

Examining the Antecedents of Sarbanes-Oxley Section 404 IT Control Weaknesses: An Empirical Study

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Basil J. Hamdan

Virginia Commonwealth University
Richmond, VA 23284 USA
hamdanbj@vcu.edu

Abstract

The current research draws on the agency theory, the IT governance literature, and the executive compensation literature to present a theory of the antecedents of IT control weaknesses as reported under Sections 404 of Sarbanes-Oxley Act. More specifically, this paper examines the association between two categories of governance mechanisms (IT governance mechanisms and IT executive incentive alignment mechanisms) and the disclosure of IT control weaknesses. As for the IT governance mechanisms, the study findings indicate that a lower likelihood of disclosing IT-related control weaknesses is associated with having IT executives with higher levels of structural and expert power and having audit committee and corporate governance committee members with IT expertise. As for the incentive alignment mechanisms, the results indicate that the lower the pay disparity between IT executives and business executives in the top management team, the lower the likelihood of disclosing IT controls weaknesses.

Keywords: Sarbanes-Oxley Act, IT Control Weaknesses, IT Governance, CIO Compensations

Introduction

In the wake of the recent high-profile corporate governance scandals (e.g. Enron, WorldCom), the United States Congress enacted the Sarbanes-Oxley Act of 2002 which aims, among other things, to improve corporate governance effectiveness, internal control quality and financial reporting reliability. Section 404 of the Act, *Management Assessment of Internal Controls*, requires managements of publicly traded companies to assess the design and operating effectiveness of internal control over financial reporting and to report that assessment in their annual filings with the Securities and Exchange Commission (SEC), namely in the 10-K forms. In the same vein, the Public Company Accounting Oversight Board's (PCAOB) Auditing Standard (AS) No. 5 requires external auditors of publicly traded companies to understand, test and evaluate the effectiveness of internal control over financial reporting and to opine on the management's report on the assessment of the effectiveness of these controls (PCAOB 2007).

Faced with increasingly computerized business environments where key business processes including accounting and financial reporting are entirely automated or exclusively or primarily manual but largely dependent on IT functionality, auditing standards (e.g. SAS No. 94, SAS No. 109, AS No. 5), practice literature (e.g. COSO 1992; COBIT, 1996), and academic research (Canada et al. 2009; Klamm and Watson 2009; Li et al. 2007; Messier Jr et al. 2004; Sutton and Hampton 2003) have all emphasized the integral role that IT controls play in enabling or constraining internal control quality, financial reporting reliability, and Sarbanes-Oxley compliance. To this end, a report by AMR Research, now a part of Gartner Inc., estimates that companies subject to Sarbanes-Oxley Act spent roughly six billion U.S. dollars a year in 2005 and 2006 to comply with the Act, 1.9 billion dollars of which (i.e. 32%) were spent on IT (Bradford and Brazel 2007). Despite these investments, many companies continue to report deficiencies

in their internal control over financial reporting with 20% of these weaknesses being related to IT controls¹ (Grant et al. 2008).

While research on IT controls provides answers regarding the impact of IT control weaknesses on internal control deficiencies (Bedard and Graham 2011; Grant et al. 2008), financial reporting reliability (Grant et al. 2008; Klamm and Watson 2009), financial performance (Stoel and Muhanna 2009), and audit fees (Canada et al. 2009), other questions pertinent to IT control weaknesses remain unanswered. The current research purports to answer the following two questions: (1) what are the antecedents of IT control weaknesses reported under Section 404 of Sarbanes-Oxley Act of 2002?, and (2) in what ways do the identified antecedents have an impact on IT control weaknesses?

This study sets out to answer the aforementioned questions by presenting and testing an integrated theoretical model of the antecedents of IT control weaknesses. The proposed model draws on the agency theory to provide a theoretical perspective of the occurrence of IT control weaknesses and the IT governance literature and the executive compensation literature to solicit potential factors that enhance or impede the achievement of effective IT controls.

By presenting and empirically testing a theory-based framework of the antecedents of IT control weaknesses, this research offers a much needed understanding for (a) managers in their effort to achieve effective IT governance and thus improve the quality of IT control and internal control over financial reporting, (b) financial auditors in their effort to obtain an understanding of how computerization and IT control risks impact internal controls in a financial statement audit, and (c) regulators in their effort to improve financial reporting quality and foster effective corporate governance.

The remainder of this paper is organized as follows. The next section presents the research background. The following section presents the theoretical perspective of the research and the research hypotheses. The next section presents the research methodology. The following section presents and analyzes the results of the proposed model and hypotheses. The conclusions, limitations, and suggestions for future research are presented in the last section.

Background

For the purpose of this research, IT control is defined as a manual or automated process designed by, or under the supervision of, the company's principal executive and principal IT officers, or persons performing similar functions, and effected by the company's board of directors, management, and other personnel, to provide reasonable assurance regarding the reliability of financial information and transactions and the continued proper operation of the information systems that capture, process and generate them. While it recognizes the broad and multidimensional nature of IT quality, this research is concerned with IT *control* quality under Section 404 of the Sarbanes-Oxley Act of 2002. As such, IT control quality is defined in terms of whether or not the firm has disclosed IT control weaknesses in the context of Section 404 reporting. To this end, firms with IT control weaknesses are viewed as having low IT control quality whereas firms with no IT-related control weaknesses are viewed as having high IT control quality.

Audit standards setting bodies (e.g. AICPA; PCOAB) have increasingly emphasized that managements and external auditors of companies subject to Section 404 of the Sarbanes-Oxley Act consider the effect of computerized systems and IT control risks when evaluating the effectiveness of internal control over financial reporting. For example, AU Section (319), titled *Consideration of Internal Control in a Financial Statement Audit* explicitly requires auditors to consider how an organization's use of IT may affect internal controls relevant to the audit of financial statements and how IT risks could result in financial misstatements (AICPA 2007). In the same vein, Statement on Auditing Standards (SAS) No. 94, titled *The Effect of Information Technology on the Auditor's Consideration of Internal Control in a Financial Statement Audit* alerts external auditors that assessing control risk at maximum and relying only on

¹ Examples of IT control weaknesses include lack of system training, lack of segregation of duties associated with accessing financial reporting records, lack of disaster recovery plans, and lack of documentation over changes made to information systems.

substantive testing may not be effective for companies with intensively computerized financial reporting systems.

Academic research has also drawn attention to the impact of computerization and IT control problems on financial reporting and internal controls over financial reporting. Evidence in the extant literature on the effect of computerization on financial statements suggests that computerized environments are more prone to internal control problems and financial misstatements than partially computerized or non-computerized environments (Bell et al. 1998; Hunton et al. 2004; Messier Jr et al. 2004). For example, findings from Lynch and Gomaa (2003) indicate that information systems may provide sophisticated means and opportunities for fraud perpetration by employees. Consistent finds were reported in Beasley et al. (2000) and Ge and McVay (2005). Along the same lines, recent empirical evidence suggests that significant financial reporting implications may arise from relatively simple to extremely complex information systems (Curtis et al. 2009). For instance, there exists substantial evidence suggesting that enterprise resource planning (ERP) systems lead to heightened risks (IT, business, and overall control risks) and higher likelihood for financial misstatements, misclassifications, and defalcations (Hunton et al. 2004; Pfennig 1999; Sutton and Hampton 2003; Turner 1999).

Furthermore, empirical evidence in the Sarbanes-Oxley regime points to a host of negative consequences associated with reporting IT control weaknesses. More specifically, findings from recent studies show that IT control weaknesses are associated with a larger number of internal control deficiencies (Bedard and Graham 2011; Grant et al. 2008), a larger number of financial misstatements (Grant et al. 2008; Klamm and Watson 2009), lower financial performance (Stoel and Muhanna 2009), and higher audit fees (Canada et al. 2009; Grant et al. 2008).

Notwithstanding the evident impact of computerization in general and IT control weaknesses in particular on the effectiveness of internal control structure and the reliability of financial reporting, there is paucity in theory-driven research on the antecedents of IT control weaknesses (Li et al. 2007). The lack of understanding about the factors that could lead to IT control weaknesses has significant implications for managers, auditors and regulators who have a vested interest in achieving effective internal control over financial reporting, reliable financial reporting and prudent corporate governance practices. Without a solid understanding of factors impacting IT control quality, how they interact, and how they vary in terms of the magnitude and direction of their influence, the organizational endeavor to achieve effective IT control is likely to fail. For instance, such lack of understanding could lead organizations to direct their attention and much needed resources towards certain governance mechanisms while ignoring others that are more critical for achieving quality IT controls. Worse yet, organization could unconsciously put in place mechanisms that have conflicting influences on IT control quality.

To the best of the researcher's knowledge, there exists no single study that has investigated the determinants of IT control weaknesses. In fact, apart from Li et al.'s (2007) study which examined the impact of internal and external governance on IT control quality, the researcher knows of no other research that has investigated the determinants of IT control weaknesses. Their study, however, suffers from three major limitations: (a) lack of theoretical grounding, (b) failure to consider other factors, beside IT governance, that may impact IT control weaknesses, and (c) employing data from only the first year of Sarbanes-Oxley Section 404 compliance.

This study contributes to the existing literature by presenting and testing an integrated theoretical model of the antecedents of IT control weaknesses. The proposed model draws on the agency theory to provide a theoretical perspective of the occurrence of IT control weaknesses and the IT governance literature and the executive compensation literature to solicit potential factors that enhance or impede the achievement of effective IT controls. The following section presents the theoretical perspective of the research as well as the research hypotheses.

Theoretical Perspective & Hypotheses Development

In spite of the evident impact of IT control weaknesses on the overall quality of internal control structure, IT controls research, especially in the area of IT control weaknesses, remains largely anecdotal with limited reliance on theory. This research presents a theory building exercise of the determinants of IT control weaknesses. More specifically, this study draws on the agency theory (Eisenhardt 1989; Jensen

and Meckling 1976) to provide a theoretical perspective of the occurrence and subsequent disclosure of IT control weaknesses. In general, an agency situation arises whenever one party (the principal) relies on another party (the agent) to perform some service on its behalf which typically involves the delegation of some decision making authority to the agent (Jensen and Meckling 1976).

The current work utilizes the agency theory as the theoretical basis for two reasons: (1) the dominance of the this theory as the guiding framework for corporate governance (Daily et al. 1998) of which IT governance is a subset and (2) the fact that the information systems (IS) function is in essence an agent that provides IT solutions and services to a principal; other business functions and the organization as a whole. In the context of Section 404 of Sarbanes-Oxley Act, the principal is the board of directors (BOD) who delegates to the top management team (TMT) the responsibility of corporate governance including internal control over financial reporting. The agent, on the other hand, is the top IS team (TIST) to whom the TMT delegates the responsibility of IT control governance. Such delegation is normally caused by business functions' lacking the time and resources, specifically specialized IT skills and knowledge, which are necessary to govern IT control over financial reporting.

A central problem that could arise in such principal-agent relationship is one of moral hazard or goal incongruence; a situation where agents engage in self-interested behavior driven by their own objectives and interests rather than those of their principals (Baiman 1982; Baiman 1990; Jensen and Meckling 1976). Evidence from the agency theory literature indicates that when such goal incongruence occurs, it could lead to the principal's interests being ill-served by the agent which could prove very harmful to the well-being of the principal. Extrapolated to the context of IT control weaknesses, this evidence would suggest that the occurrence and subsequent disclosure of IT control weaknesses is a manifestation of an agency problem caused by goal disagreement between the BOD and the TIST.

The first question that arises is: why would such goal incongruence occur? More specifically, why would the TIST, as an agent, have different goals and/or be less committed to designing and implementing a system of IT controls that is consistent with the organization's internal control objectives? According to the agency theory, the goal incongruence between the principal and the agent is affected by information (Baiman 1982; Eisenhardt 1989; Tuttle et al. 1997). To this end, the agents are less motivated to act in a way that is contrary to the objectives of their organizations when the principals possess some or complete information that enable them (i.e. the principals) to verify the quality and adequacy of the agents' actions; a condition known as information symmetry. However, when the principals cannot completely monitor and verify the actions of the agents due to information gap, the condition becomes one of information asymmetry (Baiman 1982; Tuttle et al. 1997). Here, the agents are said to possess privately held information or knowledge which could motivate them to act contrary to the objectives of their organizations without fearing detection.

Another explanation as to what could cause the goal incongruence is offered by motivation theories such as the expectancy theory (Vroom 1964) and the equity theory (Adams 1965). To this end, when people have unfavorable perceptions about their performance outcomes (e.g. recognition, rewards, pay), they are more likely to engage in self-interested behavior. Furthermore, when people perceive the ratio of their outcomes to their inputs (e.g. effort, education, expertise) to be inequitable to that of their referents, the situation becomes one of perceived inequity which can cause them to behave in ways that are not in line with the objectives of their organizations (Henderson and Fredrickson 2001; Lazear 1989). In the context of the current study, this would suggest that IT executives who perceive their outcomes unfavorably or as inequitable are more likely to engage in self-interested behavior driven by their own objectives as opposed to those of their organizations.

The second question that follows is: how can the TIST, whose motives may not be aligned with those of the organization, be influenced to behave in a way that is consistent with the organization's internal control objectives? According to the corporate governance literature, the answer to this agency problem involves the development and implementation of effective governance mechanisms whose aim is to reduce the agency costs and provide monitoring concerning the actions of the agent (Coles et al. 2001; Daily et al. 2003a; Daily et al. 2003b). More specifically, this research adopts the view that there are two important categories of governance and/or contracting mechanisms that the BOD can employ in order to align the interests of the TIST with the interests of the firm. These categories are: IT governance mechanisms and IT executive incentive alignment mechanisms.

IT Governance and IT Control Quality

Boynton et al. (1992) define IT governance as “the locus of decision making for IT-related processes within a firm where the concern is with the location, distribution and pattern of managerial responsibilities and control that ultimately affect how IT resources are applied and then implemented” (Boynton et al. 1992). The IT Governance Institute defines IT governance as “an integral part of enterprise governance and consists of the leadership and organizational structures and processes that ensure that the organization’s IT sustains and extends the organization’s strategies and objectives” (ITGI). Another definition is offered by Weill and Ross (2004) who define IT governance as “specifying the decision rights and accountability framework to encourage desirable behavior in the use of IT”. Two underlying themes can be noted in the aforementioned definitions: (a) the locus of decision authority and responsibility for IT-related activities and processes and (b) the alignment between business and IT to ensure desirable behavior in the use of IT.

In theory, IT governance; an integral part of corporate governance, is the responsibility of the board of directors. In practice, however, the board delegates the responsibility of corporate governance including internal control over financial reporting to the TMT which in turn delegates fully or partially to the TIST the authority to make key IT control decisions as well as the responsibility to design and implement IT controls over financial reporting systems. Drawing on the IT governance literature, this research proposes two IT governance elements which organizations can implement to influence the alignment between the TIST and the BOD. These elements are: the IT background of the BOD as reflected by two of its main committees, namely the corporate governance committee the audit committee, and the IT executive element as reflected in whether or not the firm has an IT executive and the power of the IT executive.

The responsibilities of the corporate governance committee include, but are not limited to, reviewing and making recommendations to the BOD regarding matters pertaining to corporate governance, reviewing the composition of committees of the BOD, and recommending persons to be members of such committees including the audit committee. To this end, it can be argued that corporate governance committees with IT background are more likely to recommend IT experienced persons for the membership of the audit committee. The audit committee, on the other hand, is responsible, among other things, for reviewing the company’s system of internal control over financial reporting, monitoring the integrity of the company’s financial statements, and ensuring the company’s compliance with laws and regulations including the Sarbanes-Oxley Act. To this end, the Auditing Standard (AS) No. 5 requires external auditors of publicly traded companies to communicate, in writing, to the audit committee all material weaknesses in internal control as identified during the audit of internal control over financial reporting. This written communication should be made prior to the issuance of the auditor's report on internal control over financial reporting.

Drawing on the agency theory and the notion of information asymmetry, this research expects organizations with IT-experienced corporate governance and audit committees to exhibit lower levels of IT knowledge gap and thus lower information asymmetry between the BOD and the TIST. In such organizations, the BOD is in a better position to monitor and verify the actions taken by the TIST in the course of governing IT controls over financial reporting. At the same time, the TIST, whose actions are being monitored and verified, is less motivated to implement a system of IT controls that is not consistent with the organization’s internal control objectives. This, in turn, is expected to result in better IT controls; hence less IT control weaknesses.

Moreover, BODs with IT knowledgeable corporate governance and audit committees are likely to have a better understanding and appreciation of the risks associated with using IT in capturing and processing business and financial transactions and the negative impact of IT control weaknesses on internal control and financial reporting. As a result, organizations with IT experienced corporate governance and audit committees are more likely to instruct the TMT to provide adequate support and resources to the TIST to design and implement an effective system of IT controls and to resolve IT control weaknesses as they arise. This, in turn, results in less IT control weaknesses. Therefore, this research posits that:

H1a: Companies with corporate governance committee members who don’t have IT-related background are more likely to have IT control weaknesses.

H1b: Companies with audit committee members who don't have IT-related background are more likely to have IT control weaknesses.

The second IT governance element is the IT executive. For the sake of simplicity and consistency with the extant literature, we use the chief information officer (CIO) title to refer to the top IT executive in an organization. Numerous IS researchers have emphasized the fundamental role that CIOs play in dictating the performance of and deriving value from IT in organizations (Earl and Feeny 1995; Preston et al. 2008; Raghunathan and Raghunathan 1989). While there is a fair amount of research on the impact of CIOs on organizational performance, the research on the impact of CIOs on the quality of IT control over financial reporting remains fairly new.

Recent empirical evidence indicates that firms with CIO positions are less likely to have IT-related control weaknesses (e.g. Li et al. 2007). Notwithstanding this evidence, it is important to note that many firms with CIO positions still disclosed IT control weaknesses. This suggests that the impact of the IT executive on the quality of IT control goes beyond the presence of the position itself. One way to further investigate this impact is by considering the IT executive power and his/her decision making authority within an organization. Here, power is seen as an enabler of authority. Finkelstein (1992) distinguishes between four dimensions of power: structural power, expert power, ownership power and prestige power. Consistent with Preston et al. (2008), this research focuses on the first two dimensions because ownership power and prestige power are more relevant to chief executive officers (CEOs).

Extant CIO literature describes the CIO's structural power in terms of the CIO's formal membership in the TMT (Preston et al. 2008; Raghunathan and Raghunathan 1989). The CIO is expected to have greater authority in influencing the performance of IT in organizations including the quality of IT control over financial reporting when the organization officially elevates his/her power so that he/she is at peer level with other executives in the top management team. Echoing an argument by Preston et al. (2008), this study argues that a CIO who is (is not) at peer level with the firm's TMT will be likely (less likely) to get accepted into the firm's inner circle and therefore will be more successful (less successful) in influencing other members of the TMT (Chatterjee et al. 2001; Earl and Feeny 1995; Preston et al. 2008). To this end, this research argues that having a CIO as one of the firm's named executive officers (NEOs) is indicative of higher level of CIO's structural power. Therefore, we posit that:

H2a: Companies with CIOs with lower level of structural power are more likely to have IT control weaknesses.

The CIO expert power can be described in terms of the extent to which the CIO is perceived as effective which in turn can be measured in terms of how long the CIO has been in the current position. To this end, this research views longer CIOs' tenures as indicative of good stewardship at the CIOs' end. CIOs that are good stewards will be entrusted by the TMT to make key IT decisions (Chan et al. 2006) and will retain their positions longer than CIOs that are not good stewards. Furthermore, this research argues that longer CIOs tenures enable the CIOs to build stronger and more lasting relationships with other members of the TMT giving the CIOs greater latitude in advising and influencing other TMT members (Earl and Feeny 1995; Preston et al. 2008). Moreover, longer CIOs tenures enable the CIOs to obtain a more comprehensive and undisrupted understanding of the organization's information systems; its structures, strengths and weaknesses, and also the organization's overall operations. Not only is this understanding paramount to the CIOs' ability to align IT and business and thus derive value from IT but it is also critical to the CIOs' ability to manage and mitigate the risks associated with using IT. Therefore, this research posits that:

H2b: Companies with shorter tenured CIOs are more likely to have IT control weaknesses.

CIO Compensation and IT Control Quality

While this research acknowledges the importance of the IT governance mechanisms in decreasing information asymmetry and increasing alignment between the BOD and the TIST, it also recognizes the reality that the behavior of the TIST is subject to the influence of multiple factors. Therefore, a pragmatic theoretical perspective must consider other mechanisms that influence IT control quality either directly or

indirectly through influencing the TIST's behavior. One such mechanism is executive compensation structure.

The executive compensation stream of research, vastly grounded in agency theory (Daily et al. 2003b; Murphy 1999), argues that organizations need to engage in incentive contracting with the TMT to address the agency problem caused by information asymmetry and the high costs associated with monitoring the TMT's behavior. To this end, the executive compensation structure is viewed as an alignment mechanism which the board can utilize to motivate the TMT members to align their interests with those of the shareholders (Coles et al. 2001; Core et al. 1999; Daily et al. 2003b; Himmelberg et al. 1999).

Studies within this stream of research examine the association between TMT pay and firm performance with a majority of which investigating the relation between CEO compensation and firm performance. The focus on CEO pay can be attributed to the crucial role of CEOs as heads of TMTs and the implicit view of the CEO pay as a proxy for the TMT pay (Jonas 2007). Collectively, evidence from this research points to a positive association between TMT pay and firm performance (e.g. Carpenter and Sanders 2004; Murphy 1999).

Recently, and as more executive compensation data became available, many studies extended their examination to include the association between TMT pay disparity and firm performance (e.g. Carpenter and Sanders 2004; Henderson and Fredrickson 2001; Main et al. 1993). Generally, when employees perceive the ratio of their performance outcomes (e.g. compensation, promotion, etc) to their inputs (e.g. effort, time, education, skills, etc) to be lower than that of others, the situation becomes one of perceived inequity (Adams 1965). Within the context of executive compensation research, a central theme is that TMT pay disparity that is perceived to be inequitable can cause members of the TMT to engage in self-interested and uncollaborative behavior (Henderson and Fredrickson 2001; Lazear 1989) leading to negative impacts on firm performance (Carpenter and Sanders 2004).

Drawing on executive compensation literature, this research argues that CIO compensation influences the CIO's behavior and the alignment between the organization and the TIST in two ways. First, the CIO compensation is viewed as an incentive alignment mechanism. More specifically, this research views CIO compensation as a means to reduce agency costs and induce the CIO to make IT-related decisions and take actions that are in line with IT governance objectives (e.g. create value from IT, mitigate IT risks, and achieve regulatory compliance). As the level of CIO pay increases, the CIO's motivation to engage in behaviors or actions that are not in the best interest of the organization is reduced. Therefore, this study expects CIOs with higher compensations to be more committed towards enhancing the quality of IT controls and correcting IT control weaknesses as they arise. Therefore, this research posits that:

H3a: Companies with lower levels of CIOs' compensations are more likely to have IT control weaknesses.

Second, the pay disparity between the CIO and other members of the TMT is viewed as a proxy of the CIO perceptions of equity with higher (lower) CIO-TMT pay gaps being indicative of higher (lower) level of perceived inequity. Evidence from the executive compensation literature and pay disparity research indicates that inequity perceptions can cause members of the TMT to engage in self-interested behavior. Extrapolated to the context of the CIO-TMT pay disparity, this evidence would suggest that CIOs who perceive their compensations as inequitable will be less committed to organizational objectives and thus less motivated to design and put in place a system of IT controls that is consistent with the organization's internal control objectives.

In addition, this research views the CIO-TMT pay gap as a proxy of CIOs level of acceptance by other members of the TMT team. This research argues that a higher (lower) pay gap between the CIO and other members of the TMT is an indication of lower (higher) level of CIO's acceptance by the TMT. As such, this study expects CIOs who are faced with lower levels of acceptance to be less committed to organizational objectives. Such CIOs, whose inputs may not be valued or even sought by the TMT, are likely to be less keen to collaborate and coordinate with other members of the TMT and less motivated to implement effective IT controls. This, in turn, is expected to result in lower quality IT controls; hence more IT control weaknesses. Based on the preceding discussion, this research posits that:

H3b: Companies with higher levels of CIO-TMT compensation gap are more likely to have IT control weaknesses.

Research Methodology

Sample Selection

Data for this research comes from two sources: Audit Analytics database (for data on IT control weaknesses) and proxy statements (for data on IT governance and executive compensations). The study sample consists of firms that reported IT control weaknesses under Section 404 of Sarbanes Oxley Act for the years 2005-2009. The identification of IT control weakness firms is performed in two steps. The first step involves identifying firms with internal control weaknesses. To this end, the current research utilizes the Audit Analytics database which, among many other things, tabulates a wide range of variables pertaining to companies subject to Sarbanes-Oxley Section 404 compliance. Of special interest to this research is a dummy variable (Yes/No) in Audit Analytics indicating the effectiveness (or ineffectiveness) of firms' internal controls as reported in the managements' reports on the assessment of the effectiveness of internal control over financial reporting, namely 10-K reports. The initial sample consists of 1,712 firm-year observations with an adverse opinion on their internal control from January 2005 to December 2009. The second step involves identifying IT control weaknesses firms. For each of the firms identified in the first step above, the particular weaknesses as reported in Audit Analytics are examined to identify the firms that reported at least one IT-related weakness. This step yields a sample of 381 firm-year observations with at least one IT control weakness, which constitutes 28.6% of all firms reporting internal control weaknesses. After eliminating foreign firms, the sample size drops 358 firm-year observations with one or more IT-related control weaknesses.

In order to study the impact of IT governance and CIO compensations on IT control quality, a matched pairs approach was used where IT control weakness firms were matched with similar firms that reported internal control weaknesses but no IT weaknesses. Consistent with extant literature (e.g. Grant et al. 2008; Li et al. 2007), the matching process was conducted based on industry (4-digit, 3-digit, or 2-digit SIC) and size (revenues at the end of the fiscal year in which the firm reported an internal control weakness). If a firm-year observation has no appropriate match based on the 4-digit SIC code, then the 3-digit SIC code is used to find a match. If no match is found, the 2-digit SIC code is used. If no match is found based on the 2-digit SIC code, the firm-year observation is dropped from the sample. The matching process resulted in eliminating 172 firm-year observations which brought the sample size to 180 firm-year observations with at least one IT control weakness. After eliminating firms for which no data was available for independent variables (18), the sample size dropped to 162. Thus, the final sample consists of 162 firm-year observations with one or more IT-related control weaknesses matched with 162 firm-year observations with non-IT weaknesses. These two samples are referred to as the "study group" sample and the "control group" sample, respectively. At the end of the matching process, 40 % of the firm-year observations in both groups were matched based on the 4-digit SIC code, 20% on the 3-digit SIC code, and 40% on the 2-digit SIC code.

Measured Variables and Research Models

Table 1 provides functional descriptions of all the study variables. In addition to the IT governance and executive compensation elements, the study includes an indicator variable to capture the effect of the IT executive background on the odds of disclosing IT control weakness. The decision to add this variable was because some firms assign the IT executive title to business executives who don't necessarily have an IT background and expertise.

Table 2 presents the research models where logistic regression is used to investigate and test the relationship between the odds of disclosing IT control weaknesses and the proposed governance elements. Model (1) tests the effect of the IT governance elements whereas Model (2) tests the impact of the IT executive incentive alignment elements. Model (3) tests the effect of the IT governance elements and the IT executive incentive elements. Hence, it combines Model (1) and Model (2).

Variable Type	Variable Label	Variable Description
Dependent	ITCW	1 if the firm disclosed an IT-related control weakness in Section 404 report, 0 if the firm is a control firm.
Independent	AUDITIT	1 if the audit committee had members with IT background in the year of disclosing an internal control weakness and/or the preceding year, 0 otherwise.
Independent	CORGOVIT	1 if the corporate governance committee had members with IT background in the year of disclosing an internal control weakness and/or the preceding year, 0 otherwise.
Independent	CIONAMED	1 if the CIO was a named executive officer in the year of disclosing an IT control weakness and/or the preceding year, 0 otherwise.
Independent	CIOTEN	The number of years the CIO has been in the current position.
Independent	lnCIOCOMP	The natural log of the CIO salary and bonus in the year of disclosing IT control weakness and/or the preceding year.
Independent	CIOTMTCOMP	The ratio of the CIO salary and bonus (CIOCOMP) to the average salary and bonus of the non-IT executive.
Control	CIOBACK	1 if the CIO had an IT background, 0 otherwise.

Governance Mechanism	Dependent Variable		Regression Model	Hypotheses Tested	Model Number
IT Governance	ITCW	=	$\beta_0 + \beta_1 \text{AUDITIT} + \beta_2 \text{CORGOVITIT} + \beta_3 \text{CIONAMED} + \beta_4 \text{CIOTEN} + \beta_5 \text{CIOBACK}$	H1a, H1b, H2a, H2b	(1)
Executive Incentive	ITCW	=	$\beta_0 + \beta_1 \ln\text{CIOCOMP} + \beta_2 \text{CIOTMTCOMP} + \beta_3 \text{CIOBACK}$	H3a, H3b	(2)
Both Mechanisms	ITCW	=	$\beta_0 + \beta_1 \text{AUDITIT} + \beta_2 \text{CORGOVITIT} + \beta_3 \text{CIONAMED} + \beta_4 \text{CIOTEN} + \beta_5 \ln\text{CIOCOMP} + \beta_6 \text{CIOTMTCOMP} + \beta_7 \text{CIOBACK}$	H1 - H3	(3)

Results

Table 3 provides a correlation matrix including all the variables included in Table 1. As displayed in the table, the disclosure of IT control weaknesses is negatively associated with the IT background of the corporate governance committee and the IT background of the audit committee. Furthermore, there is a negative association between reporting IT control weaknesses on one hand and the expert power, the structural power, the compensation level, the IT background of the CIO and the CIO-TMT pay disparity on the other hand.

A potential issue of concern that could arise in any multivariate analysis is that of multicollinearity where two or more predictor variables in a regression model are highly correlated. The high correlations, in the presence of multicollinearity, can cause the coefficient estimates to be unstable in that they can change drastically in response to minor changes in the data or model specifications. Only one pair of variables which appear together in a regression model is highly correlated and thus may raise concerns about the presence of multicollinearity. These variables are the IT background of the corporate governance committee and the IT background of the audit committee at 71.3 percent (p -value $<.01$). The high

correlation seems to suggest that corporate governance committees with IT background are more likely to recommend IT experienced persons for the membership of the audit committee.

	1	2	3	4	5	6	7	8
ITCW	1							
CORGOVIT	-.371**	1						
AUDITIT	-.371**	.713**	1					
CIONAMED	-.120*	.139*	.071	1				
CIOTEN	-.186**	.097	.144*	.066	1			
lnCIOCOMP	-.081	.084	.006	.178*	-.067	1		
CIOTMTCOMP	-.236**	.052	.146	.123	.069	.196*	1	
CIOBACK	-.259**	.224**	.162**	-.088	-.053	.084	.028	1

** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level (2-tailed).

To assess the potential of multicollinearity between these two variables as well as all other variables, multicollinearity diagnostic statistics are computed, namely the Variance Inflation Factor (VIF) for each variable. The highest two VIF values were 2.629 and 2.566 corresponding to the IT background of the audit committee and the IT background of the corporate governance committee, respectively. However, both values are well below the threshold value of 5 and the higher cut-off value of 10 which are suggested to indicate potential multicollinearity concerns. Thus, multicollinearity is not expected to pose any problem.

Table 4 below presents a summary of the logistic regression analysis of Model (1) along with the results of the hypotheses testing. As hypothesized, each of the four IT governance elements was a significant predictor of disclosing IT control weaknesses. Collectively, the model has a good explanatory power with an R-square of 46.8%. Further, the overall classification accuracy of the model is 81.9% with 84.4% of the non-IT control weakness firms and 76.7% of the IT control weakness firms predicted correctly, respectively.

Hypothesis	Variable	Expected Sign	Coefficient Estimate	Sig.	Odds Ratio	Result
H1a	CORGOVIT(1)	-	-1.571	.001	.208	Supported
H1b	AUDITIT(1)	-	-1.250	.006	.287	Supported
H2a	CIONAMED(1)	-	-.769	.034	.464	Supported
H2b	CIOTEN	-	-.118	.042	.889	Supported
	CIOBACK(1)	-	-1.886	.005	.152	
% of non-ITCW firms predicted correctly			84.4			
% of ITCW firms predicted correctly			76.7			
Pseudo R-Squared			0.468			

The results displayed in Table 4 indicate that the likelihood of disclosing IT-related control weaknesses is associated with having no IT expertise among members of the corporate governance and the audit committees providing support for H1a and H1b. Furthermore, the likelihood of disclosing IT control

weaknesses is associated with having CIOs who are not among the firm's named-executive officers (NEOs) (hence, CIOs with lower structural power) and who have shorter tenures (hence, CIOs with lower expert power) providing support for H2a and H2b. For the control variable, companies with CIOs who don't have IT background are more likely to have IT control weaknesses compared to firms with CIOs who have IT background.

Table 5 below presents a summary of the logistic regression analysis of Model (2) along with the results of the hypotheses testing. As hypothesized, the CIO-TMT compensation gap was a significant predictor of the disclosure of IT control weaknesses, providing support for H3b. While it has a negative sign as expected, the association between the CIO compensation level and the disclosure of IT control weaknesses was not significant, providing no support for H3a. These findings suggest that the level of the CIO relative compensation has a profound impact on IT control quality and underscore the importance of relative pay over absolute pay.

Hypothesis	Variable	Expected Sign	Coefficient Estimate	Sig.	Odds Ratio	Result
H3a	lnCIOCOMP	-	-.094	.861	.911	Not Supported
H3b	CIOTMTCOMP	-	-2.101	.011	.122	Supported
	CIOBACK(1)	-	-2.375	.001	.093	
% of non-ITCW firms predicted correctly			95.1			
% of ITCW firms predicted correctly			28.6			
Pseudo R-Squared			0.223			

Table 6 below presents a summary of the logistic regression analysis of Model (3) combining Model (1) and Model (2) discussed above. As the table shows, 4 of the 6 hypothesized governance elements are significant predictors of the disclosure of IT control weaknesses. These elements are the IT background of the corporate governance committee, the IT background of the audit committee, the CIO tenure, and the CIO-TMT pay disparity. Collectively, the model has a strong explanatory power with an R-square of 84.1%. Further, the overall classification accuracy of the model is 94.4% with 96.3% of the non-IT control weakness firms and 90.5% of the IT control weakness firms predicted correctly, respectively.

Hypothesis	Variable	Expected Sign	Coefficient Estimate	Sig.	Odds Ratio	Result
H1a	CORGOVIT(1)	-	-5.316	.000	.005	Supported
H1b	AUDITIT(1)	-	-1.656	.093	.191	Supported
H2a	CIONAMED(1)	-	-22.966	.999	.000	Not Supported
H2b	CIOTEN	-	-.297	.035	.743	Supported
H3a	lnCIOCOMP	-	.105	.917	1.110	Not Supported
H3b	CIOTMTCOMP	-	-5.690	.001	.003	Supported
	CIOBACK(1)	-	-1.578	.209	.206	
% of non-ITCW firms predicted correctly			96.3			
% of ITCW firms predicted correctly			90.5			
Pseudo R-Squared			0.841			

Interestingly, the CIONAMED variable capturing the CIO structural power, and which was significant in Model (1) with a p-value of .034, is no longer significant in Model (3) with a p-value of .999. One explanation of this drastic change could be that the structural power of the CIO is being captured by the CIO absolute and relative compensation. To this end, the larger the CIO pay, the higher is his/her structural power. A model excluding the CIONAMED variable (not shown in this study) has an explanatory power of an R-square of 80.9% and overall classification accuracy of 91.9% with 93.9% of the non-IT control weakness firms and 88.1% of the IT control weakness firms predicted correctly, respectively.

Conclusions

While research on IT controls provides answers regarding the consequences of IT control weaknesses in the form of having more internal control deficiencies (Bedard and Graham 2011; Canada et al. 2009; Grant et al. 2008) and a larger number of financial misstatements (Grant et al. 2008; Klamm and Watson 2009), research on the antecedents of IT control weaknesses remains in its infancy with limited reliance on theory. This research proposes and tests an integrated theoretical model of the antecedents of IT control weaknesses as reported under Section 404 of Sarbanes-Oxley Act of 2002.

The results provide support for the hypotheses that the IT governance mechanisms (the board of directors IT knowledge and the CIO structural and expert power) and the IT executive incentive mechanisms (the CIO-TMT pay disparity) are essential to the goal congruence between the overall organization, represented by the board of directors (BOD) and the IS organization represented by the top IS team (TIST) which in turn leads to effective IT control over financial reporting.

This research contributes to the current body of knowledge in several ways. First, it is the first study to propose and empirically test an integrated model of the antecedents of IT control weaknesses. Second, it contributes to the Sarbanes-Oxley literature by introducing the agency theory as a theoretical basis of the antecedents of IT control weaknesses. Third, it contributes to the Information Systems and Accounting literatures by providing empirical evidence linking IT governance mechanisms to executive incentive mechanisms. Four, it contributes to practice by offering a much needed understanding for the board of directors and the TMT in their effort to achieve effective IT control and internal control over financial reporting, the financial auditors in their effort to obtain an understanding of how governance mechanisms impact IT controls over financial reporting, and the regulators in their effort to improve financial reporting quality and to foster effective corporate governance.

One limitation of our study is that it views IT control weaknesses and subsequently IT control quality through dichotomous lens with no regard to the specific types, severity, and frequency of the weaknesses. Future research should go beyond this dichotomous view of IT control weaknesses to document and classify their specific types and examine the associations between the antecedents of IT control weaknesses and the types and severity of IT control weaknesses.

References

- Adams, J. 1965. "Inequity in Social Exchange," *Advances in experimental social psychology* (2:267-299).
- AICPA. 2007. "Consideration of Internal Control in a Financial Statement Audit," in: *AU Section 319*. American Institute of Certified Public Accountants.
- Baiman, S. 1982. "Agency Research in Managerial Accounting: A Survey," *Journal of Accounting Literature* (1:1), pp. 154-213.
- Baiman, S. 1990. "Agency Research in Managerial Accounting: A Second Look* 1," *Accounting, Organizations and Society* (15:4), pp. 341-371.
- Beasley, M.S., Carcello, J.V., Hermanson, D.R., and Lapides, P.D. 2000. "Fraudulent Financial Reporting: Consideration of Industry Traits and Corporate Governance Mechanisms," *Accounting Horizons* (14:4), pp. 441-454.
- Bedard, J.C., and Graham, L. 2011. "Detection and Severity Classifications of Sarbanes-Oxley Section 404 Internal Control Deficiencies," *Accounting Review* (86:3), pp. 825-855.
- Bell, T.B., Knechel, W.R., Payne, J.L., and Willingham, J.J. 1998. "An Empirical Investigation of the Relationship between the Computerization of Accounting Systems and the Incidence and Size of Audit Differences," *Auditing* (17:1), Spring 98, pp. 13-38.
- Boynton, A., Jacobs, G., and Zmud, R. 1992. "Whose Responsibility Is It Management," *Sloan Management Review* (33:4), pp. 32-38.
- Bradford, M., and Brazel, J. 2007. "Flirting with Sox 404," *Strategic Finance* (89:3), pp. 48-53.
- Canada, J., Sutton, S.G., and Jr, J.R.K. 2009. "The Pervasive Nature of It Controls: An Examination of Material Weaknesses in It Controls and Audit Fees," *International Journal of Accounting and Information Management* (17:1), pp. 106 - 119.
- Carpenter, M.A., and Sanders, W.G. 2004. "The Effects of Top Management Team Pay and Firm Internationalization on Mnc Performance," *Journal of Management* (30:4), August 1, 2004, pp. 509-528.
- Chan, Y.E., Sabherwal, R., and Thatcher, J.B. 2006. "Antecedents and Outcomes of Strategic Is Alignment: An Empirical Investigation," *Engineering Management, IEEE Transactions on* (53:1), pp. 27-47.
- Chatterjee, D., Richardson, V., and Zmud, R. 2001. "Examining the Shareholder Wealth Effects of Announcements of Newly Created Cio Positions," *MIS Quarterly* (25:1), pp. 43-70.
- Coles, J., McWilliams, V., and Sen, N. 2001. "An Examination of the Relationship of Governance Mechanisms to Performance," *Journal of Management* (27:1), p. 23.
- Core, J., Holthausen, R., and Larcker, D. 1999. "Corporate Governance, Chief Executive Officer Compensation, and Firm Performance," *Journal of financial economics* (51:3), pp. 371-406.
- Curtis, M.B., Jenkins, J.G., Bedard, J.C., and Deis, D.R. 2009. "Auditors' Training and Proficiency in Information Systems: A Research Synthesis," *Journal of Information Systems* (23:1), Spring2009, pp. 79-96.
- Daily, C., Dalton, D., and Cannella Jr, A. 2003a. "Corporate Governance: Decades of Dialogue and Data," *The Academy of Management Review* (28:3), pp. 371-382.
- Daily, C., Dalton, D., and Rajagopalan, N. 2003b. "Governance through Ownership: Centuries of Practice, Decades of Research," *The Academy of Management Journal* (46:2), pp. 151-158.
- Daily, C., Johnson, J., Ellstrand, A., and Dalton, D. 1998. "Compensation Committee Composition as a Determinant of Ceo Compensation," *Academy of Management Journal*, pp. 209-220.
- Earl, M., and Feeny, D. 1995. "Is Your Cio Adding Value," *The McKinsey Quarterly*:2.
- Eisenhardt, K. 1989. "Agency Theory: An Assessment and Review," *Academy of management review*, pp. 57-74.
- Finkelstein, S. 1992. "Power in Top Management Teams: Dimensions, Measurement, and Validation," *The Academy of Management Journal* (35:3), pp. 505-538.
- 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.
- Grant, G.H., Miller, K.C., and Alali, F. 2008. "The Effect of It Controls on Financial Reporting," *Managerial Auditing Journal* (23:8), pp. 803-823.
- Henderson, A., and Fredrickson, J. 2001. "Top Management Team Coordination Needs and the Ceo Pay Gap: A Competitive Test of Economic and Behavioral Views," *Academy of Management Journal* (44:1), pp. 96-117.
- Himmelberg, C., Hubbard, R., and Palia, D. 1999. "Understanding the Determinants of Managerial Ownership and the Link between Ownership and Performance," *Journal of financial economics* (53:3), pp. 353-384.

- Hunton, J.E., Wright, A.M., and Wright, S. 2004. "Are Financial Auditors Overconfident in Their Ability to Assess Risks Associated with Enterprise Resource Planning Systems?," *Journal of Information Systems* (18:2), pp. 7-28.
- ITGI. "Board Briefing on It Governance."
- Jensen, M., and Meckling, W. 1976. "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of financial economics* (3:4), pp. 305-360.
- Jonas, G.A. 2007. "An Empirical Study of Executive Management Team Compensation and Company Performance." Virginia Commonwealth University Richmond, Virginia.
- Klamm, B.K., and Watson, M.W. 2009. "Sox 404 Reported Internal Control Weaknesses: A Test of Coso Framework Components and Information Technology," *Journal of Information Systems* (23:2), Fall2009, pp. 1-23.
- Lazear, E. 1989. "Pay Equality and Industrial Politics," *Journal of Political Economy* (97:3), pp. 561-580.
- Li, C., Lim, J.-H., and Wang, Q. 2007. "Internal and External Influences on It Control Governance," *International Journal of Accounting Information Systems* (8:4), pp. 225-239.
- Lynch, A., and Gomaa, M. 2003. "Understanding the Potential Impact of Information Technology on the Susceptibility of Organizations to Fraudulent Employee Behavior," *International Journal of Accounting Information Systems* (4:4), pp. 295-308.
- Main, B., O'Reilly III, C., and Wade, J. 1993. "Top Executive Pay: Tournament or Teamwork?," *Journal of Labor Economics* (11:4), pp. 606-628.
- Messier Jr, W.F., Eilifsen, A., and Austen, L.A. 2004. "Auditor Detected Misstatements and the Effect of Information Technology," *International Journal of Auditing* (8:3), pp. 223-235.
- Murphy, K. 1999. "Executive Compensation," *Handbook of labor economics* (3), pp. 2485-2563.
- PCAOB. 2007. "An Audit of Internal Control over Financial Reporting That Is Integrated with an Audit of Financial Statements," in: *Auditing Standard No. 5*. Washington, D.C.: Government Printing Office: Public Company Accounting Oversight Board.
- Pfennig, R. 1999. "An Introduction to Auditing Sap," *IS Audit and Control Journal*, pp. 43-45.
- Preston, D., Chen, D., and Leidner, D. 2008. "Examining the Antecedents and Consequences of Cio Strategic Decision-Making Authority: An Empirical Study," *Decision Sciences* (39:4), pp. 605-642.
- Raghunathan, B., and Raghunathan, T. 1989. "Relationship of the Rank of Information Systems Executive to the Organizational Role and Planning Dimensions of Information Systems," *Journal of Management Information Systems*, pp. 111-126.
- Stoel, D., and Muhanna, W.A. 2009. "IT Internal Control Weaknesses and Firm Performance: An Organizational Liability Lens," *SSRN eLibrary*.
- Sutton, S.G., and Hampton, C. 2003. "Risk Assessment in an Extended Enterprise Environment: Redefining the Audit Model," *International Journal of Accounting Information Systems* (4:1), pp. 57-73.
- Turner, T. 1999. "Implementing and Enhancing Data Security in a Peoplesoft Environment," *IS Audit and Control Journal*, pp. 51-53.
- Tuttle, B., Harrell, A., and Harrison, P. 1997. "Moral Hazard, Ethical Considerations, and the Decision to Implement an Information System," *Journal of Management Information Systems* (13:4), p. 27.
- Vroom, V.H. 1964. *Work and Motivation*. Wiley.
- Weill, P., and Ross, J. 2004. *IT Governance: How Top Performers Manage It Decision Rights for Superior Results*. Harvard Business Press.