Cognition and Recognition: Why Complex Revenue Recognition

Challenges Auditors and Ideas for Improvement

By

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ABSTRACT

My dissertation examines complex revenue recognition and why it challenges auditors. Revenue recognition, which determines the top-line sales figure that companies record for the goods and services that they sell, represents 60 percent of fraud cases. Revenue is also an important signal of a company's potential growth, leading to its use as a forecast target for many equity analysts, for companies themselves, and for top company executives' compensation. These incentives are likely reasons why revenue is an area where such a high degree of fraud occurs.

I use a combination of qualitative analysis to probe the areas of revenue recognition that flummox auditors and an experimental intervention that helps improve auditors' decision-making related to one complex area of revenue recognition: variable consideration value estimates for rebates, discounts, and other variable price determinants. My qualitative analysis uses regulatory inspection reports from the Public Company Accounting Oversight Board (PCAOB) to examine recent audit-related findings from three years before and three years since the Financial Accounting Standards Board (FASB) issued Accounting Standards Codification (ASC) 606, representing a major change in the accounting rules for revenue recognition. For my experiment, I use statistical risk framing, which is a form of cognitive nudge, to improve experienced auditors' assessments of complex probabilistic and predictive revenue recognition estimates related to variable consideration. My dissertation also includes an analysis of the judgments that ASC 606 requires compared with the prior revenue recognition accounting rules, a literature review on complex revenue recognition, a comparison of the audit work and thinking associated with complex revenue recognition versus two other widely studied complex estimates: goodwill impairment and fair value, and ideas for future research based on my analyses. The ultimate goals of my dissertation are to help improve audit quality and guide future research in the critical area of revenue recognition and particularly in the subcategory of complex revenue recognition.

INTRODUCTION

Monsanto, Symbol Technologies, Bristol-Meyers Squibb, Under Armour, Luckin Coffee, Marvell Technology. What do these companies have in common? They have all been subject to SEC investigations in the past two decades for improper revenue recognition, using schemes ranging from inappropriately recognizing customer discounts and channel stuffing to recording fake sales and accelerating revenues from future quarters (Zuckerman, Stock, and Krems 2020). SEC attorneys indicate improper revenue recognition timing is the most prevalent accounting fraud that the SEC has investigated based on recent whistleblowing tips (Freedman 2020).

According to prior research, over 60 percent of fraud occurs in the area of revenue recognition (Beasley, Carcello, Hermanson, and Neal 2010). Revenue recognition is also consistently the most frequent area associated with Public Company Accounting Oversight Board (PCAOB) inspection deficiencies and among the top five of both critical audit matter topics and SEC comment letter issues. Revenue is high stakes given its frequent use as a metric for management compensation incentives (Stice, Stice, Stice, and Stice-Lawrence 2022), investor attention to analyst revenue forecasts, the signals revenue provides related to company growth, and its high level of fraud risk.

The complexities related to revenue recognition are readily apparent in software companies. Software companies often sell highly customized software bundled with computer systems, consulting to customize the software, software maintenance including upgrades, and training for the companies' staff. Unlike simple goods or services that companies can recognize upon delivery, these bundled sales contracts require complex estimates, including allocation of the total contract price to each good or service and percent-completion accounting for the consulting work. Some software companies never sell their software at the same price twice,

leading to embedded discounts and difficulty in the price allocation process. In such cases, the auditors' revenue confirmation process will often ask customers to review and attest to the details of their contractual arrangements, alert the auditors to any informal or written side agreements that were contrary to their primary contractual agreements, and inform the auditors of rights-of-return, implicit discounts, or other potential recognition issues. These detailed revenue confirmations provide an indication of the complexities that revenue recognition can present, particularly for companies that bundle both products and services. Software companies have been accounting for revenue recognition using these challenging methods for 25 years, since the American Institute of Certified Public Accountants' (AICPA's) issuance of SOP 97-2, *Software Revenue Recognition* (Regan and Regan 2007). Auditors also struggled with the prior complex revenue recognition for software companies, per PCAOB inspection deficiencies from 2004-2009 (Church and Shefchik 2012, p. 49).

When the Financial Accounting Standards Board (FASB) issued its most recent revenue recognition guidance, Accounting Standards Codification (ASC) 606 (FASB 2014) in 2014 and its precursor ASC 605 in 2009, the FASB essentially made the tenets of software revenue recognition from SOP 97-2 applicable to all companies (Myers, Schmardebeck, Seidel, and Stuart 2022). Similarities between the current revenue recognition guidance and the previous accounting rules for software companies raise the question: Does this sort of revenue recognition continue to challenge auditors and, if so, why?

I consulted two high-level auditors (a director and national consulting partner), a corporate controller, two FASB staff members, and a former FASB board member to probe these questions further. They shared the challenges that ASC 606 presents but also lingering issues with complex forms of revenue recognition, including variable consideration value estimates

associated with discounts, rebates, and other forms of contingent revenue; recognition over time, as in percent-completion and completed-contract methods; and general problems with understanding and accounting for lengthy revenue contracts. Through our discussions, I learned that these issues are not unique to software companies. The audit partner with whom I spoke shared that variable consideration is a major challenge for healthcare organizations, given that the prices they charge to any individual patient are highly dependent on who is paying for their care. The corporate controller said that his company struggles with determining when they can recognize revenue for large machinery that they custom-produce for their customers and revealed that they specifically structure their contracts to avoid variable consideration accounting. The FASB staff noted feedback and issues from ASC 606's post-implementation review with accounting for variable consideration and ongoing problems with accounting for contracts with multiple performance obligations, like the prior software company contracts from the late 1990s.[1] These insights have informed my dissertation topic on revenue recognition and the challenges that it presents for auditors.

My dissertation consists of two primary chapters. The first sets the stage for how and why revenue recognition challenges auditors. I begin with a summary of ASC 606 and a comparison of the judgments that it requires of both managers and auditors versus the prior accounting guidance. ASC 606 organizes the revised revenue recognition guidance into five steps: 1) identify the contract, 2) identify performance obligations in the contract, 3) determine the transaction price, 4) allocate the transaction price to performance obligations, and 5) recognize revenue as the company satisfies each performance obligation. While the FASB intended for this

[1] I obtained IRB approval for an interview project associated with revenue recognition through the University of Wisconsin – Madison, allowing me to share these insights from my discussions.

simple five-step framework to make the revenue recognition process easy to understand, each of these five stages contains multiple complex judgments that are not readily apparent from their summary-level descriptions. Revenue recognition continues to challenge both managers and auditors as a result of these complexities, which I summarize in Chapter 1.

Chapter 1 continues with a literature review that incorporates both financial and audit studies relating to revenue recognition. Relatively few past revenue recognition studies exist, but there is a growing body of recent working papers on the effects of ASC 606, mainly in the financial archival area. While revenue recognition is frequently the setting for audit experimental research, it is rarely the focus of such studies, so I do not summarize that literature.[2]

Next, I turn to complex estimates. The PCAOB considers certain forms of complex revenue recognition to represent complex estimates. I summarize the recent estimates audit standard AS 2501 and some of the literature on complex estimates, with particular emphasis on the experimental audit literature. I include a figure and related discussion that compare complex revenue recognition to the two most commonly researched and referenced complex estimate types: goodwill impairment and fair value accounting. These comparisons represent a contribution to the literature on complex estimates, as past research has focused on these two estimate types and not on complex revenue recognition. Given the incentives and high level of audit and fraud risk associated with revenue recognition, I argue that complex revenue recognition deserves greater attention in future auditing research.

Chapter 1 also includes an empirical study on the PCAOB inspection report deficiencies related to revenue recognition from three years prior to and three years since the adoption of

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[2] Audit experimental studies that use revenue recognition settings focus on interventions and types of thinking that will improve auditor judgment.

ASC 606 (2016-2018 and 2019-2021, respectively). The coding schema from Church and Shefchik (2012) informs my analysis of these six years of inspection deficiencies for the eight largest public accounting firms. I tabulate 752 deficiencies that indicate that auditors have continuing problems with basic revenue recognition and four primary types of complex revenue recognition: multiple performance obligation contracts, recognition over time using percent-completion and completed-contract methods, variable consideration, and the allocation of contract prices to performance obligations. I categorize the deficiencies according to their degree of severity, type/nature, audit standard that they violate, affected accounts, and affected financial statements. I tabulate the data pre-ASC 606 and post-ASC 606 and also by size of firm: Big 4 or Next 4. I conclude Chapter 1 with an overall discussion regarding my analyses and ideas for future research, which include examining the reasons behind high levels of deficiencies related to internal controls, systems reliance, audit sampling, and complex revenue recognition. I identify contractual interpretation and internal controls as key areas where auditors especially struggle and future research could identify training or tools to bolster auditors' decision making.

Chapter 2 contains a micro-level analysis of one particular area of complex revenue recognition: variable consideration. My 2x2 experimental study explores how statistical risk framing from the healthcare field acts as a cognitive nudge to improve auditor revenue recognition estimates. The nudge acts as a debiasing mechanism that moves auditors away from anchoring on management's assumptions. Participants are 124 experienced auditors at the senior associate and manager levels. I hypothesize and find that absolute statistical risk framing helps auditors question multiple assumptions in management's variable consideration valuation analysis most effectively, as compared with either relative risk framing alone or no framing (i.e., the control condition). The PCAOB estimates standard encourages auditors to question all of

management's analysis assumptions to make higher-quality audit estimate judgments (SEC 2019a). While my setting involves probabilistic and predictive variable consideration valuation estimates, the findings have broader application for data analytics, given its statistical focus, and for other complex estimates including goodwill impairment analyses, contingency accruals, and investment valuation estimates.

In summary, my macro-level analyses in Chapter 1 identify areas related to complex revenue recognition that challenge auditors, and my micro-level analysis in Chapter 2 identifies an intervention that helps auditors assess complex predictive and probabilistic estimates related to variable consideration. I look forward to pursuing many of the future research ideas that I identify throughout my dissertation, toward carving out a niche as an expert revenue recognition audit researcher.

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CHAPTER 1: The Revenue Recognition Audit Landscape

I. INTRODUCTION

This chapter examines revenue recognition regulations and auditing at a macro level, with the aim of determining why revenue recognition challenges auditors. Specifically, I review the regulatory guidance and prior literature related to revenue recognition and complex estimates, compare the judgments that the new and old revenue recognition accounting guidance demands of auditors and financial managers, analyze PCAOB inspection results for the revenue recognition area, and present future research ideas based on my analyses. I find that the new revenue recognition accounting guidance is at least as complicated as the old guidance, due to multiple complex estimates that the standards delineate. I develop a framework for the three most common types of complex estimates: goodwill impairment, fair value, and complex revenue recognition. This framework compares and contrasts the nature of each complex estimate and the types of audit work that they require of auditors. Through the PCAOB inspection deficiency analysis, I find that while complex revenue recognition accounts for a significant portion of the PCAOB's findings (24.6 percent), basic revenue recognition continues to flummox auditors, particularly in the areas of internal controls, audit sampling, and reliance on system-generated information.

Basic revenue recognition involves shipping goods on their own or providing standalone services to customers, whereas complex revenue recognition often involves lengthy contracts outlining bundles of goods and services termed multiple performance obligations. The revenue recognition process for multiple performance obligations requires delineating each of those goods or services as a separate deliverable, determining the standalone prices of those deliverables, allocating the overall transaction price to the goods and services, and ensuring that

the company recognizes each performance obligation appropriately, based on the delivery mechanism and timing. Understanding the contractual terms is critical to ensuring appropriate revenue recognition. Other types of complex revenue recognition include goods or services that companies deliver and recognize over time, which they may account for using percent-completion or completed-contract methods; contracts with variable consideration like discounts, rebates, or performance bonuses that the company will realize in a future period but require up-front recognition; and in-kind arrangements that require companies to establish fair value for the consideration that they will receive. The Financial Accounting Standards Board (FASB) issued its latest revenue recognition guidance, Accounting Standards Codification (ASC) 606, in 2014, effective for large accelerated filers beginning in calendar year 2018 (FASB 2020). ASC 606 modifies the accounting for several of these areas of complex revenue recognition, including variable consideration, in-kind consideration, and recognition over time.

Revenue accounts for over 60 percent of fraud (Beasley, Carcello, Hermanson, and Neal 2010). Top-line revenue fraud directly impacts the bottom line too, resulting in greater profitability as well as greater sales. Incentives related to revenue recognition are multifaceted. Revenue is a signal of future growth to investors and the market (Barth, Li, and McClure 2023). As such, companies generally publish revenue forecasts alongside bottom line forecasts, and analysts often forecast both expected revenue and profits (Koo and Lee 2018; Lorenz and Homburg 2018). Revenue growth targets are a central metric in executive compensation plans, driving bonuses and other forms of incentive compensation for top management (Bloomfield 2021). These incentives to maximize revenue render it a high-risk area, both in terms of fraud and earnings management.

Beyond these incentives and risks, regulator data indicates that revenue recognition remains challenging for both financial managers and auditors. Revenue recognition represented the second highest area of SEC comment letter issues in 2018, the third in 2019 and 2020, and the fifth in 2021 and 2022 (Coleman 2022; PwC 2022); the highest number of PCAOB inspection deficiencies by issuer per my analysis of inspection reports from 2016-2021 and prior per earlier research (Church and Shefchik 2012; Griffith, Hammersley, and Kadous 2015); and the second highest incidence of critical audit matters for both 2019 and 2020 (Burke, Hoitash, Hoitash, and Xiao 2022). Recognizing the existing backdrop of fraud and complex revenue recognition as a form of estimate that challenges financial managers and auditors, I review the current accounting and audit standards related to revenue recognition and complex estimates. As part of my discussion of the new accounting standard ASC 606, I analyze and compare the accounting and audit judgments that the new and old revenue recognition accounting guidance requires. I also summarize the existing accounting and audit literature on these topics.

I next turn to the PCAOB inspection reports from the inspection cycles three years prior to (2016-2018) and three years since ASC 606 (2019-2021) to code and analyze revenue-related deficiencies from the eight largest accounting firms. The 752 revenue-related deficiencies in these 48 reports inform what new issues challenge auditors related to ASC 606 and what prior issues persist. While the terminology changes in ASC 606, I find that the issues that challenge auditors remain the same. Basic revenue recognition is still the most prevalent problem in the inspection reports from 2019-2021, as in 2016-2018, but complex revenue recognition is a sizable chunk at 24.6 percent of the deficiencies.[3] The prevalence of complex revenue

[3] Approximately 26 percent of U.S. public companies experienced significant revenue recognition timing shifts or variable consideration changes consistent with complex revenue recognition in connection with their adoption of ASC 606 from 2017-2019 (1,111 firms out of 4,266 publicly listed companies in 2019) (Ali and Tseng 2022;

recognition issues, namely multiple performance obligations, contract recognition over time (e.g., percent-completion or completed-contract methods), variable consideration, and estimated transaction prices and allocation to performance obligations, remains similar pre- and post-606, raising the question of why these revenue recognition areas remain so challenging for auditors. PCAOB inspection deficiencies and how accounting firms address them are critical elements of audit quality (Church and Shefchik 2012), so persistent problems with specific types of revenue recognition signal areas that warrant additional analysis and research.

I close out the chapter with a discussion regarding the implications of my analyses and future research ideas that the judgments in ASC 606 and prior guidance, the literature review, and the revenue-related deficiencies from the PCAOB inspection reports pre- and since-ASC 606 inform. These research ideas build upon the past literature on complex estimates and demonstrate the need for revenue recognition to take a seat at the table among fair value estimates and goodwill impairment assessments as an area of complex estimates that deserves further study. I hope that my analyses and ideas for future research will pave the way for my and others' work in the areas that I propose, among other revenue recognition topics.

My study also provides data for practice and regulators regarding continuing problems with both complex and simple revenue recognition. I offer suggestions in my discussion section regarding additional training, technology, and specialist use that will be of interest to accounting firms and academia alike. These ideas aim to improve revenue recognition audit quality by reducing audit deficiencies and improving auditor knowledge in the areas of complex revenue recognition, internal controls, systems, processes, and contractual interpretation. Novel

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TheGlobalEconomy.com 2019). These figures suggest that the base rate of complex revenue recognition as a proportion of total revenue recognition is lower, and the rate of PCAOB deficiencies for complex revenue recognition is similar to the rate of deficiencies for basic revenue recognition.

technologies like artificial intelligence and machine learning may be able to assist auditors in these efforts over time, once the firms can train such innovations to properly identify and assess complex revenue recognition issues. In the interim, attorneys, contract specialists, and data analytics can help fill the gap in analyzing complex revenue recognition contract terms.

My study additionally informs standard-setting efforts for both accounting and audit. The FASB provides several options for accounting for both variable consideration and contract recognition over time, intending to best capture the economic substance of such transactions in the spirit of their present focus on principles-based standard-setting. Yet such choices may contribute to deficiencies and the risk of material misstatement, as they create additional complexity in these two already complex areas of revenue recognition. Investors and markets concerned about the potential for fraud and manipulation of revenue recognition may prefer rules to principles in such cases, toward the ultimate goal of ensuring stronger audit quality and resulting trust in both audited financial statements and financial markets.

II. REGULATORY AND LITERATURE REVIEW

Revenue Recognition

Accounting Standards

The FASB adopted the prior accounting rules related to general revenue recognition (ASC 605) as part of its new codification in 2009 (FASB 2017). The codification contained additional guidance on specific revenue recognition rules related to industries such as agriculture, insurance, software, non-profit, and health care. These industry-specific rules stemmed from important differences between industries and their varying types of revenue. For example, software companies often sell hardware along with their software, which may require consulting to customize the software for a specific customer, along with maintenance and

upgrades for the software. Software companies often bundle some or all of these goods and services into one sales contract. The AICPA's SOP 97-2 emerged to address issues that were specific to software companies and these multi-element, bundled revenue arrangements, and the FASB subsequently modified and extended the rules on multi-element contracts to all industries via ASU 2009-13, which they incorporated into ASC 605 in 2009 (FASB 2009).

ASU 2009-13 was a stop-gap measure associated with the FASB's larger revenue recognition project, which they began in 2002 (FASB 2002). This project culminated in the issuance of a 2010 proposed standard, which was ultimately issued in 2014 (FASB 2014). In 2015, the FASB delayed implementation of the standard (ASC 606) until 2018 for public companies and 2019 for private companies (FASB 2015). This lengthy period from project start to implementation is an indication of the complexity associated with the project, the prior regulations, and the new standard.

The economic impact of ASC 606, and complex revenue recognition generally, centers on four industries: software, consulting, engineering, and construction (Ciesielski and Weirich 2011). These industries earned approximately $2 trillion of U.S. revenues in 2018, which represented 10 percent of U.S. GDP. That said, PwC, RSM, and other firms issued implementation guidance in 2017 and 2018 indicating that ASC 606 applies to all industries, suggesting a much larger dollar impact from the new standard.[4] A recent working paper indicates that the 3,075 public companies in its sample experienced significant revenue recognition acceleration as a result of ASC 606's adoption, out of 4,256 companies that were listed as of 2019 (Ali and Tseng 2022; TheGlobalEconomy.com 2019). Complex revenue recognition timing changes from multiple performance obligations, percent-completion contracts, and variable

[4] Per Google searches on ASC 606 industry guidance for PwC, RSM, and other accounting firms.

consideration estimates accelerated revenue recognition by 22 percent in the period of adoption versus the immediately subsequent quarter (Ali and Tseng 2022). This significant shift in revenue recognition at the time of transition to ASC 606 provides an additional indication of the materiality and economic impact of the underlying complex revenue recognition accounting.

The revenue recognition accounting rules in ASC 606 further complicate an already complex area of accounting and are likely to make both managers' and auditors' decision-making related to revenue recognition at least as, if not more, difficult. This degree of difficulty is partly due to the many areas of judgment that both the old and new revenue recognition rules require of managers and auditors. Appendix A details these judgment areas, which I will discuss further below, and Appendix B summarizes these areas by judgment categorization types.

Revenue Recognition Judgments

ASC 606 relies upon five basic steps of revenue recognition, which the FASB intended to simplify their revenue-related guidance: 1) recognizing the existence of a contract with a customer; 2) delineating the contractual performance obligations; 3) determining the overall transaction price; 4) apportioning the transaction price across performance obligations; and 5) recognizing revenue as the seller delivers each performance obligation. While these five steps help boil down the guidance, the underlying rules regarding each step are more complex.

1) Existence of a Contract: Underlying the existence of a contract are five elements, focusing on the legal enforceability of the agreement. Enforceability is contingent upon both parties' approval and commitment to the agreement, the parties' rights, payment terms, commercial substance, and probable collectability, all of which may require judgment on the part of managers and auditors. The prior rules centered upon the notion of "persuasive evidence" of an agreement, which hinged upon a sufficient amount of documentation and was highly

dependent upon past business practice. This notion similarly required judgment regarding what was sufficiently persuasive, but did not require a legal determination regarding the existence of an enforceable contract. Both the old and new rules also contain guidance about combining similar contracts into one contract, although the old rules specified that the contracts had to be coincident in order to combine them. These multi-contract assessments also require judgment. However, establishing the existence of a contract is generally less tricky than the various factors involved in determining the revenue recognition timing and transaction pricing, since a contract, purchase order, or similar document generally suffices as evidence for an agreement.

2) Delineating performance obligations: The delivery pattern of goods and services helps to determine whether they represent distinct performance obligations. Each performance obligation must be separately identifiable and benefit the customer either on its own or in combination with other resources that the customer readily possesses. Similar guidance existed in ASC 605, instructing companies and auditors to examine whether goods or services had value on a standalone basis, including whether the customer could resell them. Both the new and old revenue recognition rules require judgment in determining whether contractual elements represent unique performance obligations, which is a key factor in allocating the transaction price across the contract and ultimately drives the timing of revenue recognition.

3) Determining the transaction price: ASC 606 outlines five factors that may impact a contractual transaction price, including the existence and value of variable consideration (e.g., discounts, rebates, etc.); an assessment of the probability of reversing additive revenue due to variable consideration-related contingencies, labeled a constraint; a determination regarding whether an embedded financing transaction exists; the presence of noncash consideration; and the contractual terms regarding the seller's payment of consideration to the buyer. All, some, or

none of these factors may exist in a given contract, and determining whether or not they exist, and how to treat them if they do exist, requires judgment on the part of managers and auditors. ASC 605 required deciding whether a contract price was "fixed and determinable," meaning not subject to refund/adjustment and contingencies, respectively. These assessments also required judgment, again in whether they existed and in how to account for them properly. However, the number of considerations, and therefore the extent of judgment for managers and auditors in determining the appropriate price for a given contract, increased in ASC 606.

4) Apportioning the transaction price across the contractual performance obligations: Settling upon the transaction price is the precursor to pricing the contract elements and any variable consideration present in the contract. For companies with standalone prices that they regularly charge to other customers for each contract element, this process is straightforward. However, in the absence of stated standalone prices, the company must use one of three methods to estimate the selling price: an adjusted market assessment based on other companies' selling prices, expected cost plus margin, or a residual approach, where the company has standalone prices for some contractual elements and allocates the remainder to the elements without standalone prices. These pricing estimates require both manager and auditor judgment.

For variable consideration, a company may set its value via probability weighting or a most-likely value approach. The company must reassess the value of variable consideration periodically. Deciding upon the pricing methodology for non-standalone selling prices and for variable consideration requires extensive manager and auditor judgment. ASC 605 similarly required companies to use either vendor-specific objective (VSOE) or third-party evidence of selling prices. If neither form of evidence existed, ASU 2009-13 permitted companies to estimate the selling price. Prior to ASU 2009-13, ASC 605 required companies to defer revenue on all

undelivered contract elements without VSOE or third-party pricing evidence until the company had fulfilled all contractual elements. Establishing VSOE, third-party prices, or estimated selling prices all required manager and auditor judgment, similar to the requirements in ASC 606. Determining how variable consideration such as refunds, rebates, discounts, price concessions, and other contingent offsets to revenue are allocated to performance obligations also requires manager and auditor judgment. This shift to allowing companies to recognize revenue using estimated prices and the estimated value of variable consideration is also a major change that allowed companies to record revenue sooner, making the manager and auditor judgments associated with both price estimates and variable consideration valuation higher risk.

To further complicate revenue recognition, variable consideration can either add to or deduct from revenue. In situations where the seller may be eligible to receive a bonus, as in cases of early delivery or for other contractual reasons, the variable consideration would actually increase revenue, but is subject to a "constraint." The constraint in ASC 606 requires companies to examine other factors related to additive variable consideration in determining to what extent it can recognize revenue. These constraining factors include susceptibility to economic, third-party, obsolescence-related, or other factors outside of the company's control; uncertainty regarding consideration that will take a significant period of time to resolve; limited experience with similar contracts; company practices of regularly varying pricing or payment terms; and a variety and large range of possible outcomes related to each type of variable consideration. These factors represent a constraint on additions to revenue, rather than offsets to revenue, and represent another new and complex aspect of determining the value of certain types of variable consideration that affect revenue per ASC 606.

5) Recognizing revenue as the seller completes each performance obligation: Delivery of goods or services may happen at a point in time or over time, and this timing governs how companies recognize the associated revenue. Transferring all elements of control is central to delivery and may involve assessing whether the seller or buyer holds legal title, the right to payment, the risks and rewards of ownership, customer acceptance, and other factors that might convey a shift in control. Assessing these elements of control related to delivery requires both manager and auditor judgment, particularly in complex contractual arrangements.

If delivery of goods or services occurs over time, there are several factors relating to how the customer is benefiting from the asset, whether the customer has control over the asset even as the seller continues to improve it, and whether the seller has a right to payment for the work that they have completed to-date. Since the alternative in each of these cases is delaying revenue recognition until the seller has fully completed their contractual work, determining that delivery is occurring over time requires judgment. If the transfer occurs over time, the seller may choose between input (cost-related) and output (pricing or value-related) methods of proportionately recognizing revenue for the work they have completed to date. Deciding upon the most appropriate method and estimating the work completed to-date and associated costs or value require judgment. Similar judgments existed in the prior revenue recognition rules as well.

Other areas: Beyond the five stages of revenue recognition that ASC 606 uses as an organizing framework, there are several other areas that require manager and auditor judgment. Two areas relate to contractual consideration: 1) assessing contracts for the existence of an embedded financing transaction and establishing an appropriate interest rate if one exists, and 2) if a contract includes provision of noncash consideration, the seller must estimate its fair value, similar to the prior ASC 605 barter transaction rules. ASC 606 also contains significant new

disclosure requirements, beyond those for the accounting policies and multiple-element arrangements in ASC 605. The new requirements include areas of significant judgment, changes in judgment areas related to revenue recognition, methods for estimating total transaction prices, and methods for allocating the transaction price to the contractual performance obligations. ASC 606 also requires qualitative and quantitative disclosures related to disaggregation of revenues, performance obligations, and significant outstanding contract balances. Determining what information requires disclosure under the new rules requires significantly more management judgment than the scant disclosures allowed under the prior guidance, and auditors must carefully assess the reasonableness of those disclosures, which have been a frequent target of SEC comment letters (Coleman 2022; PwC 2022).

Revenue Recognition Prior Literature

There is a limited amount of prior research on revenue recognition. A handful of recent working papers study the effects of ASC 606 using financial archival methods. These studies examine topics including changes in revenue comparability across industries resulting from ASC 606 and related disclosure processing costs for analysts (Tillet 2022), the intra-industry effects of ASC 606 for the software and computer industries (Choi, Kim, and Wang 2022), revenue forecast accuracy post-606 and the impact of management forecast guidance on accuracy (Billings, Mauler, and Tillet 2022), the dollar impact of ASC 606 on total revenue recognized in the year following its adoption (Ali and Tseng 2022), and the effects of ASC 606 on liquidity, precision, and comparability of financial reporting (Ferreira 2021). These working papers highlight the significant impact of ASC 606 on various facets of financial reporting, which have immediate implications for investors and the financial markets, and therefore also impact auditors as they assess their clients' revenue recognition.

In the auditing literature, Beasley et al. (2010) examine the nature of various revenue recognition frauds, noting that 48 percent of all frauds in their sample are fictitious sales and 35 percent represent situations where companies recognize revenue prematurely, presumably in an egregious fashion and with knowledge (scienter) in order to qualify as fraud. These fraud cases fall into ten subcategories, including purely fake sales, conditional sales involving either contractual uncertainties or rights to return goods, situations where the company compensates the customer for accepting the goods ("round-tripping") or ships unauthorized goods, loans that companies account for as revenue, bill and hold transactions, consignment sales, inappropriate revenue cutoff, recognition prior to full delivery, and inappropriate percent-completion accounting (Beasley et al. 2010). The last two of these subcategories are potential examples of complex revenue recognition, namely multiple performance obligation contracts and revenue recognition over time, which are issues I identify in my PCAOB inspection report analysis as well. The variety of fake and premature sales schemes illustrates the many ways that companies can manipulate revenue recognition and helps to explain why revenue recognition fraud comprises 61 percent of all frauds that Beasley et al. (2010) investigate.

Archival studies have also examined revenue earnings management in cases of loss firms (Callen, Robb, and Segal 2008) and negative earnings surprise avoidance (Caylor 2010). The adoption of SEC Staff Accounting Bulletin No. 101 reduced the incidence of earnings management for affected firms (Altamuro, Beatty, and Weber 2005), whereas other accounting regulation changes like the issuance of the AICPA's software revenue recognition guidance in Statement of Position 97-2 had no impact on earnings management, contrary to expectations (Srivastava 2014).

Abbott et al. (2022) bridge the financial and audit research subfields by examining the effect of PCAOB revenue recognition deficiencies on revenue quality. They measure revenue quality using a financial archival proxy that incorporates both accounts receivable and discretionary revenue changes, adjusted by average total assets (per Stubben 2010). They find mixed results, namely that increases in PCAOB inspection deficiencies improve revenue quality but deficiency decreases do not (Abbott, Boland, McCarthy, and Swenson 2022).

While the majority of the research that directly addresses the topic of revenue recognition has been financial archival in nature, behavioral studies often utilize revenue recognition as their experimental setting (e.g., Kadous, Kennedy, and Peecher 2003; Rose, Mazza, Norman, and Rose 2013). However, experimental studies like these do not focus on or manipulate revenue recognition accounting to illuminate the effects of the accounting standard itself; they focus on the underlying mechanism for the relevant judgment and decision-making inherent within the accounting setting.

The collective research on revenue recognition indicates continuing problems with earnings management and fraud, both of which remain areas of concern for auditors. The relative dearth of audit studies on revenue recognition raises the question as to why this area that continues to challenge auditors has not been a more prevalent audit research topic, particularly with the advent of ASC 606. Complex revenue recognition as a form of complex estimate also offers opportunities for future audit research.

Complex Estimates

Estimates Audit Standard

In July 2019, the PCAOB issued AS 2501, *Auditing Accounting Estimates, Including Fair Value Measurements*, effective for fiscal year audits after December 15, 2020. There is no

PCAOB audit standard specific to revenue recognition, but the PCAOB intended for AS 2501 to address revenue recognition estimates as well as other estimates (SEC 2019b). AS 2501 incorporates prior guidance on auditing fair values and derivatives to consolidate the audit standards related to estimates within "a uniform, risk-based approach" (SEC 2019a, p. 2). The new audit standard specifically:

- Prompts auditors to consider management bias associated with estimates, labeling auditors' bias assessment a form of professional skepticism.
- Instructs auditors to examine both affirming and disaffirming evidence for management's estimate-related assertions.
- Stipulates that auditors must identify and evaluate the reasonableness of major assumptions related to management estimates, including consideration of alternative assumptions, and provides examples of such assumptions.
- Advises auditors to independently develop their own estimate and address the reasonableness of management's underlying estimate assumptions and estimation method.
- Requires auditors to "obtain an understanding" of critical management estimate analyses and utilize that understanding to assess the underlying estimate assumptions and bias.
- Strengthens overall language and fair value data evaluation requirements (SEC 2019a).

While AS 2501 references fair value and derivatives due to the incorporation of those standards and extends fair value audit requirements to other accounting estimates, the standard does not otherwise specifically mention accounting estimates by type or name. That said, the PCAOB's Notice of Filing for AS 2501 specifically mentions revenue contracts several times as well as fair value, long-lived asset impairment, allowances for credit losses, and contingent

liabilities as types of estimates that the new standard addresses (SEC 2019b). This notice also indicates that "revenue-related estimates and reserves" represent one area with frequent PCAOB inspection deficiencies, in addition to the aforementioned other areas.

The PCAOB issued two Staff Audit Practice Alerts in 2014 and 2017 encouraging auditors to exercise particular caution when auditing revenue, given its higher risk of material misstatement due to fraud, and drawing attention to the revised accounting guidance in ASC 606 (PCAOB 2014, 2017). The 2017 Practice Alert in particular notes that the implementation of ASC 606 may result in "significant new accounting estimates" that provide new opportunities for fraud: "For example, companies may be required to develop estimates for variable consideration and standalone selling prices, which might involve subjective judgments or uncertainties that are difficult to corroborate." (PCAOB 2017, p. 12).[5] In addition to variable consideration and standalone selling prices, the PCAOB notes that the fair value of non-cash consideration and recognition over time are two other estimates that ASC 606 addresses. The 2017 Practice Alert also warns auditors that fraud opportunities could arise from internal control deficiencies associated with systems, controls, and process changes necessary to implement ASC 606. Lastly, the PCAOB discusses ASC 606's substantial new disclosure requirements, including information regarding, "Significant judgments, and changes in judgments, made in applying the requirements to [contracts with customers]" (PCAOB 2017).

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[5] Standalone selling price means the value of an individual good or service, termed a performance obligation in ASC 606, that a company must separately determine to recognize revenue properly as they deliver each good or service. Standalone selling prices are important to multiple performance obligation contracts, where the delivery of the goods or services does not happen concurrently. For example, in a software contract that includes consulting, maintenance, and training, the software will be recognizable when the customer is able to use it, the consulting on a percent-completion basis as the company provides it, the maintenance ratably over the contract term, and the training upon delivery to the customer's employees. A company would determine the standalone selling price for each of these contract elements or performance obligations based on prices when they sell each good or service separately, but ASC 606 allows companies to estimate the individual, or standalone, selling prices if they do not sell the goods or services separately to its customers at stated selling prices (e.g., a price list).

Two comment letters from Big 4 firms regarding the AS 2501 exposure draft specifically advise the PCAOB that further guidance is necessary for complex revenue recognition. Deloitte's comment letter asks the PCAOB to provide additional guidance regarding situations in which substantive tests do not provide sufficient audit evidence, including complex estimates like those from revenue contracts, leases, and credit losses, all of which require the use of "large volumes of data" (Deloitte 2017, p. 3). Deloitte also calls for detailed implementation guidance addressing the new accounting estimates related to ASC 606, among other new FASB standards. They note that revenue-related complex estimates rely upon data from multiple contracts, as do lease and credit loss-related complex estimates, distinguishing the recurrent nature of revenue transactions from those that hinge upon fewer transactions, like goodwill impairment or fair value estimates. PricewaterhouseCoopers similarly notes the need for further guidance to help auditors understand the new revenue recognition rules in their comment letter, implying that complex revenue estimates differ from other types of complex estimates (PwC 2017).

While the PCAOB's implementation guidance and practice alerts specifically mention complex revenue recognition as a form of complex estimate, the estimates standard itself is perhaps purposefully vague regarding what qualifies as a complex estimate. This ambiguity leaves auditors with significant leeway to decide whether management estimates for revenue recognition or other areas require additional scrutiny due to their complexity.

Figure 2 presents my analysis of the types of audit work and thinking from the four main types of complex revenue recognition in comparison to goodwill impairment and fair value. Contractual interpretation is the first area of comparison. Revenue contracts can be lengthy and contain complicated terms, requiring contractual interpretation skills to understand and appropriately account for them. Companies often enter into agreements for financial instruments

too, like Level 3 investments and debt, which similarly contain complex terms. Yet the types of contracts are quite different, based on the types of terms they contain and the agreements' purpose. Goodwill impairment testing does not involve ongoing contractual interpretation, beyond the initial accounting for the related business combination.

Contractual terms for revenue recognition and fair value estimates impact the second area in Figure 2: assessing multiple information inputs and assumptions. These assessments relate to all complex estimates. That said, the information and assumptions vary quite a bit depending on the complex estimate type. For revenue recognition, multiple inputs can include contracts and pricing with different customers, as well as the assumptions inherent in variable consideration valuation estimates, such as historical rebate and discount data, offer terms, and likelihood of redemption. The inputs and assumptions can be extremely complex for fair value and goodwill impairment, given their valuation processes, reliance on forecasting, and underlying company-specific and economic data.

The third major area in Figure 2 involves assessing multiple potential valuation methods. For revenue recognition, this area primarily relates to price estimation if standalone selling prices do not exist, recognition over time, and variable consideration valuation. All three of these areas offer two or three options for developing or modeling the estimate. Fair value similarly can involve multiple valuation methods that auditors must assess, some of which may be especially difficult to audit if a third party develops a proprietary model that determines the valuation. These valuation models tend to involve the next two areas, assessment of a) probabilistic and statistical analyses and b) forecast and related assumption assessments, in multiple ways across complex estimate types. Assumptions often involve statistical data, which is a commonality across the three types of complex estimates. Forecasting is often central to developing these three

forms of complex estimates, as valuation estimates generally depend upon future cash flow and revenue growth assumptions.

The last two areas in Figure 2 relate to the frequency of transactions and exception processing. As Deloitte noted in its AS 2501 comment letter, the volume of transactions is one major difference between revenue recognition complex estimates and either goodwill impairment or fair value. Revenue recognition is recurrent and tied to multiple transactions, whereas companies assess goodwill impairment and fair values on a quarterly or as-needed basis. Companies must have especially strong internal controls to ensure proper revenue recognition within a larger stream of transactions, especially for exceptions such as extraordinary contract terms, new forms of variable consideration, or other contractual abnormalities.

In sum, while there are many similarities between complex revenue recognition estimates and complex estimates for goodwill impairment and fair value, there are important distinctions. Valuation models, underlying assumptions, statistical analyses, forecasts, and assessment of multiple inputs are commonalities. Primary differences relate to contractual terms and interpretation, the types of underlying analyses, the volume and frequency of transactions, and the existence of and importance of exception processing.

All of the aforementioned audit work and related thinking types qualify as Type 2 thinking, in the dual-process thinking model (Stanovich and West 2008). As Griffith, Kadous, and Young (2021) note in their complex estimates framework paper, auditors may use heuristics to avoid deep thinking, particularly if management provides data that the auditors can simply accept without testing the underlying assumptions or developing their own estimate. Below Figure 2, I identify other common types of audit work that complex estimates consistently require. These audit work types involve a combination of Type 1 and 2 thinking. Testing controls

or the mathematical accuracy of a report are not deep-thinking exercises, for example, and would qualify as Type 1 activities. However, the majority of the audit work requires deep, Type 2 thinking to properly address the potential management bias inherent in complex estimates.

Complex Estimates Prior Literature

Looking back to the advent of complex estimates auditing studies in 2012-2013, it was possible to count the number of papers expressly related to complex estimates on one hand, and they all related to fair value estimates: Bell and Griffin (2012); Christensen, Glover, and Wood (2012); and Bratten, Gaynor, McDaniel, Montague, and Sierra (2013). The first two were thought pieces with literature review components, whereas the third was purely a literature review. Griffith, Hammersley, Kadous, and Young (2015) ushered in an onslaught of experimental papers on complex estimates, using goodwill impairment as their focal setting to examine interventions that improve auditor judgment and decision-making. Griffith, Hammersley, and Kadous (2015) concurrently interviewed highly experienced auditors regarding the audit process for complex estimates, providing critical background information on deficiencies in auditor knowledge regarding the pre-AS 2501 estimates audit standards. Griffith et al. (2015) also analyze PCAOB inspection reports and assess the most common deficiencies, finding that revenue is the most common problem and that deficiencies in the complex estimates area relate to six out of seven steps in the estimates audit standard.

Research on complex estimates since 2014-2015 has snowballed, using archival, experimental, and interview methods. Similar to the behavioral research on revenue recognition, most experimental research on complex estimates focuses on the underlying thinking and interventions rather than on accounting tasks. Yet the interventions themselves are instructive, in their ability to help auditors make better decisions on complex tasks. Such interventions include

the implemental and deliberative mindsets from Griffith, Hammersley, Kadous, and Young (2015), a balanced versus supportive focus when assessing management evidence (Austin, Hammersley, and Ricci 2020), concrete versus abstract thinking regarding particular elements of management's evidence (Backof, Carpenter, and Thayer 2018), systems thinking (Bucaro 2019), and intuition versus analytical thinking in impairment risk assessment (Wolfe, Christensen, and Vandervelde 2020). Griffith, Kadous, and Young (2021) label these various thinking interventions as means of helping auditors recognize a need for analytical processing in a given "mindware" task. They define mindware as including task knowledge, such as accounting regulations and both traditional and modern audit techniques, like data analytics. Their framework for complex audit tasks is dependent upon the ability to conduct sustained analysis, such as a high need for cognition, in order to successfully conduct such analysis (Griffith, Kadous, and Young 2021).

In their discussion regarding Griffith et al. 2021, included as Appendix 2 to the study, Agoglia and Jackson call for "researchers interested in investigating interventions designed to improve auditors' performance on complex tasks to work to bridge the divide between theoretically and practically minded interventions," noting the prevalence of psychology-based thinking interventions and relative lack of practical interventions that accounting firms might put to use. Other studies have identified specific elements of financial and nonfinancial fair market values that challenge auditors (Glover, Taylor, and Wu 2017; Hux 2017), which offer opportunities for the sorts of targeted studies that Agoglia and Jackson recommend to address issues occurring in practice. Complex revenue recognition provides similar opportunities.

Prior literature has examined many facets of complex estimates. Yet the topics and settings of these papers remain centered upon fair value measurement and goodwill impairment,

despite revenue representing the most common area of PCAOB deficiencies and the PCAOB specifically calling revenue recognition an important form of estimate that requires significant management judgment. Several of the prior studies note that their interventions may also positively impact auditor revenue recognition judgments, including Griffith et al. (2021) with respect to accuracy priming and Knechel and Leiby (2016) regarding contrary versus precise expert consultations.[6] These interventions are particularly useful in situations that I previously discussed regarding the complex estimates comparisons in Figure 2, where auditors use heuristics to avoid Type 2, deep thinking (Griffith et al. 2021). Such situations will arise if auditors are simply accepting management's numbers and underlying assumptions without using Type 2 thinking to thoroughly analyze complex revenue recognition estimates or to alternatively develop independent estimates. My analysis of PCAOB inspection reports provides further insights into the specific areas of complex revenue recognition that challenge auditors, including some that result from auditors using estimate-related heuristics.

III. PCAOB INSPECTION REPORT EMPIRICAL ANALYSIS

PCAOB Inspection Process

Congress established the Public Company Accounting Oversight Board (PCAOB) to register, inspect, regulate, and police public accounting firms (SEC Historical Society 2023). The PCAOB's inspection responsibility is the focus of my analysis, although inspection closely relates to standard-setting, as the PCAOB bases its inspections upon its audit standards. The PCAOB inspects firms that audit more than 100 public issuers annually and firms auditing fewer

[6] I note that many experimental complex estimates studies regarding goodwill impairment and fair value measurements utilize revenue projections as a key assumption in their experimental cases. The PCAOB also discusses revenue growth projections as a contributing factor in deficiencies related to business combinations and long-lived asset impairments in a number of their inspection reports.

than 100 issuers at least once every three years (PCAOB 2022a). According to the PCAOB, they follow a risk-based approach in determining what issuers and areas to inspect (PCAOB 2022b). In 2021, the PCAOB inspected 690 issuer audits across 141 accounting firms (PCAOB 2022b).

My analysis focuses on the top eight of the14 annually inspected firms (PCAOB 2022c), including the Big 4: Deloitte, EY, KPMG, and PricewaterhouseCoopers (PwC), and what I term the "Next 4" firms: BDO, Grant Thornton, Marcum, and RSM. The firms beyond the Big 4 that the PCAOB inspects annually shift somewhat over time. Church & Shefchik (2012) included Crowe Horwath as an annually inspected firm in their eight-firm analysis for inspections from 2004-2009, for example. Since the PCAOB has inspected fewer audits for Crowe Horwath's successor firm Crowe than my Next 4 firms (15 on average per year and only 4 for the revenue area versus 21 on average per year and 16 on average for the revenue area, respectively), I exclude Crowe from my analysis. I also exclude firms that the PCAOB now inspects annually but did not inspect annually for the full six years in my sample period of 2016-2021. Lastly, I exclude Cohen & Co. as their clients are primarily investment companies, and the firm therefore does not audit traditional types of revenue.

PCAOB inspection reports since 2017 include summary-level data on the inspection deficiencies for each firm, including the number of issuer audits with deficiencies for the past three years as compared to the total number of issuer audits; whether the deficiencies related to the financial statement or internal controls over financial reporting (ICFR) audits; the most frequently identified deficiencies in each of these types of audits; the most frequently inspected audit areas by issuer and the number of audits with deficiencies by audit area for the past three years; the number of references to specific audit standards in the deficiencies for the past three years; and various information regarding the issuers, including industry sector and revenue level.

After these statistics, the inspection reports present detailed deficiencies by issuer in Part I.A, with those issuer audits containing multiple deficiencies presented first, followed by those with single deficiencies. The remainder of each report contains a discussion of other non-compliance with PCAOB standards and rules in Part I.B and quality control observations in Part II. Appendix A of each report contains a generally cursory firm response to the inspection report.

Prior to 2017, PCAOB inspection reports only contained current-year data. In addition, older inspection reports tended to contain longer deficiency comments with fewer references to specific standards that each firm violated. I will note other shifting trends among the reports since and prior to 2017 in the results section, following my research method discussion.

The PCAOB has come under criticism for its ties to the accounting firms and especially the Big 4. PCAOB staff often move to the Big 4 and vice versa, with the PCAOB recruiting from the largest accounting firms. Recent research has examined these movements and found that the "revolving door" for staff shifting between the Big 4 and PCAOB can lead to "regulatory capture" of the PCAOB by the accounting firms, meaning that the PCAOB is no longer effectively regulating the firms (Hendricks, Landsman, and Peña-Romera 2022). The KPMG scandal, in which a former PCAOB staffer moved to the firm and shared the list of upcoming issuers that the PCAOB would be inspecting, supports this research on the topic. That said, the PCAOB inspection reports remain a unique, publicly available source of detailed information regarding the largest public accounting firms' audit quality. As prior research asserts, in spite of such shortcomings, the mere existence of and scrutiny inherent in the inspection process should strengthen audit quality at both firm and macroeconomic levels (Church and Shefchik 2012; DeFond and Lennox 2011). While I share the interests of prior research in the PCAOB inspection process's broad audit quality implications, I focus more narrowly on the audit area that has

perennially proven to be the highest risk, based on PCAOB inspections, SEC comment letters, and the incidence of fraud, namely inspection deficiencies related to revenue recognition.

Research Method

I review and code 752 deficiencies from the 48 PCAOB inspection reports related to revenue for the eight largest accounting firms during the six-year period from 2016 to 2021. This six-year inspection cycle period covers issuer audits from fiscal year 2014 to 2020, with the bulk of the issuers presumably having calendar year 2015 to 2020 fiscal year-ends. As such, this period includes three years of audits prior to the adoption of ASC 606 for public companies in 2016, 2017, and 2018 and three years of audits following its adoption, in 2019, 2020, and 2021. I expect to find a greater number of deficiencies in the fiscal year just following ASC 606's adoption, i.e., 2019 inspections of audits for 2018 calendar-year companies, compared to the three years prior to adoption.[7]

The PCAOB quantifies the number of issuer audits with deficiencies as opposed to the total number of deficiencies, meaning the PCAOB does not quantify multiple deficiencies for the same issuer. For example, the PCAOB will list an accounting firm that has 10 issuer audits each with its own individual revenue-related deficiency as having 10 issuer deficiencies, but they will list an accounting firm that has one issuer audit with 10 revenue-related deficiencies as having only one issuer with deficiencies. As such, I utilize my own deficiency coding based on the number of audit standard violation references to consistently quantify the number of deficiencies for each inspection report. The inspection reports ***do*** tabulate the total number of references to specific audit standards across issuers, which I assume denote individual violations of audit

[7] While PCAOB inspection reports do not indicate the issuers' year-ends, 71 percent of public companies and 76 percent of large public accelerated filers have 12/31 or close to 12/31 year-ends (https://blog.auditanalytics.com/when-does-a-companys-year-end/).

standards and therefore represent a proxy for total deficiencies across all issuers. I similarly tabulate the number of revenue-related deficiencies by utilizing audit standard references and treat each audit standard reference as a separate deficiency for coding purposes. I am therefore able to compare the number of revenue-related deficiencies to the total number of inspection deficiencies without coding all of the non-revenue deficiencies separately.

I utilize the coding methodology from Church and Shefchik (2012) to analyze the inspection deficiencies in my sample.[8] This methodology includes the deficiency's severity, nature, specific affected accounts, and primary affected financial statement(s). Deficiency **severity** indicates whether or not a misstatement occurred, and if so, whether a restatement was necessary (RESTATE), or the firm missed a departure from GAAP (NON-GAAP) or an accounting error (ERROR). If there was no misstatement, subcategories denote whether the firm did not test an account or accounting assertion (NO-TEST), the firm did not sufficiently evaluate an accounting issue and/or the accounting treatment (NO-EVAL), or the firm did not conduct or document its testing procedures sufficiently (NO-SUFF). Consistent with Church and Shefchik (2012), these six severity categories are unique for each deficiency. If a deficiency relates to two categories, I code it based on the most severe deficiency. For example, an error that arose from not testing a balance sheet assertion receives an ERROR severity code rather than a NO-TEST severity code.

Deficiency **nature** represents common audit issues or audit standard violations, consistent with the PCAOB's own categorization of deficiencies. Like Church and Shefchik (2012), I categorize primary and secondary audit deficiency natures. Primary audit deficiency

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[8] While other studies utilize alternative coding schemes for PCAOB inspection report deficiencies (e.g., Griffith et al. 2015; Bell and Griffin 2012; Hermanson, Houston, and Rice 2007), I find that Church and Shefchik's scheme is the most comprehensive. These coding schemes all cover the most critical deficiency types and topics though.

nature relates to the type of revenue recognition (basic, complex, or confirmation-related), whereas the secondary nature relates to the type of audit work, such as improper reliance on internal controls or improper use of sampling. Given my focus on the revenue audit area, almost all of the deficiencies that I analyze impact the revenue account and the income statement. Deficiencies sometimes impact other related accounts, like accounts receivable and deferred revenue, and therefore the balance sheet as well.

Results

Deficiency Numbers and Severity

Tables 1-6 present the number of issuer audits per report, issuer audits where the PCAOB inspected revenue recognition, the rank of revenue recognition as a deficiency area for each report, issuer audits with deficiencies, total deficiencies, and total revenue deficiencies. Over the six-year sample period, I examine and code 752 deficiencies across 1,386 issuer audits for the eight firms. Surprisingly, despite the adoption of ASC 606 and its risk-based inspection process, the PCAOB inspected fewer issuer audits related to revenue in the post-606 period, decreasing from 739 audits with 382 deficiencies in 2016-2018 to 647 audits with 370 deficiencies in 2019-2021. Despite this surprising decrease, on a per-audit basis, the number of deficiencies increased slightly from .52 per issuer audit to .57 per issuer audit. This pre- vs. post-606 per-audit difference is not significant, per an independent samples t-test (p = .93). Revenue remains the number one deficiency-related area for 41 out of the 48 inspection reports in the sample period (tied for first place in seven of those 41 instances), as shown in Table 2. In addition, revenue-related deficiencies represent 36 percent of all inspection report deficiencies over the six years, shifting from 32 percent of the deficiencies pre-606 to 40 percent of the deficiencies post-606 per Table 6. However, this difference is not significant per an independent samples t-test (p = .40).

The annual number of issuer audits in my sample ranges from a low of nine to a high of 60 for any one firm. The average number of inspected audits is 54.7 among the Big 4 and 21.5 among the Next 4 firms, whereas the average number of inspected audits covering the revenue area is 41.5 among the Big 4 (75.9 percent of audits) and 16.3 among the Next 4 firms (75.8 percent of audits). The PCAOB inspects Big 4 firms' audits at a rate that is 2.5 times higher than that of the Next 4 firms, and the number of audits the PCAOB inspects that include revenue is proportionate to the total number of audits across both types of firms. As such, it would not be surprising if the number of revenue-related deficiencies for the Big 4 firms outnumbered those from the Next 4 firms by a ratio of 2.5:1 as well, assuming risk remains constant between the two types of firms. However, in practice, the Next 4 firms' lower number of public clients may translate into those firms auditing fewer clients with complex revenue recognition. This lower exposure to high-risk revenue may result in a greater number of revenue-related deficiencies, particularly in areas related to complex revenue recognition. Past research has found that smaller, triennially inspected firms experience the highest level of GAAP-related deficiencies, whereas annually inspected firms have the highest level of GAAS violations (Prasad and Webster 2022)**.** In the revenue recognition area, I similarly find that the Next 4 firms have a higher rate of deficiencies per issuer audit than the Big 4 firms (M = .95, n = 340 versus M = .43, n = 412, $p <$ .001).

Table 7 contains the detailed coding results regarding severity of deficiencies. Like Church and Shefchik (2012), I find that misstatements are exceedingly rare (0.9 percent of all revenue-related deficiencies versus 5.3 percent from 2004-2009 for all audit areas in Church and Shefchik (2012)). Five out of these seven misstatements occurred pre-ASC 606 and are all attributable to the Next 4 firms, versus the two post-606 misstatements that are attributable to the

Big 4. Given the low incidence of revenue-related misstatements, I will not analyze the related results further. That said, as Church and Shefchik (2012) note, the number of restatement deficiencies is likely understated, as restatements generally occur in future periods.

I find that the most common deficiency subtype is NO-SUFF (44.0 percent). However, while Church and Shefchik (2012) determine that NO-EVAL is the next most common deficiency subtype after NO-SUFF in their sample from 2004-2009, I find that NO-TEST is the second most common deficiency subtype (39.9 percent). After comparing the coding from each period, I attribute this difference to a shift in language in the PCAOB inspection reports.[9] For example, the language from 2004-2009 often solely addressed the accuracy of data, whereas more recent reports address both the accuracy and completeness of data. Since completeness is one of the PCAOB's financial statement assertions per AS 1105 but accuracy is not (PCAOB 2010), I code such deficiencies with the NO-TEST subtype, denoting that the firm did not test this assertion. Church and Shefchik (2012) coded references solely to accuracy as NO-SUFF subtypes, presumably because accuracy is not a PCAOB financial statement assertion.

Types of Deficiencies

Consistent with Church and Shefchik (2012), I code the revenue-related deficiencies via their primary and secondary natures. Tables 8 and 9 present the results according to both types. The primary nature indicates whether the deficiency relates to basic revenue recognition, confirmations associated with revenue generation, or complex revenue recognition. The primary nature of each deficiency is mutually exclusive and unique to each deficiency. I code internal controls-related deficiencies that are not specifically related to confirmations or complex revenue recognition with the primary nature of basic revenue recognition. Of the 752 deficiencies over

[9] I am grateful to Lori Bhaskar for sharing the coding file from Church and Shefchik (2012) with me.

six years, 73.7 percent (n=554) relate to basic revenue recognition; 24.6 percent (n=185) relate to complex revenue recognition; and 1.7 percent (n=13) relate to revenue or accounts receivable confirmations. I also note that 9.3 percent or 57 of the simple revenue recognition deficiencies indicate that they represent a potential material weakness or misstatement.

The secondary nature coding for each of the 752 deficiencies is not mutually exclusive and often overlaps, as in Church and Shefchik (2012). I assign 858 nonexclusive secondary nature types across 752 deficiencies. For basic revenue recognition, the most common secondary nature is reliance on internal controls (27.3 percent, n=168), followed by audit sampling (20.8 percent, n=128), and reliance on information from the issuer's computer system (18.3 percent, n=113). For complex revenue recognition, the most common secondary nature is multiple performance obligation contracts (27.9 percent, n=64), revenue recognition over time, such as percent completion or completed-contract methods (24.9 percent, n=57), variable consideration (14.4 percent, n=33), and estimated transaction prices and contract price allocation (14.0 percent, n=32).[10] I also note that 7.0 percent or 16 of the complex revenue recognition deficiencies indicate that they represent a potential material weakness or misstatement, which is a large proportion compared to the 0.9 percent of revenue recognition deficiencies that are actual misstatements over the sample period.

While the majority of revenue-related deficiencies fall into the primary nature category of basic revenue recognition, the number of complex revenue recognition deficiencies is substantial at 185 over six years and 24.6 percent of all revenue-related deficiencies. The types of secondary

[10] Prior accounting guidance used the terms multiple-element contract rather than multiple performance obligation contract and discounts, rebates, and other similar terms instead of variable consideration. I refer to deficiencies across the six-year period including pre-ASC 606 years as multiple performance obligations and variable consideration for consistency and ease of comparison.

natures for complex revenue recognition are instructive, as they are among the most complex estimates that ASC 606 stipulates and the prior accounting guidance also required. In addition, these complex revenue recognition deficiency issues are not new; each of them is central to deficiencies that challenged auditors prior to ASC 606 as well. Of the variable consideration and recognition-over-time deficiencies, 63.6 percent and 59.6 percent arise post-606, respectively. For estimated transaction prices and multiple performance obligation contracts, fewer deficiencies occur post-606: 46.9 percent and 34.4 percent, respectively.

These trends indicate that complex revenue recognition continues to challenge auditors despite the five-step framework in ASC 606 that the FASB intended to simplify the revenue recognition process. It also suggests that these areas of complex revenue recognition are worthy of ongoing study, to determine why exactly they continue to challenge both auditors and financial managers. Yet, the degree of basic revenue recognition issues is also noteworthy, as is their hinging principally on internal controls, sampling, and systems data reliance. The results for both basic and complex revenue recognition provide rich data regarding common challenges in the revenue area across both pre- and post-ASC 606 inspections.

Related Accounts and Financial Statements

Most revenue-related deficiencies include references to revenue or sales (735 out of 752 or 97.7 percent). I also tabulate references to related balance sheet and income statement accounts, including accounts receivable, unbilled revenue, deferred revenue, discount accruals and reserves, allowances, incentives, rebates, and sales discounts. Some deficiencies affect multiple accounts, resulting in 1,021 account references across the 752 deficiencies. Of these deficiencies, 598 impact only one financial statement – most often the income statement, while

the remaining 154 affect both the income statement and the balance sheet. Table 10 contains the accounts and financial statement data for the revenue-related deficiencies.

Audit Standard Violations

I analyze the deficiencies based on specific audit standard violations, which the PCAOB also presents at a macro level for all deficiencies in each inspection report. Table 11 lists the audit standard violations for revenue-related deficiencies. The most common audit standard violations are in the internal controls area, related to PCAOB Audit Standard (AS) 2201, *An Audit of Internal Control Over Financial Reporting that Is Integrated with an Audit of Financial Statements*. These controls standard violations represent 43.9 percent of the violations among the Big 4 firms and 41.7 percent of the violations among the Next 4 firms. Examples of these AS 2201 violations range from inappropriate controls over price exceptions and shipments generating revenue for basic revenue recognition to a lack of controls over percent-completion accounting and historical rebate data use in developing variable consideration estimates for complex revenue recognition.

The second most common category of violations relates to AS 2301, *The Auditor's Responses to the Risks of Material Misstatement*, representing 20.6 percent of the Big 4 firm violations and 19.1 percent of the Next 4 firm violations. Examples of these AS 2301 violations range from not testing a certain type of revenue and using an inappropriately small sample size for basic revenue recognition substantive testing to not assessing revenue contracts for multiple performance obligations and not sufficiently testing rebates and discounts related to variable consideration estimates for complex revenue recognition. AS 2315, *Audit Sampling*, and AS 1105, *Audit Evidence*, are the next most commonly violated standards (n=90 and n=73, respectively), followed by AS 2501, *Auditing Accounting Estimates* (n=29). AS 2315 violations

are generally due to sample sizes being too small, either due to inappropriate controls reliance or other statistical sample size inputs, for both basic and complex revenue recognition types. AS 1105 violations are usually based on inappropriate reliance on external or systems-derived data in either controls or substantive testing situations for both basic and complex revenue recognition types, like not testing the accuracy and completeness of standalone selling price data for multiple performance obligation contracts or labor hours for percent-completion contracts.

The lower number of violations of the estimates standard compared to the number of complex revenue recognition issues (n=185) suggests that the PCAOB does not consider most of the complex revenue recognition problems to also represent estimate-related problems. In coding the complex revenue recognition deficiencies, I find it surprising that the PCAOB did not characterize more of them as violations of AS 2501, given that many of them involve complex estimates. The AS 2501 violations in my sample generally relate to assumptions for management estimates in all four forms of the most prevalent types of complex revenue recognition: multiple performance obligations, recognition over time, which all happen to be percent-completion recognition issues, variable consideration, and estimated prices and price allocation.

While the deficiency natures demonstrate how auditors' problem areas can shift depending on the accounting rules, the audit standard violations indicate that applying basic auditing methods remains a consistent area of concern for the largest accounting firms. The proportion of internal controls standard violations highlights a need for increased training in the areas of internal controls testing and reliance, particularly as relates to controls that are technology-based. At the same time, the complex estimate issues highlight the difficulties that auditors are still experiencing with auditing the assumptions underlying management estimates, particularly in the top four areas of PCAOB complex revenue recognition deficiencies.

IV. DISCUSSION AND FUTURE RESEARCH IDEAS

While the FASB designed the five steps of ASC 606 as a primer to help managers and auditors understand the stages of revenue recognition, evidence points to the post-606 rules being at least as complex as the pre-606 rules. My comparison of the judgment areas in the accounting standards pre- and post-606 reveals similar if not greater complexity under ASC 606, and the PCAOB inspection deficiencies analysis points to continuing challenges related to complex revenue recognition, particularly in the areas of multiple performance-obligation contracts, contracts accounted for over time, variable consideration, and estimated contract prices and price allocation. Auditors also have ongoing issues with basic revenue recognition per the PCAOB inspection reports, especially in the areas of internal controls, reliance on computer-generated data, and audit sampling. These results and similar findings related to the prevalence of revenue recognition fraud (Beasley et al. 2010) demonstrate the need for future research that targets the specific revenue areas that challenge auditors.

For internal controls, improved understanding of systems and in particular technology associated with revenue recognition is critical. The shift from 9.6 percent (n=64) overall controls-related PCAOB inspection deficiencies in 2004-2009 per Church and Shefchik (2012) to the recent data from 2016-2021 indicating that 27.3 percent of basic revenue recognition deficiencies relate to internal controls problems is significant. In 2010, the PCAOB advised its inspectors to focus more on internal controls, which is likely one factor driving this increase (Franzel 2014). The PCAOB has reiterated that internal controls remain a focus of its inspections in subsequent years (Franzel 2014; PCAOB 2017b), but there could be other explanations for this change as well. As noted in some of the PCAOB inspection findings, companies' internal auditors often perform the Sarbanes-Oxley controls documentation and testing work, and the

accounting firms then just review that information. These roles could reduce auditors' hands-on internal controls task knowledge. Future research could examine whether a shift in who performs Sarbanes-Oxley documentation and testing has occurred and impacted the accounting firms' ability to audit internal controls proficiently. The complexity of systems and processes related to revenue recognition also continues to advance, demanding greater technological skills in all areas of audit work but especially for system-based internal controls.

The level of reliance on system-generated report data from the PCAOB inspection findings similarly suggests a deficit in systems knowledge. Auditors need to better understand the sources of data, necessary controls surrounding the data, and who is responsible for auditing the systems and data itself (i.e., the IT auditors, internal auditors, or the financial statement audit team). The number of deficiencies citing internal controls and system-generated data reliance is relatively constant from year to year, indicating that these problems are ongoing and pervasive among both the Big 4 and Next 4 firms. Perhaps the largest accounting firms are recruiting their interns earlier in their degree programs, leading to less hands-on accounting experience that could help convey how accounting systems work in practice. Future research could probe reasons for the continuing high level of controls-related revenue recognition deficiencies, including whether a shift to specialized or internal auditors working on SOX testing, the tendency of the largest accounting firms to recruit younger interns who have not worked in other accounting positions that would convey direct, hands-on systems knowledge, and other factors such as technological, process, and systems complexity are contributing to these deficiencies.

Challenges related to audit sampling, the second most common secondary nature among basic revenue recognition deficiencies, indicate continuing issues with selecting appropriate sample sizes based upon statistical inputs. While sampling deficiencies decline post-ASC 606,

from 82 deficiencies in 2016-2018 to 46 in 2019-2021, the continuing deficiencies among both the Big 4 and Next 4 firms indicate the importance of continued training on statistical sampling and choosing appropriate sample sizes to address the risks of misstatement and fraud related to revenue recognition. While accountants have a reputation for strong math and statistics skills, the multiple inputs in statistical sampling may make it challenging for auditors to determine an appropriate sample size. Carlson (2023) finds that auditors fail basic statistical numeracy tests to a surprising degree, with 33 percent failing at least one and 7 percent failing two of three tests. Future research could address the need for greater statistical and sampling-related education and training among accounting students and auditors, particularly in light of the advanced statistical knowledge that the current and future data-driven analytical environment will require.

The deficiencies relating to complex revenue recognition often indicate the difficulties auditors experience assessing many information inputs and moving parts, similar to other complex estimates. Areas that require sorting through many different data points and sources of information, as in goodwill impairment, will apply to certain areas of complex revenue recognition as well. For example, percent-completion and completed-contract methods of recognition depend on assessment of the project's inputs or outputs to-date, including salaries and hours, versus the frequently moving target of total expected/forecasted project costs or revenues. Similarly, other fair value estimates are akin to valuing non-cash consideration in revenue contracts. That said, it would still be worthwhile for future researchers to assess whether prior study interventions for goodwill impairment and fair value estimates also work with these complex revenue recognition estimates.

Areas of complex revenue recognition that are less similar to existing complex estimates, like the probabilistic and predictive estimates required for variable consideration and delineation

and pricing of individual performance obligations in and across contracts, warrant in-depth future research. In Chapter 2, I will specifically focus on statistical risk framing as an intervention to help auditors make better probabilistic and predictive estimates (Carlson 2023).

Gaining familiarity with and interpreting contracts is also critical to these areas of revenue recognition. Future research could assess whether training beyond the basics of business law, or enlisting attorneys or other contract specialists to read and interpret complex contract terms, would help with auditing complex revenue recognition contracts. Accounting firms are already deploying artificial intelligence and machine learning technologies to read and identify abnormal contract terms. Perhaps these innovations can also help auditors interpret contractual signals of multiple performance obligations or multiple contracts that are similar enough that they actually comprise one contract or continuations of other existing contracts. Future research could examine the efficacy of such technology solutions in these contract-related areas. As accounting firms train their artificial intelligence and machine learning tools further in contract review and assessment, could data analytics and textual analysis tools similarly help auditors assess complex revenue recognition contracts? Again, these are potential areas for future research relating to contractual interpretation for complex revenue recognition.

Common cognitive biases like anchoring also continue to be a problem. Auditors are apt to default to how their clients define contractual performance obligations, transaction pricing, allocation of pricing to contractual elements, timing for recognition in percent-completion and completed-contract scenarios, and variable consideration inputs and assumptions. Understanding how the companies' products and services work at a deep level is necessary to successfully audit these areas of complex revenue recognition. Additional research-based interventions, and

evidence that existing interventions' efficacy persists, are necessary to combat common cognitive biases that auditors, like all humans, face.

As the PCAOB estimates standard emphasizes, understanding and addressing management incentives, motivations, and biases is critical. Auditors must assess whether their clients have an incentive to maximize, as is common, or minimize revenue and the bottom line. If a client is a revenue maximizer, there is higher fraud and earnings management risk, but the risk is also nonzero if they are trying to minimize revenue and thereby push it to future periods. Every auditor who examines revenue recognition should know the basis for their client's executive compensation structure and whether it includes revenue growth. Incentive-based motivations lead to still higher fraud and earnings management risk. Applying the elaboration likelihood model and interventions that offset the effects of persuasive framing to complex revenue recognition could help to illuminate auditors' susceptibility to management bias.

Auditors must also be aware of their own biases and motivations and how they impact their audit work relating to revenue recognition. The growing literature on motivated reasoning (e.g., Austin et al. 2020; Hatfield, Jackson, and Vandervelde 2011; Kadous and Kennedy 2003; Koch and Salterio 2017) and relational tendencies (Bamber and Iyer 2007; Bauer 2015) addresses these biases and motivations, but there is room for additional research specific to revenue recognition. This research is critical in the context of a relational business, especially given that partner compensation depends upon client fees (Johnstone, Warfield, and Sutton 2001).

Areas that challenge auditors are also likely to challenge managers. Opportunities exist in the managerial and financial accounting research areas to address these judgment-related areas as well, which future research could assess via archival and textual analysis. For example, upper

management may use similar framing in internal communications or emails to persuade or convince lower management of accounting that best aligns with their executive compensation incentives. Future archival research could examine how management incentives and motivations align with ASC 606's revenue recognition accounting and disclosures.

V. CONCLUSION

This study has identified areas related to revenue recognition that challenge auditors, via a comparison of the ASC 606 and prior accounting rules, a review of prior literature related to both revenue recognition and complex estimates, delineation of the thinking and audit work necessary for complex revenue recognition versus other major complex estimates, and analysis of the PCAOB inspection report deficiencies from three years prior to and three years since ASC 606's adoption. I completed these analyses with the aim of informing future revenue recognition auditing research and practice.

My analyses are subject to certain limitations. While the comparison of ASC 606 and prior accounting rules notes the judgments required under each, I have not examined the extent to which each of these judgments occurs in practice. While the levels of PCAOB inspection deficiencies related to each area provide some sense of their magnitude, the PCAOB's risk-based approach makes it likely that the magnitude reflected in the inspection reports is overstated. Future research could examine the prevalence of these complex revenue recognition areas.

There are other limitations relating to the PCAOB inspection deficiencies as well, including shifts in the PCAOB inspection focus over time (Church and Shefchik 2012). Revenue recognition was likely an inspection focus for the first year or two subsequent to ASC 606's adoption and may not remain as large a focus in future years, in spite of its high degree of fraud risk and risk of material misstatement. The deficiencies that the PCAOB inspectors note are

highly dependent on the PCAOB's definition of risk but also some degree of chance, depending on what issuer audits the PCAOB selects to inspect. It is unclear whether the PCAOB is looking at a representative sample of issuer audits; if the sample is not representative, the PCAOB's approach would limit the ability to extrapolate the deficiency results across a larger population of issuers and accounting firms. This limitation is especially relevant to my study since the largest accounting firms, and especially the Big 4, often audit the riskiest and most complex issuers. Despite these limitations, the PCAOB inspection reports remain one of the most accessible indications of public accounting firm performance, audit results, and audit quality.

Chapter 2 will probe one area of complex revenue recognition that arises from the PCAOB inspection results: variable consideration, via an experimental study examining whether statistical risk framing can help auditors make better probabilistic and predictive judgments.

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APPENDICES

APPENDIX A - Areas of judgment in ASC 606 vs. old guidance

Topic	New Standard (Standardized in ASC 606)	Old Rules (SAB 101, ASC 605/SAB 104, Various Industry-Specific Guidance)
Existence of a contract	Focuses on legal enforceability of the agreement, which allows for a contract to exist and related revenue recognition to occur if the terms are legally enforceable (i.e., not contingent on the approval chain/business practice rule as in the past guidance). Determining legal enforceability requires judgment. Generally involves both parties' approval/commitment, definition of the rights of both parties and payment terms, the existence of commercial substance within the agreement, and probable collectability in exchange for the goods or services provided to the customer. Separate contracts with the same customer could in substance represent one contract if the terms and deliverables are similar, which could impact revenue recognition timing. Requires judgment in assessing whether multiple contracts really should be treated as one contract.	"Persuasive evidence" for a contract was highly dependent on past business practice. This evidence could vary from a written sales agreement to a purchase order or electronic authorization. Note: if a company typically required board or higher-level approval of a contract for it to be finalized, revenue recognition would have to wait until the approval occurred. Existence of persuasive evidence required judgment. The notion of separate contracts representing one in substance contract also existed in the prior guidance but only applied if the contracts arose at the same approximate time.
Transaction price	Represents the amount of consideration/the ultimate payment the seller expects to earn for the transaction. May depend on five factors that involve judgment, including the existence and value of variable consideration, a low probability that the revenue that has been recognized (adjusted for variable consideration) will not require reversal when uncertainty associated with the variable consideration resolves, whether or not an embedded financing transaction exists, the presence of any noncash consideration, and whether the seller is paying any consideration to the buyer. Each of these elements is addressed below.	Generally the transaction price was the stated contract price, as long as it was "fixed or determinable." Fixed fees are not subject to refund or adjustment. The fee may not be determinable if there are contingencies in the contract that make it difficult to estimate, or if collectibility uncertainty exists. However, if the company has sufficient evidence from a considerable pool of customers' refund or return behavior, the return period is sufficiently short, and there are no major external factors present such as product/service demand changes or technological obsolescence, the company may be able to recognize the revenue and record an

		allowance for refunds or returns. Some percent-completion and milestone contracts contain pricing uncertainties too, but their recognition types account for such uncertainty (varying among different contract types). Determining whether such contingencies or uncertainties exist and the appropriate type of revenue recognition for them required judgment.
Pricing for contract elements/variable consideration	Sellers must use standalone prices or estimates of prices for each contract element and recognize the proportionate amount of revenue. If standalone prices do not exist, the company may estimate the standalone selling price using one of three methods: the adjusted market assessment approach, which is based on similar companies' selling prices; the expected cost plus margin approach, which takes their expected costs and adds a profit margin; or the residual approach, which may be used if the company knows some standalone prices but not all for every performance obligation in a transaction. The residual approach is only appropriate if the company uses highly variable pricing for a given good or service or has not yet set a standalone selling price for it and the company has not yet sold it. A given contract may require a combination of these methods. Variable consideration represents refunds, rebates, price concessions, incentives, or other contingent offsets to the revenue that the company will receive. Valuing variable consideration involves a choice of estimation method between probability weighting or the most likely amount that the seller will receive for a given good or service, whichever provides the better prediction. The probability of reversal of variable consideration must also be considered (i.e., related revenue cannot be recognized if reversal is probable), and the value of variable consideration must be reassessed over time.	Prior guidance required using vendor-specific objective evidence (VSOE) or third-party evidence of selling prices for the deliverables in a multi-element contract. VSOE is the price charged for an element when it is sold separately. If the item is not being sold separately, VSOE would represent the price set by management with any relevant authorities. If VSOE does not exist, the company may use the selling price of a vendor's or competitor's interchangeable goods or services in standalone sales to similar customers. If neither VSOE nor third-party selling prices exist, then ASU 2009-13 permits estimating the selling price. This estimated selling price guidance replaced the former residual method for recognition, which is described below. The estimated selling price must mirror how the seller would establish VSOE, consider internal costs and profit motives, and reflect both market conditions and any other entity-specific factors. There was significant judgment involved in establishing VSOE, third-party evidence of pricing, or an estimated selling price.

	Significant judgment is involved in estimating prices, deciding upon the method of valuing prices and variable consideration, and calculating the value of variable consideration initially and if/when reassessing.	
Identifying unique performance obligations	Each promised good or service represents a performance obligation if it is "distinct" or a series of distinct goods or services that are in substance the same, with the same delivery pattern. To be distinct, the good or service must be separately identifiable and benefit the customer on its own or in combination with the customer's other readily available resources. Determining whether goods or services are distinct or require combination with other goods or services requires judgment.	Similar guidance existed regarding whether or not the goods or services had value on a standalone basis, including whether the customer could resell the item (whether or not a market existed for it). Determining the existence of separate units of accounting required judgment.
Allocating the transaction price and variable consideration to performance obligations	The allocation must reflect the amount the seller expects to receive for each performance obligation, which should also reflect the impact of variable consideration, discounts, etc. The revenue allocation should be proportionate to each performance obligation based on standalone selling prices for each good or service. The allocation of discounts to the performance obligations is addressed separately from that of other forms of variable consideration. They must be allocated proportionately to all contract elements unless three criteria are met: each good or service in the contract is sold on a standalone basis, discounts are regularly provided at a similar level when selling such standalone items, and there is "observable evidence" in the contract that indicates that the discount should be applied to fewer performance obligations versus the entirety of the contract. If all three criteria are met, the discount may be applied against fewer performance obligations (e.g., one or two versus all). However, the discount must be allocated before using the residual approach to estimate each good or service's standalone price.	Prior guidance required using vendor-specific objective evidence (VSOE), third-party evidence of selling prices, or estimated selling prices if VSOE or third-party evidence did not exist for the deliverables in a multi-element contract. These prices were then totaled, and the transaction price was allocated proportionately to the units of accounting using the relative selling price method. Additionally, only amounts that were non-contingent upon undelivered goods or services or other performance conditions could be allocated to delivered performance obligations and recognized as revenue. Also revenue could only be recognized if the arrangement was noncancelable. Formerly, prior to ASC 605, in cases where prices could not be established for each of the units of accounting, the revenue was deferred until delivery had occurred for all of the elements. However, the residual method allowed allocating some amount of revenue to delivered elements without VSOE or third-party prices, assuming all other elements had VSOE or third-party prices.

	Variable consideration is allocated to the performance obligations based on the recognition of related performance obligations per the contractual terms and taking into consideration the payment terms. Deciding how discounts and elements of variable consideration apply to and allocating them to each performance obligation all require judgment. Also future adjustments to the transaction price and variable consideration estimates will result in changes to the amounts of revenue allocated to each performance obligation.	Determining VSOE, third-party, or estimated selling prices and allocating the revenue proportionately to units of accounting using the relative selling price method required judgment. Discounts or rebates to customers were also covered under ASC 605. If the seller received no benefit as a result of the discounts or rebates, they would offset their revenues for the amount of the discounts/rebates. If the seller did receive a sufficiently separable benefit associated with the discount or rebate, its fair value could be treated as an expense. However, to the extent that the actual value of the discounts or rebates exceeded the fair value, the excess would be treated as a reduction in revenue. Also if the fair value could be estimated, the full amount would be treated as an offset to revenue, even if the seller received a benefit. There was judgment involved in deciding whether such discounts or rebates would benefit the seller, which would govern whether they could be treated as expenses or had to be offset against revenue, and in determining their fair value.
Probability of revenue reversal due to variable consideration uncertainty	The seller must assess how likely it is that revenue that they have recognized to-date will require reversal due to the resolution of uncertainty associated with variable consideration. Factors involved in assessing this degree of probability include susceptibility of payment to market volatility, third party actions or decision, obsolescence risk for the promised good or service, or other factors (e.g., weather). A longer length of time required for the uncertainty to resolve, a low experience level with similar contracts (resulting in poor predictions), a broad range of price concessions or history of modifying contract terms, and a wide range or number of possible consideration amounts all increase the likelihood of revenue recognition reversal.	ASC 605 contained similar provisions regarding uncertainty but required that all revenue be deferred if uncertainty existed in the contract. Assessing the level of uncertainty required judgment, but less of it as any uncertainty required deferral.

	Assessing these factors and the likelihood of reversal all require judgment.	
Recognition of performance obligations	Recognition occurs after transferring the good or service and control of it to the customer. There may be judgment in determining whether all aspects of control passing to the customer have been satisfied if the transfer occurs at a point in time (i.e., legal title, present right to compensation, risks and rewards of ownership, customer acceptance). Several criteria govern whether performance obligations should be treated as occurring over time, including whether the customer concurrently receives and uses/ consumes the benefits as the seller is providing them, whether the seller creates or improves an asset over which the customer has control, or whether the buyer has no alternative use for the asset that the seller is creating, such as reselling it, and also has a right to payment for the work that they have completed to-date. The seller would estimate the payment amount by estimating their costs to date plus a reasonable profit margin based on contractual terms or similar contracts. Other considerations regarding payment amount include legislation, legal precedent, and the seller's ordinary business practices. Determining whether one of the criteria for treating the performance obligations as delivered over time exists and estimating the payment amount due to date require judgment. If this transfer occurs over time, there are several methods of measuring progress in order to calculate the amount of revenue to recognize. Output methods examine the value of goods or services transferred to-date proportionate to the total value of goods and services outlined in the contract, whereas input methods use costs, hours, or other inputs proportionate to total	Prior guidance focused on whether goods had been delivered or services had been rendered, which generally occurred upon delivery/transfer of title for products or provision of services (which may be accounted for via percent completion). These guidelines were dependent upon the industry and its relevant rules. Performance obligations satisfied over time are addressed separately for milestone versus percent completion/completed-contract arrangements. Milestone rules applied to R&D deliverables or units of accounting delivered over time where substantive uncertainty existed regarding the milestones and payment ("consideration is contingent upon uncertain future events or circumstances"). Substantive milestones and uncertainty determinations required judgment. Percent completion and completed-contract recognition applied to construction-type contracts that occurred over time, requiring regular assessment of progress toward completion, contract revenues, and contract costs. The seller must be able to make reasonable assessments of all three of these items in order to use the percent-completion method and must select a recognition type based on costs, units, or value-added that was best-suited to the contract. These assessments of progress toward completion, contract revenues, and contract costs as well as whether to use a percent-completion or completed-contract method require(d) judgment.

	expected inputs for the contract. Both the decision to use input or output methods and the estimates involved in the to-date inputs or outputs involve judgment.	
Existence of an embedded financing transaction	Must assess contracts for embedded financing arrangements and record revenue at a discounted value. The discount rate must be unique to the customer, mirroring what they would pay if they were borrowing money in a market transaction. A practical expedient exists that permits not assessing contracts for existence of an embedded financing transaction if payment is due one year or less from satisfaction of the performance obligation. Judgment is involved in assessing contracts for embedded financing arrangements and setting an appropriate discount rate if they exist.	SFAS 49 previously required that sales of inventory that were substantially financing arrangements be treated as borrowings instead of sales. However, the revenue recognition rules did not contain guidance for recording the fair value of contracts with extended payment terms. SAB 101 only required disclosing the fair value of receivables with extended payment terms.
Value of noncash consideration	If the customer provides noncash consideration instead of a cash payment, the consideration must be recorded at its fair value. If it cannot be reasonably estimated, the seller can use the customer's standalone selling price for the goods or services as fair value. An estimate would require judgment.	The prior rules address barter transactions and state that the value of goods or services could be used to recognize revenues and expenses only if the fair value could be established via arms-length transactions for substantially similar goods or services from six months prior to the barter. Otherwise, the value would be zero. Amounts of revenue and expense were required to be disclosed.
Disclosure judgments	Robust disclosure requirements exist in the new guidance involving a great deal of judgment for what warrants disclosure, particularly significant judgments and changes in judgments related to the timing of recognizing revenue, determining the total contract price, and allocating the contract price to the performance obligations. ASC 606 also requires both qualitative and quantitative disclosures for disaggregation of revenues, performance obligations, and outstanding contract balances. Judgment is required to determine what qualitative and quantitative information to disclose.	Prior disclosure requirements were brief and focused on accounting policies. Little to no judgment was required in the disclosure process prior to ASU 2009-13, which was unique to multiple-deliverable arrangements, and ASU 2010-17, which was on the milestone method of revenue recognition. ASU 2009-13 added new disclosure requirements for multiple-deliverable arrangements that are similar to the ASC 606 requirements. ASU 2010-17 required additional disclosures for milestone arrangements, including judgments made regarding substantive milestones, percent-completion and completed-contract recognition methods, and significant changes in related estimates.

APPENDIX B – Judgment Categorizations Comparison

Note: Bolded items (below headers) are new requirements in ASC 606

Judgment Categories	**New Standard (ASC 606)**	**Old Rules**
Legal assessments/contractual interpretations	Legal enforceability of contract	Persuasive evidence of a contract
	One contract vs. multiple contract determination	Existence of contractual contingencies or uncertainties
	Delineation of distinct or combined goods or services	Existence of separate units of accounting
	Matching variable consideration with performance obligations	Determination of whether discounts or rebates would benefit the seller or the buyer (leading to accounting as an expense or revenue offset)
	Assessment of criteria for percent-completion or milestone accounting treatment	Assessment of criteria for percent-completion, milestone, or completed-contract accounting treatment
	Judgments regarding all aspects of control passing to customer (legal title, present right to compensation, risks and rewards of ownership, customer acceptance)	Control-related judgments effectively existed in the old rules too.
	Existence of an embedded financing arrangement	
Accounting policy decisions	Pricing method for contract elements (standalone prices vs. adjusted market assessment vs. expected cost plus margin vs. residual approach)	Pricing method for contract elements (VSOE vs. third-party estimate vs. estimate selling price)
	Valuation method for variable consideration (probability weighted vs. most likely amount)	
	Input vs. output method for percent-completion contracts	

Judgment Categories	New Standard (ASC 606)	Old Rules
Valuations based on calculated estimate	Pricing estimates for contractual performance obligations	Pricing estimates for contractual units of accounting
	Allocation of variable consideration to the performance obligations	Fair value of contractual discounts and rebates
	Percent-completion revenue calculations using input or output methods and assessment of contractual progress to determine the extent of revenue recognition	Percent-completion revenue calculations and assessment of contractual progress to determine the extent of revenue recognition
	Fair value or estimated value (based on standalone selling price) of non-cash consideration	Fair value for barter transactions
Probability assessments	**Probability of variable consideration utilization to determine its value (either using probability-weighted or "most likely" amount)**	Degree of uncertainty in contract, including collectability, requiring full deferral of revenue recognition until resolved
	Likelihood of revenue reversal related to variable consideration or collectability estimate	
Disclosure decisions	**Accounting policies that warrant disclosure, including significant judgments and changes in judgments related to the timing of revenue recognition, determining the total contract price, and allocating the contract price to performance obligations**	Accounting policies that warrant disclosure (generally brief disclosures necessary, but more robust disclosures required for multiple-element and milestone arrangements)
	Qualitative and quantitative disclosures for disaggregation of revenues, performance obligations, and outstanding contract balances	

FIGURES AND TABLES

FIGURE 1 - ASC 606 Revenue Recognition Steps and Related Complexities

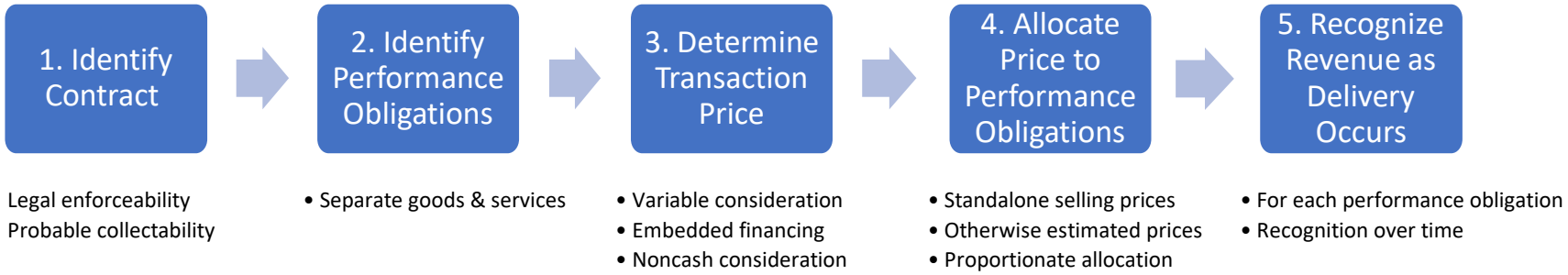

FIGURE 2 – Complex Estimates Comparison

	REVENUE RECOGNITION					
Audit Work Types	**Multiple Performance Obligations**	**Price Allocation**	**Variable Consideration**	**Recognition over Time**	**Goodwill Impairment**	**Fair Value (other than Goodwill Impairment)**
Contractual Interpretation	Yes, specialized contracts can have multiple, complicated terms that identify separate performance obligations & delivery criteria	Maybe, could be necessary to allocate variable consideration value to performance obligations based on contract terms	Maybe, could be required in identifying variable consideration that management has not recognized or the existence of an embedded financing arrangement or non-cash consideration	Maybe, could be necessary to identify milestones or whether management's assessment of total costs to complete delivery is reasonable	-	Yes, with specialized agreements for investments (e.g., private equity) or other financial instruments (e.g., debt) containing terms that bear upon valuation
Assessment of Multiple Information Inputs & Assumptions	Yes, multiple contracts can represent one contract in substance, also assessing companies' products & services for treatment as multiple performance obligations	Yes, assessing price list against prices charged to other customers, estimating prices based on fair value	Yes, to assess completeness of variable consideration estimates, probabilities assigned to each likelihood for each variable consideration value based on contract &/or discount/ rebate offer terms, past variable consideration experience, etc.	Yes if percent-completion, to assess value of inputs or outputs to-date (e.g., salary, hours) versus overall inputs & outputs for contract completion	Yes, must assess multiple inputs of information & assumptions (e.g., inflation, industry growth rate, future revenue forecast, etc.), company plans for the segment, etc. to assess goodwill value	Yes, must assess multiple inputs of information & assumptions (e.g., cash flows, discount rates, etc.) to assess fair value

	REVENUE RECOGNITION					
Audit Work Types	**Multiple Performance Obligations**	**Price Allocation**	**Variable Consideration**	**Recognition over Time**	**Goodwill Impairment**	**Fair Value (other than Goodwill Impairment)**
Assessment of Multiple Potential Valuation Methods	-	Yes, if standalone prices do not exist, there are 3 possible methods of estimating prices: adjusted market assessment approach, expected cost plus margin approach, or the residual approach	Yes, either the weighted average or the most likely method of valuation for variable consideration; also can calculate fair value for non-cash consideration using various measurement models	Yes if percent completion, can use the inputs or outputs method	-	Yes, management can select from among various measurement models or use a third-party reported value from a proprietary model
Assessment of Probabilistic/ Statistical Analyses	-	Yes, to allocate price proportionately to multiple performance obligations	Yes, to assess likelihoods under either the most likely or weighted average methods &, if the latter method, to calculate the value using a weighted average	Yes if percent-completion, to assess value of inputs or outputs to-date proportionate to overall inputs & outputs for contract completion	Yes, to assess & determine appropriate statistical assumptions (e.g., inflation, industry growth rate)	Yes, to assess & determine appropriate statistical assumptions (e.g., discount rate) & the weighting of multiple valuation approaches & techniques
Forecast and Related Assumption Assessments	-	-	Yes, to assess forecasts for likelihood of redemption for future discounts or rebates or of earning future contractual bonuses	Yes, to assess forecasts of total inputs or outputs for contract completion	Yes, to assess forecasts for future revenues & assess other forward-looking assumptions	Yes, to assess forecasts for cash flows & assess appropriate discount rates & other forward-looking assumptions

Audit Work Types	REVENUE RECOGNITION: Multiple Performance Obligations	REVENUE RECOGNITION: Price Allocation	REVENUE RECOGNITION: Variable Consideration	REVENUE RECOGNITION: Recognition over Time	Goodwill Impairment	Fair Value (other than Goodwill Impairment)
Audited Transaction/ Assessment Frequency	If contracts commonly contain multiple performance obligations, ongoing & frequent transactions	If contracts commonly contain multiple performance obligations, ongoing & frequent transactions	Quarterly	If commonly recognizes contracts over time, ongoing & frequent transactions for initial recognition & quarterly assessments of contract progress against overall inputs or outputs to complete	Quarterly	Quarterly
Exception Processing Assessment	Yes, must identify & assess contractual terms that depart from normal terms; also must identify whether multiple contracts should be combined	Yes, must identify & assess contractual terms that depart from normal terms; also must identify whether multiple contracts should be combined	-	Yes, must identify & assess contractual terms that depart from normal terms	n/a, every goodwill amount is unique & must be separately analyzed for impairment	n/a, every financial instrument is unique & must be separately analyzed for appropriate fair value treatment

Note: This analysis focuses on differences in types of processing & audit work that complex estimates require. Complex estimate similarities include other steps outlined in AS 2501:

- Understanding management's process for establishing the estimate
- Utilizing that understanding to assess estimate assumptions & biases
- Considering management's biases related to the estimate
- Assessing & testing internal controls related to the estimate
- Examining both affirming & disconfirming evidence for the estimate
- Identifying & evaluating major assumptions underlying the estimate & estimation methods
- Testing the mathematical accuracy of management's analyses
- Assessing accuracy & reasonableness of past management estimates & underlying estimates/projections
- Testing management's analyses related to the estimate, including examining & ensuring the accuracy of inputs & data that derive from source data
- Assessing extensive disclosure completeness and accuracy

Sources: Past audit knowledge of the author & various previously cited articles. Particularly ASC 606 itself; Cannon & Bedard 2017; Griffith, Hammersley, & Kadous 2015.

TABLE 1
PCAOB Revenue-Related Issuer Audits and Audits with Deficiencies*

	2021 Revenue		2020 Revenue		2019 Revenue		TOTAL Post-606 Revenue	
	Audits	Audits with Deficiencies	Audits	Audits with Deficiencies	Audits	Audits with Deficiencies	Audits	Audits with Deficiencies
Deloitte	31	1	41	2	43	2	115	5
EY	28	7	40	5	39	7	107	19
KPMG	32	6	36	5	40	9	108	20
PwC	36	0	43	1	47	9	126	10
BDO	17	6	20	8	18	8	55	22
GT	19	5	25	3	26	6	70	14
Marcum	15	4	12	5	11	5	38	14
RSM	9	2	11	4	8	1	28	7
	187	31	228	33	232	47	647	111
Big 4	127	14	160	13	169	27	456	54
Next 4	60	17	68	20	63	20	191	57

	2018 Revenue		2017 Revenue		2016 Revenue		TOTAL Pre-606 Revenue	
	Audits	Audits with Deficiencies	Audits	Audits with Deficiencies	Audits	Audits with Deficiencies	Audits	Audits with Deficiencies
Deloitte	47	1	49	6	48	3	144	10
EY	44	4	46	8	43	8	133	20
KPMG	40	10	40	11	40	7	120	28
PwC	46	4	49	8	47	6	142	18
BDO	18	5	19	3	18	6	55	14
GT	29	5	33	3	31	2	93	10
Marcum	8	3	8	2	8	1	24	6
RSM	9	3	10	5	9	3	28	11
	241	35	254	46	244	36	739	117
Big 4	177	19	184	33	178	24	539	76
Next 4	64	16	70	13	66	12	200	41

* Deficiencies numbers represent audits with deficiencies. Some audits had multiple deficiencies.

Source: Individual inspection reports, PCAOB numbers.

TABLE 2
Rank of Revenue Recognition as a Deficiency Area According to Number of Issuer Audits*

	Rank in 2021	Rank in 2020	Rank in 2019	Rank in 2018	Rank in 2017	Rank in 2016
Deloitte	#2 area	#1 area	#1 area (tie)	#2 area	#1 area	#1 area (tie)
EY	#1 area	#1 area	#1 area	#3 area	#1 area	#1 area
KPMG	#1 area	#1 area	#1 area	#1 area	#1 area	#1 area
PwC	-	#1 area (tie)	#1 area	#1 area	#1 area	#1 area
BDO	#1 area	#1 area	#1 area	#1 area	#1 area	#1 area
GT	#1 area	#1 area	#1 area	#1 area	#1 area	#2 area
Marcum	#2 area	#1 area	#1 area	#1 area	#1 area	#1 area (tie)
RSM	#1 area (tie)	#1 area	#2 area	#1 area (tie)	#1 area	#1 area (tie)

*Ranks by # of audits with inspection deficiencies

Source: My review of individual PCAOB inspection reports.

TABLE 3
Total Issuer Audits and % that Audited Revenue

	2021		2020		2019		TOTAL Post-606	
	Total Audits	% Audited Revenue	Total Audits	% Audited Revenue	Total Audits	% Audited Revenue	Total Audits	% Audited Revenue
Deloitte	54	57%	53	77%	58	74%	165	70%
EY	56	50%	52	77%	60	65%	168	64%
KPMG	54	59%	53	68%	58	69%	165	65%
PwC	56	64%	52	83%	60	78%	168	75%
BDO	30	57%	24	83%	26	69%	80	69%
GT	31	61%	29	86%	31	84%	91	77%
Marcum	25	60%	14	86%	12	92%	51	75%
RSM	17	53%	15	73%	15	53%	47	60%
	323	58%	292	78%	320	73%	935	69%
Big 4	220	58%	210	76%	236	72%	666	68%
Next 4	103	58%	82	83%	84	75%	269	71%

	2018		2017		2016		TOTAL Pre-606	
	Total Audits	% Audited Revenue	Total Audits	% Audited Revenue	Total Audits	% Audited Revenue	Total Audits	% Audited Revenue
Deloitte	52	90%	55	89%	55	87%	162	89%
EY	54	81%	55	84%	55	78%	164	81%
KPMG	52	77%	52	77%	51	78%	155	77%
PwC	55	84%	55	89%	56	84%	166	86%
BDO	23	78%	23	83%	24	75%	70	79%
GT	32	91%	34	97%	34	91%	100	93%
Marcum	10	80%	10	80%	9	89%	29	83%
RSM	17	53%	15	67%	15	60%	47	60%
	295	82%	299	85%	299	82%	893	83%
Big 4	213	83%	217	85%	217	82%	647	83%
Next 4	82	78%	82	85%	82	80%	246	81%

Source: Individual inspection reports, PCAOB numbers.

TABLE 4
Total Issuer Audits with Any Deficiencies and % of Issuer Audits with Revenue Deficiencies (Ds)

	2021 Total Audits		2020 Total Audits		2019 Total Audits		TOTAL Post-606 Audits	
	With Ds	With Revenue Ds	With Ds	With Revenue Ds	With Ds	With Revenue Ds	With Ds	With Revenue Ds
Deloitte	7	14%	2	100%	6	33%	15	33%
EY	12	58%	8	63%	11	64%	31	61%
KPMG	14	43%	14	36%	17	53%	45	44%
PwC	2	0%	1	100%	18	50%	21	48%
BDO	16	38%	13	62%	11	73%	40	55%
GT	7	71%	5	60%	7	86%	19	74%
Marcum	15	27%	9	56%	6	83%	30	47%
RSM	4	50%	7	57%	3	33%	14	50%
	77	40%	59	56%	79	59%	215	52%
Big 4	35	40%	25	52%	52	52%	112	48%
Next 4	42	40%	34	59%	27	74%	103	55%

	2018 Total Audits		2017 Total Audits		2016 Total Audits		TOTAL Pre-606 Audits	
	With Ds	With Revenue Ds	With Ds	With Revenue Ds	With Ds	With Revenue Ds	With Ds	With Revenue Ds
Deloitte	6	17%	11	55%	13	23%	30	33%
EY	14	29%	17	47%	15	53%	46	43%
KPMG	19	53%	26	42%	22	32%	67	42%
PwC	14	29%	13	62%	11	55%	38	47%
BDO	11	45%	9	33%	16	38%	36	39%
GT	8	63%	6	50%	8	25%	22	45%
Marcum	3	100%	3	67%	3	33%	9	67%
RSM	5	60%	11	45%	7	43%	23	48%
	80	44%	96	48%	95	38%	271	43%
Big 4	53	36%	67	49%	61	39%	181	42%
Next 4	27	59%	29	45%	34	35%	90	46%

Source: Individual inspection reports, PCAOB numbers.

TABLE 5
PCAOB Revenue-Related Audits and Deficiencies

	2021 Revenue		2020 Revenue		2019 Revenue		TOTAL Post-606 Revenue	
	Audits	Deficiencies	Audits	Deficiencies	Audits	Deficiencies	Audits	Deficiencies
Deloitte	31	1	41	10	43	3	115	14
EY	28	29	40	8	39	14	107	51
KPMG	32	24	36	20	40	33	108	77
PwC	36	-	43	3	47	36	126	39
BDO	17	23	20	33	18	19	55	75
GT	19	11	25	14	26	32	70	57
Marcum	15	10	12	13	11	15	38	38
RSM	9	6	11	11	8	2	28	19
	187	104	228	112	232	154	647	370
Big 4	127	54	160	41	169	86	456	181
Next 4	60	50	68	71	63	68	191	189

	2018 Revenue		2017 Revenue		2016 Revenue		TOTAL Pre-606 Revenue	
	Audits	Deficiencies	Audits	Deficiencies	Audits	Deficiencies	Audits	Deficiencies
Deloitte	47	1	49	11	48	8	144	20
EY	44	17	46	25	43	29	133	71
KPMG	40	41	40	27	40	17	120	85
PwC	46	13	49	23	47	19	142	55
BDO	18	13	19	15	18	26	55	54
GT	29	15	33	8	31	8	93	31
Marcum	8	10	8	3	8	3	24	16
RSM	9	15	10	11	9	24	28	50
	241	125	254	123	244	134	739	382
Big 4	177	72	184	86	178	73	539	231
Next 4	64	53	70	37	66	61	200	151

Source: Individual inspection reports, PCAOB #s for audits, my deficiency coding for revenue deficiency numbers.

TABLE 6
PCAOB Inspection Report Total Deficiencies (Ds)

	2021 Total		2020 Total		2019 Total		TOTAL Post-606	
	Ds	% Revenue Ds	Ds	% Revenue Ds	Ds	% Revenue Ds	Ds	% Revenue Ds
Deloitte	11	9%	10	100%	18	17%	39	36%
EY	70	41%	21	38%	39	36%	130	39%
KPMG	58	41%	57	35%	76	43%	191	40%
PwC	5	0%	6	50%	107	34%	118	33%
BDO	64	36%	64	52%	36	53%	164	46%
GT	30	37%	27	52%	60	53%	117	49%
Marcum	32	31%	23	57%	27	56%	82	46%
RSM	38	16%	25	44%	11	18%	74	26%
	308	34%	233	48%	374	41%	915	40%
Big 4	144	38%	94	44%	240	36%	478	38%
Next 4	164	30%	139	51%	134	51%	437	43%

	2018 Total		2017 Total		2016 Total		TOTAL Pre-606	
	Ds	% Revenue Ds	Ds	% Revenue Ds	Ds	% Revenue Ds	Ds	% Revenue Ds
Deloitte	8	13%	22	50%	37	22%	67	30%
EY	64	27%	70	36%	75	39%	209	34%
KPMG	87	47%	111	24%	99	17%	297	29%
PwC	51	25%	60	38%	71	27%	182	30%
BDO	42	31%	46	33%	93	28%	181	30%
GT	32	47%	18	44%	23	35%	73	42%
Marcum	15	67%	6	50%	7	43%	28	57%
RSM	36	42%	57	19%	51	47%	144	35%
	335	37%	390	32%	456	29%	1181	32%
Big 4	210	34%	263	33%	282	26%	755	31%
Next 4	125	42%	127	29%	174	35%	426	35%

Source: Auditing standards associated with identified Part I.A Deficiencies chart in each PCAOB inspection report.

TABLE 7
Severity of PCAOB Revenue Deficiencies

	2021		2020		2019		2018		2017		2016		**TOTAL**		**TOTAL Post-606**		**TOTAL Pre-606**	
	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	**Big 4**	**Next 4**	**Big 4**	**Next 4**	**Big 4**	**Next 4**
Misstatement Deficiencies:																		
RESTATE	-	-	-	-	1	-	-	-	-	-	-	-	1	-	1	-	-	-
NON-GAAP	-	2	-	1	-	1	-	-	-	1	-	-	-	5	-	4	-	1
ERROR	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	1	-
Total	-	2	-	1	1	1	-	-	1	1	-	-	2	5	1	4	1	1
Non-Misstatement Deficiencies:																		
NO-TEST	17	25	15	29	41	30	34	19	33	9	27	21	**167**	**133**	73	84	94	49
NO-EVAL	7	6	5	7	14	18	13	13	12	6	4	9	55	59	26	31	29	28
NO-SUFF	30	17	21	34	30	19	25	21	40	21	42	31	**188**	**143**	81	70	107	73
Total	54	48	41	70	85	67	72	53	85	36	73	61	410	335	180	185	230	150
Total Deficiencies	**54**	**50**	**41**	**71**	**86**	**68**	**72**	**53**	**86**	**37**	**73**	**61**	**412**	**340**	**181**	**189**	**231**	**151**

Source: My coding of revenue-related deficiencies from PCAOB inspection reports.

TABLE 8
Revenue Recognition Deficiencies - Primary Nature (mutually exclusive)

	2021		2020		2019		2018		2017		2016		**TOTAL**	
	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	**Big 4**	**Next 4**
Basic principles of revenue recognition	44	26	40	39	60	50	60	46	70	27	62	30	336	218
Confirmations on amounts due from revenue-generating transactions	-	-	1	2	2	2	-	1	1	-	-	4	4	9
Complex revenue-generating transactions or processes	10	24	-	30	24	16	12	6	15	10	11	27	72	113
TOTAL	54	50	41	71	86	68	72	53	86	37	73	61	412	340

	TOTAL Post-606		**TOTAL Pre-606**	
	Big 4	**Next 4**	**Big 4**	**Next 4**
Basic principles of revenue recognition	144	115	192	103
Confirmations on amounts due from revenue-generating transactions	3	4	1	5
Complex revenue-generating transactions or processes	34	70	38	43
TOTAL	181	189	231	151

Source: My coding of revenue-related deficiencies from PCAOB inspection reports.

TABLE 9: Revenue Recognition Deficiencies - Secondary Nature (not mutually exclusive)

	2021		2020		2019		2018		2017		2016		**TOTAL**	
	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	**Big 4**	**Next 4**
Basic principles of revenue recognition:														
Reliance on internal controls	19	10	15	12	18	6	19	12	23	7	16	11	***110***	***58***
Reliance on information in reports generated from the issuer's computer system	13	6	8	7	14	8	17	7	12	3	11	7	***75***	***38***
Reliance on 3rd-party service provider/organization	-	2	1	7	-	1	-	2	1	5	-	-	2	17
Potential material weaknesses or misstatements	-	-	-	1	2	4	5	3	15	4	17	6	***39***	***18***
Analytical procedures used as substantive tests	7	2	1	1	-	2	3	1	5	-	15	5	31	11
Audit sampling	4	5	7	7	16	7	18	10	19	7	18	10	***82***	***46***
Other	14	3	9	5	12	24	2	12	2	2	4	-	***43***	***46***
Total basic principles of revenue recognition	57	28	41	40	62	52	64	47	77	28	81	39	382	234
Confirmations on amounts due from revenue-generating transactions	-	-	1	2	2	2	-	1	1	-	-	4	4	9
Complex revenue-generating transactions or processes:														
Alternative uses for products	-	-	-	-	-	2	-	-	-	-	-	-	-	2
Contract modifications	-	5	-	-	4	3	-	-	-	-	-	-	4	8
Variable consideration	4	2	-	7	4	4	-	-	3	-	-	9	***11***	***22***
Collectability of revenue	-	-	-	2	-	1	1	-	-	-	-	-	1	3
Percent completion/completed-contract recognition	2	-	-	18	14	-	-	2	1	12	2	6	***19***	***38***
Consideration issues (In-kind, counterparty, etc.)	-	1	-	-	-	2	-	-	-	-	-	-	-	3
Custom products	-	-	-	-	-	2	-	-	-	-	-	-	-	2
Disclosures under ASC 606	-	2	-	-	-	1	-	-	-	-	-	-	-	3
Estimated transaction prices and contract allocation	3	8	-	-	2	2	10	-	2	-	5	-	***22***	***10***
Multiple elements/performance obligations	4	12	-	-	6	-	11	4	10	-	5	12	***36***	***28***
Potential material weaknesses or misstatements	-	1	-	1	1	1	2	1	3	-	3	3	***9***	***7***
Right to payment on cancelled orders	-	-	-	-	-	1	-	-	-	-	-	-	-	1
Total complex revenue-generating transactions or processes	13	31	-	28	31	19	24	7	19	12	15	30	102	127
TOTAL	70	59	42	70	95	73	88	55	97	40	96	73	488	370

Source: My coding of revenue-related deficiencies from PCAOB inspection reports.

TABLE 9: Revenue Recognition Deficiencies - Secondary Nature (not mutually exclusive), continued

	TOTAL Post-606		TOTAL Pre-606	
	Big 4	**Next 4**	**Big 4**	**Next 4**
Basic principles of revenue recognition:				
Reliance on internal controls	***52***	***28***	***58***	***30***
Reliance on information in reports generated from the issuer's computer system	***35***	***21***	***40***	***17***
Reliance on 3rd-party service provider/organization	1	10	1	7
Potential material weaknesses or misstatements	2	5	37	13
Analytical procedures used as substantive tests	8	5	23	6
Audit sampling	***27***	***19***	***55***	***27***
Other	35	32	8	14
Total basic principles of revenue recognition	160	120	222	114
Confirmations on amounts due from revenue-generating transactions	3	4	1	5
Complex revenue-generating transactions or processes:				
Alternative uses for products	-	2	-	-
Contract modifications	4	8	-	-
Variable consideration	***8***	***13***	***3***	***9***
Collectability of revenue	-	3	1	-
Percent completion/completed-contract recognition	***16***	***18***	***3***	***20***
Consideration issues (In-kind, counterparty, etc.)	-	3	-	-
Custom products	-	2	-	-
Disclosures under ASC 606	-	3	-	-
Estimated transaction prices and contract allocation	***5***	***10***	***17***	-
Multiple elements/performance obligations	***10***	***12***	***26***	***16***
Potential material weaknesses or misstatements	1	3	8	4
Right to payment on cancelled orders	-	1	-	-
Total complex revenue-generating transactions or processes	44	78	58	49
TOTAL	207	202	281	168

Source: My coding of revenue-related deficiencies from PCAOB inspection reports.

TABLE 10: Financial Statements and Accounts Impacted by Revenue-Related Deficiencies

Panel A: Financial Statements and Number of Financial Statements Impacted by Revenue-Related Deficiencies

	2021		2020		2019		2018		2017		2016		**TOTAL Post-606**		**TOTAL Pre-606**	
	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	**Big 4**	**Next 4**	**Big 4**	**Next 4**
Income Statement only	32	46	34	55	75	54	60	47	80	23	52	34	141	155	192	104
Income Statement & Balance Sheet	21	4	7	16	11	14	12	4	6	14	19	26	39	34	37	44
Balance Sheet only	1	-	-	-	-	-	-	2	-	-	2	1	1	0	2	3
TOTALS	54	50	41	71	86	68	72	53	86	37	73	61	181	189	231	151

Panel B: Number of Financial Statements Impacted by Revenue-Related Deficiencies

	2021		2020		2019		2018		2017		2016		**TOTAL Post-606**		**TOTAL Pre-606**	
	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	**Big 4**	**Next 4**	**Big 4**	**Next 4**
Two	21	4	7	16	11	14	12	4	6	14	19	26	39	34	37	44
One	33	46	34	55	75	54	60	49	80	23	54	35	142	155	194	107
TOTALS	54	50	41	71	86	68	72	53	86	37	73	61	181	189	231	151

Panel C: Accounts Impacted by Revenue-Related Deficiencies

	2021		2020		2019		2018		2017		2016		**TOTAL Post-606**		**TOTAL Pre-606**	
	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	**Big 4**	**Next 4**	**Big 4**	**Next 4**
Revenue	53	49	41	65	86	67	72	53	85	37	67	60	180	181	224	150
Accounts Receivable	16	5	13	8	13	13	13	6	9	12	21	27	42	26	43	45
Deferred Revenue	21	1	-	-	2	2	9	1	2	2	1	3	23	3	12	6
A/R & Contractual Allowances	-	1	-	-	1	5	-	5	2	2	7	5	1	6	9	12
Unbilled Revenue	-	-	-	-	-	-	3	-	-	-	-	10	0	0	3	10
Sales Discounts & Incentives	4	2	-	7	-	4	-	-	4	-	3	5	4	13	7	5
Accruals & Reserves	-	-	-	9	2	2	-	-	1	-	-	2	2	11	1	2
TOTALS	94	58	54	89	104	93	97	65	103	53	99	112	252	240	299	230

Source: My coding of revenue-related deficiencies from PCAOB inspection reports.

TABLE 11: Specific Audit Standard Violations for Revenue-Related Deficiencies

	2021		2020		2019		2018		2017		2016		TOTAL	
	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4	Big 4	Next 4
AS 1105, Audit Evidence	13	3	7	15	8	8	3	3	3	4	3	3	***37***	***36***
AS 2101, Audit Planning	-	-	1	-	1	1	-	-	1	-	5	-	8	1
AS 2110, Identifying and Assessing Risks of Material Misstatement	-	-	-	-	-	-	-	-	-	-	-	3	-	3
AS 2201, An Audit of Internal Control Over Financial Reporting That Is Integrated with An Audit of Financial Statements	21	21	14	23	37	36	39	28	42	17	28	17	***181***	***142***
AS 2301, The Auditor's Responses to the Risks of Material Misstatement	9	12	11	12	19	8	13	10	17	5	16	18	***85***	***65***
AS 2305, Substantive Analytical Procedures	5	2	1	3	-	1	1	1	3	-	8	3	18	10
AS 2310, The Confirmation Process	-	-	-	2	1	2	-	1	-	-	-	1	1	6
AS 2315, Audit Sampling	5	7	7	7	12	3	10	6	11	7	4	11	***49***	***41***
AS 2401, Consideration of Fraud in a Financial Statement Audit	-	-	-	-	-	-	-	-	-	-	1	-	1	-
AS 2501, Auditing Accounting Estimates	1	-	-	6	5	1	2	2	1	2	6	3	15	14
AS 2810, Evaluating Audit Results	-	5	-	3	3	8	4	2	8	2	2	2	17	22
TOTALS	54	50	41	71	86	68	72	53	86	37	73	61	412	340

	TOTAL Post-606		**TOTAL Pre-606**	
	Big 4	**Next 4**	**Big 4**	**Next 4**
AS 1105, Audit Evidence	***28***	***26***	***9***	***10***
AS 2101, Audit Planning	2	1	6	0
AS 2110, Identifying and Assessing Risks of Material Misstatement	-	-	-	3
AS 2201, An Audit of Internal Control Over Financial Reporting That Is Integrated with An Audit of Financial Statements	***72***	***80***	***109***	***62***
AS 2301, The Auditor's Responses to the Risks of Material Misstatement	***39***	***32***	***46***	***33***
AS 2305, Substantive Analytical Procedures	6	6	12	4
AS 2310, The Confirmation Process	1	4	-	2
AS 2315, Audit Sampling	***24***	***17***	***25***	***24***
AS 2401, Consideration of Fraud in a Financial Statement Audit	-	-	1	-
AS 2501, Auditing Accounting Estimates	6	7	9	7
AS 2810, Evaluating Audit Results	3	16	14	6
TOTALS	181	189	231	151

CHAPTER 2: Statistical Risk Framing as a Cognitive Nudge to Improve Revenue Recognition Audit Quality

Abstract

Auditors have historically struggled with probabilistic thinking. ASC 606, *Revenue from Contracts with Customers*, contains several areas, including collectability and variable consideration estimates, that require both predictive and probabilistic thinking. The FASB and AICPA have specifically identified variable consideration as an area of ASC 606 that has proven challenging for both managers and auditors, because it represents a major change from prior accounting guidance and a new complex estimate based on forward-looking probabilistic assumptions. My experimental study draws from recent advances in healthcare statistical risk framing, namely absolute and relative framing comparisons, which represent a cognitive nudge or "boost" that helps prevent auditors from anchoring on management estimates. I predict that auditors will produce better estimates under the combined absolute and relative framing condition than in the solely absolute, solely relative, or control conditions. I find that absolute framing in either the combined or solely absolute condition leads to better estimates. I also provide data on auditors' statistical numeracy, based on three probability questions, which auditors answer incorrectly at a rate that is marginally higher than that of doctors. Insights into how auditors interpret statistics and make probabilistic judgments are particularly important in the current data-driven audit climate, given the statistical focus of data analytics such as multivariate regression analysis and population testing, which offer opportunities for future research on probabilistic thinking.

What is the probability that a screening test will lower your chances of developing a disease?
What is the probability that a customer will take advantage of rebates or discounts?

I. INTRODUCTION

My experimental study examines probabilistic and predictive complex audit estimates associated with ASC 606, *Revenue from Contracts with Customers*. Variable consideration, such as a future rebate or discount, requires complex valuation estimates that either offset or boost revenue recognition (FASB 2014).[11] The probabilistic judgments that ASC 606 requires for variable consideration are predictive, multivariate, and complicated by the FASB's providing a choice of valuation methods – either the most likely method or a weighted-average expected value method. These factors may help to explain why the Financial Accounting Standards Board (FASB) and the American Institute of Certified Public Accountants (AICPA) have specifically identified variable consideration as an area of ASC 606 that challenges both managers and auditors (FASB 2021a; AICPA 2021). Prior research in the healthcare field suggests that statistical framing from the healthcare literature (e.g., Schechtman 2002, Gigerenzer et al. 2007) may help to increase the quality of probabilistic judgments. To address the challenges inherent in variable consideration, I will examine whether statistical risk framing from the healthcare literature can act as a cognitive nudge to help auditors make higher-quality probabilistic and predictive complex estimate judgments. My study's relevance could extend beyond the revenue recognition setting, as probabilistic and predictive thinking is also critical for auditing complex estimates like investment valuation, goodwill impairment, and waterfall analyses. Probabilistic

[11] Several current FASB staff and a former FASB board member have recommended examining the area of variable consideration, given how significant the changes in both management and auditor judgment are for this area as compared to the rest of ASC 606, and the challenges that the increased focus on probabilistic thinking present, based on their past experience and the prior accounting and audit literature.

thinking is similarly important to data-focused audit innovations, including multivariate regression analysis and data analytics.

PCAOB inspection deficiencies related to revenue forecasting and sampling (PCAOB 2020b, 2019, 2018b), as well as the prior audit literature (Joyce and Biddle 1981a, 1981b; Holt 1987; Amer, Hackenbrack, and Nelson 1994, 1995), have demonstrated that probabilistic thinking has also historically challenged auditors, especially in the areas of base rate use and sample size determination. The research on auditors' difficulties with base rates is consistent with Kahneman and Tversky (1972) and Kahneman and Frederick's (2002) base rate fallacy research in the field of psychology, which finds that individual decision makers tend to ignore statistical base rates. While Bonner, Libby, and Nelson (1996) and Nelson, Libby, and Bonner (1995) find that knowledge specific to the task at hand helps auditors make better probabilistic judgments, Smith and Kida (1981) summarize the literature on multiple probabilistic judgments and find that task knowledge helps with some but not all experimental scenarios. Whether task knowledge will help auditors make higher-quality probabilistic judgments related to more complex estimates remains an open question.

I expect that recently recommended methods for communicating statistical risks from the healthcare field will help auditors better understand the probabilistic decision-making required by ASC 606 and also cognitively nudge them away from management's stated numbers. Gigerenzer et al. (2007) indicates that doctors who convey information in relative rather than absolute terms have more success in helping their patients understand risk and risk reduction. For example, explaining to a patient that a cancer screening can reduce their risk of dying by 33 percent in the next ten years is more effective than explaining that it will reduce their risk of dying from cancer from 3 percent to 2 percent in the same time period. However, doctors

themselves benefit most from a combination of both absolute and relative risks when interpreting medical studies, given that a similar relative risk can mask very different underlying absolute rates (e.g., a 10 percent increase occurs both from 10 percent to 11 percent and from 50 percent to 55 percent) (Schechtman 2002). Like physicians, auditors possess domain-specific expertise and apply this expertise to complex presentations of data drawn from multiple sources in order to make probabilistic judgments. The similarities between the medical and auditing contexts suggest that relative and absolute statistical framing could help auditors make better decisions related to probabilistic, predictive data.

I hypothesize that auditors will generate better variable consideration estimates in a combined framing condition, followed by solely absolute framing, solely relative framing, and a control condition. I test this hypothesis via a 2 (absolute framing – absent vs. present) x 2 (relative framing – absent vs. present) between-subjects experimental design. I manipulate the risk-related language, using the presence or absence of relative statistical language and presence or absence of absolute statistical language.[12] The absence of both types of statistical framing, which I replace with general, non-statistical language regarding likelihoods that is similar to how managers have historically conveyed risk within these areas to auditors, operates as the control.

The experiment uses a case that contains seeded cues related to assumptions underlying the variable consideration estimate. Participants are experienced auditors, with prior experience auditing complex aspects of revenue recognition like variable consideration. The dependent variable is the amount of a revenue adjustment that they propose based on their assessment of the variable consideration estimate. The adjustment should be at least $280,000, which is above the

[12] An example of an accounting-related relative risk description is saying that the estimated likelihood of collecting a receivable is 10 percent less than the remaining population of receivables. An absolute risk description example is saying that there is an 8.1 in 10 chance of collecting a receivable versus a 9 in 10 chance for the population.

$210,000 tolerable misstatement level and the $21,000 posting materiality level stated in the case. I also ask the participants to discuss their decision process and list what items informed their decision regarding revenue recognition. I code the items that the participants discuss based on whether they represent valid criteria for reversing or recognizing revenue, which enables me to examine the depth of their thinking process and comfort level with the underlying statistics.

I do not find support for my hypothesis that the combined condition will help auditors generate better variable consideration estimates. However, I find a significant main effect for absolute framing, indicating that its presence in either the combined or absolute conditions leads auditors to question more management assumptions and therefore generate higher adjustment estimates. The PCAOB in fact instructs auditors to question all of management's assumptions underlying estimates (PCAOB 2018a), suggesting that auditors' higher number of questioned assumptions leads to higher audit quality in their assessments of variable consideration.

This study is important to practice and audit research for several reasons. First, statistical risk framing offers an alternative intervention for other types of complex estimates that involve probabilistic and predictive thinking. Past research has identified bias as a problem in auditor assessments of complex estimates, leading auditors to ignore data that contradicts management estimates (e.g., Griffith, Hammersley, Kadous, and Young 2015; Griffith 2018). The PCAOB has identified auditor bias as a major concern in its *Auditing Standard Related to Auditing Accounting Estimates, Including Fair Value Measurements* (PCAOB 2018a). The statistical framing nudges I use from the healthcare literature help debias decision makers who are making probabilistic judgments away from numerical anchors such as management's unaudited financial statement figures. As such, this statistical framing intervention could have broad application toward ensuring unbiased auditor assessments of various types of complex estimates.

Second, nudge/boosting theory and the statistical risk framing theory from the healthcare literature offer novel means of improving auditor judgment and decision-making. These cross-disciplinary ideas provide insights that can help inform the design of decision aids or workpaper templates for variable consideration and other complex estimates that rely on statistical thinking.

Lastly, my study holds several important implications for practice related to fraud risk and data analytics. Over 60 percent of fraud occurs in the area of revenue recognition (Beasley et al. 2010), indicating that revenue is subject to management manipulation. ASC 606's new probabilistic judgment requirements have higher stakes for managers, as they lead to offsets to top-line revenue, which is often a management growth incentive and analyst target, as opposed to the prior recording of cost of goods sold for most forms of variable consideration. Management could easily manipulate the value of variable consideration and thereby increase the already heightened level of fraud risk for revenue if auditors cannot detect the misstatement. To compound these issues, the current data-driven climate requires auditors to have greater statistical fluency than in the past. Data analytics and complex analyses like multivariate regressions and algorithm-based population testing have begun to take the place of audit sampling, yet still require statistical sampling if numerous exceptions exist (Issa 2013). Statistical risk framing is a low-stakes intervention that offers promise in helping auditors make better judgments in these complex, data-driven decision-making environments.

The remainder of this paper includes theory development and hypotheses in Part II, methodology in Part III, results in Part IV, and a conclusion in Part V.

II. THEORY DEVELOPMENT AND HYPOTHESES

ASC 606 Revenue Recognition Changes

The FASB issued ASC 606, the new accounting standard on revenue recognition, in

2014, and public companies adopted the standard in 2018 (FASB 2014). ASC 606 outlines a five-step process for determining when revenue is recognizable, but embedded in those five steps are a variety of additional complex requirements that managers and auditors must consider regarding revenue recognition. ASC 606 requires more judgment than the former revenue recognition accounting guidance, including modified methods of allocating transaction price values to performance obligations; calculating progress on long-term, percent-completion contracts; requiring consideration of collectibility in deciding whether revenue recognition can occur; and estimating the amount of revenue that a given company will most likely receive after calculating the effects of discounts, rebates, and other forms of "variable consideration." In addition, ASC 606 substantially increases the disclosures that companies must provide regarding their revenue recognition judgments, significant contracts, and material outstanding amounts.

Under ASC 606, variable consideration estimates reduce revenue recognition in cases of rebates or discounts but can also include additions to revenue for bonuses and incentives. The FASB changed the accounting for variable consideration to better reflect the economic substance of the related revenue transaction, while also enhancing the consistency of financial reporting across industries and companies from the prior accounting rules (FASB 2014). To value variable consideration, companies may use one of two methods, either of which is intended to reflect management's best estimate of future outcomes. Under the "expected value" method, the company applies percentage probabilities against each possible future value of variable consideration and adds them up to obtain a weighted average, termed the "expected value." Under the "most likely amount" method, the company creates several possible estimates and chooses the most probable predicted amount to offset revenue. Both of these options for how to value variable consideration require probabilistic and predictive thinking, namely determining

the likely percentage probabilities using the expected value method and both determining percentage probabilities and assessing the most probable outcome using the most likely value method. These multivariate comparisons for variable consideration are complex since they require at least two and possibly many more probability assessments under either the most likely or expected value approaches, depending upon the number of scenarios that a company is considering for variable consideration redemption.[13] In addition, variable consideration can either increase revenue, in which case a "constraint" applies that might reduce the potential amount of additional revenue recognition, or it can decrease revenue.[14] The terms variable consideration and constraint themselves are also new to the revenue recognition rules in ASC 606 and not intuitive terms at that, particularly since variable consideration covers a range of both negative offsets and positive additions to revenue.

The pre-ASC 606 accounting rules required companies to treat most types of discounts and rebates as offsets to revenue. However, the prior guidance allowed companies to record certain types of discounts that provided them with an identifiable benefit in the form of goods or services (i.e., an exchange transaction), where the company could reasonably estimate the fair value of that benefit, as an expense rather than as a reduction in revenue (EITF 01-9). Examples

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[13] For the purposes of simplifying my study setting, I only use the most likely method in my experimental case. Participants learn that management has chosen the most likely method for their variable consideration policy related to revenue recognition. Future research could examine whether the most likely or weighted-average variable consideration valuation method is easier for managers and auditors to understand, and whether statistical risk framing operates as a helpful decision-making nudge/boost under both methods.

[14] The constraint in ASC 606 requires companies to examine other factors related to variable consideration in determining to what extent it can recognize revenue. These constraining factors (i.e., the constraint) include susceptibility to economic, third-party, obsolescence, or other factors outside of the company's control; uncertainty regarding consideration that will take a significant period of time to resolve; limited experience with similar contracts; company practices of regularly varying pricing or payment terms; and a variety and large range of possible outcomes related to each type of variable consideration. These factors represent a constraint on additions to revenue, rather than offsets to revenue, but are another new and complex aspect of determining the value of certain types of variable consideration that affect revenue per ASC 606. As I solely use deductible variable consideration in my setting, however, the constraint does not apply to my study.

of these sorts of exchange transactions formerly included situations where customers would receive a discount or trade-in credit on future purchases. Under ASC 606, any form of variable consideration, including these types of exchange transactions, requires offsets to revenue rather than expense treatment.

It is also worth noting that the prior accounting rules required companies to defer revenue if uncertainty existed regarding rebates, discounts, and other forms of variable consideration. ASC 606 now allows companies to recognize the related revenue using probability-weighted or most likely values and requires them to offset revenue by the resulting estimated value of any discounts or rebates. Variable consideration valuation involves multiple factors and complex comparisons to assess whether the estimated values assigned to various forms of variable consideration are accurate. This complexity makes it less likely that the auditors will detect earnings management or financial statement fraud. Earnings management or fraud related to variable consideration could occur either due to insufficiently offsetting revenue for discounts, rebates, and similar deductions, or by recognizing too much revenue for contract incentives and performance-related bonuses that the company will not realize, in the case of variable consideration revenue additions.

These ASC 606 changes that require companies to offset revenue rather than record expenses, while also allowing companies to recognize revenue up-front rather than waiting until uncertainties associated with variable consideration resolve, have raised the degree of complexity and risks associated with companies' revenue recognition accounting. Misstating the top-line revenue balance could materially affect investor decisions, given that revenue is a focus of the majority of analyst forecasts as well as a signal of companies' potential future growth and earnings (Stice, Stice, Stice, and Stice-Lawrence 2022). As such, it is critical that the new

probabilistic judgments under ASC 606, both on the part of management and their auditors, faithfully represent companies' revenue balances.[15] Auditors must therefore utilize sound probabilistic thinking and interpretation of management's statistical analyses to properly assess their clients' revenue recognition.

Auditors' Difficulties with Statistical Thinking

ASC 606 requires additional probabilistic thinking, which past research indicates is an area where auditors have historically experienced difficulties. Auditors either ignore statistical base rates, namely the historical probability with which a given issue occurs, or they use base rates inappropriately (Joyce and Biddle 1981a, 1981b; Holt 1987; Amer et al. 1994, 1995). Inappropriate statistical sample sizes are also a frequent finding from past PCAOB inspection reports, per my analysis in Chapter 1, which further indicates that auditors struggle with statistical thinking.

Past audit research focuses on auditors' difficulties with base rates, consistent with Kahneman and Twersky (1972) and Kahneman and Frederick's (2002) base rate fallacy research in the field of psychology. These studies find that individuals generally ignore base rates when assessing the likelihood of a given scenario, instead focusing on more recent evidence or personal experience in determining risk. Auditors will similarly acknowledge base rates but fail to combine them with other relevant data in making audit judgments regarding receivables collectibility, instead using a representative heuristic regarding collectibility from comparable customers (Joyce and Biddle 1981b; Holt 1987). Auditors also inappropriately use base rates

[15] The changes related to variable consideration impact the timing of recognizing revenue offsets and revenue itself. The prior rules required deferring revenue in full if uncertainty existed regarding its recognition, whereas the new rules allow for recognition of the revenue with estimates for offsets related to variable consideration, similar to the offsets allowed under ASC 606 for collectability. These changes also affect the timing of when companies recognize associated costs of goods sold or costs of services provided, and net income associated with a revenue transaction.

when assessing whether an accounts receivable loss is probable or not, contrary to the Financial Accounting Standards Board (FASB) guidance in ASC 450, *Accounting for Contingencies* (Amer, Hackenbrack, and Nelson 1995). Auditors further have difficulty interpreting phrases such as "doubtful," "probable," and "reasonably likely" in a receivables valuation context (Amer, Hackenbrack, and Nelson 1994). While Kida (1984) finds support that auditors utilize base rates, he acknowledges that the results could be attributable to ordering or recency effects based on the design of its experimental instrument.

Nelson et al. (1995) and Bonner et al. (1996) find that task structure, meaning an audit task's process and steps, must mirror auditors' knowledge structure to help them make higher-quality probabilistic judgments. For example, experienced auditors make better decisions when assessing financial statement errors if they use an audit area approach, consistent with their audit planning work, rather than an approach that focuses on audit objectives (Bonner et al. 1996). However, these two studies ask participants to calculate the conditional probability of a type of error based on actual data versus the more complex and predictive estimates for ASC 606's variable consideration judgments. To elaborate, these two studies present auditors with a series of errors related to valuation for the accounts receivable allowance, inventory obsolescence, and investment lower of cost or market valuation. They then ask participants to estimate the conditional probability of errors occurring for a specific audit objective or accounting cycle, where there is one correct answer for each probability based on the actual data that participants receive and that they attempt to estimate based on their memory/recall of the number of errors and total items. This focus on assessments and memory based on actual, past data differs from ASC 606's requirements for predictive variable consideration estimates based on multiple inputs. The multivariate and forward-looking nature of the ASC 606 judgments, combined with greater

complexity in revenue transactions generally, results in more consistently complex probabilistic judgments than those required of auditors in the 1990s.

Variable consideration estimates require managers and auditors to either calculate a value based on two or more probability inputs using the expected value method, which is a finance concept often used to value investments that will be familiar to auditors specializing in investment valuation, but not to most other auditors. Alternatively, managers and auditors may use the most likely outcome method, which requires first establishing and then weighing the probabilities of two distinct scenarios in relation to each other. If the variable consideration increases revenue, managers and auditors must also consider constraining factors in determining whether the revenue is recognizable. In sum, ASC 606 requires that managers and auditors utilize new multivariate and predictive task and knowledge structures compared to the past literature's binary decision-making of determining whether contingencies are probable or estimating a probability based on actual data. This increased complexity coupled with auditors' difficulty with statistical thinking warrants testing new interventions to help auditors make better probabilistic judgments related to revenue recognition.

The layers of complexity and the multivariate nature of variable consideration are similar to complex estimates like goodwill impairment analyses, which prior research shows also challenge auditors. Studies on complex estimates find that auditors have difficulty incorporating disparate pieces of information into their assessments of complex estimates, including information that contradicts management's analyses and statements (e.g., Griffith, Hammersley, Kadous and Young 2015; Griffith 2018). Complex revenue recognition analyses for variable consideration valuation similarly flummox both managers and auditors, according to the FASB and AICPA, respectively (FASB 2021a; AICPA 2021).

The PCAOB frequently finds problems with auditing predictive tasks, such as forecasting revenues for goodwill impairment assessments (PCAOB 2021, 2020b, 2019, 2018b). Auditing is a field that primarily focuses on assessing historical data. Even analysts have difficulty making accurate forecasts for companies' future financial results. The predictive element of determining variable consideration utilization thereby adds another layer of complexity to revenue recognition accounting.

Management Bias

Companies must adopt and follow the revenue recognition guidance from ASC 606 in a way that auditors can digest and understand. Management produces auditable schedules and conveys information to their auditors regarding these probabilistic determinations. Implicit in the information that managers provide to their auditors is potential bias toward results that will support meeting analyst or internal earnings and revenue targets, which allow them to receive incentive compensation. Auditors have historically had difficulty identifying management bias related to complex and subjective management estimates (PCAOB 2014; PCAOB 2018a; PCAOB 2020a). The PCAOB defines certain areas of revenue recognition as complex estimates in implementation guidance for its recent estimates audit standard (PCAOB 2018a). Variable consideration estimates are one example of complex estimates, given the probabilistic and predictive data they require auditors to analyze.

How management conveys information also impacts auditors' decision-making. Prior literature demonstrates that information overload damages auditors' judgment (Blocher, Moffie, and Zmud 1986; Chewning and Harrell 1990; Wright 1995; Chung and Monroe 2001). Managers may try to confound their auditors by providing excess information in support of their revenue recognition estimates, whether purposefully due to nefarious intent or unintentionally due to their

confusion about ASC 606 or what support the auditors will need. Similar to doctors reading and interpreting complex medical studies, auditors often need to digest and assess complex and potentially extraneous audit support from management.

Statistical Insights from the Healthcare Field

We can draw parallels between the audit and medical professions and the statistical risk judgments that auditors and doctors must make. Doctors are experts at making probabilistic judgments in a healthcare setting, as auditors are in a financial reporting setting. Both have professional certification requirements, including a similar level of statistical training, and both fields deal with uncertainty and future outcomes stated in statistical terms. Their statistics-based decisions can impact future medical and audit outcomes, which will become known with the passage of time. These outcomes can be life-or-death in medicine versus fraud, bankruptcy, or lawsuits in auditing. The statistical data that each field must analyze is also admittedly different. Doctors examine medical journal articles or summaries thereof, whereas auditors assess information from management and external data sources. Another major difference between auditors' and doctors' interpretation of statistical data is that auditors are subject to biases such as motivated reasoning and both financial and relational incentives connected to their clients that may jeopardize their objectivity. Auditors also have multiple stakeholders, including investors, the client's board of directors, and the client themselves, leading to a more complex decision-making environment.

Research from the healthcare field finds that medical professionals, like auditors, have difficulty with probabilistic thinking and judgments, as demonstrated by 25 percent of doctors failing a basic statistical numeracy test (Schwartz, Woloshin, Black, and Welch 1997, Schwartz and Woloshin 2000). Doctors must interpret statistical data from research studies and convey the

implications of such data to their patients when asking them to consider treatments that can cure illness or screening tests that can detect illness with a certain degree of probability, for example.

To mitigate the difficulty that some doctors have with statistical thinking, researchers have proposed and found that doctors can digest statistical data and communicate it to their patients effectively if the information is framed differently, via absolute or relative terms. Gigerenzer et al. (2007) note that doctors who convey information in absolute rather than relative terms have more success in helping their patients understand risk and risk reduction. For example, explaining to a patient that a cancer screening can reduce their risk of dying from cancer from 3 percent to 2 percent in the next 10 years is more effective than explaining that it will reduce their risk of dying by 33 percent over the same time period. However, Schechtman (2002) finds that doctors themselves benefit from a combination of both absolute and relative risks when interpreting medical studies, given that a similar relative risk can mask very different underlying absolute rates (e.g., a 10 percent increase occurs both from 10 percent to 11 percent and from 50 percent to 55 percent). In the revenue collectibility context, an analog would be management stating that a certain customer's revenues are at 50 percent greater risk of not being collectible than the rest of the client's receivables, in relative terms, versus a customer having a 3 percent risk of bankruptcy as opposed to a 2 percent risk for the rest of the receivables, in absolute terms.

Managers are likely to use statistical risk language when they are conveying information to their auditors, given the probability-based requirements in ASC 606. Pharmaceutical companies typically use relative risks when encouraging potential patients to take their drugs, as a 50 percent relative reduction in symptoms seems more meaningful than a reduction from 4 percent to 2 percent absolute symptom severity. Given their biases, management may use either

relative or absolute risks in their communications with auditors, depending on which form of framing is most consistent with their incentives and desired financial results.

Absolute and relative risk framing can also encourage auditors away from anchoring and other biases they demonstrate toward management's numbers, particularly when assessing complex estimates. Risk framing in absolute and relative terms is one way of offsetting cognitive heuristics like anchoring (Tversky and Kahneman 1974). Varied risk framing can cognitively nudge or "boost" judgment to consider alternative results (Thaler and Sunstein 2009; John, Smith, and Stoker 2009; Grüne-Yanoff and Hertwig 2016; Hertwig 2017; Hertwig and Grüne-Yanoff 2017). Past medical research indicates that relative risk framing on its own causes doctors to overestimate how well a particular treatment will work (Forrow, Taylor, and Arnold 1992; Naylor, Chen, and Strauss 1992; Malenka et al. 1993; McGettigan et al. 1999; Barratt et al. 2004; King, Harper, and Young 2012). This tendency is likely one major reason why pharmaceutical companies provide data in relative terms, particularly if the absolute risks are very small. Relative framing encourages anchoring on one number, namely the relative change between two absolute numbers. In contrast, absolute framing provides the two underlying potential outcomes, thereby encouraging deeper thinking via consideration of one potential result in relation to another. Utilizing relative framing alongside absolute framing is a heuristic that provides the change between the two absolute results rather than requiring the decision maker to calculate the relative risk themselves. These framing heuristics should make the probabilistic decision-making process easier, by virtue of providing several viable alternative outcomes that differ from the anchor. In situations where managers may provide excessive information to their auditors and selective risk framing to steer them toward a particular result, cognitive nudges or boosts like varied risk framing can help auditors avoid anchoring on the stated result.

I hypothesize that auditors' audit judgments will improve if they receive information in both relative and absolute terms rather than in solely relative or absolute terms, consistent with doctors as they are reading and interpreting medical research studies. I define higher quality revenue recognition judgments as being consistent with probability information that best predicts actual future outcomes, and lower quality judgments as those that are less consistent with that probability information or based upon statistical data that does not reflect actual future outcomes.

> ***Hypothesis 1:*** *Auditors will make higher quality revenue recognition judgments when they receive information stated in both relative and absolute terms versus solely relative or absolute terms.*

If the manipulation is working as expected, participants will propose higher adjustments in the combined condition than in the solely absolute, solely relative, or control conditions. I will ask participants about the level of difficulty of the variable consideration task using a 10-point Likert scale. I expect that participants will rate the level of difficulty as the lowest in the combined absolute and relative framing condition, and progressively more difficult in the relative framing condition, the absolute framing condition, and the control condition. My expectations reflect the effects of the statistical framing boost on participants' probabilistic and predictive judgments.

The prior literature also indicates that doctors understand information in absolute terms better than in relative terms when they only receive one of these forms of statistical risk framing. I expect to find that auditors react similarly, with absolute framing improving upon relative framing, but relative framing still improving upon the control, which merely refers auditors to the relevant risk information without the cognitive nudge that stated risk framing provides. The control condition should be the most difficult for participants, as this nudge merely directs them to information in the case rather than specifying numerical risk framing that would debias them

away from management's probability assumptions.[16]

> ***Hypothesis 2:*** *Auditors will make higher quality revenue recognition judgments when they receive information stated in absolute framing terms rather than in relative framing terms, and in relative framing terms versus the control scenario.*

III. METHODOLOGY

I test my hypotheses via a 2 (absolute framing – absent vs. present) x 2 (relative framing – absent vs. present) between-subjects experiment that I administer to 124 experienced audit professionals. On average, participants have 4.3 years of work experience, with 70 percent at the senior associate level and 27 percent at the manager level. Table 1 contains demographic information regarding my participants. Overall, the participants appear to have sufficient experience with auditing complex revenue recognition estimates, and their backgrounds are similar to those from other estimate auditing studies (e.g., Griffith 2018; Griffith et al. 2015).[17]

I administer the instrument online via Qualtrics and collect data between June-October 2022. Participants first read background information regarding PhoneCo, a cell phone manufacturing company. Next, they read the manipulation text. This text includes either the control language that does not contain statistical data (absence of absolute and absence of relative), solely absolute statistical framing (presence of absolute, absence of relative), solely relative statistical framing (presence of relative, absence of absolute), or combined absolute and relative statistical framing language (presence of both absolute and relative). Then participants proceed to review revenue recognition policy disclosures and variable consideration audit schedules and support, with the goal of assessing the amount of revenue that management has

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[16] Future research might examine the efficacy of a practice tool that would derive the relevant framing risks from what management has provided for auditors.

[17] A prior Big 4 colleague and current national consulting partner informally polled managers on her audit teams and confirmed that senior associates typically audit complex areas of revenue recognition like variable consideration. Therefore, both senior associates and managers should have experience with complex revenue recognition estimates.

recognized in its unaudited financial statements. The Appendix contains information from the experimental case.

Participants choose whether or not to propose an audit adjustment for revenue and, if so, for what amount, which serves as my primary dependent variable. I specifically use the amount by which participants determine management should adjust revenue downward relative to the correct answer. Participants next respond to several questions related to why they chose their adjustment amount, if applicable, the difficulty of the task, and open-ended questions regarding their decision-making process throughout the case. I code the responses to the open-ended questions regarding how participants calculate the adjustment or why they did not propose an adjustment, what questions they would like to ask management, and the information they used to make their decision and why. These responses help me glean further insights into the participants' decision-making process during the experimental task per Asay et al. (2021).

After completing the case, participants answer various attention check questions. These questions ask participants to indicate what type of revenue recognition issues the case presents and to recall information on the amount of statistical data and relevant change from the case. Participants also answer questions regarding the best method to select the case's sample, to gauge their general proficiency with probabilistic thinking and sampling. Participants next complete demographic questions and a statistical anxiety scale to determine their base level of comfort with statistical concepts. Lastly, I include three basic statistical numeracy tests from Schwartz et al. (1997) and Schwartz and Woloshin (2000) that 25 percent of doctors fail in their studies. The results will indicate how auditors' statistical numeracy compares to that of doctors and will provide an overall metric for their fluency with statistical calculations.

Figure 1 outlines my four conditions, and Figure 2 contains an experimental flowchart.

IV. RESULTS

Tests of Hypotheses

My hypotheses predict that the combined condition will lead to the highest quality auditor estimates (H1), followed by the absolute, relative, and control conditions in descending quality and size order (H2). These predictions reflect the impact of the statistical framing nudge on auditor decision-making as they assess the variable consideration estimate. Figure 3 graphically depicts my predictions and results.

Sample Construction

I collect 136 total responses. Nine participants answered nine or fewer out of 70 total questions and none of the attention check or demographic questions. I drop these observations due to a lack of information regarding how well these participants attended to the case and their experience with variable consideration. I also eliminate two responses where participants fail two out of three attention check questions. Five of the remaining participants were originally assigned to one condition when they initially accessed the experiment, but an issue with the reminders to complete the study via Qualtrics inadvertently led to their assignment to a different condition. Four of these five participants did not answer any questions when they first accessed the study, and at least two weeks lapsed between the two access dates. The fifth completed a majority of the questions on their first attempt, one week prior to the second attempt. Out of an abundance of caution, I remove this fifth potentially tainted response from my sample. After removing these 12 total responses, my sample size is 124.

Upon further examination of the results, I note that one response out of the 120 final sample includes an outlier adjustment amount of $7,090,000 within the combined condition. This adjustment amount is 5.5 standard deviations away from the combined condition mean, and

removing it reduces the mean standard error by 64 percent, which represents a large decrease (Judd, McClelland, and Ryan 2017). As such, I deem the adjustment to be a significant enough outlier to warrant its removal from the sample. The descriptive statistics in Table 2, Panel A exclude this outlier. I present my main results in Table 2, Panels B, C, D, and E with and without this outlier.

Lastly, there are four responses where the adjustment direction (i.e., increasing or decreasing revenue) and one response where the adjustment amount ($140 million vs. $1.4 million, i.e., a missing decimal) are inconsistent with the explanations that the participants provide for how they calculate their adjustments. I modify these adjustments to be consistent with the participants' explanations, while blind to their conditions.

Descriptive Statistics

Table 2 reports descriptive statistics and a two-way ANOVA analysis with absolute and relative framing as independent variables and the revenue adjustment as the dependent variable. Consistent with the hypothesized prediction, auditors in the combined condition report higher adjustments to revenue (M = $461,500) than auditors in all other conditions (M = $279,300-$425,500).

My original expectation was that the "highest quality" estimates would be the closest to the correct case answer I had determined of $280,000, which is solely based on a change in the percentage of variable consideration redemptions from 50 percent to 60 percent. In fact, out of 120 participants, 38 provide $280,000 as their adjustment estimate. Yet, per the descriptive statistics in Panel A, the combined condition leads to estimates that are much larger than $280,000 on average (M = $461,500 or 164.8 percent of $280,000), suggesting that the nudge did more than simply draw participants' attention to this 50 percent to 60 percent change. The

nudge appears to lead participants to question multiple assumptions in the case and thereby develop even more conservative estimates than I had expected.

Table 3 contains bivariate correlations. In addition to examining these correlations, I also compare the means for the listed variables such as audit experience and experience with variable consideration and determine that there are no statistical differences between conditions.

Open-Ended Response Coding

The experimental instrument contains three open-ended response questions that ask participants to discuss *a)* how they calculated their proposed adjustment to revenue (if they selected "Yes" for whether they would propose an adjustment, n = 96); *b)* what information they would like to ask PhoneCo's management more about; and *c)* what specific information from the case informed their assessment regarding PhoneCo's revenue recognition and why. Participant responses to these questions will indicate whether the statistical framing interventions help auditors better understand statistical information from the client, which will move them away from the anchor of management's estimate and underlying assumptions. This improved understanding will help auditors use base rates more effectively and thereby lead to higher-quality judgments. Table 4 contains descriptive statistics for participants' open-ended responses.

Upon reviewing the responses to question *a*, I note that participants often discuss the management assumptions that they find unreasonable and incorporate into or exclude from their variable consideration estimate calculations. As such, I code the responses to question *a* based on how many assumptions each participant questions as they calculate their adjustment; to question *b* based on the number of unique questions they would ask of management; and to question *c* based on the number of unique items that inform each participant's assessment. I code these responses blind to the condition for each participant.

For the responses to questions *b* and *c*, the results are highly variable and do not seem to follow a discernable pattern. In assessing the open-ended responses for question *a*, I note that participants who receive information in absolute framing terms via either the absolute or combined condition question more of management's assumptions (M = 1.04 and 1.03, respectively) than those in the relative and control conditions (M = .90 and .94, respectively), leading to higher adjustment estimates. This result indicates that the nudge is working more effectively than I had anticipated, causing participants to question multiple assumptions beyond the shift in the rebate redemption rate from 50 percent to 60 percent.

For example, some participants question whether customers could redeem rebates from prior quarters in the next fiscal year, despite the case indicating that those older rebates had expired, and others did not accept the assumption that one-third of the rebates had already been redeemed, leaving two-thirds of the rebate value as a variable consideration offset. Questioning these and other assumptions beyond the 50 percent redemption rate is appropriate for auditors as they audit complex estimates and consistent with PCAOB guidance to question <u>all</u> management assumptions when auditing estimates (PCAOB 2018a).

Based on this PCAOB guidance, the greater number of assumption questions and resultantly more conservative adjustment estimates leads to a preferred audit outcome and higher audit quality. While the mean differences are not significant per independent t-tests, I note that the number of assumptions that participants question appears to increase as their revenue recognition adjustment increases ($r = .468$, $p < .001$).[18] This result indicates that auditors generate more conservative assessments of management estimates when they question more of management's underlying assumptions. Table 5 presents the most common adjustment estimate

[18] All p-values are one-tailed, consistent with my directional predictions.

amounts and frequency of responses for each amount, along with the questioned assumptions that lead to each adjustment amount.

ANOVA Analysis

The ANOVA analysis examines the interaction of the absolute and relative statistical framing, which corresponds to the combined condition. Hypothesis 1 predicts that the combined condition will produce the highest quality estimates. I present the ANOVA analysis with and without outlier mean replacement in Table 2, Panels B and C. In reviewing my data to ensure that it meets the ANOVA requirement of normality within each condition, I note that the adjustment amounts contain a positive skew with concentrations around the $0 and $280,000 adjustment amounts. I therefore log-adjust the data using the formula $LNAmt = \ln((Amount / 20{,}000) + 20)$, where *Amount* represents the adjustment amount that each participant proposes. Dividing by 20,000 and adding 20 as a negative start results in a workable log-transformation range of 1-100.

I do not find support for my first hypothesis that the combined condition will produce better auditor estimates, as indicated by the results for the absolute-relative interaction both with the outlier and after removing the outlier ($p = .127$ and $p = .191$, respectively). However, I find a significant main effect in each analysis for the absolute condition ($p = .013$ and $p = .021$, respectively). This main effect indicates that either of the two conditions containing absolute statistical framing, namely both the combined and absolute conditions, produces larger adjustment estimates than either the solely relative or control conditions.

Jonckheere-Terpstra Test

The second hypothesis predicts that the combined condition will produce the largest adjustment amounts on average, followed by the absolute condition, the relative condition, and the control condition. To test my second hypothesis, I perform the Jonckheere-Terpstra test of

ordered alternatives. The Jonckheere-Terpstra test produces significant results ($z = 1.807$, $p = .036$) without the outlier, as shown in Table 2, Panel E, indicating support for Hypothesis 2. Results with the outlier are also significant and are reported in Table 2, Panel D.

If I add back the one potentially tainted response or the full complement of 12 dropped responses, the results from my ANOVA tests do not change. With these sample changes, the results from the Jonckheere-Terpstra tests of ordered alternatives are marginally significant and remain statistically significant, respectively ($p = .052$ with the one potentially tainted response and $p = .033$ with all 12 dropped responses included).

Other Results

My expectation was that the participants' difficulty rating for the case would be the lowest in the combined condition and highest in the control condition, with the absolute and relative conditions in between those two extremes. This difficulty rating would act as confirmation that the nudge was working as expected to ease auditors' estimate assessment. However, I find that the difficulty ratings are actually higher for the combined and absolute conditions, contrary to my expectations, but not significantly higher.

One additional unexpected outcome relates to the participants' results on numeracy tests. In prior studies, 25 percent of doctors failed at least one of three numeracy tests relating to 1) the likelihood of a coin flip outcome over 1,000 flips, 2) a lottery proportion calculation from a percentage, and 3) a percentage calculation from a lottery proportion. In my study, 33.3 percent of auditors fail at least one numeracy question, suggesting that auditors perform poorly on these basic numeracy tests compared to doctors, and 7.3 percent fail two of the questions. Of note, the worst numeracy test result occurs in the third question, which requires translating a proportion, similar to an absolute-framed statistic, to a percent probability; followed by the second question,

which requires translating a percent probability to a proportion. The rate of participants failing each of these tests was 19.5 percent and 11.4 percent, respectively, versus 9.8 percent for the first, simple coin flip question. These results seem to indicate that auditors possess a lower level of fluency with proportions and absolute framing as compared to other forms of statistics and overall less statistical fluency than I had expected auditors might demonstrate.

Table 6 presents the numeracy test results by condition. Interestingly, 33 out of the 41 participants who incorrectly answered at least one of the statistical numeracy questions provided an adjustment estimate response other than $280,000. These 33 participants include 13 or 46.4 percent of the 28 participants who answered that they would not book a revenue adjustment for variable consideration and 20 or 34.5 percent of the 58 participants who provided adjustment amounts other than either $0 or $280,000. These figures compare to 8 or 21.1 percent of 38 participants who incorrectly answered one of the statistical numeracy questions and provided a $280,000 adjustment response. There is a significant correlation ($r = .174$, $p = .027$) between participants answering at least one statistical numeracy question incorrectly and calculating an adjustment estimate other than $280,000. It is unclear whether this correlation is due to decision fatigue on the part of those who questioned more assumptions, leading to a higher adjustment estimate, or whether it indicates a general diminished fluency with statistical numeracy that was apparent in both the adjustment estimate calculations and the statistical numeracy question responses. Future research could probe the root cause underlying this correlation further.

V. CONCLUSION

My study uses statistical framing to help auditors make probabilistic judgments related to a new area of accounting in the revenue recognition standard ASC 606: variable consideration as a revenue recognition determinant. I find that absolute framing, as in either the combined or

absolute conditions, is the most effective in helping auditors make the probabilistic comparisons that this revenue recognition area requires, as compared against either the relative framing alone or an absence of framing. Absolute framing acts as an effective cognitive nudge to help offset anchoring and other biases that auditors typically demonstrate toward management estimates, leading to auditors making higher quality probabilistic judgments.

The new revenue recognition standard's complexity offers a variety of opportunities for future research. Ideas that build upon this study fall into three main categories: further studies on auditors' probabilistic thinking, other challenges that auditors face vis-à-vis the new revenue recognition standard, and general challenges to auditors' cognition from new and complex accounting standards. First, specific to this area of probabilistic judgments, future research could examine whether practice aids or translational tools incorporating this study's statistical risk framing help audit staff reframe statistical data rather than relying on management's communications. The numeracy test results from my study could inform future research on auditors' statistical fluency. Given that the world of auditing is becoming more focused on statistical thinking within and outside of data analytics, research could examine whether auditors would benefit from greater statistical training. Educators could specifically assess how auditors apply data analytics to probabilistic judgments and what training will enable this application. Future research could also examine to what extent the study's statistical risk framing nudges help to improve other estimates that have similar layers of complexity as variable consideration judgments, such as goodwill impairment assessments, which prior research shows also flummox auditors. Other complex estimates that require predictive and probabilistic auditor assessments and would be useful to examine with this statistical risk framing lens include contingency losses, collectability estimates, valuations, waterfall analyses, and going concern evaluations.

Regarding the broader revenue recognition standard, why are auditors still struggling with multi-element arrangements? Does ASC 606 help or hinder auditors' fraud detection? Does variable consideration that adds to revenue similarly flummox auditors, particularly with the incremental complexity related to the constraint on revenue recognition? My base rate differential is relatively small; do larger base rates or changes in base rates have a similar effect on auditor decision-making for variable consideration? Unrelated to auditors, do these forms of statistical risk framing affect management estimates related to variable consideration?

Regarding broader application to other accounting standards, how do auditors implement long, complex standards like ASC 606? Do auditors experience cognitive overload from such standards, and how can accounting firms mitigate cognitive overload via their training and communication programs? I look forward to pursuing these and other related research ideas related to revenue recognition and auditor application of new accounting standards in the future.

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APPENDIX

Experimental Instrument Excerpt

The parenthetical notes regarding which sentence represents each type of framing in the combined absolute and relative manipulation condition:

> PhoneCo is currently providing $50 rebates to customers for its latest phone model, the PhoneCo 7, which was released in October 2021. Customers have 90 days to submit paperwork to receive their rebates. Since the PhoneCo 6 was released at a similar time in the prior year (October 2020), PhoneCo believes the Q1 2022 rebate redemptions will be most similar to the Q1 2021 redemptions. The rebate amount, phone price, and sales levels are similar for the two models year-over-year as well. Approximately half of the PhoneCo 6 customers redeemed their rebates in 2021. PhoneCo uses the most likely method to determine how much of these instant credits will be redeemed, based on historical PhoneCo 6 rebate redemptions for the same quarter in the prior year:

2021 Redemption Quarter	# Phone Sale Units Subject to Rebate	# of Actual Rebates	x $150 per Rebate	PhoneCo 6 Actual Rebate Redemption Values	2021 Actual Quarterly Rebate Redemption Rate
Q1	20,000	10,000	x $150 =	$ 1,500,000	50%
Q2	25,000	11,250	x $150 =	$ 1,687,500	45%
Q3	26,000	13,000	x $150 =	$ 1,950,000	50%
Q4	28,000	15,400	x $150 =	$ 2,310,000	55%

> PhoneCo determines based on rebate activity since year-end that there is a 20% greater chance that customers will redeem rebates for the PhoneCo 7 versus the PhoneCo 6 last year, given that the advertising campaign for the PhoneCo 7 rebate offer was stronger. (*relative framing*) In other words, 6 out of 10 customers will redeem rebates for the PhoneCo 7 versus 5 out of 10 customers for the PhoneCo 6 last year. (*absolute framing*)[19]

This variable consideration example requires auditors to understand that the most likely method would result in using the Q1 data, with the highest likelihood of 55 percent similarity to the prior year. However, the manipulation indicates that recent experience shows that rebates will be 20 percent higher than the 50 percent redemptions that PhoneCo experienced in the prior year. The case also provides information regarding the expected number of PhoneCo 7 rebate redemptions and the estimated proportion of them that will remain outstanding at 12/31/2021, both of which represent information that participants must incorporate into their audit adjustment if they decide to propose one. While management recorded a $1.4 million variable consideration offset, representing 14,000 rebates x $150 x 2/3 estimate of outstanding redemptions at 12/31/2021,

[19] I vary the framing language to prevent ordering effects in the combined condition.

participants should propose an audit adjustment that is 20%, or $280K, higher.[20]

[20] The experimental case contains calculations for the preliminary $1.4 million variable consideration value.

FIGURES AND TABLES

FIGURE 1

Experimental Conditions

Condition	Risk Framing
Control	Relative -- Absolute --
Solely Relative Framing	Relative ✓ Absolute --
Solely Absolute Framing	Relative -- Absolute ✓
Combined Framing	Relative ✓ Absolute ✓

FIGURE 2

Experimental Flowchart

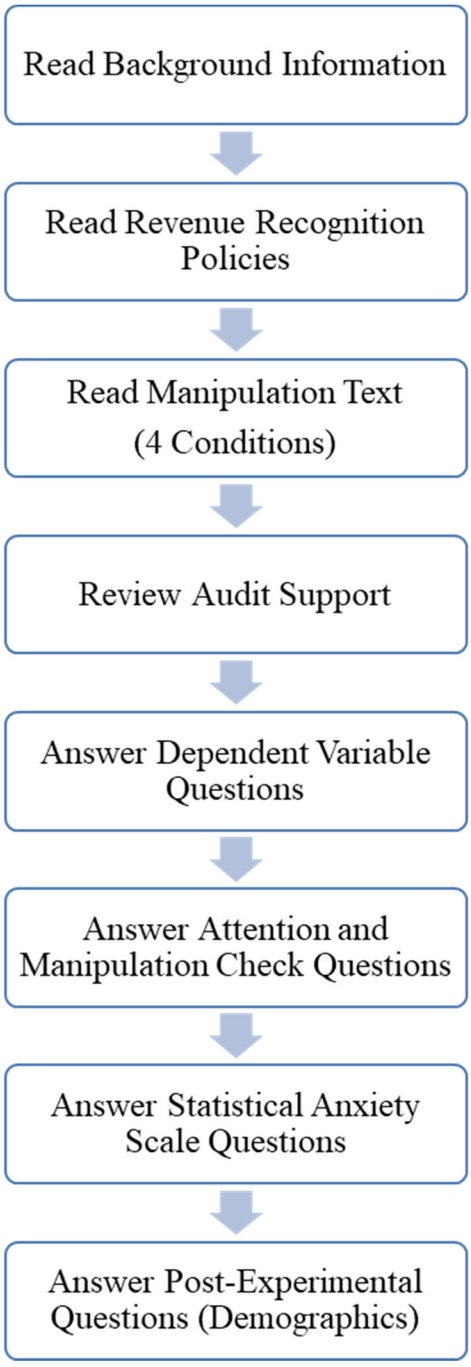
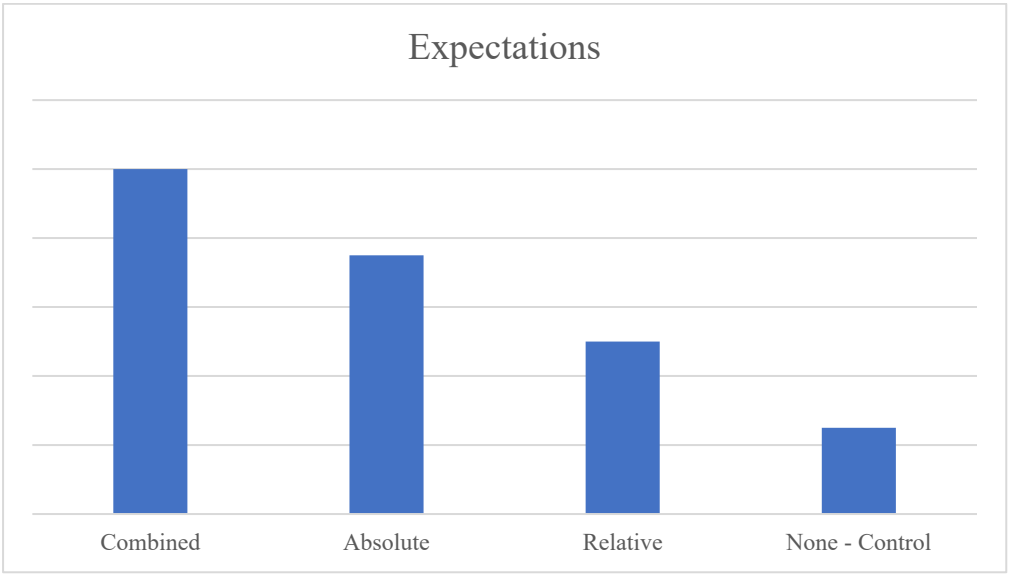


FIGURE 3

Expectations and Actual Results Graphs



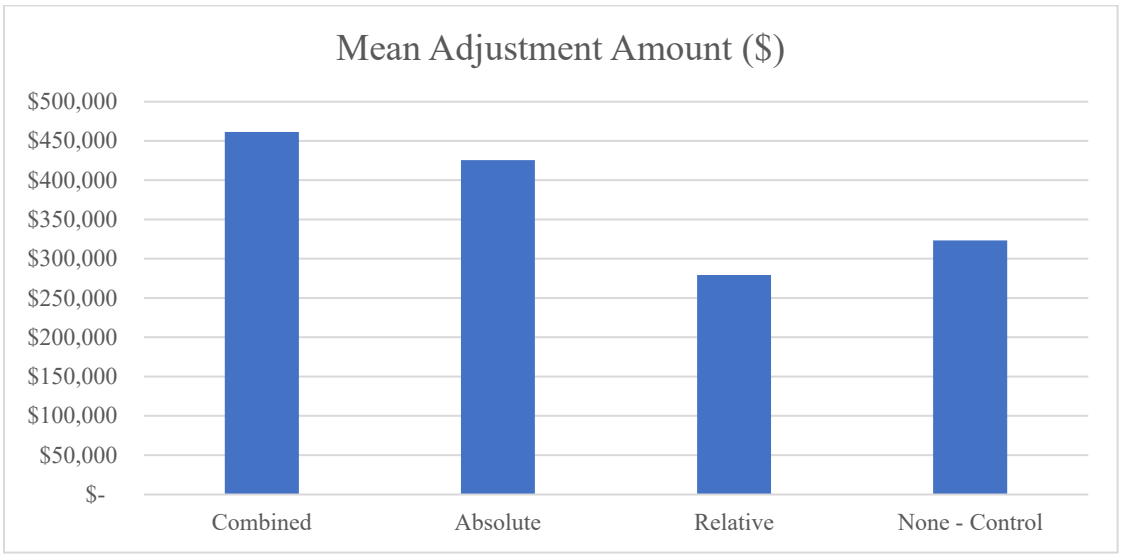


TABLE 1

Participant Demographics

	n=124	% Sample
Current job title		
Senior Associate	87	70%
Manager	34	27%
Other	3	3%
Highest degree obtained		
Masters	81	65%
Bachelors	41	33%
JD	2	2%
Audit firm size		
Big 4	93	75%
Other Large Firm	16	13%
Regional Firm	10	8%
Local Firm	5	4%
Gender		
Male	60	48%
Female	60	48%
Nonbinary or Unspecified	4	3%

	Mean	Median	Standard Deviation
Years of audit experience	4.43	4.00	1.71
Passed CPA exam	81%	100%	0.40
Passed audit section of CPA exam	88%	100%	0.33
Average age	28.8	27.0	5.70
Experience with complex revenue recognition (0 none to 10 great deal of experience)			
Variable consideration	2.89	3.00	2.70
Bundled contracts	3.36	3.00	3.07
Percent completion accounting	3.26	2.00	3.39
Milestone-based accounting	2.55	1.00	2.97
Accounting for customer acquisition costs	2.83	2.00	2.91
Revenue collectibility	5.27	5.00	3.35
Other	3.08	1.00	3.99

TABLE 2
Results by Framing Condition

Panel A: Descriptive Statistics for Variable Consideration Estimate Adjustments with Outlier Removed

Framing	Mean Adjustment Amount	Adjustment Standard Error	Correct Directional Response (Decrease Revenue)	n
Combined	$ 461,500	70,500	83%	35
Absolute	425,500	89,800	78%	28
Relative	279,300	61,900	69%	29
None - Control	323,400	66,600	71%	31
Overall	$ 375,500	36,400	76%	123

Panel B: Two-Way ANOVA+

Source of Variation	df	MS	F	p-value*
Absolute	1	1.552	5.086	**0.013**
Relative	1	0.013	0.041	0.420
Absolute x Relative	1	0.403	1.321	0.127
Error	120	0.305		

Panel C: Two-Way ANOVA with Outlier Removed+

Source of Variation	df	MS	F	p-value*
Absolute	1	1.129	4.248	**0.021**
Relative	1	0.005	0.017	0.449
Absolute x Relative	1	0.206	0.775	0.191
Error	119	0.266		

Panel D: Jonckheere-Terpstra Test for Ordered Alternatives+

Test	z-stat	n	p-value*
Is Combined > Absolute > Relative > Control?	1.983	124	**0.024**

Panel E: Jonckheere-Terpstra Test for Ordered Alternatives with Outlier Removed+

Test	z-stat	n	p-value*
Is Combined > Absolute > Relative > Control?	1.807	123	**0.036**

+ Dependent variable: Natural log of adjustment amount
** All p-values are one-tailed due to my directional predictions.*

TABLE 3
Correlation Matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	*AMOUNT*	1													
2	# Assumption Questions	**0.47*** **	1												
3	# Mgmt Info Requests	**-0.22** **	**-0.16***	1											
4	# Case Items Used	**-0.15***	-0.11	**0.39*** **	1										
5	Difficulty Rating	0.00	-0.11	**-0.16***	**-0.30*** **	1									
6	Big 4 Firm	0.03	**-0.21** **	**0.18** **	0.03	-0.06	1								
7	Years Audit Experience	-0.14	-0.01	-0.01	0.04	-0.01	**-0.17***	1							
8	Passed CPA Exam	-0.11	-0.05	0.07	-0.06	-0.06	**0.24*** **	-0.04	1						
9	Passed Audit Section	0.00	-0.05	-0.01	-0.06	0.01	**0.24*** **	-0.06	**0.76*** **	1					
10	Age - Years	-0.09	**0.16***	-0.11	0.06	**-0.23** **	**-0.32*** **	**0.48*** **	0.01	-0.09	1				
11	Var. Cons. Experience	-0.01	0.04	0.04	0.00	-0.14	0.03	**0.23** **	0.04	0.00	-0.05	1			
12	Anxiety Scale Overall	-0.12	-0.08	-0.07	-0.12	**0.35*** **	0.00	**0.16***	-0.03	0.09	-0.01	-0.04	1		
13	Numeracy # Wrong	-0.08	-0.08	0.00	0.07	-0.07	0.04	-0.04	-0.09	-0.05	0.01	-0.07	**0.17***	1	
14	Absolute Condition	**0.18** **	0.08	-0.07	**-0.20** **	0.09	-0.07	0.02	0.14	0.14	0.14	-0.07	0.11	-0.08	1
15	Relative Condition	0.01	-0.03	0.12	-0.03	-0.02	0.11	0.03	0.02	0.04	-0.06	0.06	**-0.17***	-0.05	0.06

Pearson correlations; significance noted at the *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ two-tailed levels.

TABLE 4
Open-Ended Response Results

Framing	Assumption Questions	Management Information Requests	Case Information Items Used in Assessment	n
Combined	1.03	1.83	2.00	36
Absolute	1.04	1.54	1.71	28
Relative	0.90	1.90	2.10	29
None - Control	0.94	1.81	2.48	31
Overall	0.98	1.77	2.08	124

TABLE 5
Adjustment Amount Frequencies and Related Questioned Assumptions

Adjustment Amount	Frequency	Questioned Assumptions
$ 210,000	3	50% redemption rate but used heuristic of 10% x $2.1M of rebate value (vs. increase in redemption rate from 50% to 60% of 20% x $2.1M x 2/3 = $280K)
280,000	38	50% redemption rate (moved to 60% per the case)
420,000	10	Both 50% redemption rate and 2/3 of those new outstanding redemptions
700,000	6	2/3 of all outstanding redemptions accrual estimate ($1.4M vs. $2.1M)
1,120,000	3	Both 50% redemption rate and 2/3 of all outstanding redemptions
1,400,000	7	Management already recorded a $1.4M adjustment

Notes: Five other adjustment amounts each appear twice in participant responses: -$140K, $140K, $263.2K, $277.2K, and $840K.
I have not tabulated the 28 $0 responses (i.e., for those who said they would not book an adjustment), as they questioned no assumptions.
The remaining 16 responses excluding the outlier were for unique amounts ranging from -$350K to $1.26M.

TABLE 6
Numeracy Test Results

Framing	All Correct	1 Wrong	2 Wrong	3 Wrong	No Response	n	% All Correct	% with 1+ Wrong
Combined	25	9	2	-	-	36	69.4%	30.6%
Absolute	20	5	3	-	-	28	71.4%	28.6%
Relative	19	7	3	-	-	29	65.5%	34.5%
None - Control	18	11	1	-	1	31	58.1%	38.7%
Overall	82	32	9	-	1	124	66.7%	33.3%

Note: 33 (80.5%) of the 41 participants who incorrectly answered at least 1 numeracy question provided an adjustment response other than $280K, including 13 (46.4%) of the 28 participants who provided $0 adjustment responses and 20 (34.5%) of the 58 participants who provided adjustment amounts other than $0 or $280K. Only 8 (21.1%) of the 38 participants who answered $280K for the adjustment amount answered any of the numeracy questions incorrectly.

EXPERIMENTAL INSTRUMENT

UNIVERSITY OF WISCONSIN-MADISON
Research Participant Information and Consent Form

Title of the Study: Auditing Revenue Recognition

Primary Contact: Amanda Carlson (phone: 617-877-1641; email: agcarlson@wisc.edu)

Principal Investigator: Brian Mayhew (email: brian.mayhew@wisc.edu)

DESCRIPTION OF THE RESEARCH

You are invited to participate in a research study about how auditors approach and examine the area of revenue recognition. You have been asked to participate because of your experiences as an auditor. This research will be conducted online, from your own personal device.

WHAT WILL MY PARTICIPATION INVOLVE?

If you decide to participate in this research, you will be asked to assume you are auditing a hypothetical company, review information about that company, and then answer questions about that company. Your participation will last approximately 20-25 minutes.

ARE THERE ANY RISKS TO ME?

The risks associated with this study are minimal. We will not collect your name or contact information to preserve your anonymity.

ARE THERE ANY BENEFITS TO ME?

There are no expected direct benefits to you from participation in this study.

COMPENSATION

If you submit complete answers for the study, you will receive a $20 Amazon gift card to compensate you for your time. This gift card will be sent to the email at which you were contacted to request your participation in the study within 6-8 weeks of your completion of the study.

HOW WILL MY ANONYMITY BE PROTECTED?

This study is anonymous. We will not collect your name or other identifiable information. The information you provide will only be used for the purposes of this study. You can decide to end your participation at any time.

WHOM SHOULD I CONTACT IF I HAVE QUESTIONS?

You may ask any questions about the research at any time. If you have questions about the research before or after the study, you should contact researcher Amanda Carlson at 617-877-1641 or agcarlson@wisc.edu.

If you have any questions about your rights as a research participant or have complaints about the research study or study team, call the confidential research compliance line at 1-833-652-2506. Staff will work with you to address concerns about research participation and assist in resolving problems.

Your participation is completely voluntary. If you begin participation and change your mind, you may end your participation at any time without penalty. By clicking continue and completing the survey, you will indicate your consent to participate in this study.

Continue Button

Case Information

PhoneCo manufactures and sells mobile phones internationally to customers ranging from retailers and cellular service providers to individuals. You are the Senior Associate on the December 31, 2021 PhoneCo audit engagement. **Your task is to test PhoneCo's revenue recognition.** The table below displays PhoneCo's key financial statement figures for the 2021 fiscal year (unaudited) and the 2020 fiscal year (audited).

PhoneCo, Inc. (Dollars in 000s)	12/31/2021 (Unaudited)	12/31/2020 (Audited)
Total revenues	$198,945	$199,501
Gross margin	97,813	95,057
Net income	20,954	19,721
Total assets	42,456	33,816
Accounts receivable	26,951	26,593
Allowance for doubtful accounts	1,701	1,683

PhoneCo has a market capitalization of approximately $400 million, and their stock is trading at approximately $10 per share. There are 10 analysts covering PhoneCo, and their consensus estimate for 2021 is $0.50 EPS. PhoneCo's preliminary earnings for 2021 indicate that they surpassed the 2021 target, with EPS of $0.55.

The overall planning materiality level is $425,000 (approximately 1% of total assets), the tolerable misstatement is $250,000, and posting/performance materiality is $21,000. Revenue is a significant account because it is both quantitatively material and qualitatively material due to the complexity of PhoneCo's revenue recognition. The audit team has assessed the risk of material misstatement for PhoneCo at a medium-high level (70%).

Next, you will review client-prepared audit support for the revenue area, including an excerpt from PhoneCo's variable consideration policy. Note that the information provided to you in this case represents less detail than you would see during a typical audit, but the information will be critical to your decision-making for this case. In summary, your remaining tasks include:

1. Review the background information
2. Review the revenue recognition policy excerpt
3. Review the audit support for variable consideration

Please document your work and conclusions as instructed after reading the case.

Company Background Information:

- PhoneCo's product lines range from basic flip-phones to top-of-the-line smartphones. The average mobile phone price is $695. PhoneCo releases new phones several times per year to meet market demand.

- PhoneCo sells mobile phones to major cellular phone service providers, including AT&T, Verizon, T-Mobile, and Sprint, and large retail customers, including Target, Amazon, Best Buy, and Walmart. PhoneCo also sells to smaller retailers and directly to individual customers.

Revenue Recognition Policy Excerpt:

- **Variable Consideration:** From time to time, PhoneCo offers rebates that are accounted for as variable consideration that offsets revenue. The value of the rebates is determined by calculating various redemption likelihood levels and using the most likely level (that is, the highest likelihood percentage) to calculate the estimated reduction in revenue. PhoneCo makes assumptions regarding the number and timing of future expected rebate redemptions in its variable consideration calculations.

Audit Support for Variable Consideration

Message to participants: The following information is important for you to read carefully and understand. Please pay particular attention to this information.

- At the beginning of the audit engagement, the PhoneCo Controller tells you that she just received a report of rebate redemptions from the external rebate processing company for the most recent PhoneCo model 7 (PhoneCo 7). She based the original variable consideration calculation for 12/31/2021 on last year's rebate activity for the prior PhoneCo model 6 (PhoneCo 6), since she did not yet have the rebate redemption report.
- She reviewed the report's rebate activity for the past four months and determined that (Note: participants will be randomly assigned to see one of the four following statements, without the underlined word at the beginning of each bulleted statement):
  - Control: Customers will be more likely to redeem rebates for the PhoneCo 7 than the PhoneCo 6 last year because the advertising campaign for the PhoneCo 7 rebate offer was stronger. Information regarding these levels of likelihood is available in the table and supporting information that follows.
  - Absolute: 6 out of 10 customers will redeem rebates for the PhoneCo 7 versus 5 out of 10 customers for the PhoneCo 6 last year, given that the advertising campaign for the PhoneCo 7 rebate offer was stronger.
  - Relative: There is a 20% greater chance that customers will redeem rebates for the PhoneCo 7 versus the PhoneCo 6 last year, given that the advertising campaign for the PhoneCo 7 rebate offer was stronger.
  - Combined: There is a 20% greater chance that customers will redeem rebates for the PhoneCo 7 versus the PhoneCo 6 last year, given that the advertising campaign for the PhoneCo 7 rebate offer was stronger. In other words, 6 out of 10 customers will redeem rebates for the PhoneCo 7 versus 5 out of 10 customers for the PhoneCo 6 last year.

The Controller based the 12/31/2021 preliminary unaudited calculations for variable consideration on 2021 actual rebate redemptions, as shown in the following table, since she had not yet received the new rebate report.

2021 Variable Consideration Calculations:

2021 Redemption Quarter	# Phone Sale Units Subject to Rebate	# of Actual Rebates	x *$150* per Rebate	PhoneCo 6 Actual Rebate Redemption Values	2021 Actual Quarterly Rebate Redemption Rate
Q1	20,000	10,000	*x $150* =	$ 1,500,000	50%
Q2	25,000	11,250	*x $150* =	$ 1,687,500	45%
Q3	26,000	13,000	*x $150* =	$ 1,950,000	50%
Q4	28,000	15,400	*x $150* =	$ 2,310,000	55%

The Controller assessed the likelihood of the Q1 2022 rebate redemptions **being similar** to the rebates from each 2021 quarter as follows:

2021 Redemption Quarter	Likelihood of Q1 2022 Rebates Being Similar to Rebates for Each 2021 Quarter
Q1	40%
Q2	10%
Q3	20%
Q4	30%

Per PhoneCo's variable consideration accounting policy, the Controller uses the Q1 2021 "most likely" rebate redemption level to calculate the variable consideration revenue offset associated with the Q1 2022 rebate redemptions. Note that customers will redeem rebates from Q4 2021 (October through December 2021) phone sales in Q1 2022, given the 90-day rebate redemption period. Because sales are higher toward the end of each quarter and because customers often wait to redeem their rebates until close to the 90-day submission deadline, 2/3 of the Q4 rebates are estimated to be outstanding at 12/31/2021. As such, PhoneCo is recording a revenue offset for 2/3 of one quarter's or 90 days' worth of expected rebate redemptions.

Q4 2021 Variable Consideration Revenue Offset Estimate Calculation for Q1 2022 Expected Redemptions:

2022 Redemption Quarter	# Phone Sale Units Subject to Rebate	# of Estimated Rebates	x $150 per Rebate	PhoneCo 7 Estimated Rebate Redemption Value	2021 Actual Quarterly Rebate Redemption Rate
Q1	28,000 (from Q4)	14,000	*x $150 =*	**$ 2,100,000**	50%
			x 2/3 of rebates outstanding at 12/31/2021 =	**$ 1,400,000**	

$1,400,000 = Variable consideration revenue offset estimate at 12/31/2021

Supporting Information from the Controller:

- PhoneCo is currently providing $150 rebates to customers for its latest phone model, the PhoneCo 7, which the company released in October 2021. Rebates for the PhoneCo 6 last year were also $150 apiece. The only rebates that PhoneCo is offering beginning in October 2021 are for PhoneCo 7, and they are the only rebates requiring a variable consideration revenue offset estimate at 12/31/2021.
- Customers have 90 days to submit paperwork to receive their rebates.
- Since they released the PhoneCo 6 at a similar time in the prior year (October 2020), PhoneCo originally believed the Q1 2022 rebate redemption level would be most similar to the Q1 2021 redemptions. The rebate amount, phone price, and sales levels are similar for the PhoneCo 6 and PhoneCo 7 as well.
- Approximately half of the PhoneCo 6 customers redeemed their rebates in 2021.
- The rebate redemption report received after year-end indicates that the number of PhoneCo 7 customers redeeming their rebates is closer to 60%.
- PhoneCo uses the most likely value method to determine how much of these rebates customers will redeem, per their Variable Consideration Policy.

Questions:

1. Will you propose an audit adjustment for PhoneCo's 2021 revenue recognition?

Yes
No

2. If Yes: Will the proposed audit adjustment increase or decrease PhoneCo's revenue?

Increase
Decrease

3. By what amount will the proposed audit adjustment increase or decrease PhoneCo's revenue?

Amount:

4. If Yes: How did you calculate the adjustment?

5. If No: How did you reach your conclusion regarding PhoneCo's revenue?

6. What information would you like to ask PhoneCo's management more about?

7. What specific information from the case informed your assessment regarding PhoneCo's revenue recognition and why?

8. How difficult was it to assess PhoneCo's revenue recognition?

0 not at all difficult
1
2
3
4
5
6
7
8
9 very difficult

9. Why did you choose your difficulty rating in the prior question?

10. What percentage of customers does PhoneCo initially expect to take advantage of the rebate offer for the PhoneCo 7 model?

100%
75%
50%
20%
Not sure

11. What is the company's industry?

Utilities
Mobile phone manufacturing
Internet service provider
Technology consulting

12. It is important to read questions carefully. If you are paying attention, select 2020 below.

2020
2021
2022

13. What sampling technique would be most appropriate for PhoneCo's revenue testing (vary response ordering in Qualtrics)?

Statistical
Same sample size number as last year
Haphazard

14. How frequently have you used the following types of sampling techniques on your audit engagements in the past year (0-100% bars for each line; should add up to 100% total)?

Statistical
Same sample size number as last year
Haphazard

Demographic Questions:

15. Current job title:

16. Industry Area(s) of Expertise

17. How would you describe the size of the accounting firm where you work?

Big 4 Firm
Other Large International or National Firm (e.g., RSM, Grant Thornton, BDO, etc.)
Regional Firm
Local Firm

18. How long have you held your current position at your current employer? ___ Years ___ Months

19. How many total years/months have you worked as an auditor? ___ Years ___ Months

20. Check highest degree earned:

B.S./B.A./B.B.A.
M.S./M.A.
MBA
PhD
Other _____

21. What was your undergraduate major (check all that apply)?

Accounting
Non-Accounting Business
Sciences or Social Sciences
Humanities
Other _____

22. Have you passed all of the parts of the CPA exam? ____ Yes ____ No

23. Have you passed the Audit section of the CPA exam? ____ Yes ____ No

24. Gender

Female
Male
Gender Non-Binary
Prefer not to answer

25. Age _____

26. Which of the following areas related to revenue recognition have you audited previously? Please rate your level of experience for each area (scale from 0 to 10).

Bundling of products and/or services in the same revenue arrangement
Percentage of completion accounting
Milestone-based accounting
Variable consideration
Accounting for customer acquisition costs
Accounting for revenue collectibility
Other

Statistical Anxiety Questions:

27. Measure level of anxiety with each of these questions on an 11-point Likert scale (0 no anxiety to 10 high anxiety):

Studying for an examination in a statistics course
Interpreting the meaning of a table in a journal article
Going to ask my statistics teacher for individual help with material I am having difficulty understanding
Doing the coursework for a statistics course
Making an objective decision based on data
Reading a journal research article that includes some statistical analyses
Trying to decide which analysis is appropriate for my research project
Doing an examination in a statistics course
Reading an advertisement for a car which includes figures on miles per gallon, depreciation, etc.
Walking into the room to take a statistics test
Interpreting the meaning of a probability value once I have found it
Arranging to have a body of data put into the computer
Finding that another student in class got a different answer than I did to a statistical problem
Determining whether to reject or retain the null hypothesis
Waking up in the morning on the day of a statistics test
Asking one of your lecturers for help in understanding a printout
Trying to understand the odds in a lottery
Watching a student search through a load of computer printouts from his/her research
Asking someone in the computer lab for help in understanding a-printout
Trying to understand the statistical analyses described in the abstract of a journal article
Enrolling in a statistics course
Going over a final examination in statistics after it has been graded
Asking a fellow student for help in understanding a printout

28. Measure level of agreement with each of these questions on an 11-point Likert scale (0 strongly disagree to 10 strongly agree):

I am a subjective person, so the objectivity of statistics is inappropriate for me
I have not done math for a long time. I know I will have problems getting through statistics
I wonder why I have to do all these things in statistics when in actual life I will never use them
Statistics is worthless to me since it is empirical, and my area of specialization is abstract
Statistics takes more time than it is worth
I feel statistics is a waste
Statistics teachers are so abstract they seem inhuman
I cannot even understand secondary school math; how can I possibly do statistics?
Most statistics teachers are not human
I lived this long without knowing statistics, why should I learn it now?
Since I have never enjoyed math, I do not see how I can enjoy statistics
I do not want to learn to like statistics
Statistics is for people who have a natural leaning toward math
Statistics is a pain I could do without
I do not have enough brains to get through statistics
I could enjoy statistics if it were not so mathematical
I wish the statistics requirement would have been removed from my academic program
I do not understand why someone in my field needs statistics
I do not see why I have to fill my head with statistics. It will have no use in my career
Statistics teachers speak a different language
Statisticians are more number-oriented than they are people-oriented
I cannot tell you why, but I just do not like statistics
Statistics teachers talk so fast you cannot logically follow them
Statistical figures are not fit for human consumption
Statistics is not really bad. It is just too mathematical
Affective skills are so important in my (future) profession that I do not want to clutter my thinking with something as cognitive as statistics
I am never going to use statistics so why should I have to take it?
I am too slow in my thinking to get through statistics

29. Statistical Numeracy Questions:

Imagine that we flip a fair coin 1,000 times. What is your best guess about how many times the coin would come up heads in 1,000 flips? ____times out of 1,000.

In the Big Bucks Lottery, the chance of winning a $10 prize is 1%. What is your best guess about how many people would win a $10 prize if 1000 people each buy a single ticket to Big Bucks? ____person(s) out of 1,000.

In the Acme Publishing Sweepstakes, the chance of winning a car is 1 in 1,000. What percent of tickets to the Acme Publishing Sweepstakes win a car? ____%.