The Association between Information Technology Investments and Audit Risk

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SUMMARY: The advances in information technology (IT) have changed the way companies conduct business in using electronic commerce strategies, preparing financial reports and having their financial statements audited. Therefore, client firms' IT investments could have effects on audit risk. On one hand, the IT complexity creates challenges for auditors in auditing the effectiveness of internal control and detecting accounting irregularities. On the other hand, IT decreases audit risk by improving operation and internal control effectiveness which may decrease inherent and internal control risk. Yet, the relationship between clients' IT asset portfolios and audit risk remains an empirical question. Using proprietary IT data of US firms from 2000 to 2009, we find that IT investments are positively related to audit fees and abnormal audit fees, and negatively related to the probability of issuance of a going-concern audit opinion. Furthermore, we find that audit tenure moderates the above relationship due to the learning effect.

Keywords: information technology investments; audit risk; audit efforts; audit tenure

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INTRODUCTION

Business organizations are significantly investing in information technology (IT).[1] IT spending has kept increasing in proportion of firms' budget and already exceeded spending on R&D or advertising (Mithas et al. 2012). At the same time, IT adopted by firms has become increasingly sophisticated (Dewan et al. 2007). The importance of IT investments and their impacts on firm performance, internal controls and risk assessment are being addressed by business entities, auditors and regulators, however, the evidence about the impact of IT investments on audit risk is scarce. The link between IT investments and audit risk is not only critically informative for auditors to make their audit planning but also meaningful for companies' IT investments and implementations. In this paper, we aim to explore the relationship between client firms' IT investments and audit risk by using a unique panel data about IT of U.S. companies.

A growing body of literature provides evidence that IT enhances transparency of operations, decreases intra- and inter-firm transaction costs, improves managerial decision making, increases firms' operating efficiency and also firm value (e.g., Klaus et al. 2000; Hendricks et al. 2007; Kobelsky et al. 2008; Bendoly et al. 2009; Masli et al. 2011; Mithas et al. 2011, 2012; Tambe and Hitt 2012). However, several researchers find that the effect of IT on firm performance may be either mixed or subject to contingencies (Aral and Weill 2007; Dewan et al. 2007; Xue et al. 2012). Other studies document that IT investments are risky and not cost effective (e.g., Hitt et al. 2002; Dewan and Ren 2011). In general, prior studies primarily

[1] According to a 2013 report from the US Department of Commerce, firms in 2003 invested more than half of their capital expenditure on IT and this trend continues into recent years. IT spending worldwide in 2013 was projected to total $3.7 trillion with about 2 percent increase from 2012 spending of $3.6 trillion.

concentrate on the internal risk effects of IT on companies themselves. In contrast, we focus on the external risk effects of IT on independent auditors.

Regulators realize the key role IT plays in the auditing process. From SAS No. 55 (AICPA 1988) to SAS No. 78 (AICPA 1995) and then SAS No. 94 (AICPA 2001), auditing standard setters keep updating rules and providing guidance to auditors to evaluate internal control activities regarding IT. In 2010, the Public Company Accounting Oversight Board (PCAOB) in the Auditing Standard No. 2 requires that auditors obtain an understanding of IT general control, on which other controls are dependent, and evaluate the nature and complexity of companies' use of IT. Recently, the Committee of Sponsoring Organizations (COSO) of the Treadway Commission proposes its internal control framework (2013) and places significant weight on IT control.

We posit that IT investments are associated with audit risk for several reasons. First, while IT possibly creates long-term value for companies, it also increases companies' inherent business risk (such as, earnings volatility, delayed payoff, IT failures, etc., documented in Tsui et al. 2001). Companies with higher business risk are more likely to misreport their financial statements and lead to audit risk.

Second, the use of IT increases control risk because the control risk is typically associated with inadequate integration of IT systems and lack of data flow transparency as reported in the 2013 TTI survey.[2] For instance, Enterprise Systems may only technically prevent errors and fraud incurred by lower-level managers and employees. Top managers with privileges to the system are still able to conduct misreporting and fraud. Even though most Enterprise

[2] The 2013 North America Top Technology Initiatives (TTI) survey indicates that the top three IT concerns in 2013 were managing and retaining data, securing the IT environment and managing IT risks and compliance.

Systems have ‘built-in’ controls, internal control effectiveness is not realized if companies do not have sufficient information management capability (Mithas et al. 2011).

Third, the use of IT increases detection risk. The investments of sophisticated IT systems make it more difficult for auditors with traditional audit methods to detect errors and fraud. Since each company has its own customized IT portfolio, auditing is not a standardized work anymore, and auditors without sufficient IT audit expertise are less likely to detect misstatements. Because it takes time for auditors to become familiar with their clients’ IT systems, the detection risk is even worse for new auditors. Auditors are often over-confident about their abilities to assess risk associated with IT (Hunton et al. 2004). This over-confidence and insufficient IT capacity will increase detection risk and then increase overall audit risk.

In this paper, we explicitly examine the relationship between client firms’ IT investments and audit risk that external auditors bear. We follow the existing literature (Chwelos et al. 2010; Kleis et al. 2012) to use three areas of IT infrastructure (namely decentralized computing equipment, centralized computing equipment, and network equipment) to develop a proxy of companies’ overall IT investments. Our IT data are obtained from the *CI Technology Database*. The biggest advantage of this data is that the number of computers, servers, and network nodes are tightly associated with IT investments in information system rather than automation of business process. We further validate the analysis by using an overall IT intensity measure. Regarding the measures of audit risk, we follow prior research (e.g., Simunic 1980; Bell et al. 2001; Hogan and Wilkins 2008; Cassell et al. 2011) to use audit fees as a proxy for audit risk. We also employ two alternative measures of audit risk: abnormal audit fees and the likelihood of auditor’s issuance of a going-concern opinion.

Our sample consists of 8,102 firm-year observations over a period from 2000 to 2009. Our primary models is the OLS regression of 1) logged audit fees and 2) abnormal audit fees (following Blankley et al. 2012) on IT investments and other fee determinants associated with firm risks, audit effort, and audit-client relations. We also use a probit model to regress on auditor's going-concern opinions against IT investments for financially-distressed companies. The above tests are based on the stock of IT rather than the flow of IT. We also test the effect of IT variation on the change of audit risk by employing a change model, since client firm's new addition of IT could lead to the complexity of audit tasks.

We find that client firms' IT investments are positively associated with audit fees and abnormal audit fees. The results indicate that client firms' IT investments make audit engagement more challenging and risky. Auditors need to make more efforts to understand client firms' operations and reporting based on the application of IT. Considering the "learning effect" of auditor tenure (DeAngelo 1981; Knapp 1991), we examine a possibly mitigation effect of audit tenure on the relation between IT investments and audit risk by subsampling with auditor's servicing years. We find that the positive relationship between audit risk and clients' IT investments diminishes with longer tenure, as auditors become more familiar with clients' IT systems and implementations. The results from going-concern opinion model shows that auditors are less likely to issue going-concern opinions to financially distressed firms that have higher levels of IT investments.

Our paper contributes to the literature of auditing and information systems in the following ways. First, the pros and cons of IT have been widely documented in accounting and information system literature, but empirical research on IT in auditing literature is rare even though IT has already been considered as a contributor to audit risk by auditors and becomes more critical in practice. Our research fills this gap by examining IT and audit risk in an integrated research setting. Second, prior accounting literature, such as Hayes et al. (2001), Ranganathan and Brown (2006), and Dorantes et al. (2013), documents the effects of IT by using an indicator variable to represent whether companies implement Enterprise Systems specifically (ERP, SCM, CRM system, etc.) or not. Our research uses unique IT data and aggregate IT measures which can capture the total effect of IT on companies' operating and reporting environment.

Our results generate the following implications: 1) The complicated IT systems implemented by client firms require auditors to have expertise in both auditing and IT; 2) As client firms keep investing more in IT, the impact of IT on audit risk is likely to increase and become more material; 3) In the earlier stage of their tenure, auditors have to input more efforts to study firm-specific IT systems; 4) As traditional internal control processes have changed due to IT implementation, auditors need to adjust their approaches to more appropriately assess internal control quality as required by the SOX.

The rest of this paper is organized as follows: Section 2 discusses the relevant literature and presents our hypotheses. Section 3 introduces the data and research design. Section 4 presents the main empirical tests. In Section 5, we present additional tests. Section 6 concludes the paper.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Information technology (IT) has changed the ways of business operation, managerial decision making, and information processing. IT also changes the way companies initiate, authorize, record, process, and report transactions and other financial data that auditors primarily care about. It is necessary that auditors consider both benefits and risk coming along with clients' IT systems during their audit engagements.

The Benefits of IT

There is a large body of literature documenting the benefits of IT from different perspectives of firm performance (e.g., Dedrick et al. 2003; Melville et al. 2004; Kohli and Grover 2008). Hitt and Brynjolfsson (1996) find that IT reduces production costs and increases customer satisfaction. Other studies find that investments in IT increase financial and market performance (e.g., Bharadwaj 2000; Zhu and Kraemer 2002) and improves organizational innovativeness (Kleis et al. 2012; Xue et al. 2012) across different contexts. Dorantes et al. (2013) report that Enterprise Systems improve companies' internal information environment and increases both quantity and quality of management forecasts. Kobelsky et al. (2008) suggest that investing IT is essentially a way for companies to realize their strategic goals of improving future performance.

Some other studies document that IT fosters information communication. The use of IT provides complete, transparent, and timely information for managerial decision making (Klaus et al. 2000; Hendricks et al. 2007; Bendoly et al. 2009). For example, an empirical study by Hodge et al. (2004) shows that companies that implement search-facilitating technologies (e.g., XBRL) improve the transparency of their financial statements. Another study by Choi et al. (2010b) finds that IT investments can improve information sharing among employees. They conduct a field study in South Korea using 139 on-going teams and 743 individuals and find that IT has a positive impact on team performance, knowledge sharing, and knowledge application.

The Risk of IT

The existing literature has also recognized the potential adverse effects of IT investments. IT assets are inherently risky due to the uncertainty of their economic impact, technological complexity, rapid obsolescence, and investment challenges.[3] Aral and Weill (2007) find that the impact of IT investments on performance and risk varies across companies and measures of performance. Based on data from 147 U.S. firms from 1999 to 2002, they find that companies' total IT investments are not associated with performance. In addition, an event study conducted by Dewan and Ren (2007) provides evidence that wealth effects are not significant after controlling for contemporaneous risk changes. Furthermore, Inefficient budgeting in IT also discounts the benefit of IT investments. Kobelsky et al. (2008) find that departure from the optimal IT budget level will lead to a lower level of firm performance.

IT investments involve a wider range of risks than investments in other assets. The magnitude of IT investments is often large and many IT investments projects (e.g., ERP, SCM, CRM system) are time-consuming. The payoffs from these projects are often unpredictable and take time to realize. Poston and Grabski (2001) find that it takes three years to realize improvement on firm performance from the investments of ERP systems. Besides, IT only provides comparative and temporary advantage which will diminish when peer firms also implement IT. Earlier research by Weill (1992) argues that, even though IT can improve firm performance through cost reduction and revenue expansion, the competitive advantage may disappear once IT becomes common. Dewan et al. (2007) show that IT investments make a greater contribution to overall firm risk than do non-IT investments. The main reason is that the development of IT is so rapidly that some employees, even top managers and IT specialists, do

[3] IT risks are broadly considered as the failure of IT investments to achieve its objectives as IT risk can effect risk in other areas such as financial, regulatory and legal, customer, reputation and competition. We adopt a definition of IT risk as: *"An IT risk is something that can go wrong with IT and cause a negative impact on the business"* (Jordan and Silcock 2005, p.48).

not have the capability to make full use of IT. Therefore, they conclude that IT assets are more risky than other non-IT assets. In this regard, the benefits of IT investments are often exaggerated. The utilization of IT largely hinges on the IT capabilities of management and employees.[4]

In addition, IT security risk is always a concern as the application of IT is also related to other nonconventional threats. Internet plays a pervasive and fundamental role in business IT investments, thus business will face the exposure of IT systems to external threats and breaches of information security will become more likely. Further, companies investing more in IT are more likely to be influenced by the unstable IT environment, e.g., cloud computing, virtualization, and mobile computing, etc., (Debreceny 2013). Finally, the investments of IT also introduce inherently unique risks due to tightly linked interdependencies of business processes, relational databases, and process reengineering. These risks incurred by implementing IT have not been fully considered in audit planning and process.

IT Investments and Audit Risks

Audit risk is composed of inherent risk, control risk and detection risk, and is influenced by client firms' business environments and reporting behaviors (Cushing and Loebbecke 1983). IT investments change companies' operating environment. For example, companies can make transactions and real-time financial statements through their Enterprise Systems. As described in the previous section, IT is likely to influence the inherent risk.

The investments of IT systems are also likely to increase control and detection risk for external auditors. IT automates transactions and the processing of financial information. For example, ERP systems have 'built-in' controls as a key feature. However, IT business process risks may be caused by a lack of security of information processing which affects control risk. IT

[4] See the similar arguments in Cotteleer and Bendoly (2006), Aral and Weill (2007), and Mithas et al. (2011).

control risks are often associated with inadequate integration of systems and lack of data flow transparency. Therefore, internal control could be more effective in a fully automated and integrated IT systems. Morris (2011) finds that ERP-implementing companies are less likely to be issued internal control weakness opinions than other companies. However, auditors need to augment their knowledge and professional judgments when evaluating IT-based internal control systems.

Behavioral research also shows that IT has an impact on detection risk. For example, Hunton et al. (2004) conduct an experiment on 165 CPAs and find that financial auditors are overconfident about their abilities to assess both ERP and non-ERP system risks. In addition, financial auditors often do not recognize the risk of internal control weakness, and do not indicate a need for consultation from IT audit specialists. These findings indicate that auditors may fail to identify business risk and audit risk when IT systems are in place. Moreover, although IT may increase internal control effectiveness by reducing errors and fraud made by low-level employees and managers, top managers with privileges to IT can still conduct misreporting and fraud. Figure 1 tracks how IT influences the three components of audit risk.

[Insert Figure 1 about here]

From the perspective of accounting and financial reporting, managers need to consider these potential risks and disclose information to investors in order to allow the firm values to be fairly evaluated. However, managers have incentives to overstate the benefits and understate the risks of IT. Company insiders (e.g., managers, employees, etc.) and major stakeholders (e.g., shareholders, lenders, etc.) can both share the benefits and bear risks of IT. For corporate insiders and major investors, increased benefits of IT may offset the increased risk. However, external auditors, as corporate outsiders and independent third parties, may have to bear the increased audit risk without benefiting from their clients' IT investments. Therefore, we propose our first hypothesis:

H1: Client firms' IT investments are positively associated with audit risk.

Accounting professionals realize the higher uncertainty and potential audit failures when they start new engagements (PricewaterhouseCoopers 2010). From the perspective of auditor experience, audit quality increases with auditor tenure over time as the auditor gains a better understanding of the client's system, business and industry environment, and internal controls (AICPA 1978). Audit risk is likely to be higher in the early stage of audit tenure, because new auditors lack the specific knowledge of their clients and their business.

DeAngelo (1981) propose a "learning curve" of incumbent auditors. Audit risk can be reduced when auditors become familiar with their clients' operating system, business environment and associated risk with a sufficient tenure. Knapp (1991) proposes that the positive relation between auditor tenure and audit quality reverses in the late stage of audit engagement. Johnson et al. (2002) stress the negative impact of short tenure on audit quality in initial years of the auditor-client relationship. Myers et al. (2003) document that audit quality is positively related to auditor tenure. Stanley and DeZoort (2007) find that auditor tenure is negatively associated with the likelihood of financial restatements. Brooks (2012) explains that the "learning effect" attenuates following the turning point and proves that the "learning effect" dominates "bonding effect" in an appropriate term limit. Other evidences also show that auditors with short tenure face higher litigation risk and higher likelihood of fraudulent financial reporting, and fail to issue going-concern opinions to financially distressed companies (Palmrose 1987, 1991; Stice 1991; Carcello and Nagy 2004).

Each company has its firm-specific IT investment and infrastructure. Client firms' IT investments increases the complexity of audit and particularly challenges auditors in the earlier stage of audit tenure, especially for firms whose managements and employees do not have sufficient IT capacity. To decrease audit risk, auditors would either hire IT audit specialists or seek IT consultation service. The effect of audit tenure should be stronger for firms with more sophisticated IT capabilities. After years, auditors become familiar with their clients' IT environment and have better knowledge about the clients' IT systems. Thus, we include auditor tenure as a mediating factor and we posit that audit risk associated with client firms' IT systems will decrease in the later years of audit tenure. Based on these arguments, we generate our second hypothesis:

H2: The observed positive association between IT investments and audit risk is stronger (weaker) in the earlier (later) stage of audit tenure.

DATA & RESEARCH MODELS

Sample and Variables

The data used to measure IT investments is from the *Harte-Hanks CI Technology Database*. This database covers over 500,000 sites in the United States and Canada on IT infrastructure and 10 key IT areas. We collect client firm fundamentals from *Compustat* and audit data from *AuditAnalytics* over the period from 2000 to 2009 to measure audit risk, since audit fee disclosure is available from 2000 in *AuditAnalytics*. All our sample firms are US-domiciled companies.

IT Investments

We develop two types of measures for IT investments: one type is based on IT component counts and the other is based on overall IT intensity which is defined as the ratio of IT assets to total assets or to the number of employees.

First, we obtain count measures of three key IT infrastructure components, i.e., PC, server, and network node, and we use these count measures to capture the overall IT investments. As suggested by the existing literature (e.g., Chwelos et al. 2010; Kleis et al. 2012), PC count reflects the investments of decentralized computing equipment, server count reflects the investments of centralized computing equipment, and network nodes reflects the investments of electronic communication equipment. In addition to using these three measures separately, we also use factor analysis to generate a composite measure (*ITFactor*) of these IT components to capture IT investments.

Second, we use two measures of IT intensity for robustness analysis. The IT infrastructure count measures may not sufficiently capture other IT spending on software, staff and maintenance (although it is highly correlated with infrastructure spending). Therefore, we follow the existing literature (e.g., Hitt and Brynjolfsson 1996; Xue et al. 2012) to estimate total IT hardware capital value by calculating the total nominal market value of PCs and servers, deflated using the PC price index and price index for computers and peripheral equipment from the Bureau of Economic Analysis. Then we estimate IT stock on software, staff and maintenance expense as three times the IT labor expense. The sum of IT hardware capital and IT stock on software, staff and maintenance is the total IT capital of the firm. We then develop two normalized measures of IT intensity. The first measure is the total IT capital divided by total assets. The second measure is the total IT capital divided by the number of employees.

Audit Risk

Auditors are sensitive to both the control risk and inherent risk of client firms and will respond to those risks by increasing audit service fees. Following prior research (e.g., Simunic 1980; Bell et al. 2001; Hogan and Wilkins 2008), we employ audit fees as a proxy for audit risk since higher risk is associated with greater audit effort and risk premium. A single measure of audit risk may be inadequate. To validate the measure of audit risk, we also use abnormal audit fees and the likelihood of auditor's issuance of a going-concern opinion as our alternative measures. Abnormal audit fees reflect the relationship between auditor and clients (Higgs and Skantz 2006). Dye (1991) and Choi et al. (2010a) find that auditors who are overpaid will impair audit quality and audit independence. According to these researchers, auditors who receive positive abnormal fees may allow clients to engage in opportunistic earnings managements.

A going-concern opinion issued by auditor reflects the liquidity risk of the company, the auditor's detection risk, and the audit independence. Auditors could reduce the exposure to litigation risk when engaging in a financially stressed client by issuing a going-concern report (Carcello and Palmrose 1994). Prior research documents that audit fees and litigation concerns are associated with the going-concern audit opinion (see, e.g., Blay and Geiger 2013; Chen et al. 2013). Therefore, the relationship between IT and audit risk can be tested by the likelihood that an auditor may issue a going-concern opinion to the financially distressed company.

Empirical Models

We test the association between IT investments and audit risk using three different models on audit fees, abnormal audit fees, and going-concern opinions, respectively. To estimate abnormal audit fees,[5] we use the model as in Blankley et al. (2012). The calculation of abnormal audit fees is detailed in Appendix A.

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[5] See more about the abnormal audit fee model from prior research (e.g., DeFond et al. 2002; Whisenant et al. 2003; Francis and Wang 2005; Krishnan et al. 2005; Ghosh and Pawlewics 2009; Choi et al. 2010a).

To test the relationship between audit fees and IT investments (H1), we construct our first OLS regression model as follows:

$$AuditFee_{i,t} = \beta_0 + \beta_1(PC\ or\ Server\ or\ Network\ or\ ITFactor\ or\ ITIntensity\ 1\&2)_{i,t} + \beta_2 ITFee_{i,t} + \beta_3 DumITFee_{i,t} + \beta_4 CSize_{i,t} + \beta_5 RecInv + \beta_6 ROA_{i,t} + \beta_7 Loss_{i,t} + \beta_8 Leverage_{i,t} + \beta_9 BigN_{i,t} + \beta_{10} GCAO_{i,t} + \beta_{11} Segment_{i,t} + \beta_{12} Export_{i,t} + \beta_{13} Litigation_{i,t} + \beta_{14} AuditLag_{i,t} + \beta_{15} Busy_{i,t} + \beta_{16} MTB_{i,t} + \beta_{17} Restate_{i,t} + \beta_{18} |DA|_{i,t} + \beta_{19} Technology_{i,t} + YearDummies_t + \varepsilon_{i,t} \quad (1)$$

where;

AuditFee	=	the natural log of audit fees;
PC	=	the natural log of the number of personal computers that a client firm uses during the fiscal year;
Server	=	the natural log of the number of servers that a client firm uses during the fiscal year;
Network	=	the natural log of the number of network nodes that a client firm uses during the fiscal year;
ITFactor	=	a component from factor analysis of the PC count, server count, and network node count that a client firm uses during the fiscal year;
ITIntensity 1	=	total IT capital divided by total assets;
ITIntensity 2	=	total IT capital divided by the number of employees;
ITFee	=	the ratio of IT fees to audit fees;
DumITFee	=	a dummy variable, 1if auditor receives IT fees, and 0 otherwise;
CSize	=	the natural log of market value of common equity at fiscal year-end;
RecInv	=	sum of total account receivable and total inventory, scaled by total assets;
ROA	=	earnings before interest and taxes divided by total assets at year end;
Loss	=	a dummy variable, 1 if net income is negative, and 0 otherwise;
Leverage	=	financial leverage, calculated as long-term debt divided by total assets at year end;
BigN	=	an indicator variable equals to 1 if the auditor is a Big-5 auditor before 2002 or a Big-4 after 2002, and 0 otherwise;
GCAO	=	a dummy variable, 1 if auditor issues a going-concern audit opinion, and 0 otherwise;
Segment	=	the natural log of 1 plus the number of business and geographic segments;
Export	=	the ratio of foreign sales to total sales;
Litigation	=	an indicator variable that takes the value of 1 if the firm operates in a high-litigation industry and 0 otherwise;

AuditLag	=	the natural log of the number of calendar days from fiscal year-end to the signature date of the auditor's report;
Busy	=	a dummy of 1 if a company's fiscal year is December 31st, 0 otherwise;
MTB	=	market-to-book ratio;
Restate	=	a dummy of 1 if there is a subsequent financial restatement and 0 otherwise;
|DA|	=	the absolute value of discretionary accruals scaled by lagged assets, calculated from the Kothari et al. (2005) performance-adjusted accruals model; and
Technology	=	an indicator variable equal to 1 when the firm is in high technology industries and 0 otherwise.

Model 1 above is very similar to conventional audit fee models. The sign of coefficient β_1 is expected to positive as H1 predicts. We use three groups of measures of IT investments. *PC, Server* and *Network* represent the logged number of these physical IT assets. *ITFactor* from factor analysis represents the aggregate effect of the three above. We control auditor's IT fees,[6] and other factors influencing total audit fees according to audit fees literature such as firm size (*CSize*), inherent risk (*RecInv*), profitability (*ROA*), financial leverage (*Leverage*), auditor type (*BigN*), business risk (*GCAO*), audit complexity as of business segments (*Segment*) and foreign sales (*Export*), respectively, litigation risk (*Litigation*), audit report lag (*AuditLag*), seasonal effect (*Busy*), and market-to-book ratio (*MTB*), (following Becker et al. 1998; Whisenant et al. 2003; Venkataraman et al. 2008; Cassell et al. 2011). In addition, we control accounting manipulation which also influences audit fees such as discretionary accruals ($|DA|$) and restatement (*Restate*). Since we are testing the effect of IT investments, we also control the difference of technology firms vs. non-technology firms.

Second, we use abnormal audit fees as a proxy for audit risk. We control internal control weakness (*ICW*) as an additional factor. Our second model is specified as follows:

[6] We deem that auditor's IT fees (data source: *AuditAnalytics*) are related to auditor's effort regarding IT audit.

$$AbAuditFee_{i,t} = \beta_0 + \beta_1(PC\ or\ Server\ or\ Network\ or\ ITFactor\ or\ ITIntensity\ 1\&2)_{i,t} + \beta_2 ICW_{i,t} + \beta_3 ITFee_{i,t} + \beta_4 DumITFee_{i,t} + \beta_5 CSize_{i,t} + \beta_6 RecInv_{i,t} + \beta_7 ROA_{i,t} + \beta_8 Loss_{i,t} + \beta_9 Leverage_{i,t} + \beta_{10} BigN_{i,t} + \beta_{11} GCAO_{i,t} + \beta_{12} Segment_{i,t} + \beta_{13} Export_{i,t} + \beta_{14} Litigation_{i,t} + \beta_{15} AuditLag_{i,t} + \beta_{16} Busy_{i,t} + \beta_{17} MTB_{i,t} + \beta_{18} Restate_{i,t} + \beta_{19} |DA|_{i,t} + \beta_{20} Technology_{i,t} + YearDummies_t + \varepsilon_{i,t} \quad (2)$$

where:

AbAuditFee	=	abnormal audit fees, following Blankley et al. (2012), and
ICW	=	a dummy of 1 if the client receives a material weakness opinion in the current year or the next year, 0 otherwise.

Other control variables are same as in the model (1). Detailed descriptions of these variables are also in Appendix B.

Third, we use auditor's issuance of a going-concern opinion as a proxy for audit risk. Following DeFond et al. (2002), we use a probit regression to estimate the auditor opinion model specified as follows:

$$Pr\left(GCAO_{i,t} = 1\right) = \beta_0 + \beta_1(ITFactor\ or\ ITIntensity\ 1\&2)_{i,t} + \beta_2 Altman_{i,t} + \beta_3 Loss_{i,t} + \beta_4 CSize_{i,t} + \beta_5 FirmAge_{i,t} + \beta_6 Return_{i,t} + \beta_7 RetVolatility_{i,t} + \beta_8 Leverage_{i,t} + \beta_9 ChgLeverage_{i,t} + \beta_{10} OCF_{i,t} + \beta_{11} AuditLag_{i,t} + \beta_{12} Investments_{i,t} + \beta_{13} NewFinance_{i,t} + \beta_{14} BigN_{i,t} + \beta_{15} Technology_{i,t} + YearDummies_t + \varepsilon_{i,t} \quad (3)$$

where:

Altman	=	Altman (1968) Z-score, measure of the probability of bankruptcy, with a lower value indicating greater financial distress;
FirmAge	=	the natural log of the number of years of data for the client firm since the coverage in Compustat;
Return	=	the firm's cumulative stock returns over the current year;
RetVolatility	=	the standard deviation of monthly returns over the current year;
ChgLeverage	=	change in *Leverage* from the previous year to the current year;
OCF	=	operating cash flow (Compustat item: *OANCF*) divided by total assets for the current year;
Investments	=	short- and long-term investment securities (including cash and cash equivalents) (Compustat items: *CHE* and *IVPT*), scaled by total assets; and
NewFinance	=	an indicator variable equal to 1 if a client has a new issuance of

equity or debt in the subsequent fiscal year (i.e., nonzero Compustat item: *DLTIS* or the amount of Compustat item: *SSTK* exceeding 5 percent of the firm's market value of equity) and 0 otherwise.

All the other variables are defined previously. We expect β_1 in model (3) is negative. More IT investments decrease the possibility for auditors to issue going-concern opinions to financial distressed clients when the audit risk is high. Equation (3) is estimated using a pooled logistic regression, and the significance level of the coefficients is derived based on robust standard errors clustered by the client firm and the auditor. As in DeFond et al. (2002), we classify a firm as financially distressed when it reports either negative earnings or negative operating cash flow during the current fiscal year. Firm-years following first time going-concern opinions are excluded because our focus is on auditors' decisions to issue first time going-concern opinions. Appendix B provides further details to motivate these explanatory variables.

Our panel dataset in equation (1) contains 8,102 observations from 2000 to 2009 with non-missing variables of audit fees, IT counts, firm fundamentals and audit metrics. Because *AuditAnalytics* only provides internal control weakness data after 2004, our dataset for the abnormal fee model in equation (2) contains 4,763 observations from 2004 to 2009. For measures of IT intensity, we only have data from fiscal year 2004 to 2006. The number of observations is 1,023 with all available control variables for regression. Although our IT intensity variables span only from 2004 to 2006 due to the limit of data availability, focusing on this period also help avoid the confounding effects of the 2002 SOX Act on auditing and the IT doc.com crash circa 2001.

MAIN RESULTS

Descriptive Statistics

Table 1 presents the descriptive statistics of the variables of interest and control variables that we use in our main empirical analyses and additional tests. We winsorize all continuous variables at 1% and 99% level. *AuditFee* is the natural log format of total audit fees for each fiscal year. The mean (median) audit fees charged to client firms is $13.698 logged dollars ($13.708 logged dollars). We follow the work of Blankley et al. (2012) to measure *AbAuditFee*, the abnormal (unexplained) audit fees for the whole *AuditAnalytics* sample. *PC*, *Server* and *Network* represent the logged total number of three different IT assets (computers, servers and network nodes) for each client firm-year. *ITFactor* is a component from factor analysis of the counts of these three different IT components. *ITIntensity* 1 & 2 are two different IT investments measures that incorporate the price of different IT components. Specifically, *ITIntensity1* is the ratio of total IT capital to the total assets. The mean (median) of *ITIntensity1* is 8.2% (3.4%), meaning that, on average, IT assets investments consist of 8.2% of the value of total assets. *ITIntensity2* is the IT capital per employee, total IT assets divided by the number of employee. The mean (median) of *ITIntensity2* is 14.738 (8.083), meaning that, on average, the sample firm invests 14.7 thousand dollars of IT assets on each employee.

We define *BigN* as an indicator that equals to 1 if the auditor is a Big-5 auditor before 2002 or a Big-4 after 2002, and 0 otherwise. 88% percent of our sample firms are audited by the Big-5 (Big-4) from 2000 to 2009. Client size (*CSize*), in terms of their market value, has the mean (median) value of 6.643 (6.739) logged dollars. About 1.9% clients pay IT fees to auditors. Furthermore, 1.2% of clients receive going-concern audit opinions and 17.4% of companies restate their financial statements. 21% of clients are classified by technology firms and about 30% of clients are of the litigation type simply based on their industry classification. Overall, our sample firms are just slightly larger in term of client market value and pay higher audit fees and IT fees, compared to the whole *Compustat* US sample pool.

[Insert Table 1 about here]

Table 2 Panel A reports the Pearson correlations between the selected variables. Consistent with our prediction, we find that the counts of PCs, servers, network nodes, and the aggregate measure of IT factor (*PC* or *Server* or *Network* or *ITFactor*) have positive correlations with audit fees at the p-value < 0.001 level, respectively. Meanwhile, IT investments (*PC* or *Server* or *Network* or *ITFactor*) are negatively correlated with the probability of receiving a going-concern audit opinion and the absolute value of abnormal accruals. IT investments are positively associated with Big-N auditor, financial statement restatements, and client firms' market value.

Panel B shows that the correlation between IT intensity and abnormal audit fees is positive at the p-value less than the 5% level. We also find that both measures of IT intensity are negatively correlated with the probability of receiving a going-concern audit opinion. Internal control weakness (*ICW*) is positively related to abnormal audit fees, and negatively related to the two measures of IT intensity.

[Insert Table 2 about here]

Multivariate Tests

Table 3 presents the regression results of our first test. Regressions of PC, Server and Network on audit fees are shown in the first three columns. We notice that the coefficients of all IT variables are positive and highly significant (*PC* coefficient = 0.099, p-value < 0.001; *Server* coefficient = 0.144, p-value < 0.001; *Network* coefficient = 0.083, p-value < 0.001), after controlling for other factors (e.g., client firms characteristics, client-auditor economic bonding, auditor metrics) that may influence audit fees. The adjusted R^2s are around 75%, which is not uncommon with many previously documented audit fee model results. The results are consistent with our predictions that IT investments increases audit fees. To test the effect of overall IT investments on audit fees, we use factor analysis to derive a single latent factor – *ITFactor* to represent all three types of IT assets. The coefficient of *ITFactor* is positive and highly significant (*ITFactor* coefficient = 0.295, p-value < 0.001).

Consistent with theories and prior research, most coefficients for control variables in our models have expected signs. Specifically, firms have larger size, are audited by Big-N, with higher leverage, financial restatements, and earnings losses pay higher audit fees. Firms that operate in high litigation industries and high technology industries pay higher audit fees than other firms. In contrast, firms with higher rates of return on assets and pay higher IT fees tend to pay less audit fees.

[Insert Table 3 about here]

To examine our H2, we partition the sample into two groups based on different term limits of auditor tenure (3-year as a cutoff). Geiger and Raghunandan (2002) find that auditors averagely spend three years to accommodate to new engagement. Johnson et al. (2002) and Gul et al. (2007) also use three year as a cutoff point in their research. We apply the model (1) in the two subsamples and we only use *ITFactor* as our measure of IT investments since *ITFactor* is a composite measure of total IT investments. From Table 4, the coefficients of *ITFactor* from two subsamples are significant different from each other and the coefficient of short-term tenure is greater than that of long-term (0.013 = 0.298 – 0.285). A larger coefficient in short-term sample suggests that auditors in their earlier stage of engagement need time to get familiar with clients' IT investments and/or implementation. They need to put more efforts and bear higher risk so they charge higher audit fees. In our sensitivity tests, we use five-year or longer tenure as a cutoff. The un-tabulated results show that the significant difference diminishes if we select five years or longer as our cutoff point. Overall, the results are consistent with our expectation that the positive relationship between audit risk and clients' IT investments is stronger at the early stage of audit tenure, supporting our H2.

[Insert Table 4 about here]

We further use abnormal audit fees to test the relation between audit risk and IT. Table 5 reports the results of regression on abnormal audit fees. The abnormal audit fees are part of the total audit fees and engagement profit which cannot be explained by expected audit risk and audit rendered efforts, etc. (Choi et al. 2010a; Higgs and Skantz 2006; Hope et al. 2009). Higher abnormal audit fees are presumably associated with high audit risk (Asthana and Boone 2012; Markelevich and Rosner 2013). The results again support our prediction that IT investments increases audit effort and/or risk. The results still hold in the analysis using the latent factor of IT components (*ITFactor*). The difference between Table 5 and Table 3 is that we control for internal control weakness (*ICW*) as this variable is available for the sample period of 2004 to 2009. The coefficients of *ICW* on four IT variables are significant and positive (i.e., *ICW* coefficients are between 0.132 ~ 0.139, p-values are always below 1%). Firms that receive a material weakness opinion in the current and next year pay higher abnormal fees. The other controls show similar statistical significance in the model regression.

[Insert Table 5 about here]

ADDITIONAL TESTS

To test the validity and robustness of our analysis, we introduce alternative measures of IT investments and audit risks. First, we use different IT measures to test whether the previous results are robust. Second, we use the likelihood of an auditor's issuance of a going-concern audit opinion to capture audit risk. We then test how IT affects the probability of the client receiving a going-concern opinion.

The above-mentioned results in Table 3 & 5 are based on the use of IT component count measures from 2000 to 2009. We also perform the same analysis using an alternative IT intensity measure that incorporates IT asset pricing information. We regress two different types of IT intensity measures on audit fees. *ITIntensity1* represents the ratio of the value of IT capital to total assets, and *ITIntensity2* represents the value of IT capital per employee for each firm-year. We follow the existing literature (Chwelos et al. 2010; Xue et al. 2012) to calculate IT capital. Table 6 1st Column shows that the coefficients of both *ITIntensity1* and *ITIntensity2* are positive and significant at the 5% level. Therefore, our hypothesis is still supported by using IT intensity measures. The results on control variables are qualitatively consistent with those in Table 3.

Next, we regress abnormal audit fees against IT intensity measures. In Table 6 2nd Column, the coefficients of IT intensity measures are both positive and significant (evidenced by the p-value at the 3.4% level for *ITIntensity1* and 4.9% for *ITIntensity2,* respectively). Internal control weakness (*ICW*) is again positively and significantly associated with abnormal fees. In conclusion, all of the results using different IT measures and different proxies for audit risk consistently support our H1.

Table 7 reports the results of the going-concern audit opinion (*GCAO*) probit model. Following DeFond et al. (2002), our sample is limited to the financially distressed companies (companies with negative operating income and/or non-positive operating cash flow). The dependent variable *GCAO* is a dummy variable that equals to 1 if auditor issues a going-concern audit opinion and 0 otherwise. Since *ITFactor* captures the overall effects of different IT components (i.e., PC, Server and Network nodes), we only use this variable (Panel A). Next, we use both IT Intensity measures in the model (Panel B). Table 7 Panel A, shows the coefficient of *ITFactor* is negative and significant (*ITFactor* coefficient = -0.107, p-value = 0.025). The result is consistent with our expectation. That is, client firms' IT investments increase the detection risk and, consequently, decrease the likelihood that auditors issue going-concern opinions to financially distressed firms. Panel B shows that the coefficients of *ITIntensity1* and *ITIntensity2* are both negative and significant (*ITIntensity1*: coefficient = -0.036, p-value = 0.032; *ITIntensity2*: coefficient = -0.008, p-value = 0.044). These results support our argument that IT affects auditors' judgments of clients' going-concern issues and increases auditors' detection risk.

[Insert Table 7 about here]

Analysis above reports the positive relation between IT investments and audit risk. The results imply that, *ceteris paribus*, firms with more IT investments have higher audit risk. Therefore, auditors take IT investments into account in their audit planning as a factor for the audit risk. Now that auditors are sensitive to clients' IT investments, they should also sensitive to the change of IT investments. If client firms purchase, upgrade or reconstruct their IT (purchase new computer, servers, new version of software), the risk associated with IT investments will accordingly increase. Hence, auditors need to accommodate their audit planning and exert more efforts to understand the IT systems of their clients, then they will charge higher audit fees accordingly. Conversely, if client firms decrease their IT investments, the relation will reverse. We employ a "change" model of audit fees. Audit work varies with changes in the inherent risk of client firms. O'Keefe et al. (1994) suggest that both audit hours and labor are sensitive to client size, complexity, leverage, and inherent risk. We implement change analysis, using change in IT as the inherent risk factor, for a possible root cause analysis of audit risk. Thus, we predict that change of IT investments positively associated with change in audit fees. We follow the model by Cassell et al. (2011) and test the association between IT investment change and audit fee change. The audit fee change model is specified as follows:

$$\begin{aligned}\Delta AuditFee_{i,t} = {} & \beta_1 \Delta ITFactor_{i,t} + \beta_2 \Delta ITFee_{i,t} + \beta_3 \Delta DumITFee_{i,t} + \beta_4 \Delta CSize_{i,t} + \\ & \beta_5 \Delta RecInv_{i,t} + \beta_6 \Delta ROA_{i,t} + \beta_7 \Delta Loss_{i,t} + \beta_8 \Delta Leverage_{i,t} + \beta_9 \Delta BigN_{i,t} + \\ & \beta_{10} \Delta GCAO_{i,t} + \beta_{11} \Delta Segment_{11} + \beta_{12} \Delta Export_{i,t} + \beta_{13} \Delta Litigation_{i,t} + \\ & \beta_{14} \Delta AuditLag_{i,t} + \beta_{15} \Delta Busy_{i,t} + \beta_{16} \Delta MTB_{i,t} + \beta_{17} \Delta Restate_{i,t} + \\ & \beta_{18} \Delta |DA|_{i,t} + \beta_{19} \Delta Technology_{i,t} + YearDummies_t + \varepsilon_{i,t} \qquad (4)\end{aligned}$$

All variables are defined previously. The sample decreases to 6,104 observations because some firms only have one year data and others miss one or several years during the sample period.

The estimations results are reported in Table 8. We find that the coefficient of $\Delta ITFactor_{i,t}$ is positive (β_1 = 0.224) and highly significant (p-value < 0.001). This result is consistent with our prediction. Therefore, when client companies increase their IT investments, their audit risk will increase and auditor will increase audit fees charge accordingly. This result also confirms our previous analysis and further proves that auditor concerns client firms' IT investments and will make extra audit work as new risk from IT is being plugged in.

[Insert Table 8 about here]

Other Additional Tests

In this subsection we discuss several additional tests. The results of these tests remain qualitatively consistent with the results in the abovementioned main analyses. Our supplemental tests include:

i. We adopt a more comprehensive IT intensity measure by using the sum of abovementioned IT capital value and three times of the IT labor expense (to capture IT spending on software, staff and training).[7] Further robustness checks using alternative measures with two or four times the labor cost produce qualitatively similar results;
ii. We rerun the model equation (2) without the sample observations with negative abnormal fees (i.e., keeping the sample firms that pay abnormally high audit fees and are presumably associated with higher audit risk);
iii. We use decile ranks for all of the control variables except for dummy variables in the audit fee model equations;
iv. We employ the robust cluster technique proposed by Petersen (2009) in the audit fee models. In our main analysis, we do not add the industry fixed effect because the two control variables, *Litigation* and *Technology*, are indeed used to control for industry difference.
v. We also rerun the analysis without firm-year observations when firms switch their auditors.

CONCLUSIONS

This study examines the relationship between client firms' IT investments and external auditors' audit risk. Advances in information technology have dramatically changed firms' business processes and the ways financial reports are prepared and communicated. As a result, the use of IT also has an important impact on how firms' financial reports should be audited. As firms' internal business operations and external interactions with suppliers, partners, and consumers have become more digitized and IT-based, auditors are required to possess both

[7] We calculate IT labor expense by multiplying the number of IT employees by industry-specific average compensation and deflate that figure by using the Index of Total Compensation Cost from the Bureau of Labor Statistics.

financial and IT knowledge in conducting auditing services. Prior literature has mainly focused on whether IT improves focal firms' productivity, operation efficiency and transparency, or increases business risk. This study does not repudiate IT as a promising opportunity for business but does provide a new insight on the potentially negative impact of IT from a different perspective - the audit risk for external auditors.

We use different measures of IT and audit risk in the empirical analysis and provide evidence that firms with higher levels of IT investments generate higher audit risks for external auditors. This finding suggests that implementing IT as discretionary assets has far-reaching impacts in addition to improving focal firms' performance and increasing their business risks. In addition, we also test whether auditor tenure has mitigation effect on the relation between audit risk and IT investments. We find audit risk is higher in the early stage of engagement since auditor need time to accommodate the new clients. The key implication of our findings is that independent auditors need to advance their capabilities to audit sophisticated information systems and IT-based internal control, and improve their professional skills to decrease detection risk in auditing IT-intensive business organizations.

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Appendix A: Calculation of Abnormal Audit Fees

Based on the recent work of Blankley et al. (2012), we calculate the abnormal (or unexplained) audit fees from the model as specified below:

$$AuditFee_{i,t} = \beta_0 + \beta_1 logAT_{i,t} + \beta_2 CurrRatio_{i,t} + \beta_3 CurrAT_{i,t} + \beta_4 RecInv_{i,t} + \beta_5 ROA_{i,t} + \beta_6 Loss_{i,t} + \beta_7 Foreign_{i,t} + \beta_8 Merger_{i,t} + \beta_9 Busy_{i,t} + \beta_{10} Leverage_{i,t} + \beta_{11} Intang_{i,t} + \beta_{12} Segment_{i,t} + \beta_{13} GCAO_{i,t} + \beta_{14} ICW_{i,t-(t-1)} + \beta_{15} BigN_{i,t} + \beta_{16-27} Industry_{i,t} + \varepsilon_{i,t} \quad (5)$$

where:

AuditFee	=	the natural log of audit fees;
logAT	=	the natural log of total assets at year end;
CurrRatio	=	current ratio, current assets divided by current liabilities;
CurrAT	=	current assets divided by total assets at year end;
RecInv	=	sum of total account receivable and total inventory, scaled by total assets;
ROA	=	earnings before interest and taxes divided by total assets at year end;
Loss	=	a dummy variable, 1 if net income is negative, and 0 otherwise;
Foreign	=	a dummy variable, 1 if firm has any foreign operations, 0 otherwise;
Merger	=	a dummy variable, 1 if the firm reported the impact of a merger or acquisition on net income, 0 otherwise;
Busy	=	an indicator variable, 1 if a company's fiscal year is December 31st, 0 otherwise;
Leverage	=	long-term debt divided by total assets at year end;
Intang	=	ratio of intangible assets to total assets at year end;
Segment	=	the natural log of 1 plus the number of business and geographic segments;
GCAO	=	a dummy variable, 1 if auditor issues a going-concern audit opinion, and 0 otherwise;
ICW	=	a dummy of 1 if the client receives a material weakness opinion in the current year or the next year, 0 otherwise;
BigN	=	an indicator variable equals to 1 if the auditor is a Big-5 auditor before 2002 or a Big-4 after 2002, and 0 otherwise;
Industry	=	industry fixed effects; industry membership follows Ashbaugh et al. (2003) and is determined by SIC code as follows: agriculture (0100–0999), mining and construction (1000–1999, excluding 1300–1399), food (2000–2111), textiles and printing/publishing (2200–2799), chemicals (2800–2824; 2840–2899), pharmaceuticals (2830–2836), extractive (1300–1399; 2900–2999), durable manufactures (3000–3999, excluding 3570–3579 and 3670–3679), transportation (4000–4899), retail (5000–5999), services (7000–8999, excluding 7370–7379), computers (3570–3579; 3670–3679; 7370–7379),

and utilities (4900–4999). There is the total of 13 industry groups, so 12 dummy variables are used in regression.

Following the model by Blankley et al. (2012), we control several groups of variables influencing audit fees. To control for audit effort, we include client firms' size (*logAT*), the presence of merger and acquisition (*Merger*) and foreign operations (*Foreign*), the total number of business segments and geographic segments (*Segment*), the going-concern opinion issued by auditors (*GCAO*). To control for audit risk, we include current ratio (*CurrRatio*), current assets scaled by total assets, sum of account receivable and inventory scaled by total assets (*RecInv*), return on assets (*ROA*), dummy variable of loss (*Loss*), and the ratio of intangible assets to total assets (*Intang*). Financial leverage (*Leverage*) is to control for the clients' capital structure. December is the busiest month for auditors, so firms whose fiscal yearend is the December 31st probably pay higher audit fees. We use a dummy (*Busy*) to control for this factor.

Under the SOX Act Section 404, auditors are required to assess and report the adequacy of the company's internal control on financial reporting. The SOX Act is costly to implement and likely increases audit fees. Therefore, there should be a difference in audit fee charged between firms that receive material weakness opinions and firms that do not. Actually, the effect of the material weakness opinion is "sticky". We define dummy variable (*ICW*) to distinguish between firms that receive a material weakness opinion in the current or next year and firms that do not. Audit fees may be different across different industries, so we follow Ashbaugh et al. (2003) to control for the industry fixed effects. There is the total of 13 industries classified by Ashbaugh et al. (2003). We apply the robust cluster techniques proposed by Petersen (2009) to with-firm correlation of the residuals. The regression residual of the above model equation is the estimated abnormal fees.

Appendix B: Variable Descriptions

AuditFee	=	the natural log of audit fees;
AbAuditFee	=	abnormal audit fees, following Blankley et al. (2012);
PC	=	the natural log of the number of personal computers that a client firm uses during the fiscal year;
Server	=	the natural log of the number of servers that a client firm uses during the fiscal year;
Network	=	the natural log of the number of network nodes that a client firm uses during the fiscal year;
ITFactor	=	a component from factor analysis of the PC count, server count, and network node count that a client firm uses during the fiscal year;
ITIntensity 1	=	total IT capital divided by total assets;
ITIntensity 2	=	total IT capital divided by the number of employees;
ITFee	=	the ratio of IT fees to audit fees;
DumITFee	=	a dummy variable, 1if auditor receives IT fees, and 0 otherwise;
CSize	=	the natural log of market value of common equity at fiscal year-end;
RecInv	=	sum of total account receivable and total inventory, scaled by total assets;
ROA	=	earnings before interest and taxes divided by total assets at year end;
Loss	=	a dummy variable, 1 if net income is negative, and 0 otherwise;
Leverage	=	Financial leverage, calculated as long-term debt divided by total assets at year end;
BigN	=	an indicator variable equals to 1 if the auditor is a Big-5 auditor before 2002 or a Big-4 after 2002, and 0 otherwise;
GCAO	=	a dummy variable, 1 if auditor issues a going-concern audit opinion, and 0 otherwise;
Segment	=	the natural log of 1 plus the number of business and geographic segments;
Export	=	the ratio of foreign sales to total sales;
Litigation	=	an indicator variable that takes the value of 1 if the firm operates in a high-litigation industry and 0 otherwise;
AuditLag	=	the natural log of the number of calendar days from fiscal year-end to the signature date of the auditor's report;
Busy	=	a dummy of 1 if a company's fiscal year is December 31st, 0 otherwise;
MTB	=	market-to-book ratio;

Restate	=	a dummy of 1 if there is a subsequent financial restatement and 0 otherwise;
|DA|	=	the absolute value of discretionary accruals scaled by lagged assets, calculated from the Kothari et al. (2005) performance-adjusted accruals model;
Technology	=	an indicator variable equal to 1 when the firm is in high technology industries and 0 otherwise;
ICW	=	a dummy of 1 if the client receives a material weakness opinion in the current year or the next year, 0 otherwise;
Altman	=	Altman (1968) Z-score, measure of the probability of bankruptcy, with a lower value indicating greater financial distress;
FirmAge	=	the natural log of the number of years of data for the client firm since the coverage in Compustat;
Return	=	the firm's cumulative stock returns over the current year;
RetVolatility	=	the standard deviation of monthly returns over the current year;
ChgLeverage	=	change in *Leverage* from the previous year to the current year;
OCF	=	operating cash flow (Compustat item: *OANCF*) divided by total assets for the current year;
Investments	=	short- and long-term investment securities (including cash and cash equivalents) (Compustat items: *CHE* and *IVPT*), scaled by total assets;
NewFinance	=	an indicator variable equal to 1 if a client has a new issuance of equity or debt in the subsequent fiscal year (i.e., nonzero Compustat item: *DLTIS* or the amount of Compustat item: *SSTK* exceeding 5 percent of the firm's market value of equity) and 0 otherwise.

FIGURE 1

Audit Risk and IT Investments

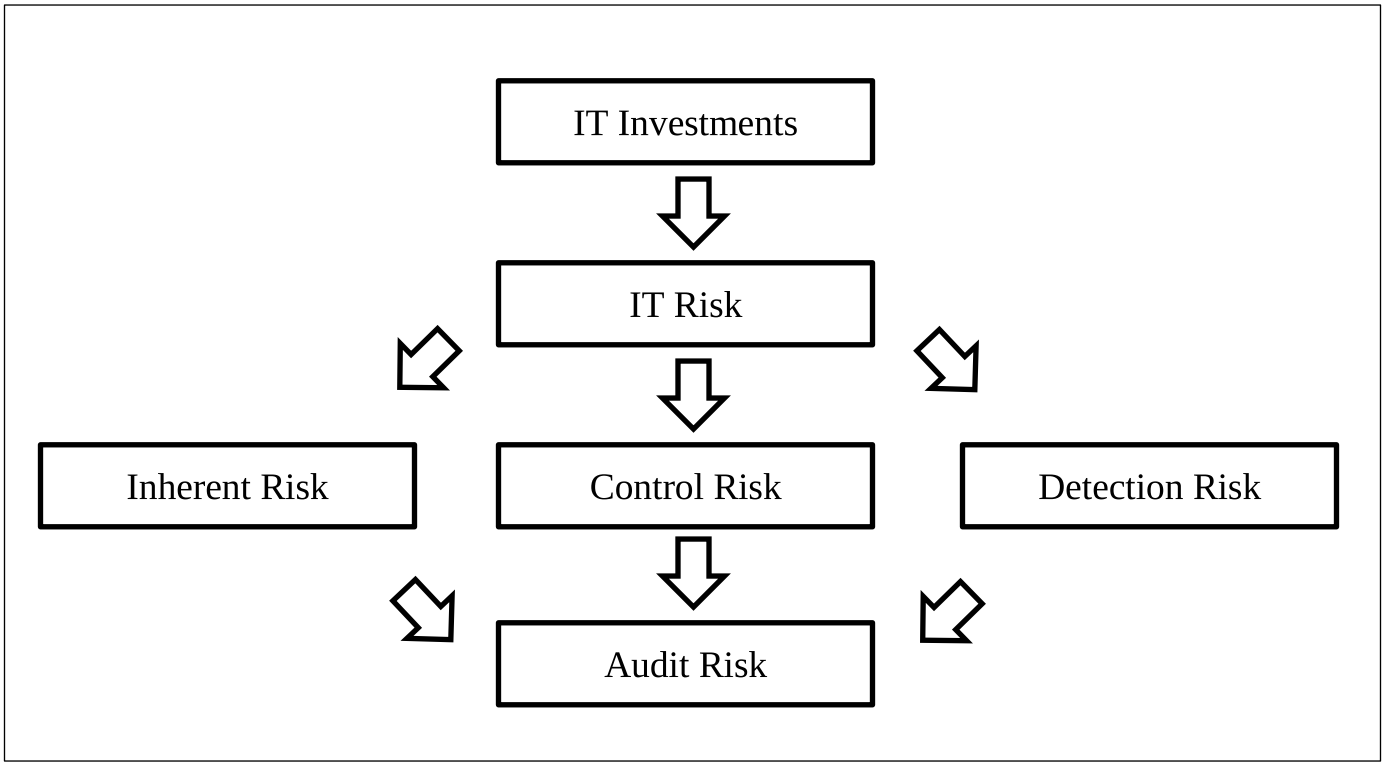

TABLE 1
Descriptive Statistics

Variable	Obs.	Sample Year	Mean	Median	Standard Deviation	Q1	Q3
AuditFee	8,102	2000-09	13.698	13.708	1.350	12.661	14.691
AbAuditFee	4,763	2004-09	0.009	0.010	0.247	-0.283	0.329
PC	8,102	2000-09	6.099	6.424	2.280	5.088	7.669
Server	8,102	2000-09	3.210	3.219	2.020	1.792	4.615
Network	8,102	2000-09	5.697	6.248	2.657	4.691	7.524
ITFactor	8,102	2000-09	0.097	0.189	0.934	-0.421	0.760
ITIntensity1	1,023	2004-06	0.082	0.034	0.133	0.008	0.088
ITIntensity2	1,023	2004-06	14.738	8.083	25.066	1.907	20.031
Tenure	8,102	2000-09	11.031	9.000	8.761	4.000	15.000
ITFee	8,102	2000-09	0.023	0.000	0.266	0.000	0.000
DumITFee	8,102	2000-09	0.019	0.000	0.129	0.000	0.000
CSize	8,102	2000-09	6.643	6.739	2.115	5.207	8.085
ICW	4,763	2004-09	0.066	0.000	0.249	0.000	0.000
RecInv	8,102	2000-09	0.276	0.257	0.178	0.131	0.381
ROA	8,102	2000-09	0.021	0.039	0.126	0.004	0.078
Loss	8,102	2000-09	0.236	0.000	0.425	0.000	0.000
Leverage	8,102	2000-09	0.197	0.161	0.184	0.018	0.294
BigN	8,102	2000-09	0.880	1.000	0.315	1.000	1.000
GCAO	8,102	2000-09	0.012	0.000	0.109	0.000	0.000
Segment	8,102	2000-09	1.715	1.792	0.484	1.386	2.079
Export	8,102	2000-09	0.017	0.000	0.040	0.000	0.021
Litigation	8,102	2000-09	0.302	0.000	0.459	0.000	1.000
AuditLag	8,102	2000-09	3.974	4.060	0.403	3.784	4.248
Busy	8,102	2000-09	0.652	1.000	0.476	0.000	1.000
MTB	8,102	2000-09	2.705	2.007	3.890	1.289	3.224
Restate	8,102	2000-09	0.174	0.000	0.379	0.000	0.000
|*DA*|	8,102	2000-09	0.222	0.083	0.538	0.033	0.194
Technology	8,102	2000-09	0.210	0.000	0.387	0.000	0.000
Altman	8,102	2000-09	0.594	1.095	5.304	-0.265	2.383
FirmAge	8,102	2000-09	3.732	3.689	0.358	3.466	4.060

All continuous variables are winsorized at the 1% and 99% level each year. Refer to the Appendix for variable descriptions.

TABLE 2

Simple Correlations

Panel A: Pearson Correlation among Audit Fees, IT Assets and Other Variables

	AuditFee	*PC*	*Server*	*Network*	*ITFactor*	*Tenure*	*GCAO*	*BigN*	*CSize*	*Leverage*	*Litigation*	*Technology*	*|DA|*
PC	**0.223**												
Server	**0.301**	**0.650**											
Network	**0.236**	**0.736**	**0.729**										
ITFactor	**0.303**	**0.718**	**0.805**	**0.815**									
Tenure	**0.095**	**0.102**	**0.097**	**0.134**	**0.120**								
GCAO	**-0.085**	**-0.059**	**-0.053**	**-0.056**	**-0.061**	**-0.038**							
BigN	**0.323**	**0.262**	**0.246**	**0.216**	**0.259**	**0.216**	**-0.083**						
CSize	**0.473**	**0.305**	**0.315**	**0.462**	**0.450**	**0.207**	**-0.162**	**0.364**					
Leverage	**0.157**	**0.144**	**0.136**	**0.137**	**0.148**	**-0.034**	**-0.033**	**0.126**	**0.060**				
Litigation	**-0.048**	**-0.232**	**-0.172**	**-0.238**	**-0.229**	**-0.045**	**0.030**	**-0.037**	*0.014*	**-0.236**			
Technology	**0.060**	**0.072**	**0.048**	**0.085**	**0.073**	**-0.080**	**0.062**	**-0.029**	*0.017*	**-0.195**	**0.503**		
|DA|	**-0.041**	*-0.013*	**-0.030**	*-0.002*	*-0.016*	*-0.016*	*0.013*	*-0.019*	**-0.029**	**-0.082**	**0.036**	**0.175**	
Restate	**0.045**	*0.019*	**0.037**	*0.015*	*0.023*	*-0.006*	**0.107**	*-0.001*	**-0.053**	*0.017*	*-0.016*	*-0.014*	*0.002*

Panel A reports the Pearson correlations of 8,102 sample observations for the firm-year period from 2000 to 2009. Correlations are bold (italic) if they are statistically significant below (above) the 5 percent level. Refer to the Appendix for variables descriptions.

Panel B: Pearson Correlation among Abnormal Audit Fees and IT Intensity

	AbAuditFee	*ITIntensity1*	*ITIntensity2*	*ICW*
ITIntensity1	**0.095**			
ITIntensity2	**0.068**	**0.501**		
ICW	**0.097**	**-0.085**	**-0.062**	
GCAO	**-0.099**	**-0.094**	**-0.056**	**0.251**

Panel B reports the Pearson correlations of 1,023 sample observations for the firm-year period from 2004 to 2006. Correlations are bold meaning that they are statistically significant below the 5 percent level. Refer to the Appendix for variables descriptions.

TABLE 3

Regression of Audit Fees on IT Assets

$$AuditFee_{i,t} = \beta_0 + \beta_1(PC\ or\ Server\ or\ Network\ or\ ITFactor\ or\ ITIntensity\ 1\&2)_{i,t} + \beta_2 ITFee_{i,t} + \beta_3 DumITFee_{i,t} + \beta_4 CSize_{i,t} + \beta_5 RecInv_{i,t} + \beta_6 ROA_{i,t} + \beta_7 Loss_{i,t} + \beta_8 Leverage_{i,t} + \beta_9 BigN_{i,t} + \beta_{10} GCAO_{i,t} + \beta_{11} Segment_{11} + \beta_{12} Export_{i,t} + \beta_{13} Litigation_{i,t} + \beta_{14} AuditLag_{i,t} + \beta_{15} Busy_{i,t} + \beta_{16} MTB_{i,t} + \beta_{17} Restate_{i,t} + \beta_{18}|DA|_{i,t} + \beta_{19} Technology_{i,t} + YearDummies_t + \varepsilon_{i,t} \quad (1)$$

Variables	Est. Coeff.	p-value	Est. Coeff.	p-value	Est. Coeff.	p-value	Est. Coeff.	p-value
PC	**0.099**	**<.0001**						
Server			**0.144**	**<.0001**				
Network					**0.083**	**<.0001**		
ITFactor							**0.295**	**<.0001**
ITFee	-0.071	0.062	-0.071	0.058	-0.077	0.044	-0.072	0.055
DumITFee	-0.197	0.013	-0.188	0.015	-0.190	0.016	-0.197	0.012
CSize	0.467	<.0001	0.445	<.0001	0.478	<.0001	0.449	<.0001
RecInv	0.791	<.0001	0.795	<.0001	0.803	<.0001	0.780	<.0001
ROA	-0.689	<.0001	-0.662	<.0001	-0.706	<.0001	-0.669	<.0001
Loss	0.183	<.0001	0.175	<.0001	0.189	<.0001	0.177	<.0001
Leverage	0.723	<.0001	0.728	<.0001	0.725	<.0001	0.725	<.0001
BigN	0.166	<.0001	0.176	<.0001	0.176	<.0001	0.169	<.0001
GCAO	0.098	0.177	0.096	0.287	0.100	0.135	0.091	0.258
Segment	0.392	<.0001	0.391	<.0001	0.387	<.0001	0.389	<.0001
Export	1.489	<.0001	1.582	<.0001	1.413	<.0001	1.583	<.0001
Litigation	0.031	0.135	0.026	0.191	0.027	0.307	0.041	0.009
AuditLag	0.002	<.0001	0.003	<.0001	0.003	<.0001	0.005	<.0001
Busy	0.042	0.013	0.039	0.031	0.040	0.006	0.039	0.022
MTB	0.006	<.0001	0.004	<.0001	0.005	<.0001	0.005	<.0001
Restate	0.072	<.0001	0.074	<.0001	0.071	<.0001	0.083	<.0001
|DA|	0.119	0.003	0.122	0.014	0.126	0.001	0.127	0.003
Technology	0.042	<.0001	0.039	<.0001	0.049	<.0001	0.039	<.0001
Observations	8,102		8,102		8,102		8,102	
Adjusted R^2	74.24%		75.44%		74.16%		75.04%	

This table reports the regression results of OLS estimation for IT assets and audit fees. Three different types (computers, servers, and network nodes) of IT assets and their latent factor (via factor analysis) – *ITFactor* are explanatory variables. Year dummies are included in all model specifications. Intercepts and year-dummy effects are omitted for brevity. All continuous variables are winsorized at 1% and 99% level to avoid the effects of outliers. The total sample includes 8,102 observations for the period from 2000 to 2009. Refer to the Appendix for variable descriptions.

TABLE 4

Regression of Audit Fees on IT Assets (Partitioned by Auditor Tenure)

$$AuditFee_{i,t} = \beta_0 + \beta_1 ITFactor_{i,t} + \beta_2 ITFee_{i,t} + \beta_3 DumITFee_{i,t} + \beta_4 CSize_{i,t} + \beta_5 RecInv_{i,t} + \beta_6 ROA_{i,t} + \beta_7 Loss_{i,t} + \beta_8 Leverage_{i,t} + \beta_9 BigN_{i,t} + \beta_{10} GCAO_{i,t} + \beta_{11} Segment_{11} + \beta_{12} Export_{i,t} + \beta_{13} Litigation_{i,t} + \beta_{14} AuditLag_{i,t} + \beta_{15} Busy_{i,t} + \beta_{16} MTB_{i,t} + \beta_{17} Restate_{i,t} + \beta_{18} |DA|_{i,t} + \beta_{19} Technology_{i,t} + YearDummies_t + \varepsilon_{i,t} \quad (1)$$

	(Short-term) Tenure ≤ 3 years		(Long-term) Tenure > 3 years		Short-term vs. Long-term	
Variables	Est. Coeff.	p-value	Est. Coeff.	p-value	Difference	p-value
ITFactor	**0.298**	<.0001	**0.285**	<.0001	**0.013**	<.0001
ITFee	0.112	0.208	-0.102	0.014	0.214	0.016
DumITFee	-0.624	0.010	-0.158	0.051	-0.466	0.021
CSize	0.439	<.0001	0.450	<.0001	-0.011	<.0001
RecInv	0.700	<.0001	0.794	<.0001	-0.094	<.0001
ROA	-0.239	0.133	-0.894	<.0001	0.655	<.0001
Loss	0.283	<.0001	0.126	<.0001	0.157	<.0001
Leverage	0.777	<.0001	0.736	<.0001	0.041	<.0001
BigN	0.137	<.0001	0.268	<.0001	-0.131	<.0001
GCAO	0.161	0.204	0.255	0.004	-0.094	0.157
Segment	0.344	<.0001	0.376	<.0001	-0.032	<.0001
Export	2.105	0.000	1.457	<.0001	0.648	<.0001
Litigation	0.065	0.192	0.043	0.051	0.022	0.087
AuditLag	0.001	<.0001	0.007	<.0001	-0.006	<.0001
Busy	0.054	0.167	0.039	0.033	0.015	0.121
MTB	0.002	<.0001	0.002	<.0001	0.000	<.0001
Restate	0.087	<.0001	0.074	<.0001	0.013	<.0001
|DA|	0.007	0.003	0.143	0.001	-0.136	0.003
Technology	0.025	<.0001	0.059	0.032	-0.034	0.001
Observations	1,725		6,377			
Adjusted R^2	69.25%		75.76%			

This table reports the results of the model (1) on two subsamples (tenure≤3 and tenure>3). The explanatory variable of our interest is *ITFactor*. Intercepts and year-dummy effects are omitted for brevity. All continuous variables are winsorized at 1% and 99% level to avoid the effects of outliers. Refer to the Appendix for variable descriptions.

TABLE 5

Regression of Abnormal Audit Fees on IT Assets

$$AbAuditFee_{i,t} = \beta_0 + \beta_1(PC\ or\ Server\ or\ Network\ or\ ITFactor\ or\ ITIntensity\ 1\&2)_{i,t} + \beta_2 ICW_{i,t} + \beta_3 ITFee_{i,t} + \beta_4 DumITFee_{i,t} + \beta_5 CSize_{i,t} + \beta_6 RecInv_{i,t} + \beta_7 ROA_{i,t} + \beta_8 Loss_{i,t} + \beta_9 Leverage_{i,t} + \beta_{10} BigN_{i,t} + \beta_{11} GCAO_{i,t} + \beta_{12} Segment_{i,t} + \beta_{13} Export_{i,t} + \beta_{14} Litigation_{i,t} + \beta_{15} AuditLag_{i,t} + \beta_{16} Busy_{i,t} + \beta_{17} MTB_{i,t} + \beta_{18} Restate_{i,t} + \beta_{19} |DA|_{i,t} + \beta_{20} Technology_{i,t} + YearDummies_t + \varepsilon_{i,t} \quad (2)$$

Variables	Est. Coeff.	p-value	Est. Coeff.	p-value	Est. Coeff.	p-value	Est. Coeff.	p-value
PC	**0.036**	**<.0001**						
Server			**0.048**	**<.0001**				
Network					**0.026**	**<.0001**		
ITFactor							**0.104**	**<.0001**
ICW	0.132	0.001	0.138	0.000	0.134	<.0001	0.139	<.0001
ITFee	-0.213	0.001	-0.225	0.001	-0.199	0.002	-0.201	0.001
DumITFee	-0.775	0.021	-0.854	0.018	-0.755	0.031	-0.078	0.022
CSize	-0.049	<.0001	-0.005	<.0001	-0.019	0.009	-0.006	<.0001
RecInv	0.223	0.000	0.218	0.000	0.248	<.0001	0.212	0.000
ROA	-0.749	<.0001	-0.683	<.0001	-0.790	<.0001	-0.693	<.0001
Loss	-0.185	<.0001	-0.196	<.0001	-0.182	<.0001	-0.186	<.0001
Leverage	0.116	0.028	0.100	0.059	0.124	0.020	0.108	0.040
BigN	0.036	0.012	0.044	0.013	0.024	0.011	0.043	0.006
GCAO	-0.098	0.410	-0.143	0.224	-0.096	0.424	-0.101	0.397
Segment	0.045	0.019	0.038	0.045	0.046	0.016	0.037	0.053
Export	0.883	<.0001	0.929	<.0001	0.834	<.0001	0.898	<.0001
Litigation	0.032	0.174	0.025	0.276	0.027	0.260	0.042	0.074
AuditLag	0.340	<.0001	0.386	<.0001	0.319	<.0001	0.356	<.0001
Busy	-0.021	0.278	-0.022	0.262	-0.031	0.333	-0.023	0.240
MTB	0.004	0.012	0.002	0.015	0.005	0.001	0.001	0.004
Restate	-0.070	0.027	-0.046	0.136	-0.065	0.042	-0.069	0.030
|DA|	0.004	0.847	-0.006	0.748	-0.009	0.620	-0.010	0.590
Technology	0.053	0.388	0.045	0.134	0.048	0.109	0.042	0.164
Observations	4,763		4,763		4,763		4,763	
Adjusted R^2	24.03%		24.20%		24.21%		24.23%	

This table reports regression results of OLS estimation for three different types of IT assets (computers, servers, and network nodes) or their latent factor (via factor analysis) – *ITFactor* on abnormal audit fees. Intercepts and year-dummy effects are omitted for brevity. Refer to the Appendix for variable descriptions.

TABLE 6

Regression of Audit Fees (Abnormal Audit Fees) on IT Intensity

$$AuditFee_{i,t} = \beta_0 + \beta_1(ITIntensity\ 1\&2)_{i,t} + \beta_2 ITFee_{i,t} + \beta_3 DumITFee_{i,t} + \beta_4 CSize_{i,t} + \beta_5 RecInv_{i,t} + \beta_6 ROA_{i,t} + \beta_7 Loss_{i,t} + \beta_8 Leverage_{i,t} + \beta_9 BigN_{i,t} + \beta_{10} GCAO_{i,t} + \beta_{11} Segment_{11} + \beta_{12} Export_{i,t} + \beta_{13} Litigation_{i,t} + \beta_{14} AuditLag_{i,t} + \beta_{15} Busy_{i,t} + \beta_{16} MTB_{i,t} + \beta_{17} Restate_{i,t} + \beta_{18}|DA|_{i,t} + \beta_{19} Technology_{i,t} + YearDummies_t + \varepsilon_{i,t} \quad (1)$$

$$AbAuditFee_{i,t} = \beta_0 + \beta_1(ITIntensity\ 1\&2)_{i,t} + \beta_2 ICW_{i,t} + \beta_3 ITFee_{i,t} + \beta_4 DumITFee_{i,t} + \beta_5 CSize_{i,t} + \beta_6 RecInv_{i,t} + \beta_7 ROA_{i,t} + \beta_8 Loss_{i,t} + \beta_9 Leverage_{i,t} + \beta_{10} BigN_{i,t} + \beta_{11} GCAO_{i,t} + \beta_{12} Segment_{i,t} + \beta_{13} Export_{i,t} + \beta_{14} Litigation_{i,t} + \beta_{15} AuditLag_{i,t} + \beta_{16} Busy_{i,t} + \beta_{17} MTB_{i,t} + \beta_{18} Restate_{i,t} + \beta_{19}|DA|_{i,t} + \beta_{20} Technology_{i,t} + YearDummies_t + \varepsilon_{i,t} \quad (2)$$

	Dependent Variable = Audit Fees in Equation (1)				Dependent Variable = Abnormal Audit Fees in Equation (2)			
Variables	Est. Coeff.	p-value	Est. Coeff.	p-value	Est. Coeff.	p-value	Est. Coeff.	p-value
ITIntensity1	**0.294**	**0.038**			**0.320**	**0.034**		
ITIntensity2			**0.001**	**0.024**			**0.016**	**0.049**
Observations	1,023		1,023		1,023		1,023	
Adjusted R^2	62.57%		62.40%		22.23%		23.12%	

This table reports the regression results of OLS estimation for two different types of IT intensity on audit fees or abnormal audit fees. *ITIntensity1* represents the ratio of the value of IT assets to total assets, and *ITIntensity2* represents the value of IT assets per employee for each firm-year. We calculate IT assets intensity by referring to Xue et al. (2012). Controls, intercepts and year-dummy effects are omitted for brevity. Refer to the Appendix for variable descriptions.

TABLE 7

Logistic Regressions of Going-concern Audit Opinion

Panel A: Logistic Regression of IT Factor on Going-Concern Opinion

$$Pr(GCAO_{i,t} = 1) = \beta_0 + \beta_1 ITFactor_{i,t} + \beta_2 Altman_{i,t} + \beta_3 Loss_{i,t} + \beta_4 CSize_{i,t} + \beta_5 FirmAge_{i,t} + \beta_6 Return_{i,t} + \beta_7 RetVolatility_{i,t} + \beta_8 Leverage_{i,t} + \beta_9 ChgLeverage_{i,t} + \beta_{10} OCF_{i,t} + \beta_{11} AuditLag_{i,t} + \beta_{12} Investments_{i,t} + \beta_{13} NewFinance_{i,t} + \beta_{14} BigN_{i,t} + \beta_{15} Technology_{i,t} + YearDummies_t + \varepsilon_{i,t} \quad (3)$$

Variables	Est. Coeff.	P>ChiSq
ITFactor	**-0.107**	**0.025**
Altman	0.120	0.030
Loss	1.128	<.0001
CSize	-0.362	<.0001
FirmAge	-0.063	0.157
Return	-0.357	0.206
RetVolatility	0.430	0.282
Leverage	0.089	0.132
ChgLeverage	-0.028	0.024
OCF	-0.853	<.0001
AuditLag	0.033	<.0001
Investments	-0.811	<.0001
NewFinance	0.125	0.089
BigN	0.088	0.267
Technology	-0.019	0.085
Observations	2,086	
Pseudo R^2	21.53%	

Panel B: Logistic Regression of IT Intensity on Going-Concern Opinion

$$Pr\big(GCAO_{i,t}=1\big)=\beta_0+\beta_1(ITIntensity\ 1\&2)_{i,t}+\beta_2 Altman_{i,t}+\beta_3 Loss_{i,t}+\beta_4 CSize_{i,t}+\beta_5 FirmAge_{i,t}+\beta_6 Return_{i,t}+\beta_7 RetVolatility_{i,t}+\beta_8 Leverage_{i,t}+\beta_9 ChgLeverage_{i,t}+\beta_{10} OCF_{i,t}+\beta_{11} AuditLag_{i,t}+\beta_{12} Investments_{i,t}+\beta_{13} NewFinance_{i,t}+\beta_{14} BigN_{i,t}+\beta_{15} Technology_{i,t}+YearDummies_t+\varepsilon_{i,t} \quad (3)$$

Variables	Est. Coeff.	P>ChiSq	Est. Coeff.	P>ChiSq
ITIntensity1	**-0.036**	**0.032**		
ITIntensity2			**-0.008**	**0.044**
Altman	0.142	0.016	0.160	0.025
Loss	0.865	<.0001	0.903	<.0001
CSize	-0.378	<.0001	-0.520	<.0001
FirmAge	-0.082	0.087	-0.084	0.009
Return	-0.255	0.285	-0.084	0.143
RetVolatility	0.406	0.521	0.068	0.082
Leverage	0.073	0.085	0.072	0.096
ChgLeverage	-0.050	0.073	-0.052	0.128
OCF	-0.648	<.0001	-0.650	<.0001
AuditLag	0.038	0.010	0.057	0.103
Investments	-0.342	<.0001	-0.148	0.002
NewFinance	0.109	0.120	0.154	0.132
BigN	0.091	0.412	0.094	0.295
Technology	-0.026	0.007	-0.024	0.005
Observations	296		296	
Pseudo R^2	19.51%		19.82%	

This table reports regression results for pooled logistic regression for IT Factor (in Panel A for 2,086 observations during 2000-2009) and IT Intensity (in Panel B for 296 observations during 2004-2006) on the likelihood of auditor's issuance of a going-concern report. The significance level of the coefficients is derived based on robust standard errors clustered by the client firm and the auditor. Intercepts and year-dummy effects are omitted for brevity. Refer to the Appendix for variable descriptions.

TABLE 8

Regression of Audit Fee Change on IT Investment Change

$$\Delta AuditFee_{i,t} = \beta_1 \Delta ITFactor_{i,t} + \beta_2 \Delta ITFee_{i,t} + \beta_3 \Delta DumITFee_{i,t} + \beta_4 \Delta CSize_{i,t} + \beta_5 \Delta RecInv_{i,t} + \beta_6 \Delta ROA_{i,t} + \beta_7 \Delta Loss_{i,t} + \beta_8 \Delta Leverage_{i,t} + \beta_9 \Delta BigN_{i,t} + \beta_{10} \Delta GCAO_{i,t} + \beta_{11} \Delta Segment_{11} + \beta_{12} \Delta Export_{i,t} + \beta_{13} \Delta Litigation_{i,t} + \beta_{14} \Delta AuditLag_{i,t} + \beta_{15} \Delta Busy_{i,t} + \beta_{16} \Delta MTB_{i,t} + \beta_{17} \Delta Restate_{i,t} + \beta_{18} \Delta |DA|_{i,t} + \beta_{19} \Delta Technology_{i,t} + YearDummies_t + \varepsilon_{i,t} \quad (4)$$

Variables	Est. Coeff.	p-value
ΔITFactor	**0.224**	<.0001
ΔITFee	-0.016	0.724
ΔDumITFee	-0.143	0.072
ΔCSize	0.415	<.0001
ΔRecInv	0.437	<.0001
ΔROA	-0.306	0.000
ΔLoss	0.131	<.0001
ΔLeverage	0.558	<.0001
ΔBigN	0.115	0.000
ΔGCAO	0.066	0.323
ΔSegment	0.372	<.0001
ΔExport	1.380	<.0001
ΔLitigation	0.113	0.000
ΔAuditLag	0.626	<.0001
ΔBusy	0.027	0.314
ΔMTB	-0.000	0.288
ΔRestate	-0.123	<.0001
Δ|*DA*|	0.021	0.063
ΔTechnology	0.036	0.356
Observations	6,104	
Adjusted R^2	59.11%	

This table reports the results for the regression of annual change in audit fees on annual changes in IT assets and changes in other control variables. Refer to the Appendix for variable descriptions. Intercepts and year-dummy effects are omitted for brevity.