6-2024

The effect of PCAOB inspections on corporate innovation: Evidence from deficiencies about the valuation of intangibles

Jungbae KIM
Singapore Management University, jungbaekim@smu.edu.sg

The Effect of PCAOB Inspections on Corporate Innovation: Evidence from Deficiencies about the Valuation of Intangibles

Jungbae Kim*

July 31, 2022

Abstract

I examine the economic consequences on corporate innovation when PCAOB inspections cite auditors for insufficient procedures in auditing the valuation of intangibles. I find that the clients of deficient auditors recognize larger and timelier impairments of intangibles, suggesting that affected auditors increase scrutiny about the valuation of intangibles in subsequent audits. This effect obtains only for valuation-related deficiencies and is salient for the clients of auditors who receive such deficiencies repeatedly. Also, I document real effects that the clients of deficient auditors exhibit less use of external M&A deals–which yield recognizable intangibles whose valuation is subject to increased auditor scrutiny. Overall, these results suggest that the intervention by the PCAOB effectively alters the measurement of intangibles and perhaps unintentionally affects how clients invest in corporate innovation.

Keywords: PCAOB, Innovation, Intangibles, Impairments, M&A, R&D
JEL Codes: G32, G34, L24, M4, O32

*School of Accountancy, Singapore Management University (jungbaekim@smu.edu.sg). I greatly appreciate my dissertation committee Baruch Lev (Chair), Stephen Ryan, Yiwei Dou, and William Greene for their guidance and support. I am especially grateful to Lakshmanan Shivakumar (Editor) and an anonymous reviewer for their helpful suggestions. I thank Aleksander Aleszczyk, Daniel Aobdia, Hye Sun Chang, Christine Cuny, Ilan Guttman, Heedong Kim, Aaron Yoon, and seminar participants at Chinese University of Hong Kong, City University of Hong Kong, CKGSB, Singapore Management University, Hong Kong Baptist University, New York University, and Tilburg University for helpful comments. I gratefully acknowledge financial support from the Fubon Center for Technology, Business and Innovation and the Center for Global Economy and Business at the Stern School of Business, and the Samsung Ph.D. Scholarship Foundation. I also thank three anonymous PCAOB inspectors for sharing their experience in implementing inspections and Serena Lee and Joyce Park for sharing their experience in receiving inspections.

1 Introduction

Companies increasingly rely on external resources for corporate innovation (Chesbrough, 2003).[1] However, anecdotal evidence and prior studies suggest significant agency costs resulting from various sources, including manager's empire-building incentives and optimism (Jensen, 1986; Masulis et al., 2007; Malmendier and Tate, 2008; Ferris et al., 2013).[2] The PCAOB conducts periodic inspections of audit engagements to detect deficiencies in procedures performed by auditors. The PCAOB, although unintended, has the potential to curb such agency costs through auditors because their inspection reports often mention audit deficiencies regarding the valuation of intangibles. In this paper, I examine whether and how these deficiencies influence audit clients' corporate innovation.

To shed light on how PCAOB inspections influence audit clients' innovation, I first examine the consequences of audit deficiencies about the valuation of intangibles on audit clients' intangible impairments. Prior studies show that managers exploit their discretion to delay the recognition of intangible impairments (e.g., Beatty and Weber, 2006; Li and Sloan, 2017). The deficiencies mention a lack of critical review of valuation assumptions or a failure to consider external evidence that contradicts managerial estimates.[3] Deficient auditors may subsequently scrutinize the valuation of intangibles by implementing more audit procedures

[1] Bena and Li (2014) mention that U.S. public firms pursue innovation in about two-thirds of all mergers between 1984 and 2006. Given the increasing trend for innovation via M&As (BCG, 2017; Deloitte, 2017), this ratio becomes a lower bound of M&As related to innovation in my study.

[2] For example, when Marissa Mayer stepped down from the CEO of Yahoo!, which was acquired by Verizon in 2017, commentators criticized that she was reluctant to admit that her major acquisitions had failed to help Yahoo! catch up with technological changes, resulting in untimely recognition of intangible impairments (Gu and Lev, 2011).

[3] In this paper, I refer to intangibles in general because the audit deficiencies mostly mention goodwill and other intangibles together or do not distinguish between goodwill and other intangibles. The valuation of intangibles other than goodwill is also subject to managerial incentives to delay the recognition of intangible impairments.

to remediate their deficiencies, leading their clients to recognize more impairments of intangibles. The remediation of audit deficiencies helps auditors protect their reputations for competence and avoid disciplinary actions from the PCAOB. However, auditors may not remediate these deficiencies if they doubt inspectors' judgments that stricter audit procedures are necessary (Johnson et al., 2019; Westermann et al., 2019). Also, auditors may hesitate to become stricter in order to retain their clients, who are concerned about negative market reactions to write-offs of intangibles (Li et al., 2011).

Therefore, I empirically examine the effect of audit deficiencies regarding the valuation of intangibles on clients' subsequent recognition of intangible impairments. The deficiencies are staggered across different auditors and often occur repeatedly for the same auditor over time. Specifically, among 38,978 company-year observations that consider M&As a viable strategy, over the sample period from 2001 to 2015, I find that 32.1 percent of company-year observations have auditors deemed deficient in their audits of intangible valuation, including 22.6 percent of company-year observations with deficient auditors in both the current and the previous year (i.e., repeated deficiency). Hence, following the prior literature (Heider and Ljungqvist, 2015; Ljungqvist et al., 2017), I use a difference-in-differences specification in a first-differenced form that suits to address the treatment structure with repetitions and reversals.

I find that the clients of deficient auditors recognize more intangible impairments, reflecting increased auditor scrutiny of the valuation of intangibles in subsequent audits. This result is consistent with the notion that the remediation of audit deficiencies involves additional audit procedures that effectively address inspectors' concerns, not just more documentation of audit procedures (DeFond and Lennox, 2017). In terms of economic significance, for compa-

nies that have already recognized non-zero impairment losses, audit deficiencies increase the amount of intangible impairments by 6 percent. Also, the proportion of companies with non-zero intangible impairments increases by 10 percent. The result suggests that auditors, in general, overcome the concerns about dismissal risk and convince their clients to report lower valuation estimates of intangibles. To further investigate the nature of increased intangible impairments, I use the framework of Li and Sloan (2017) to test whether audit deficiencies regarding the valuation of intangibles lead to timelier recognition of impairment losses. I find that the remediation of deficiencies strengthens the association between economic signals for impairment losses and impairments recognized by the clients of deficient auditors, suggesting that PCAOB inspections contribute to mitigating the untimely recognition of impairment losses in the post-SFAS 142 period.

I examine repeated deficiencies to check whether these deficiencies, which are more likely to arise from systematic audit failures in the valuation of intangibles, have stronger effects (Aobdia, 2020). I find greater economic significance than in the main test, corroborating the premise in the PCAOB literature examining Part 1 findings that deficient auditors increase scrutiny across their clients in subsequent audits (DeFond and Lennox, 2017; Hanlon and Shroff, 2020; Aobdia et al., 2021). Also, these results suggest that deficient auditors vary the degree of remediation, increasing the level of scrutiny further when the initial attempt to remediate turned out to be insufficient and thus they can better persuade their clients of the need for more audit procedures. In an additional test, I conduct a placebo test to ensure that the main result is attributable to audit deficiencies specific to the valuation of intangible assets. Using audit deficiencies related to intangibles but irrelevant to valuation issues as placebo treatments, I find an insignificant change in intangible impairments.

This finding highlights that the increase in intangible impairments is indeed attributable to valuation-related deficiencies.

Next, I examine the real effects of audit deficiencies regarding the valuation of intangibles on audit clients' investments in corporate innovation. The results about intangible impairments suggest that auditor scrutiny effectively reduces managerial discretion in the valuation of intangibles and leads intangibles to be expensed to a greater extent and in a timelier fashion. Importantly, the decrease in managerial discretion may primarily affect external innovation strategies (e.g., M&A deals) in which companies recognize intangible assets that are subject to valuation and impairment tests.[4] In essence, the increased auditor scrutiny due to PCAOB inspections can heighten the perceived cost of external innovation strategies. Although deficient auditors do not dictate how to conduct innovation activities, managers are concerned about the contractual and valuation implications of intangible impairments on financial reporting (Kanodia et al., 2004; Kanodia and Sapra, 2016).[5] As a result, the clients of deficient auditors are expected to reduce external M&A deals for corporate innovation.

To test the effect of audit deficiencies on external innovation strategies, I examine M&A deals that lead to an increase in intangibles for acquirers. I find that the clients of deficient auditors subsequently reduce such M&A deals by 6 percent. Given the decrease in M&A deals for corporate innovation, I proceed to examine the effect on in-house R&D activities, which is *ex ante* unclear. If in-house R&D activities substitute for the innovation capabilities otherwise acquired by M&A deals (Williamson, 1985; Pisano, 1990), I expect

[4]In contrast, audit deficiencies regarding the valuation of intangibles may have almost no effect on internal innovation strategies (e.g., in-house R&D) because most internally developed intangibles are expensed immediately under U.S. GAAP. Although U.S. GAAP allows the capitalization of internally developed software, the amount is economically insignificant in general.

[5]Prior studies suggest that goodwill impairments lead to decreases in CEO compensation and negative reactions in the stock market (Li et al., 2011; Darrough et al., 2014).

to find an increase in R&D expenditures. However, this substitution effect may not occur if external innovation activities complement or even trigger internal innovation activities, as evidenced in recent management and corporate finance literature (Cohen and Levinthal, 1990; Cassiman and Veugelers, 2006; Rothaermel and Alexandre, 2009). Therefore, the effect on in-house R&D activities calls for an empirical test. I find that audit deficiencies do not significantly affect in-house R&D expenditures. In additional tests, I find corroborating evidence from the joint venture investments and the results remain similar with alternative definitions of M&A deals intended for corporate innovation.[6] Overall, the results suggest that the remediation of audit deficiencies regarding the valuation of intangibles influences corporate innovation strategies.

This paper makes several contributions to the literature. First, this paper extends the real effects literature of PCAOB inspections by examining investment decisions regarding corporate innovation (Leuz and Wysocki, 2016). Specifically, this paper provides the initial evidence on how U.S. clients invest in corporate innovation.[7] The effects on investment in corporate innovation are arguably unintended consequences of PCAOB inspections. An empirical examination of unintended regulatory outcomes is important because regulators rarely have internal systems to monitor these consequences, and is in line with the recent interest of regulators and academics.[8] This setting is also advantageous to isolate regulatory

[6]Joint ventures fall between M&As and R&D expenditures in that joint venturers share corporate resources for innovation, but none of them individually control joint ventures. The accounting treatment for joint ventures reflects this economic nature–joint venturers recognize intangibles only in limited circumstances (see Section 2.2 for details).

[7]Shroff (2020) provides the real effects of non-U.S. audit clients' investment and financing decisions. Aobdia et al. (2021) provide evidence on the operating decisions of U.S. financial institutions.

[8]I use the term "unintended" in the sense that the PCAOB is primarily concerned about the effect of their inspections on audit quality, not necessarily on real decisions of audit clients, without implying negative consequences. The findings of this paper, in fact, suggest that the consequences of audit deficiencies regarding the valuation of intangibles are positive.

interventions from economic fundamentals because the relation between the motives and outcomes of regulatory activities is less endogenous.

Second, this paper shows the governance role of auditors when companies increasingly rely on external resources for innovation in recent decades. The innovation literature and numerous anecdotal cases show the frequent and increasing use of M&A deals, which allow companies to implement innovation strategies faster than in-house R&D activities (e.g., Chesbrough, 2003; Brav et al., 2018).[9] I document that the remediation of audit deficiencies regarding the valuation of intangibles creates an incentive to curb excessive use of external innovation strategies, which often suffer from agency costs such as empire-building or optimistic bias (Jensen, 1986; Malmendier and Tate, 2008).

Third, I show that PCAOB inspections mitigate the untimely recognition of intangible impairments in the post-SFAS 142 period (Hayn and Hughes, 2006; Li et al., 2011; Li and Sloan, 2017). Although the PCAOB does not change accounting standards through its inspections, their regulatory treatments of audit practices influence the timeliness of recognizing intangible impairments. This paper also extends the literature on the effect of audit deficiencies on clients' fair value estimates by documenting the evidence about the valuation of intangibles (Drake et al., 2016; Aobdia et al., 2021).

The remainder of this paper proceeds as follows. Section 2 discusses the background of PCAOB inspections and intangible accounting. Section 3 reviews prior studies and develops hypotheses. Section 4 explains the research design to test hypotheses. Section 5 shows the effect of audit deficiencies regarding the valuation of intangibles on intangible impairments and innovation strategies. Section 6 conducts additional analyses, and Section 7 concludes.

[9] PwC (2014) and BCG (2017) report an increasing trend of technology-driven deals since the early 2000s.

2 Background

2.1 PCAOB

After a series of corporate scandals in the Enron era, the Sarbanes-Oxley Act (SOX) created the PCAOB to restore investor confidence in financial reporting. To improve the audit quality of U.S. public companies, the PCAOB initiated its auditor inspection program in 2003. The PCAOB expended $220.9 million on this program in 2016, about 86% of its total budget. PCAOB inspections are annual for auditors with more than 100 public audit clients and triennial for smaller auditors. Several studies in the PCAOB literature document the effect of auditor inspections on audit quality. For example, DeFond and Lennox (2017) show that auditors with deficiencies in their internal control audits are subsequently more likely to issue adverse internal control opinions to their clients with inferior internal control systems. Also, they show that deficient auditors subsequently charge more audit fees. Fung et al. (2017) and Krishnan et al. (2017) show an overall improvement in audit quality from the international auditor inspection program. These results suggest that auditors exert costly effort to remediate their deficiencies and thereby improve the quality of their audit services.

The PCAOB dispatches a team of inspectors to the audit firm's offices and reviews a sample of audits to identify potential deficiencies in individual audits (Part I findings). This inspection fieldwork is targeted at audit engagements completed after the previous inspection but before the current inspection. Figure 1 illustrates the timeline of PCAOB inspections. The inspection fieldwork conducted in 2011 was targeted at audit engagements in 2010. The inspectors discuss identified deficiencies with auditors during and after the fieldwork period to better understand the economic significance of these deficiencies. If the inspectors

conclude that the deficiencies are material, the official inspection reports discuss the contents of deficiencies. Before the reports are released, audit firms also communicate with their clients about ongoing issues and inspection processes through the audit committee (PCAOB, 2012). The inspection reports are publicly released on the PCAOB website typically in the next year. Part I findings are disclosed in detail after anonymizing client names. The PCAOB has the authority to discipline audit firms or individual auditors for noncompliance with the inspection program.[10]

2.2 Accounting for Intangibles

U.S. GAAP has traditionally not allowed the capitalization of most internally developed intangibles. Therefore, intangibles are usually recognized on the balance sheet only in transactions with external parties. For example, business combinations give rise to goodwill and individually identifiable intangibles, including economic benefits previously not recognized as intangible assets by the target. However, goodwill does not arise if the external transaction does not qualify as a business combination.[11] U.S. GAAP requires goodwill to be fair-valued and tested for impairment losses. In 2001, SFAS 142 eliminated periodic amortization of goodwill and mandated an impairment test based on the fair value at the reporting unit level (FASB, 2001). Whether or not and to what extent to recognize impairment losses are significant estimates in intangible accounting (Beatty and Weber, 2006). Li and Sloan (2017) find evidence that, after the introduction of SFAS 142, managers exercise greater discretion to delay impairment charges on intangibles.

[10]For example, in 2017, Crowe Horwath (Hong Kong) was sanctioned for refusing to cooperate with the PCAOB's investigation.

[11]In 2001, the FASB eliminated the pooling of interest method, which does not generate any intangible assets from business combinations.

Joint ventures are also popular as an investment vehicle for corporate innovation.[12] Companies with investments in joint ventures (i.e., venturers) recognize intangible assets in two circumstances. First, venturers may recognize goodwill if the transfer from joint ventures at dissolution meets the conditions for a business combination. Second, if venturers apply proportionate consolidation, the pro-rata share of the joint ventures' assets, including goodwill and other intangibles, liabilities, revenues, and expenses are recognized and audited. In practice, this accounting treatment is applicable in the limited circumstances where the joint ventures operate in the construction or extractive industries, or joint ventures are not structured as a separate legal entity.

If proportionate consolidation is used, joint ventures' accounting, especially at its formation, matters because venturers' recognition of intangible assets depends on the joint ventures' recognition of goodwill and other intangibles. U.S. auditors generally applied "carryover basis accounting," which transfers the book value of the assets and liabilities into the joint venture and thus generates no goodwill or profit at venture formation. Under "fair value accounting," joint ventures recognize goodwill if the transferred value is greater than the fair value of identifiable net assets.[13] The release of SFAS 141R in 2007 increased the propensity to use fair value when joint ventures initially recognize assets and liabilities, and a speech by an SEC staff member in 2009 accelerated this trend (FASB, 2007).[14]

[12]The purpose of a joint venture is to share risks and rewards in developing new products or technologies, to combine complementary technological knowledge, and to pool resources in developing products or other facilities (ASC 323). For example, Energy Technology Venture is a joint venture involving General Electric, NRG Energy, and ConocoPhillips, focusing on the development of innovative energy technologies.

[13]"Financial Reporting Developments: A Comprehensive Guide on Joint Ventures", E&Y, June 2015.

[14]Joshua Forgione, associate chief accountant at the SEC, a speech at the 2009 AICPA National Conference (https://www.sec.gov/news/speech/2009/spch120709jsf.htm).

3 Prior Studies and Hypotheses

3.1 Intangible Impairments

Audit deficiencies regarding the valuation of intangibles mention that the scope and extent of audit procedures were insufficient in auditing management's assertions about the valuation of intangibles. The auditors deemed deficient in the valuation of intangibles decide whether to remediate their deficiencies, and if so, to what extent they need to do so. To remediate these audit deficiencies, deficient auditors would subsequently implement more procedures in auditing valuation assumptions or managerial estimates underlying the valuation of intangibles. As a result, auditors are likely to discover more audit evidence that contradicts management's initial assertions about the valuation of intangibles. If auditors' valuation estimates of intangibles based on more audit evidence are significantly lower than managers' valuation estimates, auditors may demand a downward adjustment of intangibles and recognition of intangible impairments on financial statements. The discussion above leads to the prediction that the clients of auditors deemed deficient by the PCAOB in auditing intangible valuation subsequently recognize more impairments of intangibles.

The PCAOB literature shows that auditors generally increase the level of scrutiny in relevant audit areas. For example, Drake et al. (2016) examine the effect of audit deficiencies regarding income tax accounts on clients' financial statements. They find that the clients of deficient auditors recognize more valuation allowance on deferred tax assets and reserve for uncertain tax benefits. DeFond and Lennox (2017) find that auditors increase the probability of issuing adverse internal control opinions when PCAOB inspection reports mention lax internal control. These results consistently suggest that deficient auditors effectively scruti-

nize relevant audit areas to address inspectors' concerns in subsequent audits and convince managers to accept adverse changes on financial statements.

However, the clients of deficient auditors may not recognize more intangible impairments for several reasons. First, auditors may not intend to further scrutinize the valuation of intangibles. They often complain that overall audit risk remains below the pre-specified acceptable level without implementing stricter audit procedures (Johnson et al., 2019). Also, the difficulty of measuring fair value could make any audit procedures, no matter how strict, insufficient to provide complete assurance (Glover et al., 2019). Second, auditors may hesitate to ask for a downward adjustment of intangibles. Managers may refuse to recognize intangible impairments because the stock market generally reacts negatively to write-downs of intangibles (Li et al., 2011). Also, managers may threaten to switch to new auditors who are less likely to demand more intangible impairments.[15] Taken together, I state the first hypothesis in the null form.

H1: The clients of deficient auditors in the valuation of intangibles do not recognize more impairments of intangible assets.

3.2 Innovation Strategies

I extend my empirical prediction to the real effects of accounting measurement for intangibles. Although auditor scrutiny does not change the accounting standards for intangibles, the remediation of audit deficiencies regarding the valuation of intangibles effectively alters the

[15]In an untabulated test, I find an insignificant change in auditor turnover around the release of inspection reports that contain relevant audit deficiencies. This is likely because deficient auditors carefully adjust the level of scrutiny and, although clients may benefit from less auditor scrutiny about the valuation of intangibles, auditor switches are also costly for clients who could experience higher bank lending costs and negative reactions in the stock market (Griffin and Lont, 2010; Francis et al., 2017).

measurement of intangible assets–they are expensed to a greater extent in a timelier fashion. That is, auditors influence the measurement of accounting numbers in financial reporting depending on how they interpret accounting and auditing standards and apply in practice.[16]

While auditors do not dictate which M&A deals are appropriate, increased auditor scrutiny about the valuation of intangibles reduces the managerial discretion of M&A transactions in which acquirers initially capitalize the costs and thereby delay the recognition of losses into later periods.[17] Because managers are concerned about the contractual and valuation implications of intangible impairments on financial reporting, the remediation of audit deficiencies could affect investment decisions for corporate innovation.[18] Therefore, I predict that the clients of deficient auditors decrease their investment in external innovation activities. A caveat is that I do not argue that managers care about auditors' opinions about innovation strategies and thereby change their real decisions. Instead, I posit that managers are concerned about the influence that auditors can exert on financial statements and adjust their investment decisions accordingly. I state my second hypothesis in the null form.

H2: The clients of deficient auditors in the valuation of intangibles do not change their investment in M&A deals for corporate innovation.

If the clients of deficient auditors reduce the use of M&A deals for corporate innovation, the decrease in external innovation activities may coincide with an increase in internal

[16]In this vein, Barrios et al. (2019) show that financial measurement practices by independent auditors lead to a significant variation in firm-level productivity.

[17]The effect of reduced managerial discretion on joint venture investments is nuanced because venturers can avoid the costs by using the equity method or fair value accounting for joint venture investments. Audit deficiencies regarding the valuation of intangibles are almost irrelevant to in-house R&D activities where companies hardly recognize intangible assets under U.S. GAAP.

[18]The real effects arise by mitigating the moral hazard problem associated with excessive M&A deals or by managers' learning about the value of external innovation strategies from auditor scrutiny (Roychowdhury et al., 2019). In this paper, the former is more plausible given the literature documenting agency costs associated with M&A deals (e.g., Masulis et al., 2007).

innovation activities because in-house innovation activities could substitute for external innovation activities (Williamson, 1985; Pisano, 1990). However, the substitution effect is not guaranteed because external innovation activities often complement and even trigger internal innovation activities. A strand of management and corporate finance literature highlights that the acquisition of external resources facilitates the internal development of intangibles and generates synergetic effects (Cohen and Levinthal, 1990; Cassiman and Veugelers, 2006; Rothaermel and Alexandre, 2009). For example, if an external acquisition is the only channel to obtain essential technologies for subsequent innovation, restricted M&A activities would hamper internal innovation activities. In this case, the decrease in M&A deals for corporate innovation is likely to entail a decrease in R&D expenditures. In sum, how the clients of deficient auditors would invest in internal innovation strategies depends on the relation between internal and externally acquired innovation resources in my empirical setting. I state the hypothesis additional to my second hypothesis in the null form.

H2a: The clients of deficient auditors in the valuation of intangibles do not change their investment in R&D expenditures.

4 Research Design

4.1 Sample Selection

I retrieve firm-level characteristics from Compustat and auditor information from Audit Analytics between 2001 and 2015. By starting the sample period in 2001, I conduct empirical tests with the pre-treatment period before the initial PCAOB inspection reports issued in

2004. Table 1 shows the sample selection procedures. Consistent with prior studies on corporate innovation (e.g., Dou and Xu, 2017; Kogan et al., 2017), I exclude financial and utility companies. I further exclude companies with missing or negative total assets, or missing information to construct company-level and auditor-level variables used in analyses, resulting in 55,873 company-year observations. To ensure that these companies consider external innovation a viable strategy, I restrict the sample to companies with at least one completed M&A deal. In the final sample, I have 38,978 company-year observations that consist of 4,724 unique companies audited by 543 unique audit firms.

4.2 Data

4.2.1 Intangible Impairments

I use Compustat variable GDWLIP to measure intangible impairments.[19] On average, impairment losses (intangible assets) constitute approximately 1.5 (18.6) percent of total assets. From PCAOB inspection reports, I identify audit deficiencies related to the valuation of intangibles, auditor name, and the release date of the inspection report.[20]

Panel A of Table 2 shows that 32.1 percent of company-year observations in my sample

[19]GDWLIP represents impairment losses from both goodwill (Compustat variable GDWL) and other intangibles (Compustat variable INTANO) for companies that report these items together. In case companies report them separately, GDWLIP only reflects goodwill impairments, and WDP includes other intangible impairments. However, WDP also includes impairment or write-down of assets other than goodwill (e.g., financial assets). Because other intangible impairments are only a small fraction of WDP, I use GDWLIP as the numerator of *Impair*.

[20]I first download the inspection reports from the PCAOB website (https://pcaobus.org/oversight/inspections/firm-inspection-reports). Next, I search for keywords (e.g., impair, intangible, and goodwill) that broadly exist in inspection reports that mention audit deficiencies related to the valuation of intangibles to minimize the false negative error that I fail to identify inspection reports that actually mention such deficiencies. Finally, if an inspection report includes any of the keywords above, I read through the inspection report to determine whether the report indeed mentions the valuation-related deficiencies of intangibles. Appendix B shows the examples of common phrases used to mention audit deficiencies related to the valuation of intangibles.

have auditors deemed deficient in the audit of intangible valuation. Auditors often receive deficiencies on the valuation of intangibles more than one year in a row. Panel A of Table 2 shows that 22.6 percent of company-year observations have auditors deemed deficient in both the current and the previous year. Panel C of Table 2 shows approximately 30.6 percent of the sample belongs to the business equipment sector as defined by the Fama-French 12 Industry Classification. The proportion of companies with deficient auditors is highest (lowest) in the energy sector (healthcare sector).[21] I winsorize continuous variables at 0.1 and 99.9 percent to mitigate the effect of outliers.

4.2.2 Innovation Strategies

To capture external innovation strategies, I use M&A deals. Thomson Reuters' SDC Platinum provides information about M&As and joint ventures, which I match with Compustat data based on CUSIP and acquirers' or participants' names. I include M&As with both U.S. and foreign targets whether public or private (Gu and Lev, 2011). Consistent with the M&A literature, I exclude recapitalizations, repurchases, spin-offs, tender offers, privatizations, and reverse takeovers (e.g., Ferris et al. 2013; El-Khatib et al. 2015).

To account for M&A deals that have little to do with corporate innovation, I only include M&A deals that lead to an increase in intangible assets over a fiscal year. Specifically, I include M&A deals if the net purchase of intangibles is greater than zero using the accounting equation, $NetPurchase_{i,t} = Intangibles_{i,t} - Intangibles_{i,t-1} + IntangibleImpairmentLoss_{i,t} + Amortization_{i,t}$. In the definition of intangibles, goodwill is included because the sample

[21] Although suggestive by nature, the reason the clients in the healthcare sector have a lower proportion of deficient auditors could be because of the importance and the number of patents which provide verifiable, hard evidence in the assessment of intangibles. The fluctuation of raw materials in the oil and gas market could contribute to a higher proportion of deficient auditors in the energy sector.

companies consider M&As a viable innovation strategy and it becomes increasingly common to conduct M&As for innovation (Bena and Li, 2014; Deloitte, 2017). As a result, the synergies from M&As have a close tie with innovation capabilities and are accounted for as goodwill.[22]

Further, to capture internal innovation strategies, I use R&D expenditures. Koh and Reeb (2015) show that companies with missing R&D often conduct nontrivial innovative activities but decide not to disclose the amount, and that replacing missing R&D with industry average best explains the actual distribution of R&D activities. Therefore, I replace missing R&D with the industry average using three-digit SIC codes. This approach is consistent with the intent to capture the actual expenditures for R&D activities.

4.3 Regression Model

The audit deficiencies regarding the valuation of intangibles are staggered across auditors over time.[23] Table 2 shows that about 70 percent of the total deficiencies regarding the valuation of intangibles involve repeated occurrences. Such repeated deficiencies in the valuation of intangibles reflect the difficulty of auditing fair value measurements in general (Glover et al., 2019). The regression model should accommodate repeated deficiencies and reversals over time. Hence, I closely follow Heider and Ljungqvist (2015) and Ljungqvist et al. (2017) that have similar treatment structures by implementing a difference-in-differences design in a

[22]In additional tests, I check the robustness of the results when the net purchase is based on non-goodwill intangibles and when all M&A deals are considered and find similar results.

[23]The recent econometric literature raises the concern that the estimated treatment effect in a staggered difference-in-differences framework may be biased where the already-treated observations still serve as a part of the control group for later-treated observations (e.g., Baker et al., 2022). To assess the effect of such a bias, in an untabulated test, I run the regression model where I remove the already-treated observations from the control group for the later-treated observations and find similar results, suggesting that the influence of such a bias is not significant.

first-differenced form.[24]

As shown in the equation below, the first-differenced specification has the first-difference operator for both independent and dependent variables.

$$\Delta Y_{i,t} = \alpha + \beta \Delta Deficiency_{i,t} + \gamma \Delta CompanyControl_{i,t-1} + \delta \Delta AuditorControl_{i,t} + IndustryYear + \varepsilon_{i,t}$$

where i and t represent companies and years, respectively; Δ is the first-difference operator; $Deficiency_{i,t}$ is an indicator for the clients of auditors cited for audit deficiencies regarding the valuation of intangibles in the inspection reports released; and $\varepsilon_{i,t}$ is the error term. The change in this variable captures the change in auditor scrutiny regarding the valuation of intangibles in response to audit deficiencies related to the valuation of intangibles, under the premise that auditors increase their effort to address the concern of the PCAOB inspectors. A value of (negative) positive one indicates an increase (decrease) in auditor scrutiny. A zero value indicates no change in auditor scrutiny because the deficiency status of the auditor does not change. In the regression model, the coefficient on $\Delta Deficiency_{i,t}$ captures the incremental change of the dependent variable, $\Delta Y_{i,t}$. In the test of H1, the dependent variable is change in intangible impairments.[25] In the test of H2 (H2a), the dependent variable is change in M&A deals (in-house R&D expenditures).[26]

[24]The regression model in this paper can be viewed as a special case of the first-differenced difference-in-differences where the change in treatment is fixed to a unit magnitude. The same research design is employed in Heider and Ljungqvist (2015) and Ljungqvist et al. (2017). The state-level tax rate changes in their paper correspond the auditor-level deficiencies over time in this paper.

[25]If the clients of deficient auditors remediate their deficiencies, I expect that an increase in intangible impairments occurs in year t (i.e., one-year after the fieldwork of inspections), in line with the timing in prior studies that examine the contents of inspection reports (DeFond and Lennox, 2017; Aobdia et al., 2021). Although managers can learn from their audit firms about pending issues that the PCAOB may include in inspection reports (PCAOB, 2012), in the context of intangible valuation, managers have strong incentives to delay the recognition of intangible impairments and therefore are expected to delay until the inspection reports are released in year t (Li et al., 2011).

[26]If audit deficiencies regarding the valuation of intangibles reduce clients' use of external innovation strategies, managers need to reconsider ongoing M&A deals. The decrease in M&A deals, which are discrete events, is likely to affect clients' investment in external innovation strategies in a timely fashion. Luo (2005)

Consistent with the model specification in Heider and Ljungqvist (2015) and Ljungqvist et al. (2017), I include Δ*Log(assets)*, Δ*Leverage*, Δ*Loss*, Δ*Cash,* Δ*Intangible,* Δ*M&A,* and Δ*R&D* measured in year t-1 as company-level control variables. I include Δ*Auditor Tenure* measured in year t. Appendix A provides detailed definitions of these variables. Also, I include time-varying industry fixed effects defined at the level of three-digit SIC codes to control for dynamic industry-level technological changes or industry-specific policy changes that have significant influences on corporate innovation.[27] Heteroskedasticity-robust standard errors are clustered by industry and by year to address the possible cross-correlations in intangible impairments and M&A events.

To provide comfort that I compare companies with similar economic fundamentals in the absence of audit deficiencies, I report the mean value of control variables between two groups of companies, in the same industry, that do not have deficient auditors in the valuation of intangibles in year t-1, representing a subset of the final sample described in Table 1. This comparison is motivated to mitigate the concern that the PCAOB, which uses risk-based sampling, might select audit clients who are more likely to delay the recognition of intangible impairments. The balanced covariates before being affected also improve the effectiveness of my research design (Angrist and Pischke, 2009). Panel B of Table 2 shows that the summary

shows that, once managers learn from negative market reactions around M&A announcements, they quickly withhold a significant number of ongoing M&A deals. Therefore, I expect that, if the decrease in M&A deals is salient, the change occurs in year t (i.e., one-year after the fieldwork of inspections). This expectation is also consistent with the notion that real effects arise when managers expect that financial statement users would update their knowledge about fundamentals.

[27]For example, the patent expiration of medicines affects innovation activities in the pharmaceutical industry. Also, the government policy that subsidizes electric vehicles spurs companies in the automobile industry to invest more in innovative technologies. deHaan (2020) shows that narrowly-defined fixed effects structure that leaves little variation could pose a significant threat to the reliability of the treatment effect. For the non-discrete control variables in my regression model, I find that the residual standard deviation after fixed effects remains similar, suggesting that the industry-year fixed effects adequately control for the time-varying industry variations without imposing significant econometric concerns.

statistics for all control variables are not statistically different between the clients who have deficient auditors in year t and the clients who continue to have non-deficient auditors in year t.

To further establish the exclusion restriction, in Appendix C, I review changes in accounting standards relevant to the valuation of intangibles. SFAS 142 was not amended from its issuance in 2001 to the FASB codification in 2009. Afterward, the FASB issued seven pertinent amendments between 2009 and 2015 (see Appendix C for the list of amendments). ASU 2010-28 issued in December 2010 has the potential to reduce managerial discretion in goodwill impairment tests and to increase the likelihood of recognizing impairment losses. This amendment is likely to have limited consequences only for reporting units with zero or negative carrying amounts. Nonetheless, to the extent that the audit deficiencies considered in this study overlap with the issuance of the amendment, the treatment effect is not solely attributable to audit deficiencies. I confirm the robustness of the impairment result when audit deficiencies issued in 2010 are set to zero. In this way, any increase in intangible impairments from 2009 to 2010 belongs entirely to the control group, and therefore the treatment effect is not overestimated.[28] Two other amendments did not affect the measurement or valuation of intangibles (ASU 2011-04 and ASU 2015-05). Three other amendments intended to reduce the costs and complexity of intangible impairment tests only for private companies (ASU 2011-08, ASU 2014-02, and ASU 2014-18). Lastly, the amendment issued in July 2012 has the potential to increase managerial discretion in goodwill impairment tests by providing an entity with the option to make a qualitative assessment about indefinite-lived intangible as-

[28] Audit deficiencies significantly increase impairment losses of intangibles (coefficient = 0.0021; t-stat. = 3.07) when the deficiencies disclosed in 2010 are not considered treatments. As expected, the magnitude of this coefficient is slightly smaller than the magnitude of coefficient reported in Table 3 (0.0025).

sets (ASU 2012-02). To the extent that managers use their discretion to minimize intangible impairments, the effect of audit deficiencies is estimated in a more robust manner.

The regression model above is designed to test the direct effect of inspection results on deficient auditors, assuming that the inspection results of the deficient (non-deficient) auditors do not affect the outcomes of the non-deficient (deficient) auditors (Glaeser and Guay, 2017). Auditors may refer to the inspection results of other auditors and tighten the audit procedures regarding the valuation of intangibles preemptively. Of course, auditors also have an incentive to restrain from such preemptive actions that may involve losing audit clients.[29] To the extent that such spillover effects from deficient auditors to non-deficient auditors exist in the context of valuation of intangibles, the estimated results become a lower bound of the true treatment effect.

4.4 Identification

A key premise of the literature that examines the economic consequences of PCAOB Part I findings is that deficient auditors increase their scrutiny in subsequent audits across engagements when they attempt to remediate their deficiencies (DeFond and Lennox, 2017; Aobdia et al., 2021).[30] In my study, this assumption means that, when deficient auditors in-

[29]This across-auditor spillover effect is distinct from the spillover effect across clients of the same auditor. The spillover effect across auditors is less likely to occur because the regulatory uncertainty about the valuation of intangibles and the costs of preemptive actions are higher.

[30]In examining the effect of PCAOB inspection results, I primarily focus on deficiencies from specific audit engagements (i.e., Part 1 findings) for several reasons. First, the research design using Part 1 findings can be implemented on a wide range of audit firms over long time-series. The research design using firm-wide quality control issues (i.e., Part 2 findings) is feasible only when audit firms receive Part 2 findings and fail to remediate adequately within a one-year period. Second, Part 2 findings are only selectively disclosed depending on the auditors' remediation results. That is, researchers cannot tell whether the absence of publicly disclosed Part 2 findings means (1) no quality control issues in the first place or (2) quality control issues remediated within a one-year period. Third, to the extent that auditors with Part 2 findings also have related Part 1 findings that are immediately disclosed, the estimates from the above regression model include the effect of Part 2 findings remediated within a one-year period. Given the strong incentive to avoid

tend to avoid deficiencies, they conduct stricter procedures in subsequent audits of intangible valuation. A couple of reasons exist why this assumption is plausible.

First, the auditors cannot reliably predict which engagements would be subject to inspections. Hence, deficient auditors, if they have strong incentives to avoid deficiencies, need to scrutinize all subsequent engagements with intangibles. Based on a survey of more than 160 inspectors, Hanlon and Shroff (2020) provide consistent evidence that, when auditors try to remediate, the propensity to change audit procedures for non-inspected clients (60.6%) is as high as that for inspected clients (78.2%).

Second, a mechanism through which this assumption works in practice is the firm-wide training to incorporate the feedback from inspection results. During the inspection process, inspectors communicate with not only engaged partners and staff members of selected audits but also with the auditor's national office. After informed of the audit deficiencies found in specific audit engagements, the auditor's national office, when it intends to remediate, would update firm-wide audit procedures to preempt similar deficiencies. Hanlon and Shroff (2020) show that 82.7% of audit firms conduct firm-wide training in response to the feedback received during inspections when they intend to avoid similar deficiencies.

Third, this assumption is broadly consistent with the empirical results from prior studies that document spillover effects across audit clients within the same auditor. Krishnan et al. (2017) find evidence of spillover effect from inspected clients to non-inspected clients in PCAOB international inspections. Aobdia (2018) reports the spillover effect that auditors

the public disclosure of quality control issues (Aobdia, 2020), the deficient auditors likely try to remediate as soon as possible. Therefore, by focusing on Part 1 findings, the economic magnitude estimated from the above model captures most of the (unobservable) entire effect from PCAOB inspections on the valuation of intangibles. Nonetheless, to supplement the research design based on Part 1 findings, in Table 5, I estimate the effect of repeated deficiencies, which are likely to capture systematic audit failures, and find stronger effects.

increase their effort on non-inspected audits of partners or offices that are inspected and found deficient.

5 Empirical Results

5.1 Intangible Impairments

5.1.1 Main Result

I examine whether the clients of auditors deemed deficient in regards to intangible valuation subsequently recognize larger impairment losses of intangibles. In the test of H1, the dependent variable is $\Delta Impair$, the change in intangible impairments scaled by lagged total assets. This variable captures the effect of audit deficiencies on both clients that recognized some but perhaps insufficient amount of intangible impairments and clients that recognized no intangible impairments. Table 3 shows that the coefficient of 0.0025 on $\Delta Deficiency$ is statistically significant at the 1 percent level.[31] Overall, this result suggests that deficient auditors generally implement more stringent procedures in their subsequent audits and induce managers to recognize more intangible impairments.[32]

This analysis does not distinguish whether the increase in the amount of intangible impairments primarily comes from the incremental losses conditional on recognizing some intangible impairments or new intangible impairments. More importantly, it does not indicate whether

[31]The untabulated variance inflation factors are not larger than 1.40 for company- and auditor-level control variables in this regression, suggesting that the effect of multicollinearity is not substantial.

[32]In an untabulated test, I find that audit fees paid by the clients of deficient auditors are significantly higher than those of non-deficient auditors, where audit fees serve as a proxy for auditor effort (Acito et al., 2018). I also examine the audit clients in the non-M&A sample. These clients are on the extensive margin, with significantly less intangibles on their financial statements and weaker incentives to avoid or delay the recognition of intangible impairments. I find consistent evidence that these clients do not significantly change intangible impairments when their auditors are deemed deficient in the valuation of intangibles.

the incremental recognition of intangible impairments is economically beneficial. Consistent with auditors' complaints, if the regulator demands unduly strict audit procedures for the valuation of intangibles, the incremental impairment losses would not associate with economic signals that necessitate impairments (Glover et al., 2019; Johnson et al., 2019). Gao and Zhang (2019) suggest that the inspection program indirectly hurts audit outcomes because the check-list approach adopted by the PCAOB discourages auditors' exercise of and long-term investment for professional judgment.

5.1.2 Timeliness of Intangible Impairment Losses

To shed light on the economic significance and nature of increased intangible impairments, I generalize the framework of Li and Sloan (2017) to estimate the probability of recognizing intangible impairments and test how timely companies recognize impairments with respect to economic signals that call for intangible impairments. As in their paper, the dependent variable is $Impair^{Indicator}$, an indicator for clients with non-zero intangible impairments. Unlike Li and Sloan (2017), my regression model includes an array of fixed effects, which lead to the incidental parameter problem in non-linear regressions (Wooldridge, 2013). Therefore, I adopt a linear probability model to estimate the likelihood of recognizing intangible impairments.[33]

In Column (1) of Table 4, the coefficient on $\Delta Deficiency$ is 0.010 and statistically significant at the 5 percent level, meaning that the remediation of audit deficiencies significantly

[33] I also examine the distribution of the fitted values to check the reasonableness of the linear probability model. According to Long (1997), the linear probability model can fit the data as well as the logistic model if the fitted values are between 20% and 80% of the discrete dependent variable's range. This is because, in the absence of extreme probabilities (e.g., 1% or 99%), the relationship between the log odds from the non-linear model and the probability from the linear model is almost linear. The minimum of -0.495 is above the left threshold of -0.6 and the maximum of 0.593 is below the right threshold of 0.6, validating the usage of the linear probability model in my setting.

increases the propensity to recognize non-zero intangible impairments. Combined with the estimate in Table 3, audit deficiencies regarding the valuation of intangibles induce about 10 percent more companies to recognize non-zero intangible impairments, and lead to about a 6 percent increase in the amount of intangible impairments for companies that have already recognized non-zero impairments.[34] All these effects obtain from a comparison between the clients of deficient auditors and the clients of non-deficient auditors in the same industry in a given year.

I also introduce two economic signals for intangible impairments, $\Delta BTMG1$ and $\Delta IMPI$, as defined in Li and Sloan (2017). These variables predict a higher propensity of recognizing non-zero intangible impairments for companies with high book-to-market ratio and companies with low profitability but substantial goodwill on their balance sheet. In Column (2) of Table 4, the coefficients on $\Delta BTMG1$ and $\Delta IMPI$ are 0.031 and 0.051, respectively, and both statistically significant at the 1 percent level. The significantly positive coefficients on these variables validate the intended economic nature of these variables as signals for intangible impairments in my sample. Next, I interact these variables with $\Delta Deficiency$ to test whether companies recognize intangible impairments in a timelier manner after the deficiencies are identified by the PCAOB. Prior studies show that in the post-SFAS 142 period, companies do not recognize impairment losses when they should, lagging behind signals of economic impairments (Hayn and Hughes, 2006; Li and Sloan, 2017). Therefore, I expect to find significantly positive coefficients on the interaction terms, if audit deficiencies regarding the valuation of intangibles strengthen the association between the economic signals and

[34] Using the coefficient on $\Delta Deficiency$ from Column (1) of Table 4 and the mean value of *Impair* from Table 2, $\frac{0.01}{0.1} = 10\%$. Similarly, $\frac{0.0025}{0.015} = 16.7\% = (1 + 6.1\%)(1 + 10\%) - 1$ where 10% comes from the first calculation.

actual impairments recognized by the clients of deficient auditors.

Column (2) of Table 4 shows the coefficient on the interaction between $\Delta BTMG1$ and $\Delta Deficiency$ is 0.034 and statistically significant. This result is consistent with the notion that PCAOB inspectors refer to market conditions in planning and executing their inspection procedures with respect to the valuation of intangibles. However, the coefficient on the interaction between $\Delta IMPI$ and $\Delta Deficiency$ is insignificant, suggesting that either (1) PCAOB inspectors are not concerned about companies with low profitability and high goodwill or (2) auditors do not remediate deficiencies on these cases because of managers' concern about the adverse impact on profitability.[35] Overall, Table 4 shows that PCAOB inspections mitigate, at least in part, the untimely recognition of intangible impairments.[36] Also, the result suggests that, before the introduction of the PCAOB inspection program, auditors' self-assessment and overall regulatory scrutiny of intangible impairments were lenient in general.

5.1.3 Repeated Deficiencies

Auditors often receive consecutive deficiencies about the valuation of intangibles, which are evidence for more systematic audit failures in the valuation of intangibles (Aobdia, 2020). To check whether auditors increase the level of scrutiny further to remediate these deficiencies, I

[35]The examples in Appendix B show that inspectors mention operating profits, suggesting that they pay attention to profitability measures to infer suggestive evidence about whether intangibles are overstated. Hence, between the two alternative interpretations, the former is less likely to explain the insignificant coefficient on the interaction term.

[36]To further shed light on the economic nature of the intangible impairments, I conduct a test on patent citations. I use the average number of truncation-adjusted citations per patent as a proxy for the efficiency or qualitative aspect of innovation. The result, untabulated, shows that the clients of deficient auditors are associated with more patent citations per patent in subsequent years. This result suggests that the (unintended) intervention by the PCAOB associates positively with the efficiency in corporate innovation. However, the patent citation test result should be interpreted as suggestive evidence because the connection between PCAOB auditor inspection and patents is relatively remote.

define a variable that represents these repeated deficiencies ($Deficiency^{Repeated}$), which takes the value of one for auditors who receive relevant deficiencies in both the current and the previous year. Table 5 shows that the coefficient on this variable is 0.004 and statistically significant at the 1 percent level. The economic magnitude of this result is approximately 60 percent greater than the magnitude reported in Table 3, suggesting that, although auditors remediate deficiencies overall, they increase the level of scrutiny further to remediate repeated deficiencies. To the extent that repeated deficiencies provide more systematic evidence of audit failures regarding the valuation of intangibles, this result strengthens the premise in the PCAOB literature examining the economic consequences of Part 1 findings that deficient auditors remediate their deficiencies across clients in their subsequent audits (DeFond and Lennox, 2017; Hanlon and Shroff, 2020; Aobdia et al., 2021).

Prior studies and audit practices provide further explanations for why the degree of remediation varies and auditors often receive repeated deficiencies. First, the level of auditor scrutiny desired by the PCAOB is *ex ante* unclear or unpredictable to auditors. PCAOB inspectors may have a different level of scrutiny in mind that they believe adequate. This aspect is especially likely in the context of intangibles because the valuation of such assets involves a collection of assumptions and estimates. Thus, auditors may not always exert sufficient effort to remediate. Also, PCAOB inspections do not examine all audit procedures due to their limited resources (Johnson et al., 2019). As a result, although auditors often do not remediate to the maximum level, it may not be detected. In this case, the clients of deficient auditors would appreciate that they do not need to recognize as much intangible impairments.

Second, in addition to these uncertainties surrounding inspections, several incentives im-

posed on auditors make them prefer less than maximum remediation. For example, the recognition of impairments leads to managerial turnover and a sharp decrease in stock prices (e.g., Li et al., 2011). For the retention of their clients, it appears not in the best interest of deficient auditors to indefinitely increase scrutiny, especially in response to new deficiencies, and subsequently receive repeated deficiencies. After receiving repeated deficiencies, auditors can now better persuade their clients of the need for more audit procedures and thus more intangible impairments because obviously the initial remediation turned out to be insufficient.[37] That is, if avoiding audit deficiencies is the only concern for auditors, they could always increase the level of scrutiny as much as possible by implementing an array of audit procedures and critically assessing valuation assumptions. However, in reality, they need to care about retaining their clients who generally do not prefer stringent audit procedures that likely incur additional intangible impairments.

5.2 Innovation Strategies

Table 6 shows the regression results about how audit deficiencies affect clients' innovation strategies. In Column (1), to test H2, I use the dollar amount of M&A deals scaled by lagged total assets as the dependent variable. I find that the coefficient on $\Delta Deficiency$ is -0.054 and statistically significant at the 1 percent level.[38] This result indicates that, conditional

[37]To illustrate, suppose an auditor A, has a client C. The auditor receives a deficiency regarding the valuation of intangibles in 2015. In light of the uncertainties surrounding inspections and the general preference of clients not to recognize intangible impairments, auditors increase the level of scrutiny modestly. As a result, the client recognizes $100,000 more intangible impairments, which could have been as large as $300,000 if fully remediated. However, suppose that the remediated level of auditor scrutiny still falls short of the expectation of inspectors in the next year. Hence, the auditor A receives a repeated deficiency and now conducts even more stringent procedures, resulting in an incremental impairment recognition of $200,000 on the client's financial statements.

[38]I find that the inclusion of intangible impairments as an additional control attenuates the significance of the coefficient on the main independent variable, suggesting that the decrease in discretion in the valuation of intangibles contributes to the real effects.

on having at least one M&A deals, the clients of deficient auditors have 6 percent lower M&A transaction value than the clients of non-deficient auditors in the same industry in a given year. Given that M&A deals decrease after audit deficiencies regarding the valuation of intangibles, I next examine whether the real effects occur with or without the substitution effect.

The effect on internal innovation strategies is not obvious from the result on M&A deals. The decrease in M&A deals for corporate innovation is expected to accompany an increase in internal innovation activities if internal innovation activities successfully substitute for external innovation activities without significant economic frictions (Williamson, 1985; Pisano, 1990). However, as evidenced in the recent literature (Cohen and Levinthal, 1990; Cassiman and Veugelers, 2006; Rothaermel and Alexandre, 2009), internal innovation activities may decrease if innovation capabilities obtained from M&A deals play a vital role in the overall innovation process. In Column (2), to test H2a, I use R&D expenditures scaled by lagged total assets as the dependent variable. The coefficient on $\Delta Deficiency$ is insignificant, meaning that audit deficiencies do not materially change the amount of R&D expenditures. Combined with the result in Column (1), this result suggests that the clients of deficient auditors reduce external M&A deals for corporate innovation and R&D expenditures do not significantly substitute for or complement external innovation activities in my empirical setting.

6 Additional Tests

In this section, I conduct several additional tests to check the robustness of my findings. First, to ensure that it is the audit deficiencies related to intangible valuation, not intangibles in general, that drive the main result, I conduct a placebo test that utilizes audit deficiencies related to intangibles but irrelevant to valuation ($Deficiency^{Placebo}$). For instance, these deficiencies include an improper internal control of intangibles or a lack of disclosures about intangibles. By construction, this variable does not overlap with *Deficiency*. In Panel A of Table 7, I find that the coefficient on $\Delta Deficiency^{Placebo}$ is insignificant. This result reinforces the inference that audit deficiencies that specifically mention insufficient audit procedures regarding the valuation of intangibles lead to the recognition of intangible impairments.

Second, I check the robustness of the inferences about innovation strategies in Panel B of Table 7. In Column (1), I test whether joint venture investments decrease after audit deficiencies are identified by the PCAOB. I construct an indicator for joint venture investments (*Joint Venture*) because, unlike M&A deals, the dollar amount of joint venture investments is not available. The result shows a negative but insignificant coefficient on $\Delta Deficiency$, consistent with the economic nature of and accounting for joint ventures that fall between M&A deals and R&D expenditures. Also, this result corroborates the notion that the extent to which external innovations are exposed to audit deficiencies regarding the valuation of intangibles affects corporate innovation strategies.[39] In Column (2), I exclude goodwill when I compute the net purchase of intangible assets. That is, the dependent variable only includes

[39]I check the robustness of the joint venture test when the accounting for joint ventures was modestly altered in 2007 when SFAS 141R was passed, and in 2009 when the SEC recommended more use of fair value accounting at the formation of joint ventures. In untabulated results, I find that the coefficients on $\Delta Deficiency$ remain insignificantly negative when the sample period is restricted to 2007-2015 and 2009-2015, respectively.

M&A deals that increase non-goodwill intangibles for acquirers. I find that the coefficient on $\Delta Deficiency$ is still negative (-0.054). The coefficient is statistically significant at the 1 percent level and the economic significance remains similar. In Column (3), I use all M&A deals in the construction of the dependent variable and repeat the test. The inference from the test remains unchanged with the negative coefficient (-0.052) statistically significant at the 5 percent level.

Third, Panel C of Table 7 examines whether the results remain robust with auditor fixed effects. Prior studies document the existence of time-invariant auditor characteristics, especially between big N auditors and non-big N auditors in terms of auditor size, auditor-client relationships, and competencies (DeFond and Zhang, 2014). I find that the results remain similar when differences in auditor characteristics are further considered. In particular, the coefficients on $\Delta Deficiency$ remain significantly positive in Column (1) and significantly negative in Column (2), suggesting that the effect of audit deficiencies also arises from within-auditor time-series variation, not merely variation across auditors.

Finally, Panel D of Table 7 examines the empirical predictions under an alternative specification that includes audit deficiency in levels, not in the first-differenced form. This test alleviates an implicit assumption in the main specification that the effect of audit deficiencies is immediate in the initial year after the shock. I find that the effect of audit deficiencies on clients' intangible impairments and their use of M&As for corporate innovation remains similar. These results suggest that the reversal of audit deficiencies (i.e., audit deficiency in year t-1 but not in year t) does not drive the main results.

7 Conclusion

This paper examines how audit deficiencies regarding the valuation of intangibles affect clients' accounting for and investment in intangibles. I find that the clients of auditors with these deficiencies subsequently recognize larger and timelier impairments of intangibles. The remediation of audit deficiencies effectively alters the measurement of intangibles and reduces the managerial discretion of M&A transactions, where managers use their discretion to delay the recognition of losses. As a result, the clients of deficient auditors subsequently reduce their investment via external M&A deals, suggesting that regulatory environments and auditor scrutiny can be a significant factor in determining how to invest in corporate innovation. The findings of this paper could inform the PCAOB that the inspection program may have unintended consequences on audit clients' investment decisions for corporate innovation. Also, the findings highlight the governance role of auditors when companies rely on external resources for innovation. Managers appear to consider the regulatory intervention by the PCAOB in corporate innovation strategies.

References

Acito, A.A., Hogan, C.E., Mergenthaler, R.D., 2018. The Effects of PCAOB Inspections on Auditor-Client Relationships. The Accounting Review 93, 1–35.

Angrist, J.D., Pischke, J.S., 2009. Mostly Harmless Econometrics: An Empiricist's Companion. 1 ed., Princeton University Press.

Aobdia, D., 2018. The Impact of the PCAOB Individual Engagement Inspection Process Preliminary Evidence. The Accounting Review 93, 53–80.

Aobdia, D., 2020. The Economic Consequences of Audit Firms' Quality Control System Deficiencies. Management Science 66, 2801–3294.

Aobdia, D., Dou, Y., Kim, J., 2021. Public Audit Oversight and Originate-to-Distribute Model. Journal of Accounting Economics 72, 101420.

Baker, A.C., Larcker, D.F., Wang, C.C., 2022. How Much Should We Trust Staggered Difference-in-Differences Estimates? Journal of Financial Economics 144, 370–395.

Barrios, J., Lisowsky, P., Minnis, M., 2019. Measurement Matters: Financial Reporting and Productivity. Working Paper.

BCG, 2017. The Technology Takeover, 1–39.

Beatty, A., Weber, J., 2006. Accounting Discretion in Fair Value Estimates: An Examination of SFAS 142 Goodwill Impairments. Journal of Accounting Research 44, 257–288.

Bena, J., Li, K., 2014. Corporate Innovations and Mergers and Acquisitions. The Journal of Finance 69, 1923–1960.

Brav, A., Jiang, W., Ma, S., Tian, X., 2018. How Does Hedge Fund Activism Reshape Corporate Innovation? Journal of Financial Economics 130, 237–264.

Cassiman, B., Veugelers, R., 2006. In Search of Complementarity in Innovation Strategy: Internal RD and External Knowledge Acquisition. Management Science 52, 68–82.

Chesbrough, H.W., 2003. Open Innovation: The New Imperative for Creating and Profiting from Technology. Harvard Business School Press, Boston.

Cohen, W.M., Levinthal, D.A., 1990. Absorptive Capacity : A New Perspective on Learning and Innovation. Administrative Science Quarterly 35, 128–152.

Darrough, M.N., Guler, L., Wang, P., 2014. Goodwill Impairment Losses and CEO Compensation. Journal of Accounting, Auditing and Finance 29, 435–463.

DeFond, M., Zhang, J., 2014. A Review of Archival Auditing Research. Journal of Accounting and Economics 58, 275–326.

DeFond, M.L., Lennox, C.S., 2017. Do PCAOB Inspections Improve the Quality of Internal Control Audits? Journal of Accounting Research 55, 591–627.

deHaan, E., 2020. Using and Interpreting Fixed Effects Models. Working Paper.

Deloitte, 2017. Fuelling Growth through Innovation, 1–30.

Dou, Y., Xu, Z., 2017. Off-Balance-Sheet Securitization, Bank Lending, and Firm Innovation. Working Paper.

Drake, K.D., Goldman, N.C., Lusch, S.J., 2016. Do Income Tax-Related Deficiencies in Publicly Disclosed PCAOB Part II Reports Influence Audit Client Financial Reporting of Income Tax Accounts? The Accounting Review 91, 1411–1439.

El-Khatib, R., Fogel, K., Jandik, T., 2015. CEO Network Centrality and Merger Performance. Journal of Financial Economics 116, 349–382.

FASB, 2001. Statement of Financial Accounting Standard No. 142: Goodwill and Other Intangible Assets.

FASB, 2007. Statement of Financial Accounting Standard No.141 (R): Business Combinations.

Ferris, S.P., Jayaraman, N., Sabherwal, S., 2013. CEO Overconfidence and International Merger and Acquisition Activity. Journal of Financial and Quantitative Analysis 48, 137–164.

Francis, B.B., Hunter, D.M., Robinson, D.M., Robinson, M.N., Yuan, X., 2017. Auditor Changes and the Cost of Bank Debt. The Accounting Review 92, 155–184.

Fung, S.Y.K., Raman, K.K., Zhu, X., 2017. Does the PCAOB International Inspection Program Improve Audit Quality for Non-U.S.-Listed Foreign Clients? Journal of Accounting and Economics 64, 15–36.

Gao, P., Zhang, G., 2019. Auditing Standards, Professional Judgement, and Audit Quality. The Accounting Review 94, 201–225.

Glaeser, S., Guay, W.R., 2017. Identification and Generalizability in Accounting Research: A Discussion of Christensen, Floyd, Liu, and Maffett (2017). Journal of Accounting and Economics 64, 305–312.

Glover, S.M., Taylor, M.H., Wu, Y.J., 2019. Mind the Gap: Why do Experts Have Differences of Opinion Regarding the Sufficiency of Audit Evidence Supporting Complex Fair Value Measurements? Contemporary Accounting Research 36, 1417–1460.

Griffin, P.A., Lont, D.H., 2010. Do Investors Care about Auditor Dismissals and Resignations? What Drives the Response? Auditing: A Journal of Practice Theory 29, 189–214.

Gu, F., Lev, B., 2011. Overpriced Shares, Ill-Advised Acquisitions, and Goodwill Impairment. The Accounting Review 86, 1995–2022.

Hanlon, M., Shroff, N., 2020. Insights into Auditor Public Oversight Boards: Whether, How, and Why They Work. Working Paper.

Hayn, C., Hughes, P.J., 2006. Leading Indicators of Goodwill. Journal of Accounting, Auditing Finance 21, 223–265.

Heider, F., Ljungqvist, A., 2015. As Certain as Debt and Taxes: Estimating the Tax Sensitivity of Leverage from State Tax Changes. Journal of Financial Economics 118, 684–712.

Jensen, M.C., 1986. Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers. The American Economic Review 76, 323–329.

Johnson, L.M., Keune, M.B., Winchel, J., 2019. U. S. Auditors' Perceptions of the PCAOB Inspection Process. Contemporary Accounting Research 36, 1540–1574.

Kanodia, C., Sapra, H., 2016. A Real Effects Perspective to Accounting Measurement and Disclosure: Implications and Insights for Future Research. Journal of Accounting Research 54, 623–676.

Kanodia, C., Sapra, H., Venugopalan, R., 2004. Should Intangibles Be Measured: What Are the Economic Trade-Offs? Journal of Accounting Research 42, 89–120.

Kogan, L., Papanikolaou, D., Seru, A., Stoffman, N., 2017. Technological Innovation, Resource Allocation, and Growth. Quarterly Journal of Economics 132, 665–712.

Koh, P.S., Reeb, D.M., 2015. Missing R&D. Journal of Accounting and Economics 60, 73–94.

Krishnan, J., Krishnan, J., Song, H., 2017. PCAOB International Inspection and Audit Quality. The Accounting Review 92, 143–166.

Leuz, C., Wysocki, P.D., 2016. The Economics of Disclosure and Financial Reporting Regulation: Evidence and Suggestions for Future Research. Journal of Accounting Research 54, 525–622.

Li, K.K., Sloan, R.G., 2017. Has Goodwill Accounting Gone Bad? Review of Accounting Studies 22, 964–1003.

Li, Z., Shroff, P.K., Venkataraman, R., Zhang, I.X., 2011. Causes and Consequences of Goodwill Impairment Losses. Review of Accounting Studies 16, 745–778.

Ljungqvist, A., Zhang, L., Zuo, L., 2017. Sharing Risk with the Government: How Taxes Affect Corporate Risk Taking. Journal of Accounting Research 55, 669–707.

Long, J.S., 1997. Regression Models for Categorical and Limited Dependent Variables. Sage Publications, Thousand Oaks, CA.

Luo, Y., 2005. Do Insiders Learn from Outsiders? Evidence from Mergers and Acquisitions. The Journal of Finance 60, 1951–1982.

Malmendier, U., Tate, G., 2008. Who Makes Acquisitions? CEO Overconfidence and the Market's Reaction. Journal of Financial Economics 89, 20–43.

Masulis, R.W., Wang, C., Xie, F.E.I., 2007. Corporate Governance and Acquirer Returns. The Journal of Finance 62, 1851–1889.

PCAOB, 2012. Information for Audit Committees About the PCAOB Inspection Process.

Pisano, G.P., 1990. The R&D Boundaries of the Firm: An Empirical Analysis. Administrative Science Quarterly 35, 153–176.

PwC, 2014. M&A Integration: Looking Beyond the Here and Now, 1–28.

Rothaermel, F.T., Alexandre, M.T., 2009. Ambidexterity in Technology Sourcing: The Moderating Role of Absorptive Capacity. Organization Science 20, 759–780.

Roychowdhury, S., Shroff, N., Verdi, R.S., 2019. The Effects of Financial Reporting and Disclosure on Corporate Investment: A Review. Journal of Accounting and Economics 68, 101–246.

Shroff, N., 2020. Real Effects of PCAOB International Inspections. The Accounting Review 95, 399–433.

Westermann, K., Cohen, J.R., Trompeter, G., 2019. PCAOB Inspections: Public Accounting Firms on "Trial". Contemporary Accounting Research 36, 694–731.

Williamson, O.E., 1985. The Economic Institutions of Capitalism. Collier Macmillan Publishers.

Wooldridge, J.M., 2013. Introductory Econometrics: A Modern Approach. Cengage Learning.

Appendix A: Definitions of Variables

Variable	Definition
Deficiency	An indicator variable for the clients of auditors deemed deficient in their audits of intangible valuation.
$Deficiency^{Placebo}$	An indicator variable for the clients of auditors deemed deficient in their audits of intangibles but unrelated to valuation.
$Deficiency^{Repeated}$	An indicator variable for the clients of auditors deemed deficient in their audits of intangible valuation in both year t-1 and year t.
Impair	The amount of intangible impairments scaled by lagged total assets.
$Impair^{Indicator}$	An indicator variable for non-zero intangible impairments.
BTMG1	An indicator variable for company-years with book-to-market ratio greater than one (Li and Sloan, 2017).
IMPI	An indicator variable having the value of one for company-years with goodwill greater than 10% and ROA less than 0, minus one for company-years with goodwill less than 5% and ROA greater than 5%, and zero otherwise (Li and Sloan, 2017).
Log(Assets)	The log transformation of total assets.
Leverage	Long-term debt scaled by total assets.
Loss	An indicator for negative operating income.
Cash	Cash and short-term investment scaled by total assets.
Intangible	Intangible assets scaled by total assets.
M&A	The dollar amount of M&A deals scaled by lagged total assets.
R&D	The dollar amount of R&D expenditures scaled by lagged total assets.
AuditorTenure	The number of years that an auditor is consecutively hired by a company for audit services.
Joint Venture	An indicator variable for companies with at least one joint ventures formed in a given year.

Appendix B: Examples of Audit Deficiencies Regarding the Valuation of Intangibles

This appendix contains the relevant excerpts from the PCAOB inspection reports.

[1] 2010 Inspection of Deloitte & Touch LLP

"The Firm failed to perform sufficient procedures to evaluate the reasonableness of the revenue growth assumptions that the issuer used in its analyses of the potential impairment of goodwill and indefinite-lived intangible assets. Specifically, there was no evidence in the audit documentation, and no persuasive other evidence, that the Firm had considered the adverse implications of industry forecasts that indicated annual declines in a key component of revenue, as opposed to the growth that the issuer projected."

"The Firm failed to perform sufficient procedures to evaluate the reasonableness of certain significant assumptions that the issuer used in its analyses of the potential impairment of certain of its goodwill and indefinite-lived intangible assets. Specifically, for certain reporting units, the Firm failed to evaluate the issuer's projected net sales growth, divisional operating profit, and capital expenditures and, for another reporting unit, the Firm's procedures to test these projections were limited to inquiries of management and reviewing management-prepared memoranda."

"The Firm failed to test the completeness and accuracy of the computer-generated information that it relied upon in its testing of the issuer's analyses of the potential impairment of goodwill and other indefinite-lived intangible assets."

[2] 2005 Inspection of PricewaterhouseCoopers LLP

"The issuer recorded an impairment charge related to goodwill in its third-quarter financial statements. The Firm failed to perform sufficient procedures related to the impairment charge. Specifically, there was no evidence in the audit documentation, and no persuasive other evidence, that the Firm had performed procedures to test the assumptions and underlying data that management used to calculate the impairment charge, including the allocation of goodwill to reporting units. The Firm failed to obtain evidence regarding the fair value of certain assets and liabilities of the impaired reporting unit, including evidence as to the existence and valuation of other intangible assets that existed as of the date of the impairment test."

Appendix C: Amendments to Accounting Standards related to Intangibles

Updates	Issuance Date	Changes	Implications
ASU 2010-28	Dec. 2010	Entities need to apply the step 2 of the goodwill impairment test when the reporting unit has zero or negative carrying amounts.	Reduces the managerial discretion in goodwill impairment test and increases the chances of recognizing impairment losses.
ASU 2011-04	May 2011	Disclosures of fair value measurement to be more consistent with IFRS.	Does not affect the recognition of intangibles.
ASU 2011-08	Sep. 2011	Intended to reduce the cost and complexity of the step 1 of the goodwill impairment test for private companies.	Does not affect the sample in this study.
ASU 2012-02	Jul. 2012	Intended to reduce the cost and complexity of the indefinite-lived intangible impairment test.	Increases the managerial discretion in goodwill impairment test by providing an entity with an option to make a qualitative assessment about indefinite-lived intangible impairments.
ASU 2014-02	Jan. 2014	Allow private companies to test goodwill for impairment at either the entity- or reporting unit-level and eliminate the step 2 of the impairment test.	Does not affect the sample in this study.
ASU 2014-18	Dec. 2014	Allow private companies to measure customer-related intangible assets and noncompetition agreements along with goodwill.	Does not affect the sample in this study.
ASU 2015-05	Apr. 2015	Establish guidance on how to account for fees paid in a cloud computing arrangement that includes internal-use software.	Does not affect the accounting for intangible impairments.

Figure 1: Timeline of PCAOB Inspections

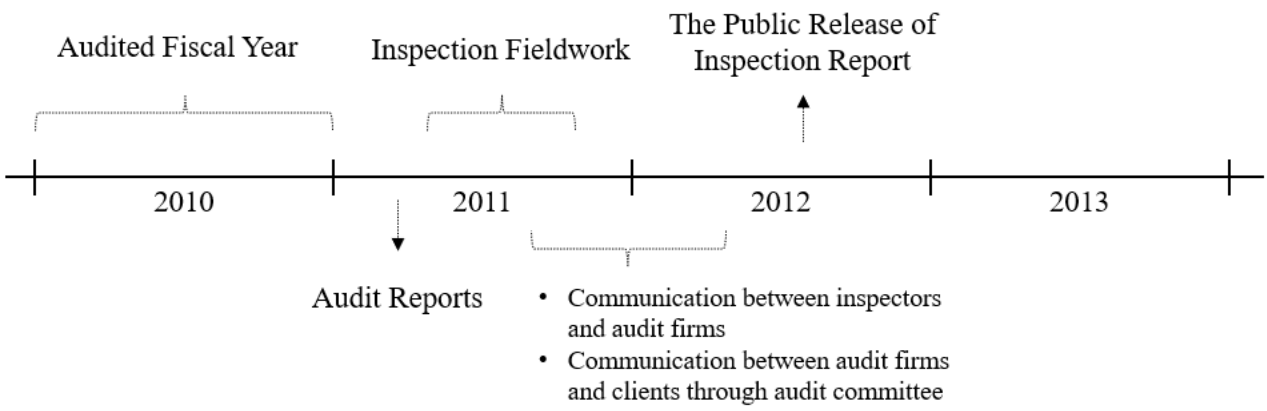

Table 1: Sample Selection

	The number of company-year observations
Compustat-Audit Analytics merged sample (2001 - 2015)	88,368
Less financial and utility companies	(22,215)
Less companies with missing or negative total assets	(4)
Less missing information for company characteristics	(5,726)
Less missing information for auditor characteristics	(4,550)
Less companies with no M&A deals during the sample period	(16,895)
Final Sample	38,978

Table 2: Descriptive Statistics

Panel A shows the summary statistics of variables used in the analyses. Panel B compares the mean value of control variables ($\Delta Log(Assets)$, $\Delta Leverage$, $\Delta Loss$, $\Delta Cash$, $\Delta Intangible$, $\Delta M\&A$, $\Delta R\&D$, and $\Delta Auditor\ Tenure$) between two groups of companies that commonly do not have deficient auditors in year t-1. Column (1) and (2) show the summary statistics for observations that become deficient and remain non-deficient, respectively. Panel C shows the sample distribution and the proportion of auditors deemed deficient in the valuation of intangibles by Fama-French 12 Industry Classification (excluding financial and utility industries). Appendix A provides detailed definitions of variables.

Panel A: Summary Statistics

		Level		First-differenced	
Variable	N	Mean	Std Dev	Mean	Std Dev
Deficiency	38,978	0.321	0.467	0.050	0.433
$Deficiency^{Placebo}$	38,978	0.048	0.214	0.002	0.268
$Deficiency^{Repeated}$	38,978	0.226	0.418	0.038	0.377
Impair	38,978	0.015	0.608	0.000	0.069
$Impair^{Indicator}$	38,978	0.100	0.300	0.009	0.371
BTMG1	38,978	0.131	0.337	-0.002	0.345
IMPI	38,978	-0.114	0.498	0.010	0.400
Log(Assets)	38,978	5.787	2.399	0.066	0.460
Leverage	38,978	0.219	2.159	-0.004	3.241
Loss	38,978	0.383	0.486	0.002	0.432
Cash	38,978	0.210	0.226	-0.001	0.122
Intangible	38,978	0.186	0.203	0.007	0.096
M&A	38,978	0.185	2.982	-0.016	3.046
R&D	38,978	0.100	0.179	-0.008	0.157
Auditor Tenure	38,978	9.454	7.506	0.459	2.570
Joint Venture	38,978	0.099	0.298	-0.004	0.368

Table 2, continued

Panel B: Comparison of Summary Statistics						
	(1) Deficient		(2) Non-Deficient		Difference	t-stat.
Change in...	Mean	Std Dev	Mean	Std Dev		
Log(Assets)	0.083	0.209	0.083	0.248	-0.000	-0.05
Leverage	0.001	0.115	-0.001	0.122	0.002	0.35
Loss	0.009	0.306	0.002	0.241	0.007	0.62
Cash	0.002	0.061	0.002	0.056	-0.000	-0.11
Intangible	0.007	0.045	0.006	0.040	0.001	0.57
M&A	-0.031	0.820	0.022	0.939	-0.053	-1.39
R&D	-0.003	0.128	-0.003	0.101	-0.000	-0.04
Auditor Tenure	0.542	1.871	0.522	1.393	0.020	0.30

Panel C: Fama-French 12 Industry Classification		
Industry	Observations	%Deficiency
Business equipment	10,719	0.306
Chemicals and allied products	1,229	0.356
Consumer Durables	1,155	0.366
Oil, gas, and coal extraction products	2,122	0.370
Healthcare, medical equipment, and drugs	5,145	0.300
Manufacturing	5,011	0.338
Consumer nondurables	2,256	0.319
Other	5,709	0.312
Wholesale, retail, and some services	4,205	0.327
Telephone and television transmission	1,427	0.331
Total	38,978	0.321

Table 3: Effect on Intangible Impairments

This table shows the effect of audit deficiencies regarding the valuation of intangibles on clients' intangible impairments by using the first-differenced regression:

$$\Delta Y_{i,t} = \alpha + \beta \Delta Deficiency_{i,t} + \gamma \Delta CompanyControl_{i,t-1} + \delta \Delta AuditorControl_{i,t} + IndustryYear + \varepsilon_{i,t}$$

The dependent variable is $\Delta Impair$ defined as change in the amount of intangible impairments scaled by lagged total assets. $\Delta Deficiency$ is change in an indicator for the clients of auditors deemed deficient in their audits of intangible valuation. $\Delta CompanyControl$ includes $\Delta Log(Assets)$, $\Delta Leverage$, $\Delta Loss$, $\Delta Cash$, $\Delta Intangible$, $\Delta M\&A$, and $\Delta R\&D$ measured in year t-1. $\Delta AuditorControl$ includes $\Delta Auditor\ Tenure$ measured in year t. Appendix A provides detailed definitions of variables. Standard errors, shown in parentheses, are clustered by industry and by year.

	(1)
Change in...	$\Delta Impair$
Deficiency	0.0025***
	(3.357)
Log(Assets)	0.004
	(1.535)
Leverage	-0.009**
	(-2.463)
Loss	-0.011***
	(-8.452)
Cash	0.004
	(0.555)
Intangible	0.137***
	(11.661)
M&A	-0.000
	(-0.716)
R&D	0.006
	(1.492)
Auditor Tenure	-0.000
	(-1.234)
Observations	38,978
R-squared	0.089
Industry-Year FE	YES

Table 4: Timeliness of Intangible Impairments

This table shows the effect of audit deficiencies regarding the valuation of intangibles on clients' likelihood of intangible impairments by using the first-differenced regression:

$$\Delta Y_{i,t} = \alpha + \beta \Delta Deficiency_{i,t} + \gamma \Delta CompanyControl_{i,t-1} + \delta \Delta AuditorControl_{i,t} + IndustryYear + \varepsilon_{i,t}$$

The dependent variable is $\Delta Impair^{Indicator}$ defined as change in an indicator for non-zero intangible impairments. $\Delta Deficiency$ is change in an indicator for the clients of auditors deemed deficient in their audits of intangible valuation. $\Delta CompanyControl$ includes $\Delta Log(Assets)$, $\Delta Leverage$, $\Delta Loss$, $\Delta Cash$, $\Delta Intangible$, $\Delta M\&A$, and $\Delta R\&D$ measured in year t-1. $\Delta AuditorControl$ includes $\Delta Auditor\ Tenure$ measured in year t. In Column (2), $BTMG1$ and $IMPI$ measure signals that necessitate the recognition of intangible impairments. Appendix A provides detailed definitions of variables. Standard errors, shown in parentheses, are clustered by industry and by year.

Table 4, continued

	(1)	(2)
Change in...	$\Delta Impair^{Indicator}$	
Deficiency	0.010**	0.010**
	(2.090)	(2.091)
BTMG1		0.031***
		(4.008)
*BTMG1*Deficiency*		0.034*
		(1.951)
IMPI		0.051***
		(8.963)
*IMPI*Deficiency*		-0.008
		(-0.679)
Log(Assets)	0.036***	0.035***
	(7.258)	(7.106)
Leverage	-0.011	-0.010
	(-1.390)	(-1.269)
Loss	-0.057***	-0.072***
	(-9.595)	(-11.295)
Cash	0.001	0.006
	(0.031)	(0.312)
Intangible	0.555***	0.499***
	(14.312)	(13.358)
M&A	-0.001	-0.001
	(-0.683)	(-0.664)
R&D	-0.012	-0.010
	(-0.855)	(-0.695)
Auditor Tenure	0.000	0.000
	(0.437)	(0.400)
Observations	38,978	38,978
R-squared	0.105	0.109
Industry-Year FE	YES	YES

Table 5: Effect of Repeated Deficiencies on Intangible Impairments

This table shows the effect of repeated deficiencies regarding the valuation of intangibles on clients' intangible impairments by using the first-differenced regression:

$$\Delta Y_{i,t} = \alpha + \beta \Delta Deficiency^{Repeated}{}_{i,t} + \gamma \Delta CompanyControl_{i,t-1} + \delta \Delta AuditorControl_{i,t} + IndustryYear + \varepsilon_{i,t}$$

The dependent variable is $\Delta Impair$ defined as change in the amount of intangible impairments scaled by lagged total assets. $\Delta Deficiency^{Repeated}$ is change in an indicator that takes the value of one for auditors who receive relevant deficiencies in both the current and the previous year. $\Delta CompanyControl$ includes $\Delta Log(Assets)$, $\Delta Leverage$, $\Delta Loss$, $\Delta Cash$, $\Delta Intangible$, $\Delta M\&A$, and $\Delta R\&D$ measured in year t-1. $\Delta AuditorControl$ includes $\Delta Auditor\ Tenure$ measured in year t. Appendix A provides detailed definitions of variables. Standard errors, shown in parentheses, are clustered by industry and by year.

	(1)
Change in...	$\Delta Impair$
$Deficiency^{Repeated}$	0.004***
	(4.464)
Observations	38,978
R-squared	0.089
Controls	YES
Industry-Year FE	YES

Table 6: Effect on Innovation Strategies

This table shows the effect of audit deficiencies regarding the valuation of intangibles on clients' innovation strategies by using the first-differenced regression:

$$\Delta Y_{i,t} = \alpha + \beta \Delta Deficiency_{i,t} + \gamma \Delta CompanyControl_{i,t-1} + \delta \Delta AuditorControl_{i,t} + IndustryYear + \varepsilon_{i,t}$$

In Column (1), the dependent variable is the dollar amount of M&A deals scaled by lagged total assets. In Column (2), the dependent variable is the dollar amount of R&D expenditures scaled by lagged total assets. Δ*Deficiency* is change in an indicator for the clients of auditors deemed deficient in their audits of intangible valuation. Δ*CompanyControl* includes Δ*Log(Assets)*, Δ*Leverage,* Δ*Loss,* Δ*Cash,* Δ*Intangible*, Δ*M&A,* and Δ*R&D* measured in year *t*-1. Δ*AuditorControl* includes Δ*Auditor Tenure* measured in year *t*. Appendix A provides detailed definitions of variables. Standard errors, shown in parentheses, are clustered by industry and by year.

	(1)	(2)
Change in...	Δ*M&A*	Δ*R&D*
Deficiency	-0.054***	-0.002
	(-2.596)	(-1.140)
Log(Assets)	-0.453***	-0.076***
	(-5.327)	(-11.526)
Leverage	0.216	0.009
	(0.903)	(1.533)
Loss	-0.055	-0.006***
	(-1.458)	(-3.765)
Cash	0.720***	-0.051***
	(3.545)	(-4.795)
Intangible	0.566**	0.005
	(2.168)	(0.277)
M&A	-0.661***	0.001*
	(-11.490)	(1.803)
R&D	0.300*	-0.257***
	(1.812)	(-5.547)
Auditor Tenure	-0.002	-0.000
	(-0.298)	(-1.436)
Observations	38,978	38,978
R-squared	0.348	0.395
Industry-Year FE	YES	YES

Table 7: Additional Tests

This table shows the results of additional tests to check the robustness of my findings. Panel A runs a placebo test using $\Delta Deficiency^{Placebo}$ which is defined as change in an indicator for the clients of auditors deemed deficient in their audits of intangibles but irrelevant to the valuation of intangibles. Panel B examines the robustness of innovation strategies results by using alternative measurement of innovation strategies. In Column (1), the dependent variable is $\Delta Joint\ Venture$ defined as change in an indicator for company-years that have at least one joint ventures formed in a given year. In Column (2), the dependent variable only includes M&A deals that increase the non-goodwill intangibles for acquirers. In Column (3), the dependent variable includes all M&A deals. Panel C examines the robustness of the main results with auditor fixed effects by using the first-differenced regression:

$$\Delta Y_{i,t} = \alpha + \beta \Delta Deficiency_{i,t} + \gamma \Delta CompanyControl_{i,t-1} + \delta \Delta AuditorControl_{i,t} + Auditor + IndustryYear + \varepsilon_{i,t}$$

In Column (1), the dependent variable is $\Delta Impair$ defined as change in the amount of intangible impairments scaled by lagged total assets. In Column (2), the dependent variable is the dollar amount of M&A deals scaled by lagged total assets. Panel D examines the main results using an alternative specification with level *Deficiency* by using the regression:

$$\Delta Y_{i,t} = \alpha + \beta Deficiency_{i,t} + \gamma \Delta CompanyControl_{i,t-1} + \delta \Delta AuditorControl_{i,t} + IndustryYear + \varepsilon_{i,t}$$

In Column (1), the dependent variable is $\Delta Impair$ defined as change in the amount of intangible impairments scaled by lagged total assets. In Column (2), the dependent variable is the dollar amount of M&A deals scaled by lagged total assets. $\Delta Deficiency$ is change in an indicator for the clients of auditors deemed deficient in their audits of intangible valuation. $\Delta CompanyControl$ includes $\Delta Log(Assets)$, $\Delta Leverage$, $\Delta Loss$, $\Delta Cash$, $\Delta Intangible$, $\Delta M\&A$, and $\Delta R\&D$ measured in year t-1. $\Delta AuditorControl$ includes $\Delta Auditor\ Tenure$ measured in year t. Appendix A provides detailed definitions of variables. Standard errors, shown in parentheses, are clustered by industry and by year.

Panel A: Placebo Test	
	(1)
Change in...	$\Delta Impair$
$Deficiency^{Placebo}$	-0.001
	(-1.052)
Observations	38,978
R-squared	0.088
Controls	YES
Industry-Year FE	YES

Table 7, continued

Panel B: Alternative Measurement of Innovation Strategies			
	(1)	(2)	(3)
Change in...	Δ*Joint Venture*	Δ*M&A*	Δ*M&A*
Deficiency	-0.007	-0.054***	-0.052**
	(-1.600)	(-2.594)	(-2.562)
Observations	38,978	38,978	38,978
R-squared	0.045	0.348	0.344
Controls	YES	YES	YES
Industry-Year FE	YES	YES	YES

Panel C: Inclusion of Auditor Fixed Effects		
	(1)	(2)
Change in...	Δ*Impair*	Δ*M&A*
Deficiency	0.002***	-0.037**
	(3.320)	(-2.220)
Observations	38,978	38,978
R-squared	0.125	0.300
Controls	YES	YES
Auditor FE	YES	YES
Industry-Year FE	YES	YES

Panel D: Level Deficiency		
	(1)	(2)
	Δ*Impair*	Δ*M&A*
Deficiency	0.002***	-0.064*
	(2.710)	(-1.927)
Observations	38,978	38,978
R-squared	0.089	0.238
Controls	YES	YES
Industry-Year FE	YES	YES