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The effect of auditor IT expertise on internal controls☆,☆☆

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ABSTRACT

Material weaknesses in internal controls related to information technology (IT) represent unique threats to organizations. Utilizing the external auditor as an example of an externally observable governance mechanism, we investigate if firms with revealed IT internal control deficiencies employ a strategy of disassociation with their current auditor. Our tests show that prior evidence of disassociation strategies hold in both IT and non-IT contexts. Of particular focus to our study, we document a positive association between firms that report IT material weaknesses and subsequent auditor dismissals or switching. We next investigate the potential internal control benefits of switching to auditors with greater expertise in environments that emphasize the importance of IT. We argue that greater audit firm IT expertise promotes improved internal controls for their clients, especially those controls that are dependent on IT. We find that clients that switch to auditors with greater IT expertise, relative to their former auditor, have a greater likelihood of material weakness remediation within one year of reporting control weaknesses. Complementing these findings, we find that audit IT expertise is negatively associated with both non-IT and IT material weaknesses in an ex ante reporting setting. Prior literature takes a longstanding interest in both the incentive for developing auditor expertise and the effects of that expertise. We contribute to this literature stream by providing additional evidence related to a specific type of expertise.

1. Introduction

Companies invest in information technology (IT) to improve their operational performance (Kobelsky et al., 2008a, 2008b) and the quality of their financial reporting (e.g. Dehning and Richardson, 2002; Dehning et al., 2003; Lim et al., 2011). Moreover, regulatory and academic literature suggests that IT serves as the foundation of an effective system of internal controls (COSO, 2009; Masli et al., 2010; Li et al., 2012). When there is a breakdown in IT-related controls, the resulting weaknesses in the firm's financial reporting environment can be acutely detrimental to the company (Klamm and Watson, 2009; Haislip et al., 2015; Li et al., 2012). As a result, when firms experience IT control deficiencies, these same firms often experience a need to engage governance mechanisms that will either signal and/or bolster the strength of such controls. We examine whether clients are more likely to switch auditors after experiencing reported IT material internal control weaknesses (ITMW). We next examine if switching to auditors with more IT expertise is associated with subsequently stronger internal controls.

☆ Data availability: The data used are publicly available from the sources cited in the text.

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Prior literature takes a longstanding interest in the incentives for and effects of auditor expertise with respect to a firm's financial reporting environment (e.g. Mayhew and Wilkins, 2003; Dunn and Mayhew, 2004; Solomon et al., 1999; Balsam et al., 2003; among others). We add to a growing auditor expertise literature that addresses specific attributes of financial reporting systems, namely IT.[1] As suggested by Ettredge et al. (2011), we argue that auditors with certain expertise can act as signals of improved financial systems. We provide an extension to Ettredge et al. (2011) by exploring the extent that a switch to auditors with greater levels of IT expertise provides benefits to the client's IT environment.

The importance and ubiquitous nature of IT within financial statement audits provides auditors with incentives to develop expertise for addressing IT. Practitioners often name IT as an area in which more training and attention is needed (Protiviti, 2006; KPMG, 2011). The American Institute of Certified Public Accountants (AICPA) includes gaining an understanding of IT in its standards for planning, evaluating risk, and performing audit procedures (AICPA, SAS 108-110, 2006a, 2006b, and 2006c). The PCAOB also recommends that auditors should "have an understanding of how the organization is dependent on or enabled by information technologies; and the manner in which information systems are used to record and maintain financial information" (PCAOB, QC Section 40, 2003). Despite the importance of IT knowledge, such knowledge is not costless. Therefore, not all auditors develop or employ equal levels of IT expertise. For example, recent research also shows that ITMW can be attributed to IT problems auditors could have detected ahead of time or a lack of IT understanding by general auditors (Canada et al., 2009; Bedard and Graham, 2011).

We examine whether switching to auditors with greater IT expertise, gained through experience with environments that emphasize the importance of IT, fosters stronger financial reporting environments by bolstering the firm's internal controls over financial reporting, particularly as it relates to IT controls. We argue IT expertise advances identification of internal control deficiencies, especially those related to IT, and the remediation of material internal control weaknesses. We develop a measure of IT expertise based on the IT expenditures of the auditor's clients.[2] We argue that audit firms develop IT audit expertise through prior experience with client environments that are particularly prone to emphasizing the importance of IT. Similar to an auditor's development of industry or tax expertise, IT expertise would shape the auditor's focus on IT-related issues or audit concerns, as well as the need to protect their potential reputation for serving clients in IT intensive environments. As a result, prior IT experience likely manifests itself in the audit firm's overall audit methodologies and investments in training. Since audit firms tend to use training "with standardized curricula" for all of their employees, it is likely that audit firms with a greater percentage of clients with IT heavy environments will allocate more training time to IT within their curriculum (Cooper, 2009). Over time, firms are seeing the need to increase significant investments to redesign audit methodologies and training to accommodate emerging technology (IFIAR, 2015). Moreover, the focus on IT investments can also spill over into other areas of audit and client support.[3] Investments in technology knowledge within the firm can also produce compounded opportunities to emphasize client-service opportunities (Lingor, 2015).

We first extend Ettredge et al. (2011) by documenting that firms follow dissociation strategies by dismissing their external auditor following both IT and non-ITMW. We next examine if the certain auditors are better at actually correcting both ITMW and non-ITMW. We apply our proxies for IT auditor experience to subsamples of firms who switch auditors in the wake of reporting material control weaknesses. We find that companies that switch to auditors with more IT expertise are more likely to remediate ITMW within one year. Consistent with the switching benefits, we find that auditor IT expertise is negatively associated with the occurrence of both IT and non-ITMW overall, in an ex ante setting. The specific impact associated with a switch to an auditor with greater IT expertise suggests that it is not just the switch decision or pre-existing client condition that is important, rather the specific switch to an auditor with more IT expertise appears to deliver the incremental benefits to the audit client.[4] Our results suggest that auditors with IT expertise are able to benefit their clients through the improvement of internal controls. It is important to note that such benefits are not dependent upon whether the client has attributed IT expertise to the auditor.

Our study contributes to the accounting literature that investigates the benefits of engaging auditors with distinct capabilities and knowledge. Specifically, prior research suggests that engaging auditors with client-industry expertise is positively associated with financial reporting quality (e.g. Reichelt and Wang, 2010; Hammersley, 2006; Ettredge et al., 2011). While the experimental literature examines the importance of IT and how it can affect auditor decisions (Messier, 1995; O'Donnell and David, 2000; O'Donnell and Schultz, 2003; Brazel et al., 2004; Bible et al., 2005; Bedard et al., 2007; Dowling and Leech, 2007; Dowling and Leech, 2009), less is known about the engagement of auditors with alternative forms of expertise, such as IT expertise, outside of experimental settings. We contribute to these lines of literature by showing that auditors with more IT expertise are better able to assess the quality of internal controls, as evidenced by the remediation of ITMW. This suggests that IT knowledge is an area where auditors can gain competitive expertise that benefits clients in ways that are consistent with the management of strategically important IT resources.

[1] A recent example of investigation into alternatives forms of auditor expertise includes McGuire et al. (2012) who investigate the impact of engaging audit firms with distinct tax expertise.

[2] A thorough discussion on sample selection appears in the Research design section.

[3] For example in response to the announcement of the 2015 expansion of KPMG's technology personnel in St. Louis Missouri, Harry Moseley, KPMG's chief information officer, noted "our technology organization provides innovative solutions that are critical to our firm's ability to deliver high-quality services to our clients and our professionals."

[4] In untabulated results we find no relation between IT material weaknesses and the choice of the new auditor. This suggests that although companies that report material weaknesses are more likely to switch auditors, as suggested by Ettredge et al. (2011), these companies do not recognize auditor IT expertise. However, our results suggest that these companies do benefit from switching to auditors with IT expertise.

2. Background and hypothesis development

2.1. Information technology weaknesses and auditor switching

Prior literature documents the use of disassociation strategies by companies that report material weaknesses in internal controls. Specifically, Li et al. (2010) and Johnstone et al. (2011) document that firms dismiss their executives and directors following the disclosure of a material weakness in internal controls. Haislip et al. (2015) extend these findings by documenting similar turnover when examining ITMW. They also find that replacing executives with those with more IT experience is associated with timelier remediation of ITMW. In sum, these outcomes are attributed to the company's desires to signal efforts at improving their internal control systems.

Most relevant to this study, Ettredge et al. (2011) find that companies are more likely to switch auditors following the revelation of a material control weakness. Specifically they argue that audit committees might dismiss their auditors due to the auditor's externally observable role in opining over the client's unobservable commitment to their internal control systems. Thus, dismissing the auditor acts as an external indicator of the company's efforts to improve or signal improvement in the company's financial reporting environment. We extend Ettredge et al. (2011) by examining whether this type of disassociation holds for both IT and non-IT material weaknesses. We follow this by also considering whether the replacement of the auditor with one with more IT experience is associated with timelier remediation of material control weaknesses.

The importance of evaluating these potential associations in an IT context is partially motivated by the importance of IT investment for companies, as well as the significant role that IT systems play in a firm's information environment. In 2010, total expenditures on hardware and software in the US were $352 billion, which represents approximately 35% of total non-residential fixed investments (BEA, 2011). The Survey of Current Business reports that in 2010 investments in IT represent close to 60% of all new fixed asset investments (BEA, 2012). The academic literature suggests that companies benefit from these investments in multiple ways including improved operating performance, higher quality financial reporting, and improvements to internal controls (Dehning and Richardson, 2002; Dorantes et al., 2013; Kobelsky et al., 2008a, 2008b; Masli et al., 2010). However, the literature also suggests that when management does not adequately support investments in IT, either through a lack of understanding or effort, it can create significant problems for the company. First, deficiencies in IT are an indicator of damaged organizational legitimacy, or the external signal of the firm's ability to operate effectively (Lim et al., 2013). Specifically, deficiencies in IT can lead to material weaknesses in internal controls (Ge and McVay, 2005; Canada et al., 2009; Bedard and Graham, 2011).

Prior literature also shows that IT-related material weaknesses (ITMW) are especially detrimental for companies, more so than other types of weaknesses. ITMW are more likely to be associated with misstatements, are associated with a greater number of deficiencies, and can negatively affect financial information (Klamm and Watson, 2009; Klamm et al., 2012; Li et al., 2012). Overall, the evidence suggests that companies who are investing more in IT, including control structure, often receive benefits; however, if not adequately supported such investments can be detrimental for companies (Kobelsky et al., 2008a). Despite a decrease in reported material weaknesses over time among publicly-registered firms, the decrease of reported ITMW's lag that of non-ITMW's, suggesting that firms continue to struggle with this area (McCann, 2010). This also establishes continued incentives to respond to ITMW in appearance and in fact.

Given that prior literature documents dissociation strategies around material weaknesses and finds ITMW are generally more severe than non-ITMW (Klamm and Watson, 2009; Klamm et al., 2012; Li et al., 2012; Lim et al., 2013), we predict that firms that report ITMW are at least as likely to follow a disassociation strategy as firm's reporting non-ITMW, and therefore are more likely to switch auditors than firms that report no material weaknesses. Specifically our first hypothesis is as follows:

Hypothesis 1a. Companies that report ITMW are more likely to switch auditors than firms that do not report any material weaknesses.

Hypothesis 1b. Companies that report non-ITMW are more likely to switch auditors than firms that do not report any material weaknesses.

2.2. The impact of auditor IT expertise on material weakness remediation

While firms may choose to disengage their auditors following a reported ITMW, it is unclear whether such a strategy would also entail a subsequent improvement in the firm's financial reporting control system, in concert with the engagement of a new auditor. Thus, we extend our tests to examine whether engaging a new auditor with IT expertise is associated with the remediation of internal control weaknesses. Prior literature takes a longstanding interest in the consequences of engaging auditors with certain areas of expertise and reputation. For example, numerous studies document enhancements in financial reporting quality (e.g. Balsam et al., 2003; Reichelt and Wang, 2010; Dunn and Mayhew, 2004, among others). Other studies document positive market price reactions to the hiring of industry experts and brand name auditors (e.g. Eichenseher et al., 1989; Knechel et al., 2007). However, little is known about the impact or incentives for alternative areas of expertise in an archival setting. One exception includes McGuire et al. (2012) who find a positive association between an audit firm's overall tax expertise and beneficial tax strategies for their clients. The current study seeks to provide evidence regarding the outcomes of switching to auditors with greater level of IT expertise.

A primary area of concern for auditors regarding IT relates to the internal controls surrounding financial reporting. Regulators and practitioners are consistently calling for auditors to increase their IT expertise specifically as it relates to the financial reporting system. These groups recommend and require that auditors gain an understanding of how information flows through IT for the specific companies that they audit (Carmichael, 2004; AICPA, 2006a; AICPA, 2006b; AICPA, 2006c; Protiviti, 2006; PCAOB, 2010; KPMG, 2011). Despite these mandates and the growing importance of IT in general, the deployment of IT expertise remains an area of great variance in the audit profession.

Historically, auditors would often choose to avoid testing controls, unless required to do so, as they believed relying solely on substantive tests was more effective and efficient (Messier et al., 2004). While recent auditing standards require auditors to assess and test the internal control environment, prior literature suggests that auditors still limit their reliance on internal controls (Waller, 1993; Briggs, 2008). Briggs (2008) notes that this strategy could be due to a "lack of understanding of IT and its role in a company's finances." The audit environment; however, is continuously evolving, and auditors should be relying on internal controls more than in the past. Prior research suggests that an understanding of IT increases the degree of internal control reliance. Auditors will often choose to use IT auditors to assess IT-related controls. However, as the academic literature shows, if the general auditor does not have a good understanding of IT, they will not adequately rely on the IT auditor's report and incorrectly assess control risk (Brazel and Agoglia, 2007). Therefore, it appears that a lack of understanding of IT is contributing to auditors' failure to rely on internal controls.

In contrast, Brazel and Agoglia (2007) find that auditors with more IT experience are more likely to rely on the work done by the IT auditors. Therefore, audit firms with more IT expertise should have auditors and IT auditors that are more willing and able to work together. We posit that auditors with greater expertise in environments that emphasize the importance of IT also exhibit a greater understanding of IT and will place greater importance on IT internal controls. Such an impact should also benefit the client through ITMW remediation.

Although audit independence standards guard against auditors taking on management-oriented responsibilities, such as IT implementations and corrections, auditor expertise and knowledge could be viewed as a source of information that aids managers in making decisions. McCracken et al. (2008) find that auditors prefer to use their expertise and roles to act more as advisors than "police officers," suggesting that they prefer to assist management in preparing quality financial statements when possible. When IT expertise is emphasized, it is in the auditors' best interest to appropriately advise their clients to correct internal control deficiencies quickly, as this will allow the auditor to rely on the internal controls. We predict that switching to auditors with greater IT expertise should be able to assist companies in remediating material weaknesses quickly due to their ability to advise management of the integration and correction of IT internal controls. Specifically our second set of hypotheses is as follows:

Hypothesis 2. The likelihood of a company remediating all IT material weaknesses in internal control within one year is positively associated with switching to an auditor with IT expertise.

We examine whether the disassociation strategies will hold in both IT and non IT contexts (i.e. Hypotheses 1a and 1b). Therefore, we also examine the extent that switching to an auditor with IT expertise would also indicate the firm's or audit committee's investment in remediation efforts for non-IT weaknesses, as well (e.g. Ettredge et al., 2011). To the extent that IT expertise raises the level of audit quality overall, we would expect the likelihood of non-IT control remediation to also improve.

Hypothesis 3. The likelihood of a company remediating all non-IT material weaknesses in internal control within one year is positively associated with switching to an auditor with IT expertise.

The auditor switching event provides a more powerful setting for observing the potential impact of auditor IT expertise on the improvement of firm internal control environments. However, if IT expertise is a factor that contributes to the strength of the firm's internal control environment, we should also find that the pre-existing use of auditors with greater IT expertise should be associated with fewer occurrences of reported IT material weaknesses, in general. If auditors are able to identify deficiencies early in the audit process, and possess more knowledge to assist companies in fixing them, then these companies are less likely to report material weaknesses (Bedard and Graham, 2011). These auditors should be able to suggest ways to implement IT to strengthen internal controls. Therefore, to supplement the support for H2 and H3, we also test whether clients of auditors with more IT expertise are less likely to report material weaknesses in internal control than other companies (in a pre-switching context). Specifically, our fourth hypothesis is as follows:

Hypothesis 4. Prior to switching auditors, the likelihood of a company reporting material weaknesses in internal control is negatively associated with engagement of an auditor with IT expertise.

3. Research design

3.1. Sample selection

To construct our sample, we begin with the entire Audit Analytics population for the years 2004–2009. We identify the companies with SOX 404 data, which include 38,443 company-year observations. We next join this database to the Compustat

database. We then eliminate observations with less than one million dollars of assets and those with missing data. We eliminate firms with less than one million in assets to ensure that all of our control variables can be calculated, as smaller firms do not report all of the items used in our tests. Additionally, we eliminate all companies that use an audit firm with no clients with available IT budget data, discussed below. We end with our initial sample of 20,407 company-year observations representing 4928 unique companies. This includes 287 ITMW firms and 1469 non-ITMW firms. Panel A of Table 1 presents a reconciliation of our sample.

To gauge the extent of auditor expertise in environments that emphasize the importance of IT, we separately use the InformationWeek database to identify company IT spending. InformationWeek conducts annual surveys to gather IT spending plans for public and private firms. The information is collected from surveyed IT budgets for hardware, software, personnel and other IT-related information. Lichtenberg (1995) finds that the information collected by InformationWeek correlates highly with other surveys and reports of IT.[5] Using the InformationWeek database we are able to identify 5657 firm-year observations from the years 2001 through 2009 using this data. This data is accessed directly from InformationWeek. For each auditor we calculate two different measures to capture IT expertise. Percent IT Spending is the total IT budget scaled by total assets for the last three years of all of the clients of an auditor. Total IT Spending is the total IT budget for the last three years of all of the clients of an auditor.[6] This variable is then multiplied by 1000 to more easily interpret the coefficients. These variables are calculated using the data from the IT budget database, and are then applied to the observations in the initial sample.[7]

We argue that our proxies for auditor IT expertise should identify audit firms that have a greater understanding of IT for multiple reasons. First, they are exposed to more IT integrated in financial reporting through the clients that they audit. Additionally, these audit firms as a whole appear to be seeking out IT-intensive clients and identifying the need to make significant investments to redesign audit methodologies and training to accommodate emerging technology (IFIAR, 2015). Investments in technology knowledge within the firm can also produce compounded opportunities to emphasize client-service opportunities (Lingor, 2015).Therefore, based on anecdotal evidence, these audit firms are more likely to incorporate more IT elements in their training of their staff. Overall, these audit firms should be more sensitive to the importance of IT within a client's financial reporting system and its concomitant audit implications, on average. Given that our measures are continuous variables, this allows us to measure the relative IT experience of all audit firms to each other on a yearly basis.[8]

Panel B of Table 1 presents the industry classification (by two-digit SIC code) for the companies included in our sample. The companies in our sample cover a wide variety of industries. The industries that appear most often include Services, Financial Institutions, and Electrical. Overall, our sample appears to be a good representation of the overall population of companies with the largest difference in Financial Institutions industries. Finally, Panel C of Table 1 shows the distribution of the sample companies across time. The number of observations increases over time until 2009 when it levels off. This again appears to be a representation of the trend in the population.

3.2. Empirical models specification

3.2.1. Auditor switch

To examine if ITMW firms follow the disassociation strategy found in prior literature, we first investigate if ITMW firms are more likely to switch auditors than other firms. Following Ettredge et al. (2011), we use the following logistic regression model to test Hypotheses 1a and 1b (see Table 2 for variable definitions):

$$\begin{aligned}\text{Auditor Switch}_{i,t+1} = {} & \beta_0 + \beta_1\,[\text{Weakness}]_{i,t+1} + \beta_2\,\text{Big4}_{i,t} + \beta_3\,\text{LnAssets}_{i,t} + \beta_4\,\text{Leverage}_{i,t} + \beta_5\text{ROA}_{i,t} + \beta_6\text{Loss}_{i,t} \\ & + \beta_7\text{BTM}_{i,t} + \beta_8\text{Going Concern}_{i,t} + \beta_9\text{Abnormal Fees}_{i,t} + \varepsilon_{i,t}. \end{aligned} \quad (1)$$

Regression model (1) includes year fixed effects[9,10] and estimate robust standard errors clustered by company. Auditor Switch is an indicator variable coded as 1 if the client switches auditors from year t to year t + 1, and zero otherwise.

The variable Weakness is measured in three different ways depending on the type of weakness: Weakness, IT Weakness, or Non-IT Weakness. Based on prior literature we expect these variables to be positive and significant. We develop the model following Ettredge et al. (2011) and include control variables found to be associated with auditor dismissal. These controls capture the aspects of the company (LnAssets, Leverage, ROA, Loss, and BTM) as well as their potential dissatisfaction with the auditor (Going Concern and Abnormal Fees).

[5] Although the use of such databases come with certain limitations, their use is commonly employed by prior IT researchers. Examples include Bharadwaj et al. (1999), Brynjolfsson and Hitt (1996), Lichtenberg (1995), and Kobelsky et al. (2008b). Nonetheless, we acknowledge the reliability limitations in our conclusion.

[6] In untabulated results, we alternatively use the IT budgets for all prior years available and arrive at similar results. Here and throughout the paper, similar results indicate that our alternative tests may result in coefficients of slightly different magnitude, but the statistical significance of our variables of interest match those in the presented tables.

[7] We alternatively limit the sample to only those firms with available IT budget data, and include the IT budget as a control variable. Our results remain essentially the same. We also alternatively use a sample eliminating high tech firms that are most likely to have IT budgets and again arrive at similar results.

[8] We also consider office level IT expertise. However, using our IT budget data we are unable to construct our variables for a sufficient number of audit firm offices because we do not have IT budget data for multiple clients of these offices. Therefore, our sample size would be too small to run a regression.

[9] In untabulated analysis we also include industry indicator variables for all of our models and arrive at similar results.

[10] We recognize that it is possible that certain audit firm characteristics may affect our results. We try two different methods to alleviate this concern. First, we run our analysis including audit firm indicator variables and arrive at similar results. Second, to ensure that the results are not due to smaller audit firm, we limit the sample to only Big 4 auditors, and again arrive at similar results.

Table 1
Sample selection.

Panel A: Sample reconciliation	
Company-year observations from Audit Analytics	38,443
Less: Companies with data missing from Compustat or Audit Analytics	10,905
Less: Companies engaging an auditor that has no IT budget data	7121
Final # of company-year observations	20,407
Final # of ITMW firms	287
Final # of non-ITMW firms	1469

Panel B: Industry representation

Industry	2-Digit SIC code	Total number	Percentage	Population percentage
Chemicals	28–29	2020	9.90%	7.39%
Electrical	36, 38	2542	12.46%	8.72%
Equipment	35	937	4.59%	2.90%
Financial institutions	60–65, 67	3846	18.85%	35.68%
Healthcare	80, 82	409	2.00%	1.36%
Media	27, 48	963	4.72%	3.23%
Oil	13, 46	728	3.57%	4.34%
Retail sales	50–59	1746	8.56%	5.61%
Services	70–79	2451	12.01%	9.86%
All others	All others	4765	23.35%	20.92%
Total		20,407	100.00%	100.00%

Panel C: Year distribution

Year	Total number	Percentage	Population percentage
2004	2630	12.89%	16.85%
2005	3113	15.25%	17.02%
2006	3389	16.61%	17.01%
2007	3851	18.87%	16.97%
2008	3914	19.18%	16.68%
2009	3510	17.20%	14.99%
Total	20,407	100.00%	100.00%

3.2.2. Material weaknesses remediation

To examine the potential impact of auditor IT expertise, we investigate the remediation of material control weaknesses after an auditor switch has occurred. We utilize sample observations in which a company reports prior period material weakness and subsequently switches auditors for the current period. We use the following logistic regression model to test Hypotheses 2 and 3 (see Table 2 for variable definitions):

$$\begin{aligned}\text{Remediate Non} - \text{IT or Remediate IT}_{i,t} = {} & \gamma_0 + \gamma_1 [\text{Auditor IT Expertise}]_{i,t+1} + \gamma_2 \text{Big4}_{i,t} + \gamma_3 \text{LnAssets}_{i,t} + \gamma_4 \text{Leverage}_{i,t} \\ & + \gamma_5 \text{ROA}_{i,t} + \gamma_6 \text{Loss}_{i,t} + \gamma_7 \text{BTM}_{i,t} + \gamma_8 \text{Going Concern}_{i,t} + \gamma_9 \text{Inventory}_{i,t} \\ & + \gamma_{10} \text{Recivables}_{i,t} + \gamma_{11} \text{Foreign}_{i,t} + \gamma_{12} \text{Restructuring}_{i,t} + \gamma_{13} \text{Restatement}_{i,t} \\ & + \gamma_{14} \text{High Tech}_{i,t} + \mu_{i,t}. \end{aligned} \quad (2)$$

Regression model (2) includes year fixed effects and estimate robust standard errors clustered by company. We additionally run this model including all observations in which a material weakness is reported, and include an indicator variable for Auditor Switch as well as an interaction of Auditor Switch and our variable of interest. We run this model using two different dependent variables. We first focus on remediation of IT material weaknesses, and then focus on remediation of non-IT material weaknesses. Remediate IT is set to 1 if all prior period IT material weaknesses are remediated in the current period, zero otherwise. Remediate Non-IT is set to 1 if the prior period non-IT material weaknesses have been remediated in the current period, zero otherwise.

Our variable of interest, Auditor IT Expertise, is captured by two different proxies: Percent IT Spending and Total IT Spending (as described in the previous section). We expect companies that switch to an auditor with more IT expertise will be more likely to remediate material weaknesses. Therefore, we expect the auditor IT expertise coefficients (Percent IT Spending and Total IT Spending) to be positive and significant. We measure these variables in year t + 1 to capture the expertise of the auditor involved in the remediation efforts. The extant literature finds that the quality of the auditor can influence a company's ability to remediate. Therefore, we run this model including Big 4.[11] The extant literature generally uses broad categories of variables shown to be associated with remediation of material weaknesses. Therefore, we include control variables because we expect companies to be better able to remediate if they are larger (LnAssets), financially stronger (Leverage, ROA, Loss, BTM, and Going Concern), less

[11] In untabulated results we also include an industry specialist control variable. This variable is not significant in our model and our results remain unchanged.

Table 2
Variable definitions.

Panel A: Dependent variable definitions	
Auditor Switch	Equals one if the company switches auditors from year t to year t + 1; zero otherwise.
Weakness	Equals one if the company reports a material weakness in internal controls in year t; zero otherwise.
Non-IT Weakness	Equals one if the company reports a non-IT material weakness in internal controls in year t; zero otherwise.
IT Weakness	Equals one if the company reports an IT material weakness in internal controls in year t; zero otherwise.
Remediate Non-IT	Equals one if the company reports no non-IT material weaknesses in year t + 1; zero otherwise.
Remediate IT	Equals one if the company reports no IT material weaknesses in year t + 1; zero otherwise.
Panel B: Independent variables	
Auditor IT expertise	
Percent IT Spending	Equals the total amount spent on IT (scaled by total assets) by all of the clients of the firm's auditor for years t − 1, t − 2, and t − 3, for which IT spending data is available.
Total IT Spending	Equals the total amount spent on IT by all of the clients of the firm's auditor for years t − 1, t − 2, and t − 3, for which IT spending data is available. This variable is then multiplied by 1000 to better interpret the coefficients.
Control variables	
LnAssets	The natural log of total assets in year t.
Leverage	Total liabilities divided by total assets in year t.
ROA	The return on assets calculated as net income before extraordinary items divided by total assets in year t.
Loss	Equals one if the company reports a net loss in year t; zero otherwise.
BTM	The book to market ratio in year t.
Going Concern	Equals one if the company receives a going concern report in year t; zero otherwise.
Abnormal Fees	The residual from a standard fee model.[a]
Inventory	Total inventory divided by total assets in year t.
Receivables	Total accounts receivable divided by total assets in year t.
Segments	The total number of reportable operating segments in year t.
Extraordinary	Equals one if the company reports extraordinary items in year t; zero otherwise.
Foreign	Equals one if the company engaged in foreign transactions in year t; zero otherwise.
Merger	Equals one if the company engaged in mergers and acquisitions in year t; zero otherwise.
High Tech	Equals one if the company operates in a high-tech industry; zero otherwise.
Big 4	Equals one if the company engages a Big 4 auditor; zero otherwise.
Specialist	Equals one if the auditor engaged by the company is considered an industry specialist using the portfolio method in year t; zero otherwise.
Restructuring	Equals one if the company engaged in restructuring activity in year t; zero otherwise.
Restatement	Equals one if the company reports a restatement in year t; zero otherwise.

[a] Following Ettredge et al., 2011, the model is LnFee = b0 + b1LnAssets + b2Sales/Assets + b3Leverage + b4ROA + b5Loss + b6BTM + b7BIG 4 + b8Audit Delay + b9Receivables + b10Inventory + b11Specialist + b12Restatement + b13LnSegments + b14Restructuring + b15Going Concern + b16Weakness + b17Count MW + YEAR. The model uses all firms with SOX 404 internal control reports over our sample period. The model is significant and all of the variables are significant indirections consistent with prior studies. LnFee is the natural log of audit fees; Sales/Assets is total client revenue divided by total client assets; Audit Delay is the number of days between the client's fiscal year end and audit report date; Count MW is the number of material weaknesses reported; YEAR is an indicator variable for fiscal years. Other variables are defined previously.

complex (Inventory, Receivables, Foreign, and Restructuring), and fewer financial reporting problems (Restatement) (Li et al., 2010; Johnstone et al., 2011). We include High Tech to control for the effects of high tech industries.

3.2.3. Material weaknesses

Recall, we develop Hypothesis 4 to provide support for Hypotheses 2 and 3 by examining whether the use of auditors (prior to an auditor switch) with greater IT expertise is associated with fewer occurrences of reported material internal control weaknesses, in general. To test Hypothesis 4, we run variations of the following logistic regression model (see Table 2 for variable definitions):

$$\begin{aligned}\text{Weakness}_{i,t} = {} & \alpha_0 + \alpha_1\,[\text{Auditor IT Expertise}]_{i,t} + \alpha_2\,\text{Specialist}_{i,t} + \alpha_3\,\text{LnAssets}_{,t} + \alpha_4\,\text{Leverage}_{i,t} + \alpha_5\text{ROA}_{i,t} + \alpha_6\text{Loss}_{i,t} \\ & + \alpha_7\text{BTM}_{i,t} + \alpha_8\text{Going Concern}_{i,t} + \alpha_9\text{Inventory}_{i,t} + \alpha_{10}\text{Receivables}_{i,t} + \alpha_{11}\text{Segments}_{i,t} \\ & + \alpha_{12}\text{Extraordinary}_{i,t} + \alpha_{13}\text{Foreign}_{i,t} + \alpha_{14}\text{Merger}_{i,t} + \alpha_{15}\text{High Tech}_{i,t} + \alpha_{16}\text{Big4}_{i,t} + \sigma_{i,t}. \end{aligned} \quad (3)$$

Regression model (3) includes year fixed effects and estimate robust standard errors clustered by company. We are interested in the probability of a company reporting a material weakness, either IT or non-IT related, prior to an auditor switch.

Similar to the first regression, we measure Auditor IT Expertise using two different proxies Percent IT Spending and Total IT Spending (as described in the previous section). However, for Hypothesis 4 we measure our auditor IT expertise variables based upon the auditor engaged as of time t, the year of reported material weaknesses. Thus, we capture auditors prior to any switch events that might have been prompted by the prior existence of a reported material weakness. Based on our hypothesis we expect the auditor IT expertise coefficients (Percent IT Spending and Total IT Spending) to be negative. This indicates that companies that previously utilized an auditor with greater IT expertise are less likely to report material weaknesses in their internal controls in the current period. We include a set of control variables based on the extant literature that examines the

Table 3

Panel A: Descriptive Statistics

Variable	Mean	Standard Deviation	25th Percentile	Median	75th Percentile
Percent IT Spending	6.270	2.574	5.334	6.560	8.158
Total IT Spending	79157.54	32312.81	65145.48	86406.11	98288.48
Big4	0.900	0.300	1.000	1.000	1.000
LnAssets	6.995	2.060	5.610	6.899	8.259
Leverage	0.560	0.393	0.342	0.541	0.731
ROA	-0.005	0.586	-0.009	0.029	0.072
Loss	0.278	0.448	0.000	0.000	1.000
BTM	0.582	0.768	0.276	0.479	0.757
Going Concern	0.022	0.147	0.000	0.000	0.000
Inventory	0.081	0.119	0.000	0.025	0.123
Receivables	0.172	0.185	0.051	0.117	0.208
Segments	2.088	3.834	1.000	1.000	1.000
Extraordinary	0.026	0.160	0.000	0.000	0.000
Foreign	0.303	0.460	0.000	0.000	1.000
Merger	0.077	0.266	0.000	0.000	0.000
High Tech	0.255	0.436	0.000	0.000	1.000
Restructuring	0.277	0.448	0.000	0.000	1.000
Restatement	0.129	0.335	0.000	0.000	0.000

Panel B: Client IT spending by firm.

	Big 4 firm 1		Big 4 firm 2		Big 4 firm 3		Big 4 firm 4	
	Total IT spending	Percent IT spending	Total IT spending	Percent IT spending	Total IT spending	Percent IT spending	Total IT spending	Percent IT spending
2004	102,205.50	9.00	100,949.50	11.09	68,341.02	8.20	65,145.48	5.66
2005	83,184.71	7.77	92,777.40	9.29	66,352.71	6.91	50,494.97	4.79
2006	86,861.12	7.00	95,239.17	8.83	63,809.80	5.33	50,037.50	4.41
2007	98,288.48	6.50	97,789.38	8.16	79,529.72	5.05	58,613.57	4.71
2008	117,645.30	6.63	98,558.56	8.54	115,851.60	6.16	86,406.11	6.36
2009	97,117.69	5.46	84,923.15	6.63	132,196.50	6.56	82,746.23	5.93

determinants of material weaknesses. These papers generally use four broad categories of variables that are associated with material weaknesses. These categories include company size, operating performance, accounting complexity, and operating complexity. We include LnAssets as a proxy for company size, as prior literature shows larger companies are less likely to report material weaknesses (Ge and McVay, 2005; Doyle et al., 2007). To capture the operating performance and financial condition of the company we include Leverage, ROA, Loss, BTM, and Going Concern. Prior literature finds that companies that are more profitable and are in better financial condition are less likely to report material weaknesses (Ge and McVay, 2005; Doyle et al., 2007; Li et al., 2007). We include Inventory and Receivables as our measures of accounting complexity. Extant literature finds that companies with larger levels of inventory and receivables require more controls and are therefore more likely to report material weaknesses (Li et al., 2007). For operating complexity, we include Segments, Extraordinary, Foreign, and Merger. The extant literature finds that companies with complex operations are more likely to report material weaknesses (Ge and McVay, 2005; Doyle et al., 2007; Li et al., 2007). We include High Tech because companies in these industries are more likely to use IT in their financial reporting and therefore may be more likely to report IT material weaknesses. The extant literature also finds that the quality of the auditor can influence the likelihood of reporting material weaknesses. Therefore, we additionally include Big 4 and Specialist.

4. Results

4.1. Descriptive statistics

Panel A of Table 3 provides descriptive statistics for our initial sample. We provide the statistics for all of our independent variables including our variables of interest. Our sample firms are generally large, profitable firms that use Big 4 auditors. The mean total assets is about $1 billion. The percent of IT spending by clients within the auditor's client portfolio is approximately 6.27% of total assets. The mean total amount spent on IT by all of the clients within an audit firm portfolio for the previous three years was approximately $79 billion. Panel B of Table 3 provides client IT spending by each Big 4 audit firm for each of the years of the sample. As the table shows there is an overall decreasing trend in IT spending that reverses in the later years. Also, there is not consistency between the Total IT spending and the scaled IT spending number due to changes in the client makeup of the audit firms. These descriptive statistics are expected given our sample constraints.[12]

[12] In addition or our other sensitivity procedures, we also winsorize all continuous variables at the 1% and 99% levels (in untabulated tests). The results hold using this method.

Table 4
Likelihood of auditor switch.

Variables	Pred	Column 1 Auditor switch	Column 2 Auditor switch
Weakness	+	1.184***	
		(0.000)	
IT weakness	+		1.289***
			(0.000)
Non-IT weakness	+		1.164***
			(0.000)
Big 4	?	−0.776***	−0.773***
		(0.000)	(0.000)
LnAssets	−	−0.103***	−0.103***
		(0.000)	(0.000)
Leverage	+	−0.039	−0.039
		(0.694)	(0.696)
ROA	−	−0.070	−0.071
		(0.202)	(0.200)
Loss	+	0.253***	0.251***
		(0.002)	(0.003)
BTM	?	0.123***	0.123***
		(0.009)	(0.009)
Going concern	+	0.178	0.179
		(0.195)	(0.195)
Abnormal fees	+	−0.538	−0.538
		(0.999)	(0.999)
Intercept	?	−2.315***	−2.313***
		(0.000)	(0.000)
Year indicator		Included	Included
Number of observations		20,407	20,407
Model χ^2		463.50***	464.28***
Pseudo R^2		0.070	0.070
Correctly classified		95.21%	95.20%

Note: The dependent variable is an indicator set equal to 1 if the company switches auditors from year t to year t + 1, 0 otherwise. The p-values are listed in parentheses under the coefficient. The sample includes all available observations.
* p < 0.10.
** p < 0.05.
*** p < 0.01.

4.2. Multivariate analysis

Table 4 examines the likelihood of auditor switch following the disclosure of material weaknesses. Consistent with prior research, in column 1 we find evidence that companies that report material weaknesses are more likely to switch auditors (Weakness coefficient = 1.184, p-value < 0.000). In addition, column 2 shows that these results hold for both IT and non-IT Weaknesses (IT Weakness coefficient = 1.289, p-value < 0.000; Non-IT Weakness coefficient = 1.164, p-value < 0.000).[13] When we calculate the marginal effects, ITMW firms are approximately 9% more likely to switch auditors and non-ITMW firms are about 7% more likely to switch auditors. These results suggest that all firms that report a material weakness, including ITMW, follow a disassociation strategy. This result is in line with our first hypothesis suggesting that these firms may be signaling to the market that they are attempting to improve controls.

Tables 5 and 6 examine remediation of previously reported material control weaknesses subsequent to an auditor switch. Table 5 presents cross-sectional logit regression results where the dependent variable represents the remediation of prior IT material control weaknesses (ITMW). The dependent variable is an indicator set equal to 1 if the company no longer reports IT material weaknesses year t + 1, 0 otherwise. Columns 1 and 2 consist of all observations in which a company reports an IT material weakness in period t. We find that the coefficients on the interaction terms are positive and significant (Percent IT Spending * Auditor Switch coefficient = 16.484, p-value < 0.000; Total IT Spending * Auditor Switch coefficient = 0.034, p-value < 0.000). In other words, companies that switch to an auditor with more IT expertise have a greater likelihood of remediating their IT control weaknesses in the first year, than companies that did not switch auditors or switched to an auditor with less IT expertise. In computing the marginal effects, we find that changes auditors with an increase in IT spending of 1% increases the likelihood of remediation by approximately 2%. Columns 3 and 4 include all IT material weaknesses firms that subsequently switched auditors.[14] We continue to find that IT control weakness remediation is positively associated with those

[13] Based on prior literature, almost all firms that report an ITMW also report at least one non-ITMW (Klamm et al., 2012). Therefore it is difficult to compare the two variables, and therefore we do not test the difference between the variables.
[14] We recognize that the small sample size is not ideal, and is a limitation of our study. We alternatively use a stepwise regression to arrive at a smaller more simplified model to allow for more degrees of freedom and arrive at similar results.

Table 5
Likelihood of IT material weakness remediation.

Variables	Pred	Column 1 ITMW sample	Column 2 ITMW sample	Column 3 Switchers only	Column 4 Switchers only
ΔPercent IT Spending	+	−16.425		0.694***	
		(0.996)		(0.007)	
ΔTotal IT Spending	+		−0.380		0.004**
			(0.996)		(0.013)
Auditor Switch	?	0.329	0.364		
		(0.437)	(0.394)		
ΔPercent IT Spending * Auditor Switch	+	16.484***			
		(0.000)			
ΔTotal IT Spending * Auditor Switch	+		0.034***		
			(0.000)		
Big 4	+	−0.309	−0.326	−8.461	−9.385
		(0.748)	(0.758)	(0.998)	(0.994)
LnAssets	+	−0.066	−0.064	−2.231**	−0.809
		(0.723)	(0.718)	(0.993)	(0.782)
Leverage	−	−0.156	−0.160	9.054	8.749
		(0.351)	(0.347)	(0.949)	(0.937)
ROA	+	−1.407	−1.409	6.599***	4.763
		(0.951)	(0.949)	(0.007)	(0.113)
Loss	−	−0.417	−0.422	1.565	3.421
		(0.107)	(0.105)	(0.788)	(0.822)
BTM	−	0.147	0.146	2.276	0.219
		(0.767)	(0.765)	(0.936)	(0.542)
Going Concern	−	−0.190	−0.182	6.072	8.327
		(0.387)	(0.392)	(0.968)	(0.949)
Inventory	−	3.375	3.361	8.504	12.704
		(0.976)	(0.976)	(0.819)	(0.964)
Receivables	−	0.446	0.443	40.715	39.298
		(0.683)	(0.684)	(0.999)	(0.918)
Foreign	−	−0.099	−0.099	−11.083***	−10.873**
		(0.364)	(0.364)	(0.005)	(0.020)
Restructuring	−	−0.025	−0.022	−5.559*	−7.073**
		(0.468)	(0.472)	(0.093)	(0.044)
Restatement	−	−0.101	−0.099	3.585	3.536
		(0.381)	(0.383)	(0.899)	(0.910)
High Tech	?	0.151	0.159	4.847*	5.526*
		(0.679)	(0.662)	(0.062)	(0.054)
Intercept		1.230	1.233	15.533***	9.788
		(0.153)	(0.154)	(0.003)	(0.182)
Year indicator		Included	Included	Included	Included
Number of observations		287	287	43	43
Model χ^2		174.22***	168.72***	97.07***	47.96***
Pseudo R^2		0.07	0.07	0.58	0.55
Correctly classified		72.82%	72.82%	88.37%	90.70%

Note: The dependent variable is an indicator set equal to 1 if the company reports no IT material weaknesses year t + 1, 0 otherwise. The p-values are listed in parentheses under the coefficient.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

companies that switch to auditors with greater IT expertise compared to firms that switched to an auditor with less IT expertise (Percent IT Spending coefficient = 0.694, p-value = 0.007; Total IT Spending coefficient = 0.004, p-value = 0.013).

Table 6 presents cross-sectional logit regression results where the dependent variable represents the remediation of prior non-IT material control weaknesses (Non-ITMW). The dependent variable is an indicator set equal to 1 if the company no longer reports non-IT material weaknesses year t + 1, 0 otherwise. Columns 1 and 2 consist of all observations in which a company reports a non-IT material weakness in period t. We find that the coefficients on our variables of interest are positive and significant (Percent IT Spending = .223, p-value = 0.084; IT Intensity Fees coefficient = 0.025, p-value = 0.062). Contrary to the analysis of IT control weaknesses in Table 5, companies that report non-ITMW do not benefit from switching auditors. In fact, the coefficient on Auditor Switch is negative and significantly different from zero suggesting that companies are better off not switching auditors in the case of non-ITMW. These companies do however benefit if their incumbent auditor gains IT expertise from the prior year. Columns 3 and 4 include all firms that exhibited non-IT material weakness observations and subsequently switched auditors. Consistent with columns 1 and 2 we do not find significance for the coefficients on our variables of interest. Consistent with Hypothesis 2, Table 5 suggests that auditor IT expertise increases the likelihood that the company will remediate all of their IT material weaknesses within one year. While the results of Table 6 do suggest some benefits of IT expertise, they do not fully support Hypothesis 3. Taken together, the results suggest that it is not just the auditor switch that significantly increases

Table 6
Likelihood of non-IT material weakness remediation.

Variables	Pred	Column 1 Non-ITMW sample	Column 2 Non-ITMW sample	Column 3 Switchers only	Column 4 Switchers only
ΔPercent IT Spending	+	0.223*		0.024	
		(0.084)		(0.335)	
ΔTotal IT Spending	+		0.025*		0.001
			(0.062)		(0.358)
Auditor Switch	?	−0.388**	−0.388**		
		(0.050)	(0.050)		
ΔPercent IT Spending * Auditor Switch	+	−0.224			
		(0.913)			
ΔTotal IT Spending * Auditor Switch	+		−0.024		
			(0.934)		
Big 4	+	0.130	0.125	−0.135	−0.114
		(0.264)	(0.272)	(0.608)	(0.593)
LnAssets	+	0.088*	0.088*	0.286**	0.285**
		(0.058)	(0.057)	(0.016)	(0.017)
Leverage	−	−0.433***	−0.434***	−1.039**	−1.047**
		(0.006)	(0.005)	(0.050)	(0.047)
ROA	+	−0.587	−0.588	−0.505	−0.486
		(0.987)	(0.988)	(0.803)	(0.795)
Loss	−	−0.224*	−0.224*	0.218	0.214
		(0.071)	(0.072)	(0.694)	(0.690)
BTM	−	0.007	0.008	−0.121	−0.123
		(0.538)	(0.539)	(0.305)	(0.301)
Going Concern	−	−0.538**	−0.534**	0.508	0.534
		(0.020)	(0.021)	(0.688)	(0.696)
Inventory	−	0.302	0.308	−1.035	−1.048
		(0.712)	(0.715)	(0.269)	(0.267)
Receivables	−	0.351	0.357	1.267	1.243
		(0.798)	(0.801)	(0.889)	(0.881)
Foreign	−	−0.589***	−0.591***	−0.860***	−0.858***
		(0.000)	(0.000)	(0.010)	(0.009)
Restructuring	−	0.004	0.007	0.301	0.295
		(0.511)	(0.517)	(0.750)	(0.744)
Restatement	−	−0.356**	−0.357**	−0.509	−0.512
		(0.018)	(0.018)	(0.126)	(0.124)
High Tech	?	−0.152	−0.151	−0.204	−0.208
		(0.327)	(0.332)	(0.634)	(0.630)
Intercept		0.876**	0.880**	−0.249	−0.242
		(0.022)	(0.022)	(0.795)	(0.802)
Year indicator		Included	Included	Included	Included
Number of observations		1469	1469	197	197
Model χ^2		52.87***	53.36***	17.72***	17.82***
Pseudo R^2		0.04	0.04	0.07	0.07
Correctly classified		72.02%	72.02%	69.04%	68.53%

Note: The dependent variable is an indicator set equal to 1 if the company reports no IT material weaknesses year t + 1, 0 otherwise. The p-values are listed in parentheses under the coefficient.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

the likelihood of remediating internal control weaknesses, rather the specific switch to auditors with greater IT expertise. To the extent that auditors with greater levels of IT expertise provide benefits to the firm's IT environment, we argue that such choices are consistent with auditors acting as a monitoring mechanism within institutional theory and improving legitimacy in both fact and appearance (e.g. Haislip et al., 2015). We argue that these results indicate that emphasizing the importance of IT can be beneficial for audit firms, as it allows them to adequately address the internal control concerns of their clients.

Complementing the findings in the internal control weakness remediation tests, Table 7 presents our results for a multivariate logit analysis of the likelihood of reporting material weaknesses. The regression observations consist of all available company-year observations. The dependent variable is an indicator set equal to 1 if the company reports an IT material weakness (columns 1 and 3) or a non-IT material weakness (columns 2 and 4) in year t, and 0 otherwise. In all of the columns, the auditor IT expertise coefficients are negative and significant. The likelihood of reporting an IT or Non-IT material weakness in time t is negatively associated with engagement of an auditor with greater IT expertise in time t, as proxied by Percent IT Spending (column 1 coefficient = −0.196, p-value < 0.000; column 2 coefficient − 0.091, p-value < 0.000). Likewise, the likelihood of reporting an IT or Non-IT material weakness in time t is negatively associated with engagement of an auditor with greater IT expertise in time t, as proxied by Total IT Spending (column 3 coefficient − 0.012, p-value = 0.013; column 4 coefficient = −0.007, p-value = 0.001). In general, the results support Hypothesis 4 and complement the results for Hypotheses 2 and 3. Clients of

Table 7
Initial likelihood of material weaknesses.

Variables	Pred	Column 1 IT weakness	Column 2 Non-IT weakness	Column 3 IT weakness	Column 4 Non-IT weakness
Percent IT Spending	−	−0.196***	−0.091***		
		(0.000)	(0.000)		
Total IT Spending	−			−0.012**	−0.007***
				(0.013)	(0.001)
Specialist	−	−0.178	−0.052	−0.167	−0.044
		(0.284)	(0.366)	(0.293)	(0.384)
LnAssets	−	0.004	−0.119***	0.007	−0.117***
		(0.530)	(0.000)	(0.562)	(0.000)
Leverage	+	0.121**	0.124	0.112**	0.123
		(0.020)	(0.101)	(0.032)	(0.109)
ROA	−	0.063	0.032	0.064	0.032
		(0.973)	(0.839)	(0.977)	(0.840)
Loss	+	1.250***	0.746***	1.248***	0.744***
		(0.000)	(0.000)	(0.000)	(0.000)
BTM	+	−0.104	0.086**	−0.110	0.084**
		(0.870)	(0.042)	(0.880)	(0.045)
Going Concern	+	0.214	0.778***	0.206	0.778***
		(0.277)	(0.000)	(0.285)	(0.000)
Inventory	+	0.536	0.747***	0.494	0.728***
		(0.178)	(0.001)	(0.198)	(0.002)
Receivables	+	0.280	0.156	0.339	0.167
		(0.302)	(0.234)	(0.265)	(0.219)
Segments	+	−0.014	0.008	−0.014	0.008
		(0.718)	(0.234)	(0.716)	(0.224)
Extraordinary	+	0.773***	0.497***	0.784***	0.498***
		(0.009)	(0.002)	(0.008)	(0.002)
Foreign	+	0.714***	0.463***	0.727***	0.469***
		(0.000)	(0.000)	(0.000)	(0.000)
Merger	+	−0.377	0.099	−0.372	0.098
		(0.879)	(0.200)	(0.876)	(0.202)
High Tech	+	−0.073	0.083	−0.081	0.079
		(0.647)	(0.199)	(0.663)	(0.209)
Big 4	−	0.234	0.393	−0.227	0.337
		(0.726)	(0.985)	(0.693)	(0.950)
Intercept		−6.035***	−3.378***	−5.851***	−3.276***
		(0.000)	(0.000)	(0.000)	(0.000)
Year indicator		Included	Included	Included	Included
Number of observations		20,407	20,407	20,407	20,407
Model χ^2		271.99***	697.80***	249.55***	671.39***
Pseudo R^2		0.12	0.08	0.11	0.08
Correctly classified		98.59%	92.79%	98.59%	92.79%

Note: The dependent variable is an indicator set equal to 1 if the company reports no IT material weaknesses year t + 1, 0 otherwise. The p-values are listed in parentheses under the coefficient.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

auditors with more IT expertise are less likely to report material weaknesses in IT and non-IT internal controls. This suggests that auditors with more IT expertise are either able to identify internal control deficiencies earlier in the audit process and assist the company in remediating them before they are reported, or they make suggestions to improve the use of IT in their internal controls before the weaknesses are reported. Overall auditors are able to make suggestions to their clients to improve the overall internal control environment. Taken together, the results in Tables 5 and 7 suggest that auditor IT expertise benefits clients by aiding the client process of identification, correction, and prevention of internal control weaknesses. This is consistent with the theoretical view of a monitoring governance role of the external auditor.

4.3. Additional analysis — disengaging an IT expert

Although the results support Hypotheses 2 and 4, it is also possible that our proxies are picking up auditors who are simply not reporting IT material weaknesses to maintain their own reputation. If this is the case, then firms who switch away from an auditor with more IT expertise should have a higher likelihood of reporting material weakness in subsequent periods (due to the non-reporting by a previous auditor). Thus, we provide an additional robustness test to see whether companies exhibit a greater likelihood of reporting IT material weaknesses in future years after switching to an auditor with less IT expertise. If they do not, then we argue that this shows that remediation results in Table 5 are consistent with Hypothesis 2 regarding the

Table 8
Identification of new IT weaknesses after an auditor switch.

Variables	Pred	Column 1 IT weakness	Column 2 IT weakness
Percent IT Spending	?	−0.022	
		(0.659)	
Total IT Spending	?		−0.000
			(0.469)
LnAssets	-	−0.036	−0.032
		(0.400)	(0.414)
Leverage	+	0.614	0.615
		(0.238)	(0.238)
ROA	−	0.520	0.511
		(0.895)	(0.887)
Loss	+	0.710*	0.705
		(0.099)	(0.101)
BTM	+	0.078	0.073
		(0.421)	(0.426)
Going Concern	+	0.167	0.164
		(0.448)	(0.449)
Inventory	+	0.830	0.761
		(0.314)	(0.327)
Receivables	+	−0.942	−0.966
		(0.778)	(0.784)
Segments	+	0.022	0.023
		(0.396)	(0.394)
Foreign	+	0.881**	0.879**
		(0.046)	(0.045)
High Tech	?	0.353	0.347
		(0.591)	(0.595)
Big 4	?	0.181	0.070
		(0.856)	(0.946)
Specialist	?	0.479	0.472
		(0.488)	(0.497)
Intercept		−4.834***	−4.758***
		(0.000)	(0.000)
Year indicator		Included	Included
Number of observations		754	754
Model χ^2		45.750***	45.020***
Pseudo R^2		0.089	0.090
Correctly classified		96.95%	96.95%

The observations consist of all firms who exhibited an auditor switch in time t. The dependent variable is an indicator variable set equal to 1 if the SOX 404 report identifies an IT material weakness in the year subsequent to an auditor switch, and 0 otherwise. The p-values are listed in parentheses under the coefficient.

* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

auditors with greater IT expertise. Table 8 presents the results of the robustness tests. The observations consist of all firms who exhibited an auditor switch. To capture auditor expertise prior to an auditor switch, we use both of our proxies and identify auditors engaged at time t. Our dependent variable is an indicator variable set equal to 1 if the company's SOX 404 report identifies an IT material weakness within a year of the auditor switch.[15] In both columns, the coefficients on our variables of interest are not significant. We additionally calculate statistical power at 99.99% for these regressions. This result indicates that these companies do not have a significantly higher likelihood of reporting IT material weaknesses following the dismissal or resignation of an auditor with greater IT expertise.

5. Conclusion

The extant literature documents the important role that IT plays in financial reporting. Regulators and practitioners continually call for auditors to improve their understanding of IT to better understand the role it plays in financial reporting so that their role as an effective monitor within a client's overall governance structure is improved. Our results suggest that auditor engagements are subject to symbolic signals of the auditor's relationship with the client. Specifically, we find a higher likelihood of auditor dismissal following the reporting of a client's IT and non-IT material weakness.

[15] In untabulated results we additionally run this analysis including IT weaknesses identified two and three years after the auditor switch and arrive at the same results.

Utilizing the external auditor as an example of an external governance mechanism employed by firms, we also provide evidence of the benefits associated with auditor IT expertise in advancing a firm's IT resources. We suggest that our findings show that IT expertise allows auditors to benefit their clients by decreasing the number of reported IT material control weaknesses. The evidence suggests that IT expertise is an important auditor characteristic that provides differential benefits to their clients. These results are important for regulators and practitioners because they suggest that improved IT training could improve the quality of audits and client financial reporting outcomes. Moreover, our results are consistent with the beneficial use of auditor expertise as an important source for a strategic monitoring mechanism. Although we do not attribute our measure of IT expertise to the client's knowledge or reputational perception of an auditor's specific expertise when selecting a new auditor, our results do suggest that clients can benefit from such expertise. Moreover our results suggest that clients may actually incur detrimental effects when selecting (even unintentionally) an auditor without certain expertise.

Our study is subject to several limitations. First, it is possible that our proxies for IT expertise are picking up some other characteristic of the audit environment. However, our measures are consistent with both incentives to develop and protect a reputation for greater IT expertise. Our source for measuring IT expertise is also consistent with prior literature that measures IT investment and concentration. Our additional testing suggests that the documented benefits are unique to the switch to these IT experts. Second, our tests focus on the remediation and reporting of material control weaknesses, however we are unable to observe the underlying detection (and possible non-reporting) of such material weaknesses. Additional testing suggests that the non-detection or non-reporting of detected material weaknesses is not associated with our measure of IT expertise.

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