

Determinants of the Persistence of Internal Control Weaknesses

Bonnie K. Klamm, Kevin W. Kobelsky, and Marcia Weidenmier Watson

SYNOPSIS: This paper analyzes the degree to which material weaknesses (MWs) in internal control reported under the Sarbanes-Oxley Act of 2002 (SOX) affect the future reporting of MWs. Particularly, we examine information technology (IT) and non-IT MWs and their breakdown into specific IT-related entity-level, non-IT-related entity-level, and account-level deficiencies. Analysis reveals that most account-level and entity-level deficiencies occur at a significantly higher rate in SOX 404 reports with at least one IT MW than in MW reports with only non-IT MWs. Further, the presence and count of both types of MWs and all three types of deficiencies are associated with increased future MWs, as are lower profitability, non-Big 6 auditor, and firm complexity. Specific control deficiencies related to senior management, training, and IT control environment have the strongest impact on future MWs. These results indicate that effective corporate governance of both the IT and non-IT domains is pivotal in establishing and maintaining strong internal controls over financial reporting.

Keywords: Sarbanes-Oxley Act of 2002; internal controls; information technology.

Data Availability: Data are available from the public sources identified in the paper.

INTRODUCTION

With the specific intention of improving the quality of financial reporting, the Sarbanes-Oxley Act of 2002 (SOX) Section 404 requires an annual evaluation of internal controls over financial reporting and the disclosure of material weaknesses (MWs) in internal control (SEC 2003). Reporting weaknesses in internal control indicates that management has been unsuccessful during the current year in identifying risks and/or establishing controls to provide reasonable assurance that financial statements are reliable, i.e., that all material misstatements have been prevented or corrected. This study examines the relationship between

Bonnie K. Klamm is an Associate Professor at North Dakota State University, Kevin W. Kobelsky is an Assistant Professor at the University of Michigan–Dearborn, and Marcia Weidenmier Watson is an Associate Professor at Mississippi State University.

The authors thank the Associate Editor and two anonymous reviewers for their helpful comments. We also thank the IMA Research Foundation, the Richard C. Adkerson School of Accountancy at Mississippi State University, and the College of Business at North Dakota State University for financial support.

Submitted: April 2008

Accepted: November 2011

Published Online: June 2012

Corresponding author: Marcia Weidenmier Watson
Email: MWatson@cobilan.msstate.edu

current and future MWs and analyzes the degree to which ineffective controls affect the future quality of internal controls over financial reporting. Specifically, we investigate the distinction between information technology (IT) and non-IT MWs and their breakdown into entity-level and account-level deficiencies.

Research indicates that the existence and nature of current internal control MWs are associated with the quality of earnings and evaluations by auditors, credit rating agencies, and investors. In particular, firms with MWs, compared to firms with effective internal controls, have lower profitability, earnings quality, returns-earnings relations, audit committee quality, and stock market returns as well as higher audit fees (e.g., Beneish et al. 2008; Chan et al. 2008; De Franco et al. 2005; Hammersley et al. 2008; Hoitash et al. 2008; Ranghunanandan and Rama 2006; Zhang et al. 2007). These effects differ depending upon the nature of the MW. For example, firms with IT-related MWs (hereafter IT MWs) have less accurate management earnings' forecasts than firms with non-IT-related MWs (hereafter non-IT MWs), especially for IT MWs related to data processing integrity (Li et al. 2011). Moreover, entity-level MWs are associated with lower accrual quality, auditors' going concern assessments, and lower three-day market returns while account-level MWs are not (Doyle et al. 2007b; Hammersley et al. 2008).

Research has not yet examined whether, or how, the existence and nature of current year MWs are related to the continued long-term reporting of MWs, which is a potentially important attribute in the evaluation of internal control. We extend prior research by classifying SOX 404 reports of MWs, and the control deficiencies underlying them, using control dimensions defined by auditor requirements (PCAOB AS 5 2007), Moody's (Jonas et al. 2007), and the Enterprise Risk Management framework (COSO 2004). We first examine IT and non-IT MWs followed by the breakdown of the MWs into three categories: IT entity-level, account-level, and non-IT entity-level deficiencies. Finally, we examine the presence of specific control deficiencies within each of these categories. We examine the relationship of all of these to: (1) the future number of MWs and (2) the future number of years with an ineffective control report—both measures of MW persistence.

Our results show that IT and non-IT MWs relate to the future quality of internal controls over financial reporting. Specifically, we find that the presence and number of MWs and (IT and non-IT) deficiencies are all positively related to the future number of MWs as well as the future number of years in which MWs are reported. Firms reporting account-level (non-IT entity-level) deficiencies have 129 percent (192) more future MWs than firms not reporting that type of control deficiency. Firms reporting an IT entity-level control deficiency also report 127 percent more future MWs than firms not reporting that type of deficiency. We find that the presence of specific entity-level deficiencies relating to training, senior management, and IT control environment in the first year reporting a MW are associated with the future reporting of MWs. The presence of an IT control environment deficiency has the largest effect of all deficiencies, so that firms reporting it have nearly twice as many future MWs and take 56 percent longer to resolve fully MWs than other firms. With respect to specific account-level deficiencies, misstatements in debt, fixed assets/capitalization, revenue recognition, and tax are positively associated with the future reporting of MWs. Thus, when evaluating management's ability to maintain adequate control over financial reporting, the type and number of control deficiencies that give rise to the MW reported are relevant to decision makers.

The analyses also reveal a negative relation between the future number of years of MWs and Big 6 auditor affiliation and ROA, indicating that auditor expertise, as well as financial resources, helps a firm eliminate MWs more quickly. There is also a positive relation between complexity, as measured by the number of firm operating segments and acquisitions, and future MWs, indicating that firms with greater scope face a greater challenge in eliminating control weaknesses.

We organize the remainder of the paper as follows. The next section provides background information and the research question, followed by descriptions of the research method and data. Then, we present the results, and the final section provides a summary and conclusion.

BACKGROUND AND RESEARCH QUESTION

SOX Section 404, effective for yearends beginning on November 15, 2004, requires CEOs and CFOs of “accelerated filers,” i.e., large firms (with at least \$75 million in public equity float) to make an annual evaluation regarding the effectiveness of internal controls over financial reporting, which is subject to auditor attestation. For non-accelerated filers, the evaluation by management is required for yearends after December 15, 2007, but is not subject to auditor attestation. To comply with Section 404, the evaluation must: (1) state that management is responsible for establishing and maintaining internal controls over financial reporting, (2) identify the framework used for evaluating internal controls, (3) provide management’s assessment on the effectiveness of internal controls over (only) financial reporting, and (4) disclose any MWs.¹ These MWs are internal control deficiencies that lead to more than a remote likelihood that a material misstatement of the annual or interim financial statements will occur (PCAOB 2005).²

Different types of MWs have different effects on financial reporting quality (Grant et al. 2008). Moody’s credit rating service divides MWs into two groups: Category A account-level, i.e., problems with specific transaction-level processes or account balances; and Category B company-level, i.e., problems at the entity-level,³ such as weaknesses in control environment or segregation of duties (Ge and McVay 2005; Doyle et al. 2007a; Jonas et al. 2005, 2007).

Moody’s considers reducing the ratings for firms with Category B MWs because entity-level deficiencies have greater scope, are less easily remedied, and are more likely to persist over time. In addition, it is difficult for auditors to compensate for Category B MWs in their audits. Firms reporting Category A MWs can often avoid lower ratings if management remediates the MWs in a timely fashion, which is generally achievable because of their isolated impact (Jonas et al. 2005, 2007). Extant research supports a distinction between these types of control weaknesses, i.e., entity-level MWs are associated with lower accrual quality, auditor’s going concern assessments, and lower three-day market returns while account-level MWs are not (Doyle et al. 2007b; Hammersley et al. 2008). Thus, entity-level MWs are seemingly more severe than are account-level MWs.

IT MWs may also be severe given that firms depend upon IT for effective and efficient business operations and for information processing, including compliance with external reporting regulations. According to the AICPA, “IT has grown (and will continue to grow) in importance at such a rapid pace and with such far reaching effects that . . . one can hardly conceive of accounting independent of IT” (AICPA 1996). IT professionals are inexperienced in the area of internal controls (IT Governance Institute 2004); thus, those responsible for internal control evaluation, i.e., investors as well as managers and auditors, should pay particular attention to IT during the evaluation process.

According to COSO’s Enterprise Risk Framework, managers need to implement, evaluate, and report on controls over IT-based systems to help ensure continuous operations and the completeness, accuracy, and validity of information processing and storage (COSO 2004). But managers frequently overlook, misunderstand, and undervalue IT-related risks (Wallace et al. 2004; Kumar 2002; Osmundson et al. 2003), including the risk of material fraud. Further, “the ease, lightning speed and covert nature of automated fraud has far surpassed the potential ever posed by

¹ Originally, Auditing Standard (AS) 2 required firms to state also that the auditors had issued an attestation report on management’s assessment of the firm’s internal control over financial reporting. However, this requirement has been deleted by AS 5, which is effective for fiscal years ending on or after November 15, 2007.

² A MW generally arises from several specific control deficiencies. This occurs because a deficiency in one control (e.g., access control) is often compensated for by another control (e.g., independent review of transactions), reducing the likelihood of a potential misstatement to be remote and/or limiting its potential amount to be less-than-material. The existence of multiple control deficiencies decreases the likelihood that such compensating controls exist.

³ Entity-level and company-level are interchangeable terms. We use the term entity-level to follow PCAOB guidance.

manual fraud” (Martin 2005, 46). Moreover, a Public Oversight Board study found numerous instances where firms “used (IT) to facilitate material frauds, such as by making inappropriate modifications to computer programs, recording hundreds of small non-standard entries rather than a few large ones, or ‘freezing the date’ in the computer system” (POB 2000, 226).

External auditors must consider the “extent of information technology (IT) involvement in the period-end financial reporting process” (PCAOB AS 5 2007, para. 27) and the identification of IT risks and controls (PCAOB AS 5 2007, para. 36) in their evaluation and reporting. The PCAOB allows reduced testing for IT processes with demonstrated effective controls. Internal auditors, who often report to the Audit Committee and external auditors, “must have sufficient knowledge of key (IT) risks and controls and available technology-based audit techniques to perform their assigned work” (IIA 2009, para. 1,210.A3). Therefore, it may be important to distinguish between IT MWs and non-IT MWs, given IT’s importance in processing business transaction as well as the significance ascribed to IT by the PCAOB and COSO.

Research on the effects of IT MWs provides evidence of the importance of implementing strong IT controls. Specifically, firms with at least one IT MW tend to have more non-IT MWs, more misstatements, lower return on assets, higher audit fees, and less accurate management earnings forecasts than firms with non-IT MWs (Klamm and Watson 2009; Canada et al. 2009; Li et al. 2011). IT MW firms also experience higher levels of executive turnover (Masli et al. 2011), potentially indicating tone-at-the-top problems. Experimental research finds that MWs in IT entity-level controls are associated with lower estimates of future stock price by nonprofessional investors, but have no effect on estimates made by professional investors (Arnold et al. 2011). This reaction by professionals may be attributable, in part, to the assumption that IT MWs are not persistent. Our study provides empirical evidence of the long-term effect of IT MWs.

Three studies examine the effect of current MWs or deficiencies on the future persistence of MWs. Goh (2009) finds that currently disclosed Moody Category B MWs in SOX Section 302 reports from July 2003 to December 2004 are associated with a delay in remediation of MWs. However, the MW measure (*MW_SEVERITY*) includes an observation if the firm reports a Category B MW in any of its subsequent control reports, rather than just the initial 302 reporting year, rendering this variable endogenous (i.e., reporting of future MWs causes changes in the value of the independent variable) and the interpretation that current MWs affect future MWs open to question. Johnstone et al. (2011) examine 733 firms’ initial reports of SOX 404 MWs and find that both the total number of MWs and the presence of Category B (entity-level) MWs make a firm less likely to remediate fully its MWs in the immediately following year.

Neither of these studies examines IT MWs or the deficiencies underlying reported MWs. A third study by Boritz et al. (2010) compares the rate of next-year remediation for individual IT MWs to the rate for individual non-IT MWs during the period 2004–2007. The results indicate no difference between these two types, but they do not compare the remediation rate for firms reporting IT MWs to the rate for firms reporting only non-IT MWs.⁴ All three studies consider a firm that reports control weaknesses, remediates them the next year, but then relapses to report control weaknesses in a subsequent year to be an example of a successful remediation rather than a firm with a potentially deep-seated structural control problem.

Thus, research has yet to examine the long-term persistence of MWs in relation to the current reporting of several different types of internal control weaknesses and the deficiencies underlying

⁴ The Boritz et al. (2010) study presents a next-year remediation rate within firms reporting IT MWs of 245/336 (73 percent) for IT MWs and 234/336 (70 percent) for non-IT MWs (Table 7, Panel A), as compared to a rate of 1112/1386 (80 percent) for firms reporting non-IT MWs (Table 7, Panel B). Analyzing data in their Table 7, we determined that the firms in their study reporting IT MWs had a significantly lower one-year remediation rates than the firms reporting non-IT MWs, consistent with the findings in this study.

them. For example, while Moody's definition of entity-level MWs includes control weaknesses that persist over time, the two studies examining the relation of current MWs to future persistence (Johnstone et al. 2011; Boritz et al. 2010) limit their examination to effects on MWs reported within the same year or the next year. To investigate the persistence of MWs, we examine the association between the future reporting of MWs (both the number of MWs and number of years a firm reports a MW), and (1) two types of MWs, IT and non-IT, and (2) three categories of deficiencies: IT entity-level, non-IT entity-level, and account-level. Thus, our research question is:

RQ: How does the persistence of reporting MWs in the future vary with the presence or number of current (1) IT and non-IT MWs and (2) IT entity-level, non-IT entity-level, and account-level deficiencies?

SAMPLE AND DATA

Table 1, Panel A describes the sample selection process. Using Audit Analytics, we identified 24,558 SOX 404 reports filed between September 20, 2004, and December 31, 2009. After deleting amended filings,⁵ firms with parent companies, non-U.S. firms, and firms without financial data from Compustat's Research Insight, our sample consists of 20,318 observations.

Table 1, Panel A classifies control reports into three groups: two ineffective control report groups, IT and non-IT, and effective reports. IT MW reports have at least one MW citing an IT-related control deficiency, but may also cite one or more other non-IT entity-level and/or account-level control deficiencies. Non-IT MW reports do not cite any IT-related control deficiencies and may cite one or more other entity-level and/or account-level control deficiencies. See Appendix A for an illustration of an ineffective control report's MWs and deficiency types.

Using Audit Analytics, we initially identified 410 SOX 404 reports with at least one IT MW. After reading through the reports to verify the IT MWs, we reclassified 59 reports because there were no IT MWs in those reports (e.g., report contained reference to remediation of prior year's IT MW). We read the internal control reports for those firms identified by Audit Analytics as having non-IT MWs, and identified an additional 46 reports with IT MWs, resulting in 397 IT MW reports.⁶ The number of non-IT MW reports is 1,386. The number of effective control reports is 18,535.

Table 1, Panel B shows the distribution of the sample by year. In 2004, 84 percent of the SOX 404 reports have effective controls; these increase to 97 percent in 2009. While control problems appear to be decreasing, the possibility exists that the number of ineffective control reports may be understated given the hundreds of financial statements restated due to error (Jonas et al. 2007). With respect to IT, an average of 2 percent of the total SOX 404 reports includes at least one IT MW, dropping from 4 percent in 2004 to 1 percent in 2009. Across the time period, the percent of ineffective control reports with IT MWs is fairly stable, ranging from 20 to 24 percent, whereas the percent of ineffective reports with only non-IT MWs decreases each year from 12 percent in 2004 to 2 percent in 2009.

RESULTS

Table 2 provides variable definitions. Tables 3 and 4 show the descriptive statistics and the correlations, respectively. Following previous research, we include three categories of control variables that differ for firms with effective/ineffective controls: operational complexity, size, and

⁵ We use the last filed (restated) financial statement.

⁶ One author was the primary data coder. Inter-rater reliability (Cohen's kappa) for three different people (another co-author and two independent parties) ranged from 0.73 to 0.90. Discrepancies were resolved by discussion and analysis of differences in coding.

TABLE 1
Sample

Panel A: Sample Selection Process

	<u>Number</u>	<u>%</u>
Number of SOX 404 reports, 2004–2009	24,558	100
Elimination of initial reports if later amended	(390)	(2)
Elimination of reports with parents	(812)	(3)
Elimination of non-U.S. firms	(1,842)	(7)
Elimination of firms missing COMPUSTAT financials	(1,196)	(5)
Control reports subject to analysis	<u>20,318</u>	<u>83</u>
Ineffective control reports with information technology (IT) MWs as reported by Audit Analytics (AA)	410	
Reports reclassified from IT to non-IT (e.g., report referred to IT as a remediation of prior year MW)	(59)	
Reports with IT MWs not identified by AA	<u>46</u>	
Ineffective reports with IT MWs	397	2
Ineffective control reports without IT MWs	1,386	7
Effective control reports	<u>18,535</u>	<u>91</u>
Control reports subject to analysis	<u>20,318</u>	<u>100</u>

Panel B: Sample Breakdown by Type of Control Report by Year

Year	Ineffective Control Reports				Effective Reports	Total	Reports with IT MW as % of Ineffective Control Reports	
	IT MW Reports		Only Non-IT MW Reports					
2004	98	(4%)	310	(12%)	2,082	(84%)	2,490	24%
2005	96	(3%)	332	(10%)	2,985	(87%)	3,413	22%
2006	71	(2%)	288	(8%)	3,261	(90%)	3,620	20%
2007	68	(2%)	221	(6%)	3,464	(92%)	3,753	24%
2008	43	(1%)	157	(4%)	3,445	(95%)	3,645	22%
2009	21	(1%)	78	(2%)	3,298	(97%)	3,397	21%
Total	397	(2%)	1,386	(7%)	18,535	(91%)	20,318	22%
# of firms	288		1,042		4,771		4,948*	22%
# of unique firms with at least one internal control report after:								
First reporting year	156		479		3,642		4,277	25%
First MW year	188		828		3,261		4,277	19%

* Represents total unique firms that filed a control report; not summative across row because a firm could appear in more than one column over the sample period.

Percentages are calculated (rounded) by year.

profitability (Ge and McVay 2005). We control for auditor (Ge and McVay 2005) as well as several new variables that capture types of MWs and their counts: (1) dummy variables equal to one for the presence of either MW (*ITMW* and *NONITMW*) or a specific MW control deficiency type (*ITEntDef*, *AcctDef*, *NonITEntDef*); (2) count variables that equal the number of IT MWs and non-IT MWs (*ITMWNum* and *NONITMWNum*) as well as the number of IT entity-level, account-level, and non-IT entity-level control deficiencies underlying these MWs (*ITEntDefNum*, *AcctDefNum*, *NonITEntDefNum*); and (3) two measures of persistence, *FUTUREMWNUM* and *FUTUREMWYRS*.

FUTUREMWNUM is the number of total MWs reported by a firm in the future. *FUTUREMWYRS* is the number of years in which a firm continues to report MWs after its initial control report. The sample period (2004 to 2009) therefore limits *FUTUREMWYRS* to a value between 0 and 5. The sample includes firms that may have only one or as many as six control reports.

Univariate results reported in Table 3 reveal that firms reporting non-IT MWs compared to firms reporting effective controls tend to have a higher level of operational complexity (*ACQ*, *FOR*, *GEONUM*, *RESTRUCT*); are smaller in size (*MCAP* and *ASSETS*); are less profitable (*ROA*), and are less likely to have a Big 6 auditor (*BIG6DUMMY*). Firms that report an IT MW are significantly smaller (*MCAP*), less profitable (*ROA*), less likely to have a Big 6 auditor (*BIG6DUMMY*) than firms with non-IT MW reports or effective control reports. Compared to firms that filed an initial ineffective control report, firms that filed an initial effective control report are less likely to subsequently file an ineffective control report, as shown by the average future number of MWs and future years with MWs for firms with effective controls (Panel A, *FUTUREMWNUM* and *FUTUREMWYRS*, 0.29 and 0.16, respectively). The above analysis provides an overall view of firm characteristics in relation to MW reports. The following sections extend this analysis by examining IT and non-IT MWs/deficiencies in current and future internal control reports.

Current Ineffective Control Reports

The results of tests presented in Table 3 show that while the majority of both types of ineffective reports include account-level deficiencies (*AcctDef*, which is 87 percent for both types) and entity-level deficiencies (*NonITEntDef*, which is 81 and 62 percent for IT and non-IT MW reports, respectively), the IT MW reports include significantly more account-level (*AcctDefNum*, 2.98 versus 1.81) and entity-level (*NonITEntDefNum*, 1.78 versus 1.03) deficiencies, and more non-IT MWs than the non-IT MW reports (*NONITMWNum*, 2.53 versus 1.84). Of the reports with at least one IT MW, 47 percent contain one or more IT entity-level deficiencies (*ITEntDef*). Overall, IT MW reports contain an average of 0.58 IT entity-level deficiencies (*ITEntDefNum*). Firms with IT MWs report more future MWs (*FUTUREMWNUM*, 3.56 versus 1.39 and 0.29) for a longer future period (*FUTUREMWYRS*, 0.98 versus 0.61 and 0.16). This is potentially due to the additional MWs—not only more non-IT MWs, but, on average, an additional 1.71 IT MWs.

Table 4 shows a positive correlation between IT MWs and non-IT entity-level deficiencies, but not between IT MWs⁷ and account-level deficiencies (*AcctDef*). There is also no significant correlation between non-IT entity-level and account-level deficiencies, indicating that account-level deficiencies may occur independently. In addition, *FUTUREMWNUM* and *FUTUREMWYRS* are positively related to IT MWs as well as non-IT account-level and entity-level deficiencies (*ITMW*, *AcctDef*, *NonITEntDef*).

Table 5 presents the average number of MWs reported each year for the period 2004 through 2009 in the 1,783 reports of ineffective control out of 20,318 control reports examined. On average, IT MW reports include more non-IT MWs in four of the six years. For the entire sample period, the average number of total MWs reported is greater in IT MW reports than in non-IT MW reports.

⁷ *ITEntDef* has the same direction and significant correlations as IT MWs and is, therefore, not shown in Table 4.

TABLE 2
Variable Definitions

Variable	Description	Calculation
Internal Control		
<i>ITMW</i>	IT MW dummy	1 if the report includes a MW citing at least one IT control deficiency, 0 otherwise; ^a
<i>ITMWNum</i>	IT MW count	number of MWs reported that cite an IT-related control deficiency;
<i>NONITMW</i>	Non-IT MW dummy	1 if the report includes at least one MW that does not include an IT control deficiency, 0 otherwise; ^a
<i>NONITMWNum</i>	Non-IT MW count	number of MWs reported that do not cite an IT control deficiency;
<i>FUTUREMWNUM</i>	Number of future MWs reported	number of (IT and non-IT) MWs reported in the future;
<i>FUTUREMWYRS</i>	Future MW years	number of future years in which at least one MW is reported (0–5);
<i>ITEntDef</i>	IT entity-level control deficiency dummy	1 if the firm reports at least one IT entity-level control deficiency (IT training, IT segregation of duties, IT foreign/subsidiary, and IT control environment), 0 otherwise; ^b
<i>ITEntDefNum</i>	IT entity-level control deficiency count	number of IT entity-level control deficiencies reported. Can be > 1 per MW;
<i>NonITEntDef</i>	Non-IT entity level deficiency dummy	1 if the firm reports at least one non-IT entity-level control deficiency (training, reconciliations, segregation of duties, foreign/subsidiary, and senior management), 0 otherwise; ^b
<i>NonITEntDefNum</i>	Non-IT entity level control deficiency count	number of non-IT entity-level control deficiencies reported. Can be > 1 per MW;
<i>AcctDef</i>	Account-level control deficiency dummy	1 if the firm reports at least one account-level control deficiency (i.e., misstated accounts), 0 otherwise; ^b and
<i>AcctDefNum</i>	Account-level control deficiency count	number of account-level control deficiencies (i.e., misstated account). Can be > 1 per MW.
Operational Complexity		
<i>ACQ</i>	Merger/Acquisition	1 if firm engaged in merger or acquisition, 0 otherwise;
<i>FOR</i>	Foreign operations	1 if firm has foreign operations, 0 otherwise;
<i>GEONUM</i>	Geographic segments	number of geographic segments;
<i>RESTRUCT</i>	Restructure	1 if firm reports restructure charges, 0 otherwise; and
<i>SEGNUM</i>	Operating segments	number of operating segments.
Firm Size		
<i>ASSETS</i>	Total assets	assets at year-end in millions; and
<i>MCAP</i>	Market value of common stock	price times outstanding shares of stock.

(continued on next page)

TABLE 2 (continued)

Variable	Description	Calculation
Profitability <i>ROA</i>	Return on (average) assets	income available to common shareholders from continuing operations divided by average assets. Winsorized at 5/95 percentiles. ^c
Other <i>BIG6DUMMY</i>	Big 6 auditor	1 if the firm is audited by one of the following: BDO Seidman, Deloitte & Touche, Ernst & Young, Grant Thornton, KPMG, or PricewaterhouseCoopers; 0 otherwise.

^a The coding of *ITMW* and *NONITMW* is mutually exclusive at the individual MW level, but not at the firm-year observation level. A firm reporting both an IT MW and a non-IT MW in the same report will have a value of 1 for both variables.

^b For each firm-year observation, the three categories of deficiencies (IT entity-level, non-IT entity-level, and account-level) are not mutually exclusive or collectively exhaustive. A firm reporting a MW may report all three, or none, of these categories of deficiencies.

^c Winsorized (re-valued amounts less than 5 percent or greater than 95 percent) to reduce the potential influence of outliers.

All financial variables are from the Compustat Research Insight Database.

To examine further the MWs by type, we use Table 6 to show selected specific account-level (Moody's Category A) and entity-level (Moody's Category B) control deficiencies associated with the ineffective control reports. We classify the accounting rule (GAAP/FASB) application failures identified in Audit Analytics as account-level (Category A) deficiencies per AS 5. Entity-level controls, as defined by AS 5, are those related to the control environment, management override, centralized processing, monitoring results of operations and other controls (e.g., activities of the internal audit function and audit committee), the period-end financial reporting process, and risk management practices (PCAOB 2007, para. 24). Guided by this AS 5 definition, we use the following non-IT deficiencies from Ge and McVay (2005): training, period-end/accounting policy, reconciliations, segregation of duties, foreign/subsidiary, and senior management.^{8,9} We then create similar categories for IT entity-level deficiencies. It was difficult to identify period-end/accounting policy and reconciliations deficiencies related to IT; therefore, no IT counterpart was created. Thus, we have the following four IT entity-level deficiencies: IT training, IT segregation of duties, IT subsidiary/foreign, and IT control environment (a broader version of senior management).

Table 6 shows that half of the Moody A/account-level deficiencies occur at a significantly higher rate in the IT MW reports than in the non-IT MW reports. The six account-level deficiencies that are not significantly different are: tax, lease, compensation, depreciation, debt, and derivatives. The latter accounts typically depend on internal decisions and accounting choices whereas the former are associated with events and assets that involve external parties (e.g., suppliers or

⁸ Ge and McVay (2005) use eight non-IT categories plus an Account Specific category. We excluded "No Detailed Disclosure" and moved Revenue Recognition to account-level to be consistent with AS 5. See Ge and McVay (2005) for a definition of the non-IT categories.

⁹ Per AS 5, period-end/accounting policy and reconciliations are integral parts of the period-end financial reporting process; segregation of duties is a monitoring activity; and senior management is a component of the control environment as well as management override. Klamm and Watson (2009) identify training and subsidiary specific as a component of the control environment/risk assessment, an entity-level control.

TABLE 3
Descriptive Statistics by Type of Control Report 2004–2009
Panel A: Means, Minimums, Maximums, and Standard Deviations

Variable	(A)			(B)			(C)		
	IT MW Reports n = 397			Only Non-IT MW Reports n = 1,386			Effective Control Reports n = 18,535		
	Mean	Std. Dev.	Max.	Mean	Std. Dev.	Max.	Mean	Std. Dev.	Max.
Internal Control									
ITMWNum	1.71	1.21	10.00	0	0	0	0	0	0
NONITMWNum	2.53	3.09	17.00	1.84	1.59	1.00	20.00	0	0
FUTUREMWNUM ^a	3.56	5.84	26.00	1.39	3.12	0	32.00	0.29	26.00
FUTUREMWYRS ^b	0.98	1.10	5.00	0.61	0.92	0	4.00	0.16	4.00
ITEntDef	0.47	0.50	1.00	0	0	0	0	0	0
ITEntDefNum	0.58	0.69	3.00	0	0	0	0	0	0
NonITEntDef	0.81	0.39	1.00	0.62	0.49	0	1.00	0	0
NonITEntDefNum	1.78	1.24	5.00	1.03	1.06	0	5.00	0	0
AcctDef	0.87	0.33	1.00	0.87	0.34	0	1.00	0	0
AcctDefNum	2.98	2.29	10.00	1.81	1.48	0	9.00	0	0
Operational Complexity									
ACQ	0.15	0.36	1.00	0.15	0.36	0	1.00	0.13	1.00
FOR	0.27	0.45	1.00	0.31	0.46	0	1.00	0.25	1.00
GEONUM	1.70	1.94	5.00	1.90	1.98	0	5.00	1.64	5.00
RESTRUCT	0.23	0.42	1.00	0.27	0.44	0	1.00	0.20	1.00
SEGNUM	1.56	1.80	9.00	1.58	1.80	0	10.00	1.57	10.00
Firm Size									
ASSETS	1,811	4,521	24,153	2,228	4,855	55	24,153	3,604	24,153
MCAP	811	1,955	15,915	1,317	2,809	63	15,915	2,431	15,915
Profitability									
ROA	-7.47	15.87	-40.54	-2.79	13.72	-40.54	17.18	0.36	13.25
Other									
BIG6DUMMY	0.76	0.43	1.00	0.85	0.36	0	1.00	0.88	1.00

(continued on next page)



TABLE 3 (continued)

Differences in Means Between Report Types

Variable	(A)		(B)	
	IT MW Reports versus (B)	Only Non-IT MW Reports	IT MW Reports versus (C)	Only Non-IT MW Reports versus (C)
Internal Control				
<i>ITMWNum</i>	***			
<i>NONITMWNum</i>	***			
<i>FUTUREMWNUM^a</i>	***		***	***
<i>FUTUREMWYRS^a</i>	***		***	***
<i>ITEntDef</i>				
<i>ITEntDefNum</i>	***			
<i>NonITEntDef</i>	***			
<i>NonITEntDefNum</i>	***			
<i>AcctDef</i>	ns			
<i>AcctDefNum</i>	***			
Operational Complexity				
<i>ACQ</i>	ns		ns	***
<i>FOR</i>	ns		ns	***
<i>GEONUM</i>	*		ns	***
<i>RESTRUCT</i>	*		ns	***
<i>SEGNUM</i>	ns		ns	ns
Firm Size				
<i>ASSETS</i>	ns		***	***
<i>MCAP</i>	***		***	***
Profitability				
<i>ROA</i>	***		***	***
Other				
<i>BIG6DUMMY</i>	***		***	***

*, **, *** Indicate that a group means are significantly different at the 0.10, 0.05, and 0.01 levels, respectively, two-tailed from the mean. Significance was determined using MANOVAs by report type followed by univariate ANOVAs and Tukey multiple comparison tests for the operational complexity, firm size, and profitability measures. Two-tailed Chi-square tests are used for the Internal Control Report and Other measures. Variables are defined in Table 2.
^a *FUTUREMWNUM* and *FUTUREMWYRS* are calculated beginning after the first year of reporting (i.e., one observation) for each unique firm (n = 4,277).

TABLE 4
Pearson/Spearman Correlations for Firms Reporting a Material Weakness in Controls
(n = 1,783)

	<i>ITMW</i>	<i>AcctDef</i>	<i>ACQ</i>	<i>ASSETS</i>	<i>BIG6</i>	<i>NonIT EntDef</i>	<i>FOR</i>	<i>FUTURE MWNUM</i>	<i>FUTURE MWNUM YRS</i>	<i>GEO</i>	<i>RSTR</i>	<i>ROA</i>	<i>SEG</i>
<i>ITMW</i>	—	0.00	-0.00	-0.04	-0.10	0.17	-0.03	0.29	0.24	-0.04	-0.04	-0.14	-0.00
<i>AcctDef</i>	0.00	—	0.03	0.05	0.11	-0.04	0.05	0.29	0.31	0.04	0.09	0.05	0.02
<i>ACQ</i>	-0.00	0.03	—	-0.03	0.08	0.03	0.11	0.03	0.05	0.16	0.12	0.09	0.15
<i>ASSETS</i>	-0.11	0.08	0.00	—	0.15	-0.01	0.10	-0.03	-0.05	0.07	0.05	0.09	0.27
<i>BIG6DUMMY</i>	-0.10	0.11	0.08	0.33	—	-0.00	0.07	-0.00	-0.01	0.22	0.19	0.19	0.17
<i>NonITEntDef</i>	0.17	-0.04	0.03	-0.03	-0.00	—	0.04	0.32	0.32	0.03	0.02	-0.10	0.02
<i>FOR</i>	-0.03	0.05	0.11	0.17	0.07	0.04	—	0.02	0.03	0.34	0.19	0.04	0.17
<i>FUTUREMWNUM</i>	0.23	0.30	0.05	-0.11	-0.03	0.31	0.04	—	0.76	0.05	0.03	-0.06	0.03
<i>FUTUREMWNUM</i>	0.22	0.30	0.05	-0.10	-0.03	0.30	0.04	1.00	—	0.08	0.06	-0.06	0.05
<i>GEO</i>	-0.04	0.03	0.16	0.08	0.22	0.03	0.32	0.06	0.06	—	0.32	0.11	0.51
<i>RESTRUCT</i>	-0.04	0.09	0.12	0.11	0.19	0.02	0.19	0.06	0.06	0.32	—	-0.04	0.25
<i>ROA</i>	-0.14	0.03	0.09	0.21	0.15	-0.11	-0.02	-0.09	-0.08	0.11	-0.09	—	0.13
<i>SEG</i>	-0.01	0.01	0.17	0.17	0.19	0.00	0.17	0.04	0.04	0.66	0.28	0.12	—

See Table 2 for variable definitions. The upper right-hand portion of the table presents Pearson correlation coefficients, while the lower presents Spearman correlation coefficients. Bold text indicates significance of at least 0.05. Correlations indicated as 0.00 mean that the correlation was less than two significant decimals (e.g., -0.00128). To be consistent with Table 3, *FUTUREMWNUM* and *FUTUREMWNUM* correlations are based on the first year of reporting (i.e., one observation) for each unique firm (n = 4,277).



TABLE 5
Number of Material Control Weaknesses (MWs) by Type of Control Report by Year
Ineffective Control Reports

	IT MW Reports ^a n = 397				Only Non-IT MW Reports n = 1,386	
	<i>ITMWN</i> um		<i>NONITMWN</i> um ^b		Total MW Reported^c	<i>NONITMWN</i> um Reported
2004 Mean	1.98	(39%)	3.16**	(61%)	5.14**	1.86
2005 Mean	1.82	(41%)	2.65**	(59%)	4.47**	1.98
2006 Mean	1.82	(43%)	2.42*	(57%)	4.24**	1.85
2007 Mean	1.37	(43%)	1.84	(57%)	3.21**	1.81
2008 Mean	1.35	(41%)	1.93	(59%)	3.28**	1.61
2009 Mean	1.48	(33%)	2.95*	(67%)	4.43**	1.69
2004–2009	1.71	(40%)	2.53**	(60%)	4.24**	1.84

*, ** Indicate that the IT MW reports mean is significantly different (two-tailed) at the < 0.05, and 0.01 levels, respectively, from the Only Non-IT MW reports mean. IT MW Reports mention at least one deficiency in IT-related controls. Only Non-IT MW Reports do not mention IT-related control deficiencies. Table 2 provides variable definitions. Significance is determined using a MANOVA by year followed by Tukey multiple comparison tests to control for family-wise error.

^a Percentages indicate the percent of *ITMWN*um and *NONITMWN*um to Total MW Reported for IT MW Reports. Non-IT MWs reports only include non-IT MWs.

^b Means compared to the average number of *NONITMWN*um for Only Non-IT MW Reports.

^c Means compared to the average number of *NONITMWN*um for Only Non-IT MW Reports.

customers). This reflects IT's pivotal role in establishing, recording, and monitoring relationships with external parties and possibly in safeguarding assets.

Table 6 separates the Moody B, entity-level deficiencies into the non-IT and IT categories. With respect to the non-IT Moody B/entity-level deficiencies, almost all of the reports (95.72 percent and 97.54 percent, IT and non-IT, respectively) include control deficiencies relating to Period End/Accounting Policy (i.e., period-end closing process) activities. IT MW reports contain a significantly higher number of deficiencies for every one of the other non-IT entity-level deficiencies. For the IT entity-level deficiencies, segregation of duties has the highest rate of occurrence. Thus, reports with an IT MW reveal that management has not only the challenge of solving more entity-level problems, but also of addressing IT entity-level problems. The additional IT entity-level problems provide some indication of possible MWs in IT governance.

Future Ineffective Control Reports–Univariate Analyses

Because Table 6 includes all ineffective control reports during 2004 through 2009, firms with multiple ineffective control reports will appear in multiple years. To analyze the relation between current and future control reporting at the firm level, we report data in Table 7 for the 1,016¹⁰ firms with data available for at least one year after their first ineffective control report.

Table 7, Panel A classifies the first ineffective report as IT MW or only non-IT MW, showing the number of future years of ineffective controls and the number of future MWs. Of the firms with

¹⁰ This includes 188 firms reporting one or more IT MWs, and 828 firms reporting one or more non-IT MWs, per Table 1 Panel B.

TABLE 6
All Account-Level and Entity-Level Control Deficiencies Reported by Type of Control Report 2004–2009

	IT MW Reports	Only Non-IT MW Reports	n	IT MW Reports	Only Non-IT MW Reports
Moody A	397	1,386		397	1,386
Account-Level Deficiencies	%	%		%	%
Revenue Recognition	47.61	24.24***		95.72	97.54
Inventory	43.83	18.47***		67.50	48.12***
Cash/Receivables	40.80	19.69***		50.38	21.65***
Liabilities	41.31	19.77***		17.88	7.65***
Tax	30.73	31.67		25.44	18.76*
Fixed Assets/Capitalization	28.72	18.61***		16.60	6.92***
Expenses	15.37	6.63***			
Lease	14.36	9.74			
Compensation	12.59	12.84		35.76	0
Depreciation	8.82	7.22		9.31	0
Debt	8.06	5.56		7.30	0
Derivatives	6.05	6.35		5.29	0
Moody B					
Non-IT Entity-Level Deficiencies					
Period End/Acct Policy					
Training					
Reconciliations					
Segregation of Duties					
Foreign/Subsidiary					
Senior Management					
IT Entity-Level Deficiencies					
IT Segregation of Duties					
IT Control Environment					
IT Foreign/Subsidiary					
IT Training					

*, **, *** Indicate that the IT MW reports mean is significantly different at the 0.10, 0.05, and 0.01 levels, respectively, from the Only Non-IT MW reports mean using a two-tailed Chi-square with a Bonferroni correction to control for family-wise error. All variables are equal to 1 if reported as a material weakness, 0 otherwise. IT MW Reports mention at least one deficiency in IT-related controls. Only Non-IT MW Reports do not mention IT-related control deficiencies. Table 2 provides variable definitions.

TABLE 7
Future Reporting of MWs by Type of Control Deficiency First Reported
(n = 1,016)

Panel A: IT MWs versus Only Non-IT MWs Relations to Number of Future MWs and Number of Future Years Reporting a MW

First Report with a MW Includes:	n	FUTURE MWNUM Average	FUTUREMZYRS						Average
			0	1	2	3	4	5	
IT MW(s)	188	3.16**	45%	33%	13%	5%	3%	1%	0.89**
Only Non-IT MW(s)	828	1.09	66%	22%	8%	3%	1%	0%	0.49

Panel B: Specific Control Deficiency Relations to Number of Future MWs and Number of Future Years Reporting a MW

	n	FUTUREMWNUM		FUTUREMZYRS	
		With Deficiency	Without Deficiency	With Deficiency	Without Deficiency
Moody A—Account-Level Deficiencies					
Liabilities	238	2.88	1.04**	0.89	0.47**
Debt	62	3.51	1.34***	0.89	0.55***
Fixed Assets/ Capitalization	219	2.76	1.13**	0.88	0.48**
Revenue Recognition	273	2.89	0.96***	0.86	0.46***
Inventory	224	2.65	1.15	0.86	0.48
Cash/Receivables	223	2.72	1.13	0.83	0.49
Expenses	62	3.47	1.35**	0.81	0.55
Tax	307	2.18	1.18***	0.79	0.47***
Depreciation	95	2.44	1.38	0.79	0.54
Lease	123	2.66	1.31**	0.74	0.54
Compensation	123	2.42	1.35***	0.71	0.55*
Derivatives	76	2.09	1.43**	0.62	0.56
Moody B—Non-IT Entity-Level Deficiencies					
Senior Management	82	4.23	1.24***	1.01	0.53**
Segregation of Duties	102	3.31	1.27***	0.93	0.52**
Reconciliations	269	2.83	0.99	0.86	0.46
Training	484	2.30	0.73**	0.77	0.38***
Foreign/Subsidiary	189	2.50	1.24	0.70	0.53
Period End/Accounting Policy	973	1.50	0.98	0.57	0.51
Moody B—IT Entity-Level Deficiencies					
IT Control Environment	21	4.95	1.40***	1.48	0.55***
IT Segregation of Duties	70	3.89	1.30***	1.00	0.53
IT Foreign/Subsidiary	11	2.82	1.46	0.91	0.56
IT Training	12	2.25	1.47	0.58	0.56

*, **, *** Group means are significantly different at the 0.10, 0.05, and 0.01 levels, respectively, using a factorial MANOVA followed by Tukey multiple comparison tests to control for family-wise error. Sample limited to one observation per firm (first year a MW is reported) having at least one future year of control reporting. All variables = 1 if reported as a material weakness, 0 otherwise. IT MW Reports mention at least one deficiency in IT-related controls. "Only Non-IT MW" reports do not mention an IT-related control deficiency. "With" includes "n" observations with each specific account-level misstatement or entity-level control deficiency. "Without" includes remainder of 1,016 observations without each specific account-level misstatement or entity-level control deficiency. Each MW observation can have multiple account-level misstatements and entity-level control deficiencies.

IT MW reports, fewer than half (45 percent) have no future ineffective internal control reports within the sample period. In contrast, two-thirds (66 percent) of the firms initially reporting only non-IT MWs have no future ineffective reports. The number of future years with ineffective control reports for firms with initial IT MW reports averages 0.89 years, which is significantly greater than the 0.49 years for firms with only non-IT MW reports (χ^2 test, $p = 0.001$).¹¹ Likewise, the average number of MWs reported during this time period is significantly greater for firms with IT MW reports (3.16) than for the firms with only non-IT MWs (1.09). Thus, while Boritz et al. (2010) find that individual IT MWs do not have longer (one-year) remediation periods than non-IT MWs,¹² we find that IT MW firms continue to report MWs for a longer period.

Table 7, Panel B compares future control reports of firms initially reporting each type of account-level and entity-level control deficiency to firms that do not.¹³ Consistent with Table 6, numerous specific deficiencies are related to future control reporting. For example, the number of future MWs reported is significantly greater for firms with a revenue recognition deficiency than those without the deficiency (2.89 MWs versus 0.96 MWs). Likewise, firms reporting a revenue recognition deficiency average 0.86 years of future ineffective control reports versus 0.46 for firms that do not.

Account-level deficiencies associated with the largest number of future MWs are debt, expenses, revenue recognition, and liabilities with 3.51, 3.47, 2.89, and 2.88 future MWs, respectively (versus 1.34, 1.35, 0.96, and 1.04 for firms not reporting those particular deficiencies). The account-level deficiencies associated with the highest number of future ineffective control reports are liabilities and debt (both with 0.89 years), fixed assets (0.88 years), and inventory (0.86 years).

The entity-level deficiency types associated with the longest reporting of ineffective controls as well as the highest number of MWs are IT control environment, non-IT senior management, IT segregation of duties, and non-IT segregation of duties. As might be expected, two of the deficiencies, IT control environment and senior management, deal with tone at the top. Moreover, for six out of twelve account-level deficiencies, firms with those particular deficiencies report more years of MWs than firms without them, and with timeframes comparable to many of the Moody B entity-level deficiencies. Thus, univariate analysis indicates that reporting of Moody A account-level deficiencies may persist as long as reporting of Moody B deficiencies. We explore this possibility next.

Future Ineffective Control Reports—Multivariate Analyses

To examine the research question in a multivariate setting, we use the following Poisson regression¹⁴ in Table 8:

¹¹ The averages for *FUTUREMWNUM* and *FUTUREMWYRS* are different in Tables 3 and 7 due to the use of slightly different samples. Table 3 uses the first control reporting year (regardless of reporting an IT MW, non-IT MW, or no MW) while Table 7 uses the first MW (IT MW or non-IT MW) reporting year.

¹² As noted earlier, Boritz et al. (2010) perform this comparison only for firms reporting IT MWs and do not compare remediation rates for IT MW firms and non-IT MW firms.

¹³ Eighty-eight percent of the 1,016 firms report Moody A account-level deficiencies; 64 percent report Moody B non-IT entity-level deficiencies; and 19 percent report Moody B IT entity-level deficiencies.

¹⁴ The Poisson regression procedure is useful for data reflecting independent events that have a low likelihood of occurrence. When events rarely occur, their probability distribution is often not normally distributed because the modeled number of events is close to zero but always positive. For example, this is applicable to estimating the number of industrial accidents in a given manufacturing plant per year (McClave and Benson 1991). Our event variables of interest are the counts of future number of MWs and future number of years of MWs reported for a firm, each of which is rare for an individual firm and not normally distributed. To interpret Poisson regression coefficients, a one-unit change in the predictor variable results in a change in the natural log of the count equal to the predictor's coefficient, given the other predictor variables in the model are held constant. This log function form means that the incremental effect of a variable is multiplicative i.e., a one-unit increase in an independent variable is associated with a change of $(\text{antilog of coefficient} - 1) \times 100$ percent in the value of the dependent variable. For example, if an independent variable's coefficient is 0.82, this has an antilog of 2.27. A one unit increase in that variable will yield a $(2.27 - 1) \times 100 = 127$ percent increase in the dependent variable.

TABLE 8
Determinants of Persistence in Reporting Material Weaknesses
(n = 1,016)

$$\begin{aligned}
 \text{Dependent Variables} = & \gamma_0 + \gamma_1 \text{ITMW/Deficiency Variables} \\
 & + \gamma_2 \text{NonITMW/Deficiency Variables} + \gamma_3 \text{BIG6DUMMY} + \gamma_4 \text{ROA} \\
 & + \gamma_5 \text{ACQ} + \gamma_6 \text{FOR} + \gamma_7 \text{RESTRUCT} + \gamma_8 \text{Log(ASSETS)} \\
 & + \gamma_9 \text{SEGNUM} + \gamma_{10} \text{GEONUM} + \text{Industry Dummies} + \varepsilon.
 \end{aligned}$$

Panel A: FUTUREMWNUM as Dependent Variable

	<u>Model (1)</u>	<u>Model (2)^a</u>	<u>Model (3)</u>	<u>Model (4)^a</u>	<u>Model (5)</u>
MW/Deficiencies Present					
ITMW	1.24***				
ITEntDef		0.82***			
NONITMW	1.80***				
AcctDef		0.83***			
NonITEntDef		1.07***			
MW/Deficiencies Count					
ITMWNum			0.16***		
ITEntDefNum				0.25***	
NONITMWNum			0.20***		
AcctDefNum				0.22***	
NonITEntDefNum				0.34***	
IT Entity-Level Deficiencies Present ^b					
IT Control Environment					0.67***
Account-Level Deficiencies Present ^b					
Compensation					0.28**
Debt					0.63***
Expenses					0.35**
Fixed Assets/Cap					0.20*
Lease					0.40***
Liabilities					0.24**
Revenue Recognition					0.48***
Tax					0.38***
Non-IT Entity-Level Deficiencies Present ^b					
Senior Management					0.62***
Segregation of Duties					0.43**
Training					0.56***
Control Variables					
BIG6DUMMY	-0.18	-0.22	-0.21	-0.43***	-0.46***
ROA	-0.02***	-0.02***	-0.01**	-0.01*	-0.00
ACQ	0.21*	0.20	0.24*	0.24**	0.18
FOR	-0.09	-0.21**	-0.07	-0.16	-0.11
RESTRUCT	-0.23*	-0.28**	-0.06	-0.16	-0.11
Log(ASSETS)	0.06	0.02	-0.07*	-0.05	-0.04
SEGNUM	0.03	0.03	0.01	0.03	0.02
GEONUM	-0.05	-0.05	-0.10***	-0.08***	-0.08**
Intercept	-3.08***	-2.34***	-0.67**	-1.03	-1.14***
Log Likelihood	-145.37	138.64	-98.32	-77.07	-54.28

(continued on next page)

TABLE 8 (continued)

	Model (1)	Model (2) ^a	Model (3)	Model (4) ^a	Model (5)
Deviance	3,610.25	3,543.33	3,181.48	3,020.11	2,870.14
Likelihood Ratio Chi-square (p value)	801.75 (0.0001)	868.68 (0.0001)	1,230.52 (0.0001)	1,391.90 (0.0001)	1,541.87 (0.0001)

Panel B: *FUTUREMWYRS* as Dependent Variable

	Model (1)	Model (2) ^a	Model (3)	Model (4) ^a	Model (5)
MW/Deficiencies Present					
<i>ITMW</i>	0.69***				
<i>ITEntDef</i>		0.41***			
<i>NONITMW</i>	1.01***				
<i>AcctDef</i>		0.42**			
<i>NonITEntDef</i>		0.60***			
MW/Deficiencies Count					
<i>ITMWNum</i>			0.12***		
<i>ITEntDefNum</i>				0.11	
<i>NONITMWNum</i>			0.12***		
<i>AcctDefNum</i>				0.15***	
<i>NonITEntDefNum</i>				0.18***	
IT Entity-Level Deficiencies Present ^b					
<i>IT Control environment</i>					0.44**
Account-Level Deficiencies Present ^b					
<i>Debt</i>					0.36**
<i>Fixed Assets/Cap</i>					0.20*
<i>Revenue Recognition</i>					0.27**
<i>Tax</i>					0.40***
Non-IT Entity-Level Deficiencies Present ^b					
<i>Senior Management</i>					0.29**
<i>Training</i>					0.38***
Control Variables					
<i>BIG6DUMMY</i>	-0.23	-0.24	-0.23	-0.35**	-0.40***
<i>ROA</i>	-0.01***	-0.01***	-0.01***	-0.01**	-0.01*
<i>ACQ</i>	0.24**	0.24**	0.26**	0.28**	0.19*
<i>FOR</i>	0.01	-0.06	0.02	-0.05	-0.01
<i>RESTRUCT</i>	-0.21*	-0.22**	-0.15	-0.18	-0.17
<i>Log(ASSETS)</i>	0.01	-0.02	-0.05	-0.04	-0.03
<i>SEGNUM</i>	0.06**	0.06**	0.05*	0.05*	0.05*
<i>GEONUM</i>	-0.03	-0.03	-0.05	-0.04	-0.04
Intercept	-3.11***	-2.66***	-1.92***	-2.07***	-2.16***
Log Likelihood	-733.02	-735.77	-744.04	-750.22	-743.77
Deviance	1121.10	1104.90	1071.58	1042.60	1013.54
Likelihood Ratio Chi-square (p value)	127.16 (0.0001)	143.37 (0.0001)	178.69 (0.0001)	205.87 (0.0001)	234.93 (0.0001)

*, **, *** Indicate (two-tailed) significance at the 0.10, 0.05, and 0.01 levels, respectively, based on a Poisson regression corrected for over/under dispersion and different reporting lengths for the firms during the sample time period.

^a Thirty-two of the 1,016 observations reported MWs where the related control deficiencies could not be categorized in any of the three deficiency categories (IT entity-level, non-IT entity-level, and account-level) as we define them. These become the reference group for estimating the coefficient for each type of deficiency.

(continued on next page)

TABLE 8 (continued)

^b All control deficiency variables shown in Table 6 were included in the Model (5) analysis, but only significant variables are shown above. See Tables 2 and 6 for financial variable definitions. Industry dummy variables are included in all regressions, but coefficients are not reported in the table. One observation per firm (first year MW is reported). Each MW observation can have multiple account-level and entity-level control deficiencies. Financial values for the initial MW reporting year.

$$\begin{aligned}
 \text{Dependent Variables} = & \gamma_0 + \gamma_1 \text{ITMW/Deficiency Variables} \\
 & + \gamma_2 \text{NonITMW/Deficiency Variables} + \gamma_3 \text{BIG6DUMMY} + \gamma_4 \text{ROA} \\
 & + \gamma_5 \text{ACQ} + \gamma_6 \text{FOR} + \gamma_7 \text{RESTRUCT} + \gamma_8 \text{Log(ASSETS)} \\
 & + \gamma_9 \text{SEGNUM} + \gamma_{10} \text{GEONUM} + \text{Industry Dummies} + \varepsilon.
 \end{aligned}
 \tag{1}$$

In order to address the possibility that the data have a greater or lesser degree of variability around the fitted values than is assumed in the Poisson distribution, i.e., over dispersion and under dispersion, respectively, we adjusted the covariance matrix. In addition, firms are observed in the sample for varying lengths of time, from two years to all six years. This difference directly affects the number of future MWs counted and the number of future years reporting MWs. Therefore, we also correct for the number of years reported by each firm so the results are unbiased.

We examine two dependent variables to capture the persistence of future MWs. *FUTUREMWNUM* is the number of future MWs reported (Panel A) and *FUTUREMWYRS* is the number of future years having ineffective control reports (Panel B). Both are measured using reports subsequent to the filing of a firm's first ineffective control report. We include only firms with ineffective control reports to evaluate whether the number and type of MWs or deficiencies help explain future MWs.

Independent variables are measured in the first year that a firm reports a MW. We use dummy and count variables for current IT MW and non-IT MWs to measure their presence (*ITMW* and *NONITMW*, in Model (1)) and extent (*ITMWNum* and *NONITMWNum*, in Model (3)). We first examine deficiencies—IT entity-level, account-level, and non-IT entity-level using dummy (0/1) (*ITEntDef*, *AcctDef*, and *NonITEntDef*, in Model (2)) and count (*ITEntDefNum*, *AcctDefNum*, and *NonITEntDefNum*, in Model (4)) variables. We then examine the effects of the presence of specific deficiencies: IT entity-level, account-level, and non-IT entity-level (e.g., revenue recognition for account-level and senior management for non-IT entity-level issues), whereby the coefficients of the IT-related variables measure the marginal effect on *FUTUREMWNUM* and *FUTUREMWYRS* (Model (5)). We exclude Accounting Policy/Period End deficiencies from *NonITEntDef* and *NonITEntDefNum* because they are present in almost all ineffective control reports (Klamm and Watson 2009). We control for industry using 17 dummy variables (coefficients not shown), consistent with Ge and McVay (2005) as well as several firm-specific control variables found to be significant in prior research.

Table 8 presents the results of the Poisson regression using *FUTUREMWNUM* (Panel A) and *FUTUREMWYRS* (Panel B).¹⁵ In Panel A, Model (1) shows that the presence of an IT MW is positively associated with the number of future MWs after controlling for the presence of non-IT MWs. Model (2)'s results show that this relation holds if the presence of non-IT MWs is

¹⁵ Variance inflation factors (VIFs) for all variables are less than 4, well below the standard criterion of 5–10 suggested by Kennedy (2003), indicating the results in Table 8 are robust to observed multicollinearity.

disaggregated into the presence of account-level and entity-level deficiencies.¹⁶ Firms reporting IT entity-level, account-level, and non-IT entity-level deficiencies have 127, 129, and 192 percent more future MWs, respectively, than firms not reporting that type of deficiency.¹⁷

Model (3) examines the effect of the number, rather than presence, of current MWs. The analysis indicates that the numbers of IT and non-IT MWs are both positively associated with the number of future MWs. Model (4) next disaggregates the IT MWs into the number of IT entity-level deficiencies and the non-IT MWs into the number of account-level and non-IT entity-level deficiencies, yielding similar results. As in Model (2), all three types of deficiencies are positively associated with future MWs. Untabulated analysis compares the coefficients for the three types and finds that only non-IT entity-level deficiencies have a significantly higher coefficient than that of account-level deficiencies ($p < 0.05$), but this is not significantly different from IT entity-level deficiencies.¹⁸ Model (4) results indicate that one additional reported deficiency is associated with an increase in the number of MWs reported in the future in the range of 24–29 percent for account-level and IT entity-level deficiencies and 40 percent for non-IT entity-level deficiencies.¹⁹

The significance of the (IT and non-IT) entity-level coefficients and the greater coefficient for non-IT entity-level deficiencies relative to account-level deficiencies are consistent with Moody's supposition. Specifically, entity-level problems are an indicator of management's capabilities with respect to internal control. But the significant coefficients on the account-level deficiencies also provide an important signal that account-level deficiencies may be more serious than previously recognized (e.g., [Jonas et al. 2007](#)) and can affect future financial reporting controls. Further, IT entity-level deficiencies provide an incremental signal of future internal control weakness persistence beyond the other two types of deficiencies. Considering all three types of deficiencies best explains the number of future MWs.

To examine whether these results are driven by specific control deficiencies, we re-estimate the regression with dummy variables for the presence of each of the specific entity-level and account-level deficiencies. Model (5) shows that eight of the twelve account-level deficiencies are positively related to the number of future MWs reported (non-significant deficiencies are not reported). This provides additional evidence that several account-level deficiencies, while not perceived by Moody's to be as important as the entity-level deficiencies, do contribute to the future number of MWs reported.

At the entity-level, both non-IT senior management and the IT control environment deficiencies are associated with an 85 and 95 percent increase in the future number of MWs reported, respectively.²⁰ This provides empirical evidence of the role that tone-at-the-top plays in assessing and managing internal controls, and the effect of that role in relation to future MWs. In particular, this confirms the need for effective IT governance, which helps ensure the mitigation of IT risk and the alignment of IT with business strategy ([IT Governance Institute 2004](#)). In addition, both non-IT training and segregation of duties affect the future number of MWs. A comparison of the likelihood and deviance values of the models suggests that using the numbers of MWs and

¹⁶ This is true whether *ITEntDef* or *ITMW* is used in Model (2) (untabulated).

¹⁷ To interpret the coefficients, the natural antilog must be taken because the Poisson regression is a log-linear model whereby it uses a logarithm for the expected (Y) value. The natural antilogs of the Model (2) coefficients for *ITEntDef* (0.82), *AccDef* (0.83), and *NonITEntDef* (1.07) are 2.27, 2.29, and 2.92, respectively, meaning that firms with an IT entity-level/account-level/non-IT entity-level deficiency have 127/129/192 percent more future MWs than firms that do not.

¹⁸ All untabulated analyses are available upon request from the corresponding author.

¹⁹ The natural antilogs of the *ITEntDefNum*, *AccDefNum*, and *NonITEntDefNum* coefficients are 1.29, 1.24, and 1.40, respectively, which translate to 29, 24, and 40 percent, respectively, meaning that firms with one additional IT entity-level/account-level/non-IT entity-level deficiency have 29/24/40 percent more future MWs.

²⁰ The natural antilogs of 0.62 and 0.67 are 1.85 and 1.95, respectively.

deficiencies (Models (3), (4), and (5)) better describes persistence than models based on only the presence of MWs and deficiencies (Models (1) and (2)).

Panel B, which examines the length of time that MWs continue to be reported (*FUTUREMWYRS*), yields results similar to those in Panel A with the exception of the relative impact of the number of IT entity-level deficiencies. The positive coefficient for *ITMW* and *ITEntDef* in Models (1) and (2), respectively, shows that both the presence of IT MWs and IT entity-level deficiencies are associated with a longer period of future reporting of MWs, and that this relation persists if the number of non-IT MWs is disaggregated into account-level and entity-level deficiencies. Firms reporting IT entity-level, account-level, and non-IT entity-level deficiencies report MWs for 51, 52, and 82 percent longer in the future, respectively, than firms not reporting that type of deficiency.²¹

Model (3) indicates that the numbers of both IT MWs and non-IT MWs are positively associated with future number of years reporting MWs. Model (4) suggests this is not the case for the number of IT entity-level deficiencies (*ITEntDefNum*), which becomes insignificant when both the number of specific account-level and non-IT entity-level deficiencies (both highly significant) are included.²² However, untabulated analysis finds no significant difference in the account-level or entity-level coefficients in Panel B Model (4), indicating that an increase in the count of any account-level or entity-level deficiency type has a similar impact on the future number of years reporting MWs. This indicates that one additional account-level or entity-level reported deficiency is associated with a 16 to 20 percent increase in the number of future years reporting MWs.²³ The results from Tables 2 and 3 indicate that firms with non-IT entity-level deficiencies report MWs for a longer period of time than firms reporting only other types of deficiencies, but this longer period is not affected by the number of current non-IT entity deficiencies (i.e., the presence, not the extent, of non-IT entity deficiencies drives the longer period of reporting).

Model (5) disaggregates Model (4)'s numbers into the specific deficiencies reported. Consistent with Panel A, deficiencies in the IT control environment and non-IT senior management continue to be significant, and are associated with 56 and 33 percent, respectively, increases in the future years of MWs being reported.²⁴ Given this result, we re-estimate Model (4) replacing *ITEntDefNum* with the IT control environment dummy variable to investigate whether the effect of the IT control environment is diluted when aggregated with other IT deficiencies and find that the IT control environment is significant (untabulated). Thus, tone-at-the-top control issues affect both the future number of MWs and the time required to remediate them fully. Model (5) also indicates that Model (4)'s results for the number of account-level and non-IT entity-level deficiencies are driven by 6 of the 18 specific deficiencies investigated, including debt, fixed assets, revenue recognition, and tax at the account-level, and non-IT training and senior management at the entity-level. In summary, only seven specific deficiencies, four at the account-level, one relating to IT at the entity-level, and two others at the non-IT entity-level, are associated with delays in the resolution of internal control MWs.

The control variables' effects are largely consistent in the two panels and across the regression models. Profitability (*ROA*) is negatively associated with the future measures, while mergers (*ACQ*)

²¹ The natural antilogs of 0.41, 0.42, and 0.60 are 1.51, 1.52, and 1.82, respectively.

²² Using a modified equation similar to Johnstone et al.'s (2011) Table 5, we substitute the presence of non-IT entity-level deficiencies for the presence of entity-level MWs and are able to replicate their finding of a positive relation between the presence of entity-level MWs (their *GENERAL* variable) and duration of reporting MWs, after controlling for the current total number of MWs (untabulated). This indicates that firms reporting current non-IT entity-level deficiencies continue to report MWs for a longer mean period than other firms. It investigates the effect of the presence, rather than number, of non-IT deficiencies.

²³ The natural antilogs of the *AcctDefNum* and *NonITEntDefNum* coefficients are 1.16 and 1.20, respectively.

²⁴ The natural antilogs of 0.44 and 0.29 are 1.56 and 1.33, respectively.

and the number of operating segments (*SEGNUM*) are positively associated with the future measures. Thus, financial capability can help a firm quickly remediate MWs while complexity appears to hinder the quick remediation of control weaknesses. In addition, we find some evidence in the expanded models (i.e., Models (4) and (5)) that having a large auditor (*BIG6DUMMY*) is negatively associated with future MW and, therefore, associated with shorter remediation times.

Based on prior literature (Ge and McVay 2005; Doyle et al. 2007a, 2007b), foreign currency (*FOR*), restructurings (*RESTRUCT*), and geographical segments (*GEONUM*) should be positively related to future number of MWs/years, and size (*ASSETS*) should be negatively related. However, these predictions are not upheld as we find insignificant or negative coefficients.

Sensitivity Analysis

To evaluate the robustness of our results, we perform several sensitivity analyses. First, to examine persistence further, we follow the structure of Table 8, Panels A and B to test the relationships of IT and non-IT MWs, as well as account-level, non-IT entity-level, and IT entity-level deficiencies, to future non-IT MWs using two new dependent variables: the number of future non-IT MWs and the number of future years of non-IT MWs. The presence of each of the two types of MWs and three types of deficiencies is associated with the number of future non-IT MWs and the number of future non-IT ineffective years.

We also examine the interaction between IT and the other two deficiency types, entity-level and account-level, but do not find significant results. This provides some evidence that the impact of either non-IT entity-level or account-level deficiencies on future reporting does not substantively depend upon the existence of an IT MW. We then estimate the regressions using market value (*MCAP*) instead of assets, winsorized *ITMWN* values, Big 4 auditor affiliation instead of Big 6 auditor affiliation, and unwinsorized *ROA*. In addition, we include Period End/Accounting Policy as a variable and re-estimate Models (2), (4), and (5). The results do not change except when including Period End/Accounting Policy as a variable in Model (2) where *NonITEntDef* becomes insignificant due to the presence of a Period End/Accounting Policy deficiency in almost every firm. Accordingly, the results appear to be robust.

CONCLUSION

While an external audit provides assurance that there are no material misstatements in the financial statements and that all MWs in internal control over financial reporting have been disclosed, creditors and investors may have concern about the relative severity of these MWs as well as the likelihood of future MWs. The basis for this concern is that some MWs may indicate that management is unable to effectively address financial reporting risk and/or establish controls mitigating that risk. Accordingly, we analyze MWs and the underlying control deficiencies using control dimensions defined by auditor requirements (AS 5, PCAOB 2007), Moody's (Jonas et al. 2007), and the Enterprise Risk Management framework (COSO 2004). Specifically, this study examines the association of two types of MWs, IT and non-IT, and the underlying deficiencies, IT entity-level, non-IT entity-level, and account-level, with future ineffective control reports to determine the effect of these MWs on the quality of *future* internal control over financial reporting. While our analysis is limited by the information provided by firms in SOX 404 reports, our study provides the following insights.

Univariate analysis finds that firms reporting IT MWs also report more non-IT MWs, non-IT entity-level control deficiencies, and account-level deficiencies in the current year. IT MW firms report more future MWs, and for more years in the future, than firms reporting only non-IT MWs. However, both types of deficiencies underlying non-IT MWs (non-IT entity-level and account-level) are also associated with higher persistence of future MWs. This leaves open the

possibility that the relation between IT MWs and future MWs arises from the effects of non-IT entity-level and account-level deficiencies. In support, multivariate analysis generally finds that IT and non-IT MWs, and all three types of deficiencies (IT entity-level, non-IT entity-level and account-level), are associated with both measures of MW persistence. Moreover, firms reporting non-IT entity-level deficiencies have a significantly higher level of future MWs than firms reporting other types of deficiencies, and the number increases with the extent of non-IT entity-level deficiencies reported. These firms also report MWs for a longer period of time, but this increased duration is not associated with the extent of non-IT entity-level deficiencies.

Our multivariate analyses extend beyond the existence and number of MWs and deficiencies to examine specific deficiencies. We find that two of the six specific non-IT entity-level deficiencies—senior management and training—are associated with both measures of persistence. While Moody's does not separately identify IT MWs/deficiencies, we analyze them separately given IT's pervasive role in processing business transactions. Of the four specific IT entity-level deficiencies that we tested, only the IT control environment has a significant effect on both measures. Thus, IT control environment problems, along with shortcomings in senior management and training, which are the bases of effective internal controls and effective employees, take time to remedy. This provides empirical support for Moody's assertion that entity-level (Category B) MWs and the related deficiencies are serious enough to contribute to a lower credit rating.

Likewise, specific account-level deficiencies are positively associated with future MWs. We find that deficiencies relating to four accounts (debt, fixed assets, revenue, and tax) increase both MW persistence measures. Each of these accounts plays an important role in financial statement analysis and the evaluation of firm performance. This appears to contradict Moody's assertion that account-level deficiencies are less relevant than entity-level deficiencies to future internal control over financial reporting. Other firm characteristics including profitability, auditor affiliation, and complexity, via acquisitions and the number of operating segments, must also be considered as they affect the future persistence of reporting MWs.

The results reflect SOX 404 reports filed during the period 2004 to 2009, during which more than 90 percent of firms reported effective controls. Therefore, our study examines only a small portion of the large accelerated filers. In addition, the percentage of firms reporting MWs and IT MWs declined throughout the sample period. Thus, on the one hand, the study's results may not be generalizable to years past 2009, potentially due to the continuing decrease in the percentage of the average number of MWs and IT MWs. On the other hand, the study does provide evidence of the effects and associations of IT MWs with future reporting, which may continue to be pertinent. Specifically, IT is dynamic and ever-changing, and future IT advancements and IT-related decisions, e.g., cloud computing, may result in additional IT MWs, which, as shown in our study, may be linked to other current and future MWs.

While we include control variables, we recognize that there could be additional, not yet captured, variables that provide further explanation of future MWs for this set of firms. Regardless, we have shown that there is a relationship between currently reported MWs and future MWs; we leave to future research the discovery of additional variables that help explain why MWs (may) persist in the future.

The number and type of MWs depend upon the accuracy of the firm's reporting of those MWs. We required that a MW report explicitly mention an IT-related issue to categorize it as an IT MW. If a MW report does not mention IT when, in fact, the MW was related to IT, this would understate IT MWs and deficiencies. This understatement reduces the likelihood of finding results. Despite this potential understatement, we find that current IT MWs are associated with increased future reporting of MWs, lending support to the argument that IT has a pervasive effect on financial reporting.

In summary, effective corporate governance of both the IT and non-IT domains is pivotal in establishing and maintaining strong internal controls over financial reporting. However, while credit agencies examine entity-level deficiencies as a possible indicator for downgrading a firm's rating (Jonas et al. 2007), we show that account-level deficiencies are associated with long-term effects on internal control as well. In addition, we show that IT MWs and underlying IT entity-level deficiencies may also have a long-term impact. Thus, consideration of the types of MWs and the specific underlying deficiencies should be important to interested stakeholders: auditors, as they assess and evaluate risk and controls; rating agencies, as they evaluate credit worthiness; investors and analysts, as they evaluate the value of the firm; and management and audit committees, as they consider investments in controls.

REFERENCES

- American Institute of Certified Public Accountants (AICPA). 1996. *IT Competencies in the Accounting Profession: AICPA Implementation Strategies for IFAC International Education*. Guideline No. 11. New York, NY: AICPA.
- Arnold, V., J. C. Bedard, J. R. Phillips, and S. G. Sutton. 2011. Do section 404 disclosures affect investors' perceptions of information systems reliability and stock price predictions? *International Journal of Accounting Information Systems* 12 (4): 243–258.
- Beneish, M. D., M. Billings, and L. Hodder. 2008. Internal control weaknesses and information uncertainty. *The Accounting Review* 83 (3): 665–703.
- Boritz, E., L. Hayes, and J. Lim. 2010. *What Do Auditor's Reports on Internal Controls Tell Us about IT Control Weaknesses in Financial Reporting Systems?* Working paper, University of Waterloo.
- Canada, J., J. R. Kuhn, Jr., and S. G. Sutton. 2009. The pervasive nature of IT controls: An examination of material weaknesses in IT controls and audit fees. *International Journal of Accounting and Information Management* 17 (1): 106–119.
- Chan, K., B. Farrell, and P. Lee. 2008. Earnings management of firms reporting material internal control weaknesses under Section 404 of the Sarbanes-Oxley Act. *Auditing* 27 (2): 161–179.
- Committee of Sponsoring Organizations of the Treadway Commission (COSO). 2004. *Enterprise Risk Management-Integrated Framework*. Jersey City, NJ: AICPA.
- De Franco, G., Y. Y. Guan, and H. Lu. 2005. The wealth change and redistribution effects of Sarbanes-Oxley internal control disclosures. April 17. Available at: <http://www.ssrn.com/abstract=706701>
- Doyle, J., W. Ge, and S. McVay. 2007a. Determinants of weaknesses in internal control over financial reporting. *Journal of Accounting and Economics* (44) 193–223.
- Doyle, J., W. Ge, and S. McVay. 2007b. Accruals quality and internal control over financial reporting. *The Accounting Review* 82 (5): 1141–1170.
- Ge, W., and S. McVay. 2005. The disclosure of material weaknesses in internal control after the Sarbanes-Oxley Act. *Accounting Horizons* (September): 137–158.
- Goh, B. W. 2009. Audit committees, boards of directors, and remediation of material weaknesses in internal control. *Contemporary Accounting Research* 26 (2): 549–579.
- Grant, G. H., K. C. Miller, and F. Alali. 2008. The effect of IT controls on financial reporting. *Managerial Auditing Journal* 23 (8): 803–823.
- Hammersley, J. A., L. A. Myers, and C. Shakespeare. 2008. Market reactions to the disclosure of internal control weaknesses and to the characteristics of those weaknesses under section 302 of the Sarbanes-Oxley Act of 2002. *Review of Accounting Studies* (13):141–165.
- Hoitash, R., U. Hoitash, and J. C. Bedard. 2008. Internal control quality and audit pricing under the Sarbanes-Oxley Act. *Auditing: A Journal of Practice & Theory* 27(1): 105–126.
- Institute of Internal Auditors (IIA). 2009. International Standards for the Professional Practice of Internal Auditing. Available at: <http://www.theiia.org/guidance/standards-and-guidance/ipff/standards/full-standards/>

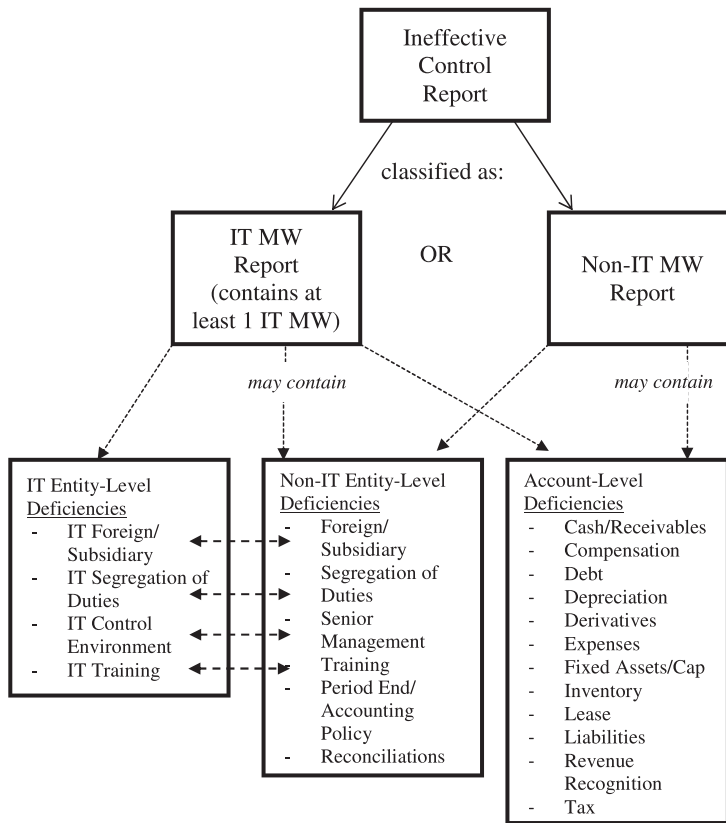
- IT Governance Institute. 2004. *IT Control Objectives for Sarbanes-Oxley: The Importance of IT in the Design, Implementation and Sustainability of Internal Control over Disclosure and Financial Reporting*. Chicago, IL: IT Governance Institute.
- Johnstone, K. M., C. Li, and K. H. Rupley. 2011. Changes in corporate governance associated with the revelation of internal control material weaknesses and their subsequent remediation. *Contemporary Accounting Research* 28 (1): 331–383.
- Jonas, G., A. Rosenbery, M. Doss, and G. Cihak. 2005. Section 404 reporting on internal control: Our early experience. *Moody's Investors Service* (April). Available at: <http://www.sec.gov/spotlight/soxcomp/soxcomp-jonas.pdf>
- Jonas, G., A. Rosenberg, M. Gale, and L. Hedges. 2007. The third year of Section 404 reporting on internal control. *Moody's Investors Service*. Available at: <http://ssrn.com/abstract=985546>
- Kennedy, P. 2003. *A Guide to Econometrics, 5th edition*. Maiden, MA: Blackwell Publishing.
- Klamm, B. K., and M. W. Watson. 2009. SOX 404 reported internal control weaknesses: A test of COSO framework components and information technology. *Journal of Information Systems* 23 (2): 1–23.
- Kumar, R. 2002. Managing risks in IT projects: An options perspective. *Information and Management* (October): 63–74.
- Li, C., G. Peters, V. Richardson, and M. Weidenmier Watson. 2011. The consequences of information technology control weaknesses on management information systems: The case of Sarbanes-Oxley internal control reports. *MIS Quarterly* 36 (1): 179–203.
- Martin, A. G. 2005. How Section 404 can help deter fraud. *Financial Executive* (May): 45–47.
- Masli, A., V. J. Richardson, M. Weidenmier Watson, and R. Zmud. 2011. *CEO and CFO Accountabilities for Information Technology Management: The Disciplinary Effects of Sarbanes-Oxley*. Working paper, University of Arkansas, Mississippi State University, and The University of Oklahoma.
- McClave, J. T., and P. G. Benson. 1991. *Statistics for Business and Economics, 5th edition*. San Francisco, CA: Dellen Publishing Company.
- Osmundson, J. S., J. B. Michael, and M. J. Machniak. 2003. Quality management metrics for software development. *Information and Management* 40 (8): 799–812.
- Public Company Accounting Oversight Board (PCAOB). 2005. Staff questions and answers on Auditing Standard No. 2—Internal control. Available at: <http://pcaobus.org/Standards/QandA/01-21-2005.pdf>
- Public Company Accounting Oversight Board (PCAOB). 2007. *An Audit of Internal Control over Financial Reporting That Is Integrated with an Audit of Financial Statements*. Auditing Standard No. 5. Available at: http://pcaobus.org/Standards/Auditing/Pages/Auditing_Standard_5.aspx
- Public Oversight Board (POB). 2000. *The Panel on Audit Effectiveness Report and Recommendations*. Available at: <http://www.pobauditpanel.org/downloads/appendixf.pdf>
- Ranghunandan, K., and D. Rama. 2006. SOX Section 404 material weakness disclosure and audit fees. *Auditing: A Journal of Practice & Theory* 25 (1): 99–114.
- Security and Exchange Commission (SEC). 2003. Management's Reports on Internal Control Over Financial Reporting and Certification of Disclosure in Exchange Act Periodic Reports, Final Rule 82-8238. Washington, D.C. Available at: <http://www.sec.gov/rules/final/33-8238.htm>
- Wallace, L., M. Keil, and A. Rai. 2004. Understanding software project risk: A cluster analysis. *Information and Management* 43: 115–125.
- Zhang, Y., J. Zhou, and N. Zhou. 2007. Audit committee, auditor independence, and internal control weaknesses. *Journal of Accounting and Public Policy* (May/June): 300–327.

APPENDIX A

INEFFECTIVE CONTROL REPORTS

Ineffective SOX 404 internal control reports (i.e., those with MWs) can be categorized as either an IT MW report (i.e., it includes at least one IT-related MW) or a Non-IT MW report (i.e., it contains only non-IT MWs). Both types of reports report a variety of MWs and may contain specific account-level (misstated accounts) as well as non-IT entity-level deficiencies (both of

which are identified by Audit Analytics). IT MW reports may also contain IT entity-level deficiencies selected to correspond with four non-IT entity-level deficiencies.



Example from Intac International 2005 Management's Report on Internal Control over Financial Reporting*

Our management assessed the effectiveness of the Company's internal control over financial reporting, as defined in Securities Exchange Commission Act Rule 13a-15 (f) as of September 30, 2005, and this assessment identified the following material weaknesses in the company's internal control over financial reporting:

1. Deficiencies existed in our information technology ("IT") environment due to inadequate procedures and controls which, when considered in the aggregate, constitute a material weakness over financial reporting. These deficiencies included: general design deficiencies that were not risk based, IT entity level controls, general computer controls, spreadsheet controls, segregation of duties controls, and physical security controls.
2. Deficiencies existed in the lack of certain established policies and procedures including the areas of expense and accounts payable accruals, and capitalization of software development costs, which constitute material weaknesses over financial reporting. The Company did not have adequate procedures and controls to ensure that: (i) expense reimbursements and accounts payable accrual policies are being consistently followed and the review by

management is being evidenced, and (ii) software development costs are being properly recorded and the review by management is being evidenced.

3. Deficiencies existed in INTAC Deutschland GmbH, our Germany subsidiary, in relation to certain key financial cycles, including financial reporting, inventory, revenue and expenses; however, remediation efforts were successfully completed and controls established as of September 30, 2005. Management was successful in testing these newly established controls; however, these controls were in place for only one month prior to year-end. Due to having only one month of activity to test these controls, management is unable to conclude as to the effectiveness of these controls, and thus considers these controls a material weakness over financial reporting.

Management's Report contains three material weaknesses identified above as 1, 2, and 3. The table below shows our analysis of the report and the coding for the variables used in our study:

<u>Variable</u>	<u>Value</u>	<u>Explanation of Value</u>
<i>ITMW (dummy)</i>	1	Report contains IT material weakness
<i>NonITMW (dummy)</i>	1	Report contains non-IT material weaknesses
<i>ITMWNum</i>	1	Identified in firm's report as MW #1
<i>ITEntDefNum</i>	2	IT Segregation of Duties IT Control Environment
<i>NONITMWNum</i>	2	Identified in firm's report as MW #2 and MW #3
<i>AcctDefNum</i>	4	Fixed Assets/Capitalization Liabilities Inventory
<i>NonITEntDefNum</i>	2	Revenue Recognition Training Foreign/Subsidiary

* http://www.sec.gov/Archives/edgar/data/1127439/000110465905061371/a05-21774_110k.htm#Item9aControlsAndProcedures_174754

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.