Association for Information Systems

AIS Electronic Library (AISeL)

PACIS 2019 Proceedings

Pacific Asia Conference on Information Systems (PACIS)

6-15-2019

CIO Turnover and Subsequent Remediation of Information Technology Material Weaknesses

Wanyun Li
Australian National University, wanyun.li@anu.edu.au

Dixin Wu
Australian National University, dixin.wu@anu.edu.au

Soon-Yeow Phang
Monash University, soon-yeow.phang@monash.edu

Ka Wai Choi
Australian National University, stanley.choi@anu.edu.au

Follow this and additional works at: https://aisel.aisnet.org/pacis2019

Recommended Citation

CIO Turnover and Subsequent Remediation of Information Technology Material Weaknesses

Indicate Submission Type: Completed Research Paper

Wanyun Li
Australian National University
Australia
wanyun.li@anu.edu.au

Dixin Wu
Australian National University
Australia
dixin.wu@anu.edu.au

Soon-Yeow Phang
Monash University
Australia
soon-yeow.phang@monash.edu

Ka Wai Choi
Australian National University
Australia
stanley.choi@anu.edu.au

Abstract

Extending the line of prior research on information technology material weaknesses (ITMWs) in internal controls, our study examines whether chief information officer (CIO) turnover is affected by the disclosure of ITMW and whether CIO turnover will affect subsequent remediation of ITMW. We find that ITMW disclosure exerts a negative influence on CIO turnover, which adds to prior findings on the effects of ICMW disclosure leading to chief executive officer (CEO) turnover and chief financial officer (CFO) turnover. Further, we find that CIO turnover exerts a positive influence on subsequent ITMW remediation. It indicates that CIO dismissals and replacements do promote the success of subsequent ITMW remediation.

Keywords: CIO turnover, information technology material weaknesses, internal control, remediation, SOX Section 404

Introduction

The purpose of this study is to examine information technology material weaknesses (ITMWs) and the subsequent remediation of these material weaknesses in relation to chief information officer (CIO) turnover. ITMWs refer to material deficiencies in information technology (IT) that jeopardise overall internal control, expose firms to vulnerability and risks and impair the legitimacy of firms (Considine et al. 2012). Accordingly, numerous federal and state legislations including the Section 404 of Sarbanes-Oxley Act (SOX) have added requirements for maintaining an effective IT control system, giving the issue of ITMWs increased prominence among firms. In light of the importance of IT control, we examine the association between ITMWs and CIO turnover and their influence on the subsequent remediation of ITMWs.

SOX highlights the responsibility of executives in public firms for establishing, evaluating, and monitoring the effectiveness of internal control (including IT control) over financial reporting and disclosure. As with Section 404, executives and external auditors must report in the adequacy of their firm's internal control over financial reporting (Karanja and Zaveri 2014). Further, Section 302 specifies that the chief executive officer (CEO) and chief financial officer (CFO) must personally certificate the evaluation of internal control effectiveness and disclosure of any material weaknesses in

financial statements both quarterly and annually (Goh 2009). The Section 302 also has a trickle-down effect regarding CEOs and CFOs'certification. CEOs and CFOs are often not IT experts. Therefore, some CEOs and CFOs that are required to certify their internal controls turn to the leaders of their IT units such as CIOs and ask them to certify IT control evaluation as well (Damianides 2005). Accordingly, CIOs are also held accountable for ITMWs (Damianides 2005; Masli et al. 2016).

Since ITMWs signal material deficiencies in internal control system, the existence of ITMWs is considered as a significant financial reporting failure (Haislip et al. 2015) and thereafter threatens a firm's legitimacy. The legitimacy of a firm refers to "the generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (Suchman 1995). Firms obtain and maintain their legitimacy by implementing socially accepted policies and procedures (Haislip et al. 2015). It is crucial for a firm as it increase firms' access to various important resources such as financial capital, experienced managers, qualified employees, government support, and advanced technology (Feldmann et al. 2009). Conversely, the cost to a firm that fails to defend legitimacy is relatively high. In a setting where a firm faces an event that impairs its legitimacy, they often adopt two methods to repair legitimacy: disassociation and creation of a monitoring mechanism (Haislip et al. 2015). To elaborate, firms can repair their legitimacy and restore the public's confidence in firms by dismissing chief executives who are accountable for IT controls effectiveness (Li et al. 2017). As a further step, firms often establish a monitoring mechanism to address the deficiency and to ensure the problem does not repeat in the future (Haislip et al. 2015). Such creation includes the replacement of the dismissed chief executives with new chief executives who has better IT expertise. Prior studies find that firms that disclose ITMWs work to repair legitimacy by dismissing their CEOs and CFOs to signal the market that they are determined to remedy ITMWs (Haislip et al. 2015; Li et al. 2017). However, CIOs are the most senior executive who are accountable for IT control effectiveness directly. CIOs are senior executives who are responsible for overseeing IT infrastructures, runs the firm's internal IT operations, and aligns the firm's IT infrastructure with business priorities (Chun and Mooney 2009). In addition, the CIO role is viewed as vital for reducing expenditure and limiting damage by setting and maintaining internal control and planning for possible disasters. As a result, CIOs have a significant corporate presence, with them most often reporting directly to CEOs or CFOs (Luftmann and Kempaiah 2008). Do ITMWs lead to the turnover of CIOs, rather than CEOs and CFOs? To our knowledge, prior studies merely focus on CEO and CFO turnover (Haislip et al. 2015; Johnstone et al. 2011; Li et al. 2017), and few have examined the association between ITMW disclosure and CIO turnover. Adding to this, we examine the implication of ITMW disclosure on CIO turnover.

Can the executive turnover after ITMW disclosure promote subsequent remediation? Prior research (Haislip et al. 2015; Li et al. 2017) shows that firms that dismiss current CEOs and replace outgoing CEOs are more likely to promote subsequent remediation relative to firms that retain their CEOs. As for CFOs, prior research provides mixed findings. For instance, Haislip et al. (2015) find that firms with new CFOs are more likely to remediate ITMWs in a timely manner. However, Li et al. (2017) find that appointment of new CFOs does not promote subsequent remediation. Thus, further research is warranted to explore the association between ITMW disclosure and CFO turnover. To our knowledge, scant research examines the implication of CIO turnover on remediation of ITMWs. Extending on this, our study examines whether CIO turnover does influence the subsequent remediation of ITMWs.

To test our hypothesis, we employ two logistic regression models. The first one measures the influence of ITMW disclosure on CIO turnover. The dependent variable of interest is CIO turnover in year t+1, and the independent variable is ITMW disclosure in year t. The second one measures the influence of CIO turnover on subsequent ITMW remediation. The dependent variable is ITMW remediation in year t+2, and the independent variable is CIO turnover in year t+1. The results of first model show that ITMW disclosure exerts a negative effect on CIO turnover. Firms that disclose ITMWs are less likely to experience CIO turnover relative to firms without ITMW disclosure. The results of the second model show that CIO turnover exerts a positive effect on subsequent ITMW remediation. Firms that replace their current CIOs with new ones are more likely to successfully remedy ITMW than firms that retain their current CIOs.

Our study makes theoretical and practical contributions. Theoretically, prior research on ITMWs and chief executives' turnover only focus on CEOs and CFOs. Adding to this, we explore how ITMW disclosure impacts CIO turnover. We further explore the impact of CIO turnover on subsequent ITMW remediation. We provide a more complete understanding of the association between ITMWs and chief executives' turnover and the underlining factors that influence ITMW remediation. Practically, our study has implication for managers dealing with ITMW disclosure and ITMW remediation. Firms lean to replace CEOs and CFOs in the wake of ITMW disclosure however replacing CEOs and CFOs may not be the only mean to help repair ITMW. On top of CEOs and CFOs turnover, replacing CIOs can further increase the ITMW remediation rate.

Literature Review and Hypothesis Development

ITMW and CIO Turnover

IT controls are crucial enablers of the operation of strong financial controls in a company (White 2014). According to Haislip et al. (2015) compared with other types of internal control material weaknesses, ITMWs have a more adverse influence on the control environment, risk assessment, and monitoring, resulting in less reliable financial reporting and generating more negative consequences. These adverse effects cause lower levels of earnings performance (Stoel and Muhanna 2011), less accurate management forecasts (Li et al. 2012), and a higher number of future internal control material weaknesses (Klamm et al. 2012). The disclosure of ITMWs signals to the general public that executives are not capable of maintaining the effectiveness of IT controls over financial reporting. Also, it often brings adverse market reactions. For instance, initial public offering firms with deficiencies in internal controls often have higher audit fees and this implies that auditors perceive these firms to have the increased risk posed by such deficiencies (Lee 2016). In addition, stock prices react negatively to the disclosure of internal control material weaknesses (Hammersley et al. 2008). Investors often re-evaluate their prior assessment of the quality of management when their firms encounter deficiencies in internal controls, because investors are less confident in the executives' oversight over financial reporting or their accounting information systems (Hammersley et al. 2008). Thus, investors may perceive a higher information risk that manifests in a higher cost of capital. Taken together, ITMW disclosure is a signal of the executives' lack of understanding of IT controls, damages the legitimacy of a firm and brings adverse market reactions. Accordingly, firms have to take action to mitigate the damage of legitimacy caused by ITMWs.

One way to mitigate this damage is to dismiss executives in charge and appoint new executives as part of improving monitoring mechanism. Firms adopt this approach in the encounter of negative performance shocks (Jenter and Kanaan 2015), financial restatements (Arthaud-Day et al. 2006), or decline in profitability (Dimopoulos and Wagner 2016). Through the turnover of executives, firms send a positive signal to the public and inform the public that the firms have a stronger intention to address the damage caused by the related executives. Given that the disclosure of ITMWs weakens firms' legitimacy, it is anticipated that ITMWs would lead to the turnover of related executives.

Under SOX Section 404, CEOs and CFOs are required to assess the effectiveness of IT control and identify ITMW as part of internal control (Ge and McVay 2005). However, CEOs and CFOs do not hold direct responsibility for ITMW because they are not accountable for proper assessment and monitoring of IT control procedures (Yayla and Hu 2014). CIOs have responsibility for the protection of accounting and financial information, and the documents on which the public relies in making investment decisions rest with the IT activities (Karanja and Zaveri 2014). Being the most IT-knowledgeable person, CIOs are constantly consulted by other senior executives for decision-making in implementing IT initiatives associated with the SOX Act (Karanja and Zaveri 2014). They track the progress of IT initiatives and issues, and report ITMWs to CEOs and CFOs (Karanja and Zaveri 2014). Given that CIOs' direct responsibilities are linked to the effectiveness of IT controls, it is expected that CIOs would be held accountable for ITMW. They would be penalized for poor performance outcomes in the encounter of ITMW. Therefore, we anticipate that the disclosure of ITMW has a positive influence on the subsequent CIO turnover.

>   *H1: The disclosure of ITMWs is positively associated with subsequent CIO turnover.*

Remediation of ITMWs and CIO Turnover

Remediation is a situation in which a firm discloses internal control material weaknesses in 10-K filings under SOX Section 404 and then, later, that the same firm discloses that internal controls were deemed effective suggesting these material weaknesses no longer exist (Hee 2013). Remediation of ITMWs is important because these deficiencies are significant threats to a firm's daily operation, and to enhance the quality of financial reporting and restore confidence in financial reporting, firms have to take action (Goh 2009), thereby repairing their legitimacy. Firms that reports remediation plans to correct deficiencies would experience less adverse market reactions such as less decrease in their stock price compared with firm that do not initiate such plans (Rezaee et al. 2012). However, the failure to remediate deficiencies leads to adverse market reactions in the form of higher audit fees (Munsif et al. 2011), poorer credit ratings and higher interest rates (Hammersley et al. 2012).

While ITMWs firms may work to restore their damaged legitimacy by dismissing current CIOs and replacing new ones, it is unclear whether such steps effectively promote the remediation of ITMWs (Haislip et al. 2015). The passing of shift in CIOs is rarely simple and smooth, and thereby will stimulate changes in firms' internal structures, processes and management. Thus, it is hard to say that the change of CIOs will generally promote the remediation of ITMWs or not. Existing literature discusses two competing arguments to explain the influence of chief executives turnover on firms' performance (Boyne et al. 2011). The first one, which is termed as the 'disruptive view of organization change', suggests that the change of chief executives in a firm is disruptive and causes a decline in firms' performance (Boyne et al. 2011). To start with, current chief executives often hold unique and valuable firm-specific knowledge that acquired from their past experience in the firm (Wang et al. 2017). Such knowledge is highly idiosyncratic and tailor-made for specific situations, and is very difficult to be transferred or imitated (Wang et al. 2017). Therefore, chief executives turnover will lead to loss of such knowledge. In the context of CIO turnover, current CIOs are often directly involved in the generation of firm-specific knowledge of their IT infrastructures and IT employee skills (Menon and Williams 2008), and are able to distribute resources to avenues that are mostly likely to remedy ITMWs contrast with new CIOs. Second, a stable relation between chief executives and employees that promotes mutual understanding and trust is important to encourage employees to follow their firm's strategies. In other words, the introduction of new CIOs will destabilize the current IT tram and disrupt the relation between CIO and employees, which is likely to create conflicts and distractions in the IT team (Boyne et al. 2011; Wang et al. 2017). The consequence is a reduction in the ability to remedy ITMWs.

On the other hand, the second argument, which is termed as the 'common sense model', suggests that chief executives turnovers make positive difference to firms' performance. This argument reflects the view that new chief executives bring new ideas and knowledge that shape the strategy of their firms, which is a crucial determinant of the performance of the firm (Boyne et al. 2011). In the case of CIO turnover, as new CIOs will bring a better fit between IT infrastructure and firms' strategy, they are expected to lead better remediation of ITMWs. The argument is also consistent with the theory of escalation of commitment. Beginning with Staw's (1976) research on escalation of commitment, a large body of literature has shown that chief executives often continue to invest in a project even when the project is falling. The escalation of commitment is, therefore, detrimental to firms' performance as it restrains chief executives from taking optimal course of actions (Wang and Wong 2012). Following the same argument, current CIOs tend to overly commit in their initial project and are reluctant to admit their mistakes and make remediation. Overall, it suggests that CIO turnover produces improvement in ITMW remediation. Between the two competing arguments, we follow the later one, and posit that CIO turnover has a positive influence on the subsequent remediation of ITMW.

H2: CIO turnover is positively associated with ITMW remediation in the subsequent year.

Research Design

Sample Selection

We construct our sample by identifying all firms from Audit Analytics SOX 404 Internal Controls during the period from 2004 to 2015. Audit Analytics classifies internal control material weaknesses

reported in firms'annual SEC fillings into non-IT related and IT related types. Consistent with prior research, we record ITMW for each firm-year (Stoel and Muhanna 2011) as binary. The value '1' indicates that the firm has at least one ITMW in the given year. The value '0' indicates that the firm has no ITMW. Secondly, we obtain director and officer turnover data from Audit Analytics Director and Officer Changes. It provides the data on turnovers of CEO and CFO but limited data on turnovers of CIO. We then remove firm-year observation without financial data from Compustat. Finally, for firms with no CIO data from Audit Analytics, we conduct a manual search. In the manual data collection process, we search online information sources such Linkedin, Businessweek, Forbes and The Wall Street Journal. In the manual process, we loss a significant number of observations because there is no CIO data. The resultant dataset contains 7,112 firm-year observations from 890 distinct firms.

For remediation of ITMW, we read SOX Section 404 fillings for firms that reported ITMW in year t, and manual code whether the ITMW has been remedied in year t+2. In Table 1, Panel A and Panel B present the sample reconciliation used in testing H1 and H2 respectively. The sample used to test H1 consists of 7,112 firm-year observations. It then shrinks to 890 firm-observation in testing H2. Note that remediation is defined only when a firm has an ITMW disclosure in a previous year. Hence the test for H2 applies only to those observations with ITMW disclosure in H1. We further restrict our sample to firms with at least three consecutive years of data, and it reduced the sample to 428 firm-year observations.

Table 1: Sample Development

Panel A: Sample Development H1 Sample Selection	Firm-year observations	Distinct firms
Audit Analytics: SOX 404 internal controls	86,869	17,547
Less: firms without Audit Analytics-Director and officer changes data	(14,480)	(3,617)
Number of observations remaining	72,389	13,930
Less: firms without Compustat data	(21,088)	(4,073)
Number of observations remaining	51,301	9,857
Less: firms with missing value in control variables	(11,446)	(1,613)
Number of observations remaining	39,855	8,244
Less: firms without CIO data	(32,743)	(7,354)
Number of observations remaining	7,112	890
Panel B: Sample Development H2		
Firm-year observations from H1 sample	7,112	890
Less: firms without three consecutive year data	(6,614)	(547)
Number of observations remaining	498	343
Less: firms with missing value in control variables	(70)	(59)
Total usable firm-year observations	428	284

Model Development

H1 posits a positive association between disclosure of ITMW and the subsequent CIO turnover. To test H1, we use a logistic regression model (Model 1). The dependent variable *ΔCIO* is used to capture the turnover of CIOs (an indicator variable takes the value of one if there is CIO turnover in year (t+1) and zero if otherwise). The independent variable *ITMW* is used to proxy for ITMW disclosure (an indicator variable that takes the value of one if a firm reports an ITMW in year (t) and zero if otherwise). Model 1 is specified as below (where P_1 is the probability that $\Delta CIO = 1$):

$$\log \frac{P_1}{1-P_1} = \beta_0 + \beta_1 \times ITMW + \beta_2 \times MW + \beta_3 \times \Delta CEO + \beta_4 \times \Delta CFO + \beta_5 \times \Delta BD + \beta_6 \times AT$$

$$+ \beta_7 \times LEV + \beta_8 \times CUR + \beta_9 \times ROA + \beta_{10} \times CASH + \beta_{11} \times RES + \beta_{12} \times LOSS$$

$$+ \beta_{13} \times BIG4 + Industry + Year + \varepsilon \qquad (1)$$

Following the approach of Johnstone et al. (2011), we measure the dependent variable ΔCIO as equal to one if there is turnover of CIOs in year t+1. Similarly, we measure the independent variable $ITMW$ as equal to one if there is discourse of ITMWs in year t. We also take account for a number of control variables. We control for total asset (AT), which is expected to be positively associated with the turnovers (Agrawal and Cooper 2017); and leverage (LEV), which relates to levels of debt that draw the attention of creditors (Agrawal and Cooper 2017). In addition, following Haislip et al. (2015) and Johnstone et al. (2011), we include four variables to control for the effect of firm performance: current ratio (CUR), which indicates some assurance that the obligations coming due to the firm will be paid; return on assets (ROA), which measures how profitable a firm is relative to its total asset; cash from operation ($CASHOP$), related to how the firm finances short-term capital; and loss ($LOSS$), related to low revenues and low profits. Regarding other firm characteristics, we include number of board directors (BD), related to the cost of management, and the provision of advisory and monitoring services (Johnstone et al. 2011); restatement (RES), which indicates severe problems in the financial reporting system; big 4 auditor ($BIG4$), which captures the quality of internal control assessment (Li et al. 2010). Further, we also take into account industry fixed effect and year fixed effect.

H2 posits a positive association between CIO turnover and the subsequent remediation of ITMWs. To test H2, we use another logistic regression model (Model 2). The dependent variable of interest is REM, which captures remediation of ITMWs (an indicator variable that takes the value of one if there is remediation of ITMW in year (t+1) and zero if otherwise). The independent variable is ΔCIO as in model 1. Model 2 is specified as below (where P_2 is the probability that $REM = 1$):

$$\log \frac{P_2}{1 - P_2} = \beta_0 + \beta_1 \times \Delta CIO + \beta_2 \times \Delta CEO + \beta_3 \times \Delta CFO + \beta_4 \times \Delta BD + \beta_5 \times MW + \beta_6 \times \Delta AT$$

$$+ \beta_7 \times \Delta LEV + \beta_8 \times \Delta CUR + \beta_9 \times \Delta ROA + \beta_{10} \times \Delta CASH + \beta_{11} \times \Delta RES + \beta_{12}$$

$$\times \Delta LOSS + \beta_{13} \times \Delta BIG4 + Industry + Year + \varepsilon \qquad (2)$$

Following Bedard et al. (2012), we measure the dependent variable REM as one if the ITMWs in year has been remedied in year t+2. The independent variable of interest is ΔCIO, which is the same as in Model 1. We control for the changes in the control variables as included in Model 1. Industry fixed effect and year fixed effect are taken into consideration as well. Definitions of all variable in Model 1 and Model 2 are present in Appendix.

Empirical Results

Descriptive Statistics

Table 2 Panel A provides the descriptive statistics of the 857 firms with CIO turnover ($\Delta CIO = 1$) contrast with the 6,255 firms with no CIO turnover ($\Delta CIO = 0$). The likelihood of having ITMW is higher in firms with CIO turnover (3 percent) that in firms without CIO turnover (2 percent). However, the difference is non-significant ($\chi^2 = 0.36$). The likelihood of having CEO turnover ($\Delta CEO = 1$) is significant higher in firms with CIO turnover (18 percent) than that in firms with no CIO turnover (9 percent; $\chi^2 = 68.02, p < 0.01$). Consistent with this, firms with CIO turnover also have a higher likelihood of CFO turnover ($\Delta CFO = 1$; 20 percent) than firms with no CIO turnover ($\Delta CFO = 0$; 13 percent; $\chi^2 = 31.43, p < 0.01$). To the contrary, firms with CIO turnover tend to have a decrease in the number of board directors (29 percent) while firms with no CIO turnover tend to have an increase in the number of board directors (4 percent; $t = 5.51, p < 0.01$). As for other control variables, firms with CIO turnover tend to have a higher number of internal control material weaknesses (MW), higher leverage (LEV), greater loss ($LOSS$), lower asset (AT), lower return on asset (ROA), lower operational cash ($CASHOP$) and less likely to have a big4 audit firm ($BIG4 = 1$) than firms without CIO turnover.

Table 2: Descriptive Statistics

Panel A: Variable Distribution (Mean) by ΔCIO				Panel B: Variable Distribution (Mean) by REM			
Variable	**ΔCIO**		**Chi2 or t-stat**	**Variable**	**REM**		**Chi2 or t-stat**
	=1	=0			=1	=0	
ITMW	0.03	0.02	0.36	ΔCIO	0.05	0.02	2.58
ΔCEO	0.18	0.09	68.02***	ΔCEO	0.16	0.08	4.38**
ΔCFO	0.20	0.13	31.43***	ΔCFO	0.24	0.24	0.00
ΔBD	-0.29	0.04	5.51***	MW	3.65	5.27	59.95***
MW	0.40	0.24	-4.31***	ΔBD	0.00	-0.15	49.87**
AT	5.68	6.55	10.36***	ΔAT	0.38	-0.40	-2.73***
LEV	0.73	0.63	-2.26**	ΔLEV	0.06	-0.43	-0.50
CUR	2.51	2.60	0.79	ΔCUR	0.15	-0.50	-1.53
ROA	-0.34	-0.09	7.75***	ΔROA	0.29	-1.15	-2.30**
CASH	-0.07	0.03	7.38***	ΔCASH	0.30	-0.91	-2.30**
RES	0.08	0.10	3.37***	ΔRES	0.02	-0.06	4.19
LOSS	0.48	0.32	79.43***	ΔLOSS	0.01	0.04	0.83
BIG4	0.53	0.68	83.74***	ΔBIG4	0.01	-0.04	1.57
No.	857	6,255		No.	315	113	

Chi-squares (t-statistics) are included for dichotomous (continuous) variables.
***, **,* denotes significance at the 0.01, 0.05, 0.1 level (two-tailed), respectively.

Table 2 Panel B presents descriptive statistics comparing 315 firms with remediation of ITMWs (*REM* = 1) with 113 without remediation (*REM* = 0). The likelihood of CIO turnover ($\Delta CIO = 1$) in firms with remediation is higher (5 percent) than that in firms with no remediation (2 percent) but the difference is not statistically significant ($\chi^2 = 2.58$). Similarly, the likelihood of CEO turnover ($\Delta CEO = 1$) in firms with remediation (16 percent) is higher than that in firms with no remediation (8 percent) and the different is significant at 0.05 level ($\chi^2 = 4.38$, p < 05). However, the likelihood of CFO turnover ($\Delta CFO = 1$) in firms with remediation (24 percent) is similar to that in firms without remediation (23 percent; $\chi^2 = 0.57$). Further, firms with remediation have little change (1 percent) in the number of board directors (ΔBD) while firms without remediation show a decrease in the number of board directors (15 percent; $\chi^2 = 49.87$, p < 0.05). As for other control variables, firms with remediation tend to have a smaller change in total asset (ΔAT), return on asset (ΔROA) and operational cash ($\Delta CASH$). Table 3 reports the Spearman correlation of variables. While the pairwise correlations are not high, some are statistically significant at 0.01 or 0.05 level, indicating some (although not severe) multicollinearity between variables[1].

Regression Results

H1 predicts a positive association between the disclosure of ITMWs and CIO turnover. Table 4 Panel A presents the results of the logistic regression Model 1. The results show that the disclosure of ITMWs (*ITMW*) is negatively associated with CIO Turnover (ΔCIO; p < 0.05), implying that firms with ITMWs are less likely to experience CIO turnover than firms without ITMWs. We then examine the marginal effects (*dy/dx*) and the results suggest that firms with ITMWs have a 6.5 percent less likelihood of CIO turnover than firms without ITMWs. Overall, the results contradict our H1, suggesting that the disclosure of ITMW is negatively associated with CIO turnover. The results may imply that when firms experience ITMW, they tend to hold their CIOs and rely them to fix the deficiencies in IT internal control. Table 4 Panel A also presents the effect of CEO turnover, CFO turnover, change in board

---

[1] Control variables such as *AT, LEV, ROA* and *LOSS* may be correlated. To address the issue of multicollinearity, we calculate the variance inflation factor (VIF). Following prior researchers, we take VIF = 3.0 as the threshold. And the results show that no VIFs exceed this threshold.

directors and other control variables on CIO turnover. There is a positive association between CEO turnover (*ΔCEO*) or CFO turnover (*ΔCFO*) and CIO turnover, and a negative association between change in board directors (*ΔBD*) and CIO turnover. Total asset (AT) and big4 audit firms (*BIG4*) are negatively associated with CIO turnover while loss (*LOSS*) and number of internal control material weaknesses (*MW*) are positive associated with CIO turnover.

H2 suggests a positive relationship between CIO turnover and subsequent remediation of ITMW. Table 5 Panel A presents the results of logistic regression Model 2. The results show that CIO turnover (*ΔCIO*) is positively associated with remediation of ITMWs (*REM*; p < 0.1), implying that firms experience CIO turnover are more likely to remedy ITMWs than firms without CIO turnover. When we examine the marginal effects (*dy/dx*), our results suggest that firms change CIOs are 24 percent more likely to remedy ITMWs than firms do not change CIOs. Overall, the results support out H2, suggesting CIO turnover is positively associated with remediation of ITMWs. The result may imply that CIO dismissal and replacement may help subsequent ITMW remediation. Table 5 Panel A also presents the effect of CEO turnover, CFO turnover, change in board directors and other control variables on remediation of ITMWs. There is a negative association between CEO turnover (*ΔCEO*) and remediation of ITMWs (*REM*) and a positive association between change in leverage (*ΔLEV*) and remediation of ITMWs. The number of internal control material weaknesses (*MW*) is positively associated with remediation of ITMWs.

Additional Analyses

We conduct four additional analyses to examine the associations between the disclosure of ITMW and CIO turnover, and between CIO turnover and remediation of ITMW respectively. In the first analysis, we perform a propensity score matching analysis for Model 1. Following Achleitner et al. (2014), we conduct a difference in difference match based on kernel weights. We associate to the outcome (*ΔCIO*) of firms with ITMWs a matched outcome given by a kernel-weighted average of the outcome of all firms without ITMWs, which yields a matched sample of 6,488 firm-year observations. We then run a logistic regression with the same independent and dependent variables in Model 1, and measure the conditional probability of receiving a CIO turnover given ITMW disclosure. We control for other variables used in Model 1. The results are presented in Table 5 Panel B. Consistent with our main test, the coefficient of *ITMW* is negative and marginally significant (p < 0.1), implying that the difference in the proportion of CIO turnover is attributable to ITMW disclosure and ITMW disclosure does affect CIO turnover. We perform another propensity score matching for H2 in the second analysis. We measure the conditional probability of ITMW remediation given CIO turnover. The results are presented in Table 6 Panel B. Consistent with our main test, the coefficient of *ΔCIO* is positive and significant (p < 0.01), implying that CIO turnover does exert a strong effect on ITMW remediation.

In the third analysis, we examine how ITMW disclosure in year t will affect CIO turnover in year t+2 rather than year t+1. The untabulated results show a negative association between ITMW disclosure (*ITMW*) and CIO turnover (*ΔCIO*). However, the association is not significant, indicating that the effect that exerted by ITMW disclosure on CIO turnover decreases as the time lag increases. In the fourth analysis, we examine how CIO turnover (*ΔCIO*) in year t+1 will affect ITMW remediation (*REM*) in year t+3 rather than year t+2. The untabulated results show that CIO turnover (*ΔCIO*) is positively and significantly (p < 0.01) associated with remediation of ITMW (*REM*). Overall, the results suggest that CIO turnover exerts a significant effect on ITMW remediation even as the time lag increases.

Conclusion

How to manage IT control is a conundrum faced by many chief executives in organizations (Masli et al. 2016). Because of personal limitations regarding time availability and IT expertise, CEOs and CFOs tend to delegate most, if not all, IT management responsibilities to a specialist-subordinate (e.g., a CIO) (Masli et al. 2016). To untangle the conundrum, our study examines how CIO turnover is associated with ITMW disclosure and the subsequent remediation of ITMW. Contrary to our prediction, we find that CIO turnover tend to be lower in firms with ITMW disclosure than firms without ITMW disclosure.

Table 3: Correlation Analysis

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1.	ΔCIO	1														
2	REM	0.07	1													
3.	ITMW	0.04	-1	1												
4.	MW	**0.18**	**0.27**	**0.46**	1											
5.	ΔCEO	**0.17**	0.09	**0.09**	**0.12**	1										
6.	ΔCFO	**0.14**	-0.01	*0.06*	**0.10**	**0.11**	1									
7.	ΔBD	-0.01	0.00	-0.02	*-0.05*	-0.03	0.03	1								
8.	AT	**-0.36**	*0.09*	**-0.08**	**-0.25**	**-0.09**	**-0.08**	**0.23**	1							
9.	LEV	**0.10**	**-0.09**	*0.04*	**0.10**	**0.08**	*0.05*	**0.11**	**0.26**	1						
10.	CUR	**-0.12**	0.05	-0.04	**-0.14**	**-0.07**	**-0.07**	**-0.10**	**-0.22**	**-0.71**	1					
11.	ROA	**-0.31**	**0.14**	**-0.09**	**-0.24**	**-0.17**	**-0.09**	0.02	**0.31**	**-0.25**	**0.17**	1				
12.	CASH	**-0.25**	**0.15**	**-0.06**	**-0.22**	**-0.13**	*-0.06*	0.02	**0.23**	**-0.22**	**0.10**	**0.71**	1			
13.	RES	-0.02	0.07	0.02	-0.02	0.01	-0.01	0.02	0.04	-0.03	0.02	0.02	*0.05**	1		
14.	LOSS	**0.31**	-0.03	**0.11**	**0.24**	**0.18**	**0.11**	*-0.06*	**-0.43**	**0.15**	**-0.07**	**-0.81**	**-0.57**	-0.04	1	
15.	BIG4	**-0.37**	0.05	**-0.15**	**-0.28**	**-0.14**	**-0.11**	**0.12**	**0.61**	0.04	0.03	*0.34*	**0.30**	0.00	**-0.37**	1.00

Bold, italic denotes significance at 0.01, 0.05 level (two-tailed) respectively.

Table 4: Logistic Regression Analysis for H1

Variable	Pred. Sign	Panel A: Without Matching	Panel B: Propensity Score Matching	
			First Stage	Second Stage
		DV = ΔCIO	DV = ITMW	DV = ΔCIO
Intercept	±	-2.4594***	-3.4223***	-2.7494
ITMW	+	-0.6466**		-0.6761*
ΔCEO	+	0.6052***	0.0706	0.9131**
ΔCFO	+	0.3318***	0.0618	0.1349
ΔBD	±	-0.0844***	-0.0248	-0.1797*
AT	−	-0.0626***	-0.0005	0.1310
LEV	+	-0.0405	-0.1017	-0.1549
CUR	−	0.0059	-0.0075	-0.0491
ROA	−	-0.0798	-0.1010	-0.3437***
CASH	−	-0.0358	0.3820**	0.3743
RES	+	-0.0213	0.2297	-0.9726
LOSS	+	0.2471***	0.3004**	0.4180
BIG4	±	-0.2058**	-0.2432*	-0.8125
MW	+	0.0983**	0.6427***	0.1145**
Industry Fixed Effect		Yes	Yes	Yes
Year Fixed Effect		Yes	Yes	Yes
Regression Type		Logistic	Logistic	Logistic
Log Likelihood		-2457.49	-375.53	-123.58
Likelihood Ratio		318.33	822.70	148.69
Chi-square		0.000	0.000	0.000
Pseudo R-square		0.061	0.523	0.220
Obs. No.		7,112	6,488	6,488

Z-statistics in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 5: Logistic Regression Analysis for H2

Variable	Pred. Sign	Panel A: Without Matching DV = REM	Panel B: Propensity Score Matching First Stage DV = ΔCIO	Second Stage DV = REM
Intercept	±	1.6436		
ΔCIO	+	1.3703*		4.2329***
ΔCEO	+	-0.1816***	-0.4728	1.0808
ΔCFO	+	0.0106	-1.1168	0.4683
ΔBD	±	0.0930	0.3335*	0.5723*
ΔAT	+	0.0589	0.1980	-0.1610
ΔLEV	−	0.0918**	-0.1542	-0.5055
ΔROA	+	0.1549*	-0.1321	0.7666
ΔLOSS	−	0.0388	0.0540	0.6841
ΔCUR	+	0.1001	0.0578	0.3316***
ΔCASH	+	0.0724	0.0377	-0.0629
ΔBIG4	±	0.3702	-0.8129	0.5843
ΔRES	±	-0.2419	0.3741	0.5854
MW	+	1.6436***	0.1254*	-0.3769***
Industry Fixed Effect		Yes	Yes	Yes
Year Fixed Effect		Yes	Yes	Yes
Regression Type		Logistic	Logistic	Logistic
Log Likelihood		-195.26	-52.57	-5.50
Likelihood Ratio		103.58	31.81	44.86
Chi-square		0.000	0.426	0.030
Pseudo R-square		0.210	0.232	0.469
Obs. No.		428	193	193

Z-statistics in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

It indicates that in the face of ITMWs disclosures, rather than dismiss CIOs, firms tend to keep their CIOs and depend them to remedy ITMWs. Further, we find that ITMW remediation tends to be higher in firms that replace current CIOs than firms that keep their CIOs. Taken together, the results suggest that CIO turnover has a positive influence in ITMW remediation, however, it has not yet fully recognized by firms.

Our study intends to make several contributions. Theoretically, it contributes to the research on internal control by providing a linkage between CIO turnover and ITMWs. We offer two insights. First, firms are likely to hold their current CIOs to resolve failures regarding IT control. Second, dismissing current CIOs and replacing with new ones are likely to resolve failures regarding IT controls more effectively. Practically, our study provides implications for internal control management and practice. Although suggested by prior research that dismissal of chief executives may be an effective way to defend the legitimacy of firms, firms tend to only focus on the dismissal of CEOs and CFOs but not CIOs. However, dismissing of CIOs and replacing outgoing CIOs with ones with better expertise is actually crucial to the remediation of ITMWs. It highlights the importance for firms to recognize that which chief executives should be responsible for which internal control management and to provide appropriate supervision.

References

Achleitner, A. K., Günther, N., Kaserer, C., and Siciliano, G. 2014. "Real Earnings Management and Accrual-Based Earnings Management in Family Firms," *European Accounting Review* (23:3), pp. 431-461.

Agrawal, A., and Cooper, T. 2017. "Corporate Governance Consequences of Accounting Scandals: Evidence from Top Management, Cfo and Auditor Turnover," *Quarterly Journal of Finance* (7:01), p. 1650014.

Arthaud-Day, M. L., Certo, S. T., Dalton, C. M., and Dalton, D. R. 2006. "A Changing of the Guard: Executive and Director Turnover Following Corporate Financial Restatements," *Academy of Management Journal* (49:6), pp. 1119-1136.

Bedard, J. C., Hoitash, R., Hoitash, U., and Westermann, K. 2012. "Material Weakness Remediation and Earnings Quality: A Detailed Examination by Type of Control Deficiency," *Auditing: A Journal of Practice & Theory* (31:1), pp. 57-78.

Boyne, G. A., James, O., John, P., and Petrovsky, N. 2011. "Top Management Turnover and Organizational Performance: A Test of a Contingency Model," *Public Administration Review* (71:4), pp. 572-581.

Chun, M., and Mooney, J. 2009. "Cio Roles and Responsibilities: Twenty-Five Years of Evolution and Change," *Information & management* (46:6), pp. 323-334.

Considine, B., Parkes, A., Olesen, K., Blount, Y., and Speer, D. 2012. *Accounting Information Systems: Understanding Business Processes*. Milton, QLD: John Wiley & Sons Australia Ltd.

Damianides, M. 2005. "Sarbanes-Oxley and It Governance: New Guidance on It Control and Compliance," *Information Systems Management* (22:1), pp. 77-85.

Dimopoulos, T., and Wagner, H. F. 2016. "Corporate Governance and Ceo Turnover Decisions,").

Feldmann, D. A., Read, W. J., and Abdolmohammadi, M. J. 2009. "Financial Restatements, Audit Fees, and the Moderating Effect of Cfo Turnover," *Auditing: A Journal of Practice & Theory* (28:1), pp. 205-223.

Ge, W., and McVay, S. 2005. "The Disclosure of Material Weaknesses in Internal Control after the Sarbanes-Oxley Act," *Accounting Horizons* (19:3), pp. 137-158.

Goh, B. W. 2009. "Audit Committees, Boards of Directors, and Remediation of Material Weaknesses in Internal Control," *Contemporary Accounting Research* (26:2), pp. 549-579.

Haislip, J. Z., Masli, A., Richardson, V. J., and Sanchez, J. M. 2015. "Repairing Organizational Legitimacy Following Information Technology (It) Material Weaknesses: Executive Turnover, It Expertise, and It System Upgrades," *Journal of Information Systems* (30:1), pp. 41-70.

Hammersley, J. S., Myers, L. A., and Shakespeare, C. 2008. "Market Reactions to the Disclosure of Internal Control Weaknesses and to the Characteristics of Those Weaknesses under Section 302 of the Sarbanes Oxley Act of 2002," *Review of Accounting Studies* (13:1), pp. 141-165.

Hammersley, J. S., Myers, L. A., and Zhou, J. 2012. "The Failure to Remediate Previously Disclosed Material Weaknesses in Internal Controls," *Auditing: A Journal of Practice & Theory* (31:2), pp. 73-111.

Hee, K. 2013. "Material Weakness Remediation and Accounting-Related Litigation," *Journal of Finance and Accountancy* (14), p. 1.

Jenter, D., and Kanaan, F. 2015. "Ceo Turnover and Relative Performance Evaluation," *The Journal of Finance* (70:5), pp. 2155-2184.

Johnstone, K., Li, C., and Rupley, K. H. 2011. "Changes in Corporate Governance Associated with the Revelation of Internal Control Material Weaknesses and Their Subsequent Remediation," *Contemporary Accounting Research* (28:1), pp. 331-383.

Karanja, E., and Zaveri, J. 2014. "Ramifications of the Sarbanes Oxley (Sox) Act on It Governance," *International Journal of Accounting and Information Management* (22:2), pp. 134-145.

Klamm, B. K., Kobelsky, K. W., and Watson, M. W. 2012. "Determinants of the Persistence of Internal Control Weaknesses," *Accounting Horizons* (26:2), pp. 307-333.

Lee, J. E. 2016. "Internal Control Deficiencies and Audit Pricing: Evidence from Initial Public Offerings," *Accounting & Finance*).

Li, C., Peters, G. F., Richardson, V. J., and Watson, M. W. 2012. "The Consequences of Information Technology Control Weaknesses on Management Information Systems: The Case of Sarbanes-Oxley Internal Control Reports," *Mis Quarterly*), pp. 179-203.

Li, C., Sun, L., and Ettredge, M. 2010. "Financial Executive Qualifications, Financial Executive Turnover, and Adverse Sox 404 Opinions," *Journal of Accounting and Economics* (50:1), pp. 93-110.

Li, W., Phang, S. Y., and Ho, S. Y. 2017. "Ceo/Cfo Turnover and Subsequent Remediation of Information Technology Material Weaknesses," *Accounting & Finance*).

Luftmann, J., and Kempaiah, R. 2008. "Key Issues for It Executives 2007," *MIS Quarterly Executive* (7:2).

Masli, A., Richardson, V. J., Watson, M. W., and Zmud, R. W. 2016. "Senior Executives' It Management Responsibilities: Serious It-Related Deficiencies and Ceo/Cfo Turnover," *MIS Quarterly* (40:3), pp. 687-708.

Menon, K., and Williams, D. D. 2008. "Management Turnover Following Auditor Resignations," *Contemporary Accounting Research* (25:2), pp. 567-604.

Munsif, V., Raghunandan, K., Rama, D. V., and Singhvi, M. 2011. "Audit Fees after Remediation of Internal Control Weaknesses," *Accounting Horizons* (25:1), pp. 87-105.

Rezaee, Z., Espahbodi, R., Espahbodi, P., and Espahbodi, H. 2012. "Firm Characteristics and Stock Price Reaction to Sox 404 Compliance," *The 10 th Annual Iranian Accounting Conference*, p. 1.

Staw, B. M. 1976. "Knee-Deep in the Big Muddy: A Study of Escalating Commitment to a Chosen Course of Action," *Organizational behavior and human performance* (16:1), pp. 27-44.

Stoel, M. D., and Muhanna, W. A. 2011. "It Internal Control Weaknesses and Firm Performance: An Organizational Liability Lens," *International Journal of Accounting Information Systems* (12:4), pp. 280-304.

Suchman, M. C. 1995. "Managing Legitimacy: Strategic and Institutional Approaches," *Academy of management review* (20:3), pp. 571-610.

Wang, H., and Wong, K. F. E. 2012. "The Effect of Managerial Bias on Employees' Specific Human Capital Investments," *Journal of Management Studies* (49:8), pp. 1435-1458.

Wang, H., Zhao, S., and Chen, G. 2017. "Firm-Specific Knowledge Assets and Employment Arrangements: Evidence from Ceo Compensation Design and Ceo Dismissal," *Strategic Management Journal* (38:9), pp. 1875-1894.

White, J. 2014. "How to Use Coso to Assess It Controls," *Journal of Accountancy* (217:5), p. 34.

Yayla, A. A., and Hu, Q. 2014. "The Effect of Board of Directors' It Awareness on Cio Compensation and Firm Performance," *Decision Sciences* (45:3), pp. 401-436.

Appendix: Variable Descriptions

Variables		Operational Definitions
ΔCIO	DV	An indicator variable that takes the value of one if there is CIO turnover in year (t+1) and zero if otherwise
REM	DV	An indicator variable that takes the value of one if there is remediation of ITMW in year (t+2) and zero if otherwise
ITMW	IV	An indicator variable that takes the value of one if a firm reports an ITMW in year (t) and zero if otherwise
MW	CV	The number of internal control material weaknesses as reported by a firm in year (t)
ΔCEO	CV	An indicator variable that takes the value of one if there is CEO turnover in year (t+1) and zero if otherwise
ΔCFO	CV	An indicator variable that takes the value of one if there is CFO turnover in year (t+1) and zero if otherwise
ΔBD	CV	The change in the number of board director as reported by a firm between year (t) and year (t+1)
AT	CV	The logarithm of total asset in year (t)
LEV	CV	The ratio of total liabilities to total assets in year (t)
CUR	CV	The ratio of current assets to current liabilities in year (t)
ROA	CV	The ratio of net income to total assets in year (t)
CASH	CV	Cash from operations scaled by total assets in year (t)
RES	CV	An indicator variable that takes the value of one if the firm announces a restatement in year (t) and zero if otherwise
LOSS	CV	An indicator variable that takes the value of one if a firm reports a net loss in year (t) and zero otherwise
BIG4	CV	An in indicator variable that takes the value of one if a firm has a big4 auditor in year (t) and zero if otherwise
ΔBD	CV	The change in the number of board director as reported by a firm between year (t+1) and year (t+2)
ΔAT	CV	The change in AT (logarithm of total asset) as reported by a firm between year (t+1) and year (t+2)
ΔLEV	CV	The change in LEV (total liabilities divided by total assets) as reported by a firm between year (t+1) and year (t+2)
ΔROA	CV	The change in ROA (net income divided by total assets) as reported by a firm between year (t+1) and year (t+2)
ΔLOSS	CV	The change in LOSS (one if a firm reports a net loss; zero otherwise) as reported by a firm between year (t+1) and year (t+2)
ΔCUR	CV	The change in CUR (current assets divided by current liabilities) as reported by a firm between year (t+1) and year (t+2)
ΔCASH	CV	The change in CASH (cash from operations divided by total assets) as reported by a firm between year (t+1) and year (t+2)
ΔBIG4	CV	The change in BIG4 (one if a firm has a big4; zero otherwise) as reported by a firm between year (t+1) and year (t+2)
ΔRES	CV	The change in RES (one if the firm announces a restatement; zero otherwise) as reported by a firm between year (t+1) and year (t+2)
IND	CV	An indicator variable for industry fixed effect
YEAR	CV	An indicator variable for year fixed effect