J Bus Ethics (2017) 146:419–450
https://doi.org/10.1007/s10551-015-2891-y

What Does CEOs' Pay-for-Performance Reveal About Shareholders' Attitude Toward Earnings Overstatements?

Katherine Guthrie[1] · **Illoong Kwon**[2] · **Jan Sokolowsky**[3]

Received: 2 October 2014 / Accepted: 28 September 2015 / Published online: 3 November 2015

Abstract If overstatements were a symptom of the agency conflict, pay-for-performance sensitivities should have increased in response to the additional penalties for misreporting imposed by SOX. Our finding of their decrease is inconsistent with the view that overstatements were an unintended consequence of incentive pay prior to 2002. To corroborate our interpretation, we show that (i) CEO pay-for-performance sensitivities are higher among firms whose shareholders stand to benefit from overstatements; (ii) this cross-sectional relationship weakens significantly after SOX; and (iii) the within-firm decrease in pay-for-performance sensitivity is most pronounced among firms with high pre-SOX shareholder benefits from overstatements.

Keywords CEO incentive pay · Earnings management · Firm objectives · Pay-for-performance sensitivity · Sarbanes–Oxley Act · Shareholder myopia

JEL Classification G32 · G34 · J33 · L21 · M41 · M43 · M52

✉ Katherine Guthrie
katherine.guthrie@mason.wm.edu

Illoong Kwon
ilkwon@snu.ac.kr

Jan Sokolowsky
sokolowsky.jan@gmail.com

[1] College of William and Mary, P.O. Box 8795, Williamsburg, VA 23187-8795, USA

[2] Seoul National University, Seoul, South Korea

[3] Society for Financial Studies, Cary, USA

Introduction

CEO incentive pay has been linked to income-increasing accrual choices, earnings reports that systematically exceed analysts' forecasts, earnings restatements, consecutive strings of earnings increases, and securities class action law suits for financial misrepresentation. The purpose of our paper is to shed light on whether such earnings overstatements are an intended or unintended consequence of pay-for-performance.

We take two approaches to answer this question. First, we infer shareholders' preferences about earnings overstatements by comparing the observed change in pay-for-performance sensitivities around the Sarbanes–Oxley Act (SOX) with predictions from optimal contracting theory. Second, we validate these findings by relating proxies for shareholder benefits from overstatements to CEOs' pay-for-performance sensitivities both in the cross section and around SOX. In a nutshell, our results are inconsistent with the view that overstatements were an undesired side-effect of inducing productive effort in the years leading up to SOX.

The theoretical literature on incentive design has long recognized the potential tradeoff between inducing long-term value creation and short-term overstatements. While incentive pay is used to align the interests of managers with those of owners, managers also inflate the stock price to improve their performance evaluation and increase compensation. This tradeoff is based on the premise that managers benefit from increasing firm value in the short term, whereas shareholders care about firm value in the long run.

In reality, however, current shareholders could benefit from short-run overstatements for several reasons. For example, Bushee (2001) emphasizes the short-term value preferences of transient institutional investors, and Shleifer (2004) argues that shareholders benefit from attracting

external finance at lower cost. Some of the theoretical studies on incentive design explicitly recognize the potential for shareholders to use pay-for-performance to induce overstatement by managers. Dye (1988), for example, calls the possibility of shareholders using pay-for-performance to reward managers for overstatements the external demand for earnings management, and Bolton et al. (2006) refer to it as the strong form of their theory. To the best of our knowledge, however, there exists no empirical evidence to distinguish between the views that overstatements are an intended or unintended consequence of incentive pay. To this end, we investigate empirically whether CEO incentive pay reflects shareholder costs and benefits of overstatements.

To differentiate between these two opposing views on shareholders' underlying preference for earnings overstatements, we develop a novel test based on predictions derived from a principal-agent model linking pay to the costs and benefits of overstatements. We show that when the cost of overstatement increases, the change in the optimal pay-for-performance sensitivity (PPS) for a CEO depends on shareholders' preference for overstatements. Specifically, if shareholders do not value overstatements, optimal PPS strikes a balance between inducing productive effort and avoiding overstatements. Since managers overstate less following an increase in the cost of overstatement, shareholders can raise PPS to induce more productive effort. On the other hand, if shareholders value overstatements, optimal PPS falls in response to an increase in the cost of overstatement (like other ordinary goods, the quantity of overstatements demanded is inversely related to its price). Throughout the paper, we refer to such shareholders as myopic to describe their preference for maximizing a firm's market value in the short-run as opposed to its fundamental value in the long run.[1]

Our first approach to infer shareholder objectives from observed changes in pay-for-performance sensitivities exploits the increase in CEOs' and shareholders' expected cost of overstatement with the passage of the Sarbanes–Oxley Act of 2002.[2] Using SOX as an exogenous shock to firms' optimal design of incentive pay offers a quasi-experimental setting which allows us to circumvent the typical endogeneity issues plaguing much of empirical research on corporate governance (e.g., see Hermalin and Weisbach 2003 for a literature survey on corporate boards as endogenously determined institutions).[3] We find that pay-for-performance sensitivity decreases significantly in the fiscal year of and after SOX, but not in other years. In particular, we estimate that PPS falls by about 8 % (or about $23,000 per 1 % change in firm value at the median and $85,000 at the mean) from before to after SOX. The empirical evidence is consistent with the view that SOX decreased the shareholder demand for overstatements.

Our second approach relies on empirical proxies for shareholder benefits from overstatements (SBO) to substantiate our finding that shareholder objectives are reflected in the design of CEO incentive compensation. Our model makes two predictions in this regard. First, greater benefits from overstatements should lead to higher pay-for-performance sensitivity. Second, PPS should fall by more around SOX in firms whose shareholders benefit more from overstatements. To test these predictions, we use two sets of proxies for shareholder benefits from overstatements: (i) the Kaplan and Zingales (1997) and Hadlock and Pierce (2010) measures of capital constraints; and (ii) the portfolio turnover rate of firms' institutional owners (Gaspar et al. 2005) and the ownership fraction of transient institutional investors (Bushee 2001). Our choice of proxies for shareholder benefits from overstatements reflects the motivations used in the theoretical literature cited above, as well as empirical evidence linking these firm attributes to myopia or earnings management. Overstatements temporarily reduce the cost of capital (e.g., Shleifer 2004; Linck et al. 2010), and overstatements increase the return to influential short-term investors (e.g., Bolton et al. 2006; Bushee 2001).

Higher capital constraints and shorter investor horizons are indicative of higher PPS cross-sectionally. Moving from the 25th to the 75th percentile of each measure corresponds to differences in CEO $-pay-for-%-performance of 39, 47, 22, and 12 % in the years prior to SOX. The cross-sectional relationship weakens significantly in the post-SOX years of the sample: the interquartile effects drop to 26, 20, 4, and 3 %. We also find that the decrease in PPS is concentrated among firms whose shareholders were more likely to benefit from overstatements prior to SOX. log(PPS) falls by 0.121–0.205 more in firms with high pre-SOX shareholder benefits than in firms with low pre-SOX shareholder benefits (where we delineate high from low based on the median score). These estimates translate into an additional decrease in PPS

[1] Firm values are based on managers' reported earnings. A firm's market value can temporarily exceed its fundamental value, because managers can report inflated earnings in excess of fundamental, or true, earnings.

[2] SOX increased the cost to CEOs for overstating earnings by (i) increasing the limits on financial penalties and prison terms for financial misrepresentation; (ii) requiring CEOs to reimburse any incentive-based compensation or profit from the sale of stock received within 12 months after the misreporting if there is an accounting restatement as a result of misconduct; (iii) providing an additional 776 million in funding to the Securities and Exchange Commission (SEC) to step up its monitoring and enforcement efforts; and numerous other provisions.

[3] Our conjecture that a change in the cost of overstatements affects the optimal level of PPS is corroborated by Karpoff et al. (2008a, b). The authors show that managers and firms suffer substantial penalties for financial misrepresentation if caught, which suggests that those consequences factor into managers' and shareholders' choices.

for high-SBO firms between $123,000 and $200,000 at the mean level of pre-SOX PPS, and between $35,000 and $57,000 at the median level of PPS.[4]

Our findings contribute to a deeper understanding of the design of managerial incentive pay. We show that both costs and benefits of overstatements are reflected in CEO contracts through pay-for performance. To be clear, we do not offer direct evidence (nor do we argue) that boards or shareholders actively and deliberately offered pay-for-performance to induce greater misreporting. The evidence is equally consistent with a more passive role of boards and shareholders: e.g., certain boards could have been less averse to accepting high-powered incentive schemes in contract negotiations with CEOs, or their shareholders were merely less vocal on issues of managerial compensation. While it is difficult to ascertain whether overstatements were an intentional or unintentional side-effect of inducing productive effort with pay-for-performance, our evidence shows that prior to SOX pay-for-performance was higher in firms whose shareholders were less averse to overstatements. This finding calls into question that CEOs' high-powered incentives (and the resulting overstatements) are necessarily a symptom of poor governance. Instead, excessive PPS could also be a symptom of the conflict between current and future shareholders.

In an effort to improve the quality of financial reporting, recent corporate governance reforms have put great emphasis on board and committee independence to bolster directors' ability to act independently from management, and possibly to the detriment of directors' access to information. We emphasize that directors must also want to act as monitors. If the shareholders they represent benefit from overstatements, then one cannot expect the directors to be effective at preventing overstatements. Since our findings are not attributable to the board independence reforms, we conjecture that the provisions of SOX that increased the expected cost of overstatements have done more to improve the quality of financial reporting than the board composition mandates.

Related Literature

Numerous empirical studies show a positive relationship between CEO incentive pay and various measures of earnings overstatements (for example, see Kadan and Yang 2004; Ke 2004; Cheng and Warfield 2005; Bergstresser and Philippon 2006; Burns and Kedia 2006; Denis et al. 2006; Efendi et al. 2007; Peng and Röell 2008).[5] A conjecture that commonly emerged from those findings was that incentive pay proved to be a double-edged sword: inducing earnings overstatements was an unintended, though necessary consequence of inducing productive effort. In other words, managers benefited from inflating short-term firm performance at the expense of shareholders. We contribute to this literature by investigating the role of shareholder objectives in the design of incentive pay.

To this end, we formalize how optimal incentive contracts respond to an exogenous increase in the cost of overstatements. The theory provides a framework that allows us to infer shareholder objectives from the observed changes in CEO pay around SOX. The key point in the theoretical model is the potential tradeoff—depending on shareholders' preference for overstatements—between inducing overstatement and inducing productive effort through pay-for performance. Few models have captured this tradeoff because most of them look at either overstatements or productive effort, but not both. For example, Stein (1989) and Fischer and Verrecchia (2004) do not consider the agent's productive effort or the optimal contract. Gibbons and Murphy (1992) and Holmström (1999) do not consider the agent's overstatement. And several models that capture this tradeoff do not consider different objectives of the principal. While Crocker and Slemrod (2005) and Kwon and Yeo (2009) do not model shareholder benefits from overstatements, Dye (1988), Bolton et al. (2006), and Goldman and Slezak (2006) do not offer empirically testable implications to distinguish between principals that discourage and principals that encourage overstatements.

Although our paper primarily focuses on the attitude of shareholders toward overstatements, using SOX as a quasi-experimental shock to optimal PPS also places it in the ongoing debate on the effects of SOX on the performance sensitivity of managerial compensation. Here, we provide a brief sketch of the conflicting empirical evidence on changes in pay-for-performance around SOX and competing interpretations.[6] Carter et al. (2009) find an increase in the earnings-sensitivity of bonuses following SOX. They argue that the increase reflects firms' willingness to offer greater incentives for productive effort, because SOX constrains managers' flexibility in managing earnings. In

[4] Our findings are qualitatively robust to numerous robustness checks, including those pertaining to variable definitions and measurement (e.g., pre/post-SOX period, treatment of bonus pay, flow vs. level of incentive pay) and to various sample restrictions (e.g., non-high-tech firms, firms that were compliant with contemporaneous governance regulations, market-value-matched pre/post-SOX firm-year-pairs).

[5] Two notable exceptions are Erickson et al. (2006) and Armstrong et al. (2010). However, Erickson et al. (2006) base their study on a small number of accounting frauds that likely reflect idiosyncratic managerial expropriation; and the sample period of Armstrong et al. (2010) spans pre- and post-SOX years and their results are not robust when restricted to the pre-SOX period.

[6] See "Discussion" section for further discussion of alternative explanations of our findings.

contrast, Indjejikian and Matějka (2009) find that bonuses become less sensitive to financial performance measures in the post-SOX period. They interpret the decrease in performance sensitivity to reveal that firms must have experienced an increase in the cost of misreporting that warrants a cutback in misreporting above and beyond the response of CFOs to SOX. Our study differs from Carter et al. (2009) and Indjejikian and Matějka (2009) in a number of dimensions, e.g., sample period, coverage of executives, breadth of explanations considered, and most importantly in how we measure incentive compensation. We do not only study the performance sensitivity of bonus pay, but also include the incentive effects from stocks and options. Our more comprehensive incentive measure is better suited for drawing inferences about the nature of incentive pay.

Several other contemporaneous working papers touch on this topic using broad measures of incentive pay. While we study the determinants of changes in PPS around SOX, Cohen et al. (2007) investigate the implications on managerial risk-taking and firm performance. They find that in response to the greater risk faced by CEOs, total pay remains unchanged while CEOs' exposure to risk through pay-for-performance decreases. They conjecture that the decrease in incentive pay is due to public pressure to rein in executive compensation. Jayaraman and Milbourn (2010), on the other hand, find incentive pay to have increased around SOX, which they interpret analogously to Carter et al. (2009).[7]

Finally, our work complements prior research linking earnings management to firm objectives. Our revealed-preference-approach to uncovering shareholder objectives from changes in optimal PPS circumvents the problem of how to identify earnings overstatements. Researchers disagree whether accruals (or which accruals) are good proxies for earnings management and whether a discontinuity in the distribution of forecast errors around various earnings benchmarks constitutes evidence of earnings management. Other measures of overstatements, such as shareholder litigation, earnings restatements, and enforcement actions by the SEC suffer from the drawback that only a fraction of overstatements is detected.[8] It is also unclear where to draw the line between desired and undesired earnings management, because the cost of overstatement increases with its magnitude. Our research design has the advantage that we infer shareholders' underlying objectives from observed CEO contracts without relying on a proxy for earnings management. On the other hand, one disadvantage to our study is the presumption that shareholders or their representatives influence the design of executive compensation schemes.

Despite the different approaches, our findings are consistent with recent studies documenting a decrease in accruals-based earnings management and the frequency of meeting or beating analysts' consensus forecasts, as well as an increase in accounting conservatism around SOX (e.g., Cohen et al. 2008; Bartov and Cohen 2009; Lobo and Zhou 2009). In addition, Cohen et al. (2007) and Bargeron et al. (2010) show that firms reduce their capital and research and development expenditures. These findings are consistent with our model's prediction that the decrease in CEO pay-for-performance also curtails productive effort. Analyzing the extent to which the documented change in firm values, earnings management, productive effort, and risk-taking around SOX are attributable to a change in CEO incentive pay, or how they are related to our proxies for SBOs, is beyond the scope of the present paper.

Theory

Our theory builds on the standard principal-agent problem, in which a principal (e.g., shareholders represented by a board) designs a compensation scheme that induces the agent (e.g., a CEO) to exert costly productive effort to generate firm profits. The agent, however, can also manipulate the performance measure to which his compensation is tied. In the traditional view, the agent's manipulation is an unavoidable by-product of using pay-for-performance as a solution to the principal-agent problem. Because manipulation generates compensation for the agent without generating extra firm value for the principal, its presence reduces the efficacy of pay-for-performance in inducing productive effort.

The novelty of our model lies in encompassing the additional scenario in which the principal also benefits from manipulation. In this case, the principal does not object to manipulation by the agent; rather she uses pay-for-performance to encourage both productive and manipulative effort to temporarily inflate firm value. The principal's attitude toward manipulation is expressed through a parameter, λ, which captures how much weight the principal places on benefits from manipulations. The model yields predictions about optimal pay-for-performance sensitivities that depend on λ, which in turn allows us to empirically infer the principal's attitude toward manipulation from data on pay-for-performance sensitivities.

[7] Their result is likely driven by their research design. They estimate the SOX effect after controlling for year and industry effects, but not for firm-fixed effects.

[8] For example, see Schipper (1989), Beneish (2001), Dechow and Dichev (2002), Kothari et al. (2005) and Ball and Shivakumar (2006) on the accruals debate, Durtschi and Easton (2005) on forecast errors, and Dechow et al. (1996), Burns and Kedia (2006), Hennes et al. (2008), Peng and Röell (2008), Wang (2012) on enforcement actions, restatements, and litigation.

Set-up

We consider a firm with one principal and one agent.[9] The agent exerts productive effort (a) to increase a firm's underlying fundamental value, $y = a + \epsilon_a$, where ϵ_a follows a normal distribution $N(0, \sigma_a^2)$. As in Kwon and Yeo (2009), we allow the agent to overstate the fundamental value by m. Neither the principal nor the market observes the fundamental value (y) or overstatement (m). However, the market can discount the reported value by its expectation on overstatement (m^e). Then, a firm's *market* performance (e.g., stock price), denoted by $\tilde{y}$, is determined by $\tilde{y} = y + m + \epsilon_m - m^e$, where ϵ_m is random noise following a normal distribution $N(0, \epsilon_m^2)$.[10]

As in Bolton et al. (2006), we assume that investors have heterogenous beliefs on the agent's overstatement, and that the firm's market value is determined by the most optimistic investor (or the smallest expected overstatement). In other words, investors who value the firm's shares most highly hold the long positions. More specifically, let us denote an investor i's expectation on the agent's overstatement by m_i^e, where m_i is distributed over $[\underline{m}, \overline{m}]$, and $\overline{m} > \underline{m} > 0$. We assume that $E[m_i^e] = m^*$, where m^* is the agent's equilibrium overstatement level. Therefore, investors' expectations are rational on average. However, Bolton et al. (2006) show that if short selling is costly, the market price is determined by the most optimistic belief, $m_i^e = \underline{m}$. In this case, the market's expectation is $m^e = \underline{m}$.[11]

Let us define θ such that $m^e = \underline{m} = \theta m^*$. Note that $0 < \theta < 1$, since $E[m_i^e] = m^* > \underline{m} > 0$, and the market underestimates the extent of overstatement. If market uncertainty increases and investors' beliefs are more dispersed (holding the mean constant), then $\underline{m}$ (θ) becomes smaller and the market will underestimate the extent of overstatement by more. Thus, we can interpret θ as a measure of mispricing in the market.

The agent's wage (w) is contingent on the firm's market value.[12] In the spirit of Holmström and Milgrom (1992), we assume a linear contract, where $w = s + \beta\tilde{y}$.[13]

The principal is risk-neutral, and the agent is risk-averse. The agent's utility function is given by $U(w, a, m) = -\exp^{-r(w - \frac{1}{2}a^2 - \frac{k}{2}m^2)}$, where $\frac{1}{2}a^2$ is the cost of productive effort and $\frac{k}{2}m^2$ captures the cost of overstatement. More specifically, we assume that the probability of getting caught overstating (q) is proportional to the size of overstatement, i.e., $q = \rho_1 m$. Once caught, the punishment for overstatement (P) is also proportional to the size of overstatement, i.e., $P = \rho_2 m$. Let $\rho = \rho_1\rho_2$, and the expected punishment amount to $qP = \rho m^2$. The punishment is shared between the agent (η) and the principal ($1 - \eta$). Then, the expected punishment of overstatement to the agent is $\eta qP = \eta\rho m^2 = \frac{k}{2}m^2$, where $k = 2\eta\rho$. Note that the marginal cost of overstatement to the CEO (=km) is increasing in m. Similarly, the expected cost of overstatement to the principal is $(1 - \eta)qP = (1 - \eta)\rho m^2 = \frac{c}{2}m^2$, where $c = 2(1 - \eta)\rho$. Recall that SOX has increased both funding to the SEC to increase enforcement, as well as penalties for CEOs (e.g., through required reimbursement of performance-contingent compensation obtained from overstatement). Thus, SOX has increased both ρ_1 and ρ_2, or k and c. We normalize the agent's reservation utility to -1 and assume that the principal has all the bargaining power.

The timing of the game is as follows. First, the principal and the agent sign a binding wage contract. Then, the agent chooses productive effort (a). After the fundamental value (y) is realized, the agent chooses his overstatement level (m). The market discounts the reported value and determines the market value of the firm ($\tilde{y}$). The agent then gets paid based on the initial contract.

Overstatement and Effort

We solve the model by backward induction. Given the contract and the market's expectation, we first characterize the agent's incentive constraints for overstatement (m) and productive effort (a).

[9] Throughout the paper, we ignore the possible agency problem between the shareholders and the board. Allowing such agency problem in this model would be an interesting topic for future research.

[10] In this paper, we do not consider the agent's incentive to understate performance to smooth income, for example. If there is such an incentive, we can regard m as the overstatement above and beyond the understated performance.

[11] For example, D'Avolio (2002), Geczy et al. (2002) and Jones and Lamont (2002) provide empirical evidence that it is costly to short sell stocks.

[12] This assumption reflects the usual stock- and option-based compensation packages for CEOs; the model's predictions are unchanged if the agent's compensation were tied to an accounting performance measure instead. The crucial assumption in our model is that the agent's report on fundamental performance is not verifiable. For example, the agent may only know the probability distribution of the true performance, and can only report the mean of the distribution. Then, the agent is unlikely to become liable for the report. This assumption allows us to circumvent the revelation mechanism, as discussed in Dye (1988) and Crocker and Slemrod (2005).

[13] For recent attempts to characterize general non-linear contracts, see Hemmer et al. (2000) and Crocker and Slemrod (2005).

Overstatement Given fundamental value $(y = a + \epsilon_a)$, the agent solves the following maximization problem to determine the optimal level of overstatement:

$$\max_m E\left[-\exp\left(-r(s+\beta\tilde{y}-\frac{1}{2}a^2-\frac{k}{2}m^2)\right)\right]$$
$$\iff \max_m s+\beta(y+m-m^e)-\frac{1}{2}a^2-\frac{k}{2}m^2-\frac{r}{2}\beta^2\sigma_m^2.$$

From the first order condition, we obtain the optimal level of overstatement

$$m^*(y)=\frac{\beta}{k}. \tag{1}$$

Since the agent's overstatement level does not depend on the realized fundamental value, it is rational for the market to discount the reported value by a constant. Therefore, in this simple equilibrium, the agent can take the market expectation (m^e) as given.[14]

Effort Given the agent's optimal overstatement rule in Eq. (1), the agent's optimal choice of effort solves the following optimization problem:

$$\begin{aligned}&\max_a \mathrm{s}+\beta\mathrm{E}\left[\mathrm{a}+\epsilon_\mathrm{a}+\mathrm{m}^*(\mathrm{y})+\epsilon_\mathrm{m}-\mathrm{m}^\mathrm{e}\right]\\&-\frac{1}{2}a^2-\frac{k}{2}m^*(y)^2-\frac{r}{2}\beta^2(\sigma_a^2+\sigma_m^2)\\&=\max_a \mathrm{s}+\beta\left(\mathrm{a}+(1-\theta)\frac{\beta}{\mathrm{k}}\right)-\frac{1}{2}\mathrm{a}^2-\frac{\beta^2}{2\mathrm{k}}-\frac{\mathrm{r}}{2}\beta^2(\sigma_\mathrm{a}^2+\sigma_\mathrm{m}^2).\end{aligned}$$

When the agent decides on his effort level, both ϵ_a and ϵ_m are still random variables. The first order condition yields

$$a^*=\beta. \tag{2}$$

Not surprisingly, if β increases, the agent exerts more productive effort. But from Eq. (1), the agent will also overstate the fundamental value by more, which presents a potential tradeoff to the principal.

The agent's participation constraint must also be binding. That is,

$$\begin{aligned}&E\left[-\exp^{-r(w-\frac{1}{2}a^2-\frac{k}{2}m^2)}\right]=-1\\&\Updownarrow\\&s+\beta\left(a+(1-\theta)\frac{\beta}{k}\right)-\frac{1}{2}a^2-\frac{\beta^2}{2k}-\frac{r}{2}\beta^2(\sigma_a^2+\sigma_m^2)=0.\end{aligned} \tag{3}$$

[14] Kwon and Yeo (2009) show that there is another, more complex equilibrium where market expectation is a strictly increasing function of reported performance. Such an equilibrium becomes quickly untractable in this paper, but the qualitative results of this paper should hold in that equilibrium too.

The Optimal Contract

We model two opposing views on shareholder objectives: maximization of either the market value or fundamental value of the firm. To encompass both views, we assume that the principal maximizes the weighted average of market performance and fundamental performance of the firm. We introduce λ to capture the weight the principal places on her firm's market value instead of its fundamental value. The principal's optimization problem is thus given by

$$\begin{aligned}&\max_{s,\beta} E\left[\lambda\tilde{y}+(1-\lambda)y-w-\frac{c}{2}m^2\right]\\&=a+\lambda(m-m^e)-(s+\beta(a+m-m^e))-\frac{c}{2}m^2,\end{aligned}$$

subject to the incentive constraints (1) and (2), and the participation constraint (3).

Substituting Eqs. (1), (2), and (3) into the principal's objective function yields

$$\begin{aligned}&\max_\beta \beta+\lambda(1-\theta)\frac{\beta}{k}\\&-\left[-\left(\beta\left(\beta+(1-\theta)\frac{\beta}{k}\right)-\frac{\beta^2}{2}-\frac{\beta^2}{2k}-\frac{r}{2}\beta^2(\sigma_a^2+\sigma_m^2)\right)\right.\\&\left.+\beta\left(\beta+(1-\theta)\frac{\beta}{k}\right)\right]-\frac{c}{2}\left(\frac{\beta}{k}\right)^2.\end{aligned}$$

The first order condition is

$$1+\lambda\left(\frac{1-\theta}{k}\right)-\left(1+\frac{1}{k}+r(\sigma_a^2+\sigma_m^2)\right)\beta-\frac{c}{k^2}\beta=0. \tag{4}$$

This first order condition reveals the tradeoff in choosing the optimal pay-for-performance sensitivity (PPS), β. The marginal benefits of raising β include the increased productive effort and the returns from the agent's overstatement, $\lambda\left(\frac{1-\theta}{k}\right)$. The marginal costs of raising β include the increased cost of productive effort, overstatement, and risk-premium, as well as the increased cost from overstatement to the principal.

The optimal PPS, β^*, is given by

$$\begin{aligned}\beta^*&=\frac{1+\lambda\left(\frac{1-\theta}{k}\right)}{1+\frac{c+k}{k^2}+r(\sigma_a^2+\sigma_m^2)}\\&=\frac{1+\lambda\left(\frac{1-\theta}{2\eta\rho}\right)}{1+\frac{1}{2\eta^2\rho}+r(\sigma_a^2+\sigma_m^2)}.\end{aligned} \tag{5}$$

We are interested in how optimal PPS changes in response to an exogenous increase in the cost of overstatement (ρ). The following proposition states that optimal PPS can either increase or decrease depending on the principal's degree of myopia (λ) and market uncertainty (θ).

Proposition 1 $\frac{\partial \beta^*}{\partial \rho} < 0$ if and only if $\lambda > \frac{1}{\eta(1-\theta)(1+r(\sigma_a^2+\sigma_m^2))}$.

Proof See Appendix 1. □

Proposition 1 states that an increase in the cost of overstatement (ρ) will *decrease* optimal PPS only if the principal is sufficiently myopic (i.e., λ is sufficiently large). This result is significant, as it shows that we can potentially distinguish between shareholder objectives of maximizing firms' market values and fundamental values from observed changes in pay-for-performance around SOX. For PPS to fall in response to the SOX-imposed increase in the cost of overstatement, it must have been used to incentivize short-run market value rather than long-run fundamental value. An increase in PPS, on the other hand, could arise from overstatements being ineffective (θ close to one) or the agent bearing insufficient costs of overstatements (low η), regardless of the degree of shareholder myopia (because $\lambda \leq 1$).

Intuitively, a myopic principal's optimal PPS reflects not only the desire to induce high productive effort, but also her benefits from manipulative effort. As the cost of overstatement increases, it becomes more costly for the principal to induce the agent to inflate the market value of the firm, and consequently optimal PPS falls.

A non-myopic, but otherwise identical, principal's optimal PPS would initially be lower, as it sacrifices incentives for productive effort in an attempt to rein in the unintended manipulative effort. As the cost of overstatement increases, the agent reduces overstatements voluntarily, which in turn allows the principal to raise PPS to induce more productive effort with less overstatement.

To the extent that we can find empirical measures of λ, we can test the model's predictions directly (i.e., without inferring shareholder objectives). In particular, the model predicts:

Proposition 2

(i) $\frac{\partial \beta^*}{\partial \lambda} > 0$.

(ii) $\frac{\partial^2 \beta^*}{\partial \rho \partial \lambda} < 0$.

Proof See Appendix 1. □

When the principal focuses more on the market value instead of the fundamental value, the principal wishes to encourage more overstatement by increasing the performance sensitivity of the agent's compensation. Thus, as λ increases, optimal PPS increases too.

However, exactly when the principal cares more about the market value (i.e., λ is large), the effect of the increased cost of overstatement (ρ) becomes even bigger. In other words, when the cost of overstatement increases, optimal PPS in firms that focus relatively more on market value will decrease by more (or increase by less) compared to firms that focus relatively more on fundamental value.

Empirical Analysis

Hypotheses and Identification Strategy

Our empirical analysis consists of three parts. First, we utilize Proposition (1) to infer shareholder objectives from observed changes in PPS around SOX:

Hypothesis 1 According to Proposition (1), an observed decrease in CEOs' pay-for-performance sensitivity in response to SOX is consistent with market value maximization, but inconsistent with maximization of fundamental value (i.e., shareholders must benefit from overstatements). On the other hand, if CEOs' pay-for-performance sensitivity increases in response to SOX, overstatements are either ineffective or too costly, and/or shareholders do not value gains from overstatements.

Intuitively, shareholders who do not value overstatements are constrained in offering their CEO higher PPS, because it leads to costly overstatements. An increase in the cost of overstatement induces the CEO to reduce overstatements for any given level of pay-for-performance sensitivity, and the shareholders' constraint loosens—they can now raise incentive pay to induce more productive effort. On the other hand, if shareholders value overstatements, an increase in the cost of overstatements leads to fewer/smaller overstatements desired by them (the quantity demanded decreases as the price rises, reflecting a downward sloping demand curve for overstatements), which in turn lowers optimal PPS.

The Sarbanes–Oxley Act of 2002 provides a quasi-experimental increase in the cost of overstatements that allows us to assess the model's predictions. We argue that SOX increased the cost to the agent for overstating earnings directly by increasing CEOs' personal exposure to liability (e.g., through higher expected penalties) and indirectly by making financial misrepresentation more difficult (e.g., through more auditor oversight and independence).

Specifically, SOX requires CEOs to reimburse any incentive-based compensation or profit from the sale of stock received within 12 months after the misreporting if there is an accounting restatement as a result of misconduct (section *304*). SOX also grants the SEC power to permanently bar fraudulent executives from serving as officers or directors in the future (*1105*). Maximum criminal penalties for fraud under the Securities and Exchange Act of 1934 are increased to $5 million and 20 years of prison (*1106*), and maximum prison terms increase to 25 years for

securities fraud and up to 20 years for mail and wire fraud (*807* and *903*). In addition, SOX requires CEOs to personally certify the correctness and completeness of the financial statement (*302*), as well as to disclose any significant deficiencies and changes in internal controls over financial misrepresentation (*404*). According to Bainbridge (2007), the purpose of these certifications is to prevent CEOs from hiding behind the veil of ignorance. SOX also institutes stiff penalties for non-compliance with the certification requirements; they are punishable with up to $5 million in fines and 20 years in prison (*906*).

Furthermore, the SEC is apportioned an additional $776 million of funding for fiscal year 2003, of which $201 million are intended for higher staff compensation and at least 200 new hires (*601*). To better protect investors, SOX mandates the SEC to review each firm's disclosures at least once every three years (*408*). SOX also makes it more difficult to misrepresent a firm's financial situation by creating the Public Company Accounting Oversight Board (title I); requiring auditor independence (title II); improving the quality of audit committees through independence (*301*) and financial expertise (*407*); and providing explicit protection of whistleblowers (*806* and *1107*).

The second and third parts of our empirical analysis are tests of Proposition (2). The model makes the following testable predictions about the relationship between CEO incentive pay and shareholder benefits:

Hypothesis 2 According to Proposition 2(i), higher shareholder benefits from overstatements are reflected in higher CEO pay-for-performance sensitivity.

Hypothesis 3 According to Proposition 2(ii), higher shareholder benefits from overstatement prior to SOX are reflected in a larger decrease in CEO pay-for-performance sensitivity around SOX.

The intuition for Hypothesis (2) is straightforward: The more shareholders benefit from overstatements, the more they are willing to pay their CEO to achieve them. Hypothesis (3) is a combination of Hypotheses (1) and (2). The effect of the increase in the cost of overstatements is more pronounced the more shareholders benefit from overstatements.

These tests are independent from inferred shareholder objectives based on Proposition (1). To test Hypothesis (2), we link cross-sectional variation in the proxies for shareholder benefits to CEOs' PPS. In testing Hypothesis (3) we use a difference-in-difference approach: does pay-for-performance sensitivity fall by more around SOX in firms with high pre-SOX shareholder benefits? This approach allows us to rule out a number of alternative explanations of the decrease in PPS that do not offer differential predictions based on the presence of shareholder benefits from overstatements, as discussed in the "Discussion" section below.

Because the weight that shareholders assign to the market value as opposed to the fundamental value of the firm is not directly observable, we must identify suitable proxies that can differentiate between firms whose shareholders stand to benefit from overstatements and firms whose shareholders do not. Note that our hypotheses assume that a firm's market value can be inflated by overstatements in the short-run, but not in the long run. For example, in the long run, real performance fails to justify the increased stock price, earnings borrowed from the future fail to appear then, or repeated audits eventually uncover overstatements of earnings or assets. Therefore, our empirical measures for shareholder benefits from overstatements must be based on the myopia of shareholders.

To identify viable proxies for shareholder myopia, we seek guidance from the theoretical literature on contract design in the presence of manipulable performance measures. The three theoretical papers that explicitly mention shareholder benefits from inflated share prices in the short-run are Dye (1988), Shleifer (2004), Bolton et al. (2006). While Dye cites accounting-based contracts with suppliers, debt covenants, and rate-of-return regulations as factors that can make earnings management desirable to shareholders, he goes on to say that he specifically focuses on "analyz[ing] the external demand for earnings management induced by current shareholders' attempts to alter prospective investors' perceptions of the firm's value." Prospective investors' perceptions of firm value benefit current shareholders in one of two ways. First, Shleifer argues that temporarily inflated firm value reduces the cost of capital when firms seek external financing. Holding the amount of equity capital to be raised fixed, a higher selling price of new shares mitigates the dilution of current shareholders' ownership. Second, Bolton et al. build their model on the premise that current shareholders will eventually want to sell their shares to the next generation of investors, preferably at inflated prices. In their words, "in a speculative stock market, incumbent shareholders have a shorter horizon and align the manager's horizon to theirs by weighing the CEO's compensation more heavily on short-term stock price performance." To summarize, the theoretical papers point us to external equity financing and investor trading as two likely sources of conflict between current and future shareholders.

To capture firms' need to access external capital markets, the empirical corporate finance literature offers several measures of capital constraints. We use the KZ-score (the original financial constraint measure easily calculable from Compustat data, developed by Kaplan and Zingales 1997) and the HP-score (the most recent competing measure advocated by Hadlock and Pierce 2010). While the KZ-score has been subject to numerous critiques over the

years, it remains widely used (e.g., Lamont et al. 2001; Malmendier and Tate 2005; Bergman and Jenter 2007, Hong et al. 2012). More importantly, the KZ-score exhibits two desirable properties for our research setting. First, unlike the HP-score, it does not include firm size as an indicator of financial constraint. Firm size directly affects PPS. That is, small firms tend to be more financially constrained according to the HP-score, but also offer lower PPS (e.g., because the marginal returns of CEO effort are smaller). Second, the KZ-score is more highly correlated with actual debt and equity issuances in our sample. We posit that it is this access to capital markets that provides shareholders with benefits from overstatements. Teoh et al. (1998a, b), Rangan (1998), and Guthrie and Sokolowsky (2010), among many others, provide empirical evidence of earnings overstatements around IPOs and SEOs. More recently, Linck et al. (2010) find that discretionary accruals are significantly higher in financially constrained than unconstrained firms prior to investment. Their evidence suggests that managers use earnings management to ease financial constraints, gain access to external funds, and invest.

To capture differences in the investment horizons of incumbent investors across firms, we utilize information about each firm's institutional investors.[15] Our first measure is based on institutional shareholders' portfolio turnover rates. Institutional investors who have higher turnover rates are more likely to value short-term performance over long-term fundamental value, because they are more likely to sell their shares to the next generation of investors in the near future. Consequently, they care more about the share price in the short-run than the share price in the long run. To this end, we calculate firms' annualized investor turnover rates (the IT-score). The IT-score is an ownership-weighted average of firms' institutional investors' portfolio churn rates based on Gaspar et al. (2005). Our second measure uses the fraction of shares held by transient institutional investors, as classified in Bushee (2001) (the TRA-score). Bushee finds that transient institutional owners overweigh expected short-term earnings in valuing firms, and underweigh long-term earnings potential. The myopic pricing of a firm's earnings exerts pressure on managers to boost short-term results.[16]

[15] We focus on institutional investors rather than retail shareholders for two reasons: (i) they have greater influence on firm policies and characteristics due to larger ownership stakes and greater financial sophistication, and (ii) they dominate the shareholder base of our sample firms.

[16] The classification is available at http://acct.wharton.upenn.edu/faculty/bushee/IIclass.html.

Sample Description

Our sample covers over 850 large publicly traded firms with fiscal years 1999–2005. Our choice of the sample period is similar to other empirical studies of the implications of SOX or the contemporaneous governance reforms (Chhaochharia and Grinstein 2009; Duchin et al. 2010).[17] We require annual data on CEO compensation (from Execucomp) and firm characteristics (from Compustat). To avoid entry and exit effects, we only keep firms with CEO compensation data for all seven years of the sample. However, our results are qualitatively unchanged if we relax this restriction. Our findings are also robust to excluding firms with missing control variables, to excluding financial firms and utilities, and to restricting the sample to non-high-tech firms.[18] Definitions of all variables are provided in Table 1 (Appendix 2 describes the calculation of PPS in more detail). To mitigate the effect of outliers, we winsorize all variables at the top and bottom percentile (the results are qualitatively similar if we do not winsorize, but the mean estimates tend to increase).[19] Table 2, panel A, displays the means of all variables for each fiscal year. Panel B provides further summary statistics for the pooled cross section. All nominal values are expressed in December 2006 dollars (using the BLS CPI for all urban consumers—current series).

Results

Timing of SOX and Changes in CEO Incentive Pay

To infer shareholder objectives from Hypothesis (1), we need to determine how CEOs' pay-for-performance sensitivities change with the passage of SOX in 2002. Whether firms had sufficient time to react to SOX in the fiscal year of its passage is a priori uncertain. Therefore, we treat fiscal year 2002 as the transition year (event year $t = 0$). Initially, we consider fiscal years 1999–2001 as the pre-SOX period ($-3 \leq t \leq -1$) and fiscal years 2003–2005 as the

[17] We add fiscal year 1999 to balance the number of pre- and post-SOX years, with 2002 being the transition year.

[18] We tested two definitions of high-tech: (i) firms in the communications, computer, electrical, and electronic equipment industries based on the Fama-French 48-industry classification and (ii) firms with SIC codes 3570–3572, 3576–3577, 3661, 3674, 4812–4813, 5045, 5961, 7370–7373 as in Ferri et al. (2006). See estimates in Appendix Tables 13, 14, 15.

[19] The results are also qualitatively robust to excluding firms in the tails of the distribution of the change in average PPS from the pre- to post-SOX period.

Table 1 Definition of variables

Variable	Unit	Transformation	Definition
PPS	Thsd. $	Log	Δ in $ value of CEOs' equity and option holdings from a 1 % increase in share price; inflation adjusted; see Core and Guay (2002) for details
PPS-ratio	Fraction	Log	PPS scaled by sum of PPS, salary, and bonus value of option and stock grants scaled by annual pay; ([blk_valu]+[rstkgrnt]) / [tdc1] from Execucomp
Equity-ratio	Fraction		
Market value	Mill. $	Log	[199] * [25] from Compustat; inflation adjusted
Stock price volatility		Log	[bs_volat] from Execucomp
Market-to-book ratio	Multiple	Log	([6] − [60] − [74] + ([199] * [25]))/[6] from Compustat
Leverage	Fraction		([9] + [34])/[6] from Compustat
Return on assets	Fraction	Log(1+roa)	[18]/[6] from Compustat
Shareholder return	Fraction	Log(1+ret)	Calculated from monthly [ret] from CRSP; inflation adjusted
Market return	Fraction	Log(1+ret)	Calculated from monthly value-weighted market return incl. dividends [vwretd] from CRSP; inflation adjusted
CEO tenure	Years	Log	Based on [becameceo] from Execucomp
Option exercise ratio	Fraction		Fraction of exercisable options exercised; [opt_exer_val] / ([opt_exer_val]+[opt_unex_exer_est_val]) from Execucomp
CEO turnover	Dummy		=1 if Δ_t[co_per_rol]≠ 0 from Execucomp
Board size	Count	Log	Number of directors on the board from IRRC
Board independence	Fraction		Fraction of independent directors on the board from IRRC
Board ownership	Fraction		Fraction of voting rights held by independent directors from IRRC
Board tenure	Years	Log	Average tenure of directors from IRRC
Board age	Years	Log	Average age of directors from IRRC
Board busyness	Count		Average number of board seats held by directors from IRRC
KZ-score	Index		Based on Kaplan and Zingales (1997); inputs are scaled by [6] (lagged) = −1.002 * [308] − 39.368 * [127] − 1.315 * [1] + 3.139*[lev]+0.283*[mb]
HP-score	Index		Based on Hadlock and Pierce (2010); inputs are winsorized at log($4.5 bill) and 37 yrs; = −0.737 * [6] + 0.043 * [6]^2 − 0.040*[firm age]
IT-score	Fraction		Based on Gaspar et al. (2005); rescaled/annualized as (1+GMM/2)^4−1
TRA, DED, QIX	Fraction		Ownership by transient, dedicated, and quasi-indexing institutions as classified by Bushee (2001)

post-SOX period ($1 \leq t \leq 3$).[20] To study changes in PPS around SOX, we estimate the regression

$$\text{pay-for-performance sensitivity}_{it} = \sum_{t=-2}^{+3} \delta_t D_t + \alpha_0 + \sum_{j=1}^{k} \alpha_j X_{jit} + \upsilon_i + \epsilon_{it} \ , \quad (6)$$

where t denotes the number of years before or after SOX, i denotes firms, and j denotes control variables. δ_{-2}–δ_{+3} are the coefficients of interest. D_t are year dummies, X_{jit} includes standard control variables used in the literature on executive compensation, namely market value of equity, stock price volatility, market-to-book ratio, and leverage as measures of firm characteristics; return on assets, firms' total shareholder returns, and market returns as performance controls; as well as CEO tenure, CEO turnover, and CEO option exercises.[21] υ_i are firm-fixed effects. We estimate heteroskedasticity-robust standard errors, clustered at the firm level to address serial correlation concerns.

We set $D_t = 1$ for all fiscal years in or after event year t, and equal to zero otherwise. That is, D_t is not the usual year dummy which captures the *cumulative* change from the base year (in our case 1999). Instead, we define it to capture the *marginal* change from the prior year. This definition allows us to use the t-test for significant difference from zero to determine if PPS falls or rises from its level in the previous year. To the extent that pay-for-performance sensitivities adjust slowly (i.e., over several years), one has

[20] SOX was passed in July 2002 in response to the large corporate scandals in the preceding year (e.g., Enron, Tyco, Worldcom). We assume that fiscal year 2003 falls into the post-SOX period, as its begin date falls between June 2002 and May 2003. To the extent that the expected cost of overstatements increased prior to the adoption of SOX (e.g., through anticipated regulatory changes or higher scrutiny by investors and enforcement agencies), effects on incentive pay can already be visible in earlier years.

[21] Controlling for R&D and cash constraints as predictors of option usage does not materially affect our estimates.

Table 2 Summary statistics on CEO and firm characteristics

Panel A: means by fiscal year

	1999	2000	2001	2002	2003	2004	2005
PPS ($ thsd.)	1178	1223	976	752	921	984	969
PPS-ratio	0.29	0.29	0.28	0.23	0.25	0.25	0.24
Equity-ratio	0.43	0.44	0.48	0.45	0.41	0.42	0.42
Market value ($ mill.)	8688	9518	8125	6707	8098	8732	8960
Return volatility	0.40	0.46	0.48	0.50	0.48	0.45	0.39
Market-to-book ratio	2.38	2.22	1.95	1.63	1.88	1.90	1.87
Leverage	0.24	0.24	0.25	0.24	0.23	0.22	0.22
Return on assets	0.05	0.05	0.02	0.02	0.03	0.04	0.04
Shareholder return	0.24	0.19	0.06	−0.12	0.41	0.17	0.07
Market return	0.22	−0.09	−0.15	−0.22	0.27	0.10	0.05
CEO tenure	8.49	8.35	8.01	8.13	8.08	8.46	8.16
Option exercise ratio	0.13	0.15	0.15	0.16	0.11	0.16	0.17
CEO turnover	0.11	0.13	0.13	0.10	0.11	0.10	0.13
KZ-score	0.98	0.97	0.79	0.62	0.69	0.62	0.57
HP-score	−3.83	−3.86	−3.89	−3.90	−3.97	−4.01	−4.04
IT-score	0.61	0.61	0.50	0.45	0.49	0.45	0.51
TRA	0.13	0.13	0.14	0.15	0.14	0.14	0.15
DED	0.08	0.09	0.09	0.09	0.10	0.10	0.10
QIX	0.34	0.36	0.37	0.39	0.41	0.43	0.46
Compliant boards	0.77	0.79	0.80	0.82	0.88	0.93	0.95
Board independence - compliers	0.70	0.72	0.73	0.75	0.76	0.77	0.78
Board independence - non-compliers	0.43	0.44	0.44	0.42	0.52	0.60	0.62
Board size	9.94	9.72	9.54	9.58	9.53	9.58	9.51
Board ownership (indep.)	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Board tenure	9.73	9.72	9.67	9.73	9.84	9.82	9.89
Board age	59.02	59.02	58.94	59.22	59.57	59.88	60.13
Board busyness	1.76	1.69	1.67	1.60	1.59	1.57	1.54

Panel B: summary statistics for the pooled cross section

	25th %ile	50th %ile	75th %ile	Mean	SD	# obs
PPS ($ thsd.)	102	294	790	1001	2417	6153
PPS-ratio	0.09	0.18	0.34	0.26	0.24	6153
Equity-ratio	0.19	0.46	0.67	0.43	0.29	6106
Market value ($ mill.)	650	1786	6209	8404	20,920	6152
Return volatility	0.30	0.39	0.55	0.45	0.21	5913
Market-to-book ratio	1.12	1.45	2.19	1.97	1.45	6150
Leverage	0.08	0.23	0.35	0.24	0.18	6137
Return on assets	0.01	0.04	0.08	0.04	0.09	6152
Shareholder return	−0.16	0.07	0.32	0.15	0.54	6131
Market return	−0.14	0.04	0.22	0.03	0.18	6146
CEO tenure	3.00	6.00	11.00	8.24	7.37	5891
Option exercise ratio	0.00	0.00	0.19	0.15	0.26	6152
CEO turnover	0.00	0.00	0.00	0.12	0.32	6054
KZ-score	0.16	0.65	1.22	0.74	1.03	5721
HP-score	−4.47	−3.89	−3.48	−3.93	0.53	6152
IT-score	0.43	0.50	0.58	0.52	0.13	6153
TRA	0.08	0.12	0.19	0.14	0.09	5980

Table 2 continued

Panel B: summary statistics for the pooled cross section

	25th %ile	50th %ile	75th %ile	Mean	SD	# obs
DED	0.04	0.08	0.14	0.10	0.08	5980
QIX	0.31	0.40	0.48	0.40	0.13	5980
Board independence	0.60	0.73	0.82	0.70	0.16	5509
Board size	8.00	9.00	11.00	9.63	2.68	5509
Board ownership (indep.)	0.00	0.00	0.00	0.01	0.04	5509
Board tenure	7.13	9.29	11.88	9.77	3.74	5509
Board age	57.14	59.63	61.88	59.40	3.76	5509
Board busyness	1.20	1.50	1.93	1.63	0.54	5509

Our sample covers large publicly traded firms with fiscal years 1999–2005. We require annual data on CEO compensation (from Execucomp) and firm characteristics (from Compustat). To avoid entry and exit effects, we only keep firms with data on their CEOs' pay-for-performance sensitivities for all seven years of the sample. However, our results are qualitatively unchanged if we relax this restriction. Table 2, panel A, displays the means of all variables (winsorized at the 1st and 99th percentiles) for each fiscal year. We consider fiscal years 1999–2001 as pre-SOX and fiscal years 2003–2005 as post-SOX. It is a priori unclear how fiscal year 2002 is affected by SOX, so we treat it as a transition year. Panel B provides further summary statistics for the pooled cross section

to add the coefficients for $t \geq 0$ to obtain the full impact of SOX on PPS.

Column 1 in Table 3 shows the results for CEOs' pay-for-performance sensitivity as the dependent variable. Following Core and Guay (2002), we define PPS as the dollar change in executives' stock and option holdings for a hypothetical one percent change in firm value. In column 2, the dependent variable is the PPS-ratio, an alternative measure of incentive pay (as used in Bergstresser and Philippon 2006; Cornett et al. 2008). It scales PPS by the sum of PPS, salary, and bonus. The PPS-ratio measures the importance of CEOs' compensation that is directly tied to the stock price relative to their total compensation. It provides a check on the relevance of the absolute magnitude of PPS for CEOs' overall financial well-being (for example, a PPS of \$100,000/1 % can ultimately have different incentive effects for CEOs earnings salaries of \$1 vs. \$4,000,000). It also implicitly controls for changes in the level of CEO pay, because the denominator captures the bulk of annual CEO pay.[22]

We make the following three observations. First, we observe that PPS and the PPS-ratio fall in fiscal years 2002 and 2003 by a statistically significant amount, but not in other years: the adjustment begins immediately in the transition year and is completed by the following year. The empirical evidence thus suggests that firms adjust the performance sensitivity of CEO pay in response to SOX. Second, the economic magnitude of the adjustment is significant. We find that log(PPS) falls by a combined 0.232 over 2002 and 2003, which translates into an average drop in PPS of about 20.7 % (or about \$59,000 per 1 % change in firm value at the median and \$222,000 at the mean).[23] Similarly, we estimate that the PPS-ratio falls by 5.0 percentage points around SOX, or by about 18.7 % from its average pre-SOX level. Third, the adjustment seems permanent in the sense that it is not reversed in fiscal years 2004 and 2005. While we estimate that log(PPS) increases in 2004 by 0.042 from the previous year, the magnitude of the increase is not sufficient to offset the earlier decrease.

Incentive Pay Levels Versus Flow One potential drawback to our incentive measure PPS is that it may not only reflect optimal contracting considerations, but also CEOs' timing of option exercises and stock sales. For example, if CEOs choose to unwind their holdings of exercisable options following SOX, then we could mistakenly attribute the decrease in PPS to shareholders' preference for maximizing market values. We provide three arguments against this alternative explanation. First, as is evident from Table 2, panel A, the option exercise ratio drops sharply in 2003. Fewer exercised options translate into higher PPS. Second, we include the option exercise ratio as a control variable in our regressions. As expected, its effect on PPS is negative. Third, we use the equity grant ratio as an

[22] Optimally designed pay-for-performance packages encompass a variety of performance measures (e.g., see Merchant 2006 on the benefits and drawbacks of various market and accounting performance measures and Schiehll and Bellavance 2009 on non-financial performance measures). However, we focus on pay-for-performance arising from stock and option holdings for the following reasons: (i) lack of granular data on incentive plans and performance measures, (ii) their economic significance in CEO compensation packages among our sample firms during the sample period, and (iii) empirical evidence linking specifically stock and option holdings to earnings overstatements that culminated in the passage of SOX.

[23] We calculate the percentage change as $\exp(-0.232) - 1 = 20.7\%$. We calculate the dollar change by multiplying the percentage change with the mean and median values of PPS of the sample firms before SOX.

Table 3 The change in incentives around SOX: year dummies

	log(PPS)	log(PPS-ratio)	Equity-ratio
2000 (pre-SOX)	0.114*** (0.009)	0.048 (0.246)	0.034* (0.082)
2001 (pre-SOX)	0.031 (0.228)	0.089*** (0.000)	0.046*** (0.000)
2002 (transition year)	−0.044** (0.049)	−0.110*** (0.000)	−0.046*** (0.000)
2003 (post-SOX)	−0.188*** (0.001)	−0.097* (0.075)	−0.053** (0.046)
2004 (post-SOX)	0.042 (0.100)	−0.033 (0.166)	−0.001 (0.926)
2005 (post-SOX)	0.013 (0.645)	−0.016 (0.513)	−0.009 (0.395)
Market value (log)	0.901*** (0.000)	0.465*** (0.000)	0.063*** (0.000)
Return volatility (log)	0.183* (0.074)	0.109 (0.242)	−0.021 (0.441)
Market-to-book ratio (log)	0.232** (0.039)	0.298*** (0.000)	0.027 (0.250)
Leverage	−0.120 (0.347)	−0.065 (0.589)	0.010 (0.829)
Return on assets (log)	0.097 (0.536)	−0.307* (0.050)	−0.073 (0.173)
Shareholder return (log)	0.188*** (0.000)	0.058*** (0.008)	−0.049*** (0.000)
Market return (log)	0.282*** (0.010)	0.224** (0.030)	0.050 (0.329)
CEO tenure (log)	0.441*** (0.000)	0.276*** (0.000)	−0.054*** (0.000)
Option exercise ratio	−0.174*** (0.000)	−0.132*** (0.000)	0.029** (0.038)
CEO turnover (dummy)	0.073* (0.069)	0.076** (0.041)	0.017 (0.257)
# of observations	5549	5549	5511
# of firms	857	857	856
Within-R^2	0.540	0.325	0.069

In this table, we document that pay-for-performance sensitivities decrease around SOX, which was signed into law on 7/25/2002. We define 2002 as the transition year, as SOX falls into fiscal year 2002 for most companies. The year dummies are defined to capture the *marginal* effect of each year on each incentive measure (i.e., each year dummy captures the change from the previous year). Our measures of the level of CEO incentives are the dollar change in CEOs' stock and option holdings from a hypothetical 1 % increase in firm value (PPS) in column 1; the fraction of income derived from PPS relative to the sum of PPS, salary, and bonus (PPS-ratio) in column 2; and the fraction of stock and option grants of total pay (equity-ratio) in column 3, which captures the relative importance of stock- and option-based incentives in the compensation flow. Two-sided *p*-values—based on heteroskedasticity-robust standard errors clustered at the firm level—are in parentheses. ***, **, and * denote significant differences from zero at the 1, 5, and 10 % confidence levels

alternative compensation design measure that is arguably less affected by CEOs' choices and market conditions. The equity grant ratio captures the fraction of annual pay in the form of stock and option grants, which are more performance sensitive than salary, bonus, and other pay. In contrast to PPS which measures the performance sensitivity of CEOs' accumulated stock and option holdings, the equity-ratio captures the performance sensitivity of the flow of pay. The results are presented in column 3; the composition of the flow of incentive pay mirrors the fall in the level of PPS.

Pre-SOX Versus Post-SOX Period While estimating year dummies sheds light on when the change in CEO incentive pay takes hold, the year dummies are not well-suited for interacting with proxies for shareholder benefits from overstatements, which we do in parts 2 and 3 of our empirical analysis. Thus, for ease of interpretation and comparison of performance sensitivities between the pre- and post-SOX periods, we re-estimate Eq. (6), but replace the year dummies with one post-SOX dummy. When using the post-SOX dummy, we cluster standard errors by firm-periods to address serial correlation concerns and to account for the fact that SOX affected the firms simultaneously.[24]

Figure 1 offers a graphical representation of the change in PPS around SOX. It plots the kernel density estimates of average residual pay-for-performance sensitivities for the pre- and post-SOX periods. We obtain residual PPS from regressing PPS on known economic determinants used in estimating Eq. (6), but without time effects. For each firm, we then average the residuals over the pre- and post-SOX years.

Table 4 displays the estimation results. For the first two columns, we define fiscal years 2002 and later as the post-SOX period, because PPS starts falling in fiscal year 2002. As a robustness check, we define all fiscal years beginning

[24] Clustering only at the firm level does not materially alter any estimated standard errors.

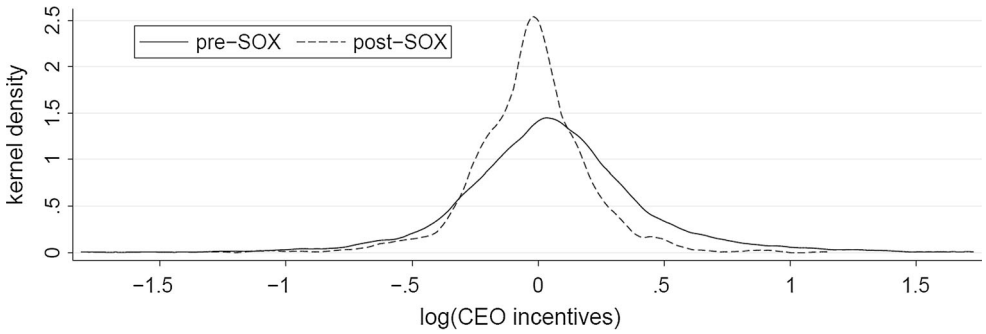

Fig. 1 Residual CEO pay-for-performance sensitivities before and after SOX. This figure captures the change in CEO incentive pay around SOX. It plots the kernel density estimates of average residual pay-for-performance sensitivities for the pre- and post-SOX periods. We obtain residual PPS from regressing PPS on its known economic determinants used in estimating Eq. (6), but without time effects. For each firm, we then average the residuals over the pre- and post-SOX years

Table 4 The change in incentives around SOX: post-SOX dummy

	Fiscal year $\geq$ 2002		Fiscal year begins $\geq$ 8/1/2002	
	log(PPS)	log(PPS-ratio)	log(PPS)	log(PPS-ratio)
Post-SOX (dummy)	−0.082*** (0.000)	−0.117*** (0.000)	−0.083*** (0.000)	−0.128*** (0.000)
Market value (log)	0.901*** (0.000)	0.464*** (0.000)	0.905*** (0.000)	0.473*** (0.000)
Return volatility (log)	0.217*** (0.001)	0.209*** (0.000)	0.194*** (0.003)	0.175*** (0.003)
Market-to-book ratio (log)	0.234*** (0.007)	0.289*** (0.000)	0.247*** (0.004)	0.301*** (0.000)
Leverage	−0.121 (0.247)	−0.063 (0.529)	−0.105 (0.314)	−0.045 (0.649)
Return on assets (log)	0.091 (0.493)	−0.360*** (0.008)	0.092 (0.488)	−0.361*** (0.007)
Shareholder return (log)	0.188*** (0.000)	0.065*** (0.001)	0.188*** (0.000)	0.067*** (0.001)
Market return (log)	−0.065* (0.059)	0.010 (0.757)	0.023 (0.635)	0.152*** (0.001)
CEO tenure (log)	0.441*** (0.000)	0.276*** (0.000)	0.441*** (0.000)	0.276*** (0.000)
Option exercise ratio	−0.175*** (0.000)	−0.134*** (0.000)	−0.175*** (0.000)	−0.134*** (0.000)
CEO turnover (dummy)	0.073* (0.051)	0.071** (0.038)	0.078 (0.030)	0.078** (0.019)
# of observations	5549	5549	5549	5549
# of firms	857	857	857	857
Within-R^2	0.539	0.321	0.538	0.319

In this table, we simplify our regressions from Table 3 by replacing the year dummies with a single dummy variable to differentiate between pre- and post-SOX years. We use this specification for ease of interpretation of our subsequent results. In the first two columns, we define fiscal years 2002 and later to be post-SOX. We choose to count fiscal year 2002 toward post-SOX, because the downward adjustment in PPS becomes evident in fiscal year 2002, as shown in Table 3. In columns 3 and 4, we document that our finding is robust to an alternative definition of the post-SOX period. There, the post-SOX period includes all fiscal years that begin on or after 8/1/2002 (i.e., the first month after the Sarbanes–Oxley Act was signed into law on 7/25/2002). Two-sided *p*-values—based on heteroskedasticity-robust standard errors clustered at the firm-period level—are in parentheses. ***, **, and * denote significant differences from zero at the 1, 5, and 10 % confidence levels

on or after August 1, 2002 as post-SOX years, as SOX was signed into law on July 30, 2002. The change in the definition of post-SOX affects a large number of firm-years. 840 observations of fiscal year 2002 and 61 observations of fiscal year 2003 are considered post-SOX in columns 1 and 2, but pre-SOX in columns 3 and 4. The results, however, are very similar across the definitions of post-SOX. We estimate that, on average, log(PPS) falls by 0.082–0.083 and the log(PPS-ratio) by 0.117–0.128 from before to after SOX. The reason that the definition of post-SOX does not significantly affect the results is that PPS in 2002 lies in between those of earlier and later years. Shifting fiscal year 2002 observations from the post- to the pre-SOX period raises the averages in both periods, but leaves the difference largely unaffected.

In untabulated robustness checks, we estimate variations of Eq. (6) for different event windows (±1, 2, or 3 years around SOX, including and excluding 2002). While our estimates of the magnitude of the decrease in PPS vary

depending on the size of the event window, the results are qualitatively unchanged. Since our theory only makes directional predictions about PPS, and not its magnitude, the choice of the event window is largely inconsequential. Appendix 3 contains further robustness tests dealing with influential observations, methodology, and measurement of the performance sensitivity of CEO compensation, including a detailed discussion of bonuses.

To summarize, we find that CEOs' pay-for-performance sensitivities decrease in response to SOX by an economically large and statistically highly significant amount. This evidence is inconsistent with shareholders trying to discourage overstatements through optimal compensation design. Instead, it supports the view that CEOs' compensation in the pre-SOX years reflected shareholder myopia.

CEO Incentive Pay and Shareholder Benefits from Overstatements

In the previous section, we infer shareholder objectives from the change in pay-for-performance sensitivities in response to an increase in the cost of overstatements. Here we proxy for shareholder objectives and test if they are reflected in PPS as predicted by the model. As stated in hypothesis (2), we expect firms whose shareholders benefit from overstatements to provide higher PPS. To test this prediction, we build on the following regression equation linking PPS and shareholder benefits:

$$PPS_{it} = \psi_1\ SBO_{it} + \psi_2\ D(t \geq 0)_t + \alpha_0 + \sum_{j=1}^{k} \alpha_j X_{jit} + \upsilon_i + \epsilon_{it} \tag{7}$$

where ψ_1 is the coefficient of interest and SBO_{it} is the generic label for our proxies for shareholder benefits from overstatements. As before, $D(t \geq 0)_t$ is the post-SOX dummy and X_{jit} includes control variables: market value of equity, stock price volatility, market-to-book ratio, leverage, firms' total shareholder returns, market returns, CEO tenure, CEO turnover, and CEO option exercises.

A difficulty in estimating Eq. (7) is that PPS may reflect variation in shareholder benefits either over time and/or across firms. The fixed effects estimator, however, utilizes only within-firm variation and the between estimator uses only cross-sectional variation. Applying the random-effects estimator to Eq. (7) constrains the within-effect to equal the between-effect. Yet, there is no reason to expect that the difference in PPS between two firms reflecting a one unit difference in SBO is equal to the change in PPS within a firm for a one unit increase in SBO. Furthermore, our SBO measures exhibit greater variation between firms than within firms.

To allow the between-firm effects to differ from the within-firm effects, we decompose every right-hand side variable from Eq. (7) into a firm-fixed component (the average value for each firm—denoted by $\varnothing$) and the firm-change component (the period-to-period fluctuations around the firm average—denoted by Δ), as explained in Gould (2001):

$$PPS_{it} = \psi_1^{\varnothing}\ SBO_i^{\varnothing} + \psi_2^{\varnothing}\ D(t \geq 0)_i^{\varnothing} + \sum_{j=1}^{k} \alpha_j^{\varnothing} X_{ji}^{\varnothing} + \psi_1^{\Delta}\ SBO_{it}^{\Delta} + \psi_2^{\Delta}\ D(t \geq 0)_t^{\Delta} + \sum_{j=1}^{k} \alpha_j^{\Delta} X_{jit}^{\Delta} + \upsilon_i + \epsilon_{it}. \tag{8}$$

To account for the increase in the cost of overstatements from SOX, we allow the effect of the shareholder benefit measures to vary from before to after SOX by interacting them with pre- and post-SOX dummies. We estimate the regression using the random-effects estimator. $\varnothing$-coefficients equal the coefficients that would be estimated using the between estimator; the Δ-coefficients equal the coefficients that would be estimated using the fixed-effects estimator. $D(t \geq 0)_i^{\varnothing}$ gets dropped from the regression, because it does not vary between firms (due to our requirement of no entry into and exit from the sample). Again, we estimate heteroskedasticity-robust standard errors and account for clustering at the firm-period level.

We run eight versions of regression (8): two measures for the performance sensitivity of CEO compensation (log(PPS) and log(PPS-ratio)) times four measures of shareholder benefits (KZ, HP, IT, TRA). The results are displayed in Table 5. In six out of eight cases, we obtain a positive and statistically significant estimate of the effect of shareholder benefits on PPS in the cross section before SOX. The exceptions are for transient institutional ownership, where we obtain an economic sizable point estimate, though it is somewhat imprecise (with p values of 0.165 and 0.117). We also find that the cross-sectional link between shareholder benefits and PPS weakens after SOX. In all eight cases, we find that the cross-sectional relationship between SBO and PPS is weaker after SOX than before SOX.[25]

To compare the economic magnitudes across the different measures of SBOs, we evaluate the percentage difference in expected PPS for moving from the 25th to the

[25] In contrast to the strong results in the cross section, we uncover no systematic relationship between within-firm variation in the SBO-scores and PPS. The within-firm variation comes from only 3 years in the pre-SOX period, and 4 years in the post-SOX period, but not from across the periods. Given the limited number of observations per firm over time and the lower within-variation in SBO-scores mentioned previously, this finding is not surprising.

Table 5 The link between CEO pay-for-performance and shareholder benefits from overstatements in the cross-section

SBO measure	KZ-score		HP-score	
	log(PPS)	log(PPS-ratio)	log(PPS)	log(PPS-ratio)
Panel A: capital constraints				
SBO-score × pre-SOX	0.288*** (0.000)	0.236*** (0.000)	0.399*** (0.000)	0.424*** (0.000)
SBO-score × post-SOX	0.239*** (0.002)	0.188*** (0.000)	0.193** (0.038)	0.230*** (0.000)
p-value for Δ_{sox}	0.037**	0.007***	0.000***	0.000***
# of observations	5217	5217	5549	5549
# of firms	813	813	857	857
Overall-R^2	0.645	0.443	0.645	0.441
SBO measure	IT-score		TRA Ownership	
	log(PPS)	log(PPS-ratio)	log(PPS)	log(PPS-ratio)
Panel B: shareholder horizon				
SBO-score × pre-SOX	1.248** (0.025)	0.931** (0.027)	1.046 (0.165)	0.729 (0.117)
SBO-score × post-SOX	0.288 (0.580)	0.097 (0.804)	0.255 (0.719)	−0.019 (0.962)
p-value for Δ_{sox}	0.000***	0.000***	0.004***	0.001***
# of observations	5549	5549	5441	5441
# of firms	857	857	857	857
Overall-R^2	0.641	0.428	0.642	0.430

Our model predicts that greater shareholder benefits from overstatements lead to higher pay-for-performance sensitivities. This table presents empirical evidence linking shareholder benefits to CEOs' PPS by utilizing variation between firms. As proxies of shareholder benefits we use: the Kaplan–Zingales and Hadlock-Pierce measures of capital constraints in Panel A; and the portfolio turnover rate of firms' institutional owners and the ownership fraction of transient institutional investors as classified by Bushee in Panel B. We employ generalized random-effects regressions to estimate the between-firm effect of each right-hand side variable separately from the within-firm effect. The regressions include all the previous control variables, including the post-SOX dummy. In the regressions of pay-for-performance on Bushee's transient institutional ownership, we also include ownership by quasi-indexers and dedicated institutional investors, each interacted with pre- and post-SOX dummies. Two-sided p-values—based on heteroskedasticity-robust standard errors clustered at the firm-period level—are in parentheses. ***, **, and * denote significant differences from zero at the 1, 5, and 10 % confidence levels. p-values for Δ_{sox} provide the confidence level for rejecting the null hypothesis that the link between shareholder benefits from overstatements and PPS is stronger after SOX than before SOX

75th percentile in the pooled cross-sectional distribution of the SBO measures. The interquartile ranges ($\Delta_{iq}SBO$) before SOX are 1.15 for the KZ-score and 0.97 for the HP-score, 0.16 for the IT-score and 0.11 for transient institutional ownership. The percentage change in PPS is then given by $\exp(\widehat{\psi_1^{\varnothing}} \times \Delta_{iq}SBO)$. We obtain KZ- and HP-effects of 39 and 47 % on PPS, which translate into differences between \$391,000–\$470,000 per 1 % increase in firm value at the mean of pre-SOX PPS, and \$113,000–\$136,000 at the median of pre-SOX PPS. The corresponding IT- and TRA-effects amount to 22 and 12 % of PPS, or \$121,000–\$220,000 per 1 % increase in firm value at the mean of pre-SOX PPS, and \$35,000–\$64,000 at the median of pre-SOX PPS. Post-SOX, the interquartile effects drop to 26, 20, 4, and 3 % of PPS for the interquartile ranges of the KZ-, HP-, IT-, and TRA-scores.

Our findings on the cross-sectional relationships between proxies for SBO and PPS are consistent with those of contemporaneous work on executive compensation: Wang (2008) finds that CEO pay-for-performance sensitivities are higher in financially constrained firms than in unconstrained firms; and Shin (2008) documents that short-term institutional ownership is associated with higher option compensation.[26]

To summarize, we show that cross-sectional variation in shareholder benefits from overstatements is reflected in cross-sectional variation in CEOs' pay-for-performance

[26] Dikolli et al. (2009) also find that bonuses—which capture only a fraction of total incentive pay—are more sensitive to stock returns than earnings, and equity grants are larger when transient institutional ownership is high. The authors interpret these findings as evidence that CEO incentive contracts are designed to offset myopia.

sensitivities before SOX. We also document that the cross-sectional link between shareholder benefits and PPS is stronger before SOX than after SOX.

The Change in CEO Incentive Pay around SOX: The Effect of Shareholder Benefits from Overstatements

In the preceding section, we show that our measures of shareholder benefits of overstatements are consistent with the model's prediction about the effect of shareholder myopia λ in the cross section. In this section, we go one step further and test whether PPS also falls by more around SOX in firms with high shareholder benefits, as stated in hypothesis (3). That is, we allow the average within-firm response of PPS to SOX to vary cross-sectionally. To that end, we run the regression

$$PPS_{it} = \phi_1\ SBO_{it} + \phi_2\ D(t \geq 0)_t \times D(SBO|t<0)_i + \phi_3\ D(t \geq 0)_t + \alpha_0 + \sum_{j=1}^{k} \alpha_j X_{jit} + \upsilon_i + \epsilon_{it}\ , \quad (9)$$

where $D(t \geq 0)_t$ is a dummy set to one for fiscal years 2002–2005 and $D(SBO|t<0)_i$ is a dummy that indicates high shareholder benefits from overstatements in the period before SOX. In particular, for the time-varying SBO-scores, we average the score over the three-year pre-SOX period for each firm. We consider the upper half of the distribution to have high SBO ($D(SBO|t<0)_i = 1$). While separating the SBO groups at the median is coarse, it is transparent and easily interpretable.[27] ϕ_2 is the coefficient of interest. The fixed effects estimator identifies ϕ_2, because the time-invariant shareholder benefits variable is interacted with the time-varying post-SOX dummy. A negative estimate of ϕ_2 would indicate that PPS falls by more in firms with high shareholder benefits from overstatements before SOX. To control for the possibility that the within-firm change in PPS is driven by the within-firm change in shareholder benefits from overstatements over time, we also include the time-varying continuous measure of shareholder benefits in the regression. X_{jit} contains the same standard determinants of PPS as regression (6). As before, υ_i are firm-fixed effects. We estimate heteroskedasticity-robust standard errors, clustered by firm-period.

The results are displayed in Table 6. The coefficients are directly comparable across SBO measures for the same measure of PPS, because the interaction term uses a dummy for SBO. Our estimates are remarkably similar across the different specifications. Specifically, we find that log(PPS) falls by 0.121–0.205 more in firms with high pre-SOX shareholder benefits than in firms with low pre-SOX shareholder benefits. Translating these estimates into dollar figures yields an additional decrease in PPS for high-SBO firms between $123,000 and $200,000 at the mean level of pre-SOX PPS, and between $35,000 and $57,000 at the median level of PPS. The results for the PPS-ratio are similar. All interaction terms are significant at the 1 % confidence level or better.

It is worth noting that, when measuring the performance sensitivity of CEO compensation with log(PPS), the coefficient for the post-SOX dummy loses its statistical significance and much of its economic magnitude compared to the specifications in Table 4 (it even turns statistically significantly positive for the HP-score specification). This finding suggests that the decrease in stock- and option-derived performance sensitivity around SOX is fully concentrated in firms with high benefits from overstatements prior to SOX: only firms with high shareholder benefits from overstatements value market performance. When measuring the performance sensitivity of CEO compensation with the log(PPS-ratio), however, the post-SOX dummy remains negative with sizable magnitude in all regressions. This finding suggests that all firms—with and without benefits from overstatements—increase the relative importance of salary and bonus pay around SOX.

The evidence in Table 6 is arguably stronger than the evidence presented in Table 4. While significant changes in PPS coincide with SOX, the estimated SOX effect potentially reflects other events or changes in market conditions. The results in Table 6 implicitly control for such confounding effects, because we compare the change in PPS around SOX between firms with high and low shareholder benefits from overstatements. Through this difference-in-difference approach we are able to rule out alternative explanations that affect the two groups equally.

Discussion

In this section, we address several confounding effects of SOX and plausible alternative interpretations of our findings.

Contemporaneous Decrease in SBOs ($\Delta\lambda < 0$)

Shareholder benefits from overstatements may have decreased contemporaneously around SOX. That is, the observed change in pay-for-performance could also reflect the change in shareholder objectives. This interpretation does not affect our conclusions for two reasons. From a theoretical perspective, a decrease in λ implies that λ must have been greater than zero to begin with. The optimal pay-for-performance sensitivity

[27] The results remain qualitatively unchanged if we use continuous pre-SOX averages of the proxies for shareholder benefits instead of their dummy versions, or consider only the top quartile of each SBO-score as benefitting shareholders.

Table 6 The change in incentives around SOX: the effect of shareholder benefits from overstatements

SBO measure	KZ-score		HP-score	
	log(PPS)	log(PPS-ratio)	log(PPS)	log(PPS-ratio)
Panel A: capital constraints				
Post-SOX × pre-SOX SBO-dummy	−0.121*** (0.000)	−0.079*** (0.004)	−0.205*** (0.000)	−0.175*** (0.000)
SBO-score	0.049*** (0.008)	0.013 (0.433)	0.461*** (0.001)	−0.145 (0.250)
Post-SOX (dummy)	−0.019 (0.414)	−0.081*** (0.000)	0.060** (0.016)	−0.049** (0.019)
# of observations	5096	5096	5431	5431
# of firms	779	779	823	823
Within-R^2	0.546	0.327	0.554	0.332
SBO measure	IT-score		TRA ownership	
	log(PPS)	log(PPS-ratio)	log(PPS)	log(PPS-ratio)
Panel B: shareholder horizon				
Post-SOX × pre-SOX SBO-dummy	−0.164*** (0.000)	−0.100*** (0.000)	−0.130*** (0.000)	−0.075*** (0.005)
SBO-score	−0.064 (0.497)	−0.217** (0.026)	0.092 (0.593)	−0.255* (0.087)
Post-SOX (dummy)	−0.010 (0.679)	−0.089*** (0.000)	−0.061 (0.101)	−0.053* (0.066)
# of observations	5431	5431	5302	5302
# of firms	823	823	817	817
Within-R^2	0.549	0.329	0.546	0.332

In this table we test the model's prediction that around SOX PPS falls by more in firms with higher benefits from overstatements before SOX. *Post-SOX* equals one for fiscal years 2002–2005, and zero otherwise. *Pre-SOX SBO-dummy* equals one if the mean value of the KZ/HP/IT/TRA-scores over the Pre-SOX period falls in the upper half of the distribution, and zero otherwise. We also control for the variation in the KZ/HP/IT/TRA-scores over time, as well as all the previous control variables. In the regressions of PPS on *Post-SOX* × *Pre-SOX TRA-dummy* we include institutional ownership by quasi-indexers and dedicated investors. Two-sided *p*-values—based on heteroskedasticity-robust standard errors clustered at the firm-period level—are in parentheses. ***, **, and * denote significant differences from zero at the 1, 5, and 10 % confidence levels

would have been unchanged if shareholders did not place any value on overstatements. From an empirical perspective, in estimating the differential change in pay-for-performance around SOX by firms' pre-SOX SBOs, we control for contemporaneous changes in SBO-scores. Thus, we can rule out $\Delta\lambda < 0$ as an alternative explanation.

Contemporaneous Decrease in Speculative Mispricing ($\Delta\theta > 0$)

Another alternative explanation of our findings is that the extent of speculative mispricing changed in the years around SOX. After all, our model predicts that overstatements are more beneficial in times of high speculative mispricing (i.e., when $\theta < 1$), especially among firms that were more likely to raise equity financing. Focusing on the extent of mispricing rather than shareholder benefits from overstatements shifts the emphasis of the story from 'some firms benefit from overstatements all the time' to 'all firms benefit from overstatements some of the time.' This alternative interpretation does not affect our main conclusions either. Again, from a theoretical perspective, a decrease in mispricing would result in a lower optimal pay-for-performance sensitivity only if $\lambda > 0$.

Empirically, speculative mispricing offers an alternative identification strategy. For example, Hong et al. (2012) use the internet bubble from 1996 to 2000 as an exogenous temporary relaxation of firms' financing constraints to estimate their causal effect on corporate goodness. While the approach has its merits, it is not as suitable for our purposes. Both SOX and mispricing serve to identify changes in optimal pay-for-performance sensitivities, but there is less potential for error in identifying pre- vs. post-SOX years than in identifying years of high vs. low speculative mispricing. The timing of the bubble period (and which stocks, if any, were overvalued) is debatable, so it becomes less clear what to make of our finding that pay-for-performance sensitivities dropped in years 2002 and 2003 but not in other years. Should we reject the alternative story? Or did shareholders wait to adjust incentive pay until the market had bottomed out?

Disproportionate Increase in the Cost of Overstatements to Shareholders ($\Delta c > 0$)

Using survey data on the sensitivity of bonus pay to financial performance measures, Indjejikian and Matějka (2009) find that bonuses in publicly traded firms become

less sensitive to financial performance measures in the post-SOX period relative to those paid in privately held firms. To guide the interpretation, Indjejikian and Matějka (2009) model the optimal contract as balancing benefits from productive effort and costs from misreporting. Based on this tradeoff, they interpret the decrease in the performance sensitivity of pay to reveal that firms must have experienced an increase in the cost of misreporting that warrants a cutback in misreporting above and beyond CFOs' response to SOX.

Their model is a special case of ours, namely when shareholders do not place any value on overstatements (i.e., $\lambda = 0$). Our theoretical extension shows that the predictions of Indjejikian and Matějka (2009) are not uniquely interpretable. In other words, their evidence is equally consistent with our interpretation.[28] More importantly, it is difficult to reconcile our findings of systematic cross-sectional and intertemporal variation in PPS by various measures of SBOs with the interpretation offered by Indjejikian and Matějka (2009). Specifically, we can think of no reason why shareholders of capital-constrained firms or firms with short-term investors would have faced a greater increase in the expected cost of overstatements or why their expected cost of overstatements was lower prior to SOX to justify higher PPS to begin with. Appealing to shareholder benefits from overstatements offers a plausible alternative.

Learning Hypothesis

The revelation of the numerous accounting scandals that led to the passage of SOX might have changed shareholders' beliefs about the appropriateness of high-powered incentive schemes prevalent at the time. That is, the observed change in pay-for-performance could reflect the fact that pre-SOX contracts were not optimal in the first place. Two observations cast doubt on this interpretation. First, the timing of the observed changes in pay-for-performance fits better with the SOX explanation than the learning hypothesis. For example, a study by the United States General Accounting Office shows that the rate of earnings restatements among publicly traded firms in the U.S. had almost doubled between 1997 and 1999 and almost tripled by 2001 (GAO 2002). The fraction of listed companies issuing an accounting restatement steadily increased from 0.89 % in 1998 to 2.47 % in 2001, which represents an annualized growth rate of over 29 %. Note that the largest increase occurred from 1998 to 1999, when the fraction of restating firms jumped from 1.02 to 1.73 %. Firms could have responded to the revelations about the extent and pervasiveness of opportunistic accounting prior to 2002, much faster than was possible by going through the political process of drafting, negotiating, and legislating SOX. Second, the learning hypothesis does not offer a straightforward explanation for why pay-for-performance decreased by more in firms with high pre-SOX SBO-scores, as it does not address the excess PPS among those firms in the pre-SOX period.

Stock Market Decline

Ideally, we would like to compare the performance sensitivity of CEOs' compensation from before to after SOX, holding all else equal. The single most important determinant of CEO incentives and pay is a firm's market value, because it captures how much value shareholders entrust to their CEO. Yet, over the sample period, the stock market experienced high volatility, and high- and low-SBO firms may have been affected differently during the market swings. The S&P 500 index started off in 1999 at 1,275 points, rose to over 1,500 points during 2000, then bottomed out at 800 points in September 2002, and finished 2005 at 1220 points. Figure 2 shows the aggregate market value (log) of the firms that are classified as high- or low-SBO based on their pre-SOX values of the KZ-, HP-, and IT-scores, as well as transient institutional ownership. The market downturn has indeed affected high-SBO firms more severely than low-SBO firms. Consequently, the relative decline in pay-for-performance in high-SBO firms could be attributable to the market downturn.

As a robustness check that changes in market values are not driving our result, we match one observation from the post-SOX years to one observation from the pre-SOX years based on inflation-adjusted market values. For each firm, we keep the pair of observations with the smallest percentage difference in market values. The sharp drop in market values in fiscal year 2002 and the subsequent recovery allow us to match almost half of the firms in our sample to within 10 % of the pre-SOX market value. The results are presented in Table 7. The regressions include the same set of explanatory variables as before. As expected, the relatively minor fluctuations in market values no longer help explain within-firm variation in PPS. The estimated effects of SOX on log(PPS) and log(PPS-ratio) are qualitatively similar to the previous results. That the standard errors are larger for the smaller sample is not surprising. Interestingly, all point estimates in the matched

[28] We believe that our implicit assumption that managers' and shareholders' cost of overstatement increased proportionately is rather conservative. The main cost of overstatements to shareholders stems from loss of reputation rather than legal and regulatory penalties if caught (Karpoff et al. 2008b). Since SOX does not alter the market's perception of reputation loss, its main direct effect on shareholders' expected cost comes from a greater enforcement effort (i.e., the probability of getting caught). Managers are equally affected by the increase in the probability of getting caught, but are subject to the numerous additional new or increased personal penalties that SOX imposes on them.

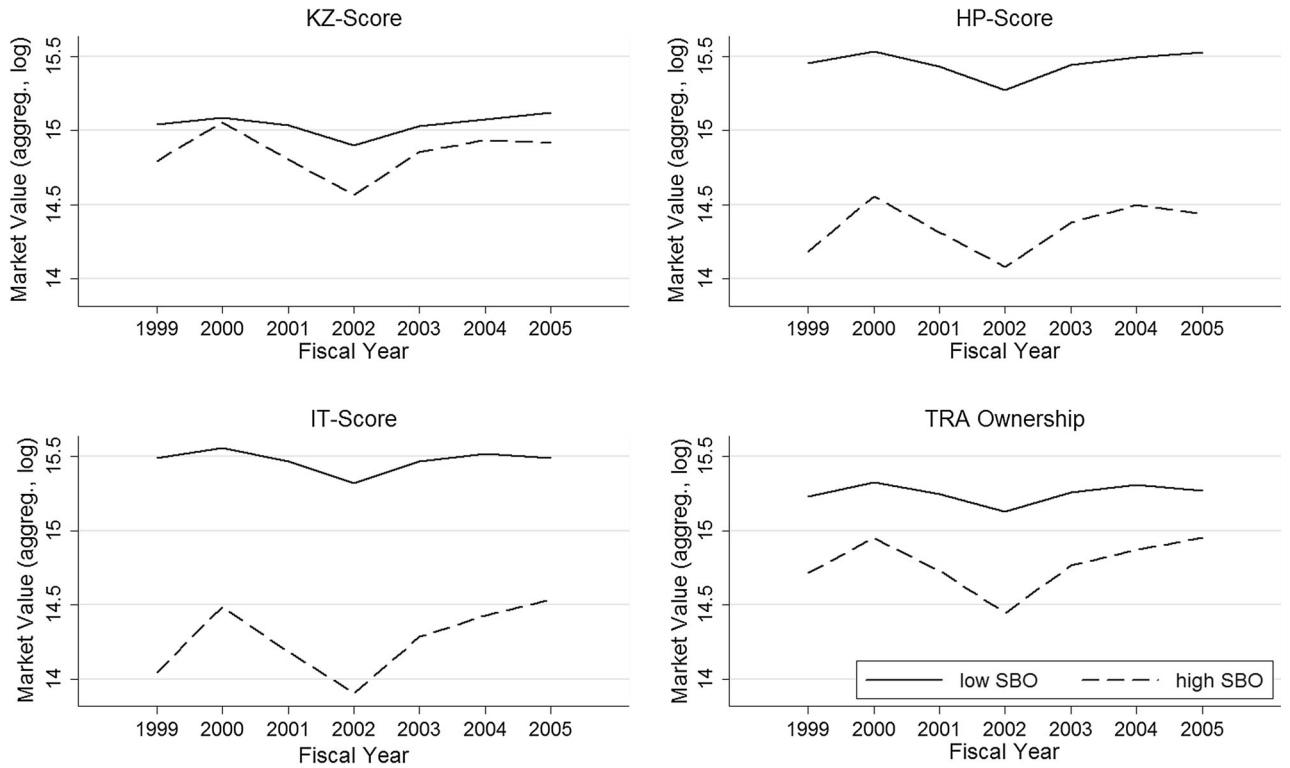

Fig. 2 Change in aggregate market value of high- vs. low-SBO firms. This figure shows that the market downturn during the sample period affected high-SBO firms more than low-SBO firms. The graphs plot the log of aggregate market value of all firms belonging to the top vs. bottom half in each SBO-score during the pre-SOX period

sample are larger in magnitude than their counterparts in the main sample (as shown in Table 6).[29] This suggests that the differential change in market values is not the driving force behind the cross-sectional heterogeneity in pay-for-performance adjustments over time.

Contemporaneous Corporate Governance Reforms

SOX not only increased the cost of overstatements, but also set in motion a number of other corporate governance reforms. Shortly after SOX, NYSE and Nasdaq revised their listing requirements. The goal of these reforms was to improve the quality of corporate governance by increasing the independence of corporate boards and their committees. In particular, the new listing requirements on the NYSE and Nasdaq require each board to have a majority of independent directors, as well as fully independent compensation and audit committees. The new NYSE and Nasdaq rules became effective with a company's first annual meeting occurring after January 15, 2004, but no later than October 31, 2004. For the majority of firms, the new requirements became binding for fiscal year 2003 reports.

The theoretical literature on optimal contracting essentially offers two competing views on the effect of the quality of corporate governance on the provision of incentives through pay-for-performance. In Holmström (1979), monitoring and incentives are substitutes: the better the manager is monitored, the less need there is to align his interests with those of the owners through incentive pay. The competing view goes back to Milgrom and Roberts (1992), who show that monitoring can increase the precision of incentives, and therefore monitoring and incentives act as complements. Either way, the relationship between incentives and governance is potentially confounding our results.

Therefore, we rerun our previous tests on the restricted sample of firms that were unaffected by the board independence requirements. The results are shown in Appendix 3.3. In a nutshell, our previous results continue to hold. We again find that around SOX (i) pay-for-performance falls, (ii) the cross-sectional link between our various measures of SBO and pay-for-performance weakens, and (iii) the decrease in pay-for-performance is more pronounced among firms with high pre-SOX SBOs. Moreover, the story of alternative governance mechanisms does not readily

[29] Including firms with less accurately matched observations does not affect our findings.

Table 7 The change in incentives around SOX: the effect of shareholder benefits from overstatements (matched sample)

SBO measure	KZ-score		HP-score	
	log(PPS)	log(PPS-ratio)	log(PPS)	log(PPS-ratio)
Panel A: capital constraints				
Post-SOX × pre-SOX SBO-dummy	−0.181* (0.078)	−0.115 (0.162)	−0.325*** (0.001)	−0.309*** (0.000)
SBO-score	−0.045 (0.690)	−0.013 (0.864)	0.780 (0.334)	0.333 (0.602)
Post-SOX (dummy)	−0.077 (0.414)	−0.093 (0.208)	0.112 (0.447)	0.054 (0.552)
# of observations	728	728	772	772
# of firms	366	366	386	386
Within-R^2	0.258	0.176	0.289	0.215
SBO measure	IT-score		TRA Ownership	
	log(PPS)	log(PPS-ratio)	log(PPS)	log(PPS-ratio)
Panel B: shareholder horizon				
Post-SOX × pre-SOX SBO-dummy	−0.205** (0.027)	−0.122 (0.146)	−0.279*** (0.002)	−0.208*** (0.005)
SBO-score	0.159 (0.704)	0.216 (0.588)	−0.400 (0.454)	−0.385 (0.397)
Post-SOX (dummy)	−0.019 (0.850)	−0.037 (0.612)	−0.019 (0.910)	0.068 (0.499)
# of observations	772	772	751	751
# of firms	386	386	384	384
Within-R^2	0.269	0.184	0.277	0.214

This table replicates the tests reported in Table 6, except that we restrict the sample in two ways. First, for each firm we use only one observation from the pre-SOX period and one observation from the post-SOX period, namely those that yield the smallest change in market values. That is, we do not match firms on market values cross-sectionally, but we match observations within firms. Second, we keep only those firms for which the market values are within 10 % of each other. Due to the market downturn in 2002 and subsequent recovery, we are able to obtain a close match for almost half of the firms in the main sample. Two-sided *p*-values—based on heteroskedasticity-robust standard errors clustered at the firm-period level—are in parentheses. ***, **, and * denote significant differences from zero at the 1, 5, and 10 % confidence levels

explain why firms' response would differ by capital constraints and institutional investment horizon. We conclude that our findings are not attributable to the contemporaneous governance reforms.

Option Expensing (FAS 123R)

The Sarbanes–Oxley Act was passed at a time when executive compensation was under intense public scrutiny. Since 1995, the Financial Accounting Standard (SFAS) 123 granted firms the choice whether to recognize stock option compensation (i.e., expense the fair value of option grants which lowers reported earnings) or whether to merely disclose its hypothetical impact on net income in the footnotes to the financial statements. As noted in Aboody et al. (2004), very few firms elected to expense options up until 2002. Yet, between July 2002 and March 2003, over 150 firms began to voluntarily expense option compensation. In December 2002, the SEC permitted shareholder proposals on option expensing to be voted on at annual shareholder meetings. According to Ferri and Sandino (2009), by the time the Financial Accounting Standards Board (FASB) released FAS 123R mandating option expensing in December 2004, about 800 firms had already adopted it.

We do not think that the contemporaneous movement toward option expensing poses a threat to our interpretation of the findings for two reasons. First, option expensing remained voluntary until SFAS 123R became effective in June 2005. Since firms were not forced to recognize option expenses over most of our sample period, it is difficult to attribute the shift in pay-for-performance primarily to the changing accounting treatment rather than the changing tradeoff between productive effort and overstatements. If anything, voluntary option expensing provided a convenient cover for the redesign of incentive compensation.[30] Second, as shown in Appendix Tables 13, 14, 15, all of our findings are robust to excluding high-tech firms, in which stock- and option-based compensation was especially

[30] One might argue that shareholder proposals to vote on option expensing forced firms to expense options, and consequently affected pay-for-performance. However, our results are robust to excluding all firms with such shareholder proposals during the 2003 and 2004 proxy seasons (as identified in Table 1 in Ferri et al. (2006).

pervasive during the pre-SOX years, likely for reasons other than overstatements (e.g., labor market competition and preservation of cash for further investments). These are precisely the firms that would have been most affected by option expensing.

Conclusion

Recent corporate governance reforms and proposals have put great emphasis on improving board independence and empowering shareholders. The view behind these reforms is that shareholder voice is an important building block to improving corporate decision making and the quality of financial reporting. In contrast, opponents cite shareholders' influence—and their insatiable appetite for higher returns—as a major reason for firms' focus on short-term performance. However, empirical evidence on shareholder preferences for overstatements is scant. By inferring shareholder objectives from observed changes in pay-for-performance sensitivities around SOX we are able to differentiate between these two opposing views.[31]

Our two approaches—inferring shareholder objectives and proxying for shareholder objectives—yield results that are consistent with each other. We find that firms of large public companies in the U.S. respond to the increase in the cost of earnings overstatements imposed by the Sarbanes–Oxley Act of 2002 by reducing CEO pay-for-performance sensitivities. Using two sets of proxies for shareholder benefits from overstatements (capital constraints and investment horizons of institutional owners), we document a positive relationship between SBO and PPS in the cross section. We also find that the decrease in PPS is concentrated among firms with high shareholder benefits from overstatements during the pre-SOX years. These results indicate that CEO incentive pay reflects costs and benefits of overstatements in a way that casts doubt on overstatements being an unintended consequence of inducing productive effort, at least prior to SOX.

A defining characteristic of publicly traded firms is the conflict of interest that arises between dispersed owners and managers (Berle and Means 1932). Corporate governance can mitigate, but never completely resolve such conflicts, which creates a role for business ethics to guide managers' behavior.

The rise in ownership by sophisticated, institutional investors from 5 % in 1950 to over 60 % in 2005 has had a profound influence on the types and efficacy of governance mechanisms in place today (Useem 2012). The shift in the balance of power from managers to shareholders has made managers more responsive to shareholder preferences, elevating the relevance of stock- and stakeholder conflicts relative to agency conflicts.

This development necessitates a more nuanced understanding of stock- and stakeholder objectives, to which our findings contribute. We show that what has been considered a symptom of the agency conflict (pay-for-performance can induce an agent to manipulate earnings to the detriment of the principal) could in fact be the manifestation of a broader stockholder-stakeholder conflict (the principal encourages the agent to manipulate earnings through pay-for-performance to the detriment of a future principal). This finding has important implications for how to improve ethical behavior in capital markets.

After the wave of corporate scandals, much emphasis has been placed on board independence to curb and prevent corporate fraud. Yet, our results hold even if we restrict the sample to firms that were compliant with the board independence requirements instituted by the stock exchanges in 2003. Thus, shareholder myopia—and not just lack of board independence—could have been responsible for performance overstatements. We conjecture that corporate boards as representatives of shareholders may face the same ethical dilemma in their effort to prevent overstatements as the managers they oversee and advise.

Under the stakeholder view of business ethics, the ethical obligations of the firm do not just extend to stockholders, but also to customers, employees, suppliers, and communities—the parties assumed to be most directly and significantly affected by the economic activities of the firm (Freeman et al. 2010). With the integrity of capital markets at stake, the treatment of prospective stockholders as stakeholders has received surprisingly little attention.

Our results are also pertinent under the stockholder view of business ethics, which posits that managers owe a fiduciary duty solely to the shareholders (e.g., Friedman 1970). The conflict of interest between current and future stockholders revolves around many of the same issues that arise between current short-term and long-term investors. More broadly, it shares numerous features with principal-principal or multiple-agency conflicts (e.g., Peng and Sauerwald 2013, Hoskisson et al. 2012). Finally, we contend that addressing stockholder myopia can reduce the tensions between the stock- and stakeholder views on

[31] We do not speak to the efficiency of overstatements. On the one hand, earnings overstatements can distort investment decisions. If firms appear more profitable than they are, managers invest in insufficiently profitable projects to mimic investment and employment of truly profitable firms (as documented in Kedia and Philippon (2009), for example). On the other hand, Shleifer and Vishny (1990) argue that short-term arbitrage being cheaper than long-term arbitrage leads to firms focusing on short-term assets to avoid prolonged underpricing. That is, firms may avoid long-term investments with positive net present values, because of fear of underpricing. Therefore, contracts that encourage CEOs to avoid underpricing by inflating earnings could in fact alleviate underinvestment in long-term assets.

firms' ethical responsibilities that arise from divergent time horizons.

Acknowledgments We thank Anwer Ahmed, Vlado Atanasov, John Boschen, Larry Brown, Naomi Feldman, Scott Gibson, Radha Gopalan, Leslie Marx, Uday Rajan, Dan Silverman, Mel Stephens, John Strong, Arun Upadhyay, Michael Wolff, and the anonymous referees for their valuable suggestions. We are also grateful for the helpful comments from participants at the Conference on Corporate Governance and Fraud Prevention at George Mason University, the Workshop on Corporate Governance at the Copenhagen Business School, and the FMA Annual Meeting. All errors are ours.

Appendix 1: Proofs

Proof of Proposition 1

From (5),

$$\frac{\partial\beta^*}{\partial\rho}=\frac{2\eta^2\left(1-\lambda\eta(1-\theta)\left(1+r(\sigma_a^2+\sigma_m^2)\right)\right)}{\left(1+2\eta^2\rho\left(1+r(\sigma_a^2+\sigma_m^2)\right)\right)^2}\geq 0 \iff \lambda\leq\frac{1}{\eta(1-\theta)(1+r(\sigma_a^2+\sigma_m^2))}. \tag{10}$$

Since $\lambda\leq 1$, $\frac{\partial\beta^*}{\partial\rho}$ is always non-negative if $\frac{1}{(1-\theta)(1+r(\sigma_a^2+\sigma_m^2))}\geq 1$, that is, if $\theta\geq\frac{\eta r(\sigma_a^2+\sigma_m^2)-1}{\eta r(\sigma_a^2+\sigma_m^2)}$.

If $\theta<\frac{\eta r(\sigma_a^2+\sigma_m^2)-1}{\eta r(\sigma_a^2+\sigma_m^2)}$, however, $\frac{\partial\beta^*}{\partial\rho}<0$ if and only if $\lambda>\frac{1}{\eta(1-\theta)(1+r(\sigma_a^2+\sigma_m^2))}$.

Proof of Proposition 2

(i) From (5), it is straightforward to show that

$$\frac{\partial\beta^*}{\partial\lambda}=\frac{\frac{1-\theta}{2\eta\rho}}{1+\frac{1}{2\eta^2\rho}+r(\sigma_a^2+\sigma_m^2)}>0. \tag{11}$$

(ii) From (10),

$$\frac{\partial^2\beta^*}{\partial\lambda\partial\rho}=-\frac{2\eta^3(1-\theta)\left(1+r(\sigma_a^2+\sigma_m^2)\right)}{\left(1+2\eta^2\rho\left(1+r(\sigma_a^2+\sigma_m^2)\right)\right)^2}<0. \tag{12}$$

Appendix 2: Details on Calculating PPS

We construct the incentive measure following Core and Guay (2002). In particular, we compute the dollar change in executives' stock and option holdings for a hypothetical one percent change in firm value [we call this variable pay-for-performance sensitivity (PPS)]. We separately calculate PPS for newly granted options, previously granted exercisable and unexercisable options, and stock holdings. Measuring PPS requires six inputs: the risk-free rate, stock price volatility, dividend yield, time-to-maturity, stock price, and number of options granted or held. All variables except for the risk-free rate can be obtained from Execucomp, either directly (e.g., dividend yield and volatility, stock price) or indirectly (time-to-maturity, number of options held).

Following the Execucomp convention in calculating option grant values, we winsorize volatility and dividend yields within each fiscal year. The largest and smallest values are least likely to be good representations of expectations about their future values. We replace missing values of the 3-year average dividend yield (*bs_yield*) with current dividend yields, missing values for volatility (*bs_volat*) with the Execucomp sample mean, and missing values for exercise price (*expric*) with either the market price (*mktpric*) or the average of the fiscal-year-end closing price (*prccf*) and the closing price discounted by total shareholder returns that year (*trs1yr*). We also observe that firms who make only one grant to an executive within a fiscal year often only report the total number of options granted (*soptgrnt*), but not the number of options in that grant (*numsecur*). We estimate maturity to be the difference between exercise date and grant date. Missing values are assumed to be 10 years. Some maturities are computed to be 0 years, so we replace those with 1 year. We also value the options at the end of the fiscal year, not at the time of the grant to make all values comparable and current at fiscal year end. Finally, we weight the individual grants' deltas by the grant values to each executive within each year to compute PPS from new option grants for each executive-firm-year.

Estimating the inputs for previous grants is harder. Information on the characteristics of past option grants is not available. For example, the number and value of unexercisable options are available, but we do not know the composition of the unexercisable options from previous grants. Similarly, for exercisable options, we do not know which previously granted options were exercised by the executives and which ones were kept in the portfolio. However, Core and Guay's main contribution lies in showing that imputing the missing characteristics yields a very close approximation to hand-collected, full-information option portfolios. Unfortunately, the documentation in Core and Guay does not allow us to replicate their imputation strategy directly. We encounter a number of problems. For example, the reported value of (un)exercisable options pertains only to in-the-money options, but the number of (un)exercisable options also includes out-of-the-money options. Furthermore, adjusting the value and number of unexercisable options for current year option grants imply that about half of our observations would end up with negative values. We assume that the reported

Table 8 The change in PPS around SOX: median regression

	Fiscal year ≥ 2002		Fiscal year begins ≥ 8/1/2002	
	log(PPS)	log(PPS-ratio)	log(PPS)	log(PPS-ratio)
Post-SOX (dummy)	−0.080*** (0.000)	−0.110*** (0.000)	−0.084*** (0.000)	−0.120*** (0.000)
Market value (log)	0.879*** (0.000)	0.424*** (0.000)	0.875*** (0.000)	0.426*** (0.000)
Return volatility (log)	0.064** (0.034)	0.155*** (0.000)	0.028 (0.420)	0.110*** (0.007)
Market-to-book ratio (log)	0.293*** (0.000)	0.270*** (0.000)	0.319*** (0.000)	0.297*** (0.000)
Leverage	−0.032 (0.605)	−0.067 (0.412)	−0.044 (0.529)	−0.046 (0.577)
Return on assets (log)	0.124* (0.098)	−0.353*** (0.000)	0.144* (0.091)	−0.345*** (0.001)
Shareholder return (log)	0.136*** (0.000)	0.054*** (0.003)	0.131*** (0.000)	0.057*** (0.002)
Market return (log)	−0.029 (0.286)	0.033 (0.365)	0.057 (0.121)	0.166*** (0.000)
CEO tenure (log)	0.382*** (0.000)	0.256*** (0.000)	0.382*** (0.000)	0.248*** (0.000)
Option exercise ratio	−0.132*** (0.000)	−0.110*** (0.000)	−0.137*** (0.000)	−0.121*** (0.000)
CEO turnover (dummy)	0.007 (0.742)	0.030 (0.248)	0.020 (0.368)	0.041 (0.123)
# of observations	5549	5549	5549	5549
# of firms	857	857	857	857
Pseudo-R^2	0.389	0.189	0.388	0.187

In Tables 3 and 4, we report results from firm-fixed-effects regressions that estimate the mean change in CEOs' pay-for-performance sensitivities from before to after SOX. To ensure that our results are representative of the typical firm in the sample (instead of being driven by large changes in a few firms), we also estimate median regressions. We purge firm-fixed effects by demeaning all variables. In columns 1 and 2, the post-SOX period includes fiscal years 2002 and later. In columns 3 and 4, the post-SOX period includes all fiscal years that begin on or after 8/1/2002. Two-sided *p*-values are in parentheses. ***, **, and * denote significant differences from zero at the 1, 5, and 10 % confidence levels

number of unexercisable options held includes newly granted options, unless the number of options granted exceeds the holdings. Similar to our approach for newly granted options, we estimate the exercise price for previously granted options by appropriately discounting the adjusted fiscal-year end stock price by total shareholder returns (*trs3yr*). The maturity of unexercisable options is assumed to be one year less than the maturity of any option grant in the previous year, or 9 years if no options were granted in the previous year. The maturity of exercisable options is assumed to be 3 years less than that of unexercisable options.

Appendix 3: Robustness Checks

Representativeness of the Mean Effect

In Tables 3 and 4 we report results from firm-fixed-effects regressions that estimate the mean change in CEO pay-for-performance sensitivities from before to after SOX. To ensure that our results are representative of the typical firm in the sample instead of being driven by large changes in a few firms, we also estimate median regressions. The results are presented in Table 8. We purge firm-fixed effects by demeaning all variables.[32] The estimated median change in PPS from before to after SOX is almost identical to the mean effect. We conclude that the change in PPS is pervasive and representative of the typical firm in our sample.

Bonus Pay

Our measures of the performance sensitivity of CEO compensation emphasize CEOs' wealth gains from stock and option holdings. In practice, however, other forms of pay, such as bonuses, are also tied to firm performance and can thus provide incentives for overstatements. Our first measure of the level of performance sensitivity—log(PPS)—completely ignores CEOs' bonus compensation. Although our second measure—log(PPS-ratio)—includes bonuses, it assumes that bonuses provide CEOs with fewer incentives to overstate performance than stock and option holdings. To rule out the possibility that CEO incentive pay shifted from PPS to bonus pay around SOX without affecting the link between total CEO pay and firm performance, we take an alternative approach offered in the prior literature on CEO pay to estimate how the performance sensitivity of CEO pay has changed around SOX. We regress bonus pay and total CEO pay on two measures of firm performance: return on assets and firm stock returns. We also interact the performance measures with the post-SOX dummy to allow for changes in the performance sensitivity of CEO pay:

[32] First-differencing instead of demeaning does not materially affect the results.

Table 9 The changing link between CEO pay and firm performance

	Bonus pay	Total pay w/o bonus	Total pay
Post-SOX (dummy)	0.166*** (0.000)	−0.022 (0.988)	0.119 (0.937)
Market value (log)	0.338*** (0.000)	2.285 (0.490)	2.785 (0.402)
Return volatility (log)	−0.232*** (0.003)	−15.564*** (0.001)	−15.829*** (0.001)
Market-to-book ratio (log)	−0.262*** (0.000)	24.413*** (0.000)	23.970*** (0.000)
Leverage	−0.060 (0.606)	25.788** (0.012)	25.601** (0.013)
Return on assets (log)	1.035*** (0.000)	−28.228 (0.262)	−27.218 (0.280)
Return on assets (log) × post-SOX	−0.504** (0.015)	−3.552 (0.874)	−4.136 (0.853)
Shareholder return (log)	0.133*** (0.000)	67.652*** (0.000)	67.780*** (0.000)
Shareholder return (log) × post-SOX	0.135*** (0.005)	−31.716*** (0.000)	−31.631*** (0.000)
Market return (log)	−0.072 (0.445)	21.567*** (0.006)	21.243*** (0.007)
Market return (log) × post-SOX	−0.027 (0.819)	−4.672 (0.618)	−4.330 (0.646)
CEO tenure (log)	0.030 (0.294)	4.311*** (0.001)	4.360*** (0.001)
Option exercise ratio	0.055 (0.194)	−0.693 (0.790)	−0.628 (0.810)
CEO turnover (dummy)	−0.031 (0.489)	3.650* (0.074)	3.576* (0.081)
# of observations	5549	5361	5361
# of firms	857	857	857
Within-R^2	0.104	0.228	0.229

Our primary measure of the strength of CEO incentive pay—log(PPS)—has the potential drawback that it does not include CEOs' bonus compensation, which can also be tied to firm performance. To rule out the possibility that the performance sensitivity of CEO pay shifted from the performance exposure of firm wealth to bonus pay around SOX without affecting the link between total CEO pay and firm performance, we take an alternative approach offered in the prior literature on CEO pay. To this end, we regress CEO pay (in $ mill.) on two measures of firm performance: return on assets and firm stock returns. We also interact the performance measures with the post-SOX dummy to allow for changes in the performance sensitivity of CEO pay. Column 1 shows the results for bonuses only, column 3 for total CEO pay which includes both the flow of compensation (e.g., stock and option grants, salary, and bonus) as well as changes in the value of CEOs' stock and option holdings. In column 2 the dependent variable is CEO total pay without bonuses. Two-sided *p*-values—based on heteroskedasticity-robust standard errors clustered at the firm-period level—are in parentheses. ***, **, and * denote significant differences from zero at the 1, 5, and 10 % confidence levels

$$pay_{it} = \tau_1\ performance_{it} + \tau_2\ D(t \geq 0)_t \times performance_{it} + \tau_3\ D(t \geq 0)_t + \alpha_0 + \sum_{j=1}^{k} \alpha_j X_{jit} + \upsilon_i + \epsilon_{it}, \qquad (13)$$

where $D(t \geq 0)_t$ is a dummy set to one for fiscal years 2002–2005. The interaction term captures whether the link between pay and performance has strengthened or weakened from before to after SOX. Again, we estimate heteroskedasticity-robust standard errors, clustered at the firm-period level.

The results are displayed in Table 9. In column 1, we use bonus pay as the dependent variable. In column 3, we use total CEO pay as the dependent variable, which includes the flow of compensation (such as salary, bonus, stock and option grants), as well as changes in the value of CEOs' stock and option holdings. Column 2 is the in-between case, where we exclude bonuses from total pay. We use the dollar value of bonus and total pay (in $ mill.) instead of their logarithmic values, because the dollar amounts are zero or negative in a non-negligible fraction of observations. To alleviate the concern that outliers severely affect the magnitude of our estimates, we winsorize the pay and performance measures at the top and bottom percentile.

The result for bonus pay confirms that incentive pay has in fact shifted from stocks and options toward bonus pay. We estimate that bonus pay has increased by $166,000 around SOX on average. Furthermore, bonus pay does increase with return on assets (accounting performance) and with firm stock returns (market performance). Most interesting, however, is the finding that the accounting-performance sensitivity decreases around SOX, while the market-performance sensitivity of bonus pay increases. This shift towards bonus pay and its increasing market-performance sensitivity suggest that our earlier results based on log(PPS) overstate the true decrease in the performance sensitivity of CEO pay.

Table 10 The change in incentives around SOX: controlling for changes in board characteristics

	log(PPS)		log(PPS-ratio)	
	Compliant	Non-compliant	Compliant	Non-compliant
Post-SOX (dummy)	−0.047** (0.015)	−0.133 (0.105)	−0.108*** (0.000)	−0.099** (0.048)
Market value (log)	0.936*** (0.000)	0.817*** (0.000)	0.516*** (0.000)	0.185** (0.042)
Return volatility (log)	0.124** (0.029)	0.594** (0.027)	0.211*** (0.000)	0.255* (0.078)
Market-to-book ratio (log)	0.233*** (0.000)	−0.098 (0.847)	0.262*** (0.000)	0.307** (0.034)
Leverage	−0.080 (0.526)	−0.308 (0.339)	−0.086 (0.485)	−0.016 (0.950)
Return on assets (log)	−0.046 (0.806)	0.475 (0.349)	−0.800*** (0.000)	−0.012 (0.971)
Shareholder return (log)	0.231*** (0.000)	0.191* (0.057)	0.061** (0.013)	0.067 (0.228)
Market return (log)	−0.057 (0.108)	−0.037 (0.709)	0.017 (0.644)	0.033 (0.724)
CEO tenure (log)	0.406*** (0.000)	0.674*** (0.000)	0.263*** (0.000)	0.363*** (0.000)
Option exercise ratio	−0.185*** (0.000)	−0.294** (0.039)	−0.143*** (0.000)	−0.181* (0.090)
CEO turnover (dummy)	0.033 (0.437)	0.240* (0.059)	0.052 (0.201)	0.081 (0.415)
Board size (log)	−0.301*** (0.000)	0.155 (0.515)	−0.236*** (0.001)	−0.234 (0.162)
Board independence	0.156 (0.161)	−0.161 (0.564)	0.098 (0.347)	−0.144 (0.392)
Board ownership (indep.)	0.326 (0.592)	−0.841 (0.210)	1.048 (0.194)	−0.248 (0.657)
Board tenure (log)	0.029 (0.681)	0.206 (0.355)	0.070 (0.317)	0.057 (0.703)
Board age (log)	−1.203** (0.012)	0.093 (0.928)	−0.773* (0.099)	0.316 (0.626)
Board busyness	−0.065 (0.120)	0.224 (0.133)	−0.051 (0.167)	0.128 (0.174)
# of observations	4056	802	4056	802
# of firms	642	138	642	138
Within-R^2	0.565	0.421	0.311	0.314

This table replicates the tests reported in columns 1 and 2 of Table 4, except that we run the regressions separately for firms whose boards of directors were compliant and non-compliant with the new NYSE/Nasdaq listing requirements for board independence and control for various board characteristics. We determine compliance status in fiscal year 2002, which for most firms is the year preceding the announcement of the new governance standards. PPS decreased even in compliant firms, although by a smaller magnitude than in non-compliant firms, indicating that our results are not fully attributable to the contemporaneous changes in governance. Two-sided *p*-values—based on heteroskedasticity-robust standard errors clustered at the firm-period level—are in parentheses. ***, **, and * denote significant differences from zero at the 1, 5, and 10 % confidence levels

Turning to total pay in column 3, we find that it primarily responds to firms' market performance. The economic magnitude of its performance sensitivity swamps the wealth effects from bonus pay.[33] More importantly, the performance sensitivity of total pay decreases sharply around SOX by almost half.

How large is the contribution of bonus pay on the performance sensitivity of total pay? Comparing the coefficient estimates between columns 2 and 3 reveals that bonus pay has a negligible effect; most of the performance sensitivity derives from the firm's stock return, and the coefficient estimate is almost unchanged when bonus is excluded from total pay (and bonus has a minor impact on the sensitivity to accounting performance). We conclude that the declining performance sensitivity of stock and option holdings outweighs the increasing weight placed on bonus pay and its increasing market-performance sensitivity.

[33] As CEO pay is highly skewed, estimated mean effects are not representative of the typical firm. Using median regressions reduces the magnitude of the estimates by factors ranging from 2 to 4, but the qualitative findings do not change.

Contemporaneous Corporate Governance Reforms

In this section, we assess the robustness of our main findings to excluding firms affected by the contemporaneous board independence requirements.

We use board data provided by Riskmetrics to determine firms' compliance status. We match the Riskmetrics observation to the fiscal year into which the board meeting date falls. We classify boards as compliant or non-compliant based on their board independence in fiscal year 2002, the year prior to the rule change. Following Chhaochharia and Grinstein (2009), we reclassify directors as independent when their employment relationship terminated three or more years ago to reconcile the differences in how Riskmetrics and the NYSE/Nasdaq listing

Table 11 The link between CEO pay-for-performance and shareholder benefits from overstatements in the cross-section: controlling for changes in board characteristics

SBO measure	KZ-score		HP-score	
	log(PPS)	log(PPS-ratio)	log(PPS)	log(PPS-ratio)
Panel A: capital constraints				
SBO-score × pre-SOX	0.242*** (0.000)	0.193*** (0.000)	0.279** (0.013)	0.311*** (0.000)
SBO-score × post-SOX	0.202*** (0.002)	0.139*** (0.003)	0.135 (0.191)	0.149** (0.039)
p-value for Δ_{sox}	0.076*	0.012**	0.022**	0.002***
# of observations	3777	3777	4056	4056
# of firms	601	601	642	642
Overall-R^2	0.667	0.461	0.670	0.456
SBO measure	IT-score		TRA Ownership	
	log(PPS)	log(PPS-ratio)	log(PPS)	log(PPS-ratio)
Panel B: shareholder horizon				
SBO-score × pre-SOX	1.390** (0.048)	1.172** (0.018)	1.464** (0.037)	1.089** (0.033)
SBO-score × post-SOX	0.852 (0.189)	0.494 (0.305)	0.697 (0.277)	0.462 (0.330)
p-value for Δ_{sox}	0.022**	0.002***	0.006***	0.013**
# of observations	4056	4056	3978	3978
# of firms	642	642	642	642
Overall-R^2	0.668	0.451	0.670	0.454

This table replicates the tests reported in Table 5, except that we restrict the sample to firms whose boards of directors were compliant with the new NYSE/Nasdaq listing requirements for board independence and control for various board characteristics (as displayed in Table 10). This restriction ensures that our results are not driven by the contemporaneous changes in governance. The regressions include all the previous control variables, including the post-SOX dummy. Two-sided p-values—based on heteroskedasticity-robust standard errors clustered at the firm-period level—are in parentheses. ***, **, and * denote significant differences from zero at the 1, 5, and 10 % confidence levels. p-values for Δ_{sox} provide the confidence level for rejecting the null hypothesis that the link between shareholder benefits from overstatements and PPS has strengthened around SOX

standards define independence. Of our 857 sample firms, we classify 138 as non-compliant, and lack board data for 77.

The new listing requirements had a noticeable impact on board independence. The change in board independence is evident in Table 2, panel A. Firms that were failing the new director independence standards in the year prior to those rules going into effect, improved their governance drastically over the following years. In the non-compliant firms, only 42 % of directors were independent before the new rules, but independence increased by 10 percentage points within one year and by 20 percentage points by 2005. On the other hand, firms that already met the requirements show an increase of only 3 percentage points from 2002 to 2005. The fraction of compliant boards in our sample jumps from 82 % in 2002 to 93 % in 2004.

We allow the effect of SOX on PPS to differ between compliant and non-compliant firms by estimating regression (6) separately for compliers and non-compliers. In addition, we add various measures of board characteristics that might either affect PPS (e.g., board ownership, tenure and age of directors) or vary systematically around SOX (e.g., board size, board independence, and the number of directorships of board members) as control variables. Table 10 displays the results. PPS decreases in compliant firms, which suggests that even independent boards emphasize market values over fundamental values. Thus, we should not expect independent boards to be effective monitors of overstatements.

The economic magnitude of the change in log(PPS) is three times larger for non-compliers than compliers, but not for incentives measured as log(PPS-ratio). The difference between the SOX effects, however, is not statistically significant for log(PPS) with a p-value of 29.9 %.

Note that the estimate of the decrease in PPS around SOX for compliant firms isolates the effect of shareholder myopia from changes in board independence. In contrast, the estimate for non-compliant firms captures both myopia and changes in board independence. Under the assumption that the effect of myopia is the same for compliant and non-compliant firms, our estimates suggest that board independence leads to an economically significant decrease in the performance sensitivity of CEO pay [at least if measured as log(PPS)]. There are at least two possible explanations for this finding. First, the decrease in PPS in non-compliant firms is consistent with the view that oversight and incentive pay

Table 12 The impact of shareholder benefits from overstatements on the change in incentives around SOX: controlling for changes in board characteristics

SBO measure	KZ-score		HP-score	
	log(PPS)	log(PPS-ratio)	log(PPS)	log(PPS-ratio)
Panel A: capital constraints				
Post-SOX × pre-SOX SBO-dummy	−0.061* (0.063)	−0.063** (0.037)	−0.152*** (0.000)	−0.143*** (0.000)
SBO-score	0.057** (0.017)	0.025 (0.245)	0.401** (0.012)	0.029 (0.855)
Post-SOX (dummy)	−0.002 (0.933)	−0.073*** (0.001)	0.048* (0.064)	−0.050** (0.039)
# of observations	3710	3710	3988	3988
# of firms	582	582	622	622
Within-R^2	0.568	0.314	0.575	0.321
SBO measure	IT-score		TRA Ownership	
	log(PPS)	log(PPS-ratio)	log(PPS)	log(PPS-ratio)
Panel B: shareholder horizon				
Post-SOX × pre-SOX SBO-dummy	−0.104*** (0.002)	−0.056* (0.068)	−0.109*** (0.001)	−0.062** (0.042)
SBO-score	0.030 (0.794)	−0.146 (0.217)	0.259 (0.217)	−0.148 (0.462)
Post-SOX (dummy)	0.001 (0.978)	−0.097*** (0.000)	−0.006 (0.874)	−0.047 (0.179)
# of observations	3988	3988	3901	3901
# of firms	622	622	619	619
Within-R^2	0.572	0.317	0.573	0.326

This table replicates the tests reported in Table 6, except that we restrict the sample to firms whose boards of directors were compliant with the new NYSE/Nasdaq listing requirements for board independence and control for various board characteristics (as displayed in Table 10). This restriction ensures that our results are not driven by the contemporaneous changes in governance. Two-sided *p*-values—based on heteroskedasticity-robust standard errors clustered at the firm-period level—are in parentheses. ***, **, and * denote significant differences from zero at the 1, 5, and 10 % confidence levels

Table 13 The change in incentives around SOX: non-high-tech vs. high-tech firms

	log(PPS)		log(PPS-ratio)	
	Non-high-tech	High-tech	Non-high-tech	High-tech
Post-SOX (dummy)	−0.055*** (0.004)	−0.257*** (0.000)	−0.103*** (0.000)	−0.214*** (0.000)
Market value (log)	0.853*** (0.000)	0.981*** (0.000)	0.445*** (0.000)	0.475*** (0.000)
Return volatility (log)	0.175*** (0.008)	0.500** (0.016)	0.192*** (0.003)	0.352*** (0.007)
Market-to-book ratio (log)	0.365*** (0.000)	−0.147 (0.601)	0.322*** (0.000)	0.194** (0.039)
Leverage	0.050 (0.643)	−0.927*** (0.005)	0.038 (0.715)	−0.578* (0.051)
Return on assets (log)	0.038 (0.802)	0.362 (0.203)	−0.362** (0.026)	−0.228 (0.381)
Shareholder return (log)	0.188*** (0.000)	0.265*** (0.000)	0.073*** (0.001)	0.079 (0.127)
Market return (log)	−0.047 (0.188)	−0.158 (0.200)	0.024 (0.477)	−0.062 (0.650)
CEO tenure (log)	0.452*** (0.000)	0.372*** (0.000)	0.280*** (0.000)	0.242*** (0.000)
Option exercise ratio	−0.187*** (0.000)	−0.152* (0.096)	−0.135*** (0.000)	−0.164* (0.069)
CEO turnover (dummy)	0.077* (0.052)	0.037 (0.729)	0.064* (0.081)	0.103 (0.264)
# of observations	4817	732	4817	732
# of firms	741	116	741	116
Within-R^2	0.538	0.568	0.301	0.432

This table replicates the tests reported in columns 1 and 2 of Table 4, except that we run the regressions separately for non-high-tech and high-tech firms. High-tech firms are those in the communications, computer, electrical, and electronic equipment industries based on the Fama-French 48-industry classification. Two-sided *p*-values—based on heteroskedasticity-robust standard errors clustered at the firm-period level—are in parentheses. ***, **, and * denote significant differences from zero at the 1, 5, and 10 % confidence levels

Table 14 The link between CEO pay-for-performance and shareholder benefits from overstatements in the cross-section: excluding high-tech firms

SBO measure	KZ-score		HP-score	
	log(PPS)	log(PPS-ratio)	log(PPS)	log(PPS-ratio)
Panel A: capital constraints				
SBO-score × pre-SOX	0.301*** (0.000)	0.238*** (0.000)	0.408*** (0.000)	0.427*** (0.000)
SBO-score × post-SOX	0.223*** (0.001)	0.183*** (0.000)	0.197** (0.041)	0.228*** (0.001)
p-value for Δ_{sox}	0.001***	0.005***	0.000***	0.000***
# of observations	4493	4493	4817	4817
# of firms	697	697	741	741
Overall-R^2	0.646	0.444	0.646	0.441
SBO measure	IT-score		TRA Ownership	
	log(PPS)	log(PPS-ratio)	log(PPS)	log(PPS-ratio)
Panel B: shareholder horizon				
SBO-score × pre-SOX	1.348** (0.030)	1.059** (0.020)	1.610*** (0.009)	1.050** (0.043)
SBO-score × post-SOX	0.393 (0.496)	0.227 (0.587)	0.562 (0.318)	0.232 (0.592)
p-value for Δ_{sox}	0.000***	0.000***	0.000***	0.001***
# of observations	4817	4817	4728	4728
# of firms	741	741	741	741
Overall-R^2	0.642	0.427	0.645	0.430

This table replicates the tests reported in Table 5, except that we restrict the sample to non-high-tech firms. This restriction ensures that our results are not driven by the subset of firms in which stock- and option compensation was most prevalent prior to SOX. The regressions include all the previous control variables, including the post-SOX dummy. Two-sided p-values—based on heteroskedasticity-robust standard errors clustered at the firm-period level—are in parentheses. ***, **, and * denote significant differences from zero at the 1, 5, and 10 % confidence levels. p-values for Δ_{sox} provide the confidence level for rejecting the null hypothesis that the link between shareholder benefits from overstatements and PPS has strengthened around SOX

Table 15 The impact of shareholder benefits from overstatements on the change in incentives around SOX: excluding high-tech firms

SBO measure	KZ-score		HP-score	
	log(PPS)	log(PPS-ratio)	log(PPS)	log(PPS-ratio)
Panel A: capital constraints				
Post-SOX × pre-SOX SBO-dummy	−0.151*** (0.000)	−0.105*** (0.000)	−0.204*** (0.000)	−0.161*** (0.000)
SBO-score	0.057*** (0.005)	0.024 (0.211)	0.648*** (0.000)	0.080 (0.578)
Post-SOX (dummy)	0.020 (0.410)	−0.055** (0.012)	0.104*** (0.000)	−0.017 (0.428)
# of observations	4385	4385	4712	4712
# of firms	667	667	711	711
Within-R^2	0.544	0.306	0.554	0.312
SBO measure	IT-score		TRA Ownership	
	log(PPS)	log(PPS-ratio)	log(PPS)	log(PPS-ratio)
Panel B: shareholder horizon				
Post-SOX × pre-SOX SBO-dummy	−0.161*** (0.000)	−0.122*** (0.000)	−0.150*** (0.000)	−0.093*** (0.001)
SBO-score	−0.003 (0.975)	−0.218** (0.036)	−0.187 (0.301)	−0.362** (0.029)
Post-SOX (dummy)	0.022 (0.383)	−0.062*** (0.006)	0.028 (0.432)	−0.016 (0.606)
# of observations	4712	4712	4606	4606
# of firms	711	711	706	706
Within-R^2	0.547	0.309	0.544	0.310

This table replicates the tests reported in Table 6, except that we restrict the sample to non-high-tech firms. Two-sided p-values—based on heteroskedasticity-robust standard errors clustered at the firm-period level—are in parentheses. ***, **, and * denote significant differences from zero at the 1, 5, and 10 % confidence levels

are substitutes (Holmström 1979). The large decrease could thus reflect not just the change in the cost of overstatement, but also the improvement in the quality of corporate governance. Second, as suggested by Bertrand and Mullainathan (2001), non-independent boards may not have been setting or enforcing optimal incentive contracts. Therefore, the large decrease in PPS could also be attributable to a regime shift from managerial skimming to optimal contracting. That compliant and non-compliant boards differ in the allocation of power between managers and shareholder becomes evident when one compares board ownership. The mean pre-SOX ownership of compliant boards is only 6.4 %, but 20.0 % in non-compliant firms. Ownership by independent directors, however, is much smaller in magnitude and about equal at 1.1 % in compliant firms and 1.2 % in non-compliant firms.

Our model does not contain a parameter for board independence and thus does not offer predictions about the effect of independence (and its interaction with SBO) on CEO incentive pay. In light of the alternative views on the role of board independence, we simply replicate the empirical tests of Hypotheses (2) and (3) for the subsample of firms in compliance with the new board independence requirement in fiscal year 2002 and control for the various board characteristics mentioned previously. The results remain qualitatively, and in most cases even quantitatively, unchanged, as shown in Tables 11 and 12. We conclude that our findings are not attributable to the contemporaneous changes in board characteristics.

References

Aboody, D., Barth, M., & Kasznik, R. (2004). Firms voluntary recognition of stock-based compensation expense. *Journal of Accounting Research*, *42*, 123–150.

Armstrong, C., Jagolinzer, A., & Larcker, D. (2010). Chief executive officer equity incentives and accounting irregularities. *Journal of Accounting Research*, *48*, 225–271.

Bainbridge, S. (2007). *The complete guide to Sarbanes–Oxley*. New York: Adams Media.

Ball, R., & Shivakumar, L. (2006). The role of accruals in asymmetrically timely gain and loss recognition. *Journal of Accounting Research*, *44*, 207–242.

Bargeron, L., Lehn, K., & Zutter, C. (2010). Sarbanes–Oxley and corporate risk-taking. *Journal of Accounting and Economics*, *49*, 34–52.

Bartov, E., & Cohen, D. (2009). The numbers game in the pre- and post-Sarbanes–Oxley eras. *Journal of Accounting, Auditing, and Finance*, *24*, 505–534.

Beneish, M. (2001). Earnings management: A perspective. *Managerial Finance*, *27*, 3–17.

Bergman, N., & Jenter, D. (2007). Employee sentiment and stock option compensation. *Journal of Financial Economics*, *84*, 667–712.

Bergstresser, D., & Philippon, T. (2006). CEO incentives and earnings management. *Journal of Financial Economics*, *80*, 511–529.

Berle, A., & Means, G. (1932). *The modern corporation and private property*. London: Macmillan.

Bertrand, M., & Mullainathan, S. (2001). Are CEOs rewarded for luck? The ones without principals are. *Quarterly Journal of Economics*, *116*, 901–929.

Bolton, P., Scheinkman, J., & Xiong, W. (2006). Executive compensation and short-termist behavior in speculative markets. *Review of Economic Studies*, *73*, 577–610.

Burns, N., & Kedia, S. (2006). The impact of performance-based compensation on misreporting. *Journal of Financial Economics*, *79*, 35–67.

Bushee, B. (2001). Do institutional investors prefer near-term earnings over long-run value? *Contemporary Accounting Research*, *18*, 207–246.

Carter, M., Lynch, L., & Zechman, S. (2009). Changes in bonus contracts in the post-Sarbanes–Oxley era. *Review of Accounting Studies*, *14*, 480–506.

Cheng, Q., & Warfield, T. (2005). Equity incentives and earnings management. *Accounting Review*, *80*, 441–476.

Chhaochharia, V., & Grinstein, Y. (2009). CEO compensation and board structure. *Journal of Finance*, *64*, 231–261.

Cohen, D., A. Dey, & T. Lys. 2007. The Sarbanes Oxley Act of 2002: Implications for compensation contracts and managerial risk-taking. Working Paper.

Cohen, D., Dey, A., & Lys, T. (2008). Real and accrual-based earnings management in the pre- and post-Sarbanes–Oxley periods. *Accounting Review*, *83*, 757–787.

Core, J., & Guay, W. (2002). Estimating the value of employee stock option portfolios and their sensitivities to price and volatility. *Journal of Accounting Research*, *40*, 613–630.

Cornett, M., Marcus, A., & Tehranian, H. (2008). Corporate governance and pay-for-performance: The impact of earnings management. *Journal of Financial Economics*, *87*, 357–373.

Crocker, K., & Slemrod, J. (2005). The economics of earnings manipulation and managerial compensation. *Rand Journal of Economics*, *38*, 698–714.

D'Avolio, G. (2002). The market for borrowing stock. *Journal of Financial Economics*, *66*, 271–306.

Dechow, P., & Dichev, I. (2002). The quality of accruals and earnings: The role of accrual estimation errors. *Accounting Review*, *77*, 35–59.

Dechow, P., Sloan, R., & Sweeney, A. (1996). Causes and consequences of earnings manipulation: An analysis of firms subject to enforcement actions by the SEC. *Contemporary Accounting Research*, *13*, 1–36.

Denis, D., Hanouna, P., & Sarin, A. (2006). Is there a dark side to incentive compensation? *Journal of Corporate Finance*, *12*, 467–488.

Dikolli, S., Kulp, S., & Sedatole, K. (2009). Transient institutional ownership and CEO contracting. *Accounting Review*, *84*, 737–770.

Duchin, R., Matsusaka, J., & Ozbas, O. (2010). When are outside directors effective? *Journal of Financial Economics*, *96*, 195–214.

Durtschi, C., & Easton, P. (2005). Earnings management? The shapes of the frequency distributions of earnings metrics are not evidence ipso facto. *Journal of Accounting Research*, *43*, 557–592.

Dye, R. (1988). Earnings management in an overlapping generations model. *Journal of Accounting Research*, *26*, 195–235.

Efendi, J., Srivastava, A., & Swanson, E. (2007). Why do corporate managers misstate financial statements? The role of in-the-money options and other factors. *Journal of Financial Economics*, *85*, 667–708.

Erickson, M., Hanlon, M., & Maydew, E. (2006). Is there a link between executive equity incentives and accounting fraud? *Journal of Accounting Research*, *44*, 113–143.

Ferri, F., & Sandino, T. (2009). The impact of shareholder activism on financial reporting and compensation: The case of employee stock options expensing. *The Accounting Review*, *84*, 433–466.

Ferri, F., Sandino, T., & Markarian, G. (2006). Stock options expensing: Evidence from shareholders votes. Working Paper.

Fischer, P., & Verrecchia, R. (2004). Disclosure bias. *Journal of Accounting and Economics*, *38*, 223–250.

Freeman, E., Harrison, J., Wicks, A., Parmar, B., & de Colle, S. (2010). *Stakeholder theory: The state of the art*. Cambridge: Cambridge University Press.

Friedman, M. (1970). The social responsibility of business is to increase its profits. *The New York Times Magazine*. September 13.

Gaspar, J.-M., Massa, M., & Matos, P. (2005). Shareholder investment horizons and the market for corporate control. *Journal of Financial Economics*, *76*, 135–165.

Geczy, C., Musto, D., & Reed, A. (2002). Stocks are special too: An analysis of the equity lending market. *Journal of Financial Economics*, *66*, 241–269.

General Accounting Office. (2002). In *Financial statement restatements, trends, market impacts, regulatory responses, and remaining challenges*. GAO-03-138.

Gibbons, R., & Murphy, K. (1992). Optimal incentive contracts in the presence of career concerns: Theory and evidence. *Journal of Political Economy*, *100*, 468–505.

Goldman, E., & Slezak, S. (2006). An equilibrium model of incentive contracts in the presence of information manipulation. *Journal of Financial Economics*, *80*, 603–626.

Gould, W. (2001). What is the between estimator? *Stata FAQs*. Available for download at ⟨.

Guthrie, K., & Sokolowsky, J. (2010). Large shareholders and the pressure to manage earnings. *Journal of Corporate Finance*, *16*, 302–319.

Hadlock, C., & Pierce, J. (2010). New evidence on measuring financial constraints: Moving beyond the KZ index. *Review of Financial Studies*, *23*, 1909–1940.

Hemmer, T., Kim, O., & Verrecchia, R. (2000). Introducing convexity to optimal compensation contracts. *Journal of Accounting and Economics*, *28*, 307–327.

Hennes, K., Leone, A., & Miller, B. (2008). The importance of distinguishing errors from irregularities in restatement research: The case of restatements and CEO/CFO turnover. *Accounting Review*, *83*, 1487–1519.

Hermalin, B., & Weisbach, M. (2003). Boards of directors as an endogenously determined institution: A survey of the economic literature. *Economic Policy Review*, *9*, 7–26.

Holmström, B. (1979). Moral hazard and observability. *Bell Journal of Economics*, *10*, 74–91.

Holmström, B. (1999). Managerial incentive problems: A dynamic perspective. *Review of Economic Studies*, *66*, 169–182.

Holmström, B., & Milgrom, P. (1992). Multitask principal agent analysis: Incentive contracts, asset ownership, and job design. *Journal of Law, Economics, and Organization*, *7*, 24–52.

Hong, H., Kubik, J., & Scheinkman, J. (2012). Financial constraints on corporate goodness. Working Paper

Hoskisson, R., Arthurs, J., White, R., & Wyatt, C. (2012). Multiple agency theory: An emerging perspective on corporate governance. In M. Wright, D. Siegel, K. Keasey, & I. Filatotchev (Eds.), *The Oxford handbook of corporate governance*. Oxford: Oxford University Press.

Indjejikian, R., & Matějka, M. (2009). CFO fiduciary responsibilities and annual bonus incentives. *Journal of Accounting Research*, *47*, 1061–1093.

Jayaraman, S., & Milbourn, T. (2010). Whistle blowing and CEO compensation: The qui tam statute. Working Paper

Jones, C., & Lamont, O. (2002). Short-sale constraints and stock returns. *Journal of Financial Economics*, *66*, 207–239.

Kadan, O., & Yang, J. (2004). Earnings management and the vesting of executive stock options. Working Paper

Kaplan, S., & Zingales, L. (1997). Do investment-cash flow sensitivities provide useful measures of financing constraints? *Quarterly Journal of Economics*, *112*, 169–215.

Karpoff, J., Lee, S., & Martin, G. (2008). The consequences to managers for financial misrepresentation. *Journal of Financial Economics*, *88*, 193–215.

Karpoff, J., Lee, S., & Martin, G. (2008). The cost to firms of cooking the books. *Journal of Financial and Quantitative Analysis*, *43*, 591–612.

Ke, B. (2004). The influence of equity-based compensation on CEO's incentives to report strings of consecutive earnings increases. Working Paper

Kedia, S., & Philippon, T. (2009). The economics of fraudulent accounting. *Review of Financial Studies*, *22*, 2169–2199.

Kothari, S., Leone, A., & Wasley, C. (2005). Performance-matched discretionary accrual measures. *Journal of Accounting and Economics*, *39*, 163–197.

Kwon, I., & Yeo, E. (2009). Overstatement and rational market expectation. *Economics Letters*, *104*, 9–12.

Lamont, O., Polk, C., & Saá-Réquejo, J. (2001). Financial constraints and stock returns. *Review of Financial Studies*, *14*, 529–554.

Linck, J., Netter, J., & Shu, T. (2010). Can earnings management ease financial constraints? Evidence from earnings management prior to investment. Working Paper

Lobo, G., & Zhou, J. (2009). Changes in discretionary financial reporting behavior following the Sarbanes–Oxley Act. *Journal of Accounting, Auditing and Finance*, *25*, 1–26.

Malmendier, U., & Tate, G. (2005). CEO overconfidence and corporate investment. *Journal of Finance*, *60*, 2661–2700.

Merchant, K. (2006). Measuring general managers' performances: Market, accounting, and combination-of-measures systems. *Accounting, Auditing & Accountability Journal*, *19*, 893–917.

Milgrom, P., & Roberts, J. (1992). *Economics, organization and management*. Upper Saddle River: Prentice-Hall.

Peng, L., & Röell, A. (2008). Executive pay, earnings manipulation and shareholder litigation. *Review of Finance*, *12*, 141–184.

Peng, M., & Sauerwald, S. (2013). Principal–principal conflicts. In M. Wright, D. Siegel, K. Keasey, & I. Filatotchev (Eds.), *The Oxford handbook of corporate governance*. Oxford: Oxford University Press.

Rangan, S. (1998). Earnings management and the performance of seasoned equity offerings. *Journal of Financial Economics*, *50*, 101–122.

Schiehll, E., & Bellavance, F. (2009). Boards of directors, CEO ownership, and the use of non-financial performance measures in the CEO bonus plan. *Corporate Governance: An International Review*, *17*, 90–106.

Schipper, K. (1989). Earnings management. *Accounting Horizons*, *3*, 91–102.

Shin, J. (2008). Institutional investment horizons and CEO compensation. Working Paper

Shleifer, A. (2004). Does competition destroy ethical behavior? *American Economic Review*, *94*, 414–418.

Shleifer, A., & Vishny, R. (1990). Equilibrium short horizons of investors and firms. *American Economic Review*, *80*, 148–153.

Stein, J. (1989). Efficient capital markets, inefficient firms: A model of myopic corporate behavior. *Quarterly Journal of Economics*, *104*, 655–669.

Teoh, S., Welch, I., & Wong, T. (1998). Earnings management and the long run market performance of initial public offerings. *Journal of Finance*, *53*, 1935–1974.

Teoh, S., Welch, I., & Wong, T. (1998). Earnings management and the post-issue performance of seasoned equity offerings. *Journal of Financial Economics*, *50*, 63–99.

Useem, M. (2012). The ascent of shareholder monitoring and strategic partnering: The dual functions of the corporate board. In T. Clarke & D. Branson (Eds.), *The SAGE handbook of corporate governance*. Thousand Oaks: SAGE Publications Ltd.

Wang, R. (2008). Executive incentives and financial constraints. Working Paper

Wang, T. (2012). Corporate securities fraud: Insights from a new empirical framework. *Journal of Law, Economics and Organization*, *29*, 535–568.