Regulatory Commitment to Auditing and Pay-Performance Sensitivity

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Abstract

The purpose of this paper is to investigate the impact on pay-performance sensitivity of a commitment by regulatory bodies to monitor the auditing of managers' financial reporting. We approach our investigation first by modeling the effect of an imposed mandatory audit of the auditor. We then test our model in an empirical setting by comparing managers' pay-performance sensitivity before and after the passage of the Sarbanes-Oxley (SOX) Act of 2002. Our model reveals that, in a laissez-faire economy with random audits and inspections, the pay-performance sensitivity remains the same as that of the classic moral hazard problem. However, when required audits or inspections are introduced, the change in pay-performance sensitivity is shown to vary depending on the state of nature. We draw on the predictions of the model to investigate in an empirical setting the impact on managerial incentive schemes of the regulatory commitment initiated by SOX. Consistent with a generally "good" state of nature in the post-SOX era, we conclude that pay-performance sensitivity should, and does, increase.

Introduction

"*Nothing* in business excites so much interest in the wider world as the pay of top executives" (*Economist*, October 9, 2003).[1] The usual complaint in the popular press is not so much that the absolute amount of pay to the executives is too high, but rather that the pay-performance sensitivity is too low (although the press may not use this particular term) – that executive pay does not seem to be adequately aligned with performance (Bebchuk and Fried 2004). In particular, executives often find ways, through their ability to influence their own pay schemes, to enjoy upward rewards while avoiding downward risk. As one reporter put it, "Have they no shame? Their performance stank last year, yet most CEOs got paid more than ever" (*Fortune*, April 28, 2003).

Academics have expressed their interest in the topic of pay-performance sensitivity by generating a stream of research, but have not reached a conclusion on the various aspects of the debate over pay-performance sensitivity. Unresolved issues include: Is higher sensitivity necessarily better? Are current levels of pay-performance sensitivity too low? How is it best measured?

Theoretically, pay-performance sensitivity may be viewed as the coefficient of variable pay b in the linear contract taking the form $S = a + bx$. The manager's total pay S is a function of the shareholder value x, where a is the fixed portion of the manager's pay and bx is the variable portion of the manager's pay (Murphy 1990). Empirically, pay-performance sensitivity is often defined as a dollar change in the CEO's wealth associated with a dollar change in the wealth of shareholders (Jensen and Murphy 1988). Murphy (1990) refers to "pay-performance elasticity," which is essentially the

[1] "Executive Pay – Fat Cats Feeding", *Economist*, Oct 9th, 2003.

same measure except that the natural log is taken of pay data, and performance is measured in rates of return in the regression. Murphy claims that pay-performance ***elasticity*** is more stable than pay-performance ***sensitivity***. Although we view these two constructs as two ways of measuring pay-performance sensitivity, we use the term elasticity when taking logs throughout our analyses as a means of distinguishing between the two.

Jensen and Murphy (1990) imply that the optimal incentive is not achieved, presenting evidence that the average pay-performance sensitivity is only 0.325% (CEOs receive only $3.25 for a $1,000 increase in shareholder value). Holmstrom and Kaplan (2004), on the other hand, claim that CEO pay-performance sensitivity has in fact increased more than ten fold between the years 1980 and 1999, and provide evidence to demonstrate that the American incentive system works fairly well compared to other countries.

Although higher pay-performance sensitivity is not necessarily better, common opinions seem to favor high pay-performance sensitivity, which incentivizes managers but also incurs high cost for shareholders. The optimal pay-performance sensitivity may be viewed as the one that provides the best tradeoff between preventing the manager from shirking and the incremental costs associated with providing such incentives. In a speech given in December 2004, SEC Chief Economist Chester Spatt summarized the advantages and disadvantages of high pay-performance sensitivity. Higher pay-performance sensitivity encourages the manager to take riskier projects and allows him to signal the level of his managerial capability. However, too high a pay-performance sensitivity could over-incentivize the manager, causing her to take unnecessary risks not advantageous to firm shareholders. Further, excessively high pay-performance sensitivity may motivate the manager to manipulate the firm's short-run value at the expense of longer-run benefits.

The question of how high executive pay-performance sensitivity "should" be continues to puzzle business researchers and practitioners. Clearly, the optimal level of pay-performance sensitivity depends on many factors. The solution to the classic moral hazard problem in LEN[2] settings shows that the optimal pay-performance sensitivity is a function of the manager's capability, the degree of risk aversion, and the uncontrollable noise in the environment. In addition, the heterogeneity of the managerial labor market can lower the average pay-performance sensitivity in equilibrium (Chen and Leng 2004); and the manager's opportunity costs can impact pay-performance sensitivity choices (Dutta 2005).

This paper demonstrates that the optimal level of pay-performance sensitivity is affected by the system in place for auditing management's reporting and for preventing collusion between management and auditors. In our model, we distinguish between a commitment to auditing the auditor (for example, consistent with the post-Sarbanes-Oxley environment) and a random audit (or inspection) of the auditor (more consistent with the pre-SOX environment).

In general, a firm's shareholders hire managers to run the firms and auditors to verify the managers' reports.[3] In our model, prior to the introduction of a regulatory

[2] LEN is the acronym for a linear contract, exponential utility function and normally distributed noise. It is often used because it is simple and easy to interpret. See Hemmer (2004) for a detailed explanation as well as counter examples for circumstances when LEN is not appropriate.

[3] Although auditors are (theoretically) paid by firm shareholders, their hiring is commonly done by firm managers and directors. "The real clients of the auditors – investors – never see the auditors. Even if they could, they could not tell by watching them if the auditors have done their job diligently." (Sunder 2003)

commitment, auditors, in their zest to keep a lucrative client happy and encourage future business, may fall into unethical (even illegal) side agreements with managers that damage the shareholders' interests. Due to a lack of commitment and effective tools to investigate the auditors, the shareholders had limited power to prevent such collusion between managers and auditors prior to SOX.

The passage of the Sarbanes-Oxley Act adds one player to the game: the Public Company Accounting Oversight Board (PCAOB), which serves as the auditor of the auditors. SOX requires public accounting firms that audit publicly traded companies to be registered with PCAOB, and subjected to inspections on a regular basis. Any firm auditing more than 100 public company clients is subject to an annual inspection, while firms not meeting the 100-audits threshold are subject to inspection every three years. PCAOB, as a non-profit organization reporting to the SEC, claims to represent and protect the interests of the shareholders.[4] By committing to inspect the auditors, the Board creates an extra tool for shareholders to reduce the agency problem.[5]

In addition, SOX raised the potential penalty levels for both managers and auditors who are found to be at fault. CEOs and CFOs are now required to sign off on their companies' financial statements attesting to their accuracy. The Act also creates potential criminal liability for the destruction of records, even when conforming to an otherwise applicable "records management" policy and even if no federal investigation was in process at the time the records were destroyed. An individual can be charged with

[4] "Our view is that Sarbanes-Oxley serves, at least simplistically, to protect investors in the U.S. market" ("Auditing the Auditors," Peter Morton, *CA Magazine*, August, 2004).
[5] The benefit of the new requirements is far from free: accounting costs, auditing fees, and salaries of related personnel are all expected to increase. A survey of board members conducted by RHR International for *Directorship* magazine found that companies with $4 billion or more in revenues are spending an average of $35 million to comply with the Act. Another survey (by Financial Executives International) found $3.1 million in added costs for companies with average revenues of $2.5 billion.

obstruction of justice (carrying 20 years imprisonment) for destroying evidence if he/she should have known to preserve the document for any possible future government inquiries.

The question at the heart of this paper is whether the passage of SOX allows shareholders to use pay-performance more, or less, effectively in motivating managers to perform to their potential. Let us consider how managers are motivated to maximize their compensation, both before and after the passage of such legislation as SOX. Essentially, they have two outlets: (1) They exert effort on behalf of shareholders' interests. (2) They exert effort on behalf of their own interests that depart from those of the shareholders. For example, they take actions that inflate short-term profits at the expense of long-term profits, or they might simply manipulate the numbers. If we assume that the passage, and implementation, of SOX has succeeded, to some extent, in reducing the managers' potential for outlet (2) above, then talented, ambitious managers should concentrate more extensively on outlet (1), *provided* they are rewarded for doing so. If shareholders know this, we would expect the pay-performance sensitivity to increase after SOX as a mechanism to encourage managers to exert effort on behalf of their shareholders. However, we must acknowledge that a host of other factors can affect firm performance, as observed by shareholders. Let's call these factors the "state of nature."

If the state of nature is such that a manager can work very hard, but still not see those efforts reflected in firm performance, shareholders might take one of two actions. They might penalize the manager for the firm's performance, ignoring the state of nature, or they might keep the manager's compensation high, allowing for the impact of “nature.” If we assume that, in the real world, the manager is adept at communicating such factors to the shareholder, we believe the latter to be more likely. Unfortunately, a bad manager would also be likely to take advantage of a poor state of nature to try to keep his or her compensation high as well, or even to convince the shareholder of a poor state of nature when such is not the case. However, the reduction in manipulation of profits resulting from aforementioned facets of SOX enables the shareholder to distinguish more successfully than pre-SOX between good and bad managers. Nonetheless, we are likely to see the pay-performance sensitivity decline in a poor state of nature. This is not necessarily a “bad” consequence, as performance measures are less reflective of effort than in a more positive state of nature.

On the other hand, suppose that the state of nature is good, and managers’ efforts ***are*** reflected in performance. When the opportunity for manipulation is reduced, then pay-performance sensitivity is likely to increase (post-SOX) as shareholders are more confident that managers are not misleading them in their reporting. In our empirical analysis, our economic indicators are consistent with a “good” state of nature post-SOX, and thus with an expected increase in the pay-performance sensitivity. Our empirical findings are consistent with this scenario.

The remainder of this paper is structured as follows. Section 2 provides an overview of the analytical literature and sets up the assumptions of our models. Section 3 presents the optimal contracts without regulatory auditing commitment. Section 4 introduces a commitment to regulatory audits and contrasts this solution with that of Section 3. Section 5 presents our empirical analysis, and Section 6 concludes the study.

Analytical Literature and Setup of Our Model

The following sections of the paper analyze the impact of regulatory policies such as those brought forth by Sarbanes-Oxley. The interjection of a regulatory body as the fourth player into the original shareholder-manager-auditor game is explicitly modeled, as well as how its commitment to regular inspection of the auditor's work can prevent manager-auditor collusion (which would otherwise occur in equilibrium).

The analytical literature concerning audits as a monitoring mechanism often extends to such contexts as monopolist regulation (Baron and Besanko 1984), procurement (Dunne and Loewenstein 1995), financial contracting (Townsend 1978; Gale and Hellwig 1985; Williamson 1987), and tax audits (Reinganum and Wilde 1985; Graetz et al. 1986; Scotchmer 1987; Mookherjee and P'ng 1989), in addition to the traditional audits of financial statements (Demski and Sappington 1984; Baiman et al. 1991). The role of a principal can be played by the government, the buyer of an intermediate product, the bank, the shareholder or the tax authority, depending on the context. Correspondingly, the agent, who possesses private information and is subject to audits, can be a monopolistic producer, a supplier, a loan borrower, a manager or a tax-paying individual. Most of the studies in this literature assume either that the principal conducts the audit herself or that the auditor is incorruptible.

Only a few papers deal with potential collusive behavior between the auditor and the agent. Baiman et al. (1991) allow a costly auditor to observe the agent's output on behalf of the principal, while the agent and the auditor may randomly collude. Kofman and Lawarree (1993) model the use of both a costless but corruptible internal auditor and a costly but incorruptible external auditor. They find that expected maximum deterrence of collusion is not desirable, even with unbounded punishments, risk-neutral agents and costless auditing. Kofman and Lawarree (1996) show that allowing collusion can be optimal due to the reward the principal offers to the auditor for turning down the agent's bribe. Khalil and Lawarree (2005) characterize the optimal auditing contract in the absence of a commitment to auditing when collusion between the agent and the auditor is possible. The model in this paper most closely relates to Khalil and Lawarree (2005). However, it differs from the above studies in that it investigates the relation between the method of auditing and its impact on managerial contracts.

There are four players in our single-period game: a shareholder who owns the firm but does not have the time and knowledge to run it; a manager hired by the shareholder to run the firm and report to the shareholder; an auditor who audits the manager's report on behalf of the shareholder; and a regulator who is interested in protecting the shareholder's interest. The auditor may choose to collude with the manager at the shareholder's expense when the manager wants to hide his private information from the shareholder. The regulator has the right to conduct independent inspections of the auditor's work. If the independent inspection reveals collusion between the manager and the auditor, the shareholder will impose penalties on both the manager and the auditor. The cost of the independent inspection is financed by the shareholder.

Suppose the manager possesses private information regarding a certain state of nature q_i, where $i = \{g, b\}$, representing good or bad.[6] The state of nature affects the outcome to be reported to the shareholder, which may be viewed as reaching (or failing to

[6] The state of nature could represent any factor affecting true economic performance, which may or may not be communicated honestly via the reported profit. For example, there could be a problem with production that would significantly lower the profit, or a sales spurt that increases the profit level.

reach) a desired level of profits. Knowing that outcome is a function of the state of nature and that the manager's knowledge of the state of nature exceeds the shareholder's, the manager communicates both an outcome and, through more implicit forms of communication, the impact of the state of nature on that outcome.

The firm's profit takes the form $x_i = e_i + e$, where e_i represents the level of effort exerted by the manager and $e \sim N(0, s^2)$ represents uncontrollable market fluctuations. The manager's cost of effort is $v_i(e) = \frac{q_i}{2} e^2$. When the state of nature is bad, the manager has to work harder to achieve the desired profit; when the state of nature is good, the manager does not have to work as hard. We therefore assume $q_b > q_g > 0$, which indicates $v_g(e) = \frac{q_g}{2} e^2 < \frac{q_b}{2} e^2 = v_b(e)$. Whether the state of nature is good or bad is only known to the manager, but the probabilities of the realization of these two states, f for bad state and $1 - f$ for good state, are common knowledge to everybody.

The shareholder pays the manager a linear contract $S_i = a_i + b_i x_i$, where a_i is the manager's fixed pay and $b_i x_i$ is the manager's variable pay. We assume the manager is risk averse with CARA utility function $u(y) = -e^{-ry}$, $(r > 0)$, where r is the degree of risk-aversion and y is the manager's income. Using the mean variance expression, we know the manager's risk premium is $\frac{1}{2} r b^2 s^2$.

The shareholder provides a menu of contracts $\{(q_g, b_g); (q_b, b_b)\}$ for her manager to choose from; the manager reports truthfully by choosing the contract corresponding to the state of nature and misreports by choosing the contract that does not correspond to the true state of nature. After the manager submits his report, the auditor comes to verify the truthfulness of the report. The shareholder has to pay the auditor C^a for his service. The auditor is, however, corruptible. For a bribe (future business promised to the auditor of value B), the auditor may sign off an untruthful report submitted by the manager. The shareholder and the regulator are aware of the possibility of such collusion. The regulator may order another independent inspection on the audited report at cost C^i. If collusion is detected, the manager will be subject to a penalty P^m while the auditor will be subject to a penalty P^a. Due to his limited liability, the manager's penalty is not collectible by the shareholder.[7] The auditor's penalty is collectible.

The sequence of events is:

1. The state of nature is realized and the manager learns it.
2. The shareholder offers a menu of contracts for the manager to choose.
3. The manager chooses a contract and exerts effort.
4. The manager prepares a performance report, and communicates the state of nature to the shareholder.
5. The shareholder hires an auditor to audit the manager's report (if the firm is publicly traded), or decides whether to hire an auditor if the firm is private.
6. The auditor decides whether to collude with the manager.
7. The regulator decides whether to conduct an independent inspection of the auditor's report.
8. Payment is imposed and penalty collected if appropriate.

[7] This assumption is based on the belief that individual managers possess relatively limited financial resources and cannot afford large fines. When caught at fault, they are merely fired (or put in jail in more serious cases) but not asked to compensate for the company's loss.

We investigate two settings in the following sections of the paper. The first regulatory setting is a laissez-faire economy, in which the regulator may conduct an independent inspection when the need arises but does not commit to doing so. This economy represents the state before Sarbanes-Oxley. The second setting is a regulated economy, in which the regulator commits to conduct systematic inspections and all shareholders are required to obtain audits. It represents the state after Sarbanes-Oxley was passed.

Model without Commitment

In a laissez-faire economy, the regulator does not specify whether or not the shareholder requires an annual audit or inspection of the auditor, if one is selected. All audits and inspections are therefore conducted on a random basis. However, in the pre-SOX environment, we recognize that audits were required by the SEC for publicly traded companies while inspections of the auditor were random. We initially develop our model to allow for both choices, whether to be audited and whether to inspect the auditor. Thus, the true laissez-faire economy is consistent with an economy without the impact of either the SEC or the PCAOB. Our initial analysis allows us to view a world without regulatory intervention at any level (and to contrast the outcomes when regulatory intervention occurs). We acknowledge, as we move to the empirical analysis, that this world does not translate directly into the pre-SOX environment. However, the effects of introducing two regulatory bodies or only one yield the same essential result.

Suppose the manager's probability of being truthful is t.[8] When the state of nature is good, he may choose to report the bad state so that he can hide his shirking or lack of effort. Let the manager report the true state of nature with probability t, and cheat by reporting a bad state with probability $1-t$. When the state of nature is bad, we assume the manager will always report truthfully because he has no incentive to cheat. One way to view the role of the state of nature in the reports prepared by management is to think of earnings as being decomposed into controllable and noncontrollable components. For purposes of our analysis, we assume that the manager knows the exact breakdown between these two components, while the shareholder knows only an approximation. The manager may choose to lie about the noncontrollable component, or about the breakdown between the two. The noncontrollable component may be a function of a host of factors related to the supply market, the competitors of the firms, the controls in place within the firm, etc.

The shareholder and the regulator do not know the true state of the nature, but they anticipate that the manager might misreport. Given this information, the estimated probability of the manager reporting bad state of nature is $f+(1-f)(1-t)$; and the estimated probability of the state of nature being good while the manager reporting a bad state is $\frac{(1-f)(1-t)}{f+(1-f)(1-t)}$.

The shareholder uses the auditor with probability r.[9] As the shareholder knows the manager will always report the state of nature truthfully when it is bad, she need not

[8] Throughout this section and the following one, we assume the manager to be male, the shareholder to be female, and the auditor to be male. The regulator is also female, and for simplicity, we assume the shareholder to also do the inspections (thus, she is the regulator).

[9] The assumption of shareholders can choose not to use the auditor implies the option that companies can remain private instead of going public, or that companies can even go private from public especially after Sarbanes-Oxley.

use the auditor when she receives a report of bad state. If the auditor is indeed used, he conducts his audit and learns the true level and components of profit. He then decides whether to confirm the manager's profit report. The auditor may collude with the manager by confirming the manager's report when it is fraudulent; he does not collude by turning in the misreporting manager to the shareholder. We assume the auditor will not initiate any collusive agreements with the manager should the manager decide to report truthfully, which means he will always choose to confirm the manager's report when it is truthful. Let the auditor confirm the manager's report with probability m.

After the auditor submits his report to the shareholder, the regulator may decide to conduct an independent inspection of the audited report at cost C_i. If the auditor already reports that the manager has misreported before the regulator's inspection, there will be no need for further inspection. The manager will be penalized, but the auditor will not get any reward for turning in the manager. Otherwise the shareholder will conduct (or order) an inspection with probability n. If the inspection shows the manager and the auditor have both been truthful, they will get their payment according to the contract. If both the manager and the auditor turn out to be untruthful, they will get their penalties respectively.

Both the auditor's audit and the shareholder's inspection are assumed to be perfect, which means they will find out the underlying true state of nature with 100% probability. The regulator is also aware that the manager will not report a good state when the state is actually bad, and the auditor will always confirm a truthful report from the manager; she therefore will never invoke an extra inspection on a report of a good state because she knows both the manager and the auditor to be truthful in that case.

Note the difference between the *actual* state of nature and the *reported* state of nature. When the *actual* state of nature is bad, the manager always reports truthfully. But when the *reported* state of nature is good, the investor knows the manager and auditor are reporting truthfully.

In the model without commitment, we assume that the regulator's goal is to maximize shareholder value. She does not care about the profit of the auditor. We also assume the regulator's inspection is completely financed by the shareholder. Effectively the regulator can be regarded as an extension of the shareholder's power in solving her agency problem. The regulator, however, has only one tool to use—the frequency of independent inspections she conducts. She does not have the right to intervene with the contract the shareholder provides to her manager, or the price the auditor sets for his service.

The problem facing the shareholder is:

Program I:

$$\max_{x_g, x_b, S_g, S_b, r} E_e\{[f+(1-f)(1-t)]\{x_b - S_b + r[\frac{(1-f)(1-t)}{f+(1-f)(1-t)} mn(P^a - C^i)$$

$$-(1-\frac{(1-f)(1-t)}{f+(1-f)(1-t)})nC^i - C^a] + (1-f)t(x_g - S_g)\}$$

$$=\max_{a_g, a_b, b_g, b_b, r}[f+(1-f)(1-t)]\{-a_b - (1-b_b)e_b + r[\frac{(1-f)(1-t)}{f+(1-f)(1-t)} mn$$

$$(P^a - C^i) - (1-\frac{(1-f)(1-t)}{f+(1-f)(1-t)})nC^i - C^a]\} + (1-f)t[-a_g - (1-b_g)e_g]$$

subject to:

(1) $a_b + b_b e_b - \frac{1}{2} r b_b^2 s^2 - \frac{q_b}{2} e_b^2 \geq 0$

$$(2)\quad t[a_g + b_g e_g - \frac{1}{2} r b_g^2 s^2 - \frac{q_g}{2} e_g^2] + (1-t)\{a_b + b_b e_b - \frac{1}{2} r b_b^2 s^2 - \frac{q_g}{2} e_g^2$$
$$- r[(1-m)P^m + mnP^m]\} \geq 0$$

$$(3)\quad e_b \in \arg\max_{e_b*} a_b + b_b e_b^* - \frac{1}{2} r b_b^2 s^2 - \frac{q_b}{2} e_b^*$$

$$(4)\quad e_g \in \arg\max_{e_g*}\ t[a_g + b_g e_g^* - \frac{1}{2} r b_g^2 s^2 - \frac{q_g}{2} e_g^{*2}] + (1-t)\{a_b + b_b e_b - \frac{1}{2} r b_b^2 s^2 - \frac{q_g}{2} e_g^{*2}$$
$$- r[(1-m)P^m + mnPm]\}$$

$$(5)\quad t \in \arg\max_{t*} t*[a_g + b_g e_g - \frac{1}{2} r b^2 s^2 - \frac{q_g}{2} e_g^2] + (1-t*)\{a_b + b_b e_b - \frac{1}{2} r b_b^2 s^2 - \frac{q_h}{2} e_h^2$$
$$- r[(1-m)P^m + mnP^m]\} \geq 0$$

$$(6)\quad r \in \arg\max_{r^*} r*[\frac{(1-f)(1-t)}{f+(1-f)(1-t)} mn(P^a - C^i) - (1 - \frac{(1-f)(1-t)}{f+(1-f)(1-t)}) nC^i - C^a]$$

$$(7)\quad m \in \arg\max_{m*} m*(B - nP^a) + (1-m*)C^a$$

$$(8)\quad n \in \arg\max_{n*} n*[\frac{(1-f)(1-t)}{f+(1-f)(1-t)} P^a - C^i]$$

The shareholder's objective function is her expected payoff upon different types of reports that she expects to receive and a series of decisions made by her and the other players in the game. These decisions include whether the manager misreports, whether the shareholder uses the auditor, whether the auditor colludes with the manager, and whether the regulator conducts an independent inspection. When she receives a report of a good state of nature, she simply pays the manager the contracted amount because she knows the manager must be reporting truthfully. When she receives a report of a bad state submitted by the manager, she decides whether to use the auditor. If she does not use the auditor, she must pay the manager the amount for the bad state. If she uses the auditor and the auditor reveals that the manager is misreporting, she penalizes the manager and pays the auditor. If the auditor actually colludes with the manager and the regulator does not further inspect, she pays both the manager and the auditor as contracted. When the regulator inspects and reveals the manager's misconduct and the auditor's collusion, the shareholder can penalize both the manager and the auditor.

We assume the manager's opportunity cost is zero. Condition (1) is the manager's participation constraint when the state of nature is bad. Condition (2) is the manager's participation constraint when the state of nature is good. These two conditions guarantee that the manager and the auditor both enter the contract. Conditions (3) and (4) are the manager's incentive compatibility constraints. They imply that the manager chooses the amount of effort that maximizes his own utility. Conditions (5), (6), (7) and (8) are the strategies chosen by each player respectively in maximizing their payoffs. Condition (5) is the manager's reporting strategy. Condition (6) is the shareholder's strategy in choosing to use the auditor's service. Condition (7) is the auditor's colluding strategy after auditing the manager's report. Condition (8) is the regulator's strategy regarding independent inspection.

Proposition 1. In a laissez-faire economy, the pay-performance sensitivities of the manager's contract are:

$b_g = \dfrac{1}{1+q_g r s^2}$, *when the state of nature is good;*

$b_b = \dfrac{1}{1+q_b r s^2}$, *when the state of nature is bad.*

Proof: Taking the first order condition of Conditions (5), (6), (7) and (8), we get:

$$(5')\quad a_g + b_g e_g - \frac{1}{2} r b^2 s^2 - \frac{q_g}{2} e_g^2 = (1-t^*)\{a_b + b_b e_b - \frac{1}{2} r b_b^2 s^2 - \frac{q_h}{2} e_h^2$$
$$- r[(1-m)P^m + mnP^m]\}$$

$$(6')\quad \frac{(1-f)(1-t)}{f+(1-f)(1-t)} mn(P^m - C^i) - (1 - \frac{(1-f)(1-t)}{f+(1-f)(1-t)}) nC^i - C^a = 0$$

$$(7')\quad B - nP^a = C^i$$

$$(8')\quad \frac{(1-f)(1-t)}{f+(1-f)(1-t)} P^a = C^i$$

These are simply the familiar indifference conditions in games with a mixed strategy. They show that the manager chooses a probability so he is indifferent between reporting truthfully and misreporting; the shareholder chooses a probability so she is indifferent between using the auditor and not using him; the auditor chooses a probability so he is indifferent between colluding and not colluding; and the regulator chooses a probability so she is indifferent between inspecting independently and not inspecting.

Substitute (5') into (2), we get:

$$(2')\quad a_g + b_g e_g - \frac{1}{2} r b_g^2 s^2 - \frac{q_g}{2} e_g^2 \geq 0$$

(1) and (2') must both bind. Otherwise, the shareholder can simply lower her payment to the manager by a small amount to improve her own profit.

Taking the first order condition of (3), we get:

$$(3')\quad e_b = \frac{b_b}{q_b}$$

Substituting (5') into (4) and taking the first order condition, we then get:

$$(4')\quad e_g = \frac{b_g}{q_g}$$

Substituting $(6')$ into the objective function, the objective function can be simplified into:

$$\max_{a_g, a_b, b_g, b_b} [f + (1-f)(1-t)][-a_b - (1-b_b)e_b] + (1-f)t[-a_g - (1-b_g)e_g]$$

Using (1), $(2')$, $(3')$ and $(4')$ solving for b_g and b_b, we get $b_g = \dfrac{1}{1+q_g r s^2}$ and

$b_b = \dfrac{1}{1+q_b r s^2}$.

The Model with Commitment

Keeping everything else the same, we now introduce the scenario of a regulated economy. The regulator ***requires*** the shareholder to use the auditor to verify the manager's report and imposes an independent inspection on the auditor's work. As soon as the shareholder commits to the audits and inspections, the structure of the game changes. The Revelation Principle now applies, and misreporting and collusion no longer take place in equilibrium.

As the regulator always inspects the auditor, the auditor knows that any collusion he has with the manager will always be detected. Hence his best strategy is never to collude with the manager at all. Similarly, the manager knows that his attempt to misreport and collude will always be turned down by the auditor; therefore, his best strategy is to always report truthfully.

The problem facing the shareholder is:

Program II:

$$\max_{x_g, x_b, S_g S_b} E_e\{f(x_b - S_b - C^i - C^a) + (1-f)(x_g - S_g)\}$$

$$= \max_{a_g, a_b, b_g, b_b} f[-a_b - (1-b_b)e_b - C^i - C^a] + (1-f)[-a_g - (1-b_g)e_g]$$

subject to:

$$(9)\ \ a_g + b_g e_g - \frac{1}{2} r b_g^2 s^2 - \frac{q_g}{2} e_g^2 \geq 0$$

$$(10)\ \ a_b + b_b e_b - \frac{1}{2} r b_b^2 s^2 - \frac{q_b}{2} e_b^2 \geq 0$$

$$(11)\ \ e_g \in \arg\max_{e_g^*} a_g + b_g e_g^* - \frac{1}{2} r b_g^2 s^2 - \frac{q_g}{2} e_g^{*2} \geq 0$$

$$(12)\ \ e_b \in \arg\max_{e_b^*} a_b + b_b e_b^* - \frac{1}{2} r b_b^2 s^2 - \frac{q_b}{2} e_b^{*2} \geq 0$$

$$(13)\ \ a_g + b_g e_g - \frac{1}{2} r b_g^2 s^2 - \frac{q_g}{2} e_g^2 \geq a_b + b_b e_b - \frac{1}{2} r b_b^2 s^2 - \frac{q_g}{2} e_g^2 - P^m$$

$$(14)\ \ a_b + b_b e_b - \frac{1}{2} r b_b^2 s^2 - \frac{q_b}{2} e_b^2 \geq a_g + b_g e_g - \frac{1}{2} r b_g^2 s^2 - \frac{q_b}{2} e_b^2 - P^m$$

$$(15)\ \ C^a \geq B - P^a$$

The shareholder's objective function is her expected payoff under two different states of nature. When the manager reports a good state, neither does the shareholder need to use the auditor nor does the regulator need to conduct independent inspection. When the manager reports bad state of nature, the auditor will use the auditor and the regulator will conduct the inspection. Therefore the audit and inspection costs only incur when the reported state is bad.

Condition (9) ensures that the manager enters the contract when the state of nature is good. Condition (10) ensures the manager enters the contract when the state of nature is bad. Conditions (11) and (12) indicate that the manager exerts the optimal amount of effort to maximize his own payoff. Conditions (13) and (14) ensure that the manager does not misreport by setting his payoff when he misreports lower than his payoff when he is truthful. These two incentive compatibility conditions are similar to the incentive compatibility conditions in a regular adverse selection problem *except* that the potential punishment serves to further relax the constraints. Condition (15) guarantees that the auditor does not collude by setting his payoff when he colludes with the manager lower than his payoff when he does not.

Proposition 2: With a regulatory commitment to auditing, the optimal pay-performance sensitivities are given by:

$b_g = \frac{1}{1+q_g r s^2}$ *, when the state of nature is good;*

$b_b = \frac{1}{1+q_b r s^2 + \frac{f}{1-f}\frac{q_b - q_g}{q_g}}$ *, when the state of nature is bad.*

Proof: As in a regular adverse selection problem, condition (9) and condition (11) are redundant. Condition (10) and condition (11) are both binding. We therefore get the reduced form of the shareholder's problem:

$$\max_{a_g, a_b, b_g, b_b} f[-a_b - (1-b_b)e_b - C^i - C^a] + (1-f)[-a_g - (1-b_g)e_g]$$

$$(10') \quad a_b + b_b e_b - \frac{1}{2} r b_b^2 s^2 - \frac{q_b}{2} e_b^2 = 0$$

$$(11') \quad a_g + b_g e_g - \frac{1}{2} r b_g^2 s^2 - \frac{q_g}{2} e_g^2 = a_b + b_b e_b - \frac{1}{2} r b_b^2 s^2 - \frac{q_g}{2} e_g^2 - P^a$$

Substituting (10) and (11) into the objective function, taking first order conditions over a and b and then solving for them, we get the solution as stated in the proposition.

One comment on the assumption of a commitment to auditing is that such a commitment is subject to ex post inefficiency. Once the regulator knows that the manager does not misreport and the auditor does not collude, she will lose her incentive to conduct an independent inspection. However, if she stops inspecting, the manager and the auditor will anticipate this and no longer be truthful. As a result, a commitment to auditing is not observed very often in private sectors. Only governmental/regulatory bodies can make such a commitment in a credible manner by legalizing the issue.

Proposition 3: The average pay-performance sensitivity in the regulated economy is likely to be higher than the average pay-performance sensitivity in the laissez-faire economy when the probability of the state of nature being bad is small.

Proof: The weighted average of pay-performance sensitivity in the regulated economy is: $f\frac{1}{1+q_b r s^2+\frac{f}{1-f}\frac{q_b-q_g}{q_g}}+(1-f)\frac{1}{1+q_g r s^2}$.

The weighted average of pay-performance sensitivity in the laissez-faire economy is:

$$[f+(1-f)(1-t)]\frac{1}{1+q_b r s^2}+(1-f)t\frac{1}{1+q_g r s^2}.$$

The difference between the pay-performance sensitivities before and after Sarbanes-Oxley is:

$$f\frac{1}{1+q_b r s^2+\frac{f}{1-f}\frac{q_b-q_g}{q_g}}+(1-f)\frac{1}{1+q_g r s^2}-[f+(1-f)(1-t)]\frac{1}{1+q_b r s^2}-(1-f)t\frac{1}{1+q_g r s^2}$$

$$=f\left[\frac{1}{1+q_b r s^2+\frac{f}{1-f}\frac{q_b-q_g}{q_g}}-\frac{1}{1+q_b r s^2}\right]+(1-f)(1-t)\left[\frac{1}{1+q_g r s^2}-\frac{1}{1+q_b r s^2}\right]$$

.

Plugging in equation $(8')$, we have:

$$f\left[\frac{1}{1+q_b r s^2 + \frac{f}{1-f}\frac{q_b - q_g}{q_g}} - \frac{1}{1+q_b r s^2}\right] + \frac{fC^i}{(P^a - C^i)}\left[\frac{1}{1+q_g r s^2} - \frac{1}{1+q_b r s^2}\right]$$

The first bracketed expression takes a positive value if $\frac{1}{1+q_b r s^2 + \frac{f}{1-f}\frac{q_b - q_g}{q_g}}$ is bigger than $\frac{1}{1+q_b r s^2}$. The second bracketed expression takes a negative value if $\frac{1}{1+q_g r s^2}$ is smaller than $\frac{1}{1+q_b r s^2}$. It is obvious that there exists an f^*, when $f < f^*$, such that the whole term is positive. We predict that the direction of the change in pay-performance sensitivity after SOX, therefore, depends on the probability of a bad state of nature, f. The pay-performance sensitivity after SOX will be greater than that before SOX if f is small enough.

Empirical Analysis

In the previous section, we found that the change in pay-performance sensitivity after SOX is a function of the state of nature. The state of nature is not directly observable or measurable. Further, the state of nature is specific to each individual firm, as it is a function of a set of factors involving the supply and competitors' markets, internal control and production aspects unique to the firm in question, as well as the condition of the overall economy. However, on average, the state of nature during a given time period may be classified as generally "good" or "bad" by turning to the "Index of Leading Economic Indicators" to assess the general business environment. This composite index is derived from a basket of different economic components such as indexes of stock prices, indexes of consumer expectations, new building permits, average workweeks of workers in manufacturing businesses, etc. It is often used to predict the business trend in the following half year. From the Index in the period of 1993 through 2005, as shown in Table 1, we deduce that the general economic environment has been expected to improve, which means the probability of the "state of nature" being bad is relatively small as we moved from the pre-SOX to the early years of the post-SOX era. We therefore expect to see an increase in pay-performance sensitivity for our sample period.

Insert Table 1 about here

Methodology

In this section, we empirically examine the impact of a regulatory commitment to auditing, specifically the passage of the Sarbanes-Oxley (SOX) Act, on the pay-performance sensitivity between executive compensation and firm performance. Our regression model is as follows:

$$BETA_{j,t} = \alpha_0 + \alpha_1 SOX + \alpha_2 TENURE_{j,t} + \alpha_3 LNASSETS_{j,t} + \alpha_4 VOLATILITY_{j,t} + \alpha_5 IND\_PERFORMANCE_{j,t} + \alpha_6 MKT\_PERFORMANCE_{j,t} + \varepsilon_{j,t}, \quad (1)$$

where pay-performance sensitivity (BETA) is measured as the yearly change in executive pay divided by the yearly change in shareholder value (and where the yearly change in shareholder value is defined as the rate of return realized by shareholder, r_t, multiplied by the beginning-of-period market value, V_{t-1}). We also estimate this regression using alternate measures for pay-performance sensitivity based on prior research, and these measures are defined and discussed subsequently.

Our variable of interest is SOX, a dummy variable set equal to one in or after year 2002, and zero otherwise. We control for variables that prior research has found to be related to pay-performance sensitivity. The control variables included are executive tenure (TENURE), firm size (LNASSETS), firm risk (VOLATILITY), industry performance (IND_PERFORMANCE), and market performance (MKT_PERFORMANCE).

Chen and Leng (2004) find that the more capable the managers in the market, the more likely the market's average pay-performance sensitivity is to be high. As managers' capability is not observable and companies are more likely to retain the experienced and capable ones, we include TENURE in the control variables to proxy for capability and practical experience. We measure tenure by the number of years the executive has been in office at the fiscal year-end. Empirical evidence shows that pay-performance sensitivity decreases with firm size (Schaefer 1998; Jensen and Murphy 1990). We measure firm size by the natural log of total assets at fiscal year-end.

Prior studies show that the uncertainty in the firm's operating environment may affect the degree to which the manager's performance can be efficiently monitored and may relate to pay-performance sensitivity (Demsetz and Lehn 1985; Lippert and Moore 1994). Therefore, we control for firm risk using the volatility in the Black-Scholes model. Gibbons and Murphy (1990) find that changes in CEO pay are positively and significantly related to firm performance, but negatively and significantly related to industry and market performance. Their findings support the theory of relative performance evaluation that CEOs are not only rewarded on the basis of absolute performance but also on performance “relative to other firms in the industry or market in order to filter common risk from the compensation of risk-averse managers” (Gibbons and Murphy 1990). We control for industry and market performance in the pay-performance sensitivity regression. Industry performance equals the average yearly change in shareholder value of all Compustat companies in the same two-digit SIC code. Market performance equals the average yearly change in shareholder value of all Compustat companies.

Data

We obtain executive compensation data from ExecuComp for the years 1992 through 2005. We use the data from 1992 to compute yearly changes for 1993; thus our sample period begins in 1993. We calculate executive pay by summing the following: salary, bonus, value of restricted stock granted, value of stock options granted, long-term incentive payouts, and other benefits that cannot be easily categorized. The value of stock options is estimated using the Black-Scholes model. We obtain financial data from Compustat Industrial Annual data files to calculate the average annual industry and market performance (IND_PERFORMANCE and MKT_PERFORMANCE).

Our initial sample consists of 90,985 executive-year observations. The sample size reduces to 32,432 executive-year observations with complete executive tenure data. Missing financial data eliminates another 1,165 observations, leaving us with 31,267 executive-year observations. We further exclude observations where BETA is in the top or bottom percentile to eliminate the impact of outliers. The final sample consists of 30,643 executive-year observations.

Table 2 provides summary statistics related to the change of executive compensation components and shareholder wealth over time. The proportion of compensation from bonuses shows a decreasing trend in the pre-SOX era; however, it increases substantially post-SOX. The proportion of compensation from salary decreases from 43.83% in 1993 to 31.71% in 2001, though it rebounds to 36.12% in 2002 and drops back to 31.15% in 2005. Restricted stock granted as a percentage of total compensation is between 3% and 4% before SOX, but increases from 4.64% in 2002 to 12.30% in 2005. "Options" is the only portion of variable pay that decreases significantly after SOX. It increases as a percentage of total compensation substantially through 2001 and decreases considerably by 2005, "possibly as a result of concerns about a requirement to expense stock options" (Carter et al. 2005).

Overall, the t-statistics show that the average proportion of compensation from bonuses and restricted stock granted, the average change in shareholder value, and the average change in earnings before nonrecurring items are higher in the post-SOX period than pre-SOX, while the average proportion of compensation from salary and options is lower in the post-SOX period than pre-SOX. There is no significant difference in the average total compensation before and after SOX.

Results

Panels A and B of Table 3 provide the summary statistics for pay-performance sensitivity estimates, BETA and ELASTICITY, respectively. The estimated coefficients are generally positive and small, consistent with Jensen and Murphy's (1990) finding of low pay-performance sensitivity. The average BETA in the period from 1993 to 2001 is 0.051 percent, and that in the period from 2002 to 2005 is 0.076 percent. The average BETA in the post-SOX era is significantly higher than that in the pre-SOX era (t=1.86, p<0.05). This initial univariate result suggests an increase in pay-performance sensitivity after the passage of the Sarbanes-Oxley Act. As shown in Panel B, the average ELASTICITY in the period from 1993 to 2001 is 0.29, while that in the period from 2002 to 2005 is 0.611; thus, the average ELASTICITY in the post-SOX era is also significantly higher than that in the pre-SOX era (t=2.10, p<0.05). Consistent with our univariate findings for BETA, these ELASTICITY measures reveal an increase in pay-performance sensitivity after the passage of the Sarbanes-Oxley Act.[10]

Panels A and B of Table 4 report our descriptive statistics and correlation matrix, respectively. The average executive tenure of our sample is 12.59 years. The natural logarithm of company total assets averages 7.24 (which translates to approximately $1,394 million dollars). The average annual change in shareholder value of all Compustat companies in the same two-digit SIC code (IND_PERFORMANCE) ranges from -10,233 million dollars in the worst year to 8,605 million dollars in the best, while the average annual change in shareholder value of all Compustat companies (MKT_PERFORMANCE) ranges from -630 to 585 million dollars.

Insert Tables 2, 3, and 4 about here

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[10] As a robustness test, we eliminate the top and bottom 1% of ELASTICITY, and find that our results, as presented in Panel B, Table 3, are not altered qualitatively or in terms of statistical significance.

Table 5 reports our multivariate regression results. The dependent variable in column A is BETA, as defined previously, while column B presents the results specifying ELASTICITY as the dependent variable. Columns C and D present the results with alternate measures of pay-performance sensitivity. As shown in column A, the coefficient on SOX is positive, significant at the 10% level when BETA is specified as the dependent variable. The results are similar when ELASTICITY is used in the place of BETA, but the coefficient on SOX becomes significant at the 1% level. The empirical findings indicate that pay-performance sensitivity increased after the passage of the SOX Act, consistent with our prediction in the theoretical model taken in conjunction with the evidence of a generally "good" state of nature in the years after SOX.

As mentioned previously, Murphy (1998) discusses the methodological issues in examining pay-performance relations and defends the use of ELASTICITY as a potentially superior measure of the pay-performance relation. In this computation, executive pay is measured in logarithms and performance is in rates of return.[11]

The coefficient on LNASSETS is negative and significant at the 1% level when BETA is specified as the dependent variable, but insignificant when ELASTICITY is specified. The resulting pay-performance sensitivity is therefore smaller for larger companies based on the former measure, but inconclusive when logs are used. Gibbons and Murphy (1990) find that while changes in CEO pay are positively related to firm performance, they are negatively related to industry and market performance. In addition,

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[11] The specification used to analyze pay-performance sensitivities is:
Δ(Executive Pay) = a + bΔ(Shareholder Value),
where b is interpreted as "pay-performance sensitivity". In contrast, the regression coefficient, B, in the following specification is interpreted as "pay-performance elasticity": Δln(Executive Pay) = A + BΔln(Shareholder Value). Δln(Shareholder Value) ignores share issues or repurchases and therefore equals a continuous rate of return on common stock, r. We can express the latter specification as Δln(Executive Pay) = A + Bln(1+r).

Gibbons and Murphy find that the CEO's performance is more likely to be evaluated relative to aggregate market movements than relative to industry movements. Consistent with Gibbons and Murphy, we find the coefficient on MKT_PERFORMANCE to be negative and significant in both columns A and B, while our coefficient on IND_PERFORMANCE is insignificant in column A.

In addition to examining the sensitivity between total executive pay and stock price movements, we further examine how the sensitivities between executive compensation components and accounting-based firm performance measures changed concurrent with the introduction of SOX Act. Executive compensation plans often include a stated objective of firm value maximization and formally tie compensation to a measure of firm value such as earnings. Given that the objective of the Act is to improve the quality of financial reporting, in the post-SOX era firms should be more likely to tie executive bonuses to earnings, which are arguably less biased.[12] We therefore expect that the *bonus*-performance sensitivity would increase in the post-SOX period.

We define bonus-performance sensitivity, BETA_BONUS, as the yearly change in executive bonuses divided by the yearly change in earnings before nonrecurring items. As shown in column C of Table 5, the coefficient on SOX is positive and significant at the 10% level. The result indicates that bonus-performance sensitivity increases after the passage of the SOX Act. This finding is somewhat surprising in view of prior research (Cohen et al. 2005), which suggests that the ratio of incentive compensation to fixed compensation declined significantly after SOX. Cohen et al., however, did not examine pay-performance sensitivity. Thus, we infer that while incentive compensation may be

[12] Carter et al. (2005) find that after the introduction of Sarbanes-Oxley, greater reliance on non-discretionary earnings for bonuses occurs, and significantly greater penalties for income-decreasing accruals appear to be imposed.

used more sparingly, its link to performance is heightened in those instances where it is used.

We also examine whether the salary-performance sensitivity, BETA_SALARY, defined as the yearly change in executive salaries divided by the yearly change in earnings before nonrecurring items, changed concurrent with the introduction of the SOX Act. The coefficient on SOX is insignificant in this regression (column D of Table 5), suggesting that the relation between the fixed component of executive compensation and companies' accounting performance did not vary with the introduction of the SOX Act.

Insert Table 5 about here

As a robustness check, we estimate alternative model specifications from prior research (Jensen & Murphy 1990; Murphy 1998). Adapted from Murphy (1998, p.30), our next regression model is as follows:

$$\Delta(\text{Executive Pay})_{j,t} = \beta_0+\beta_1\Delta(\text{Performance})_{j,t}+ \beta_2\text{SOX}+ \beta_3\text{SOX}*\Delta(\text{Performance})_{j,t} + \beta_{4\sim8}(\text{Control Variables})_{j,t} + \varepsilon_{j,t.} \quad (2)$$

The regression coefficient β_1 is interpreted as a measure of pay-performance sensitivity. Our variable of interest is SOX*Δ(Performance), the interaction of SOX and Δ(Performance). We control for the same variables as in equation (1), including executive tenure (TENURE), firm size (LNASSETS), firm risk (VOLATILITY), industry performance (IND_PERFORMANCE), and market performance (MKT_PERFORMANCE). Table 6 reports these results.

Similar to Table 5, column A of Table 6 contains the results of estimating equation (2) using the change in total executive compensation, while column B presents the results using the change in the *natural log* of total executive compensation. As before, columns C and D present the results with alternative measures of pay-performance sensitivity. As seen in column A, the coefficient on SOX*Δ(SHRHLDR_VALUE) is positive, significant at the 1% level. When executive pay and shareholder value are measured in logarithms, the results (reported in column B of Table 6) are generally consistent with those reported in column A, and the coefficient on SOX*Δln(SHRHLDR_VALUE) is positive, also significant at the 1% level. The empirical findings indicate that pay-performance sensitivity increases after the introduction of SOX.

We further examine whether the elasticity between executive compensation *components* and accounting-based firm performance changed in the post-SOX period. As shown in column C of Table 6, the coefficient on SOX*Δln(IBEI) is positive and significant at the 5% level. This result indicates that *bonus*-performance elasticity increases after the passage of the SOX Act. We also examine whether the *salary*-performance elasticity changed concurrent with the introduction of the SOX Act. The coefficient on SOX*Δln(IBEI) is insignificant (column D of Table 6), suggesting that the salary-performance elasticity did not vary after SOX. Overall, the results are consistent with our findings in Table 5.

Insert Table 6 about here

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6. Conclusion

The models in this study suggest a change in the optimal managerial incentive scheme when a regulatory body makes a commitment to auditing the auditors. When there is no such commitment, the pay-performance sensitivity reflects only the basic risk-incentive tradeoff in a typical moral hazard problem. When there is a commitment to auditing, ceteris paribus, the pay-performance sensitivity on average is altered. If the probability of a good state of nature is high, the sensitivity increases, while the opposite result emerges if that probability is low. We present empirical evidence consistent with a relatively "good" state of nature in the years following the passage of SOX and consistent with an increase in pay-performance sensitivity in the post-SOX period, suggesting that shareholders may have been more successful in using the bonus as a mechanism for motivating management than in the pre-SOX period.

This paper provides an important link between the idea of a regulatory commitment to auditing and the optimal design of incentive contracts, as reflected in the level of pay-performance sensitivity. The results presented in this paper provide some insight into one of the consequences of the passage of the Sarbanes-Oxley Act of 2002. A potential extension of the model would be to investigate the impact of a regulatory commitment to auditing on the auditor's pricing strategy. A limitation of the current model is that we assume the regulator is concerned only with the shareholders' interests, while totally ignoring the welfare of the auditor. In reality, the auditing industry has enormous lobbying power over both the FASB and the PCAOB. Another extension might investigate how each player's behavior would change if the auditor's payoff is also considered. Other limitations include the omission of cost considerations from the model, and the possibility that the observed change was due to other aspects of the Sarbanes-Oxley Act, or indeed to other factors not controlled for in our analysis.

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Table 1
Index of Leading Economic Indicators in the Period of 1993-2005

Year	Index of Leading Economic Indicator
1993	90.483
1994	95.367
1995	97.192
1996	99.983
1997	105.325
1998	108.95
1999	112.908
2000	114.958
2001	112.9
2002	118.392
2003	124.308
2004	133.458
2005	136.583

Data source: http://www.conference-board.org

Table 2
Summary Statistics of Executive Compensation Components and Firm Performance Measures over Time (1993-2005, mean values reported)

Pre-SOX	1993	1994	1995	1996	1997	1998	1999	2000	2001	1993-2001
Bonuses as a % of total compensation	19.95%	19.42%	19.78%	18.98%	18.75%	16.45%	16.88%	15.60%	13.37%	17.57%
Salaries as a % of total compensation	43.84%	43.83%	43.71%	40.84%	37.12%	34.81%	31.63%	31.79%	31.71%	37.32%
Options as a % of total compensation	24.30%	25.89%	23.70%	27.58%	32.55%	38.24%	42.09%	42.57%	44.80%	34.06%
Restricted stock granted as a % of total compensation	3.45%	2.99%	3.47%	3.92%	3.56%	3.48%	3.16%	3.54%	3.86%	3.50%
Total compensation[b]	1.50	1.54	1.63	2.06	2.46	2.91	3.41	4.27	3.59	2.66
Δ in shareholder value[b]	88.19	-308.62	827.31	328.77	262.27	594.85	-469.89	-1238.92	-1662.42	-182.30
Δ in earnings before nonrecurring items[b]	54.43	54.41	26.87	35.29	18.25	5.64	74.62	35.61	-180.94	12.37

Post-SOX	2002	2003	2004	2005	2002-2005	t-test for diff. in means[a]
Bonuses as a % of total compensation	17.19%	18.89%	20.74%	21.79%	19.42%	9.27***
Salaries as a % of total compensation	36.12%	37.28%	34.27%	31.15%	35.11%	-7.66***
Options as a % of total compensation	35.67%	30.18%	28.89%	25.26%	30.49%	-10.79***
Restricted stock granted as a % of total compensation	4.64%	6.30%	8.86%	12.30%	7.56%	24.31***
Total compensation[b]	2.68	2.47	2.81	3.34	2.77	1.43
Δ in shareholder value[b]	-1663.04	1248.25	393.50	95.71	31.83	2.40**
Δ in earnings before nonrecurring items[b]	104.62	108.99	40.32	97.15	86.98	5.28***

[a] Test for difference between pre-SOX and post-SOX means on various components of compensation.
[b] Amounts for total compensation, changes in shareholder value, and changes in earnings are given in millions of dollars.

Table 3
Summary Statistics for Pay-Performance Sensitivity Regression Coefficient Estimates (BETA and ELASTICITY)

Panel A: BETA

Year	# of Obs	Mean	Min	Max	Std Dev	t-value[a]
1993	1,555	0.029%	-7.416%	8.187%	1.189%	0.95
1994	2,175	-0.018	-7.760	8.368	1.305	-0.65
1995	2,239	0.062	-7.125	8.317	1.004	2.94
1996	2,345	0.031	-7.639	7.854	1.147	1.30
1997	2,529	0.112	-7.803	8.224	1.249	4.51
1998	2,488	0.062	-7.341	8.223	1.152	2.69
1999	2,426	0.021	-7.123	8.389	1.034	0.99
2000	2,397	0.074	-6.629	8.351	1.048	3.46
2001	2,319	0.069	-7.625	7.466	1.272	2.62
1993-2001	20,473	0.051	-7.803	8.389	1.159	6.29
2002	2,756	0.095%	-7.579%	7.969%	1.177%	4.23
2003	2,921	0.026	-7.784	8.099	1.016	1.36
2004	2,790	0.109	-6.902	8.256	1.026	5.59
2005	1,703	0.077	-7.657	8.377	1.068	2.98
2002-2005	10,170	0.076	-7.784	8.377	1.073	7.12
1993-2005	30,643	0.059	-7.803	8.389	1.131	9.15

[a] Test for mean differs from zero.

BETA = Yearly change in executive pay divided by yearly change in shareholder value. Executive pay is the total pay that an executive receives in a year including salary, bonus, restricted stock, stock option, long-term incentive plan, and other benefits that cannot be easily categorized. Yearly change in shareholder value is defined as the rate of return realized by shareholder, r_t, multiplied by the beginning-of-period market value, V_{t-1}.

Table 3 Continued

Panel B: ELASTICITY

Year	N	Mean	Min	Max	Std Dev	t-value[a]
1993	1,555	0.148	-190.740	99.413	11.742	0.50
1994	2,175	-0.102	-147.623	120.472	12.356	-0.39
1995	2,239	0.361	-113.316	156.948	7.131	2.39
1996	2,345	0.434	-122.331	221.749	10.729	1.96
1997	2,529	0.473	-178.523	139.202	11.611	2.05
1998	2,488	0.454	-157.017	221.660	11.372	1.99
1999	2,426	-0.076	-121.316	119.593	8.850	-0.42
2000	2,397	0.808	-69.779	247.192	11.361	3.48
2001	2,319	0.010	-579.664	187.346	17.736	0.03
1993-2001	20,473	0.290	-579.664	247.192	11.742	3.53
2002	2,756	0.615	-101.642	177.615	11.607	2.78
2003	2,921	-0.022	-210.845	207.920	9.782	-0.12
2004	2,790	0.938	-230.294	254.951	13.207	3.75
2005	1,703	1.154	-238.479	314.158	18.720	2.54
2002-2005	10,170	0.611	-238.479	314.158	13.064	4.72
1993-2005	30,643	0.396	-579.664	314.158	12.197	5.69

[a] Test for mean differs from zero.

ELASTICITY = Yearly change in natural log of executive pay divided by yearly change in natural log of shareholder value. Executive pay is the total pay that an executive receives in a year including salary, bonus, restricted stock, stock option, long-term incentive plan, and other benefits that cannot be easily categorized. Yearly change in natural log of shareholder value ignores share issues or repurchases and therefore equals the continuously accrued rate of return on common stock, r_t.

Table 4
Descriptive Statistics and Correlation Matrix

Panel A: Descriptive statistics

Variable	Mean	Median	Min	Max	Std Dev
SOX	0.33	0	0	1	0.47
TENURE	12.59	8.33	0.08	61.92	11.21
LNASSETS	7.24	7.03	1.77	14.22	1.81
VOLATILITY	0.46	0.40	0.11	4.12	0.24
IND_PERFORMANCE	-4.57	26.96	-10233	8605.29	718.16
MKT_PERFORMANCE	-18.33	75.23	-630.11	585.62	338.89

Panel B: Correlation Matrix

Variable	SOX	TENURE	LNASSETS	VOLATILITY	IND_ PERFORMANCE	MKT_ PERFORMANCE
SOX	1	-0.08	0.08	0.19	0.14	0.28
TENURE	-0.06	1	0.24	-0.27	0.02	0.01
LNASSETS	0.08	0.2	1	-0.43	0.06	0.01
VOLATILITY	0.18	-0.27	-0.51	1	-0.11	-0.11
IND_PERFORMANCE	0.18	0.02	0.07	-0.13	1	0.48
MKT_PERFORMANCE	0.45	-0.01	0.03	-0.09	0.61	1

Panel A reports the descriptive statistics and Panel B reports the correlation matrix of the independent variables. The lower left-hand side of the matrix reports Spearman rank correlations, and the upper right-hand side reports Pearson correlations. The sample ranges from 1993-2005 and contains 8,037 individuals and 30,643 individual-year observations.

Variable definitions:

SOX = a dummy variable equals to 1 if data are from the years 2002, 2003, 2004, or 2005; 0 otherwise;

TENURE = the number of years the executive has been in office at the fiscal year end;

LNASSETS = natural logarithm of total assets;

VOLATILITY = the volatility used in the Black-Scholes model;

IND_PERFORMANCE = the change in shareholder value of all Compustat companies in the same two-digit SIC code, averaged across sample years;

MKT_PERFORMANCE = the change in shareholder value of all Compustat companies, averaged across sample years.

Table 5
Multivariate Regression Results

VARIABLE	A BETA	B ELASTICITY	C BETA_BONUS	D BETA_SALARY
SOX	0.00027506 *	0.1691 ***	0.00040827 *	0.00000616
	(1.83)	(2.67)	(1.70)	(0.06)
TENURE	-0.00000835	-0.00325	0.00005242 ***	-0.00001595 ***
	(-1.38)	(-1.21)	(5.40)	(-4.04)
LNASSETS	-0.00012937 ***	0.01046	-0.00074107 ***	-0.00028820 ***
	(-3.17)	(0.58)	(-11.35)	(-10.85)
VOLATILITY	0.00063678 **	-0.10361	-0.00280 ***	-0.00192 ***
	(2.02)	(-0.75)	(-5.58)	(-9.41)
IND_PERFORMANCE	0.00000009		-0.00000015	-0.00000006
	(0.94)		(0.92)	(0.91)
MKT_PERFORMANCE	-0.00000043 **		-0.00000045	-0.00000034 **
	(-1.88)		(-1.22)	(-2.27)
Δln(IND_PERFORMANCE)		0.29970 **		
		(2.19)		
Δln(MKT_PERFORMANCE)		-0.37476 *		
		(-1.91)		
Adj. R^2	0.0011	0.0003	0.0046	0.0056
F-value	6.71 ***	2.61 **	24.75 ***	29.58 ***

The two-tailed t-statistics are in the parenthesis under the coefficient estimates.
*, **, and *** indicate the regression coefficients are significantly different from zero at the 10%, 5%, and 1% level, respectively.
Variable definitions:

BETA = yearly change in executive pay divided by yearly change in shareholder value;
ELASTICITY = yearly change in natural log of executive pay divided by yearly change in natural log of shareholder value;
BETA_BONUS = yearly change in executive pay divided by yearly change in earnings before nonrecurring items;
BETA_SALARY = yearly change in executive salary divided by yearly change in earnings before nonrecurring items;
SOX = a dummy variable equals to 1 if data are from the years 2002, 2003, 2004, or 2005; 0 otherwise;
TENURE = the number of years the executive has been in office at the fiscal year end;
LNASSETS = natural logarithm of total assets;
VOLATILITY = the volatility used in the Black-Scholes model;
IND_PERFORMANCE = the average yearly change in shareholder value of all Compustat companies in the same two-digit SIC code;
MKT_PERFORMANCE = the average yearly change in shareholder value of all Compustat companies.
Δln(IND_PERFORMANCE) = the change in the natural log of shareholder value of all Compustat companies in the same two-digit SIC code, averaged across sample years;
Δln(MKT_PERFORMANCE)= the change in the natural log of shareholder value of all Compustat companies, averaged across sample years.

Table 6
Multivariate Regression Results Using Alternative Model Specifications

VARIABLE	A Δ(TOTAL_PAY)		B Δln(TOTAL_PAY)		C Δln(BONUS)		D Δln(SALARY)	
Δ(SHRHLDR_VALUE)	0.00000908							
	(1.34)							
Δln(SHRHLDR_VALUE)			0.161	***				
			(15.84)					
Δln(IBEI)					0.201	***	0.00001446	**
					(24.62)		(2.36)	
SOX	-0.432	***	-0.124	***	-0.007		-0.025	***
	(-4.01)		(-12.58)		(-0.59)		(-4.18)	
SOX*Δ(SHRHLDR_VALUE)	0.00005987	***						
	(4.37)							
SOX*Δln(SHRHLDR_VALUE)			0.054	***				
			(2.93)					
SOX*Δln(IBEI)					0.035	**	0.003	
					(2.27)		(0.52)	
TENURE	0.012	***	0.000		-0.002	***	-0.005	***
	(2.71)		(-0.81)		(-3.45)		(-21.04)	
LNASSETS	0.016		0.001		0.003		-0.000	
	(0.56)		(0.48)		(1.11)		(-0.26)	
VOLATILITY	-0.251		-0.082	***	0.007		-0.016	
	(-1.11)		(-3.80)		(0.25)		(-1.05)	
IND_PERFORMANCE	-0.00000633							
	(-0.08)							
MKT_PERFORMANCE	0.00023146							
	(1.42)							
Δln(IND_PERFORMANCE)			0.084	***	0.113	***	-0.025	**
			(3.81)		(4.77)		(-1.98)	
Δln(MKT_PERFORMANCE)			-0.096	***	-0.067	**	0.032	*
			(-3.07)		(-2.05)		(1.83)	
Adj.R^2	0.002	***	0.02	***	0.05	***	0.02	***
F-value	9.18		92.02		127.38		59.82	

The two-tailed t-statistics are in parenthesis beneath the coefficient estimates.
*, **, and *** indicate the regression coefficients are significantly different from zero at the 10%, 5%, and 1% level, respectively.
Variable definitions:

Δ(TOTAL_PAY) = yearly change in total executive compensation;
Δln(TOTAL_PAY) = yearly change in natural log of total executive compensation;
Δln(BONUS) = yearly change in natural log of bonus;
Δln(SALARY) = yearly change in natural log of salary;
Δ(SHRHLDR_VALUE) = yearly change in shareholder value;
Δln(SHRHLDR_VALUE) = yearly change in natural log of shareholder value;
Δln(IBEI) = yearly change in natural log of earnings before nonrecurring items;
SOX = a dummy variable equals to 1 if data are from the years 2002, 2003, 2004, or 2005; 0 otherwise;
SOX*Δ(SHRHLDR_VALUE)= the interaction of SOX and Δ(SHRHLDR_VALUE);

SOX*Δln(SHRHLDR_VALUE)= the interaction of SOX and Δln(SHRHLDR_VALUE);
SOX*Δln(IBEI) = the interaction of SOX and Δln(IBEI);
TENURE = number of years the executive has been in office at fiscal year end;
LNASSETS = natural logarithm of total assets;
VOLATILITY = the volatility used in the Black-Scholes model;
IND_PERFORMANCE = change in shareholder value of all Compustat companies in the same two-digit SIC code, averaged across sample years;
MKT_PERFORMANCE = change in shareholder value of all Compustat companies, averaged across sample years;
Δln(IND_PERFORMANCE) = change in natural log of shareholder value of all Compustat companies in the same two-digit SIC code, averaged across sample years;
Δln(MKT_PERFORMANCE)= change in natural log of shareholder value of all Compustat companies, averaged across sample years.