A THEORY OF ASSURANCE: BALANCING COSTLY FORMAL CONTROL WITH TONE AT THE TOP

ABSTRACT: While organizations depend on *both* informal tone at the top (TATT) and formal controls to assure objectives and safeguard resources, how they interrelate has not yet been firmly established. For example, are they complements or substitutes? To that end, I model an assurance setting, and find that TATT and optimal formal controls are complements when TATT is low, but are substitutes when TATT is high. These reversals have several implications. First, reversals contribute to the mixed results reported by academic studies. Second, a given level of optimal formal control may be consistent various levels of overall control, creating ambiguity if reporting requirements put undue weight on documentable formal controls. Third, increases in control aversion may result in more formal control (rather than less), and reversals may completely disappear at sufficiently high levels of control aversion.

Key Words:. Tone at the top; Formal control; SOX; COSO.

A THEORY OF ASSURANCE: BALANCING COSTLY FORMAL CONTROL WITH TONE AT THE TOP

1. Introduction

Accountants, as a profession, have long had an interest in establishing and evaluating internal control. Formal (hard) control is achieved in a number of ways, including lists of forbidden activities, restrictions on physical movement, codes of conduct, separation of duties, incentive plans, and cost and revenue standards. While informal organizational culture is considered to be an equally – if not the most — important element of control,[1] it has been more difficult to say exactly what it is. For example, the Institute of Internal Auditors (2016, p. 1) comment on "organizational culture":

> It can be difficult to define. It is nebulous, yet, over time, culture greatly influences the long-term success of an organization, separating the ethical performers from the unethical; the valuable organizations from the questionable; those that achieve their mission from those that do not.

Due to the soft nature of organizational culture, much of the scholarship on informal control does not emphasize analytical modeling, To fill that gap, I construct a model grounded on comments and findings from scholars in related fields, as well as statements taken from standard setters and influential professional groups. Specifically, to frame the relationship between formal and informal control, I focus on 'tone at the top' (TATT), and assume that, *ceteris paribus*, a stronger TATT contributes to a higher *expectation* that agents will not behave opportunistically. This expectation, in turn, is tempered by the level of formal control. While TATT is fixed in the short run, I assume formal control to be the organization's decision variable to the extent that it is not fixed. The model provides a simple explanation of how the marginal benefit of formal controls increases with the organization's TATT at low levels of TATT, and then decreases with TATT at high levels of TATT. Specifically, a threshold is identified where the relation between formal control and TATT cleanly reverses from being complements to being substitutes.

[1] For example, Marden et al. (1997, p. 52) comment that tone at the top is "commonly regarded as the most important factor the auditor considers in the evaluation of the CE [control environment]."

The reversals are then shown to have a number of implications. First, reversals may make it difficult to consistently find empirical associations between the level of formal control and organizational size, or to find associations between the level of formal control and the resulting level of overall control. Second, reversals may generate ambiguity if a single level of optimal documentable formal control is consistent with several levels of undocumentable informal control, and the reporting regime emphasizes documentation. Third, increasing an agent's aversion to formal controls may eliminate scenarios where formal control and TATT were originally complements, and may cause the level of formal control to increase rather than decrease depending on the level of TATT. Furthermore, long-term programs aimed at reducing control aversion (e.g. increasing 'empowerment') may be the most cost-effective at moderate levels of TATT.

An overview, including the background and motivation for the model, is presented in Section 2. Section 3 describes a diversion model, followed by results in Section 4. Section 5 discusses implications of the diversion model, Section 6 contains an extension incorporating an agent's aversion to formal controls, and Section 7 considers an alternative setting exclusively based on formal *monitoring* controls. All proofs are found in the appendix and relevant accounting literature is interpreted as the results are presented.

2. Background and Overview

Accountants have been interested in internal control for over a century.[2] More recently, the U.S. Sarbanes Oxley (SOX) Act of 2002 requires both management (Section 302) and external auditors (Section 404) to perform top-down assessments of an organization's ability to identify and prevent fraud and to safeguard assets.[3] SOX has been followed by similar laws in Australia, Canada, France, Germany, Israel, Italy, India, Japan, and South Africa.[4] The majority of U.S. publicly traded companies have adopted the Committee of Sponsoring Organizations of the

[2] For example, Chatfield (1974, p. 120) traces the external auditor's evaluation of internal controls back to the 19th century.

[3] See Institute of Internal Auditors (2008).

[4] See Weiss (2014, p. 463).

Treadway Commission's (COSO's) framework to comply with SOX.[5] COSO's definition of control is broader in nature than traditional definitions of accounting control (e.g., Anthony, 1965), and expands COSO's original ''financial reporting objective'' since it now recognizes all types of reporting (internal, external, financial, and nonfinancial).[6] The then COSO chair, David Landsittel, explains (Tysiac, 2012, p. 27):

> I know a lot of people continue to think of internal controls and immediately think of accounting and financial reporting; but internal control is so important in a broader way, specifically in assuring the accomplishment of the organization's objectives … In the updated [COSO] document, there's an additional focus on operational and compliance controls and how they are beneficial in helping assure the accomplishment of operational and compliance objectives. In this regard, the document responds to some current concerns that in recent years some organizations haven't been fully "under control" in a broad sense.

By drawing attention to an increasingly broad range of issues over the last several decades,[7] COSO has emphasized organizational culture – and in particular, "tone at the top." In contrast, actual practitioner and academic responses to this development appear to have been slow. For example, Hermanson et al. (2012) conducted a survey indicating that (p. A36):

> Despite the emphasis placed on an organization's tone at the top (e.g., from the Treadway Commission report to the present day), it appears that many companies do not regularly assess the tone at the top.

On the academic side, Swinkels (2012) scrutinizes COSO's work for "theoretical groundedness" and concludes (p. 189):

> There is no common, comprehensive theory regarding the concept of control; different concepts of control are assumed in various researches, depending on the academic field involved.

---

[5] The COSO framework is sometimes used in lieu of, or alongside, non U.S. frameworks as well. For example, the (French) Autorité des Marchés Financiers (AMF, 2009, p. 5) reports from their sampling of French companies that 60% apply the AMF framework, 21% apply COSO, and 14% apply a combination of the two.

[6] See Janvrin et al. (2012) for a summary and overview.

[7] This process began in 1992 when the original framework was released, and most recently updated in COSO's 2013 document. See COSO (2013a, p. i).

Swinkels' comment is affirmed by the subtitle of COSO's recent major document (COSO 2013a): "A Compendium of Approaches and Examples." A area of particular concern is noted by Chtioui and Thiéry-Dubuisson (2011, p. 295):

> Although formal and informal controls do coexist in today's systems of corporate governance, understanding the nature of the interaction between these two methods of control is a subject of debate amongst the researchers. It is therefore difficult to assert whether the use of one could replace or could complement the use of the other.

To address these gaps, my starting point is to develop a basic understanding of how formal and informal controls might *interrelate* in providing assurance that assets are safeguarded.[8] To frame the tradeoff between formal and informal control, I focus on 'tone at the top' (TATT), and to structure the model, I narrow TATT to the role that it plays in fostering *trust* — I assume that, *ceteris paribus*, a stronger TATT contributes to a higher *expectation* that agents will not behave opportunistically (i.e., divert resources for their own consumption).[9] This expectation will also be affected by the strength of formal controls, and by the nature of the opportunities that individuals may face to betray that trust. The resulting perspective has been adopted elsewhere, particularly, in the organizational literature.[10] For example, in a well-cited paper, Nooteboom (1996, p. 993) recommends that the study of governance/controls should take into consideration "how opportunism may be mitigated by trust, and how loyalty may be broken by some 'golden opportunity' to defect." Accordingly, the term, 'TATT' will used interchangeably with 'trust' and 'trustworthiness' throughout this paper.

I model a simple setting that includes an authority (e.g., a board of directors or an audit committee) and an agent who values trust as a component of his or her utility. While organizational culture is generally fixed in the short run, formal controls may be more quickly

---

8 The U.S. Securities and Exchange Commission (2008) maintains that "Safeguarding of assets had been a primary objective of internal accounting control."

9 COSO (McNally, 2013, pp. 7-8) similarly states that "appropriate tone at the top" entails "the *expectation* that all employees will fulfill their internal control obligations." (Emphasis added.)

10 Appealing to a similar framework, Yang et al. (2010) perform a literature review of sociology, economics, management, marketing, and strategy literatures and conclude that "relevant literature suggests that formal control and trust simultaneously can help secure transactions, whereas other research argues the two control mechanisms can substitute for each other."

adjusted.[11] Accordingly, I assume that the authority takes the current level of TATT as given, and responds by choosing the appropriate level of formal control. The purpose of the controls is to provide reasonable assurance that the resources claimed by the organization are secure. The agent's trust component may be viewed as the combined present value of organizational status, esteem, job security, the feelings that accompany a clean employment record, career concerns, etc.[12] This utility will be jeopardized, however, if the agent decides to betray that trust by giving in to a temptation. Philosopher Sissela Bok (1999, p. 11) summarizes this universal idea by asserting that, "It is far harder to regain trust, once lost, than to squander it in the first place." Accordingly, the utility-based benefits of being trusted may be withdrawn by the authority through shame, demotion or discipline, or completely lost if the relationship is severed and the position filled with a ready replacement who is waiting in line.[13] Terminations may also be voluntary, such as when an employee severs a relationship by leaving a formative stage firm to start a new venture based on stolen ideas (Rajan and Zingales, 2001). On a broader scale, a member of an coalition with external parties[14] who betrays the trust of the other members in the group may be expelled and thereby lose its privileges.[15]

The setting presents the agent with an opportunity to betray trust and damage the organization in the process by diverting resources to his or her own consumption. Because it is impossible for the authority to fully anticipate the magnitude of a such a temptation, I model the intensity of the temptation as the realization of a random variable which the authority seeks to temper *ex ante* by imposing a blanket of formal controls on the agent. These controls determine the authority's vulnerability by protecting a given fraction of the resources otherwise misappropriated by an

---

11 For example, Moody's Investors Service (Jonas et al., 2005, p. 2) generally assumes that a reported weakness in controls over specific account balances or transaction-level processes (most likely formal controls) will generally result in "corrective action to address it in a timely manner."

12 Alternatively, the utility from trust may implicitly correspond to the benefits derived from cooperation in a repeated prisoner's dilemma game. See the next section for a discussion.

13 Brennan (1998, p. 197) argues that within the theory of *institutional economics*, "it is rational for at least some agents to acquire the motivational disposition to keep promises (to be trustworthy persons)." Unlike the incumbent, the replacement has not yet been disloyal.

14 The COSO (2013a, p. i) framework applies to "strategic alliances, joint ventures, and other complex contractual arrangements with external parties, implementing shared services, and engaging outsourced service providers."

15 Greif (1993) studies how coalitions were a response to problems of contract enforceability in 11th century trade, where agency relations were "characterized by the prevalence of trust" and cheaters were ostracized or suspended from membership when "expectations," upon which the coalition was based, were not met.

opportunistic agent.[16] Any formal control that eliminates *all* vulnerability is prohibitively costly, which means that overall control nontrivially depends on *whatever* degree of trust is present.[17] Overall control is characterized as the interval of those opportunities which are insufficient to successfully tempt the agent (i.e., compliance). The upper boundary of that interval represents a *tipping point*, or the minimal temptation required to induce noncompliance. The tipping point increases with the degree of trust and/or the level of formal control. Because higher tipping points correspond to bigger losses for the authority, an increasing tipping point increases the marginal benefit to formal control. Consequently, formal control optimally increases with the degree of trust, or the two are complements. This relation continues until the level of maximum possible assurance is reached, at which point further increases in the degree of trust allow the authority to reduce costly formal controls while maintaining maximum assurance. This simple relation allows me to obtain the fundamental result that formal control and the degree of trust (TATT) are complements at lower degrees of trust, and are substitutes at higher degrees of trust.

If scaling up the magnitude of an agent's opportunities to cheat is positively associated with the organization's size, then the model implies that increasing size unambiguously leads to an increase in the level of formal controls. The model indicates, however, that a corresponding reversal may all but eliminate this effect at intermediate degrees of TATT. In addition, control failures and the level of formal control are unrelated when the degree of trust exceeds a certain threshold, and lower levels of formal control for small organizations do not necessarily indicate that their controls provide less assurance. These effects collectively explain why robust negative associations either between size and formal control – or between formal control and reported control failures –or between formal controls and TATT –may be difficult to consistently document in practice.

While assurance is the fundamental goal of formal control design, 'assurance' also refers to the objective of SOX-required reports which are prepared by management and the external auditor for the benefit of those outside of the organization. Gaining an understanding of proper design is

[16] Rousseau et al. (1998, p. 394), in summarizing a cross-disciplinary forum held on trust, conclude that positive *expectations* of the trustee and a willingness to be *vulnerable* represent a generally accepted definition of trust.
[17] COSO (2013b, p.3) acknowledges that effective controls need not be "absolute."

a necessary condition for developing and documenting those evaluations—and design remains the focus of this study. To address related reporting issues, however, a subsection considers certain problems that might arise under post-SOX reporting requirements. First of all, the criteria used by the external auditor to determine material weaknesses will likely differ from the authority's criteria, meaning that management may feel pressure to overinvest in formal control unless checked by the authority. Second, the external auditor must document its conclusions. Informal control is, by nature, difficult to document, and common practices such as the increasing use of standardized checklists which are narrow in scope (one-size-fits-all) ignore the undocumentable role of organizational culture.[18] Undocumented informal control constitutes a blocked communication channel which encourages audit workarounds to avoid otherwise ambiguous reports.[19] A theoretical workaround which clearly communicates control weakness based only on a threshold for (documentable) formal control is identified. But (due to reversals) this workaround entails reporting weak formal controls for one organization and no weaknesses in formal controls for another, even though both organizations have identical formal controls. Consequently, because the auditor in the latter case has evidence that might otherwise be construed as overall weak control (and the informal state remains undocumented), the theoretical workaround may be scuttled in favor of a practical policy of *conservative* assurance, meaning that both firms are reported to have weak controls. While this policy suffers from false negatives, a report indeed provides assurance that the overall control exceeds a given level when no control weaknesses are noted.

It is widely believed that trust is eroded when formal control is imposed on otherwise trusted agents (Argyris, 1952). Falk and Kosfeld (2006) refer to this erosion as the "hidden costs of control." The academic literature has again been unclear about the influence of control aversion on the tradeoff between formal controls and the degree of trust.[20] To examine this question, I

---

18 See, for example, Bhattacharjee et al. (2007), Houghton et al. (2013) and Dowling et al. (2015)) for discussions of the increased use of checklists. Hogan et al. (2008, p. 242) find that "auditors seem to be simply checking off items on a checklist but then not expanding audit procedures to address the identified fraud risk factors."

19 More generally, it has been shown that the need to work around communication restrictions is a key reason for report manipulation, which (if *understood* by the receiver of the message) may help to complete otherwise blocked communication channels. See Arya et al. (1998) for a discussion.

20 For example, Weibel (2007, pp. 511-512) frames the research gap this way: "Formal control seems to be a double-edged sword. It may complement trustworthiness and trust but can also have a harmful effect on employees' trustworthiness and thus negatively affect trust."

extend the model to capture the agent's aversion to formal controls. The model indicates that increasing control aversion increases (decreases) the level of optimal formal control at higher (lower) degrees of trust, again exhibiting a reversal-type effect. However, excess levels of control aversion may cause reversals to disappear altogether, at which point formal control and the degree of trust unconditionally become substitutes. Finally, the extended model indicates that the greatest gain to long-term managerial initiatives designed to reduce control aversion (e.g., 'empowerment')[21] may occur at intermediate degrees of trust, but disappears at the lowest and highest levels of trust.

3. A Diversion Model

I model a risk-neutral authority (e.g., a board of directors or an audit committee) and a risk-neutral agent. I introduce the control problem with the realization of a uniformly distributed random variable, $\tilde{x} \in [0, \bar{x}]$, designating an opportunity for this agent to cheat. While the agent may benefit from exploiting this opportunity, doing so will harm the authority. Given x, the agent makes a *binary choice* to either cheat and exploit the opportunity (to be non-complaint), or to resist the temptation (to be compliant). Let $d \in \{0,1\}$ indicate whether the agent complies ($d = 0$ means noncompliance). A formal control, c determines the authority's vulnerability to a noncompliant agent. That is, conditional on x, the authority has a payoff :

$$R(d \mid x) = \begin{cases} cx - K(c) & \text{if the agent is noncompliant } (d = 0) \\ x - K(c) & \text{if the agent is compliant } (d = 1), \end{cases} \tag{1a}$$

where formal control c is chosen by the authority at the beginning of the period before the agent's temptation occurs, and $0 \le c \le 1$. The direct (administrative) cost of c to the authority is:

$$K(c) = \frac{\lambda}{1 - c} \tag{1b}$$

[21] Love et al. (2002) describe the "control vs. empowerment" dilemma.

Next consider the agent's utility, $U(d \mid x)$, where conditional on x:

$$U(d \mid x) = \begin{cases} \beta\eta + \gamma(1-c)x & \text{if the agent is noncompliant } (d=0) \\ \eta & \text{if the agent is compliant, } (d=1) \end{cases} \quad (1c)$$

where η represents the combined present value of the benefits enjoyed by the agent as a member in good standing of the organization (or coalition), $\beta < 1$, and $0 < \gamma < 1$. Note that β is permitted to be negative. I assume that (η, β, γ) is exogenous and known by both the authority and the agent at the beginning of the period, as well as the various probabilities and rules of the game (common knowledge). Exogenously fixing (η, β, γ), is intended to reflect the characteristics of an organizational culture which cannot be changed in the short run.

This is a 'diversion' model where the agent misappropriates a fraction of the firm's resources for his or her own consumption.[22] Because $\gamma < 1$, the agent places less value on x than does the authority, meaning that diversion is socially wasteful. To the extent that the authority loses $(1-c)x$ whenever the agent is noncompliant, it will be 'vulnerable' as long as $c < 1$. Condition (1b) ensures that formal control will never be 'absolute,' because $K(1) = \infty$, making $c = 1$ infinitely costly.

Tipping Point

Figure 1 illustrates the agent's utility given his or her preferred choice, d^*.

-- Place Figure 1 about here --

To describe Figure 1, note that the agent obtains an increasing utility, $\beta\eta + \gamma(1-c)x$, from succumbing to a temptation as x increases, but chooses to comply as long as $\beta\eta + \gamma(1-c)x$ is

[22] See Shleifer and Wolfenzon (2002), Newman et al. (2005) or Desai et al. (2007) for applications of diversion models. As a vulnerable resource, x may represent recorded or unrecorded tangible or intangible assets. Formal control c might also include any clawbacks of misappropriated *tangible* assets.

less than η. Define the *tipping point*, $x_T = \frac{(1-\beta)\eta}{\gamma(1-c)}$ so that $\beta\eta + \gamma(1-c)x_T = \eta$, meaning that when

$$\begin{aligned} x \le x_T \quad & \text{the agent will comply} \\ x > x_T \quad & \text{the agent will not comply.} \end{aligned} \tag{2}$$

Tipping point (2) is the linchpin of the diversion model, and defines the regions over which the agent will be compliant/noncompliant. From inspection, x_T is increasing in η and c, and decreasing in β and γ.

Because $\beta < 1$, the noncompliant agent suffers a loss of trust-based utility by losing some, possibly all, of his or her good standing. The authority may orchestrate this by firing, shaming, or disciplining the agent.[23] Furthermore, β may be negative, resembling an external penalty assessed for noncompliance. Actions, such as these, must be enforceable, however, in order to make (2) credible. With the passage of the Sarbanes-Oxley Act (Section 406) and related exchange listing standards, all U.S. publicly listed companies are required to have a code of ethics that includes an enforcement mechanism. Accordingly, the simplest way to enforce (2) would be for the organization to commit to a formal code of conduct that serves as the basis for imposing punishment.[24] Condition (2) is consistent with a view that is deeply rooted in experiments which holds that individuals naturally reciprocate cooperation in one-shot encounters;[25] but choose to cease cooperating if they assess a sufficient gain to cheating.[26]

---

[23] Parameter $\beta > 0$ may be also regarded as a fixed probability that a noncompliant agent, who would otherwise be fired, is not discovered in a setting *without* any clawbacks. While the ability to successfully clawback is open to question (see, for example, Melby and Onaran, 2016), Section 7 examines an alternative model with clawbacks where formal monitoring is itself the short-term choice variable, and finds features similar to those depicted in Figure 2 below.

[24] For example, Orin (2008) suggests that the "Sarbanes-Oxley Act attempts to ensure that codes of ethics are more than window-dressing," and (p. 143) concludes from his study that "all of the codes of ethics within the survey contained enforcement mechanisms … [that are sufficient] to deter unethical conduct or, alternatively, ensure punishment of those who choose not to comply."

[25] La Porta et al. (1997, p. 333) argue that trust may be viewed as a "propensity … to cooperate to produce socially efficient outcomes and to avoid socially inefficient noncooperative traps such as that in the prisoner's dilemma."

[26] After reviewing the experimental literature, Hardin (2003, p. 99) observes that motivations to cooperate are "easily trumped by self-interest when the game is played at … dramatic stakes." Here x_T serves to mark that threshold.

Condition (2) corresponds to a single period of an infinitely repeated prisoner's dilemma game,[27] where it is a Nash equilibrium for one player to stop cooperating whenever a defection by the other player occurs, meaning that the defecting player must compare (as he or she does in (2)) the current benefit of defection, $\gamma(1-c)x$, with the incremental loss of the present value of future benefits, $(1-\beta)\eta$.[28] Interestingly, Kreps (1990, pp. 90-143) suggests that such games capture the notion of "corporate culture" – which returns us to organizational culture, or the major subject of this study. Finally, Condition (2) corresponds to several narrower settings. If a member of an organization steals secrets and then leaves to exploit them elsewhere, η represents the lost value of the severed relationship. In this case, a commitment to punish is not required because it is the agent him- or herself who voluntarily relinquishes η. Setting $\eta = 0$ might also represent an nonmember, such as a hacker, who is located outside of the organization's legal jurisdiction, and has nothing to lose by hacking into the organization's information system.

The authority's problem can now be restated as finding c to minimize the sum of its expected loss from noncompliance plus the direct administrative cost of formal control:

$$L = \left(\frac{\bar{x} - x_T}{\bar{x}}\right)(1-c)\left(\frac{\bar{x} + x_T}{2}\right) + \frac{\lambda}{1-c} \quad . \tag{3}$$

Because the authority's problem is stated in terms of $x_T = \left(\frac{(1-\beta)\eta}{\gamma}\right)\left(\frac{1}{1-c}\right)$, TATT can be summarized as $\tau = \frac{(1-\beta)\eta}{\gamma}$, which in turn, is comprised of individual components, η, β and γ. Assume that

$$\tau \leq \bar{x} \tag{4}$$

---

[27] For example, Fudenberg and Tirole, (1993, pp. 146-165).

[28] Technically, I would add a non-contractable action, with cost ε, which the authority chooses to ensure that a cooperative agent receives η in full. Because it values cooperation (see Observation 1 below) it will be strictly in the interest of the authority to incur ε upon detecting agent compliance as long as ε is not too large. Given that the prior literature has established (2) as an (enforceable) equilibrium, I leave this detail out of the text.

Observation 1 summarizes the authority's overall preferences toward TATT:

Observation 1: The authority's expected loss strictly decreases in τ.

4. Results for the Diversion Model

Optimal Tradeoffs Between TATT and Formal Control

The value, c, of formal control which minimizes the authority's expected loss (3), along with the corresponding value of the tipping point, x_T, are given in Proposition 1:

Proposition 1:

$$c = \begin{cases} 1 - \dfrac{\sqrt{2\lambda\bar{x} - \tau^2}}{\bar{x}} & \text{if } \tau < \sqrt{\lambda\bar{x}} \\ 1 - \dfrac{\tau}{\bar{x}} & \text{if } \tau \geq \sqrt{\lambda\bar{x}} \end{cases} \tag{5a}$$

and

$$x_T = \begin{cases} \dfrac{\tau\bar{x}}{\sqrt{2\lambda\bar{x} - \tau^2}} & \text{if } \tau < \sqrt{\lambda\bar{x}} \\ \bar{x} & \text{if } \tau \geq \sqrt{\lambda\bar{x}} \end{cases} \tag{5b}$$

Figure 2 aids in the interpretation of the results presented above.

-- Place Figure 2 about here –

The upper panel of Figure 2 illustrates that the probability of compliance, or *assurance,* $\frac{x_T}{\bar{x}}$, increases with TATT, or τ, until the probability reaches one at $\tau = \sqrt{\lambda \bar{x}}$.[29] The lower panel depicts the corresponding level of optimal formal control, *c.* The highest possible value of c, or the peak of the graph, also occurs at $\tau = \sqrt{\lambda \bar{x}}$. Figure 2 indicates that because both τ and c increase together, TATT and formal control are complements when $\tau < \sqrt{\lambda \bar{x}}$. To see why this is so, consider two values of TATT, τ_L and τ_H, where $\tau_L < \tau_H$. Then because $\tau_H > \tau_L$, it algebraically follows that

$$\frac{\tau_H}{1-(c+\varepsilon)} - \frac{\tau_H}{1-c} > \frac{\tau_L}{1-(c+\varepsilon)} - \frac{\tau_L}{1-c}, \tag{6}$$

for $\varepsilon > 0$. Because the tipping point is $\frac{\tau}{1-c}$, (6) simply means that a small increase in c will increase x_T by more when $\tau = \tau_H$ than would the same increase for c accomplish when $\tau = \tau_L$. That is, the broader $x-$neighborhood, $\left[\frac{\tau_H}{1-c}, \frac{\tau_H}{1-(c+\varepsilon)}\right]$, contains higher (and more) values than does the narrower $x-$neighborhood, $\left[\frac{\tau_L}{1-c}, \frac{\tau_L}{1-(c+\varepsilon)}\right]$. Because each neighborhood identifies gains from preventing noncompliance, an increase in c will consequently provide the authority with a higher expected marginal benefit when $\tau = \tau_H$ than when $\tau = \tau_L$, and the authority optimally responds by increasing c as τ increases. Figure 2 indicates that there is, however, a limit $\left(\frac{x_T}{\bar{x}} = 1\right)$ as to how much additional assurance an increase in τ can elicit. This occurs when $\tau \geq \sqrt{\lambda \bar{x}}$. For this subset of TATT values, the optimal amount of formal control imposed on the agent decreases as the level of τ increases, because a lower c is now required to maintain $x_T = \bar{x}$. Consequently, formal control and TATT now act as substitutes.

---

[29] This definition of assurance refers only to the *probability* that noncompliance will occur. An external auditor's definition of *materiality* (multiplying the probability with the expected loss from noncompliance) produces a different criterion, and is considered below.

5. Implications of the Diversion Model

Pre-SOX Studies

Willingham and Wright (1985) obtain reports for controls from a large sample of clients drawn from a proprietary data base of *Peat Marwick, Mitchell & Co.*'s clients, and advance this interpretation of their results (p. 68):

> All firms of moderate size have some minimal level of accounting [inventory and accounts receivable] controls; thus there may be a "threshold effect" above which additional controls have little impact on the prevention and detection of errors.

To explore the effect of organizational size further, suppose that scaling up the magnitude of the agent's opportunities is accompanied by a scaling up of organizational size as well. Then increasing $\bar{x}$ itself can be regarded as reflecting an increase in organization size. Consider Figure 3.

-- Place Figure 3 about here --

Assume that inventory and accounts receivable are *formal* controls. The upper panel of Figure 3 graphs the optimal level of formal control for two different values of $\bar{x}$. It shows that increasing $\bar{x}$ from $\bar{x} = 8$ to $\bar{x} = 12$ raises the $c-$curve and visually confirms that organizational size and the strength of formal control are positively related for the chosen parameters. Or more generally:

Corollary 1: The level of formal control, c, increases with $\bar{x}$.

The upper panel of Figure 3 indicates, however, that increasing $\bar{x}$ from $\bar{x} = 8$ to $\bar{x} = 12$ stretches the reversal point, $\sqrt{\lambda \bar{x}}$, and the $c-$curve for $\bar{x} = 8$ to the right. As a result, the $c-$curve for $\bar{x} = 12$ is not located a uniform distance above the $c-$curve for $\bar{x} = 8$, and the upper panel of Figure 3 indicates a weakening of the relation between formal control and size as $\tau \to \tau'$, and the

two curves begin to approach each other; while the lower panel indicates no relation between overall assurance and size for $\tau \geq \tau''$. Consequently, the result of empirical investigations may depend on the underlying levels of τ, where the former effect (found in the neighborhood of $\tau \approx \tau'$) would suggest that there is no significant difference in the actual level of formal controls due to size, while the latter effect (at $\tau \geq \tau''$) is consistent with DeFond and Jiambalvo (1991) who find that firm size is not a statistically significant variable in their multivariate regression analysis of actual errors for public companies.

Post-SOX Documentation Requirements

Section 302 of SOX requires that management perform quarterly top-down reviews to develop the documentation required for public reports indicating known material control weaknesses. The U.S. Securities and Exchange Commission (SEC) emphasizes this aspect of reporting as well (Wells, 2011, p. 400):

> in order to demonstrate that management's assessment was reasonable, the SEC advised companies that they must maintain documentary evidence to substantiate the basis for management's conclusion that the company's internal controls are effective.

This creates a burden for management if it is unable to properly document its organizational culture, but, as widely asserted, TATT remains the major element of control. The U.S. Public Company Accounting Oversight Board (PCAOB, 2007, p. A1-23) acknowledges this very real possibility:

> documentary evidence regarding some aspects of the control environment, such as management's philosophy and operating style, might not exist.

Consequently when Hermanson et al. (2012) report that "many companies do not regularly 'assess the tone at the top,'" it may be that these companies are indicating instead that they are unable to articulate and *document* TATT, even though (as part of their everyday environment), they are *fully aware* of it, and have accordingly optimized their formal control with respect to TATT.

SOX Section 404 reports have even stricter documentation requirements than the 302 reports, and therefore similar issues apply.[30] Section 404 requires that the external auditor perform an annual top-down audit of control and issue a red flag if internal control is determined to have a 'material' weakness. The PCAOB (2006) uses plain language to describe the overall 404 process:

> Under existing SEC and PCAOB rules, material weaknesses in ICFR [Internal Control Over Financial Reporting] must be publicly reported. Flaws in control systems that fall below "material" are reported within the company, either to company management or the audit committee (depending upon the severity of the flaw).

Expression (3') below is a candidate for the external auditor's materiality judgments since it combines the likelihood of a control failure with the magnitude of the expected loss given a control failure.

$$L_U = \left(\frac{\bar{x} - x_T}{\bar{x}} \right)(1-c)\left(\frac{\bar{x} + x_T}{2} \right). \qquad (3')$$

Note that (3') omits $K(c)$ as a potentially verifiable sunk cost, leaving only L_U as the focus for the external auditor's risk assessment. Expression (3') is clearly inappropriate as the authority's objective function since it is minimized at $c = 1$ (which would bankrupt the firm). Instead, expression (7) below expresses (3') *under the assumption* that c minimizes (3).

Corollary 2: Suppose the authority chooses c to minimize (3). Then

$$L_U = \begin{cases} \dfrac{\lambda\bar{x} - \tau^2}{\sqrt{2\lambda\bar{x} - \tau^2}} & \text{if } \tau < \sqrt{\lambda\bar{x}} \\ 0 & \text{if } \tau \geq \sqrt{\lambda\bar{x}} \end{cases} \qquad (7)$$

and L_U is strictly declining in τ for $\tau < \sqrt{\lambda\bar{x}}$.

[30] See Rice and Weber (2012) who also point out that the exact reporting requirements related to material weaknesses are "somewhat ambiguous" under SOX 302.

For comparison, let L^* designate the minimized value of (3). Figure 4 depicts both L_U as described in (7) and L^* for a given set of parameters.

-- Place Figure 4 about here --

Rice and Weber (2012) suggest that our understanding of SOX 404 reports' effectiveness remains limited. To the point, Figure 4 suggests that the red-flag objective assigned to the external auditor may be inconsistent with the objectives of organization stakeholders such as existing shareholders – placing a materiality threshold, m, on formal controls may pressure a myopic management organization to request an additional (over) investment in formal control to the extent that they care about outsiders' reactions to the 404 report.[31]

The second limitation of Section 404 reports is that the categories (weak/effective) themselves are vague and are difficult to implement.[32] For example, Moody's (Jonas et al., 2005) expresses the concern that the external auditor cannot adequately report on company-wide control weaknesses by noting that: "We question the ability of the auditor to effectively "audit around" a [company wide] material weakness."[33] To the extent that it is difficult to document informal control, it is not surprising that the current PCAOB Chairman James Doty (2012) reports that the PCAOB's inspections of external audits "continue to reveal an unacceptable level of deficiencies." In particular, he notes that deficiencies include situations where "the [audit] firm has failed to obtain sufficient audit evidence to provide a basis for an audit opinion."

[31] COSO (2013b, p. 8) states "An effective system of internal control reduces, to an acceptable level, the risk of not achieving an entity objective…" But COSO and the SEC also have a concern for 'cost effectiveness." For example, he SEC (2008) notes: "Over the past few years, the Commission and PCAOB have committed extensive resources to improving the efficiency and cost-effectiveness of the implementation of Section 404's requirements…"

[32] Similarly, Hammersley at al. (2008) consider the "auditability" and the "vagueness" of SOX Section 302 (management) disclosures.

[33] In contrast, Moody's does not challenge disclosures for weaknesses related to controls over specific account balances or transaction-level processes (which I would interpret as formal controls). They note (Jonas et al., 2005) "We typically give companies reporting [these] material weaknesses the benefit of the doubt."

Post-SOX public scrutiny and documentation requirements may ironically increase the demand for standardized checklists which are biased toward more easily documented formal measures and away from informal controls.[34] For example, Bhattacharjee et al. (2007, p. 1098) argue:

> Specifically, the dramatic increase in workloads and time pressures faced by auditors in the post-Sarbanes-Oxley era and the associated increase in the use of standardized checklists means that auditors make similar audit evaluations using relatively uniform information across multiple clients in a very short time frame.

An external auditor who is unable to provide documentation faces the well-known problem of 'blocked communication' (Arya et al., 1998). Here, blocked communication may lead the auditor to 'report around' material that can't be documented (visa-vis 'audit around'). To consider blocked communication within the context of the model, suppose that management and the external auditor both observe τ, and that the authority cares only about fundamental value by enforcing the formal control c defined in Proposition 1. The key assumption is that c is documentable, but τ is not.

A 'solution' to the auditor's reporting problem is represented in Figure 5. Suppose that (under a standard of negligence) the auditor is required to acknowledge a materiality threshold, m, such that a clean report (no material weaknesses) provides assurance that $L_U \leq m$. The auditor must base the documentation of its evaluation only on formal control, which requires a materiality threshold, c', for c. To find c', first match up m with its associated $\tau = \tau'$. This can be found in the upper panel of Figure 5.

-- Place Figure 5 about here --

Now that we have found τ', match it up with c' in the lower panel of Figure 5. If the outside user of the statement is sophisticated and understands this reporting strategy, then the external

[34] The PCAOB (2005, p. 1) suggests that auditors refrain from using standardized checklists: "a one-size-fits-all audit plan driven by standardized checklists … may have little to do with the unique issues and risks of the particular client's financial reporting processes."

auditor can discharge its duty and communicate its assurance by disclosing a material weakness in documentable formal control only when $c < c' \; and \; \tau < \tau'$. For all other cases, the lack of a reported material weakness indicates that $L_U \leq m.$ In theory, this reporting strategy successfully conveys materiality.

This reporting strategy may result in one firm being identified as having a material weakness in, say, inventory control, while nothing is noted for the another firm, even though both firms have *identical* inventory controls. But because the auditor is unable to document its deciding factor, the two sets of working papers may not support differing evaluations,[35] particularly if the auditor evaluates the organization as having no control weaknesses (catering to the client?). As a result, the auditor may decide to (conservatively) resolve this apparent inconsistency by treating both firms alike. If two organizations with identical formal controls are reported to have weak formal control only when one or both has $L_U > m$, then a 404 report indicating no weaknesses indeed provides assurance that $L_U \leq m$, but a report of a control weakness does not assure that $L_U > m$.

Figure 3 also applies to the Section 302 reports required from management. Suppose that management again resolves its Section 302 reporting problem by documenting weaknesses in formal control (e.g., inventory or receivables) using defensible one-size-fits-all guidelines and a common threshold. Ashbaugh-Skaife et al. (2007) examine Section 302 control judgments and find a negative relation between judged control weaknesses and size.[36] As depicted in the upper panel, however, this relation may be weakened if the firms examined by the researcher have TATTs in the neighborhood of τ'. If we also consider the pre-SOX findings of DeFond and Jiambalvo (1991) and Willingham and Wright (1985), we see that the mixed results for associations between size and various measures of control as found in the literature may be due, in part, to undocumented interactions with TATT.

Innovation and Hackers

35 Under SOX, the PCAOB inspects the external auditor's work.

36 Doyle et al. (2007) document a similar relation for a sample containing both Section 302 and 404 reports.

Doyle et al. (2007) find that firms reporting material weaknesses in internal controls tend to be younger, financially weaker, more complex, growing rapidly, or undergoing restructuring. To explain this type of result, elsewhere Drew et al (2006, p. 137) highlight the commonly-held belief that:

> In highly uncertain market conditions, such as those encountered in innovative industries … [an] industry may be too young to have established widespread formal control systems and procedures.

On first impression, the inexperience with control design that Drew et al. refer to could be represented by a higher value of λ, which would be then interpreted as a higher learning cost. Inspection of (5a) reveals that formal control c declines with λ, leading to less overall control, which is indeed consistent with their observation. But Figure 2 suggests another possible explanation. It (as well as Proposition 1) indicates that assurance, $\frac{x_T}{\bar{x}}$, declines to zero as $\tau \to 0$, which happens when either $\eta \to 0$ and/or $\beta \to 1$, which means that a strictly positive TATT is a necessary condition for nonzero assurance –highlighting its accepted importance.[37] Similar to Kinney and McDaniel (1989) and Stice (1991), who describe slow adjustments to new personnel, processes and technology; allowing $\eta \to 0$ is consistent with scenarios where innovation occurs too swiftly for traditional relationships to form, or situations where revamped business models destroy organizational culture. The case where $\eta = 0$ is also consistent with unidentified outside hackers who escape punishment and have no relationship to protect. The final possibility is $\beta \to 1$, where opportunistic actions are accepted by the organization, but may be misinterpreted by the public as being unconventional or innovative.[38]

6. Extension: Aversion to Formal Control

[37] The [U.S.] Institute of Internal Auditors has even named its bimonthly newsletter, "Tone at the Top."

[38] *Fortune Magazine* ranked Enron as the "Most Innovative Company in America" in 2000 shortly before it filed for bankruptcy in 2001. A subcommittee of the Committee On Governmental Affairs United States Senate (2002) concluded that "the Enron Board of Directors failed to safeguard Enron shareholders and contributed to the collapse of the seventh largest public company in the United States…." Interestingly, Proposition 1 predicts that an independent authority (board of directors) should allow assurance to go to zero as $\beta \to 0$, and accordingly (in spite of the subcommittee's report), the board (excluding the CEO) resumed their prominent careers after Enron's failure.

There is a longstanding belief that trust may be eroded when formal controls are imposed on otherwise trustworthy agents. For example, Christ et al. (2008, p. 41) note that:

> formal control can limit the decision rights of the controlled party by specifying behaviors, operations, and activities of the controlled party, and this threat to autonomy can provide a signal of mistrust separate from that conveyed by scrutiny or intrusion. A large body of research documents a generally negative reaction—often hostility—when individuals feel that their freedoms are being restricted.

I model this erosion with a fractional component, αc, where the agent's utility equals:

$$U(d \mid x) = \begin{cases} (\beta\eta(1-\alpha c) + \gamma(1-c)x & \text{f the agent is noncompliant} \\ \eta(1-\alpha c) & \text{f the agent is compliant.} \end{cases} \tag{8}$$

And $\alpha < 1$.

The formulation is consistent with the idea that an agent with a higher value of η will have more trust to erode would than another agent with a lower value of η. Recalling that $\tau \equiv \frac{(1-\beta)\eta}{\gamma}$, the tipping point now becomes

$$x_T = \frac{\tau(1-\alpha c)}{1-c}. \tag{9}$$

Proposition 2 (Control Aversion): Let

$$\hat{\tau} = \frac{\sqrt{\lambda\left(\alpha^2\lambda + 4(1-\alpha)^2\bar{x}\right)} - \alpha\lambda}{2(1-\alpha)^2} \tag{10a}$$

Then $\hat{\tau}$ represents the threshold where $\frac{x_T}{\bar{x}}$ equals one (is less than one) for $\tau \geq \hat{\tau}$ $(\tau < \hat{\tau})$ and the authority who minimizes (3) sets

$$c=\begin{cases}1-\sqrt{\dfrac{2\lambda\bar{x}-(1-\alpha)^2\tau^2}{\bar{x}^2-\alpha^2\tau^2}} & \textit{if} \quad \tau<\hat{\tau} \\ \dfrac{\bar{x}-\tau}{\bar{x}-\alpha\tau} & \textit{if} \quad \tau\geq\hat{\tau}\end{cases} \tag{10b}$$

-- Place Figure 6 about here --

Figure 6 aids in interpreting (10a) and (10b). The upper panel indicates that the general effect of increasing α is to stretch the c - curve for $\alpha=.4$ to the right, causing it to intersect the c - curve for $\alpha=0$ at $\tau=\tau_1$. The intersection means that formal control may decrease or increase in the level of α, depending on τ. Consequently, for $\tau>\tau_1$, the indicated increase in control aversion from $\alpha=0$ to $\alpha=.4$ is accompanied by an *increase* in optimal control. Consequently control aversion also exhibits a reversal-like quality.

The Moderating Effect of Control Aversion

Figure 7 illustrates the decreasing marginal benefit of formal controls accompanying an increase in α. Note how the ascending portion of the c-curve flattens over $\tau\in[0,\hat{\tau}]$ as α increases, and then declines. This is important, because establishing complementarity between formal control and τ requires that the c-curve increase.

-- Place Figure 7 about here --

Corollary 3 below identifies the critical value of α, α_C, for which the c-curve completely flattens over $\tau\in[0,\hat{\tau}]$; and for $\alpha>\alpha_C$ it declines over $\tau\in[0,\hat{\tau}]$ for. Because the c-curve declines for all $\tau>\hat{\tau}$ regardless of α, α_C identifies a threshold for which the relation between c and τ becomes exclusively one of substitution (as is the case for $\alpha=.7$).

Corollary 3: Formal control c will be constant over $\tau\in[0,\hat{\tau}]$ when

$$\alpha = \alpha_C \equiv 1 - \sqrt{\frac{2\lambda}{\bar{x}}} \tag{11}$$

For Figure 7, $\alpha_C = .585786$. For α values greater than α_C, the authority uses the occasion of an increase, $\Delta\tau$, to *reduce* c, which, in turn, *magnifies* the marginal benefit of $\Delta\tau(1-\alpha c)$.[39] Expression (11) indicates that an increase in λ or a reduction in $\bar{x}$ (both of which serve to reduce the marginal benefit of c even more) increase of range of α over which the relation between c and τ is everywhere one of substitution.

Practical Implications of Control Aversion

Suppose that certain long-term initiatives, such as encouraging empowerment or teamwork initiatives, are aimed, in part, at reducing agents' resistance to control.[40] While the lower panel of Figure 7 indicates that while reducing α increases the level of assurance, the greatest gain from reducing α appears at intermediate levels of τ. Organizations facing low levels of τ rely primarily on formal control anyway, and organizations with high levels do not require much formal control, thereby limiting the opportunity for negative reaction. This observation might suggest that young or mature organizations may be the least interested in such programs, (if, indeed, τ tends to increase over time).

7. Monitoring as a Formal Control

To complete the study, consider a yet unaddressed issue – the role of formal monitoring. Monitoring is one of the five core components of COSO's internal-control framework, and is

---

[39] Due to the complexity of the expressions, ((10b) was graphed for a haphazardly chosen set of numerical parameters. All tests indicated that for $\tau \in [0, \hat{\tau}]$, c is convex (and increasing) for $\alpha < \alpha_C$ and concave (and decreasing) for $\alpha > \alpha_C$.

[40] These initiatives are controversial. Raelin (2011, p. 141) warns that management may create an illusion of empowerment by, say, replacing the term 'control' with 'commitment,' or that 'team-player' is often a euphemism for someone who plays his part without dissent or complaint.

clearly important in its own right.[41] In this section, I briefly describe a simple alternative model formulation and plot Figures that are similar to those plotted in in Figure 2.

Suppose that formal control is represented by the probability, g that the authority will detect noncompliance, should it occur. More specifically, suppose that an undetected noncompliant agent is able to maintain his or her trust while keeping the resources misappropriated from the authority, while a detected noncompliant agent must return the misappropriated assets (i.e., a clawback) and has a utility of $\beta\eta$ (fired, shamed, or penalized). Consequently, a *risk-neutral* agent who observes x has an expected utility of:

$$E[U(d \mid x)] = \begin{cases} g\beta\eta + (1-g)(\eta + \gamma x) & \text{if the agent is noncompliant} \\ \eta & \text{if the agent is compliant} \end{cases} \tag{12}$$

and the tipping point is now:

$$x_T = \left(\frac{(1-\beta)\eta}{\gamma} \right) \frac{g}{1-g} = \tau \frac{g}{1-g} \ , \tag{13}$$

Continuing to allow $\tau = \frac{(1-\beta)\eta}{\gamma}$ to summarize tone at the top allows for a comparison with previous results. Suppose that the authority's direct administrative cost of g equals $\hat{K}(g) = \frac{\omega}{1-g}$, where $0 < \omega < \frac{\bar{x}}{2}$. Conditional on a particular x, the authority has an expected payoff:

$$E[R(d \mid x)] = \begin{cases} gx - \hat{K}(g) & \text{if the agent is noncompliant} \\ x - \hat{K}(g) & \text{if the agent is compliant.} \end{cases} \tag{14}$$

[41] COSO's framework includes: monitoring; control environment (including tone at the top); risk assessment; control activities; and information and communication. See Orenstein (2009).

This implies that, subject to (13), the authority's total expected cost is:

$$\hat{L} = \left(\frac{\bar{x} - x_T}{\bar{x}} \right)(1-g)\left(\frac{\bar{x} + x_T}{2} \right) + \frac{\omega}{1-g}, \tag{15}$$

The model contains a nuance – the probability of noncompliance is $\frac{\bar{x} - x_T}{\bar{x}}$, but the control is assumed to be self-correcting with probability g. That is, upon discovery, the authority is able to claw back x from a noncomplying agent. Accordingly, I define the level of *net assurance* as

$$a = \begin{cases} \frac{x_T}{\bar{x}} + g\frac{\bar{x} - x_T}{\bar{x}} \text{ if } x_T < \bar{x} \\ 1 \text{ f } x_T = \bar{x} \end{cases} \tag{16}$$

Proposition 3 (Formal Monitoring Control): Let

$$\breve{\tau} = \frac{\omega + \sqrt{\omega^2 + 4\bar{x}\omega}}{2} \tag{17a}$$

Then $\breve{\tau}$ represents the threshold where $\frac{x_T}{\bar{x}}$ equals one (is less than one) for $\tau \geq \breve{\tau}$ $(\tau < \breve{\tau})$, and the authority who minimizes (3) sets

$$g = \begin{cases} 1 - \sqrt{\frac{2\omega\bar{x} - \tau^2}{\bar{x}^2 - \tau^2}} & \textit{if} \quad \tau < \breve{\tau} \\ \frac{\bar{x}}{\bar{x} + \tau} & \textit{if} \quad \tau \geq \breve{\tau} \end{cases} \tag{17b}$$

and tipping point is

$$x_T = \begin{cases} \tau\left(\sqrt{\frac{\bar{x}^2 - \tau^2}{2\omega\bar{x} - \tau^2}} - 1 \right) & \textit{if} \quad \tau < \breve{\tau} \\ \bar{x} & \textit{if} \quad \tau \geq \breve{\tau} \end{cases} \tag{17c}$$

Figure 8 illustrates Proposition 3.

-- Place Figure 8 about here --

Figure 8 illustrates that formal monitoring control and TATT are complements for low values of TATT and substitutes for high values. The minimum probability of compliance, $\frac{x_T}{\bar{x}}$ again equals zero, but minimum value of net assurance, a, equals one-half due to a self-correction when a noncompliant agent is caught.

8. Concluding Remarks

Two former COSO chairs, David Landsittel and Larry Rittenberg (2010), emphasize the need for further academic research on a number of areas, including 'tone at the top.' Theoretical research, however, has been hindered by the fact that tone at the top is a soft notion, thereby presenting challenges to the modeler. To that end, I have a chosen an exploratory model grounded on comments and findings from scholars in related fields, as well as statements taken from standard setters and influential professional groups. Returning to my initial question, "Are formal control and TATT complements or substitutes?," we see that the answer is "They could be either." One of the key contributions of this study is to identify a simple explanation for why and how a particular relation might hold. That explanation entails a demonstration of how the marginal benefit of costly formal control increases with TATT for low levels of TATT, and reverses by decreasing for with TATT for high levels of TATT. This result, in turn, has additional implications: the mixed results reported by academic studies may be caused by reversals; Sarbanes Oxley (SOX) reporting requirements that put undue weight on documentable (formal) control may create ambiguous assurance reports; an increasing aversion to formal control may result in more formal control rather than less – depending in the level of TATT; and an extreme aversion to formal control may lessen or eliminate the possibility of complementary relations between formal control and TATT.

References

Anthony, Robert, 1965, *Planning and Control Systems: Framework for Analysis*, Boston, Harvard University Press.

Argyris, Chris, 1952, *The Impact of Budgets on People*, New York: Controllership Foundation.

Arya, Anil, Jonathan Glover and Shyam Sunder, 1998, Earnings Management and the Revelation Principle, *Review of Accounting Studies,* Vol. 3, pp. 7-34.

Ashbaugh-Skaife, Hollis, Daniel Collins and William Kinney, 2007, The Discovery and Consequences of Internal Control Deficiencies Prior to SOX-Mandated Audits, *Journal of Accounting and Economics* Vol. 44: pp. 166-192.

Autorité des Marchés Financiers (AMF), 2009, *AMF 2009 Report On Corporate Governance And Internal Control*, Paris, AMF. Last accessed 6/15/16 at http://www.amf-france.org/en_US/Publications/Rapports-etudes-et-analyses/Gouvernement-d-entreprise.html

Bhattacharjee, Sudip, Mario Maletta and Kimberly Moreno, 2007, The Cascading of Contrast Effects on Auditors' Judgments in Multiple Client Audit Environments, *The Accounting Review*, Vol. 82, pp. 1097-1117.

Bierstaker, James and Jay Thibodeau, 2006, The Effect of Format and Experience on Internal Control Evaluation, *Managerial Auditing Journal*, Vol. 21, pp. 877-891

Bok Sissela, 1995, Shading the Truth in Seeking Informed Consent for Research Purposes, *Kennedy Institute of Ethics Journal*, Vol. 5, pp. 1–17.

Brennan, Geoffrey, 1998, Democratic Trust: A Rational Choice Theory View, in *Trust and Governance*, Valerie Braithwaite and Margaret Levi, editors, New York, Russell Sage Foundation, pp. 197-217.

Chatfield, Michael, 1974, *A History of Accounting Thought*, Hinsdale, IL, Dryden Press.

Christ, Margaret, Karen Sedatole, Kristy Towry, and Myra Thomas, 2008, When Formal Controls Undermine Trust and Cooperation, *Strategic Finance*, Vol. 89, pp. 39-44.

Chtioui, Tawhid and Stéphanie Thiéry-Dubuisson, 2011, Hard and Soft Controls: Mind the Gap!, *International Journal of Business*, Vol. 16, pp. 289-302.

Committee of Sponsoring Organizations of the Treadway Commission (COSO), 2013a, *Internal Control – Integrated Framework: Internal Control over External Reporting: A Compendium of Approaches and Examples*, New York, COSO.

Committee of Sponsoring Organizations of the Treadway Commission (COSO), 2013b, *Internal Control – Integrated Framework: Executive Summary*, New York, COSO. Last accessed 5/17/16 at http://www.coso.org/documents/990025p_executive_summary_final_may20_e.pdf

Committee on Governmental Affairs United States Senate, 2002, The Role Of The Board Of Directors In Enron's Collapse, U.S. Government Printing Office, Washington, D.C. Last accessed 9/15/2016 at https://www.gpo.gov/fdsys/pkg/CPRT-107SPRT80393/html/CPRT-107SPRT80393.htm

DeFond, Mark and James Jiambalvo, 1991, Incidence and Circumstances of Accounting Errors. *The Accounting Review*, Vol. 66, pp. 643–655.

Desai, Mihir , Alexander Dyck, and Luigi Zingales, 2007, Theft and Taxes, *Journal of Financial Economics*, Vol. 84, pp. 591-623.

Doty, James, 2012, *The Relevance of Audits and the Needs of Investors*. Washington, D.C.: Public Company Accounting Oversight Board (PCAOB). Last Accessed 9/5/16 https://pcaobus.org/News/Speech/Pages/05312012_DotyAuditsInvestors.aspx

Dowling, Carlin, W. Robert Knechel, and Robyn Moroney, 2015, Public Oversight of Audit Firms: The Slippery-Slope of Enforcing Regulation, SSRN. Last Accessed 9/11/16 at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2678828

Doyle, Jeffrey, Weili Ge, and Sarah McVay, 2007, Determinants of Weaknesses in Internal Control over Financial Reporting, *Journal of Accounting and Economics*, Vol. 44, pp. 193–223.

Drew, Stephen, Patricia Kelley and Terry Kendrick, 2006, CLASS: Five Elements of Corporate Governance to Manage Strategic Risk, *Business Horizons*, Vol. 49, pp. 127-138.

Falk, Armin, and Michael Kosfeld, 2006, The Hidden Costs of Control, *The American Economic Review*, Vol. 96, pp. 1611-1630.

Fudenberg, Drew and Jean Tirole, 1993, *Game Theory*, Cambridge, MA, MIT Press.

Greif, Avner, 1993, Contract Enforceability and Economic Institutions in Early Trade: The Maghribi Traders' Coalition, *The American Economic Review*, Vol. 83, pp. 525-548.

Hammersley, Jacqueline, Linda Myers and Catherine Shakespeare, 2008, Market reactions to the disclosure of internal control weaknesses and to the characteristics of those weaknesses under section 302 of the Sarbanes Oxley Act of 2002, *Review of Accounting Studies*, Vol. 13, pp. 141-165.

Hardin, Russell, 2003, Gaming Trust, in *Trust and Reciprocity: Interdiscplinary Lessons form Experimental Research*, edited by Elinor Ostrom and James Walker, New York, Russell Sage Foundation, pp. 80-101.

Hermanson, Dana, Jason Smith and Nathaniel Stephens, 2012, How Effective are Organizations' Internal Controls? Insights into Specific Internal Control Elements, *Current Issues in Auditing*, Vol. 6, pp. A31-A50.

Hogan, Chris, Zabihollah Rezaee, Richard Riley, Jr. and Uma Velury, Financial Statement Fraud: Insights from the Academic Literature, *Auditing: A Journal of Practice and Theory*, Vol. 27, pp. 231-252.

Houghton, Keith, Michael Kend and Christine Jubb (2013), The CLERP 9 Audit Reforms: Benefits and Costs Through the Eyes of Regulators, Standard Setters and Audit Service Suppliers, *ABACUS*, Vol. 49, pp. 139-160.

Institute of Internal Auditors (IAA), 2016, More Than Just Setting the Tone: A Look at Organizational Culture, *Tone at the Top*, Issue 76 (February) Altamonte Springs, FL, IAA. Last accessed 5/19/16 at https://na.theiia.org/periodicals/Public%20Documents/TaT-February-2016.pdf

Institute of Internal Auditors (IAA), 2008, *Sarbanes-Oxley Section 404: A Guide for Management by Internal Controls Practitioners, Second Edition* (January), Altamonte Springs, FL, IAA. Last accessed 5/30/16 at https://na.theiia.org/standards guidance/Public%20Documents/Sarbanes-Oxley_Section_404_--_A_Guide_for_Management_2nd_edition_1_08.pdf

Janvrin, Diane, Elizabeth Payne, Paul Byrnes, Gary Schneider, and Mary Cutis, 2012. The Updated COSO Internal Control— Integrated Framework: Recommendations and Opportunities for Future Research, *Journal of Information Systems*, Vol. 26, pp. 189-213.

Jonas, Gregory, Alan Rosenberg, Michael Doss and Garry Cihak, 2005, *Section 404 Reporting on Internal Control: Our Early Experience, New York Moody's Investor Service.* Report Number: 92048. Last accessed 7/3/16 at http://www.chugachelectric.com/pdfs/agenda/fcagenda_060805.xii.a.pdf

Kinney, William and Linda McDaniel, 1989, Characteristics of Firms Correcting Previously Reported Quarterly Earnings, *Journal of Accounting and Economics*, Vol. 11, pp. 71-93.

Kreps, David, 1990, Corporate Culture and Economic Theory, in *Perspectives on Positive Political Economy*, James Alt and Kenneth Shepsle, editors, Cambridge University Press, Cambridge, pp. 90-143.

La Porta, Rafael, Florencio Lopez-De- Silanes, Andrei Shleifer and Robert Vishny, 1997, Trust in Large Organizations, *The American Economic Review*, Vol. 87, pp. 333-338.

Landsittel, David and Larry Rittenberg, 2010, COSO: Working with the Academic Community, *Accounting Horizons*, Vol. 24, pp. 455-469.

Love, Leonard, Richard Priem, and G.T. Lumpkin, 2002, Explicitly Articulated Strategy and Firm Performance Under Alternative Levels of Centralization, *Journal of Management*, Vol. 28, pp. 611-627.

Marden, Ronald, Gary Holstrum and Sandra Schneider, 1997, Control Environment Condition and the Interaction Between Control Risk, Account Type and Management's Assertions, *Auditing: A Journal of Practice and Theory*, Vol. 16, pp. 51-68.

McNally, Stephen, 2013, *The 2013 COSO Framework & SOX Compliance: One Approach to an Effective Transition*, New York, Committee of Sponsoring Organizations of the Treadway Commission. Last accessed 5/19/16 at http://www.coso.org/documents/coso%20mcnallytransition%20article-final%20coso%20version%20proof_5-31-13.pdf

Melby, Caleb and Yalman Onaran, 2016, Clawing Back Bankers' Pay at Wells Fargo Is Harder Than It Looks, *Bloomberg News* (September 21). Last accessed (9/22/16) at; http://www.bloomberg.com/news/articles/2016-09-21/clawing-back-bankers-pay-at-wells-fargo-is-harder-than-it-looks

Newman, D. Paul, Evelyn Patterson and J. Reed Smith, 2005, The Role of Auditing in Investor Protection, *The Accounting Review*, Vol. 80, pp. 289-313.

Nooteboom, Bart, 1996, Trust, Opportunism and Governance: A Process and Control Model, *Organization Studies*, Vol. 17, pp. 985-1010.

Orenstein, Edith, 2009, COSO's New Guidance for Monitoring Internal Control, *Financial Executive*, Vol. 25 (January/February), pp. 57-59.

Orin, Richard, 2008, Ethical Guidance and Constraint Under the Sarbanes-Oxley Act of 2002, *Journal of Accounting, Auditing and Finance*, Vol. 23, pp. 141-171.

Public Company Accounting Oversight Board (PCAOB), 2007, *Report On The Second-Year Implementation Of Auditing Standard No. 2, An Audit Of Internal Control Over Financial Reporting Performed In Conjunction With An Audit Of Financial Statements*. Washington D.C., PCAOB. Last accessed 8/1/16 at https://pcaobus.org/Inspections/Documents/2007_04-18_Release_2007-004.pdf

Public Company Accounting Oversight Board (PCAOB), 2006, *A Layperson's Guide to Internal Control Over Financial Reporting (ICFR).* Washington, D.C.: PCAOB. Last Accessed 8/2/16 at https://pcaobus.org/News/Speech/Pages/03312006_GillanCouncilInstitutionalInvestors.aspx

Public Company Accounting Oversight Board (PCAOB), 2005, *Policy Statement Regarding Implementation Of Auditing Standard No. 2, An Audit Of Internal Control Over Financial Reporting Performed In Conjunction With An Audit Of Financial Statements*, Washington D.C., PCAOB. Last accessed 7/19/16 at https://pcaobus.org/Rulemaking/Docket008/2005-05-16_Release_2005-009.pdf

Raelin, Joseph, 2011, The End of Managerial Control? *Group and Organization Management*, Vol. 36, pp. 135-160.

Rajan, Raghuram and Luigi Zingales, 2001, The Firm as a Dedicated Hierarchy: A Theory of the Origins and Growth of Firms, *Quarterly Journal of Economics*, Vol.116, pp. 805-851.

Rice, Sarah and David Weber, 2012, How Effective Is Internal Control Reporting under SOX 404? Determinants of the (Non-) Disclosure of Existing Material Weaknesses, *Journal of Accounting Research,* Vol. 50, pp. 811-843.

Rousseau, Denise, Sim Sitkin, Ronald Burt, and Colin Camerer, 1998, Not So Different After All: A Cross-discipline View of Trust, *Academy of Management Review*, Vol. 23, pp. 393-404.

Securities and Exchange Commission (SEC), 2008, *Final Rule: Management's Report on Internal Control Over Financial Reporting and Certification of Disclosure in Exchange Act Periodic Reports*. Washington D.C., SEC. Last accessed 9/22/16 at https://www.sec.gov/rules/final/33-8238.htm

Securities and Exchange Commission (SEC), 2008, *SEC Approves One-Year Extension for Small Businesses From Auditor Attestation Requirement in Sarbanes-Oxley Act*, Washington D.C., SEC. Last accessed 9/22/16 at https://www.sec.gov/news/press/2008/2008-116.htm

Shleifer, Andrei and Daniel Wolfenzon, 2002, Investor Protection and Equity Markets. *Journal of Financial Economics*, Vol. 16: pp. 3-28.

Stice, James, 1991, Using Financial and Market Information to Identify Pre-Engagement Factors Associated with Lawsuits against Auditors, *The Accounting Review*, Vol 66, pp. 516-533.

Swinkels, Walter, 2012, *Exploration of a Theory of Internal Audit,* Delft, Netherlands, Eburon Delft.

Tysiac, Ken, 2012, Internal Control Revisited: Prominent COSO officials discuss proposed updates to framework. *Journal of Accountancy*, Vol. 213 (March), pp. 24-29.

Weibel, Antoinette, 2007, Formal Control and Trustworthiness: Shall the Twain Never Meet?, *Group and Organization Management*, Vol. 32, pp. 500-517.

Weiss, Dan, 2014, Internal Controls in Family Owned Firms. *European Accounting Review*, Vol. 23, pp. 463-482.

Weiss, Eliot, 2003, Some Thoughts on an Agenda for the Public Company Accounting Oversight Board, *Duke Law Journal*, Vol. 53, pp. 491-515.

Wells, Bret, 2011, New Schedule UTP: Uncertain Tax Positions In The Age Of Transparency, *Baylor Law Review*, Vol. 63, pp. 392-438.

Willingham, John., and William Wright, 1985, Financial Statement Errors and Internal Control Judgments, *Auditing: A Journal of Practice & Theory*, Vol. 5, pp. 57-69.

Yang, Zhilin, Chen Zhou, and Ling Jiang, 2010, When Do Formal Control and Trust Matter? A Context-Based Analysis of the Effects in Marketing Channel Relationships in China, *Industrial Marketing Management*, Vol. 40, pp. 86-96.

Appendix

Proof of Observation 1: Either $x_T < \bar{x}$ or $x_T = \bar{x}$. Return to Figure 1. Suppose that $x_T < \bar{x}$. Then, ceteris paribus, increasing τ increases the point of intersection, x_T, leaves the authority with a strictly lower expected cost. If $x_T = \bar{x}$, then compliance is 100% and increasing τ allows the authority to decrease c while maintaining 100% compliance, thus strictly lowering the authority's expected cost as well, completing the proof.

Proof of Proposition 1: Noting that $\tau = \frac{(1-\beta)\eta}{\gamma}$, condition (3) simplifies to

$$\frac{2\lambda\bar{x} + (1-c)^2\bar{x}^2 - \tau^2}{2(1-c)\bar{x}} \tag{A1}$$

(A1) is strictly convex in c (ensuring a unique minimum) as long as

$$\tau < \sqrt{2\lambda\bar{x}}\,. \tag{A2}$$

The first-order condition of (A1) with respect to c is

$$c = 1 - \frac{\sqrt{2\lambda\bar{x} - \tau^2}}{\bar{x}}, \tag{A3}$$

Which is a valid expression as long as

$$\tau \le \sqrt{2\lambda\bar{x}}\,. \tag{A4}$$

(A3) is increasing in τ which implies that $x_T = \frac{\tau}{1-c}$ is increasing in τ and represents an interior solution as long as $\frac{\tau}{(1-c)} < \bar{x}$. The corner solution is reached when

$$\frac{\tau}{(1-c)} = \bar{x}\,. \tag{A5}$$

Inserting (A3) into (A5), results in $x_T = \bar{x}$ when

$$\tau = \sqrt{\lambda\bar{x}}\,. \tag{A6}$$

which meets requirements (A2) and (A4). A corner solution means that $\beta\eta + \gamma(1-c)x_T = \eta$, or

$$c = 1 - \left(\frac{(1-\beta)\eta}{\gamma}\right)\frac{1}{\bar{x}} = 1 - \frac{\tau}{\bar{x}}, \text{ for } \tau \ge \sqrt{\lambda\bar{x}} \tag{A7}$$

and c is defined by (A3) when $\tau < \sqrt{\lambda \bar{x}}$. Finally, inserting (A3) into the definition of $\frac{\tau}{1-c}$ we get $x_T = \frac{\tau \bar{x}}{\sqrt{2\lambda \bar{x} - \tau^2}}$ when $\tau < \sqrt{\lambda \bar{x}}$, **c**ompleting the proof.

Proof of Corollary 1: First consider the case where $\tau < \sqrt{\lambda \bar{x}}$ and $c = 1 - \frac{\sqrt{2\lambda \bar{x} - \tau^2}}{\bar{x}}$. The derivative of c with respect to $\bar{x}$ is

$$\frac{\lambda \bar{x} - \tau^2}{\bar{x}^2 \sqrt{\left(2\lambda \bar{x} - \tau^2\right)}} > 0. \tag{A8}$$

Next, if $\tau \geq \sqrt{\lambda \bar{x}}$, then $c = 1 - \frac{\tau}{\bar{x}}$, which is clearly increasing in $\bar{x}$, completing the proof.

Proof of Corollary 2: Insert the optimal values of c into L_U to obtain

$$L_U = \begin{cases} \frac{\lambda \bar{x} - \tau^2}{\sqrt{2\lambda \bar{x} - \tau^2}} & \text{if } \tau < \sqrt{\lambda \bar{x}} \\ 0 & \text{if } \tau \geq \sqrt{\lambda \bar{x}} \end{cases}$$

Noting that the derivative of L_U equals $\tau \frac{\tau^2 - 3\lambda \bar{x}}{\left(2\lambda \bar{x} - \tau^2\right)^{\frac{3}{2}}} < 0$ for $\tau < \sqrt{\lambda \bar{x}}$ completes the proof.

Proof of Proposition 2: The proof of Proposition is similar in nature to that of Proposition 1. In this case

$$x_T = \frac{(1-\beta)\eta(1-\alpha c)}{\gamma(1-c)} = x_T = \frac{\tau(1-\alpha c)}{1-c} \tag{A9}$$

Condition (3) simplifies to

$$\frac{2\lambda \bar{x} + (1-c)^2 \bar{x}^2 - (1-\alpha c)^2 \tau^2}{2(1-c)\bar{x}}, \tag{A10}$$

which is strictly convex as long as $\tau < \frac{\sqrt{2\lambda \bar{x}}}{(1-\alpha)}$. The first order condition of (3) with respect to c implies that

$$c = 1 - \sqrt{\frac{\left(2\lambda\bar{x} - (1-\alpha)^2\tau^2\right)}{\bar{x}^2 - \alpha^2\tau^2}}, \tag{A11}$$

which noting that $\tau \le \bar{x}$ (assumed), is valid as long as $\tau < \frac{\sqrt{2\lambda\bar{x}}}{(1-\alpha)}$, which is also the condition noted above for a unique solution.

Substituting (A11) into (A9), and solving gives

$$\frac{\tau\left(1+\alpha\left(\sqrt{\frac{2\lambda\bar{x}-(1-\alpha)^2\tau^2}{\bar{x}^2-\alpha^2\tau^2}}-1\right)\right)}{\sqrt{\frac{2\lambda\bar{x}-(1-\alpha)^2\tau^2}{\bar{x}^2-\alpha^2\tau^2}}}. \tag{A12}$$

(A12) represents the value of x_T whenever $x_T < \bar{x}$. That value of τ for which $x_T = \bar{x}$ (corner solution) is

$$\hat{\tau} = \frac{\sqrt{\lambda\left(\alpha^2\lambda + 4(1-\alpha)^2\bar{x}\right)} - \alpha\lambda}{2(1-\alpha)^2}. \tag{A13}$$

When $x_T = \bar{x}$, $\beta\eta(1-\alpha c) + (1-c)x_T = \eta(1-\alpha c)$ which (solving for c) means that whenever $x_T = \bar{x}$,

$$c = \frac{\bar{x} - \frac{(1-\beta)\eta}{\gamma}}{\bar{x} - \alpha\frac{(1-\beta)\eta}{\gamma}} = \frac{\bar{x}-\tau}{\bar{x}-\alpha\tau}. \tag{A14}$$

(A11) – (A14) complete the proof.

Proof of Corollary 3: Suppose that $\tau < \hat{\tau}$. Then $c = 1 - \sqrt{\frac{2\lambda\bar{x} - (1-\alpha)^2\tau^2}{\bar{x}^2 - \alpha^2\tau^2}}$. The derivative of c with respect to τ is

$$\frac{\tau\bar{x}\left(\bar{x}(1-\alpha)^2 - 2\alpha^2\lambda\right)}{\left(\bar{x}^2 - \alpha^2\tau^2\right)^2\sqrt{\frac{2\lambda\bar{x} - \tau^2(1-\alpha)^2}{\bar{x}^2-\alpha^2\tau^2}}}. \tag{A15}$$

The derivative (A15) will equal zero when the numerator $\tau\bar{x}\left(\bar{x}(1-\alpha)^2 - 2\alpha^2\lambda\right)$ equals zero. The numerator equals zero when $\alpha = \frac{\bar{x} - \sqrt{2\lambda\bar{x}}}{\bar{x} - 2\lambda} = 1 - \sqrt{\frac{2\lambda}{\bar{x}}}$, completing the proof.

Proof of Proposition 3: The proof of Proposition is similar in nature to that of Proposition 1. Let $\tau = \frac{(1-\beta)\eta}{\gamma}$ and $x_T = \tau\left(\frac{g}{1-g}\right)$. Then expression (15) becomes

$$\frac{2\omega\bar{x} + (1-g)^2\bar{x}^2 - g^2\tau^2}{2(1-g)\bar{x}} \tag{A16}$$

(A1) is strictly convex in c as long as $\tau < \sqrt{2\omega\bar{x}}$ .The first order condition with respect to g is:

$$g = 1 - \sqrt{\frac{\left(2\omega\bar{x} - \tau^2\right)}{\bar{x}^2 - \tau^2}} \tag{A17}$$

Put (A17) into x_T to find that $x_T = \bar{x}$ when

$$\tau = \frac{\omega + \sqrt{\omega^2 + 4\bar{x}\omega}}{2} \tag{A18}$$

and we have a corner solution. For $\tau > \frac{\omega + \sqrt{\omega^2 + 4\bar{x}\omega}}{2}$ a corner solution means that $(1-g)(\eta + \gamma x_T) + g\beta\eta = \eta$, or

$$g = \frac{x_T}{x_T + \tau} \tag{A19}$$

To find x_T for $\tau \le \frac{\omega + \sqrt{\omega^2 + 4\bar{x}\omega}}{2}$, insert (A17) into the definition of x_T to get

$$x_T = \tau\left(\sqrt{\frac{\bar{x}^2 - \tau^2}{2\omega\bar{x} - \tau^2}} - 1\right)$$

It can be verified that $\sqrt{2\omega\bar{x}} - \left(\frac{\omega + \sqrt{\omega^2 + 4\bar{x}\omega}}{2}\right)$ is positive for all $\omega \in \left(0, \frac{\bar{x}}{2}\right)$. Noting that $\omega < \frac{\bar{x}}{2}$ (assumed), (A18) is less than $\sqrt{2\omega\bar{x}}$, meaning that (A17) describes the optimal control over a valid interval, completing the proof.

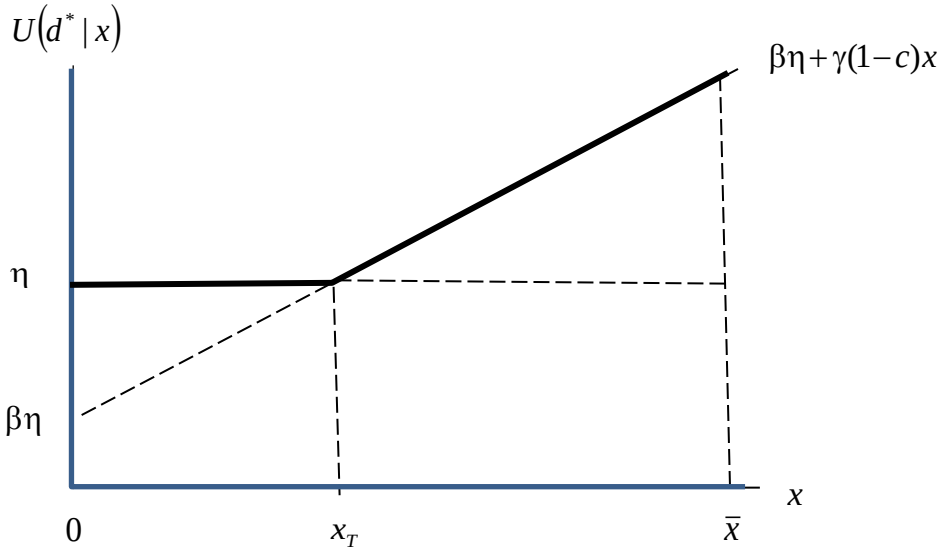

Figure 1: The agent's utility (darkened segments) where $x_T = \frac{(1-\beta)\eta}{\gamma(1-c)}$.

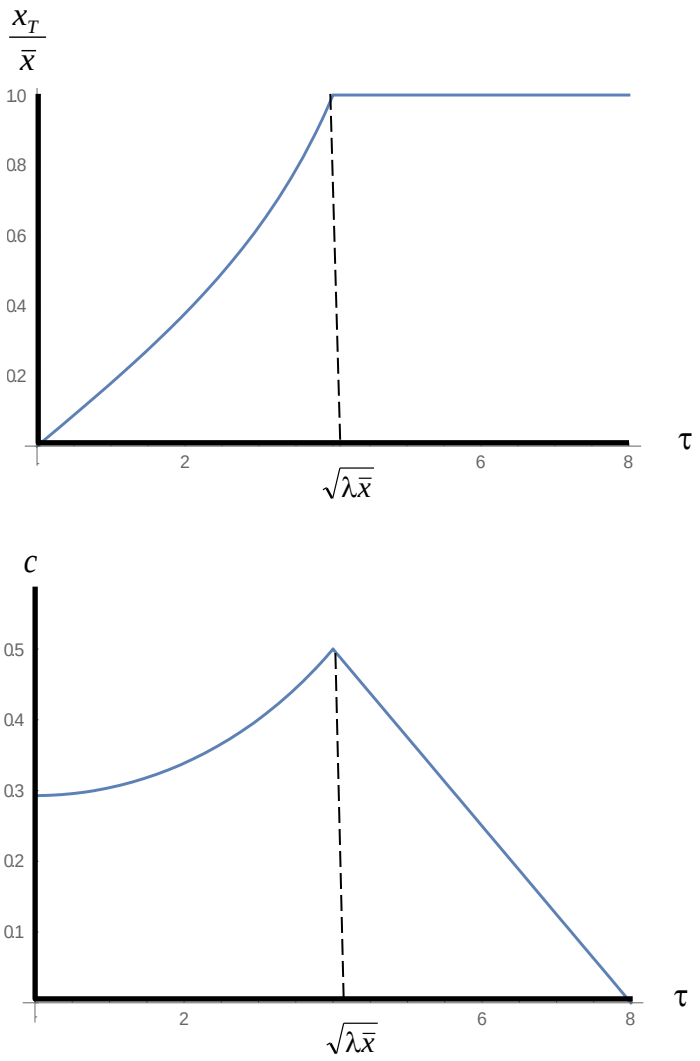

Figure 2: The optimal levels of assurance and formal control as a function of TATT ($\lambda = 2$ and $\bar{x} = 8$).

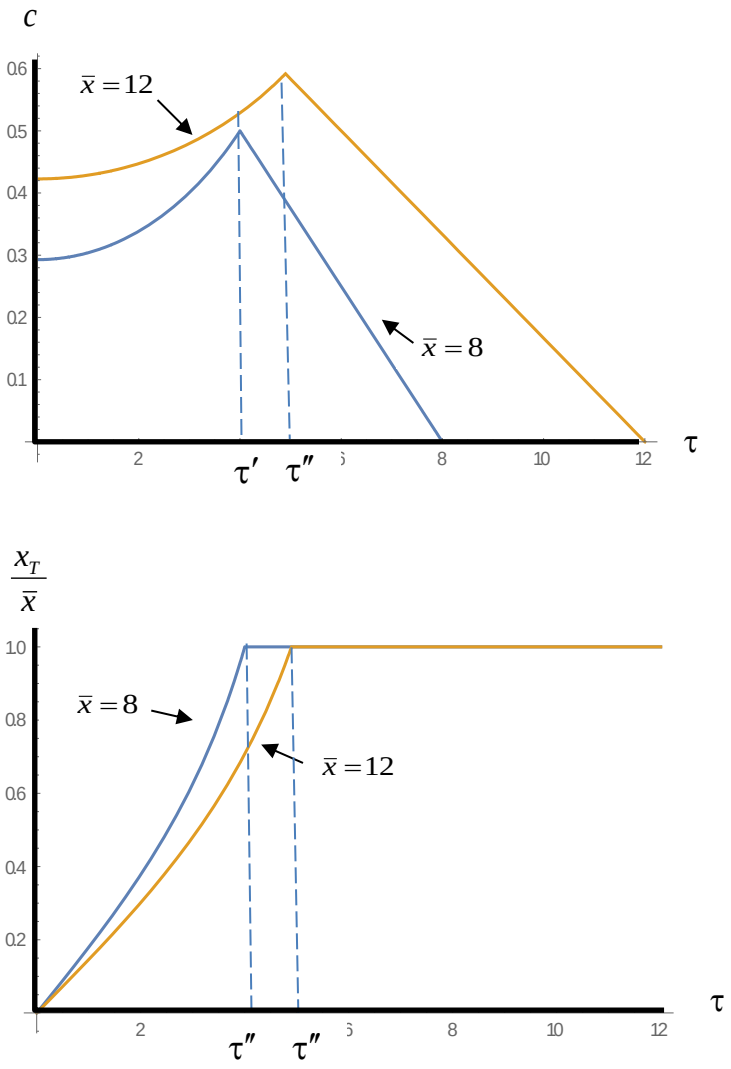

Figure 3: The optimal level of formal control and assurance as a function of TATT ($\lambda = 2$, for upper bounds, $\bar{x} = 8$ and $\bar{x} = 12$).

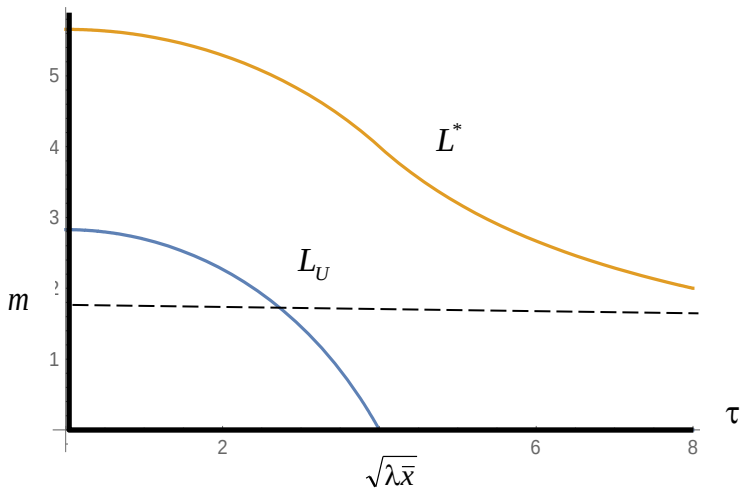

Figure 4 (Differing Points of View): L^* is the minimized value of (3). L^* is of concern to the authority, while L_U is of concern to the external auditor ($\lambda = 2$ and $\bar{x} = 8$).

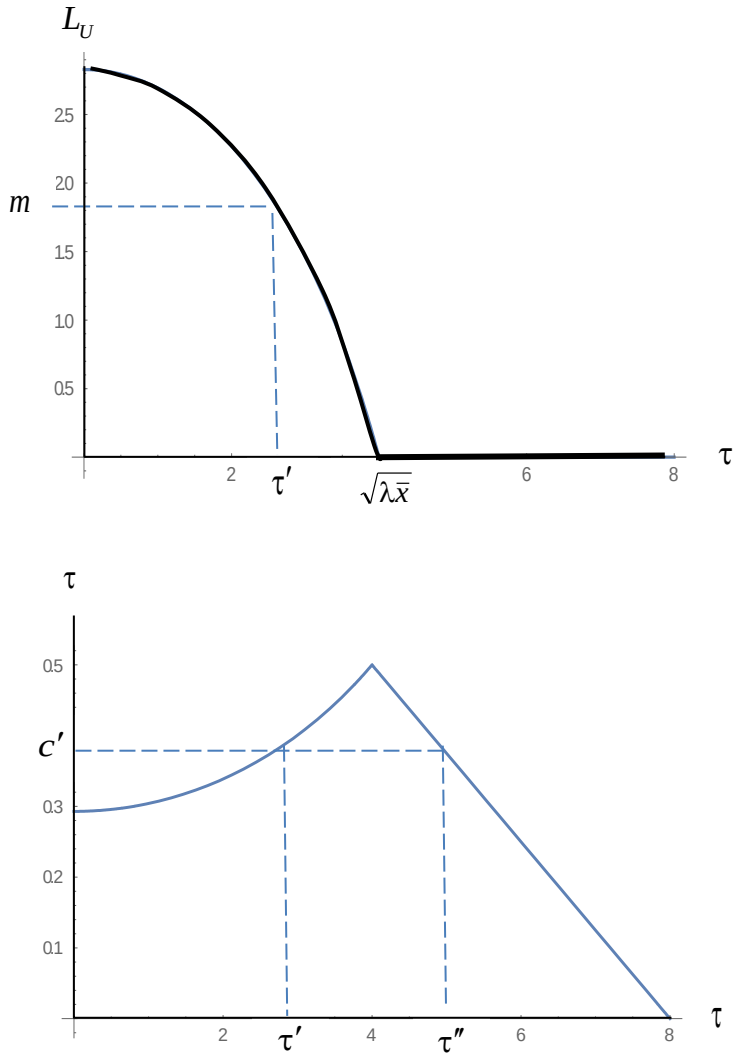

Figure 5 (A Proposed Reporting Strategy): A minimal level of formal control used to document a Section 404 report. The materiality threshold for L_U is *m.* This determines τ', which in turn, specifies c' ($\lambda = 2$ and $\bar{x} = 8$).

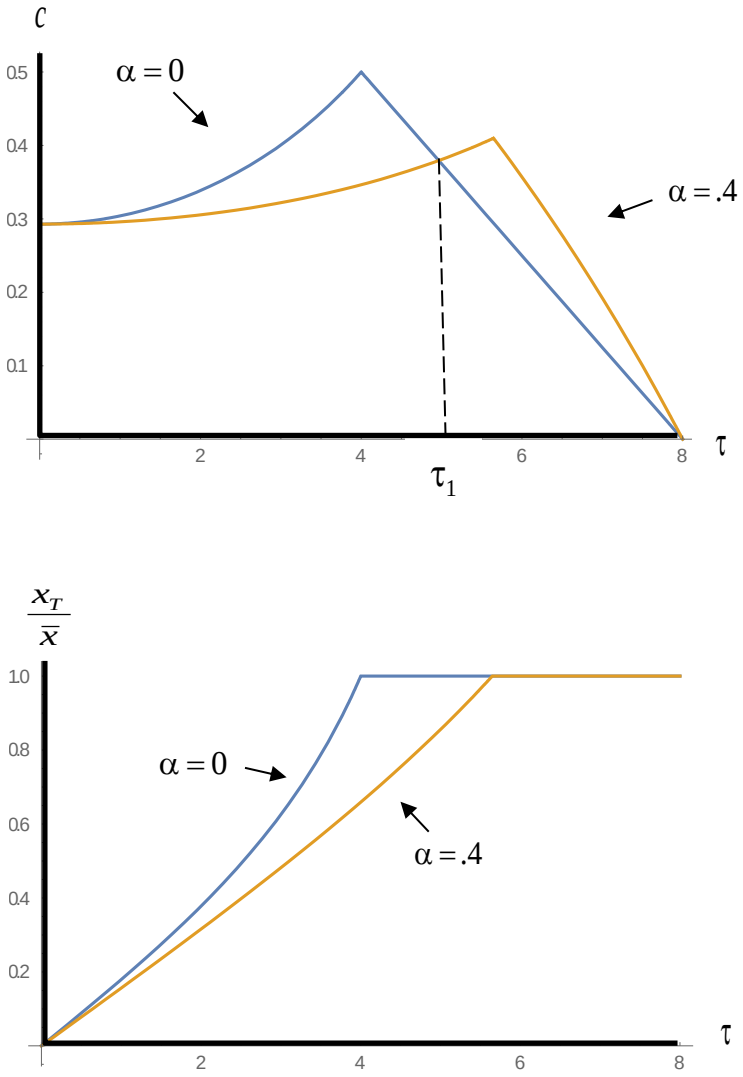

Figure 6 (Aversion to Formal Control) : The optimal levels of formal control and assurance for $\alpha = 0$ and $\alpha = .4$ ($\lambda = 2$ and $\bar{x} = 8$).

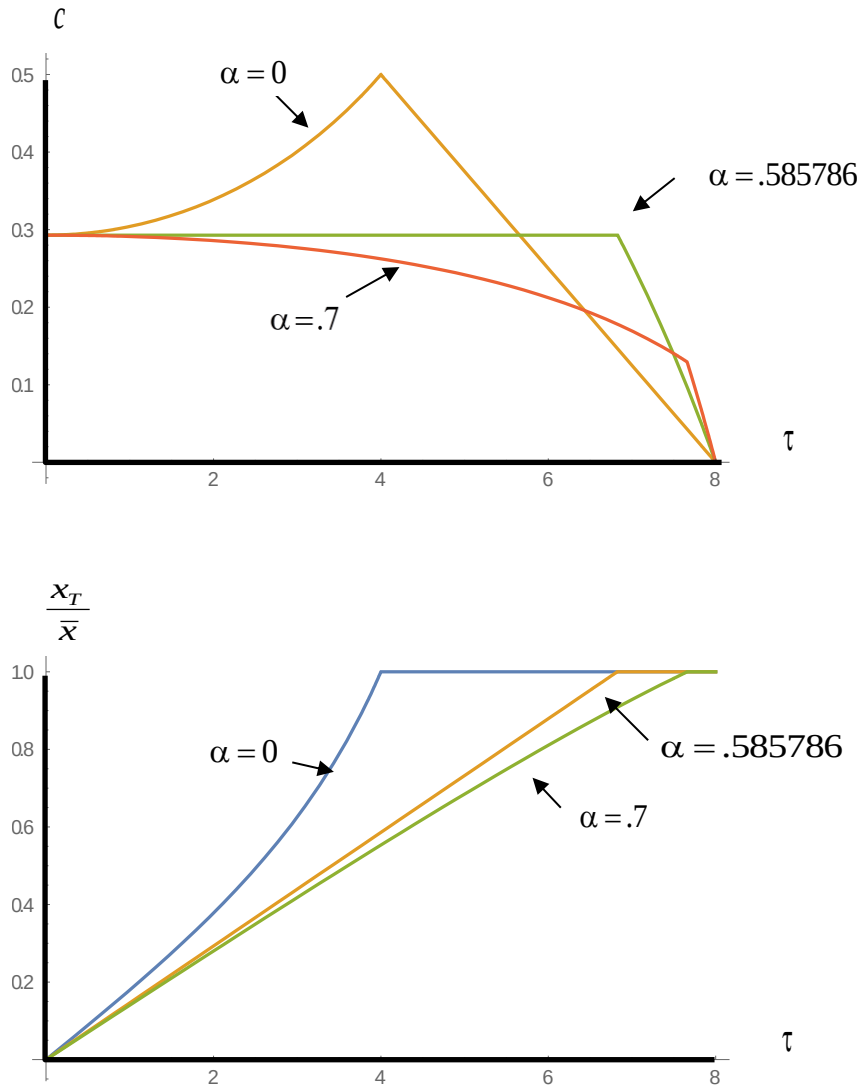

Figure 7 (Aversion to Formal Control) : The optimal levels of formal control and assurance for $\alpha = .4$, $\alpha = .585786$ and $\alpha = .7$ ($\lambda = 2$ and $x = 8$).

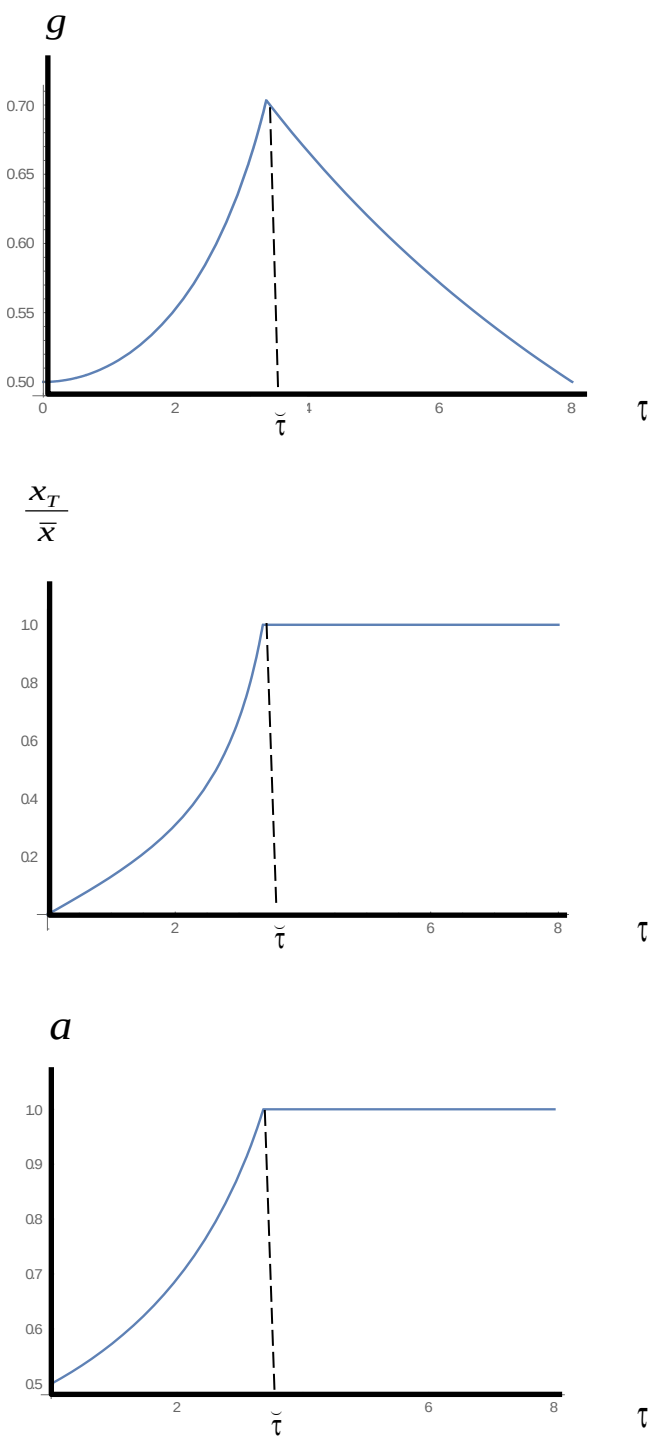

Figure 8: (**Formal Monitoring Control)**. The optimal level of formal control, probability of compliance and the level assurance, a, as a function of TATT for a monitoring scenario where g represents the probability of detecting a noncompliant agent. ($\omega = 1$ and $\bar{x} = 8$).