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Internal Control Weaknesses and Financial Reporting Fraud

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SUMMARY: This study examines whether and how weak internal controls increase the risk of financial reporting fraud by top managers. There is a longstanding debate on whether control strength significantly affects fraud risk, yet little evidence on this issue. Further, there is no evidence on the mechanism linking control strength to fraud risk. We find a strong association between material weaknesses and future fraud revelation. We theorize that this link could be attributable to weak controls (1) giving managers greater opportunity to commit fraud, or (2) signaling a management characteristic that does not emphasize reporting quality and integrity. We find support for the opportunity explanation, but not through specific accounts linked to control weaknesses. Instead, consistent with the PCAOB's assertion, weaknesses in entity-wide controls, not process-level controls, are associated with a higher risk of reporting fraud.

Keywords: internal control weaknesses; Sarbanes-Oxley Act (SOX); fraud; PCAOB.

JEL Classifications: M41.

INTRODUCTION

This study examines whether and how disclosed internal control weaknesses are linked to future revelations of financial reporting fraud. We examine future fraud revelation because the contemporaneous disclosure of fraud with an auditor-issued material weakness opinion would be expected. This is because auditors routinely amend internal control reports whenever a restatement is issued (see Rice and Weber 2012) and material weaknesses are issued after the vast majority of restatement-related frauds (Scholz 2014). Instead, we focus on whether disclosed material weaknesses indicate that management is engaging in not-yet-revealed accounting fraud (hereafter, unrevealed) or will engage in accounting fraud in the future.

Our analysis is interesting for three reasons. First, the idea that strong internal controls reduce fraud risk has long been controversial. Supporting a link, Securities and Exchange Commission (SEC) Commissioner Goldschmid stated that strong controls "significantly deter management from committing fraud" (Solomon 2003). However, others dispute this link because management can override controls (e.g., Kinney 2005). The American Institute of Certified Public Accountants (AICPA 2005) states that "controls cannot be relied upon to prevent, detect, or deter fraudulent financial reporting perpetrated by senior

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management." Also, auditors should respond to weak controls by increasing substantive procedures, increasing the likelihood that auditors detect fraud and deterring managers from committing fraud (Smith, Tiras, and Vichitlekarn 2000).

Second, no empirical evidence links internal control weaknesses with a higher risk of unrevealed accounting fraud. This is an important issue because the Sarbanes-Oxley Act (SOX), which was intended to reduce fraud (Lucas 2004), mandates internal control audits. While material weaknesses are related to restatements (Chan, Farrell, and Lee 2008; R. Hoitash, U. Hoitash, and Bedard 2008) and lower accrual quality (Doyle, Ge, and McVay 2007a), these studies generally do not distinguish between errors and fraud. One exception is Ashbaugh-Skaife, Collins, Kinney, and LaFond (2008), who conclude that the link between internal control weaknesses and accrual quality is driven by errors, not intentional manipulation.

Third, recent research raises concerns as to the quality of material weakness disclosures under SOX, because many firms with apparently weak internal controls do not receive adverse control opinions (Rice and Weber 2012). Thus, even if strong controls do reduce financial reporting fraud by managers, it is unclear that material weaknesses disclosed under SOX Section 404(b) would be associated with future revelations of fraud by top management.

We gather auditor internal control opinions from Audit Analytics from 2004–2007 and identify those with and without material weaknesses. We measure financial reporting fraud based upon credible allegations of fraud, in the form of settled accounting-based securities class-action lawsuits, as well as SEC and Department of Justice enforcement actions claiming fraud or other intentional misconduct from Karpoff, Lee, and Martin (2008a, 2008b). The sample includes frauds revealed from 2005–2010. Ending the revelation measurement window in 2010 allows time for government investigations to conclude and for private litigation to be resolved.

We first document a statistically and economically significant relation between material weaknesses and future fraud revelation using both a logistic regression and a propensity score matched-pairs test. In our logit analysis, firm-years with a material weakness are, on average, 1.24 percentage points more likely to have a future fraud revelation. This represents roughly 78 percent of the base fraud rate. In our matched-pairs analysis, firm-years with a material weakness are, on average, 1.54 percentage points more likely to have a future fraud revelation, which represents 90 percent of the base rate of fraud. Importantly, firms with adverse control opinions do not have a higher risk of future fraud revelation simply because they have poorer accrual quality or a higher incidence of prior or concurrent restatements, as we control for these factors.

We also investigate the mechanism through which material weaknesses are linked to the future revelation of fraud. Advocates of a link between internal controls weaknesses and fraud typically do not specify a mechanism to explain how or why weak internal controls should be associated with increased fraud risk. We explore three potential explanations.

First, we investigate whether internal control weaknesses provide managers with an opportunity to commit fraud in a specific account. This explanation relies on the intuition that internal control weaknesses make fraud commission easier due to poor control over the specific area in which fraud is committed. We term this the "specific opportunity" explanation.

Second, we investigate whether certain internal control weaknesses provide a more general opportunity to commit fraud. Auditing Standard (AS) No. 5 links certain entity-level controls (e.g., controls that increase the cost for managers to commit fraud, such as a strong internal audit function) with reduced risk of fraud and management override of other controls (Public Company Accounting Oversight Board [PCAOB] 2007, 14, 24). Poor entity-level controls would not enable fraud in a particular account, but would allow for fraud commission in any account. We term this the "general opportunity" explanation. Both the first and second explanations fall under the umbrella of "opportunity" in the "fraud triangle," which conceptualizes how accounting fraud can occur (AS 2401, para. 7).

Third, we investigate whether internal control weaknesses represent a more systemic cultural characteristic of the firm or its management. For example, tolerance of internal control weaknesses may reflect a propensity for poor financial reporting integrity and/or a firm culture tolerant of fraud and other misconduct. Under this view, it is not the control weakness *per se* that leads to the fraud commission. Rather, the control weakness signals that the manager or firm is a "bad apple." We term this the "management characteristic" explanation. This idea is consistent with the "rationalization" or "attitude" portion of the fraud triangle (AS 2401, para. 7).

Overall, we find support for the general opportunity explanation. Only five frauds have a connection between a weakness in a specific account or process and the area of the fraud. Moreover, the link between material weaknesses and unrevealed fraud is entirely driven by entity-level material weaknesses. These findings are consistent with the general opportunity explanation, but are inconsistent with the specific opportunity explanation. Inconsistent with the management characteristic explanation, material weaknesses predict fraud ongoing during the weakness period, but do not predict fraud beginning after the weakness period. This is, however, consistent with a general opportunity explanation since the weakness and fraud periods overlap.

A potential alternative explanation for our findings is that material *weaknesses* do not lead to higher underlying fraud risk, but instead, their *disclosure* leads to greater discovery and/or prosecution of fraud. This could occur if the material weakness disclosure: (1) provides evidence that lawyers or regulators can use to build cases; (2) leads to investigation by directors, the press, or other parties, leading to fraud being uncovered; or (3) causes auditors to conduct more substantive procedures, leading

to more fraud discovery. To guard specifically against (1) and (2), we exclude frauds where the complaint mentions the material weakness disclosure (i.e., if the disclosure was necessary to build a case or trigger an investigation, then it likely would have been mentioned by the SEC or plaintiffs' attorneys). The material weaknesses that we link to fraud (i.e., those that are disclosed *prior to* fraud revelation) are mentioned in only three suits, and inferences remain the same if we exclude these three suits from the analysis. To guard specifically against (3), we control for abnormal audit fees in the year after the material weakness as a proxy for auditors' increased substantive procedures. Results are robust to these tests.

Another potential concern is that fraud and material weakness disclosure are partially observable. If certain managers can suppress both fraud revelation and material weakness disclosures, then this could drive our results. To test whether partial observability confounds our inferences, we use *FSCORE* from Dechow, Ge, Larson, and Sloan (2011) as a proxy for the *underlying commission* of fraud. *FSCORE* is based on financial statement data such as unusual accruals or sales growth. We find that firms with material weakness disclosures have a significantly higher *FSCORE* than control firms, consistent with material weaknesses being associated with more *underlying* fraud. Thus, it is unlikely that inferences are driven by detection-related explanations (e.g., some managers can conceal detection of both material weaknesses and frauds, while others cannot) or reverse causation (e.g., material weakness disclosures trigger SEC investigations).

Our study contributes to the existing literature in several ways. First, we provide the first evidence that weak internal controls are associated with a higher risk of unrevealed accounting fraud. This is important given the conclusion in Ashbaugh-Skaife et al. (2008) that errors drive the link between poor accrual quality and weak controls. Second, we offer the first evidence on the mechanism by which weak controls lead to increased fraud risk. In particular, entity-level control issues provide the opportunity for top managers to commit fraud. This supports the "top-down" focus on entity-level controls in Auditing Standard No. 5, at least in terms of reducing financial reporting fraud risk. Finally, although this study cannot speak to the completeness of SOX Section 404(b) reporting in identifying all firms with weak controls, our findings indicate that those control opinions that *do* cite material weaknesses provide a meaningful signal of increased fraud risk. Thus, our findings extend the literature regarding the quality of material weakness disclosures (e.g., Rice and Weber 2012; Ge, Koester, and McVay 2014), effectiveness of integrated audits (Bhaskar, Schroeder, and Shepardson 2016), and fraud prediction (e.g., Dechow et al. 2011).

HYPOTHESIS DEVELOPMENT

Whether reported internal control weaknesses should be related to the risk of financial reporting fraud by top management has been extensively debated. First, managers can override controls, as indicated by auditing textbooks (e.g., Messier, Glover, and Prawitt 2014), academic commentary (e.g., Hogan, Rezaee, Riley, and Velury 2008), and the AICPA (2005). Kinney (2005) contends that "better internal control is unlikely to significantly reduce (intentional) management misrepresentation fraud resulting from management override of internal controls, or collusion."[1] Similarly, just prior to SOX, the Panel on Audit Effectiveness declined to endorse auditor testing of internal controls because it was unclear that strong controls would reduce financial reporting fraud (Public Oversight Board [POB] 2000).

Second, detection of internal control issues by the auditor should result in increased substantive procedures that could deter managers from committing fraud (see, e.g., PCAOB 2010, 38). Increased substantive procedures reduce the risk of a material misstatement and, thus, could counteract increased fraud risk from weak controls (Smith et al. 2000).

Third, not all internal control weaknesses are observable. Some weaknesses are remediated prior to the end of the reporting period, eliminating the need for disclosure. The incentive to remediate may be particularly high for managers committing fraud, so as not to draw attention to the firm's accounting system. In addition, the quality of internal control disclosures is questionable. Rice and Weber (2012) report that a vast majority of restating firms failed to report existing material weaknesses until after the restatement announcement.[2] Thus, there may be no relation between *disclosed* material weaknesses and future revelations of fraud because many firms with "clean" internal control opinions may, in fact, have weak internal controls.

Alternatively, there is reason to suspect an association between disclosures of weak controls and fraud risk. Around the time of SOX's passage, several regulators stated that internal controls are related to fraud, but they did not specify the mechanism.[3] Similarly, auditing standards for integrated audits (audits of both internal controls and financial statements) suggest a link between

[1] Paragraph 14 of Auditing Standard No. 5 (PCAOB 2007) instructs auditors to specifically consider the risk of management fraud/override of controls. However, the issuance of a material weakness by an auditor specifically for the risk of management fraud/override is likely rare. We read every material weakness opinion for firms with future fraud revelation and none mentioned the risk of management fraud/override as a reason for the weakness.

[2] Similarly, a report by the Committee of Sponsoring Organizations of the Treadway Commission (COSO 2010, 5) that investigated fraudulent financial reporting found that "adverse Section 404 opinions for the small sample examined were not diagnostic of future reporting problems, but . . . only highlighted already-announced reporting problems."

[3] For instance, the former Comptroller General of the United States testified to Congress "that expanding auditors' responsibilities to report on the effectiveness of internal control over financial reporting would assist auditors in assessing risks for the opportunity of fraudulent financial reporting . . . internal control is the major line of defense in preventing and detecting fraud" (Walker 2002).

strong controls and fraud prevention. For example, Auditing Standard No. 2 (PCAOB 2004) states, "many frauds resulting in . . . restatement relied upon the ability of management to exploit weaknesses in internal control . . . assessments of internal controls over financial reporting should emphasize controls that prevent or detect errors as well as fraud."[4]

Despite these suggestions, there is little direct evidence linking poor internal controls to a higher *ex ante* risk of fraud.[5] While Hogan et al. (2008) note that practitioner standards (like Statement on Auditing Standards [SAS] 99) claim that weak controls can increase the opportunities for fraud, they find very little evidence on this point in their review of the academic literature.[6] For this reason, we focus on the link between control weaknesses and unrevealed fraud. We state our first hypothesis in the null:

H1: There is no association between material weaknesses in financial reporting and the future revelation of fraud.

Conditional on finding such a link, we turn to potential mechanisms by which internal control weaknesses might predict the future revelation of fraud. We test two explanations: "opportunity" and "management characteristic," which form the basis of our second and third hypotheses below. Both explanations are consistent with the "fraud triangle," which identifies three necessary conditions for accounting fraud: opportunity, rationalization/attitude, and incentives/pressure (Messier et al. 2014). We assume that weak controls themselves do not cause pressure on management to commit fraud. Thus, we assume that any link between internal control weaknesses and fraud likely does not arise from the "incentives" portion of the fraud triangle, but instead arises from either the "opportunity" or "attitude" portion of the fraud triangle.[7]

The opportunity explanation is that weak controls provide opportunity to commit fraud (AICPA 2012; Caplan 1999). We split this explanation into control weaknesses that allow for specific versus general opportunities. The specific opportunity explanation relies on control weaknesses enabling fraud by allowing the manager improper control over a particular account or process. Under this explanation, the fraud should be in the area of the control weakness.

For the general opportunity explanation, we distinguish between entity-level and process-level control weaknesses based on Auditing Standard No. 5.[8] Process-level weaknesses (those limited to a specific account or process) provide opportunities to commit fraud in that specific area, while entity-level weaknesses (such as ineffective internal audit) reflect heightened fraud opportunities in any area. Auditing Standard No. 5 (PCAOB 2007, 14) suggests a link between entity-level controls and fraud: "As part of identifying and testing entity-level controls . . . the auditor should evaluate whether the company's controls sufficiently address identified risks of material misstatement due to fraud and controls intended to address the risk of management override of other controls." We state two forms of our second hypothesis, H2, in the null:

H2a: There is no association between material weaknesses that provide a specific opportunity to commit fraud and the future revelation of fraud.

H2b: There is no association between material weaknesses that provide a general opportunity to commit fraud and the future revelation of fraud.

Our final hypothesis concerns the "management characteristic" explanation, which deals with managers who tolerate poor controls. Under this view, internal control weaknesses reflect the type of firm where fraud is likely, but the control weakness itself does not lead to or allow fraud. The presence of internal control weaknesses may reflect management's lack of attention to controls due to financial distress or other business pressures, which may also lead managers to commit fraud (Rosner 2003). Under this explanation, internal controls are predictive of fraud in general, but do not enable it. Thus, internal control weaknesses would be associated with all types of fraud, including "non-opportunity" frauds where the internal control weakness does not give management a direct opportunity. For example, in pure disclosure cases, shareholders allege that a

[4] Auditing Standard No. 5, which superseded Auditing Standard No. 2 as of May 24, 2007, also links control strength and fraud prevention, and specifically considers the possibility of management override (PCAOB 2007).

[5] Prior research links disclosed material weaknesses and low accrual quality (Ashbaugh-Skaife et al. 2008; Doyle et al. 2007a). Doyle et al. (2007a) find that the relation between material weaknesses and accrual quality is driven by "company-level" material weaknesses and that Section 404 disclosures of material weaknesses *are not* associated with accrual quality. Lower accrual quality can be caused by both unintentional errors, as well as intentional misstatements (fraud). In fact, Ashbaugh-Skaife et al. (2008) conclude that the association between low accrual quality and control weaknesses reported under SOX 404(b) is primarily driven by unintentional errors, rather than intentional misstatements. Some studies (Chan et al. 2008; Hoitash et al. 2008) have also documented an association between restatements and internal control weaknesses, although this is not their primary focus. Like poor accrual quality, restatements can be triggered by either errors or fraud.

[6] One exception is Bell and Carcello (2000), who survey audit partners to compare characteristics of fraud and non-fraud engagements. Auditors are more likely to report weak control environments for engagements they worked on involving fraud or "irregularities," consistent with a link between internal control weaknesses and fraud. However, the direction of causation is unclear. The existence of a material intentional misstatement is, by definition, an indicator of weak internal controls (PCAOB 2007, 69). Thus, the discovery of fraud likely increases the auditors' *ex post* reporting of weak control environments.

[7] Incentives to engage in fraud may involve, for example, compensation, stock price, maintaining job security, etc.

[8] Auditing Standard No. 5 uses "entity-level controls" to replace "company-level controls" from Auditing Standard No. 2. This was done "to use the same term as the SEC uses in its final management guidance" (PCAOB 2007, 6).

firm's disclosures were misleading, but they do not allege that the financial statements failed to comply with generally accepted accounting principles (GAAP).[9] We state our third hypothesis in the null:

H3: There is no association between material weaknesses and the future revelation of "non-opportunity" frauds.

Ultimately, these predictions are empirical issues, which we examine in the next section.

EMPIRICAL ANALYSIS

Sample Selection

We obtain our initial sample of auditor internal control opinions from Audit Analytics. SOX Section 404(b) requires auditors to opine on the effectiveness of internal controls and became effective for accelerated filers starting on November 15, 2004.[10] We use material weaknesses disclosed under 404(b) as opposed to management disclosures (i.e., 404(a) and 302) because 404(b) disclosures are more accurate. For example, auditors detect more internal control deficiencies than do management, and auditors are more likely than management to detect more severe and pervasive internal control deficiencies (Bedard and Graham 2011). Another benefit of using 404(b) disclosures is that fraudulent managers are likely less able to suppress auditor disclosures than management disclosures. We collect all auditor internal control opinions for fiscal years ending during the period from November 15, 2004 through December 31, 2007. We collect internal control opinions through 2007 because we utilize a three-year fraud revelation window and our fraud revelation sample ends in 2010 (see below). The final sample includes 14,093 firm-years, 1,488 of which have ineffective internal controls (i.e., at least one material weakness exists at year-end). Table 1, Panel A provides details of the sample selection.

To identify instances of fraud, we gather settled securities class-action lawsuits that allege violations of GAAP from RiskMetrics, as well as SEC and Department of Justice enforcement actions alleging fraud or other intentional accounting misconduct from the Federal Securities Regulation Database.[11] We select lawsuits filed and enforcement actions revealed between January 2005 and December 2010. We retain cases that allege intent under Section 17(a) of the Securities Act of 1933, or either Section 10(b) (including Rule 10b-5) or 13(b)(5) of the Securities Exchange Act of 1934. Overall, our sample contains 87 unique lawsuits and 71 unique enforcement actions, which correspond to 127 unique cases, as 31 cases have both a lawsuit and an enforcement action. Panels B and C of Table 1 provide further case details.

Variable Definitions

Material Weaknesses

To test H1, we create *MW,* which is an indicator variable that is equal to 1 if the firm's auditor disclosed at least one material weakness over financial reporting in year *t,* and 0 otherwise. To test H2 and H3, we utilize the coding of material weakness type by Audit Analytics to identify entity-level and process-level material weaknesses. Although there are likely many ways to define "entity"-level weaknesses, we define *MW_ENTITY* based upon the controls listed in Auditing Standard No. 5 that address the risk of fraud and management override (PCAOB 2007, 14).[12] *MW_PROCESS* is set to 1 when there is a material weakness for year *t,* but not an entity-level material weakness. Process- or account-level weaknesses are usually present when entity-level weaknesses are noted in the control opinion.[13] Thus, an observation with $MW\_ENTITY = 1$ may involve process weaknesses, but a $MW\_PROCESS = 1$ observation will never involve entity-level weaknesses.

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[9] Another type of non-opportunity fraud might arise if a firm has an internal control weakness in time *t,* a remediation of this weakness in *t*+1, and the fraud starts in *t*+1. In this case, the weakness predicts future fraud revelation, but the fraud did not occur when the weakness existed. Thus, the fraud was not "latent."

[10] Our sample includes all auditor internal control opinions that also have required data for control variables. Only accelerated filers are required to have an audited internal control opinion. There are 91 firm-years in the sample from non-accelerated filers who voluntarily engage their auditor to opine on internal controls. Inferences remain the same if we exclude these 91 observations from non-accelerated filers. Accelerated filers have public float of $75 million or more as of six months before fiscal year-end. Firms with public float less than $75 million as of six months before their fiscal year-end are defined as non-accelerated filers.

[11] For more information on the SEC/DOJ data, see: http://www.fesreg.com/. These data were initially used in Karpoff et al. (2008a, 2008b). The RiskMetrics (now ISS) data cover all federal securities class-action cases in the U.S.

[12] Specifically, *MW_ENTITY* is an indicator variable that is equal to 1 if Audit Analytics identifies at least one material weakness in the following categories: (1) non-routine transaction control issues (code 77); (2) journal entry control issues (code 76); (3) foreign, related-party, affiliated, or subsidiary issues (code 38); (4) an ineffective, nonexistent, or understaffed audit committee (code 11); (5) senior management competency, tone, or reliability issues (code 13); (6) an insufficient or nonexistent internal audit function (code 18); (7) ethical or compliance issues with personnel (code 21); or (8) accounting personnel resources, competency, or training issues (code 44). These categories loosely map into the categories identified in paragraph 14 of Auditing Standard No. 5, which addresses the risk of management override as it relates to fraud.

[13] We conjecture that an auditor will usually need to point to an actual or potential misstatement in a particular account or process to justify (to the client and audit committee) disclosing an entity-level material weakness.

TABLE 1
Sample Details

Panel A: Sample Selection

Audited internal control opinions in Audit Analytics for 2004 through 2007	15,919
Less: Duplicate internal control opinions (in the case of joint audits). Note: we keep the observation associated with the largest audit fee.	(22)
Less: Restated internal control opinions. Note: in the case of an unqualified original internal control opinion, we keep the earliest adverse restated internal control opinion, if one exists.	(286)
Less: Observations with zero audit fees	(284)
Less: Observations with missing CRSP or Compustat data required for control variables	(1,234)
Final Sample	14,093

This panel presents details about the sample selection.

Panel B: Fraud Revelation by Year

Frauds Revealed in											
2005		2006		2007		2008		2009		2010	
Lawsuits	SEC/DOJ	Lawsuits	SEC/DOJ	Lawsuits	SEC/DOJ	Lawsuits	SEC/DOJ	Lawsuits	SEC/DOJ	Lawsuits	SEC/DOJ
17	18	26	29	14	11	18	8	9	3	3	2

This panel presents the fraud sample by year of revelation. The sample period for frauds is 2005 through 2010. We obtain a fraud sample made up of (1) SEC and Department of Justice enforcement actions that establish intent under Section 17(a) of the Securities Act of 1933, or either Section 10(b) (including Rule 10b-5) or 13(b)(5) of the Securities Exchange Act of 1934 per the Federal Securities Regulation Database; and (2) settled securities class-action lawsuits that allege violations of Generally Accepted Accounting Principles per RiskMetrics (ISS).

Panel C: Fraud Details

	Number of Cases	Number Where the CEO is Named	Number Where the CFO is Named	Number Where Either the CEO or CFO is Named	Number Where the Company is Named
SEC/DOJ Enforcement Action Only	40	25	23	28	30
Class-Action Lawsuit Only	56	55	54	56	55
Both Enforcement Action and Lawsuit	31	31	31	31	30
Total	127	111	108	115	115

This panel presents whether the CEO, CFO, or company is named in the fraud case. The sample period for frauds is 2005 through 2010. We obtain a fraud sample made up of (1) SEC and Department of Justice enforcement actions that establish intent under Section 17(a) of the Securities Act of 1933, or either Section 10(b) (including Rule 10b-5) or 13(b)(5) of the Securities Exchange Act of 1934 per the Federal Securities Regulation Database; and (2) settled securities class-action lawsuits that allege violations of Generally Accepted Accounting Principles per RiskMetrics (ISS).

Panel D: Fraud and Material Weaknesses by Year

	2004 (n = 2,854)	2005 (n = 3,461)	2006 (n = 3,786)	2007 (n = 3,992)	Total (n = 14,093)
FRAUD	65	73	50	37	225
FRAUD_NO_DUPS	65	39	14	9	127
MW	472	396	330	290	1,488
MW_ENTITY	271	250	196	200	917
MW_PROCESS	201	146	134	90	571

(continued on next page)

TABLE 1 (continued)

This panel presents the fraud and material weakness counts by year. The sample period is 2004 through 2007 for material weaknesses and 2005 through 2010 for frauds. We obtain a fraud sample made up of (1) SEC and Department of Justice enforcement actions that establish intent under Section 17(a) of the Securities Act of 1933, or either Section 10(b) (including Rule 10b-5) or 13(b)(5) of the Securities Exchange Act of 1934 per the Federal Securities Regulation Database; and (2) settled securities class-action lawsuits that allege violations of Generally Accepted Accounting Principles per RiskMetrics (ISS). *FRAUD* is equal to 1 if fraud is announced within three years of the filing date (plus seven days) of the firm's audited internal control opinion for year *t*, and 0 otherwise. *FRAUD_NO_DUPS* is equal to *FRAUD*, but only counts each fraud one time. Specifically, only the first year within the three-year window is retained, thus removing duplicate frauds. The other firm-years from the fraud firm are excluded. The number of firm-years for *FRAUD_NO_DUPS* is 2,831, 3,387, 3,688, and 3,892 for years 2004 through 2007, respectively. *MW* is an indicator variable that is equal to 1 if the firm's auditor disclosed a material weakness over financial reporting as reported by Audit Analytics, and 0 otherwise. *MW_ENTITY* is an indicator variable that is equal to 1 if the firm's auditor disclosed at least one entity-level material weakness over financial reporting as reported by Audit Analytics, and 0 otherwise. *MW_PROCESS* is an indicator variable that is equal to 1 if the firm's auditor disclosed at least one process-level material weakness and no entity-level material weaknesses as reported by Audit Analytics, and 0 otherwise.
See Appendix A for detailed variable definitions.

Panel E: Types of Entity-Level Material Weaknesses by Year

	2004 (n = 2,854)	2005 (n = 3,461)	2006 (n = 3,786)	2007 (n = 3,992)	Total (n = 14,093)
Non-routine transaction control issues (code 77)	84	73	62	46	265
Journal entry control issues (code 76)	52	60	43	25	180
Foreign, related-party, affiliated, or subsidiary issues (code 38)	61	58	51	38	208
Ineffective, nonexistent, or understaffed audit committee (code 11)	8	2	1	6	17
Senior management competency, tone, or reliability issues (code 13)	29	23	21	17	90
Insufficient or nonexistent internal audit function (code 18)	12	5	8	8	33
Ethical or compliance issues with personnel (code 21)	22	23	21	15	81
Accounting personnel resources, competency, or training issues (code 44)	225	202	149	172	748

This panel presents the count of the types of material weaknesses that are included in *MW_ENTITY*. The Audit Analytics' identification code is in parentheses.
See Appendix A for detailed variable definitions.

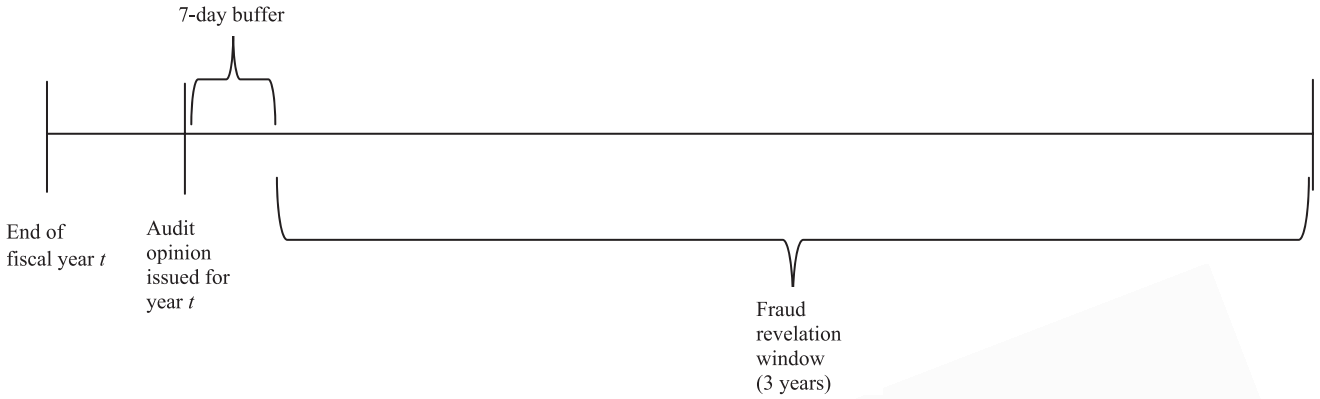
Panel F: Descriptive Statistics for Control Variables

n = 1,488	Mean	Std. Dev.	25th Percentile	Median	75th Percentile
FRAUD	0.024	0.154	0.000	0.000	0.000
LN_MARKETCAP	6.244	1.462	5.203	6.035	7.045
AGGREGATE_LOSS	0.382	0.486	0.000	0.000	1.000
LN_SEGCOUNT	1.066	0.733	0.693	1.099	1.609
FOREIGN_CURRENCY_TRANSLATION	0.321	0.467	0.000	0.000	1.000
EXTREME_SALES_GROWTH	0.173	0.378	0.000	0.000	0.000
MERGER	0.097	0.296	0.000	0.000	0.000
RESTRUCTURING_CHARGE	0.001	0.635	0.000	0.000	0.005
BIG4	0.777	0.416	1.000	1.000	1.000
AUDITOR_RESIGN	0.052	0.223	0.000	0.000	0.000
BANKRUPTCY_RISK	5.512	2.778	3.000	6.000	8.000

This panel presents descriptive statistics for control variables in our main regression.
Variable definitions are provided in Appendix A.

Table 1, Panel D reports the number of each type of material weakness across the sample period. The number of internal control opinions with material weaknesses declines monotonically over the sample period. A similar decreasing trend is observed for each type of material weakness. However, out of the opinions with material weaknesses, the percentage with entity-level material weaknesses increases over time compared to those with only process-level

FIGURE 1
Research Design Timeline



This figure depicts the timeline for the research design used in our main tests. The auditor's internal control opinion for year t ($MW = 1$ or $MW = 0$) is associated with future fraud revelation ($FRAUD = 1$ or $FRAUD = 0$) using a three-year window starting seven days after the issuance of the opinion for year t's financial statements.

weaknesses. For example, in 2004 (2007), approximately 57 (69) percent of adverse internal control opinions reported at least one entity-level material weakness.[14]

Table 1, Panel E reports the number of each type of material weakness included in the entity-level classification. The most common type of entity-level material weakness relates to accounting personnel resources, competency, or training issues (code 44). There are very few instances where audit committee or internal audit function weaknesses are disclosed.

Fraud

We are not interested in instances where the auditor reveals evidence of fraud contemporaneously with the issuance of a material weakness. In such a case, the material weakness disclosure is likely a reaction to the discovery of fraudulently misstated financial statements, and even without this material weakness disclosure, outsiders could reasonably infer that the firm has problems with the integrity of its financial reporting system.

For this reason, we are interested only in revelations of fraud that *follow* the issuance of the auditor's internal control opinion. For lawsuits, we use the class period end date as a proxy for the fraud revelation date. The class period is the timeframe the plaintiff alleges that the firm's stock price was inflated due to fraud, and the end of the class period coincides with the revelation of the fraud and the correction of the stock price. For SEC and Department of Justice enforcement actions, we utilize the "trigger date" from the Federal Securities Regulation Database. This is the first date involving public revelation of the accounting improprieties mentioned in the enforcement action. In many cases, this revelation comes from the company itself (e.g., the firm announces a restatement, irregularity, or commencement of an SEC or Department of Justice inquiry), while in other cases, the first public revelation comes from the SEC or Department of Justice (e.g., a press release indicating that the SEC will pursue or has filed charges against a company or its executives). For frauds that involve both an enforcement action and a lawsuit, we use the earlier of the class period end date or the trigger date.

We then create an indicator variable for each firm-year, *FRAUD,* that equals 1 if fraud is announced within three years of the filing date (plus seven days) of the firm's audited internal control opinion for year *t,* and 0 otherwise.[15] Figure 1 depicts our research design graphically. While we require a minimum of seven days between the filing date and the revelation date, we find

[14] An adverse internal control opinion is one where the auditor concludes that internal controls are ineffective and, thus, reports at least one material weakness.

[15] The median duration of fraud committed by executives is two years (Association of Certified Fraud Examiners [ACFE] 2014); thus, a three-year window should capture most frauds that would be associated with a material weakness in year *t*. In addition to requiring the fraud revelation to follow the filing date of the internal control opinion, we also require at least seven days between the filing date of the internal control opinion and the fraud revelation date to help avoid any possible mechanical relation between material weaknesses and fraud. For example, if a firm has a calendar year-end and the related 2004 internal control opinion is filed on March 1, 2005, then *FRAUD* is set to 1 for this observation if the fraud was revealed on March 9, 2005 through March 8, 2008, and 0 otherwise.

that most frauds come well after the filing date. The shortest lags are 40, 55, and 58 days, respectively, and the average (median) lag is 526 (464) days. Thus, it is unlikely that the auditor knows of the subsequent fraud revelation *ex ante*.

In testing H1, we do not require the fraud commission period to overlap with the control weakness period because an internal control weakness could increase both: (1) the chance that fraud already occurred, but went undiscovered, or (2) the chance that fraud will occur in the future if the weakness is not remediated. However, in testing H2 and H3, where we are interested in the management characteristic story versus the opportunity story, we do condition on the fraud commission period and whether it overlaps with the internal control weakness period.

To ensure that results are not driven by counting frauds across multiple firm-years (e.g., a fraud revealed in 2006 could possibly be counted for the 2004 and 2005 observations), we create *FRAUD_NO_DUPS,* which is equal to 1 for only the first firm-year in the three-year window. When this variable is used, we exclude firm-years from fraud firms other than the first firm-year that is matched to a fraud.[16] Table 1, Panel D reports the count of frauds across the sample period. There are 225 firm-years (127 firm-years when counting frauds only one time) within the sample period where an internal control opinion precedes future fraud revelation within three years.

Future Fraud Revelation

As an initial test of H1, we estimate a pooled logistic regression using available data on all audited internal control disclosures over our sample period. Compared to a propensity-matched design, which we utilize later, this specification allows us to use all of the fraud revelations over our sample period. The propensity-matched sample excludes many fraud revelations involving firms without material weaknesses that are not matched to firms with material weaknesses. Our pooled design is as follows:

$$\begin{aligned}&\text{Prob}(FRAUD/FRAUD\_NO\_DUPS = 1)\\&= F(\beta_0 + \beta_1 MW + \beta_2 LN\_MARKETCAP + \beta_3 AGGREGATE\_LOSS + \beta_4 LN\_SEGCOUNT\\&\quad + \beta_5 FOREIGN\_CURRENCY\_TRANSLATION + \beta_6 EXTREME\_SALES\_GROWTH + \beta_7 MERGER\\&\quad + \beta_8 RESTRUCTURING\_CHARGE + \beta_9 BIG4 + \beta_{10} AUDITOR\_RESIGN + \beta_{11} BANKRUPTCY\_RISK)\end{aligned} \quad (1)$$

We control for determinants of material weaknesses drawn from Ashbaugh-Skaife, Collins, and Kinney (2007) and Doyle, Ge, and McVay (2007b). These control variables are all measured for year *t*. Detailed variable definitions are provided in Appendix A. Table 1, Panel F provides descriptive statistics for control variables in Equation (1). Table 2 presents correlations between variables of interest.

Table 3 presents results from estimating Equation (1). The first column uses *FRAUD* as the dependent variable, and the coefficient on *MW* is positive and significant (p-value less than 1 percent). To put this in economic perspective, firm-years with a material weakness are 1.24 percentage points more likely to have a fraud revelation within the next three years compared to firm-years without a material weakness. This represents approximately 78 percent of the 1.60 percent unconditional probability of fraud.[17] For the control variables, size, sales growth, and merger activity are positively associated with fraud. These variables have been linked to high incidence of SEC enforcement actions, lawsuits, and upward earnings management in prior research (e.g., Dechow et al. 2011; Erickson and Wang 1999; Kim and Skinner 2012; Louis 2004). The second column reports results when *FRAUD_NO_DUPS* is the dependent variable, and once again, the coefficient on *MW* is positive and significant (p-value less than 1 percent). Thus, it does not appear that results are affected by counting frauds more than once.

We also use propensity score matching to test H1 (Armstrong, Jagolinzer, and Larcker 2010; Tucker 2010). This approach allows us to match firms on observable characteristics, comparing treatment firms (those with material weaknesses) to the most similar control firms (those without material weaknesses). We match 1,488 firm-years from firms with at least one material weakness to firm-years from firms that never had a material weakness over the sample period, but that have the closest predicted probability of reporting a material weakness. To match, we first estimate the following logistic regression for the probability of reporting a material weakness:

$$\begin{aligned}\text{Prob}(MW = 1) = F(&\beta_0 + \beta_1 LN\_MARKETCAP + \beta_2 AGGREGATE\_LOSS + \beta_3 LN\_SEGCOUNT\\&+ \beta_4 FOREIGN\_CURRENCY\_TRANSLATION + \beta_5 EXTREME\_SALES\_GROWTH + \beta_6 MERGER\\&+ \beta_7 RESTRUCTURING\_CHARGE + \beta_8 BIG4 + \beta_9 AUDITOR\_RESIGN + \beta_{10} BANKRUPTCY\_RISK)\end{aligned} \quad (2)$$

[16] Using the example above, for a fraud revealed in 2006, *FRAUD_NO_DUPS* equals 1 for 2004 and other firm-years for that firm are excluded. Results are similar if we keep other years and set *FRAUD_NO_DUPS* to 0.

[17] Marginal effects are the average of discrete or partial changes over all observations (Bartus 2005).

TABLE 2
Correlations

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 *FRAUD*														
2 *FRAUD_NO_DUPS*	**1.000**													
3 *MW*	**0.023**	**0.033**												
4 *MW_ENTITY*	**0.017**	**0.026**	**0.768**											
5 *MW_PROCESS*	**0.014**	**0.019**	**0.598**	**−0.054**										
6 *LN_MARKETCAP*	**0.055**	**0.033**	**−0.133**	**−0.109**	**−0.070**									
7 *AGGREGATE_LOSS*	**−0.024**	−0.012	**0.139**	**0.138**	**0.045**	**−0.344**								
8 *LN_SEGCOUNT*	**0.016**	**0.019**	**0.048**	**0.053**	0.009	**0.280**	−0.008							
9 *FOREIGN_CURRENCY_TRANSLATION*	−0.008	0.006	**0.055**	**0.074**	−0.007	**0.172**	**0.032**	**0.424**						
10 *EXTREME_SALES_GROWTH*	**0.025**	**0.018**	−0.002	0.004	−0.007	**−0.028**	**0.044**	**−0.058**	**−0.020**					
11 *MERGER*	**0.041**	**0.021**	0.001	0.003	−0.002	**0.081**	−0.013	0.010	**0.022**	**0.066**				
12 *RESTRUCTURING_CHARGE*	0.000	0.001	−0.006	−0.012	0.005	−0.009	**0.042**	0.000	0.002	−0.005	0.003			
13 *BIG4*	**0.025**	0.014	**−0.056**	**−0.054**	**−0.021**	**0.363**	**−0.051**	**0.197**	**0.106**	**−0.037**	0.011	0.000		
14 *AUDITOR_RESIGN*	−0.003	0.000	**0.098**	**0.093**	**0.036**	**−0.073**	**0.065**	0.003	0.000	**0.015**	0.007	0.007	**−0.177**	
15 *BANKRUPTCY_RISK*	**−0.029**	**−0.024**	**0.121**	**0.106**	**0.056**	**−0.624**	**0.356**	**−0.325**	**−0.182**	−0.010	0.001	0.011	**−0.230**	**0.054**

This table provides Pearson correlation coefficients for primary variables. The sample period is from 2004 through 2007 for material weaknesses and 2005 through 2010 for frauds. We obtain a fraud sample made up of (1) SEC and Department of Justice enforcement actions that establish intent under Section 17(a) of the Securities Act of 1933, or either Section 10(b) (including Rule 10b-5) or 13(b)(5) of the Securities Exchange Act of 1934 per the Federal Securities Regulation Database; and (2) settled securities class-action lawsuits that allege violations of Generally Accepted Accounting Principles per RiskMetrics (ISS). Bold coefficients are significant at the 10 percent level.
Variable definitions are provided in Appendix A.

TABLE 3

Multiple Regression Fraud Results

	Logistic Regression: Dependent Variable is:			
	FRAUD		*FRAUD_NO_DUPS*	
Independent Variables	**(1)**	**Marginal Effects**	**(2)**	**Marginal Effects**
MW	0.6286***	0.0124	0.7262***	0.0085
	(0.214)		(0.234)	
LN_MARKETCAP	0.2513***	0.0039	0.2123***	0.0019
	(0.077)		(0.074)	
AGGREGATE_LOSS	−0.3079	−0.0043	−0.1616	−0.0014
	(0.276)		(0.276)	
LN_SEGCOUNT	0.1246	0.0019	0.1672	0.0015
	(0.161)		(0.152)	
FOREIGN_CURRENCY_TRANSLATION	−0.3518	−0.0051	0.0310	0.0003
	(0.245)		(0.236)	
EXTREME_SALES_GROWTH	0.4910***	0.0088	0.4954**	0.0052
	(0.187)		(0.211)	
MERGER	0.7366***	0.0150	0.6308**	0.0072
	(0.234)		(0.249)	
RESTRUCTURING_CHARGE	0.0541	0.0008	0.2730	0.0025
	(0.088)		(0.904)	
BIG4	0.2351	0.0034	−0.1645	−0.0016
	(0.313)		(0.322)	
AUDITOR_RESIGN	−0.1094	−0.0016	−0.2591	−0.0021
	(0.602)		(0.753)	
BANKRUPTCY_RISK	0.0233	0.0004	−0.0120	−0.0001
	(0.043)		(0.043)	
Year Fixed Effects?	Yes		Yes	
Obs. where Dependent Variable = 1	225		127	
Total Obs.	14,093		13,801	
Area under the ROC Curve	0.69		0.77	

*, **, *** Represent two-tailed statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.
This table reports the results of the following logistic regression for the probability of fraud revelation, which controls for contemporaneous determinants of material weakness disclosure:

$$\text{Prob}(FRAUD/FRAUD\_NO\_DUPS = 1) = F\left(\beta_1 MW + \beta'(CONTROLS)\right)$$

The sample period is 2004 through 2007 for material weaknesses and 2005 through 2010 for frauds. We obtain a fraud sample made up of (1) SEC and Department of Justice enforcement actions that establish intent under Section 17(a) of the Securities Act of 1933, or either Section 10(b) (including Rule 10b-5) or 13(b)(5) of the Securities Exchange Act of 1934 per the Federal Securities Regulation Database; and (2) settled securities class-action lawsuits that allege violations of Generally Accepted Accounting Principles per RiskMetrics (ISS). *FRAUD* is equal to 1 if fraud is announced within three years of the filing date (plus seven days) of the firm's audited internal control opinion for year *t,* and 0 otherwise. *FRAUD_NO_DUPS* is equal to *FRAUD,* but only counts each fraud one time. Specifically, only the first year within the three-year window is retained, thus removing duplicate frauds. The other firm-years from fraud firms are excluded. *MW* is an indicator variable that is equal to 1 if the firm's auditor disclosed a material weakness over financial reporting as reported by Audit Analytics, and 0 otherwise. Marginal effects are the average of discrete or partial changes over all observations (Bartus 2005). Standard errors clustered by firm are in parentheses.
Variable definitions are provided in Appendix A.

Results from estimating Equation (2) are presented in Table 4, Panel A. Using the predicted probabilities from Equation (2), we match each firm-year reporting a material weakness to the firm-year without a reported material weakness in the same year with the closest predicted probability of a material weakness.[18] We retain only those pairs whose scores match within 0.01. This results in 1,406 treatment firm-years and 1,406 control firm-years. To assess the effectiveness of matching, or covariate

[18] Although we lose observations, results are similar and slightly stronger if we match firms by industry (untabulated).

TABLE 4
Propensity Score Results

Panel A: Propensity Score Matching Regression

Logistic Regression: Dependent Variable is *MW*	
Independent Variables	**(1)**
LN_MARKETCAP	−0.1980***
	(0.033)
AGGREGATE_LOSS	0.4626***
	(0.075)
LN_SEGCOUNT	0.3367***
	(0.054)
FOREIGN_CURRENCY_TRANSLATION	0.3361***
	(0.082)
EXTREME_SALES_GROWTH	−0.0165
	(0.079)
MERGER	0.0882
	(0.106)
RESTRUCTURING_CHARGE	−0.0768
	(0.061)
BIG4	−0.0848
	(0.091)
AUDITOR_RESIGN	1.1501***
	(0.157)
BANKRUPTCY_RISK	0.0725***
	(0.016)
Obs. where Dependent Variable = 1	1,488
Total Obs.	14,093
Area under the ROC Curve	0.68

The sample period is 2004 through 2007 for material weaknesses.

Panel B: Covariate Balance

	Mean Treatment	**Mean Control**	**t-test Difference p-value (on Mean)**	**Paired t-test Difference p-value (on Mean)**
LN_MARKETCAP	6.3267	6.3009	0.6451	0.5017
AGGREGATE_LOSS	0.3521	0.3748	0.2098	0.0799
LN_SEGCOUNT	1.0395	1.0216	0.5128	0.4977
FOREIGN_CURRENCY_TRANSLATION	0.2994	0.2809	0.2802	0.2516
EXTREME_SALES_GROWTH	0.1735	0.1970	0.1093	0.1036
MERGER	0.0982	0.0875	0.3298	0.3301
RESTRUCTURING_CHARGE	0.0135	0.0103	0.3405	0.3385
BIG4	0.7916	0.8250	0.0243	0.0213
AUDITOR_RESIGN	0.0263	0.0263	1.0000	1.0000
BANKRUPTCY_RISK	5.3599	5.3670	0.9463	0.9311

This panel reports the covariate balance between matched pairs. Test statistics are for the difference between treatment group (those with auditor-reported material weaknesses) and control group (those without auditor-reported material weaknesses, but with the closest probability of having a material weakness). There are 1,406 firm-year observations for the treatment group, which are matched to 1,406 firm-year control group observations.

(continued on next page)

TABLE 4 (continued)

Panel C: Frequency of Fraud for Treatment and Control Groups

Logistic Regression: Dependent Variable is *FRAUD*

Independent Variables	(1)	Marginal Effects
MW	0.9975***	0.0154
	(0.370)	
LN_MARKETCAP	0.2275	0.0038
	(0.155)	
AGGREGATE_LOSS	−0.1908	−0.0030
	(0.464)	
LN_SEGCOUNT	0.5313**	0.0088
	(0.241)	
FOREIGN_CURRENCY_TRANSLATION	−0.4637	−0.0072
	(0.406)	
EXTREME_SALES_GROWTH	0.6326	0.0125
	(0.391)	
MERGER	0.3970	0.0076
	(0.477)	
RESTRUCTURING_CHARGE	−0.8067	−0.0134
	(2.454)	
BIG4	−0.5541	−0.0110
	(0.445)	
AUDITOR_RESIGN	−0.4060	−0.0056
	(1.117)	
BANKRUPTCY_RISK	0.0064	0.0001
	(0.083)	
Obs. where dependent variable = 1	48	
Total Obs.	2,812	
Area under the ROC curve	0.72	

*, **, *** Represent two-tailed statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.
This table reports the results of the following logistic regression for the probability of a material weakness disclosed within an auditor's internal control opinion:

$$\text{Prob}(MW = 1) = F(\beta_0 + \beta_1 LN\_MARKETCAP + \beta_2 AGGREGATE\_LOSS + \beta_3 LN\_SEGCOUNT + \beta_4 FOREIGN\_CURRENCY\_TRANSLATION + \beta_5 EXTREME\_SALES\_GROWTH + \beta_6 MERGER + \beta_7 RESTRUCTURING\_CHARGE + \beta_8 BIG4 + \beta_9 AUDITOR\_RESIGN + \beta_{10} BANKRUPTCY\_RISK)$$

There are 1,406 firm-year observations for the treatment group, which are matched to 1,406 firm-year control group observations. Frauds are matched to firm-years where the fraud revelation date is after the SEC filing date for the audit opinion. This helps ensure that the relationship between material weakness and fraud is not mechanical. Thirty-five (13) of the frauds are (not) preceded by a material weakness. Standard errors clustered by firm are in parentheses.
Variable definitions are provided in Appendix A.

balance, we compare the average level of the covariates in Equation (2) across treatment and control samples. In Table 4, Panel B, we report t-tests of means and paired t-tests of means between the two samples. The only t-test that is statistically significant at the 0.05 level is for *BIG4*. Therefore, in general, our matching procedure selects a set of control observations that are comparable to our treatment observations. However, because there is a difference for *BIG4,* we utilize a multivariate model to obtain more precise estimates of the effect of *MW* on *FRAUD* (Armstrong, Core, and Guay 2014; Ho, Imai, King, and Stuart 2007).

Table 4, Panel C presents the results of estimating Equation (1) on the 2,812 treatment and control observations. Using this multiple regression approach, the coefficient on *MW* is 0.9975 with a p-value of 0.007. To put these results in economic perspective, firm-years with a material weakness are 1.54 percentage points more likely to have a fraud revelation within the next three years compared to firm-years without a material weakness. This represents approximately 90 percent of the 1.71 percent unconditional probability of fraud. These results and the results of the pooled sample in Table 3 support the conclusion that disclosure of material weaknesses is associated with future revelation of fraud. Thus, we reject the null hypothesis in H1.

Nature of Internal Control Weaknesses that Predict Fraud Revelation

Given the strong relation between material weaknesses and the future revelation of fraud, a natural question is whether certain types of material weaknesses predict fraud better than others. H2a, H2b, and H3 explore this possibility.

Specific versus General Opportunity

Before testing the specific versus general opportunity hypotheses, we identify and limit our focus to ongoing or "latent" fraud. By "latent," we mean fraud occurring while internal controls were deemed ineffective. We do this because these hypotheses deal with the *opportunity* to commit fraud. If a material weakness provides either a specific or general opportunity to commit fraud, then the fraud should be ongoing during the timeframe when the material weakness is present. *FRAUD_LATENT* is equal to 1 if fraud is ongoing during year *t* and is announced after the filing date (plus seven days) of the firm's audited internal control opinion for year *t,* and 0 otherwise. We then examine whether entity- versus process-level control weaknesses can predict latent fraud. Specifically, we estimate the following logistic model:

$$\begin{aligned}\text{Prob}(FRAUD\_LATENT = 1) = F(&\beta_0 + \beta_1 MW\_ENTITY + \beta_2 MW\_PROCESS + \beta_3 LN\_MARKETCAP \\ &+ \beta_4 AGGREGATE\_LOSS + \beta_5 LN\_SEGCOUNT \\ &+ \beta_6 FOREIGN\_CURRENCY\_TRANSLATION + \beta_7 EXTREME\_SALES\_GROWTH \\ &+ \beta_8 MERGER + \beta_9 RESTRUCTURING\_CHARGE + \beta_{10} BIG4 \\ &+ \beta_{11} AUDITOR\_RESIGN + \beta_{12} BANKRUPTCY\_RISK) \end{aligned} \quad (3)$$

If the specific opportunity hypothesis is true, then β_2 should be positive and significant, as process-level material weaknesses would provide a specific opportunity for managers to commit fraud in the area of the process or account weakness. If the general opportunity hypothesis is true, then we expect β_1 to be positive and significant since entity-level material weaknesses make it easier for managers to commit fraud in any area, not just one particular account or process.

Column (1) of Table 5 presents the results, and the coefficient on *MW_ENTITY* is positive and significant (p-value less than 1 percent), while the coefficient on *MW_PROCESS* is insignificant. The fact that process-level weaknesses by themselves are not associated with unrevealed fraud is inconsistent with the specific opportunity hypothesis. Instead, these results are more consistent with the general opportunity hypothesis, as entity-level weaknesses must be present in order for a material weakness report to predict heightened fraud risk.[19]

However, as we note above, even when an auditor reports an entity-level weakness (i.e., *MW_ENTITY* = 1), it is common for process-level weaknesses to exist, as well. It is, therefore, possible that the positive association between *MW_ENTITY* and fraud is driven by instances where there is a direct correspondence between the fraud area and a specific account or process weakness, which would support the specific opportunity hypothesis. To help rule out this possibility, we read each legal complaint/enforcement release and the associated internal control opinion (for all *MW* = 1 and *FRAUD_LATENT* = 1 observations) and note whether internal control opinions contained material weaknesses that were in the area of the fraud.

Out of the 27 latent fraud cases preceded by an adverse internal control opinion, only five have any material weaknesses in the area of the fraud. This low rate of correspondence suggests that managers are not typically committing fraud in the specific process areas or accounts with weak internal controls. This finding is more consistent with the general opportunity hypothesis, where entity-level weaknesses open the door for fraud in any area, rather than the specific opportunity hypothesis, which implies that the link between *MW* and fraud should be dominated by instances where the fraud and the material weakness share the same process or account.

[19] Although we are unaware of theory for why a certain type of entity-level material weakness should be more or less strongly related to future latent fraud revelation, we also test which types of entity-level material weaknesses predict latent fraud revelation. When we estimate Equation (3) after replacing *MW_ENTITY* with indicators for the components for entity-level weaknesses, only the coefficients for foreign, related-party, affiliated, or subsidiary control issues (Audit Analytics code 38) and ethical or compliance issues (Audit Analytics code 21) are positive and significant (p-value less than 10 percent) (untabulated). Additionally, because information technology (Audit Analytics code 22) and segregation of duties (Audit Analytics code 42) material weaknesses could also be considered within the definition of entity-level controls, we run an additional analysis including indicators for each. The coefficients for both types of material weaknesses are insignificant, and the coefficients for foreign, related-party, affiliated, or subsidiary control issues (Audit Analytics code 38) and ethical or compliance issues (Audit Analytics code 21) remain positive and significant. However, we caution the reader in making inferences from these results for two reasons. First, some of these material weakness types are very rare. For example, an ineffective, nonexistent, or understaffed audit committee (code 11) and an insufficient or nonexistent internal audit function (code 18) only occur 17 and 33 times in our sample, respectively. Second, it is often the case that more than one of the entity-level types is disclosed in the same year. For example, the correlation between ethical or compliance issues with personnel (code 21) and senior management competency, tone, or reliability issues (code 13) is 56 percent. Similarly, the correlation between accounting personnel resources, competency, or training issues (code 44) and journal entry control issues (code 76) is 41 percent.

TABLE 5

Types of Material Weaknesses and Fraud Revelation

Logistic Regression: Dependent Variable is *FRAUD_LATENT*

Independent Variables	(1)	Marginal Effects	(2)	Marginal Effects
MW_ENTITY	0.8728***	0.0122	0.6353**	0.0078
	(0.282)		(0.308)	
MW_PROCESS	−0.1007	−0.0009	−0.3146	−0.0026
	(0.462)		(0.512)	
LN_MARKETCAP	0.0885	0.0009	0.0911	0.0009
	(0.085)		(0.087)	
AGGREGATE_LOSS	−0.1849	−0.0017	−0.0704	−0.0006
	(0.299)		(0.295)	
LN_SEGCOUNT	0.2948	0.0029	0.2566	0.0024
	(0.209)		(0.216)	
FOREIGN_CURRENCY_TRANSLATION	−0.2533	−0.0023	−0.2154	−0.0019
	(0.303)		(0.310)	
EXTREME_SALES_GROWTH	0.4659**	0.0052	0.4294*	0.0046
	(0.224)		(0.228)	
MERGER	0.9012***	0.0123	0.9012***	0.0119
	(0.292)		(0.296)	
RESTRUCTURING_CHARGE	0.1046	0.0010	0.0682	0.0006
	(0.195)		(0.124)	
BIG4	−0.1033	−0.0010	−0.1637	−0.0016
	(0.376)		(0.381)	
AUDITOR_RESIGN	−1.0747	−0.0065	−1.0083	−0.0061
	(0.858)		(0.856)	
BANKRUPTCY_RISK	−0.0468	−0.0005	−0.0591	−0.0006
	(0.045)		(0.046)	
Year Fixed Effects?	Yes		Yes	
Removed observations with MWs in the area of the fraud?	No		Yes	
Obs. where *FRAUD_LATENT* = 1	139		134	
Total Obs.	14,093		14,088	
Area under the ROC Curve	0.70		0.69	

*, **, *** Represent two-tailed statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.
This table reports the results of the following logistic regression for the probability of fraud revelation, controlling for contemporaneous determinants of material weakness disclosure:

$$\text{Prob}(FRAUD\_LATENT = 1) = F\left(\beta_1 MW\_ENTITY + \beta_2 MW\_PROCESS + \beta'(CONTROLS)\right)$$

FRAUD_LATENT is an indicator variable equal to 1 if fraud is ongoing during year *t* and is announced after the filing date (plus seven days) of the firm's audited internal control opinion for year *t*, and 0 otherwise. *MW_ENTITY* is an indicator variable that is equal to 1 if the firm's auditor disclosed at least one entity-level material weakness over financial reporting as reported by Audit Analytics, and 0 otherwise. *MW_PROCESS* is an indicator variable that is equal to 1 if the firm's auditor disclosed at least one process-level material weakness and no entity-level material weaknesses as reported by Audit Analytics, and 0 otherwise. In the second column, five fraud observations are removed that have material weaknesses in the area of the fraud. Marginal effects are the average of discrete or partial changes over all observations (Bartus 2005). Standard errors clustered by firm are in parentheses.
Variable definitions are provided in Appendix A.

To demonstrate this more formally, we estimate Equation (3) after excluding the five instances where a material weakness area specifically corresponds with the fraud area. This exclusion results in a sample where there is no direct correspondence between the fraud and control weakness areas for all observations where $MW = 1$ and $FRAUD\_LATENT = 1$. The specific opportunity hypothesis, therefore, cannot be a factor in this sample. Results are presented in Column (2) of Table 5, and the coefficient on *MW_ENTITY* is positive and significant (p-value less than 5 percent), while the coefficient on *MW_PROCESS* is again insignificant. This evidence suggests that the positive association between unrevealed fraud and material weaknesses is

driven by instances where entity-level weaknesses exist and there is no correspondence between specific account or process weaknesses and the fraud area.[20]

As a final test of the specific opportunity story, we also dichotomize internal control weaknesses into those related to the revenue process versus all other internal control weaknesses because most frauds involve revenue (e.g., Stubben 2010; Donelson, McInnis, and Mergenthaler 2012). We perform this test to alleviate any concern with the interpretation of whether a material weakness is in the area of fraud alleged in an enforcement action or lawsuit. We rerun Model (3) (above), substituting revenue-related and non-revenue-related material weakness variables for the process and entity variables. If the specific opportunity explanation holds, then revenue-related internal control weaknesses should predict fraud revelation, while other internal control weaknesses should have much weaker or no predictive power. The results from this test (untabulated) show that revenue-related material weaknesses are unrelated to the likelihood of future fraud revelation, while non-revenue-related material weaknesses are significantly related to future fraud revelation. Overall, the evidence does not support the specific opportunity hypothesis (H2a), but does provide support for the general opportunity hypothesis (H2b).

Management Characteristic

To test H3 (i.e., a management characteristic indicates the type of firm that would have poor internal controls and managers who would commit fraud), we test whether material weaknesses are associated with non-GAAP fraud and non-latent fraud. By "non-latent," we mean that the fraud commission period does not include the period where internal controls were deemed ineffective. Non-GAAP and non-latent frauds are "non-opportunity" frauds, where a current material weakness in internal control should play no *direct* role in providing an opportunity for fraud. If existing material weaknesses predict these types of fraud, then such evidence would tend to support the management characteristic explanation.[21]

Non-latent frauds occur when fraud begins after the report date on the internal control opinion. *FRAUD_NON_LATENT* is equal to 1 if the fraud begins after year *t* and is announced after the filing date (plus seven days) of the firm's audited internal control opinion for year *t,* and 0 otherwise. Non-GAAP fraud includes securities class-action filings that *do not* contain an allegation related to misstated financial statements, but rather allege the failure to disclose regulatory investigations or other material information.[22] *FRAUD_NON_GAAP* is equal to 1 if a class-action lawsuit unrelated to accounting is announced within three years of the filing date (plus seven days) of the firm's audited internal control opinion for year *t,* and 0 otherwise.

If material weaknesses are associated with either non-latent or non-GAAP fraud, then this would be consistent with the management characteristic theory H3 because the weakness itself does not lead to an opportunity for fraud. To test H3, we estimate the following logistic regression with three separate dependent variables:

$$\begin{aligned}&\text{Prob}(FRAUD\_LATENT/FRAUD\_NON\_LATENT/FRAUD\_NON\_GAAP = 1)\\&= F(\beta_0 + \beta_1 MW + \beta_2 LN\_MARKETCAP + \beta_3 AGGREGATE\_LOSS + \beta_4 LN\_SEGCOUNT\\&\quad + \beta_5 FOREIGN\_CURRENCY\_TRANSLATION + \beta_6 EXTREME\_SALES\_GROWTH + \beta_7 MERGER\\&\quad + \beta_8 RESTRUCTURING\_CHARGE + \beta_9 BIG4 + \beta_{10} AUDITOR\_RESIGN + \beta_{11} BANKRUPTCY\_RISK)\end{aligned} \quad (4)$$

Table 6 presents the results. Material weaknesses are positively associated with latent fraud (p-value less than 5 percent in Column (1)), but unassociated with non-latent fraud (Column (2)) and non-GAAP fraud (Column (3)).[23] The Column (2) and (3) results are robust to excluding observations with latent fraud and accounting fraud, respectively. These results support the overall opportunity hypothesis, which requires the weakness period and fraud period to overlap. However, the findings do not support the management characteristic hypothesis.

To summarize, we find no support for the specific opportunity hypothesis in H2a or the management characteristic hypothesis in H3, but do find support for the general opportunity hypothesis in H2b. Therefore, our findings support the view that entity-level internal control weaknesses provide a general opportunity for managers to commit fraud.

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[20] We also performed an equivalent untabulated test where we retained only the direct correspondence frauds for the $MW = 1$ sample. Using this sample, the positive association between *MW* and unrevealed reporting fraud disappears, which again is inconsistent with the specific opportunity hypothesis. In fact, since we exclude so many non-corresponding frauds for $MW = 1$ observations, the fraud rate for this group drops dramatically, and the relation between *MW* and reporting fraud becomes negative.

[21] This could be consistent with the opportunity hypothesis if many existing material weaknesses are erroneously deemed remediated. Thus, this test is biased toward finding evidence of the management characteristic explanation.

[22] A common example of a non-GAAP suit involves an announcement of bad news (e.g., product launch failure, sluggish sales, an earnings decline, etc.), which triggers a large price decline. In a non-GAAP suit, plaintiffs would not allege that previously issued financial statements were misstated. Instead, they will allege that the entity had a duty to disclose this adverse information sooner or that management knowingly made prior false statements outside the financial statements (e.g., a conference call or press release).

[23] It is possible that the lack of association in Columns (2) and (3) is due to low power.

TABLE 6

Latent, Non-Latent, and Non-GAAP Fraud

	Logistic Regression: Dependent Variables are:		
Independent Variables	***FRAUD_LATENT*** **(1)**	***FRAUD_NON_LATENT*** **(2)**	***FRAUD_NON_GAAP*** **(3)**
MW	0.5698**	0.3337	0.1952
	(0.245)	(0.366)	(0.349)
LN_MARKETCAP	0.0894	0.5901***	0.2461**
	(0.085)	(0.134)	(0.102)
AGGREGATE_LOSS	−0.1670	−0.3731	−0.1045
	(0.298)	(0.529)	(0.426)
LN_SEGCOUNT	0.3016	−0.3749	−0.0944
	(0.211)	(0.234)	(0.183)
FOREIGN_CURRENCY_TRANSLATION	−0.2297	−0.4902	−0.4721
	(0.300)	(0.425)	(0.344)
EXTREME_SALES_GROWTH	0.4769**	0.3295	0.3614
	(0.224)	(0.278)	(0.285)
MERGER	0.8976***	0.3704	0.6977**
	(0.292)	(0.319)	(0.306)
RESTRUCTURING_CHARGE	0.1097	−0.0379	−0.0546
	(0.261)	(0.063)	(0.059)
BIG4	−0.1207	0.2909	−0.7532*
	(0.380)	(0.718)	(0.394)
AUDITOR_RESIGN	−1.0360	0.3335	−0.7402
	(0.862)	(0.811)	(1.001)
BANKRUPTCY_RISK	−0.0444	0.1438*	−0.1074**
	(0.045)	(0.077)	(0.045)
Year Fixed Effects?	Yes	Yes	Yes
Obs. where Dependent Variable = 1	139	118	112
Total Obs.	14,093	14,093	14,093
Area under the ROC Curve	0.69	0.73	0.69

*, **, *** Represent two-tailed statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.
This table reports the results of the following logistic regression for the probability of latent fraud revelation, non-latent fraud revelation, and non-GAAP fraud revelation, which controls for contemporaneous determinants of material weakness disclosure:

$$\text{Prob}(FRAUD\_LATENT/FRAUD\_NON\_LATENT/FRAUD\_NON\_GAAP = 1) = F\left(\beta_1 MW + \beta'(CONTROLS)\right)$$

FRAUD_LATENT is an indicator variable equal to 1 if fraud is ongoing during year *t* and is announced after the filing date (plus seven days) of the firm's audited internal control opinion for year *t*, and 0 otherwise. *FRAUD_NON_LATENT* is an indicator variable equal to 1 if fraud begins after year *t* and is announced after the filing date (plus seven days) of the firm's audited internal control opinion for year *t*, and 0 otherwise. *FRAUD_NON_GAAP* is equal to 1 if a class-action lawsuit unrelated to accounting is announced within three years of the filing date (plus seven days) of the firm's audited internal control opinion for year *t*, and 0 otherwise. *MW* is an indicator variable that is equal to 1 if the firm's auditor disclosed a material weakness over financial reporting as reported by Audit Analytics, and 0 otherwise. Standard errors clustered by firm are in parentheses.
Variable definitions are provided in Appendix A.

Fraud Prediction Model

While the results above demonstrate that material weaknesses predict fraud revelation, it is possible that more complete controls for fraud would drive out such a result. We do not examine this as our primary analysis because the inclusion of such variables could result in "over-controlling" for factors that are also associated with the presence of a material weakness. However, for completeness, we report the results of logistic regressions that control for indicators of ongoing fraud (i.e., the F-score from Dechow et al. [2011]) and indicators of future litigation (Kim and Skinner 2012). These regressions allow us to gauge the extent to which the material weakness variable retains its predictive ability for future fraud revelation in the face of other common fraud or litigation risk indicators. Our model is as follows:

$$\begin{aligned}\text{Prob}(FRAUD = 1) = F0(&\beta_0 + \beta_1 MW + \beta_2 LN\_MARKETCAP + \beta_3 AGGREGATE\_LOSS + \beta_4 LN\_SEGCOUNT \\ &+ \beta_5 FOREIGN\_CURRENCY\_TRANSLATION + \beta_6 EXTREME\_SALES\_GROWTH \\ &+ \beta_7 MERGER + \beta_8 RESTRUCTURING\_CHARGE + \beta_9 BIG4 + \beta_{10} AUDITOR\_RESIGN \\ &+ \beta_{11} BANKRUPTCY\_RISK + \beta_{12} FSCORE + \beta_{13} FPS + \beta_{14} RETURN \\ &+ \beta_{15} RETURN\_SKEWNESS + \beta_{16} RETURN\_STD\_DEV \\ &+ \beta_{17} TRADING\_VOLUME\_TURNOVER) \end{aligned} \quad (5)$$

FSCORE measures "the likelihood of earnings management or misstatement" (Dechow et al. 2011, 18). Equation (5) also controls for industry, stock returns, and stock volatility, as these are predictors of litigation risk (Kim and Skinner 2012). Variable definitions are in Appendix A.

Table 7 presents the results. In the first column, we include *FSCORE;* in the second column, we include litigation risk controls; and in the third column, we include all fraud predictors. The coefficient on *MW* is consistently positive and significant. From an economic perspective, the marginal effect for firm-years with a material weakness is between 1.06 and 1.18 percentage points, which is approximately 66 and 74 percent of the 1.60 percent unconditional probability of fraud. This is consistent with disclosed material weaknesses within auditor internal control opinions being a significant predictor of future fraud revelation within three years. In fact, it appears to be a better predictor of fraud than extant predictors such as *FSCORE*.[24]

Additional Analysis and Robustness Tests

Do Internal Control Weakness Disclosures Mechanically Lead to Fraud Filings?

In our main tests, we protect against a mechanical relation between fraud and material weaknesses by requiring the fraud be revealed at least seven days after the internal control opinion. However, it is possible that when choosing between otherwise identical cases, plaintiffs' attorneys and regulators (i.e., the SEC or DOJ) may select cases with material weaknesses because this item represents one more fact that strengthens their case. In other words, material weaknesses could merely provide stronger cases for attorneys or lead to heightened suspicions or investigations, which, in turn, lead to greater uncovering of accounting fraud.

To address this issue, we read the internal control opinions, as well as the first complaint filed by plaintiffs, in the related lawsuit or the enforcement action from the SEC or the DOJ for all frauds with a prior adverse internal control opinion. Of these 36 frauds, only three mention the specific material weaknesses from the associated internal control opinion.[25] We then drop these three firm-years from our analyses. Results from both the regression and propensity-score analyses are robust to dropping these frauds. The logic of this approach is that to the extent that the material weakness provides a stronger case or aids in the actual revelation of the fraud, there is no apparent reason that the lawyers from the SEC or Department of Justice or the lawyers representing the plaintiffs would not mention the adverse internal control opinion.

Do Auditors Discover Fraud Due to Additional Procedures?

Prior studies suggest that auditors perform more substantive procedures when material weaknesses are present (Hogan and Wilkins 2008). It is possible that auditors continue to perform additional substantive procedures in the year after the material weakness because the past material weakness increases the perceived risk of material misstatement of the client. These additional procedures could increase the chance of fraud discovery and be the reason there is a positive association between material weakness disclosure and future fraud revelation. To test this possibility, we control for *ABNORMAL_AUDIT_FEES,* which is the year *t*+1 residual of an audit fee regression based off of Equation (2) from Hogan and Wilkins (2008) that is estimated for all public nonfinancial firms for years 2004 through 2012 covered by both Compustat and Audit Analytics.[26] In untabulated results, the coefficient on *MW* remains positive and significant after controlling for *ABNORMAL_AUDIT_FEES*.

Using FSCORE to Proxy for Underlying Fraud

The common theme in both of the alternative explanations above (weakness disclosures mechanically leading to filings or greater auditor investigation) is that material weakness disclosures do not increase the underlying incidence of fraud, but instead

[24] While *FSCORE* is insignificant in the test, this is driven by the *EXTREME_SALES_GROWTH* variable, which is correlated with the sales growth variable in *FSCORE*. If we exclude *EXTREME_SALES_GROWTH,* then the coefficient on *FSCORE* is positive, with a p-value less than 15 percent (two-tailed).

[25] All 36 frauds preceded by a material weakness are included in the regression analysis presented in Table 3. Thirty-five of these are included in the propensity-score analysis presented in Table 4, Panel C. One was dropped because an appropriate match (i.e., control firm-year) could not be found.

[26] We do not include *MW* in the audit fee regression to prevent *ABNORMAL_AUDIT_FEES* from being mechanically orthogonal to *MW*.

TABLE 7

Fraud Prediction Model

Logistic Regression: Dependent Variable is *FRAUD*

Independent Variables	(1)	(2)	(3)
MW	0.6334***	0.6423**	0.5944**
	(0.245)	(0.250)	(0.249)
LN_MARKETCAP	0.0974	0.1234	0.0879
	(0.090)	(0.099)	(0.093)
AGGREGATE_LOSS	−0.3747	−0.4170	−0.4594
	(0.310)	(0.328)	(0.337)
LN_SEGCOUNT	0.4164**	0.3990**	0.4159**
	(0.204)	(0.194)	(0.207)
FOREIGN_CURRENCY_TRANSLATION	−0.3235	−0.3790	−0.3225
	(0.258)	(0.253)	(0.256)
EXTREME_SALES_GROWTH	0.6306***	0.5779***	0.6381***
	(0.233)	(0.218)	(0.226)
MERGER	0.8270***	0.7169***	0.7854***
	(0.272)	(0.269)	(0.270)
RESTRUCTURING_CHARGE	0.0906	0.0848	0.0920
	(0.112)	(0.083)	(0.089)
BIG4	−0.2114	−0.1798	−0.2095
	(0.345)	(0.350)	(0.349)
AUDITOR_RESIGN	−0.1208	−0.1490	−0.1660
	(0.639)	(0.640)	(0.646)
BANKRUPTCY_RISK	−0.0149	−0.0657	−0.0599
	(0.049)	(0.070)	(0.073)
FSCORE	−0.0009		0.0006
	(0.003)		(0.003)
FPS		0.4325*	0.5306**
		(0.243)	(0.250)
RETURN		−0.4240	−0.4517
		(0.273)	(0.291)
RETURN_SKEWNESS		−0.1572	−0.1817*
		(0.108)	(0.108)
RETURN_STD_DEV		0.7570	0.6712
		(1.860)	(1.905)
TRADING_VOLUME_TURNOVER		0.0028*	0.0024**
		(0.002)	(0.001)
Year Fixed Effects?	Yes	Yes	Yes
Obs. where Dependent Variable = 1	153	163	153
Total Obs.	10,270	10,806	10,270
Area under the ROC Curve	0.69	0.71	0.72

*, **, *** Represent two-tailed statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.
This table reports the results of the following logistic regression for the probability of fraud revelation, which controls for contemporaneous determinants of material weakness disclosure and contemporaneous determinants of fraud included in Dechow et al. (2011) and Kim and Skinner (2012):

$$\text{Prob}(FRAUD = 1) = F\left(\beta_1 MW + \beta'(CONTROLS)\right)$$

FRAUD is equal to 1 if fraud is announced within three years of the filing date (plus seven days) of the firm's audited internal control opinion for year *t*, and 0 otherwise. *MW* is an indicator variable that is equal to 1 if the firm's auditor disclosed a material weakness over financial reporting as reported by Audit Analytics, and 0 otherwise. Column (1) includes the F-score from Dechow et al. (2011). Column (2) includes control variables from the litigation risk model two of Kim and Skinner (2012). Column (3) includes both the F-score from Dechow et al. (2011) and the control variables from the litigation risk model of Kim and Skinner (2012). Columns (1) and (3) have fewer observations than Column (2) because of data requirements to calculate *FSCORE*. Standard errors clustered by firm are in parentheses.
Variable definitions are provided in Appendix A.

increase the incidence of fraud detection and/or prosecution. To further guard against this possibility, we examine *FSCORE,* developed by Dechow et al. (2011) as a proxy for underlying fraud commission. In our propensity-matched analysis, we find the mean *FSCORE* in year *t* for the treatment group is more than double the mean for the control group (1.41 versus 0.60, $p = 0.05$, untabulated).[27] Results are similar for *HIGHFSCORE,* an indicator variable set to 1 for the highest quintile of *FSCORE* in our sample ($p < 0.01$, untabulated).[28] When we estimate Equation (1) after replacing the dependent variable with the *HIGHFSCORE* in year *t,* the coefficient on *MW* is positive and significant ($p < 0.05$, untabulated). These results suggest that the underlying commission of fraud, not just its revelation, is higher for firms with material weakness opinions. Thus, it is unlikely that reverse causation—disclosure of material weaknesses triggering SEC investigations or securities lawsuits—is driving our main inferences.

The results above also help rule out other potential detection-related explanations for our findings. For example, not all material weaknesses are disclosed, and some managers may have more skill in suppressing disclosures. Additionally, if the same managers are able to conceal both fraud and material weaknesses, then the positive association we observe between material weakness disclosure and future fraud revelation may be driven by managerial ability. However, based on *FSCORE,* the underlying incidence of fraud appears higher among firms with material weaknesses, which suggests that managerial ability to suppress control weaknesses and fraud is not driving our main inferences.[29]

Number of Areas Affected by the Material Weaknesses

We next test whether the pervasiveness of internal control issues drives our findings. *MW_SUM* is a count of the areas associated with the material weaknesses disclosed in the internal control opinion as coded by Audit Analytics. Higher counts reflect more pervasive issues. In untabulated results, the coefficient on *MW_SUM* is positive and significant when omitting *MW* from the regression. However, it is insignificant when *MW* is included, and the coefficient on *MW* remains positive and significant.[30] Overall, this suggests that it is the area of the material weakness (i.e., entity-level) that matters for future fraud revelation.

Are Material Weaknesses Really Just a Proxy for Poor Accrual Quality?

Accrual quality is negatively associated with material weaknesses (Ashbaugh-Skaife et al. 2008; Doyle et al. 2007a), suggesting that weak controls lead to worse accrual quality. There is mixed evidence as to whether accrual quality is associated with fraud. For example, Jones, Krishnan, and Melendrez (2010) provide evidence that accrual quality is positively associated with fraud. However, Price, Sharp, and Wood (2011) find little to no correlation between accrual quality and observable measures of fraud. Additionally, Ashbaugh-Skaife et al. (2008) report that the relation between material weaknesses and accrual quality is driven by errors. Our results are robust to controlling for *ACCRUAL_QUALITY,* which is the standard deviation of the residuals from Dechow and Dichev (2002), as implemented by Doyle et al. (2007a), for years *t*–4 to *t*.

Remediation versus Recurrence of Material Weaknesses

Next, we investigate whether the recurrence or remediation of material weaknesses affect the results because prior studies find that earnings quality improves after remediation (e.g., Ashbaugh-Skaife et al. 2008). We reestimate Equation (1) and include an indicator equal to 1 when there is an adverse internal control opinion in both *t* and *t*+1 and the *t*+1 opinion is not mechanically related to the fraud revelation (i.e., it has to be filed before seven days of the fraud revelation). In this untabulated test, the coefficient on the recurring material weakness indicator is insignificant, while the coefficient on *MW* remains positive and significant (p-value less than 1 percent). This does not support the proposition that recurrence or remediation of material weaknesses affect the likelihood of future fraud revelation.[31]

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[27] We exclude *EXTREME_SALES_GROWTH* from the matching regression because it is a determinant of *FSCORE*.

[28] Dechow et al. (2011) indicate that the majority of revealed frauds fall in the top quintile of *FSCORE*.

[29] We also ran a bivariate probit model similar to Wang (2011), which jointly estimates fraud incidence and detection models. We find a positive coefficient on *MW* (p-value of 18.1 percent) in the incidence regression. However, we could not reject the null that there was no correlation across the incidence and detection equations (p-value of 99.1 percent), suggesting that this bivariate model is either not well specified or inappropriate for our sample.

[30] The results are also robust to including a count of the material weaknesses (as opposed to a count of the material weakness areas) as reported by Audit Analytics.

[31] In our matched-pairs analysis, we also examined how remediation affected fraud duration. For each firm-year in the matched-pairs analysis that is (1) associated with future fraud, and (2) preceded by an adverse internal control opinion, we read subsequent opinions and find that 18 out of 35 were fully remediated because they have an unqualified internal control opinion prior to fraud revelation. Three had no full remediation (i.e., a repeat *MW*), while 14 were indeterminate because there were no other opinions before fraud revelation. In univariate tests, the 18 firm-years with remediated material weaknesses are associated with a *longer* time to fraud revelation than the other 17 firm-years ($p < 0.01$), which seems inconsistent with remediation of control weaknesses reducing fraud risk. It is unclear how to interpret these results, however. As firms have incentives to report remediated material weaknesses, it is possible that material weaknesses associated with future fraud revelation are not remediated despite the absence of a recurring material weakness in the auditor's internal control opinion. That is, perhaps management does enough to satisfy the auditor and receive a "clean" opinion, but does not fully remediate the underlying weakness in place.

AS 2 versus AS 5

Our sample includes 10,598 observations with year-ends prior to November 15, 2007 (i.e., the AS 2 regime) and 3,495 observations with year-ends at or later than November 15, 2007 (i.e., the AS 5 regime). When estimating our main regressions separately on each sample, inferences remain unchanged for the AS 2 sample, but material weaknesses are not associated with future fraud for the AS 5 sample (e.g., coefficients on *MW* and *MW_ENTITY* are insignificant) (untabulated).[32] However, our sample essentially only includes one year of AS 5 opinions, and many of the frauds matched to AS 2 internal control opinions were revealed during the AS 5 regime. Thus, inferences from our sample regarding the effect of each regime on internal control weaknesses and fraud should be interpreted with caution.

SOX 302 Material Weaknesses versus SOX 404 Material Weaknesses

In untabulated tests, we added an indicator to the main regression (Equation (1)) that equals 1 if a 302 disclosure from any of the first three quarters for the year stated that disclosure controls were ineffective. The coefficient on this variable is positive, but insignificant (p-value = 0.61). The coefficient on *MW* is 0.5845, with a p-value of 0.004. If we interact the 302 variable with *MW,* then the coefficient on the interaction is insignificant and the coefficient on *MW* remains positive and significant (p-value = 0.01). Thus, the association between internal control weaknesses and future fraud revelation is confined to 404 weaknesses.

Other Robustness Tests

We also perform several additional robustness tests. First, we separately examine SEC enforcement actions and securities class actions. Results are somewhat stronger using enforcement actions as the dependent variable as compared to securities class actions. Second, after excluding the 12 cases that do not explicitly name either the CEO or CFO, results remain robust. Third, inferences remain the same after controlling for director, CEO, CFO, and auditor appointments during the revelation window. Thus, our inferences are robust to controlling for the concern that a "fresh set of eyes" might be increasing the likelihood of fraud disclosure.

Fourth, we test whether restatements drive our results. We control for *RESTATEMENT,* an indicator variable equal to 1 if there is a restatement announced on the filing date or within 365 days before the filing date of the auditor's internal control opinion for year *t* as reported by Audit Analytics. Results are robust to controlling for restatement announcements. Also, inferences remain similar even if we control for restatement announcements that occur within the 90 days subsequent to the filing date of the auditor's internal control opinion for year *t*.

CONCLUSION

This study finds a statistically and economically significant association between material weaknesses and the future revelation of fraud. This association is driven entirely by instances where the internal control issue reflects a general opportunity to commit fraud (as captured by entity-level material weaknesses) rather than account- or process-specific control deficiencies.

Our findings have implications for financial statement users, accounting scholars, policymakers, standard setters, and auditors. For users, our results indicate that the issuance by an auditor of an adverse internal control opinion is a "red flag," indicating a higher probability that managers are committing (unrevealed) fraud. Further, the type of internal control weakness is important from a fraud prediction standpoint. For researchers, our findings imply that fraud and/or litigation prediction models should control for internal control weaknesses. For policymakers and regulators, our findings indicate that SOX Section 404(b) provides a potential benefit of an early warning system for future fraud revelation. Given the criticisms of SOX (e.g., Romano 2005) and discussion in favor of its repeal or curtailment (e.g., Rosen 2011), this benefit is an important consideration alongside the costs of internal control reporting. Policymakers and regulators could also consider ways to improve the accuracy of material weakness disclosures.

Our results support the premise of Auditing Standard No. 5 that certain entity-level controls reduce the risk of material misstatement due to fraud. Our sample is mostly from the time before the effective date of Auditing Standard No. 5. Although we expect that inferences generalize to future time periods, future research could examine whether this is so. It is possible that the shift in focus by auditors from a "bottom up" approach under Auditing Standard No. 2 to a "top down" approach in Auditing Standard No. 5 resulted in auditors performing greater substantive procedures relating to entity-level material weaknesses. If so, then the relation between disclosed entity-level material weaknesses and future fraud revelation could be

[32] If, instead of estimating the regressions separately for each period, we include an indicator for AS 5 and interact it with *MW* or *MW_ENTITY,* inferences are the same (i.e., the coefficients on the interaction terms are insignificant).

weaker than what we find. Our results are also consistent with auditors not sufficiently expanding the scope of audit procedures in the presence of internal control weaknesses to negate the heightened fraud risk. This is an avenue for future research. Finally, future research could examine whether auditor expertise or other characteristics mitigate the relation between material weaknesses and the future revelation of financial reporting fraud.

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APPENDIX A

Variable Definitions

Variable[a]	Definition
MW	An indicator variable that is equal to 1 if the firm's auditor disclosed a material weakness over financial reporting as reported by Audit Analytics, and 0 otherwise.
MW_ENTITY	An indicator variable that is equal to 1 if the firm's auditor disclosed at least one entity-level material weakness over financial reporting as reported by Audit Analytics, and 0 otherwise. Entity-level material weaknesses are those where Audit Analytics identifies (1) non-routine transaction control issues (code 77); (2) journal entry control issues (code 76); (3) foreign, related-party, affiliated, or subsidiary issues (code 38); (4) an ineffective, nonexistent, or understaffed audit committee (code 11); (5) senior management competency, tone, or reliability issues (code 13); (6) an insufficient or nonexistent internal audit function (code 18); (7) ethical or compliance issues with personnel (code 21); or (8) accounting personnel resources, competency, or training issues (code 44). Audit Analytics' codes are in parentheses.
MW_PROCESS	An indicator variable that is equal to 1 if the firm's auditor disclosed at least one process-level material weakness and no entity-level material weaknesses as reported by Audit Analytics, and 0 otherwise.
MW_SUM	A count of the areas associated with the material weaknesses disclosed within the internal control opinion as coded by Audit Analytics.
FRAUD	An indicator variable equal to 1 if fraud is announced within three years of the filing date (plus seven days) of the firm's audited internal control opinion for year *t,* and 0 otherwise. Frauds are made up of (1) SEC and Department of Justice enforcement actions that establish intent under Section 17(a) of the Securities Act of 1933, or either Section 10(b) (including Rule 10b-5) or 13(b)(5) of the Securities Exchange Act of 1934 per the Federal Securities Regulation Database; and (2) settled securities class-action lawsuits that allege violations of Generally Accepted Accounting Principles per RiskMetrics.
FRAUD_NO_DUPS	An indicator variable equal to 1 if fraud is announced within three years of the filing date (plus seven days) of the firm's audited internal control opinion for year *t,* and 0 otherwise. For firm-years from fraud firms, only the first firm-year within the three-year window is kept. All firm-years other than the first firm-year within the three-year window are excluded.
FRAUD_LATENT	An indicator variable equal to 1 if fraud is ongoing during year *t* and is announced after the filing date (plus seven days) of the firm's audited internal control opinion for year *t,* and 0 otherwise.
FRAUD_NON_LATENT	An indicator variable equal to 1 if the fraud begins after year *t* and is announced after the filing date (plus seven days) of the firm's audited internal control opinion for year *t,* and 0 otherwise.
FRAUD_NON_GAAP	An indicator variable equal to 1 if a class-action lawsuit unrelated to accounting is announced within three years of the filing date (plus seven days) of the firm's audited internal control opinion for year *t,* and 0 otherwise.
LN_MARKETCAP	The natural log of market capitalization (PRCC_F $*$ CSHO).
AGGREGATE_LOSS	An indicator variable equal to 1 if earnings before extraordinary items (IB) in years *t* and *t* -1 sum to less than zero, and 0 otherwise.
LN_SEGCOUNT	The natural log of the sum of the number of operating and geographic segments reported by the Compustat Segments database for the firm.
FOREIGN_CURRENCY _TRANSLATION	An indicator variable that is equal to 1 if the firm has a non-zero foreign currency translation (FCA), and 0 otherwise.
EXTREME_SALES_ GROWTH	An indicator variable that is equal to 1 if year-over-year industry-adjusted sales growth (SALE) falls into the top quintile, and 0 otherwise.
MERGER	An indicator variable that is equal to 1 if the firm has a non-zero acquisition expense (AQP) in years *t* or $t-1$, and 0 otherwise.
RESTRUCTURING_ CHARGE	The aggregate restructuring charges (RCP $*$ -1) in years *t* and $t-1$ scaled by the firm's year *t* market capitalization (CSHO $*$ PRCC_F).

(continued on next page)

APPENDIX A (continued)

Variable[a]	Definition
BIG4	An indicator variable that is equal to 1 if the firm engaged one of the largest four audit firms as reported by Audit Analytics. The largest four audit firms include Deloitte, Ernst & Young, KPMG, and PricewaterhouseCoopers.
AUDITOR_RESIGN	An indicator variable that is equal to 1 if the firm experienced an auditor resignation in year *t* as reported by Audit Analytics.
BANKRUPTCY_RISK	The decile rank of the percentage probability of bankruptcy in year *t* from the default hazard model prediction based on Shumway (2001). Note: higher score translates to higher probability of bankruptcy.
FSCORE	Equals the predicted probability from Model (1) of Dechow et al. (2011) divided by the unconditional fraud rate of 0.0037 in Dechow et al. (2011).
HIGHFSCORE	An indicator variable that is equal to 1 if a firm in year *t* has an *FSCORE* in the top quintile of the sample, and 0 otherwise.
FPS	Equals 1 if the firm is in the biotech (SIC codes 2833–2836 and 8731–8734), computer (3570–3577 and 7370–7374), electronics (3600–3674), or retail (5200–5961) industry, and 0 otherwise.
RETURN	Market-adjusted stock return for year *t*.
RETURN_SKEWNESS	Skewness of the firm's stock return for year *t*.
RETURN_STD_DEV	Standard deviation of the firm's stock return for year *t*.
TRADING_VOLUME_ TURNOVER	Trading volume accumulated over year *t*.
ABNORMAL_AUDIT_FEES	The year *t*+1 residual of an audit-fee regression based off of Equation (2) from Hogan and Wilkins (2008) that is estimated for all public nonfinancial firms for years 2004 through 2012 covered by both Compustat and Audit Analytics. We do not include a material weakness variable when estimating *ABNORMAL_AUDIT_FEES* so that our estimate is not mechanically orthogonal to *MW*.
RESTATEMENT	An indicator variable that is equal to 1 if there is a restatement announced on the filing date or within 365 days before the filing date of the auditor's internal control opinion for year *t* as reported by Audit Analytics.
ACCRUAL_QUALITY	The standard deviation of the residuals from Dechow and Dichev (2002), as implemented by Doyle et al. (2007a), for years *t*−4 to *t*. The proxy for accrual quality is estimated cross-sectionally within each two-digit SIC code and year.

[a] Data come from Audit Analytics, Compustat, CRSP, RiskMetrics, and the Securities Regulation Database. Compustat variable names are in parentheses.