In performing these additional analyses, two coauthors read through each Big 4 inspection report, coded each revenue-related deficiency into the three mutually exclusive severity categories, and classified each deficiency into two mutually exclusive type categories. The coauthors then jointly determined a final coding for discrepancies. Appendix B provides examples of the coding of deficiencies by type and severity. Presented in Table 5, Panel A, this procedure identified 820 deficiencies across 232 revenue-deficient engagements. There are several notable items. First, the distribution of deficiencies by type is similar: 425 (395) of the disclosed deficiencies pertain to controls (substantive) testing, representing 52 percent (48 percent) of the total deficiencies. Second, among deficiency severity, *No-Suff* (*No-Eval*) was the most (least) commonly disclosed deficiency, comprising 48 percent (17 percent), whereas *No-Test* represented 34 percent of disclosed deficiencies. Third, nearly two-thirds of all *No-Test* and *No-Eval* severity deficiencies correspond to tests of controls. Conversely, nearly two-thirds of all *No-Suff* severity deficiencies correspond to substantive tests. The Mann-Whitney test suggests significant differences in means between control and substantive for the *No-Test* and *No-Eval* categories (z-statistic of 5.28 and 2.52, respectively). Year-over-year changes in substantive-testing deficiencies have a pairwise correlation of 0.72 with year-over-year changes in controls-testing deficiencies, whereas the pairwise correlations for year-over-year changes in deficiency severity range from 0.66 to 0.68.³⁰

To test whether there are differential effects on our dependent variable based on deficiency type, we aggregate the total quantity of each deficiency type for each inspection report and calculate the year-over-year change in quantity. We restrict this analysis to the subset of observations where revenue-deficient engagements are increasing. Table 5, Panel B presents our results. We first modify Equation (1) by replacing *ChRevDefEngagements* with the year-over-year change in total revenue deficiencies identified, *ChRevDefCount*.³¹ We then decompose *ChRevDefCount* and replace this variable with the change in revenue-related internal control deficiencies (*ChRevDefCount_Control*) and the change in revenue-related substantive procedure deficiencies (*ChRevDefCount_Substantive*) in column (2). Finally, we decompose the variable of interest into the change in the severity categories (*ChRevDefCount_NoTest*, *ChRevDefCount_NoEval*, and *ChRevDefCount_NoSuff*) in column (3).

Column (1) shows consistent evidence in support of H1 when replacing our variable of interest with the change in the count of revenue deficiencies, *ChRevDefCount* (coefficient = 0.000040, t-statistic = 2.64). Column (2) disaggregates the change in deficiencies into the changes in revenue control (*ChRevDefCount_Control*) and revenue substantive procedure deficiencies (*ChRevDefCount_Substantive*). When included in the same model, *ChRevDefCount_Substantive* (*ChRevDefCount_Control*) is positive and significant (t-statistic = 2.33) (insignificant), suggesting firms respond to increases in substantive procedures findings.

The evidence in column (2) suggests that, conditional on an annual increase in revenue-deficient engagements, deficiencies in substantive procedures drive H1 results. There may be two, nonmutually exclusive reasons for this. First, per the audit risk model, the auditor can adjust substantive procedures (and detection risk) based on controls testing results. This suggests a potential second-order effect of a recalibrated set of revenue-related, control-based audit procedures on revenue quality. Specifically, well-constructed substantive procedures can offset poorly constructed tests of controls. Second, our dependent variable (changes in revenue quality) is, by definition, based on year-end financial statement variables. Given that substantive testing primarily pertains to year-end financial statement accounts, it is reasonable to

²⁸ Church and Shefchik (2012) also note whether the deficiency identifies a financial statement misstatement. Revenue misstatements in the inspection reports are rare and limited to only two Big 4 audit firms (KPMG in 2008, 2011, and 2013; EY in 2009 and 2014). In an untabulated analysis, we create a dichotomous variable *Misstate* coded “1” in instances where the inspection report referenced an inspection-induced revenue misstatement (i.e., restatement, GAAP departure, or error) and “0” otherwise. *Misstate* is also interacted with our test variable. We find positive coefficient estimates on *Misstate* and *ChRevDefEngagements*, although the interaction is negative (significance levels at $p < 0.10$). The negative interaction indicates that large annual increases in revenue-deficient engagements lessen the effect of a revenue misstatement on the recalibration of the firm’s approach to auditing revenue, suggesting a substitutive effect. We also remove observations where the inspection report references an inspection-induced revenue misstatement ($n = 1,520$, Table 3), and inferences are unchanged. Finally, we restrict our sample to observations pertaining to PWC and Deloitte (neither had an inspection report with a misstatement). We find a pattern of evidence consistent with our primary analysis (significance levels at $p < 0.01$).

²⁹ Although Church and Shefchik (2012) examine all PCAOB inspection deficiencies, our analysis is limited to deficiencies in revenue and the related assertions.

³⁰ The pairwise correlation between *No-Suff* and *No-Test* is 0.68, between *No-Suff* and *No-Eval* is 0.66, and between *No-Test* and *No-Eval* is 0.68. VIFs from regressions using these variables suggest multicollinearity is not an issue.

³¹ By changing the variable of interest from engagements with deficiencies to the count of deficiencies, we can examine variation in individual deficiencies rather than an aggregated (engagement-level) quantity. The Pearson correlation between these two measures is 0.64. Primary analysis results are consistent in both specifications.

TABLE 5
Additional Analyses—Nature and Severity

Panel A: Descriptives

	<u>No-Test</u>	<u>%</u>	<u>No-Eval</u>	<u>%</u>	<u>No-Suff</u>	<u>%</u>	<u>Total</u>	<u>%</u>
Control	187	64	85	62	153	39	425	52
Substantive	104	36	53	38	238	61	395	48
Total	291	35	138	17	391	48	820	100

Panel B: Regressions

<u>Variables</u>	<u>(1)</u> <u>Count of Revenue Deficiencies</u> <u>Coefficient</u> <u>(t-stat)</u>	<u>(2)</u> <u>Nature</u> <u>Coefficient</u> <u>(t-stat)</u>	<u>(3)</u> <u>Severity</u> <u>Coefficient</u> <u>(t-stat)</u>
<i>ChRevDefCount</i>	0.000040*** (2.64)		
<i>ChRevDefCount_Control</i>		-0.000015 (-0.39)	
<i>ChRevDefCount_Substantive</i>		0.000115*** (2.33)	
<i>ChRevDefCount_NoTest</i>			0.000007 (0.13)
<i>ChRevDefCount_NoEval</i>			-0.000099 (-0.64)
<i>ChRevDefCount_NoSuff</i>			0.000124** (2.25)
Controls	Included	Included	Included
Observations	6,040	6,040	6,040
Adjusted R ²	0.009	0.009	0.009

Panel C: Mediation Analysis—Change in Revenue Deficiencies Count

$$ChRevQuality_t = \beta_0 + \beta_1 ChRevDefCount_{t-1} + \beta_2 ChLogFees_t + \overrightarrow{\beta Controls}_t + \varepsilon_t \quad (1c)$$

$$ChLogFees_t = \alpha_0 + \alpha_1 ChRevDefCount_{t-1} + \alpha Controls_t + \varepsilon_t \quad (2c)$$

	<u>Coefficient</u>	<u>z-stat</u>
Direct Path		
p(ChRevDefCount, ChRevQuality) β_1	0.000040***	(2.40)
Indirect Path		
p(ChRevDefCount, ChLogFees) α_1	0.000230	(1.18)
p(ChLogFees, ChRevQuality) β_2	-0.003697	(-1.74)
Total Mediated Path $\alpha_1 * \beta_2$	-0.000001	(-0.88)
Controls	Included	
Observations	6,028	

(continued on next page)

conjecture that there would be a more direct effect of a recalibrated set of revenue-related, substantive audit procedures on revenue quality.

Column (3) disaggregates the annual change in deficiencies into the annual change in each severity category. In this model, only the least severe category, *ChRevDefCount_NoSuff*, is significant (t-statistic = 2.25). We provide two

TABLE 5 (continued)

Panel D: Mediation Analysis—Nature

$$ChRevQuality_t = \beta_0 + \beta_1 ChRevDefCount_Control_{t-1} + \beta_2 ChRevDefCount_Substantive_{t-1} + \beta_3 ChLogFees_t + \overrightarrow{\beta Controls}_t + \varepsilon_t \tag{1d}$$

$$ChLogFees_t = \alpha_0 + \alpha_1 ChRevDefCount_Control_{t-1} + \alpha_2 ChRevDefCount_Substantive_{t-1} + \overrightarrow{\alpha Controls}_t + \varepsilon_t \tag{2d}$$

	Coefficient	z-stat
Direct Path		
p(<i>ChRevDefCount_Substantive</i> , <i>ChRevQuality</i>) β_2	0.000112**	(2.16)
Indirect Path		
p(<i>ChRevDefCount_Substantive</i> , <i>ChLogFees</i>) α_2	0.000471	(0.96)
p(<i>ChLogFees</i> , <i>ChRevQuality</i>) β_2	-0.003589	(-1.69)
Total Mediated Path $\alpha_1 * \beta_2$	-0.000002	(-0.74)
Controls	Included	
Observations	6,028	

Panel E: Mediation Analysis—Severity

$$ChRevQuality_t = \beta_0 + \beta_1 ChRevDefCount_NoTest_{t-1} + \beta_2 ChRevDefCount_NoEval_{t-1} + \beta_3 ChRevDefCount_NoSuff_{t-1} + \beta_4 ChLogFees_t + \overrightarrow{\beta Controls}_t + \varepsilon_t \tag{1e}$$

$$ChLogFees_t = \alpha_0 + \alpha_1 ChRevDefCount_NoTest_{t-1} + \alpha_2 ChRevDefCount_NoEval_{t-1} + \alpha_3 ChRevDefCount_NoSuff_{t-1} + \overrightarrow{\alpha Controls}_t + \varepsilon_t \tag{2e}$$

	Coefficient	z-stat
Direct Path		
p(<i>ChRevDefCount_NoSuff</i> , <i>ChRevQuality</i>) β_2	0.000128**	(2.30)
Indirect Path		
p(<i>ChRevDefCount_NoSuff</i> , <i>ChLogFees</i>) α_2	0.000242	(0.31)
p(<i>ChLogFees</i> , <i>ChRevQuality</i>) β_2	-0.003858	(-1.82)
Total Mediated Path $\alpha_1 * \beta_2$	-0.000009	(-0.26)
Controls	Included	
Observations	6,028	

***, ** Indicate significance at the 0.01 and 0.05 levels, respectively.

Table 5, Panel A presents descriptive statistics on the test variables used in Panel B. Panel B presents the regression results of the change in revenue quality on the change in the total number of revenue deficiencies in column (1), the change in the number of revenue deficiencies in the test of controls and substantive testing in column (2), and the change in the number of revenue deficiencies in which the audit firm failed to test an account and/or assertion (*No-Test*), failed to adequately evaluate whether an accounting issue or accounting treatment was appropriate (*No-Eval*), or performed the requisite procedures, however only to an insufficient extent (*No-Suff*) in column (3) for the subsample of observations that had an increase in revenue-deficient engagements from the prior year. Panel C (D) [E] presents the mediation analysis to test for an indirect effect of increases in revenue-deficient counts (revenue-deficient counts that are substantive in nature) [revenue-deficient counts in which the firm performed procedures that were insufficient to test the account or assertion] on client revenue quality driven by audit fees for the subsample of observations that have an increase in revenue-deficient engagements. The mediator is measured as the changes in the natural log of audit fees (*ChLogFees*). All untransformed continuous variables are Winsorized at the 1st and 99th percentiles of their distributions. Standard errors are robust to heteroskedasticity and clustering at the firm level. Tests of significance are reported as two-tailed tests except for our variables of interest, which are one-tailed tests as predicted by the hypotheses.

Variable definitions appear in [Appendix A](#).

potential, nonmutually exclusive explanations for the results in column (3). First, *No-Test* and *No-Eval* deficiency categories are more likely to be engagement specific and idiosyncratic to the engagement-level audit staff and audit partner. In contrast, the *No-Suff* category reflects more systematic, firm-wide deficiencies in the firm's revenue-auditing approach. The *No-Suff* deficiencies allow national office personnel to utilize their expertise to effectively recalibrate the firm's revenue audit approach—particularly when augmenting revenue audit approaches with enhanced data analytics-based audit procedures designed by the national office. Second, recall that column (2) suggests that substantive testing changes affect revenue quality the most and that *No-Suff* is disproportionately represented in substantive testing. Together, the results in columns (2) and (3) suggest that auditors improve client revenue quality in response to increases in substantive audit deficiencies, which are disproportionately categorized within the *No-Suff* category.³²

In Table 5, Panels C–E, we repeat our mediation analyses used to test H2 by replacing our test variable, *ChRevDefEngagements*, with change in revenue-deficient counts, *ChRevDevCount*, (Panel C) and our nature (Panel D) and severity variables (Panel E) from Panel B. We report indirect and direct paths only on those variables that are significant in Table 5, Panel B. In all instances, results continue to support direct-only nonmediation (Zhao et al. 2010). Consistent with our results reported in Table 4, we fail to find evidence that the relation between increases in deficiency counts by nature or severity of deficiencies and revenue quality is mediated by increased audit effort.

Dropped Auditor

Another possible consequence of revenue-deficient engagement increases is that the client-auditor relationship is severed. In an untabulated regression, we explore whether increases in revenue-deficient engagements are related to a subsequent loss of clients. We regress the probability of changing auditors on the change in revenue-deficient engagements. We compute the dependent variable as an indicator variable equal to 1 if the client changes its auditor after the publication of the last PCAOB inspection report for their auditor and 0 otherwise. We run a logistic regression on our test variable and control variables consistent with prior auditor turnover literature (Adams, J. Krishnan, and J. Krishnan 2021; Lennox and Kausar 2017); results suggest no relation between changes in revenue-deficient engagements and the likelihood of subsequently changing auditors (*ChRevDefEngagements* = -0.0176 , z -statistic = -0.91). We obtain similar findings when evaluating our increases subsample (coefficient = -0.0585 , z -statistic = -1.16). These results provide evidence suggesting that the client-auditor relationship is not severed in response to changes in revenue-deficient engagements.

Levels and Percentage Change in Revenue-Deficient Engagements

As noted earlier, an important assumption underlying H1 is that year-over-year changes in the number of revenue-deficient engagements motivate firms to consider revenue auditing recalibration. As larger increases would be considered more adverse due to the distance from the reference point, they would be more likely to result in an audit approach recalibration.

To test this assumption empirically and support our use of the lagged change in year-over-year, revenue-deficient engagements, in untabulated analyses, we include the number of revenue-deficient engagements at time $t-1$ and time $t-2$ as separate regressors (instead of a single change variable). If national offices focus exclusively on the level of inspection deficiencies ($t-1$) rather than the change, we would expect the coefficient estimate on the level of $t-2$ inspection deficiencies to be insignificant. In the increases subsample, we find that the coefficient estimates on *ChRevDefEngagements* at $t-1$ ($t-2$) are significantly positive (negative). These results support the use of changes in the number of revenue-deficient engagements as our test variable.

We also investigate whether our results are similar if we use the scaled change in revenue-deficient engagements (untabulated). We replace our test variable with *ChRevDefEngagements%*, calculated by taking the difference between the number of revenue-deficient engagements at $t-1$ and $t-2$ and dividing it by the number of revenue-deficient engagements at $t-2$. For observations without prior period revenue-deficient engagements, we replace the prior period number of revenue-deficient engagements with 1. We fail to find a relation between *ChRevDefEngagements%* and subsequent year improvements in revenue quality. This underscores (1) the use of unscaled, year-over-year changes in revenue-deficient engagements as our test variable and (2) that, regardless of its magnitude, the starting point (i.e., the number of

³² A *No-Suff* deficiency commonly contains verbiage like “the (audit) firm failed to perform sufficient procedures to support their conclusion on the issuer's valuation of these contracts and their revenue generating capabilities.” We conjecture that recalibrating the audit approach would entail adding alternative audit procedures to augment existing (insufficient) audit procedures. Generating and tailoring the additional audit procedures to address PCAOB inspection concerns and potentially improving audit quality likely requires more inspection process expertise than *No-Test* or *No-Eval*. Moreover, more sophisticated audit procedures involving data analytics that would address *No-Suff* deficiencies are likely better understood and communicated by a centralized national office analytics staff.

revenue-deficient engagements in $t-2$) serves as an easily understood heuristic for annual benchmarking of performance and trend evaluation.³³

Sensitivity Analyses

Sensitivity analyses focus on the following: (1) if our results provide evidence of auditor conservatism rather than improved revenue quality, (2) expanding our sample to include the next two largest annually inspected audit firms, (3) the nonexistent contemporaneous association between revenue-deficient engagements and revenue quality, and (4) if our evidence is driven by instances of clients with extreme values of revenue quality.

Stubben measure. Our dependent variable for testing H1 uses the absolute value of the residual from the regression of the annual change in accounts receivable on the annual change in revenue, both scaled by average total assets (Stubben 2010). Theoretically, this measure should not capture conservatism, as we do not distinguish between income-increasing or income-decreasing values. Deviations from zero—positive or negative—are considered more discretionary and of lower quality; larger deviations are relatively lower quality than smaller ones. However, to ensure that results are not driven by initial positive or negative residuals, in an untabulated analysis, we split our sample of observations with increasing revenue-deficient engagements into subsamples of positive and negative residuals (before taking the absolute values). If improvements are due to increased conservatism rather than a general improvement in revenue quality, we would expect results only in the subsample of negative residuals. However, we find positive and significant coefficients on *ChRevDefEngagements* in the positive and negative residual subsamples (coefficient = 0.0003 and t-statistic = 1.95; coefficient = 0.0004 and t-statistic = 2.10, respectively). These differences are not significantly different and suggest that our results capture changes in revenue quality rather than changes in conservatism.³⁴

Contemporaneous associations. Our results could suggest a negative, contemporaneous association between revenue-deficient engagements and revenue quality. That is, a greater number of revenue-deficient engagements reflects poorer, contemporaneous revenue quality. In untabulated analyses, we replicate our primary model (Equation (1)) with contemporaneous measurement of our variable of interest. We find no significance on *ChRevDefEngagements* in the increases subsample (coefficient = 0.0001; t-statistic = 0.89). We posit this is a function of annual changes in inspection emphases, the degree of “noise” in the revenue-deficient engagements (particularly for documentation deficiencies), and potential measurement error/noise in the Stubben (2010) revenue quality measure.

Extreme values of revenue quality. Finally, a potential flaw in many research designs is whether a subset of observations drives results. In untabulated analyses, we execute our primary analyses with additional variables to capture the effect of the “worst” observations. Specifically, we decile rank observations by their Stubben (2010) revenue quality and create the variable *Worst*, which equals “1” for observations in the decile with the lowest revenue quality and “0” otherwise. We include *Worst* in our primary models and interact it with *ChRevDefEngagements*. The main effect on *Worst* is positive and significant, confirming that these issuers have the worst revenue quality. However, the insignificant interaction (coefficient = 0.0004; t-statistic = 0.62) indicates that these “worst” observations are not driving our results.

VI. CONCLUSION

The PCAOB asserts that it “contributes directly to audit quality through its oversight functions, including...inspections” (PCAOB 2017), but limited research has directly tested this claim. Given the importance of revenue and revenue auditing, we argue that auditors are motivated to respond to the change in the number of revenue-deficient engagements disclosed in the inspection reports. However, we hypothesize that this reaction is context specific. In particular, Big 4 audit firms will recalibrate their efforts in response to an increase in revenue-deficient engagements but will be unlikely to do so in response to a decrease. We examine whether lagged, annual changes in revenue-deficient audit engagements for Big 4 auditors are associated with subsequent changes in revenue quality for these auditors’ clients. Using Stubben’s (2010) measure of revenue quality, we document a positive association between increases in revenue-deficient engagements and subsequent year revenue quality. We find no relation between decreases in revenue-deficient engagements and subsequent year revenue quality. We also examine the mechanisms through which Big 4 auditors implement their recalibrated revenue auditing approaches. Thus, we evaluate audit effort as the channel through which firms improve client

³³ One issue with these tests is that the denominator can disproportionately affect the *ChRevDefEngagements%* variable. A relatively smaller revenue-deficient engagement denominator can distort the impact that a percentage change in revenue-deficient engagements (an increase to 3 from 1 is a 200 percent increase, whereas an increase to 15 from 6 is 150 percent) can have *vis-à-vis* an unscaled change in revenue-deficient engagements. These results speak to the importance of the magnitude of the deviation from the number of prior year revenue-deficient engagements as a reference point.

³⁴ As an additional robustness test, we restrict our sample to the upper or lower 25th percentile of the distribution of residuals. The results on these reduced samples are similar in that there is a positive and significant coefficient on *ChRevDefEngagements* in both the positive and negative 25th percentile of the distribution (coefficient = 0.0004 and t-statistic = 1.41; coefficient = 0.0006 and t-statistic = 2.20, respectively).

revenue quality in response to increases in revenue-deficient engagements. We use mediation analysis to investigate the potential relation between audit effort (proxied for using audit fees) and revenue quality. We fail to document a mediating effect suggesting recalibration efforts in auditing revenue without increasing client audit fees.

Our study provides audit firm-level evidence linking specific PCAOB inspection report deficiencies to a specific financial reporting quality or “outcome-based” audit quality measure. In doing so, we recognize the inextricable link between audit quality and financial reporting quality. Our evidence is consistent with PCAOB inspections providing meaningful and, more importantly, “actionable” information about audit quality to audit firms. Notably, our results indicate that auditors’ actions do not necessarily reflect increased auditor conservatism.

Our evidence indicates that audit firms respond strategically and asymmetrically to increases (rather than decreases) in revenue-deficient engagements. Although it would be reasonable for audit firms to strive for zero revenue deficiencies (i.e., zero revenue-deficient engagements), this may not be an optimal response strategy. Such a strategy would need to consider declining marginal rates of return for national office efforts needed to drive revenue-deficient engagements to zero and the potential opportunity costs of focusing too narrowly on revenue deficiencies at the expense of neglecting to address other non-revenue-related deficiencies.

All studies have limitations, and ours is no exception. First, our research design cannot distinguish between “window dressing” to appease the PCAOB and substantive changes in the revenue auditing approach. However, our set of tests reveals a positive association between year-over-year increases in revenue-deficient engagements and subsequent year improvements in revenue quality. This evidence, although not causal, is nonetheless consistent with the public interest mission of the PCAOB. Second, although there are benefits to our more targeted research design focus, the unique nature of revenue auditing (and corresponding inspection focus) may not generalize to other audit areas or financial statement accounts. Despite these limitations, we provide evidence of a pervasive, informational content benefit of the PCAOB inspection process in the form of increased revenue quality. We encourage future research to delve further into the capital market-related costs, benefits, and consequences of the PCAOB inspection process.

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APPENDIX A

Variable Definitions

Variable Name	Definition
Variables of Interest	
<i>ChRevQuality</i>	Change in discretionary revenues calculated as the change in the absolute value of the residual from year $t-1$ to year t , multiplied by -1 (Stubben 2010). [Compustat]
<i>ChRevDefEngagements</i>	Change in the number of revenue-deficient engagements from year $t-2$ to year $t-1$. [PCAOB]
<i>ChRevDefCount</i>	Change in number of revenue deficiencies from year $t-2$ to year $t-1$. [PCAOB]
<i>ChRevDefCount_Control</i>	Change in number of revenue deficiencies in tests of controls from year $t-2$ to year $t-1$. [PCAOB]
<i>ChRevDefCount_Substantive</i>	Change in number of revenue deficiencies in substantive procedures from year $t-2$ to year $t-1$. [PCAOB]
<i>ChRevDefCount_NoTest</i>	Change in number of revenue deficiencies in which the audit firm failed to test an account and/or assertion from year $t-2$ to year $t-1$. [PCAOB]
<i>ChRevDefCount_NoEval</i>	Change in number of revenue deficiencies in which the firm failed to adequately evaluate whether an accounting issue or accounting treatment was appropriate from year $t-2$ to year $t-1$. [PCAOB]
<i>ChRevDefCount_NoSuff</i>	Change in the number of revenue deficiencies in which the firm performed the requisite procedures, however only to an insufficient extent from year $t-2$ to year $t-1$. [PCAOB]
<i>ChLogFees</i>	Change in the natural logarithm of audit fees from year $t-1$ to year t . [Audit Analytics]
Control Variables	
<i>LogAssets</i>	Natural logarithm of total assets. [Compustat]
<i>ROA</i>	Return on assets, defined as net income before extraordinary items divided by average total assets. [Compustat]

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APPENDIX A (continued)

Variable Name	Definition
<i>ROE</i>	Return on equity, defined as net income before extraordinary items divided by average total equity. [Compustat]
<i>StdROA</i>	Standard deviation of return on assets, measured at the firm level over the five-year period beginning in year $t-4$ and ending in year t with at least three annual observations. [Compustat]
<i>Leverage</i>	Financial leverage, measured as total liabilities divided by total assets. [Compustat]
<i>Growth</i>	Growth in total assets in the current year compared with the previous year. [Compustat]
<i>OpCycle</i>	Operating cycle of the firm, measured as $(\text{Inventory}/[\text{Cost of Sales}/365]) + (\text{Receivables}/[\text{Sales}/365])$. [Compustat]
<i>CapitalNeeds</i>	The percentage change in common stock, preferred stock, and long-term debt in the following year. [Compustat]
<i>Inventory</i>	Total inventory divided by total assets. [Compustat]
<i>PercLoss</i>	Cumulative percentage from year $t-4$ to year t that the firm reported a loss. [Compustat]
<i>Specialist</i>	An indicator variable equal to 1 if a national industry specialist audits the company and 0 otherwise. A national industry specialist is calculated based on Reichelt and Wang (2010) . [Audit Analytics]
<i>LogTenure</i>	Natural logarithm of the number of years the auditor has audited the firm's financial statements. [Compustat]
<i>Importance</i>	The ratio of the focal firm's audit fees to the total audit fees generated by the office of the focal firm's auditor. Following Bills et al. (2020) , observations are grouped by core-based statistical area (CBSA) when measuring total audit fees in an engagement office. [Audit Analytics]
<i>HighImportance</i>	An indicator variable equal to 1 if <i>Importance</i> for the focal firm is in the top quartile for a given year and 0 otherwise. [Audit Analytics]
<i>NAS%</i>	The ratio of nonaudit fees to total fees paid by the firm to its auditor. [Audit Analytics]
<i>MW</i>	An indicator variable equal to 1 if the auditor disclosed a material weakness under Section 404 and 0 otherwise. [Audit Analytics]
<i>ACQ</i>	An indicator variable equal to 1 if the firm reported a cash outflow of funds used for and/or costs related to acquisition of a company and 0 otherwise. [Compustat]
<i>ARInv</i>	Accounts receivable plus inventory scaled by total assets. [Compustat]
<i>Loss</i>	The dichotomous variable is coded 1 in instances where the firm has experienced a net loss and 0 otherwise.
<i>Quick</i>	The sum of Cash and Total Receivables divided by Total Current Liabilities. [Compustat]
<i>Foreign</i>	An indicator that equals 1 if a firm presents foreign currency adjustments and 0 otherwise. [Compustat]
<i>LogSegments</i>	Number of active business segments for which a client reports operations. [Compustat]
<i>GoingConcern</i>	An indicator that equals 1 if a firm receives a going-concern audit report and 0 otherwise. [Compustat]

Data source is in brackets. All untransformed continuous variables are Winsorized at the first and 99th percentiles.

APPENDIX B

Deficiency Coding Procedures and Examples

Identifying Revenue-Deficient Engagements and Findings

To identify revenue-deficient engagements, two authors each reviewed inspection reports of the Big 4 audit firms for our sample period and identified issuers and their respective deficiencies. Revenue deficiencies were identified using a keyword search that included “sales,” “revenue,” and “accounts receivable.” These terms are often included in nonrevenue deficiencies (e.g., goodwill); however, the authors exercised judgment to exclude these instances. Next, the authors

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APPENDIX B (continued)

quantified individual revenue-related deficiencies. Some inspection reports clearly identify deficiencies; however, in other cases, several deficiencies are included in a single paragraph. To capture all deficiencies without duplicates, the authors relied on keywords (e.g., “in addition,” “specifically,” “further,” “also”). For example, in the following deficiency from the 2013 KPMG inspection report for issuer B, we identified four revenue-related deficiencies:

In this audit, the Firm failed in the following respects to obtain sufficient appropriate audit evidence to support its audit opinions on the financial statements and on the effectiveness of ICFR –

- The Firm failed to perform sufficient substantive procedures to test revenue. [1] Specifically, despite identifying a deficiency in the issuer’s control over manual journal entries, which the issuer used to record certain revenue, and identifying a risk of fraud related to inappropriate revenue recognition, the Firm selected only a small number of journal entries for testing, none of which related to the issuer’s most significant type of revenue. [2] In addition, the Firm’s sample of revenue transactions was insufficient, as the Firm determined its sample size based on the requirements for control testing rather than those for substantive testing, which required a larger sample. [3] The Firm also tested revenue by testing the issuer’s analysis of revenue, which involved forming an expectation based on the amount of cash received related to revenue during the period, taking into account the change in the recorded accounts receivable. The Firm’s testing of the issuer’s calculation of the revenue-related cash receipts was insufficient, as it failed to test the completeness of the deductions from the cash receipts for non-revenue-related items. [4] In addition, the Firm failed to evaluate the significant difference between the expected revenue and the revenue recorded by the issuer.

Categorizing Revenue Findings

After identifying the sample of revenue-related deficiencies, two coauthors independently coded all deficiencies and then jointly resolved any discrepancies. Coding was based on two mutually exclusive dimensions: the type of deficiency and the severity. The type was coded as *Control* if the report identified “controls” as the source of the failure and *Substantive* if the report identified a substantive procedure, a test of assertion, or another item suggesting substantive audit procedures. Severity was coded into three mutually exclusive classifications developed by Church and Shefchik (2012). *No-Test* indicates that the audit firm failed to test an account and/or assertion, whereas *No-Eval* indicates that the firm failed to adequately evaluate whether an accounting issue or treatment was appropriate. Finally, *No-Suff* indicates that, although the firm performed the requisite procedures, the procedures were insufficient to support the conclusion.

Example of Deficiencies

		Deficiency Type	
		Control	Substantive
Deficiency Severity	<i>No-Test</i>	Failed to identify and test any controls for one category of revenue. Deloitte & Touche LLP November 28, 2012 Issuer H	The Firm failed to perform tests of details that were specifically responsive to the risk of fraud it had identified related to the reserve for sales discounts and allowances. Ernst & Young LLP May 19, 2009 Issuer F
	<i>No-Eval</i>	Failed to sufficiently test the design effectiveness of important controls it selected for testing in that it failed to evaluate whether the controls it tested met the issuer’s control objectives. Deloitte & Touche LLP November 28, 2012 Issuer Q	The Firm failed to evaluate whether the issuer’s accounting related to these types of provisions was in conformity with GAAP. PricewaterhouseCoopers LLP August 10, 2016 Issuer D

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APPENDIX B (continued)

		Deficiency Type	
		Control	Substantive
<i>No-Suff</i>	As a result of the deficiencies in testing controls that are discussed above, the Firm did not have a sufficient basis for its reliance, when performing its tests of revenue, on the information provided by the service organization after the acquisition. PricewaterhouseCoopers LLP November 8, 2011 Issuer X	The Firm failed to perform sufficient substantive procedures to test revenue recognized using the completed contract method. Specifically, the Firm selected for testing only contracts whose gross margin exceeded a certain monetary threshold; as a result, the untested amount of this type of revenue exceeded the Firm's established level of materiality and represented almost half of this type of revenue. Ernst & Young LLP June 16, 2016 Issuer C	

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