Abstract

We investigate the implications of stock-based compensation on earnings management, both theoretically and empirically. In particular, we address the following question: does restricted stock compensation induce more earnings management than stock option compensation? We show that increasing the moneyness of the options intensifies earnings management. Ceteris paribus, restricted stock thereby induces more earnings management than stock options. Our empirical evidence supports these predictions. The lag between the stock/option grants and the induced earnings management lies in the range of one to four years, which is consistent with the typical vesting schedules of restricted stock and stock options. Moreover, we examine theoretically the implications of regulatory changes on the optimal design of stock-based compensation. Our results suggest that when accounting standards are improved, more stock options should be granted and with higher exercise prices.

Keywords: Executive Stock Options; Restricted Stock; Earnings Management; Discretionary Accruals; Incentives.

JEL Classifications: D82, G34, J33, M41, M52
1 Introduction

Aimed at aligning the interests of executives and shareholders, stock-based compensation has become the key component of executive compensation over the past two decades. The recent corporate scandals, however, have spurred regulators, investors, and scholars to reexamine the implications of stock-based compensation on shareholder wealth.

Stock-based compensation, on one hand, motivates executives to take real actions to increase firm value. On the other hand, it induces executives to engage in earnings management, which is essentially the difference between the firm’s reported earnings and the economic earnings. This research examines the trade-off between these two effects, focusing on the comparison between restricted stock and stock options - two important, yet arguably controversial components of executive compensation. Hereafter, we will refer to compensation by restricted stock and stock options as Executive Stock Options (ESOs), since restricted stock can be considered a special case of stock options when the exercise price is zero.

This paper addresses the following questions. How do ESOs affect executives’ reporting? In particular, do restricted stock and stock options affect reporting differently? How should compensation committees design ESOs trading off incentives and earnings management? And ultimately, how do regulatory changes affect earnings management and the design of ESOs?

We propose a three-stage principal-agent model. In the first stage, investors (the principal) design an ESO contract. In the second stage, executives (the agent) choose effort levels that determine the distribution of earnings. In the third stage, executives report earnings, and the stock price is determined based on the earnings report. Executives may manipulate the report trading off the benefit of a higher option value and the cost of misreporting. The contract design in the first stage takes the executives’ effort choice and reporting strategy into consideration.

Given that it is costly to engage in earnings management, the executives will only do so

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1See for instance, Demsetz and Lehn (1985); Himmelberg, Hubbard, and Palia (1999); Core and Guay (1999); Rajgopal and Shevlin (2002); and Hanlon, Rajgopal, and Shevlin (2003).
3Actually, restricted stock differs from stock options in some respects; for instance, as opposed to stock options, restricted stock is required to be expensed. In addition, restricted stock holders are entitled to receive dividends while stock option holders are typically not. These distinctions, while possibly important, are not within the scope of this paper.
when the gains from a higher stock price exceed the costs. One main result is that lowering the exercise price of the options induces more earnings management. Essentially, lowering the exercise price makes the options more in-the-money, and hence the marginal benefit from an increased stock price is higher. For this reason, it is more likely that the cost of earnings management will be outweighed by the benefit from the boost in stock price. As an extreme case of stock options, restricted stock is always in-the-money regardless of the stock price. Consequently, restricted stock induces more earnings management than do stock options. A second main result is that increasing the number of ESO grants intensifies earnings management. Intuitively, increasing the number of ESO grants magnifies the extent of stock-based compensation; thus, it is more likely that the benefit from an increased stock price will exceed the cost of earnings management. Additionally, we show that earnings management for both restricted stock and stock options will be mitigated by improved accounting standards that severely penalize executives for misreporting.

We further show numerically how stock-based compensation contracts should be designed in the face of improved regulatory conditions. Our results suggest that more stringent accounting standards that severely penalize the manager for misreporting (1) increase the number of ESO grants as well as the exercise price of the options; (2) reduce earnings management; and (3) improve the real actions of the executives and enhance firm value. Intuitively, more stringent accounting standards mitigate earnings management and therefore allow investors to grant more ESOs. Increasing the exercise price is a way to counterbalance the dilution effect and to prevent excessive earnings management. In general, better accounting standards improve shareholder welfare.

We provide empirical evidence supporting the prediction that lowering the exercise price intensifies the extent of earnings management as measured by discretionary accruals. We find that restricted stock induces more earnings management than stock options. More generally, the moneyness of ESO grants from previous years affects the extent of current earnings management. The lag between the stock/option grants and the induced earnings management lies in the range of one to four years, which is commensurate with the standard vesting schedules of ESOs.

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4Moneyness, defined as the market price of the stock divided by the exercise price of the option, quantifies how much in-the-money an option is.
The prediction that increasing the amount of ESOs induces more earnings management has been tested by Bergstresser and Philippon (2004), Burns and Kedia (2003), and Cheng and Warfield (2004), and their findings corroborate our prediction. Additionally, the prediction that firms tend to increase the exercise price of ESOs is consistent with IBM’s recent moves to grant out-of-the-money executive stock options. On February 25, 2004, IBM announced that its 300 senior executives would receive stock options with an exercise price 10% above the market price on the date of grant. In fact, several European companies, including SAP and Siemens, already made this move in 2003. Interestingly, Microsoft has recently replaced executive stock options with restricted stock. According to our model, this change may lead to more earnings management in the future.

The remainder of the paper is organized as follows. Section 2 reviews related literature. Section 3 models the three-stage principal-agent problem. Section 4 analyzes the model and proposes empirical implications. In Section 5, we provide empirical evidence supporting the model. Section 6 concludes. Appendix A includes proofs and Appendix B contains extensions of the model.

2 Related Literature

Stock-based compensation comprises the fastest-growing component of executive compensation. Jensen and Murphy (1990) find that on average, CEO wealth changes by $3.25 per $1,000 of shareholder value. Most of these performance-related payments are in the form of executive stock holdings. Using more recent data, Hall and Liebman (1998) document a stronger relationship between firm performance and CEO compensation. They credit stock option grants for this change. By the end of the 1990s, stock-based pay peaked at over 60% of total executive pay (Hall 2002).

The incentive alignment aspect of stock-based compensation has been tested extensively. Hanlon, Rajgopal and Shevlin (2003) find a markedly positive relation between ESO grants and future earnings. The future operating income associated with a dollar of stock options granted to top five executives is $3.71. In addition, Demsetz and Lehn (1985), Himmelberg, Hubbard, and Palia (1999), Core and Guay (1999), and Rajgopal and Shevlin (2002) confirm
that granting options is consistent with firm value maximization.\textsuperscript{5}

Executive compensation has also been blamed for inducing earnings management. This observation dates back to Healy’s (1985) seminal paper showing that earnings management relates to earnings-based compensation. Three recent papers document that a higher extent of stock-based compensation also induces more earnings management. The papers differ in the way they measure earnings management: Bergstresser and Philippon (2004) use discretionary accruals and Burns and Kedia (2003) use earnings restatements to measure earnings management, while Cheng and Warfield (2004) capture earnings management by detecting earnings announcements that meet or beat analyst forecasts by only one penny.

A growing theoretical literature has recently begun to examine the relation between executive compensation and earnings management. Goldman and Slezak (2003) link executive stock compensation to fraudulent misreporting and conclude that the public policy actions intended to reduce misrepresentation may sometimes increase fraudulent behavior. They show that separating the provision of auditing and consulting services will reduce fraud, but will also reduce firm value. Guttman, Kadan, and Kandel (2004) show that executive stock compensation rationalizes the kink in accounting earnings.\textsuperscript{6} Contrary to these two papers, we focus on the comparison between restricted stock and stock options, and their impact on earnings management.


To the best of our knowledge, there is no other paper that compares the incentive effects of restricted stock and stock options incorporating their impact on earnings management. This

\textsuperscript{5}In contrast, Yermack (1995) claims that stock option awards are not consistent with the economic theory that suggests granting them. Hall and Murphy (2003) argue that employee stock options are used inefficiently, perhaps, because boards and executives falsely perceive stock options to be inexpensive due to accounting and cash flow considerations.

\textsuperscript{6}The compensation contract in Guttman et al. (2004) is exogenously given while it is determined optimally by investors in our model.
paper focuses on this comparison. The paper does not, however, address intertemporal aspects of earnings management such as earnings smoothing.\textsuperscript{7}

3 Model

We present a three-stage principal-agent model. In the first stage, risk neutral investors (the principal) design a stock option compensation contract to motivate an effort-averse manager (the agent). We assume that the manager is risk neutral and wealth constrained. Risk neutrality allows us to focus on the trade-off between incentives and earnings management.\textsuperscript{8} The wealth constraint implies that investors cannot sell the firm to the manager precluding the first-best implementation of the incentive contract. In the second stage, the manager chooses the level of effort that determines the distribution of earnings. In the third stage, earnings are realized. The manager reports earnings to investors trading off the benefit of a boosted stock price and the cost of earnings management. Based on the earnings report, investors form beliefs on true earnings and determine the stock price accordingly. Figure 1 presents the time line of the model.

[Insert Figure 1 about here]

We restrict attention to restricted stock and stock options. These contracts are widely used in executive compensation, and we believe that studying them thoroughly is of practical importance.\textsuperscript{9} Formally, a contract is a pair \((\alpha, K)\) where \(\alpha \in [0, 1]\) is the proportion of outstanding shares granted to the manager if the options are exercised, and \(K \geq 0\) is the exercise price.\textsuperscript{10} While taking a small liberty with the notation, we refer to \(\alpha\) as the number of ESO grants in later discussions. Restricted stock is represented by \(K = 0\) while stock options are represented by \(K > 0\).

Given this contract, the manager chooses an effort level \(a \geq 0\) in the second stage to maximize his expected payoff function. This effort level determines the distribution of earnings

\textsuperscript{7}See, for instance, DeFond and Park (1997) for empirical evidence and Graham, Harvey, and Rajgopal (2004) for survey information on earnings smoothing.

\textsuperscript{8}The trade-off between incentives and risk sharing of ESOs has been explored by Cadenillas, Cvitanic, and Zapatero (2004) and Kadan and Swinkels (2004). Carpenter (2000) and Ross (2004) show that option grants do not necessarily lead to risk-taking behaviors.

\textsuperscript{9}Ross (2004) makes a similar argument in support of restricting attention to stock option contracts.

\textsuperscript{10}Most executive stock options vest over certain periods. In this static model, we do not differentiate the newly granted and the exercisable ESOs. Or equivalently, we only deal with the vesting years.
$x$ as follows: for any effort level $a$, the cumulative distribution is $F(x|a)$ and the density function is $f(x|a)$. We assume that $F(x|a)$ is twice differentiable. The effort level does not change the support of the distribution. Moreover, $f(x|a)$ satisfies the Monotone Likelihood Ratio Property (MLRP), namely, $\frac{f_a(x|a)}{f(x|a)}$ increases in $x$. This, in turn, implies that a higher effort level shifts the distribution of earnings to the right in the sense of first-order stochastic dominance; namely, $F_a(x|a) < 0$.

In the third stage, earnings $x$ are realized and observed by the manager. The manager chooses an earnings report $x^R = \rho(x)$. Given this report, investors set the stock price at $\varphi(x^R)$ based on their beliefs. The value of the option in this case is $\max\{\varphi(x^R) - K, 0\}$. The third stage payoff to a manager who observes $x$ and reports $x^R$ is given by

$$u^M(x, x^R) = \alpha \max\{\varphi(x^R) - K, 0\} - \beta(x^R - x)^2. \tag{1}$$

The first term is the total value of the stock options. It is the number of ESO grants multiplied by the value of a stock option upon expiration. The second term is the cost of earnings management which is convex in the amount of misreporting. The unit penalty for misreporting $\beta > 0$ represents the stringency of the accounting rules. The higher is the $\beta$, the more severely the manager is penalized for misreporting. The coefficient $\beta$ could be interpreted as the penalty when the manager is caught committing fraudulent actions. It could also be interpreted as the negative price effects when earnings management is reversed or the financial statements are restated in the future. Notice that in this static model, $\beta$ captures, to a certain extent, the long-run mean-reverting properties of earnings management. Under this formulation, only the manager bears the cost of earnings management. The case that earnings management damages firm value directly is discussed in Appendix B. The results are similar.

Basically, the third stage is a signaling game. The informed manager provides a signal (a report) to the uninformed investors. Signalling is costly because earnings management is

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11 This objective function is a variant of the one originally used by Fischer and Verrecchia (2000). They, however, restrict attention to stocks only. Given that the manager is risk neutral, a fixed wage will not affect incentives. Thus, we ignore it.

12 The choice of a quadratic cost function is for mathematical tractability. It is a convenient way to capture the tension between the benefits and the costs of earnings manipulation.

13 According to the report of the U.S. General Accounting Office (GAO), over the period of January 1, 1997 and June 30, 2002, there were 919 financial restatements in which about 10 percent of publicly traded companies were involved. On average, the stock prices dropped by 10 percent from the day before to the day after the restatement.

14 See, for instance, Defond and Park (2001) for the empirical evidence on the mean reversion property of discretionary accruals.
costly to the manager.

Given (1), the manager maximizes the following objective function when choosing the effort level in the second stage:

\[
U_M(\alpha, K, \beta, a) = \int_{x=0}^{\infty} u^M(x, \rho(x)) f(x|a) dx - c(a)
\]

\[
= \alpha \int_{x=0}^{\infty} \max\{\varphi(\rho(x)) - K, 0\} f(x|a) dx - \beta \int_{x=0}^{\infty} (\rho(x) - x)^2 f(x|a) dx - c(a),
\]

(2)

where \(c(a)\) denotes the disutility of exerting effort and satisfies \(c' > 0\) and \(c'' > 0\).

In the first stage, investors design an ESO contract by optimally choosing the number of ESO grants and the exercise price of the options. Formally, investors choose \(\alpha^* \in [0, 1]\) and \(K^* \geq 0\) to maximize

\[
U_I(\alpha, K, \beta) = \int_{0}^{\infty} \varphi(\rho(x)) f(x|a^*) dx - \alpha \int_{K}^{\infty} (\varphi(\rho(x)) - K) f(x|a^*) dx,
\]

(3)

subject to

\[
a^* = \arg\max_a U_M(\alpha^*, K^*, \beta, a).
\]

(4)

The first term of (3) is the expected firm value given the optimal effort level of \(a^*\). The second term is the expected compensation to the manager. Equation (4) reflects the fact that the manager chooses the optimal effort level in the second stage. Essentially, the investors design the ESO contract by trading off the benefit of the improved incentives and the cost of diluting ownership in the firm.

4 Analysis

In this section, we solve the proposed three-stage principal-agent model backwards. We start by characterizing the unique separating equilibrium in the third stage reporting game. Then, we study the effort choice of the manager in the second stage that takes into account the equilibrium reporting strategy in the third stage. Finally, we provide numerical results regarding the optimal design of ESO contracts in the first stage.
4.1 The Third Stage: Reporting

In the reporting stage, the manager observes the realized earnings and reports to the investors. Recall that the payoff to the manager who observes true earnings $x$ and reports $x^R$ is given by

$$u^M(x, x^R) = \alpha \max\{\varphi(x^R) - K, 0\} - \beta(x^R - x)^2.$$ 

A Perfect Bayesian Equilibrium in this stage is composed of a reporting function for the manager $\rho(\cdot)$ and a pricing function for investors $\varphi(\cdot)$ such that:

1. Reporting $\rho(x)$ is optimal for the manager given the pricing function of investors. Namely,

   $$\rho(x) = \arg\max_{x^R} u^M(x, x^R).$$

2. Investors’ pricing function $\varphi(\cdot)$ is consistent with $\rho(\cdot)$ using Bayes’ Rule whenever possible.

This reporting game may have multiple equilibria. While all other equilibria involve some extent of pooling and require additional distributional conditions as well as restrictive assumptions on out-of-equilibrium beliefs, there exists a unique separating equilibrium. We focus on this separating equilibrium in our model.

4.1.1 The Separating Equilibrium

Formally, an equilibrium is separating if the reporting function of the manager completely reveals his private information to the investors. Namely, $\rho(\cdot)$ is invertible and $\varphi = \rho^{-1}$. In a separating equilibrium, investors are not fooled by the manager’s report; they can precisely infer the manager’s type (true earnings) based on the earnings report. The manager, however, may still find it optimal to misreport trading off the benefit of an increased option value and the cost of earnings management. An alternative approach would be to assume that investors are naive and are misled by the manager. We analyze this case in Appendix B. The results are similar.

The following proposition characterizes this separating equilibrium.

PROPOSITION 1 There exists a unique separating equilibrium in the reporting stage given
implicitly by
\[
\varphi(x^R) = \rho^{-1}(x^R) = \begin{cases} 
  x^R & \text{if } x^R < K; \\
  x^R - \frac{\alpha}{2\beta} + \frac{\alpha}{2\beta} e^{\frac{2\beta(K-x^R)}{\alpha}} & \text{if } x^R \geq K.
\end{cases}
\]  
(6)

The equilibrium reporting function \(\rho(x)\) strictly increases in \(x\) for all \(x \geq 0\). Moreover, both earnings management \(\rho(x) - x\) and the manager’s payoff \(u^M(x, \rho(x))\) strictly increase in \(x\) for \(x \geq K\).

Proof. See Appendix A.

Deriving the reporting function \(\rho(\cdot)\) directly is not possible. Equation (6) gives the inverse of the equilibrium reporting function. This implicit formulation allows us to study all the properties of this equilibrium.

Observe first that a manager with earnings below or at \(K\) reports truthfully. In contrast, a manager with earnings above \(K\) manipulates reported earnings upwards. The extent of earnings manipulation is \(\rho(x) - x = \frac{\alpha}{2\beta} \left(1 - e^{\frac{2\beta(K-x^R)}{\alpha}}\right)\) when \(x \geq K\). Since the expression in the parentheses is positive and smaller than 1, earnings management is positive and bounded from above by \(\frac{\alpha}{2\beta}\). Figure 2 depicts the reporting strategy using \(\alpha = 0.4, \beta = 0.5,\) and \(K = 0.3\).

[Insert Figure 2 about here]

The intuition of this implicit reporting function is as follows. The manager, regardless of the true earnings (referred to hereafter as the type of the manager), never manipulates earnings downwards; such a manipulation not only reduces the stock price, and hence the option value, but also incurs a cost of earnings management. Additionally, a type \(K\) manager strictly prefers to report truthfully. This assures him a zero profit: the options have zero value and there is no manipulation cost. In contrast, if the type \(K\) manager manipulates earnings upwards, he has to manipulate significantly due to the steep curve at \(K\) (see Figure 2; the slope of the reporting function at \(K\) is infinite). The cost of earnings management then dominates the value of the options.

Moreover, any manager with true earnings less than \(K\) also reports truthfully. The payoff for the truthful reporting is zero. If he manipulates earnings upwards and reports a value below \(K\), the payoff is negative: the options remain underwater and he incurs the cost of earnings.
management. On the other hand, if this manager reports above $K$, he obtains the same option values as the type $K$ manager, while he has to manipulate earnings by a larger amount. Since a type $K$ manager is better off telling the truth, the manager whose type is below $K$ reports truthfully as well. Finally, any manager whose type is above $K$ manipulates earnings upwards. The extent of manipulation is determined by the first order condition of the maximization problem.

### 4.1.2 Properties of the Separating Equilibrium

In the following, we discuss how the compensation contract $(\alpha, K)$ and the stringency of the accounting standards $\beta$ affect the reporting strategy and the extent of earnings management.

Lowering the exercise price (a smaller $K$) increases the moneyness of the ESOs and thus increases the marginal benefit of a higher stock price. The manager then tends to manipulate earnings more to boost the stock price. Graphically, a lower exercise price has two effects: first, it enlarges the range within which earnings are misreported; secondly, it increases the extent of misreporting for each realization of earnings above $K$; see Figure 3. Both effects work in the direction of intensifying the extent of earnings management. Given that restricted stock is always in-the-money ($K = 0$), the marginal benefit from earnings management in this case is the highest. Thus, everything else being equal, restricted stock induces more earning management than stock options.

[Insert Figure 3 about here]

Increasing the number of ESO grants (a higher $\alpha$) also increases the marginal benefit of a higher stock price and hence induces the manager to engage in earnings management. In contrast, increasing the penalty for misreporting (a higher $\beta$) mitigates earnings management. Figure 4 demonstrates these two effects. The magnitude of earnings management is bounded from above by $\frac{\alpha}{2\beta^2}$. As $\alpha$ increases or $\beta$ decreases, this bound shifts upwards, and the magnitude of earnings management increases everywhere above $K$.

[Insert Figure 4 about here]

Corollary 1 summarizes the above results.
**COROLLARY 1** For any realized earnings \( x \geq K \), the reporting strategy \( \rho(x) \) given in (6) strictly decreases in the exercise price \( K \), strictly increases in the number of ESO grants \( \alpha \), and strictly decreases in the stringency of the accounting standards \( \beta \). Namely, (1) \( \frac{\partial \rho(x)}{\partial K} < 0 \), (2) \( \frac{\partial \rho(x)}{\partial \alpha} > 0 \), and (3) \( \frac{\partial \rho(x)}{\partial \beta} < 0 \) hold.

Proof. See Appendix A.

Notice that we have not used any distributional assumption on earnings in deriving the separating equilibrium. Indeed, the reporting strategy does not depend on the underlying distribution of earnings because earnings are already realized in the third stage. We do, however, need to use the distributional information to calculate the expected earnings management and the expected cost of earnings management in this separating equilibrium.

The expected earnings management, \( eem \), is
\[
eem = \int_{x=K}^{\infty} (\rho(x) - x) f(x|a) \, dx, \tag{7}
\]
where \( \rho(x) \) satisfies the implicit function (6).

The expected cost of earnings management incurred by the manager, \( cem \), is
\[
cem = \beta \int_{x=K}^{\infty} (\rho(x) - x)^2 f(x|a) \, dx. \tag{8}
\]

We have the following comparative statics:

**PROPOSITION 2** Both the expected earnings management and the expected cost of earnings management strictly decrease in the exercise price \( K \), strictly increase in the number of ESO grants \( \alpha \), and strictly decrease in the stringency of the accounting standards \( \beta \). Namely, \( \frac{\partial eem}{\partial K} < 0 \), \( \frac{\partial eem}{\partial \alpha} > 0 \), \( \frac{\partial eem}{\partial \beta} < 0 \), \( \frac{\partial cem}{\partial K} < 0 \), \( \frac{\partial cem}{\partial \alpha} > 0 \), and \( \frac{\partial cem}{\partial \beta} < 0 \) hold.

Proof. See Appendix A.

Proposition 2 is the main theoretical result used in our empirical analysis. It implies that the more in-the-money the option is, the higher the extent of induced earnings management. Everything else being equal, stocks induce more earnings management than options.

### 4.2 The Second Stage: Effort Choice

In the second stage, the manager chooses the level of effort to maximize the expected payoff net of the disutility of exerting effort. Recall that with the separating equilibrium in the third
stage, the stock price \( \varphi(x^R) \) equals the true earnings \( x \). Thus, the manager chooses the effort level \( a^* \geq 0 \) to maximize

\[
U^M(\alpha, K, \beta, a) = \int_{x=K}^{\infty} u^M(x, \rho(x)) f(x|a) dx - c(a)
\]

\[
= \int_{x=K}^{\infty} \left( \alpha(x - K) - \beta(\rho(x) - x)^2 \right) f(x|a) dx - c(a).
\]

We use the First-Order Approach (see Holmström 1979); i.e., we replace (9) with its first order condition. In order to justify this approach, we assume that \( f(x|a) \) satisfies the Convexity of the Distribution Function Condition (CDFC: \( F_{aa}(x|a) \geq 0 \) for any \( x \) and \( a \); see Rogerson 1985).

Define the derivative of \( u^M(\alpha, K, \beta, a) \) with respect to \( a \) as

\[
H(\alpha, K, \beta, a) \equiv \frac{\partial U^M(\alpha, K, \beta, a)}{\partial a} = \int_{x=K}^{\infty} \left( \alpha(x - K) - \beta(\rho(x) - x)^2 \right) f_a(x|a) dx - c'(a).
\]

The first order condition \( H(\alpha, K, \beta, a) = 0 \) yields the optimal level of effort \( a^* \) as a function of \( \alpha, K, \) and \( \beta \).

We know from Proposition 1 that \( u^M(x, \rho(x)) \) increases in \( x \). Additionally, an increased level of effort shifts the distribution of earnings to the right in the sense of first-order stochastic dominance. These conditions imply that \( \int_{x=K}^{\infty} u^M(x, \rho(x)) f(x|a) dx \) increases in \( a \). The following proposition is a direct consequence of this observation. It shows that the increased value of the options from exerting higher effort dominates the increased cost of induced earnings management.

**PROPOSITION 3** The positive effect of higher effort on the value of stock options dominates its negative effect on the cost of earnings management. Namely, we have

\[
\frac{\partial}{\partial a} \int_{x=K}^{\infty} \alpha(x - K)f(x|a) dx > \frac{\partial}{\partial a} \int_{x=K}^{\infty} \beta(\rho(x) - x)^2 f(x|a) dx.
\]

\[15\]Note that

\[
\frac{\partial H(\alpha, K, \beta, a)}{\partial a} = -\alpha \int_{x=K}^{\infty} F_{aa}(x|a)(1 - e^{2(K - x-a)} \rho(x)) dx - c''(a).
\]

Because \( c''(a) > 0 \) and \( F_{aa}(x|a) \geq 0 \) by the CDFC, the manager’s utility is concave in effort \( a \): \( \frac{\partial H(\alpha, K, \beta, a)}{\partial a} < 0 \). Therefore, the first-order approach is indeed valid and we replace the maximization of (9) with its first order condition \( H(\alpha, K, \beta, a) = 0 \).
Proof. See above.

Intuitively, increasing effort while $\alpha$, $K$, and $\beta$ are fixed, increases the value of the stock options as well as the cost of earnings management. However, the expected cost of earnings management never increases as rapidly as the expected value of ESOs; see Figure 5.

[Insert Figure 5 about here]

The following proposition gives the comparative statics of the optimal effort level with respect to the changes in the compensation contract ($\alpha, K$) and the stringency of the accounting standards $\beta$.

**PROPOSITION 4** The optimal effort $a^*$ strictly decreases in the exercise price $K$, strictly increases in the number of ESO grants $\alpha$, and strictly increases in the stringency of accounting standards $\beta$. Namely, we have $\frac{\partial a^*}{\partial K} < 0$, $\frac{\partial a^*}{\partial \alpha} > 0$, and $\frac{\partial a^*}{\partial \beta} > 0$.

Proof. See Appendix A.

A higher $K$ or a lower $\alpha$ reduces the cost of earnings management, but it reduces the value of the stock options even more. As a result, an increased $K$ or a reduced $\alpha$ reduces the level of optimal effort. Increasing $\beta$ does not directly affect the value of the stock options, yet it reduces earnings management. As a result, a higher $\beta$ induces the manager to exert higher effort.

### 4.3 The First Stage: Contract Design

In the first stage, investors design an ESO contract by optimally choosing the number of ESO grants and the exercise price of the options. Investors trade off firm value and dilution, taking into account the manager’s optimal effort choice and reporting strategy in later stages. Formally, investors choose $\alpha^* \in [0, 1]$ and $K^* \geq 0$ to maximize

$$U^I(\alpha, K, \beta) = \int_0^\infty x f(x|a^*) dx - \alpha \int_K^\infty (x - K) f(x|a^*) dx,$$

subject to

$$a^* \in \arg\max_a U^M(\alpha^*, K^*, \beta, a).$$

We are unable to solve this optimization problem analytically. Therefore, we provide numerical results using three distribution functions of earnings:
1. **The Power Distribution.** For $x \in [0, 1]$ and $a \in (0, 1]$, the density is $f(x|a) = ax^{a-1}$. This distribution satisfies MLRP and CDSC.

2. **The Farlie-Gumbel-Morgenstern Copula Distribution.** For $x \in [0, 1]$ and $a \in [0, 1]$, the density is $f(x|a) = 1 + \frac{1}{2}(1 - 2x)(1 - 2a)$. This distribution satisfies MLRP and CDSC.\(^{16}\)

3. **The Lognormal Distribution.** For $x > 0$ and $a \geq 1$, the density is $f(x|a) = \frac{1}{\sigma x \sqrt{2\pi}} e^{-\left(\ln(x) - \ln(a)\right)^2/2 \sigma^2}$. This distribution satisfies MLRP but not CDSC, which is sufficient but not necessary for our results. To validate the results with this distribution, we have checked numerically that the solution to the optimization problem (9) is unique. The numerical results use $\sigma = 0.1$.

Under all three distributions, we use a quadratic disutility function of $c(a) = 0.25a^2$. The primary interest is the impact of improved accounting standards, measured by $\beta$, on the optimal design of the ESO contract, total compensation, earnings management, and social welfare (defined as the total value of the firm less the cost of earnings management and the disutility of exerting effort). The range of $\beta$ is $[1, 5]$.\(^{17}\)

[Insert Figures 6, 7, and 8 about here]

**Optimal Contract.** Under all three distributions, we obtained similar results: improving accounting standards (a higher $\beta$) increases both the number of ESO grants $\alpha^*$ and the exercise price of the options $K^*$. Intuitively, improving accounting standards increases the unit cost of earnings management; hence, the manager is less likely to engage in earnings management. This allows investors to grant more stock options. To prevent excessive earnings management and to counterbalance the dilution effect caused by the increase in ESO grants, investors raise the exercise price of the options as well. The top boxes of Figures 6, 7, and 8 show these results: both $\alpha^*$ and $K^*$ increase in $\beta$.

**Total Compensation.** Improving accounting standards increases the number of ESO grants as well as the exercise price of these options. These two changes have contradictory

\(^{16}\)The Uniform Distribution $U(0, 1)$ is a special case of the Power Distribution when $a = 1$ and a special case of the Copula Distribution when $a = 0.5$.

\(^{17}\)If the unit cost of exerting effort $c$ is sufficiently high or the unit penalty $\beta$ is sufficiently low, it is then not optimal for the investors to grant any option to the manager: $\alpha^* = 0$. 

15
effects on total compensation of the manager: more ESO grants increase the total compensation while a higher exercise price reduces it. As a result, the net effect of improving accounting standards on total compensation remains unclear. Specifically, as the accounting standards get improved, the total compensation increases under the Power Distribution and the FGM Copula Distribution and decreases under the Lognormal Distribution; see the middle left box of Figures 6, 7, and 8.

**Earnings Management.** Under all three distributions, improving accounting standards reduces earnings management; see the middle right box of Figures 6, 7, and 8. This allows investors to increase ESO grants to incentivize the manager without inducing him to excessively engage in costly earnings management.

**Social Welfare.** In all three cases, the optimal effort increases as the stringency of the accounting standards rises. As a result, shareholder wealth and social welfare are improved as well; see the bottom boxes of Figures 6, 7, and 8.

In summary, the numerical results show that improving accounting standards increases the number of ESO grants as well as the exercise price of the options, reduces earnings management, enhances social welfare, and has an ambiguous effect on total compensation.

### 4.4 Empirical Implications

The model yields several testable implications.

- **Everything else being equal, lowering the exercise price of ESOs intensifies earnings management.** Lowering the exercise price increases the moneyness of the options. Thus, we expect to find a positive correlation between the moneyness of the ESOs and earnings management. In particular, restricted stock induces more earnings management than stock options. To the best of our knowledge, this prediction has not been empirically tested. We test it in Section 5.

- **Everything else being equal, increasing the amount of stock-based compensation induces more earnings management.** This prediction is consistent with the findings in Bergstresser and Philippon (2004), Burns and Kedia (2004), and Cheng and Warfield (2004).

- **Improved accounting standards reduce the extent of earnings management.** This prediction is consistent with the findings in Cohen, Dey, and Lys (2004) and Leuz, Nanda, and
• Improved accounting standards increase the number of ESO grants as well as the exercise price of options, and enhance firm value.

Observe that a clean test of the last prediction is precluded by the current regulatory environment. Under current accounting rules (FASB 123), as opposed to restricted stock, stock options are not required to be expensed in the income statement. This gives an advantage to stock options compared to restricted stock, which is not captured by our model. As a result, stock options might have been overused; see Hall and Murphy (2003) for such an argument. The FASB proposed to mandate public companies to expense employee stock options granted, modified, or settled after December 15, 1994 starting on June 15, 2005. Consequently, some firms may adjust stock option grants downwards and increase restricted stock grants. The last prediction of our model is useful in deriving the optimal stock-based compensation when restricted stock and stock options are treated more equally by accounting rules.

5 Empirical Tests

In this section, we empirically test the predictions of the theoretical model. We propose the main hypothesis, explain the econometric approach, describe the data, and demonstrate the results.

5.1 Hypothesis

Our main hypothesis is that, ceteris paribus, restricted stock compensation induces more earnings management than stock option compensation. Moreover, increasing the moneyness of ESOs induces more earnings management. To test this, we use the following generic model:

\[ DA = \delta + \eta X + \sum_{j=1}^{n} \theta_j Y_j + \varepsilon, \]  

(14)

where \( DA \) is earnings management measured by Discretionary Accruals, and \( X \) is a variable capturing the mix between restricted stock and stock options or the moneyness of ESOs. \( Y_j, j = 1, \ldots, n, \) are control variables. The \( \eta \) coefficient is the primary interest of this test. It provides a point estimate of the magnitude of earnings management attributable to changes in \( X \). The null hypothesis is \( \eta = 0 \).
We perform two tests. The first one tests the effect of the compensation mix between restricted stock and stock options on earnings management. The $X$ variable is measured by the value of restricted stock grants as a percentage of the total stock-based compensation. A higher value of $X$ implies that the stock-based compensation is tilted more towards restricted stock. Thus, the $\eta$ coefficient is expected to be positive according to our model. The second test examines the impact of the moneyness of ESOs, as measured by the value-weighted exercise price scaled by the average price of the stock, on earnings management. A higher value of $X$ implies that the options are less in-the-money. Hence, we expect to have a negative $\eta$.

In order to test the hypothesis, we first estimate earnings management. The next subsection explains the methodology used for this purpose.

### 5.2 Measuring Earnings Management

Earnings management is measured by discretionary accruals. We use a cross-sectional version of the modified Jones (1991) model introduced by Dechow, Sloan, and Sweeney (1995). It is similar to the cross-sectional Jones model used in Teoh, Welch, and Wong (1998a,b). All the data used in calculating discretionary accruals are from the *Compustat* database.

The first step is to calculate total accruals which are basically the difference between net income before extra items and operating cash flows. Formally, we follow Dechow, Sloan, and Sweeney (1995) and calculate total accruals for firm $i$ in year $t$, $TA_{i,t}$, as:

$$TA_{i,t} = (\Delta CA_{i,t} - \Delta Cash_{i,t}) - (\Delta CL_{i,t} - \Delta STD_{i,t}) - Dep_{i,t},$$

where all terms in (15) are scaled by the beginning-year firm assets $A_{i,t-1}$ (*Compustat* item 6 in year $t-1$) and

\[
\begin{align*}
\Delta CA_{i,t} &= \text{change in current assets (item 4)} \\
\Delta Cash_{i,t} &= \text{change in cash and cash equivalent (item 1)} \\
\Delta CL_{i,t} &= \text{change in current liabilities (item 5)} \\
\Delta STD_{i,t} &= \text{change in debt included in current liabilities (item 34)} \\
Dep_{i,t} &= \text{depreciation and amortization (item 14)}.
\end{align*}
\]

\[\text{All the results remain qualitatively the same when discretionary accruals are calculated using the cash flow based approach proposed by Teoh, Welch, and Wong (1998a,b).}\]
Total accruals are decomposed into two components: non-discretionary accruals and discretionary accruals. Non-discretionary accruals are the accruals induced by normal business activities, such as increased sales and fixed assets. Discretionary accruals are not a direct consequence of normal business activities and are subject to managerial judgement.

In order to separate discretionary accruals from non-discretionary accruals, we follow DeFond and Subramanyam (1998) and run the following cross-sectional regression using all firms with the same two-digit SIC code for each year:

\[
TA_{i,t} = \delta + \eta_1 (\Delta Sales_{it} - \Delta REC_{it}) + \eta_2 PPE_{it} + v_{i,t},
\]

(16)

where all terms in (16) are scaled by the beginning-year firm assets \(A_{i,t-1}\) (item 6 in year \(t-1\)) and

\[
TA_{i,t} = \text{total accruals calculated in Equation (15)}
\]
\[
\Delta Sales_{it} = \text{change in revenues (item 12)}
\]
\[
\Delta REC_{it} = \text{change in accounts receivable (item 2)}
\]
\[
PPE_{it} = \text{level of gross property, plant and equipment (item 7)}.
\]

The change in sales less the change in accounts receivable, and the level of property, plant and equipment capture the normal changes in accruals driven by the growth in operating activities and investments. Thus, the residuals of the regressions reflect transitory accounting distortions. By running industry-year regressions, we control for the influence of changing industry-wide economic conditions on earnings management.

5.3 Data

We use the Compustat Industrial Annual database for the financial statement data and the Standard & Poor’s ExecuComp database for the compensation data. The period under consideration is 1992 to 2003 because the ExecuComp database does not contain data prior to 1992.

We only look at CEO compensation using firms that appear in both databases and have the required information to calculate total accruals along with the changes in sales and accounts receivable and the levels of gross property, plant, and equipment. We exclude financial institutions (SIC codes between 6000 and 6999) and regulated utilities (SIC codes between 4900 and 4999) because they are subject to unique disclosure requirements.\(^{19}\)

\(^{19}\)We further drop firms with a market capitalization below $1 million, the ratio of operating cash flows to lagged total assets below -1, or book-to-market equity below -100. The results are not sensitive to these cut-off
To calculate discretionary accruals, we group the observations into industries by the first two-digit SIC code in each year. The model is then estimated individually for each two-digit SIC-year with at least 10 observations, similar to Teoh, Welch, and Wong (1998a,b) and Kothari, Leone, and Wasley (2004). This leaves us with 319 industry-year groups for running regressions specified in (16). We drop the top 1% and bottom 1% firm-years in the sample in terms of discretionary accruals, resulting in 10,485 firm-years of which 10,213 firm-years have monthly return data available in CRSP. These 10,213 observations (covering 1,716 firms in 35 industries) are used in the regressions specified in (14).

Panel A of Table 1 reports statistics on CEO compensation. The mean of the total compensation is about $4 million, of which over 50% is awarded in stock options. On average, the value of stock option grants is roughly nine times the value of restricted stock grants. Moreover, restricted stock is present in 19.3% of firm-years, stock options are present in 74.9% of firm-years, and bonuses are present in 77.7% of firm-years.

Panel B of Table 1 reports firm characteristics. Observe that firms in the sample are large, consistent with previous empirical examinations that use the ExecuComp data. The mean market capitalization and book assets are about $6 billion and $4 billion, respectively.

Table 2 summarizes regression fit statistics and distributional properties of discretionary accruals. We find a positive coefficient on $(\Delta Sales - \Delta REC)$ and a negative coefficient on $PPE$. This is consistent with prior research on discretionary accruals; see, for instance, Larcker and Richardson (2004). The mean adjusted $R^2$ is 21%. On average, discretionary accruals account for 0.14% of the beginning-year total assets. In dollar terms, there is $5.42$ million ($0.014*3,958$) of earnings management for the average firm in the sample. It accounts for about 3% ($5.42/177.9$) of earnings as measured by income before extra items (Compustat item 123).

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20 Winsorizing the top 1% and bottom 1% samples does not change the results.
5.4 Empirical Results

5.4.1 Restricted Stock vs. Stock Options

Our model suggests that everything else being equal, restricted stock induces more earnings management than stock options. The main variable of consideration is the ratio of the value of restricted stock grants to the total value of stock-based compensation in a specific year.

Notice that the model proposed in Section 4 is a one-period model. Essentially, it only deals with the vesting years. It is a convention that stock options vest over a period of three to four years, typically in equal installments each year. In contrast, we know very little about the vesting schedules of restricted stock.\textsuperscript{21} We checked the proxy statements of 50 randomly-selected firms (in various industries) that granted restricted stock during 2003. While showing various vesting patterns, the majority of the restricted stock vests in three to four years, similar to stock options.\textsuperscript{22}

Since both restricted stock and stock options typically vest over three to four years, when looking at earnings management in year $t$, we are interested in the structure of CEO compensation in year $t - \tau$ with $\tau = 0, \ldots, 4$. Formally, we define:

$$RSRATIO_{i,t-\tau} = \frac{RSTKGRNT_{i,t-\tau}}{RSTKGRNT_{i,t-\tau} + BLKVALU_{i,t-\tau}},$$

where $RSTKGRNT_{i,t-\tau}$ is the total value of restricted stock granted by firm $i$ in year $t - \tau$ and $BLKVALU_{i,t-\tau}$ is the aggregate Black-Scholes value of stock options granted during the year.

Our model suggests that a higher $RSRATIO$ in year $t - \tau$ induces more earnings management in year $t$, where the relevant $\tau$ relates to the vesting schedules. To test this prediction, we control for firm characteristics and CEO compensation data that potentially affect discre-

\textsuperscript{21}The ExecuComp database does contain partial information regarding the initial vesting date of restricted stock in the variable $RSTKVYRS$. We suggest that one should use this information with caution. $RSTKVYRS$ is defined as “the number of years until restricted stock granted during the year begins vesting.” This is only reported when vesting begins in three years or less.” Actually, $RSTKVYRS$ is only reported when vesting begins in two years or less: $RSTKVYRS \in \{0, 1, 2\}$. In our sample, 94% of the firm-years that have restricted stock grants are reported “missing” in the variable $RSTKVYRS$. We compared the information in this variable to a sample of proxy statements and found significant differences between the two.

\textsuperscript{22}The distribution of the vesting schedules over the 50 samples is: 19 vest in full 3 years after the grant date (8 of equal installments, 10 of lump sum vesting at the third anniversary of the grant, and 1 of lump sum vesting at the second anniversary of the grant), 4 vest in 3 years only if predetermined performance goals are achieved, 9 vest 4 years after the grant date (6 of equal installments and 3 of lump sum vesting at the fourth anniversary of the grant), 1 vests in 4 years only if predetermined performance goals are achieved, 11 finish vesting in longer periods, 2 are purely performance-based, and 4 have no vesting information reported in the proxy statements.
tionary accruals. We run five separate regressions ($\tau = 0, \ldots, 4$) of the form:\(^{23}\)

$$DA_{i,t} = \delta + \eta RSRATIO_{i,t-\tau} + \theta_1 SBCLEVEL_{i,t-\tau} + \theta_2 OWNERSHIP_{i,t} + \theta_3 BONUS_{i,t}$$

$$+ \theta_4 SALARY_{i,t} + \theta_5 TENURE_{i,t} + \theta_6 SIZE_{i,t} + \theta_7 BM_{i,t}$$

$$+ \theta_8 CFO_{i,t} + \theta_9 RETURN_{i,t} + \varepsilon_{i,t}. \quad (18)$$

where

- $DA_{i,t} =$ discretionary accruals scaled by lagged assets
  
- $SBCLEVEL_{i,t-\tau} =$ total number of restricted stock and options granted during the year scaled by total outstanding shares
  
- $OWNERSHIP_{i,t} =$ percentage of ownership
    $$(SHROWN/(1000 \times SHRSOUT))$$

- $BONUS_{i,t} =$ bonus payments ($BONUS$) scaled by total compensation ($TDC1$)

- $SALARY_{i,t} =$ salary payments ($SALARY$) scaled by total compensation ($TDC1$)

- $TENURE_{i,t} =$ log of number of years from becoming CEO ($BECAMECE$) to 12/31/04

- $SIZE_{i,t} =$ log of market value of assets
  $$(Compustat \text{ item 6} - \text{ item 60} + \text{ item 25} \times \text{ item 199})$$

- $BM_{i,t} =$ book value of assets ($\text{ item 6}$) divided by market value of assets
  $$(\text{ item 6} - \text{ item 60} + \text{ item 25} \times \text{ item 199})$$

- $CFO_{i,t} =$ operating cash flows ($\text{ item 308}$) scaled by lagged assets ($\text{ item 6}$)

- $RETURN_{i,t} =$ annual stock return (using $\text{ RETX$ in CRSP$}$).

The most important control variable is $SBCLEVEL$, which captures the level of stock-based compensation as opposed to the mix of stock-based compensation captured by $RSRATIO$. Intuitively, we are asking the following question: Does the compensation mix affect earnings management given a fixed amount of stock-based compensation? For instance, assume that

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\(^{23}\)To deal with the potential auto-correlation of DAs within firms, we run the regressions specified in (18) year-by-year, since there is at most one observation from each firm in a given year. Then, we calculate the mean coefficient for each independent variable over the relevant years. This yields qualitatively the same results.
a manager receives $1 million in stock-based compensation in a specific year. Do incentives to engage in earnings management differ if he gets 30% in stock and 70% in options or vice versa? In order to answer this, we control for the level of stock-based compensation. To treat the heterogeneity across firms, we use a scaled measure: the total number of restricted stock and option grants as a fraction of the total number of shares outstanding.

Table 3 shows that a larger fraction of stock grants in year $t$ to $t-4$ seems to intensify earnings management in year $t$. Interestingly, this effect is only significant in year $t-2$ (with a p-value of 0.023) and in year $t-3$ (with a p-value of 0.068). This seems to be a consequence of the standard vesting schedules of restricted stock and stock options. Essentially, moving from the all-stock-option compensation to the average restricted stock grants in the sample in year $t-2$ increases earnings management scaled by lagged assets in year $t$ by 0.0008 ($0.117\times0.0071$).

In dollar terms, this increases discretionary accruals of the average firm of the sample (with book assets of $3,958$ million) by $3.29$ million ($0.117\times0.0071\times3,958$), accounting for 60.7% ($3.29/5.42$) of discretionary accruals. Equivalently, this increases the discretionary accruals as a percentage of earnings, measured by income before extra items, by 1.8% ($3.29/177.9$).

Importantly, the coefficient of $SBCLEVEL$ ($\theta_1$) is positive in years $t-1$ through $t-3$, whereas it is negative and highly significant in year $t$. This suggests that a larger amount of stock-based compensation in year $t$ induces managers to lower the earnings in this year. Perhaps, during the grant year, managers manipulate earnings downwards in order to better the conditions of the grants (to lower the exercise price) or to save accruals for future vesting years.

Observe that bonus payments induce more earnings management (positive $\theta_3$), which is consistent with prior research; see, for instance, Healy (1985). In contrast, salary payments appear to mitigate earnings management (negative $\theta_4$ with weak evidence), perhaps, due to the wealth effect. Interestingly, the CEOs with longer tenures tend to manipulate earnings more. Moreover, large firms tend to have more discretionary accruals (positive $\theta_6$) consistent with the observation in Coffee (2003).

\footnote{In unreported separate regressions, we use the log of market capitalization ($\text{Compustat item 25 \times item 199}$) as $SIZE$ and book-to-market equity ($\text{item 60/(item 25 \times item 199)}$) as $BM$. The results are qualitatively the same.} Firms with more growth opportunities and lower...
current operating performance are engaged in more earnings management (negative $\theta_7$ and $\theta_8$), in line with Larcker and Richardson (2004). Not surprisingly, firms with a higher stock return have less incentives to manipulate earnings (negative $\theta_9$). We use stock returns without dividends ($RETX$) because stock options are not entitled to receive dividends. The results are qualitatively the same if holding period returns ($RET$) are used instead.

5.4.2 Moneyness and Earnings Management

In this subsection, we test the prediction that increasing the moneyness of the ESOs intensifies earnings management. Recall that the moneyness has been defined as the stock price divided by the exercise price of the option. Since the moneyness of restricted stock is infinite, we use the reciprocal of the moneyness in the empirical tests. As in the previous subsection, we take into account the fact that earnings management in year $t$ may be affected by the moneyness of ESOs granted in year $t-\tau$ for $\tau = 0, \ldots, 4$.

A complicating issue is that there may be multiple grants of restricted stock or stock options in a specific year for one CEO. To incorporate this, we first calculate the weighted average exercise price using the Black-Scholes value of each grant as weights.\textsuperscript{25} Restricted stock is treated as options with a zero exercise price.\textsuperscript{26}

Formally, the weighted average exercise price of ESOs ($WAK$) for firm $i$ in year $t-\tau$ is defined as:

$$WAK_{i,t-\tau} = \sum_{j=1}^{m_{i,t-\tau}} \frac{BLKSHVAL_{i,t-\tau,j}}{EXPRIC_{i,t-\tau,j} RSTKGRNT_{i,t-\tau} + BLKVALU_{i,t-\tau} + BLKVALU_{i,t-\tau}},$$

(19)

where all terms in (19) are from the ExecuComp database and

$RSTKGRNT_{i,t-\tau} = $ total value of restricted stock granted for firm $i$ in year $t-\tau$

$BLKVALU_{i,t-\tau} = $ aggregate Black-Scholes value of options granted during the year

$m_{i,t-\tau} = $ frequency of option grants during the year

$BLKSHVAL_{i,t-\tau,j} = $ Black-Scholes value of the options in the $j$th grant.

\textsuperscript{25}In unreported separate regressions, we replaced the value-weighted average exercise price by a number-weighted average exercise price and obtained qualitatively the same results. The weight for the number-weighted average exercise price is the ratio of the number of individual option grants ($ExecuComp \text{NUMSECUR}$) to the sum of the aggregate number of options ($SOPTGRNT$) and the estimated number of restricted stock ($RSTKGRNT/PRCCF$) granted during the year.

\textsuperscript{26}In unreported regressions, we look at the exercise prices of stock options only ignoring restricted stock. The results are qualitatively the same.
EXPRIC\(_{i,t-\tau,j}\) = exercise price of the options in the \(j\)th grant.

Next, we divide \(WAK\) by the average stock price at the beginning and the end of the relevant fiscal year and obtain the scaled weighted average exercise price (\(SWAK\)) as:

\[
SWAK_{i,t-\tau} = \frac{WAK_{i,t-\tau}}{(PRCCF_{i,t} + PRCCF_{i,t-1})/2},
\]

where \(PRCCF_{i,t}\) is the close price of firm \(i\)'s stock at the end of fiscal year \(t\). The \(SWAK\) variable measures how much in-the-money the stock options are when they vest. It is the reciprocal of the moneyness of the options. Our model suggests that earnings management will be negatively correlated with \(SWAK\).

We run five separate regressions (\(\tau = 0, \ldots, 4\)) of the form:

\[
DA_{i,t} = \delta + \eta SWAK_{i,t-\tau} + \theta_1 SBCLEVEL_{i,t-\tau} + \theta_2 OWNERSHIP_{i,t} + \theta_3 BONUS_{i,t} \\
+ \theta_4 SALARY_{i,t} + \theta_5 TENURE_{i,t} + \theta_6 SIZE_{i,t} + \theta_7 BM_{i,t} \\
+ \theta_8 CFO_{i,t} + \theta_9 RETURN_{i,t} + \varepsilon_{i,t}.
\]

The results are presented in Table 4. The table shows that earnings management in year \(t\) increases in the moneyness of the ESOs granted in years \(t - 1\) to \(t - 4\), significant at the 1% level. For the average firm of the samples (with book assets of $3,958 million), a 10% increase in \(SWAK\) in years \(t - 1\) to \(t - 4\) reduces earnings management in year \(t\) by $2.18 million \((0.1*0.0055*3,958)\), $1.19 million, $0.63 million and $0.91 million, respectively, accounting for 40.2% \((2.18/5.42)\), 21.4%, 11.6%, and 16.8% of discretionary accruals.\(^{27}\) These results are consistent with the findings in Section 5.4.1 regarding the influence of restricted stock and stock options on earnings management.

In the year of ESO grants, the level of stock-based compensation is negatively correlated with earnings management as in Section 5.4.1. Additionally, bonus payments and growth opportunities induce more earnings management, while good current operating performance, high stock returns and salary payments seem to mitigate earnings management.

\[^{27}\text{In unreported separate regressions, we use the log of market capitalization (Compustat item 25 * item 199) as SIZE and book-to-market equity (item 60/(item 25 * item 199)) as BM. The results are qualitatively the same.}\]
6 Conclusion

Stock-based compensation is designed to align the interests of executives with those of shareholders. A large body of evidence suggests that stock-based compensation indeed enhances firm value. However, mechanisms that ensure incentive provisions inevitably induce executives to engage in earnings management. In equilibrium, investors can perfectly infer the true earnings; still, executives cannot avoid the costly earnings management because if they do not manipulate, they suffer deep price losses. Thus, earnings management is a deadweight loss. Additionally, more extensive use of ESOs (a greater number of ESO grants or a lower exercise price) intensifies earnings management. As a result, earnings management is more severe when there are more exercisable (vested) in-the-money stock options. Everything else being equal, restricted stock induces more earnings management than stock options. The solution to the social welfare loss due to earnings management lies in improved regulations and, in particular, better accounting standards. The Sarbanes-Oxley Act is certainly a move in the direction of improving the accounting standards.

We treat restricted stock as a special case of stock options when the exercise price is zero. In practice, restricted stock and stock options differ. Restricted stock is required to be expensed while executive stock options are not. Hence, restricted stock dilutes the existing shareholders’ wealth more than stock options. Moreover, as opposed to restricted stock holders, stock option holders are typically not entitled to receive dividends. Thus, a CEO compensated mainly by stock options may tend to distribute less dividends than is optimal.

Our numerical results suggest that when accounting standards are improved, firms should grant more stock options and with higher exercise prices. This prediction should be implemented and tested in an environment that treats stock options and stocks equally. The current difference in the accounting treatment of these two contracts and the imminent change in regulation prevent an empirical analysis of this issue.

Finally, our empirical tests focus on the implications of the compensation mix between restricted stock and stock options on earnings management. Our paper does not conclude that executive stock options dominate restricted stock. Rather, it suggests that stock options have certain advantages over restricted stock in terms of mitigating earnings management. The optimal compensation mix between restricted stock and stock options may largely depend on
firm and industry characteristics as well as market conditions, and would feasibly evolve with changes in regulations.
Appendix A. Proofs

Proof of Proposition 1.

For $x < K$ we have $\rho(x) = x$ and

$$u^M(x, x) = 0. \tag{22}$$

For $x \geq K$ we have

$$u^M(x, x^R) = \alpha(\varphi(x^R) - K) - \beta(x^R - x)^2. \tag{23}$$

The first order condition with respect to $x^R$ renders

$$\frac{d}{dx^R}\varphi(x^R) = \frac{2\beta}{\alpha} x^R + \frac{2\beta}{\alpha} x = 0. \tag{24}$$

Since in equilibrium $x = \varphi(x^R)$, we obtain the following linear, first-order differential equation for an equilibrium

$$\frac{d}{dx^R}\varphi(x^R) = -\frac{2\beta}{\alpha}\varphi(x^R) + \frac{2\beta}{\alpha} x^R. \tag{25}$$

All potential solutions of this equation are given by

$$\varphi(x^R) = x^R - \frac{\alpha}{2\beta} + M e^{-\frac{2x^R \beta}{\alpha}}, \tag{26}$$

where $M$ is a constant.

The constant $M$ is given by the boundary condition $\varphi(K) = K$. We then have

$$M = \frac{\alpha}{2\beta} e^{\frac{2K \beta}{\alpha}}, \tag{27}$$

and the separating equilibrium is given by

$$\varphi(x^R) = x^R - \frac{\alpha}{2\beta} + \frac{\alpha}{2\beta} e^{\frac{2\beta}{\alpha} (K - x^R)}. \tag{28}$$

Plugging (28) into (23), we can show that the utility of the manager is concave in $x^R$; i.e.,

$$\frac{d^2}{dx^R^2} u^M(x, x^R) = 2\beta \left( e^{\frac{2\beta}{\alpha} (K - x^R)} - 1 \right) \leq 0 \tag{29}$$

for any $x^R \geq K$. Therefore, the first order condition is sufficient for a global maximum.

\[28\] We assume that the risk-free rate is zero without loss of generality.
For $x \leq K$, $\rho(x) = x$. Thus, the reporting strategy $\rho(x)$ strictly increases in $x$. For $x > K$, denote $y = y(x) \equiv \frac{2\beta(K - \rho(x))}{\alpha}$ for notational convenience. Since $-\infty < K - \rho(x) < 0$, we have $0 < e^y < 1$. Implicit differentiation then yields

$$
\frac{\partial \rho(x)}{\partial x} = \frac{1}{1 - e^y} > 0
$$

$$
\frac{\partial (\rho(x) - x)}{\partial x} = \frac{e^y}{1 - e^y} > 0
$$

$$
\frac{\partial u^M(x, \rho(x))}{\partial x} = \alpha - 2\beta (\rho(x) - x) \frac{\partial (\rho(x) - x)}{\partial x} = \alpha - 2\beta \left( \frac{\alpha}{2\beta} (1 - e^y) \right) \frac{e^y}{1 - e^y}
$$

(30)

$$
\frac{\partial u^M(x, \rho(x))}{\partial x} = \alpha (1 - e^y) > 0.
$$

Q.E.D.

**Proof of Corollary 1.**

Recall that the reporting strategy $\rho(x)$ satisfies the implicit function (6). For notational convenience, denote $y = y(x) \equiv \frac{2\beta(K - \rho(x))}{\alpha}$ for $x > K$. We have $-\infty < y < 0$ and thus $0 < e^y < 1$. Additionally, because $\rho(x)$ increases in $x$ by (30), $y$ decreases in $x$. Implicit differentiation yields:

$$
\frac{\partial \rho(x)}{\partial K} = -\frac{e^y}{1 - e^y}
$$

$$
\frac{\partial \rho(x)}{\partial \alpha} = \frac{1}{2\beta} \frac{1 - e^y + ye^y}{1 - e^y}
$$

$$
\frac{\partial \rho(x)}{\partial \beta} = \left( -\frac{\alpha}{2\beta^2} \right) \frac{1 - e^y + ye^y}{1 - e^y}
$$

(31)

Because, $0 < e^y < 1$, we have $\frac{\partial \rho(x)}{\partial K} < 0$. Notice that $\frac{1 - e^y + ye^y}{1 - e^y}$ decreases in $y$, and hence increases in $x$ for $x > K$. Moreover, as $y \to 0$ ($x \to K$), the limit of this expression is 0 (using L’Hospital’s Rule). Thus, for any $y < 0$, we have $\frac{1 - e^y + ye^y}{1 - e^y} > 0$. Therefore, we have $\frac{\partial \rho(x)}{\partial \alpha} > 0$ and $\frac{\partial \rho(x)}{\partial \beta} < 0$.

Q.E.D.

**Proof of Proposition 2.**

Recall that the expected earnings management is

$$
eem = \int_{x=K}^{\infty} (\rho(x) - x) f(x|a) dx,
$$

(32)

where the reporting strategy $\rho(x)$ satisfies the implicit function (6).
Denote \( y = y(x) \equiv \frac{2\beta(K - \rho(x))}{\alpha} \) for \( x > K \). Thus, we have \( 0 < e^y < 1 \). The first order conditions are
\[
\frac{\partial eem}{\partial K} = \int_{x=K}^{\infty} \frac{\partial \rho(x)}{\partial K} f(x|a) dx < 0
\]
\[
\frac{\partial eem}{\partial \alpha} = \int_{x=K}^{\infty} \frac{\partial \rho(x)}{\partial \alpha} f(x|a) dx > 0
\]
\[
\frac{\partial eem}{\partial \beta} = \int_{x=K}^{\infty} \frac{\partial \rho(x)}{\partial \beta} f(x|a) dx < 0,
\]
where the three inequalities hold point-wise by Corollary 1.

On the other hand, the expected cost of earnings management is given by
\[
\text{cem} = \beta \int_{x=K}^{\infty} (\rho(x) - x)^2 f(x|a) dx.
\]

Using Corollary 1 and the notation for \( y \), we obtain the following first order conditions:
\[
\frac{\partial \text{cem}}{\partial K} = 2\beta \int_{x=K}^{\infty} (\rho(x) - x) \frac{\partial \rho(x)}{\partial K} f(x|a) dx - \alpha \int_{x=K}^{\infty} e^y f(x|a) dx
\]
\[
\frac{\partial \text{cem}}{\partial \alpha} = 2\beta \int_{x=K}^{\infty} (\rho(x) - x) \frac{\partial \rho(x)}{\partial \alpha} f(x|a) dx + \frac{\alpha}{2\beta} \int_{x=K}^{\infty} (1 - e^y + ye^y) f(x|a) dx
\]
\[
\frac{\partial \text{cem}}{\partial \beta} = \frac{\alpha^2}{4\beta^2} \int_{x=K}^{\infty} (1 - 2ye^y + e^{2y}) f(x|a) dx.
\]

It is clear that \( \frac{\partial \text{cem}}{\partial K} < 0 \) holds because of \( e^y > 0 \). We will show that \( \frac{\partial \text{cem}}{\partial \alpha} > 0 \) is true. Denote \( g(y) = 1 - e^y + ye^y \). Then, we have \( g(y) \to 0 \) as \( y \to 0 \). Moreover, \( g(y) \to 1 \) as \( y \to -\infty \) because \( e^y \to 0 \) and \( ye^y \to 0 \) by L’Hospital’s Rule. Additionally, we have \( g'(y) = ye^y < 0 \). Therefore, \( g(y) > 0 \) holds for any \( y < 0 \). This ensures that \( \frac{\partial \text{cem}}{\partial \alpha} > 0 \). The inequality \( \frac{\partial \text{cem}}{\partial \beta} < 0 \) can be proved similarly.

\[Q.E.D.\]

**Proof of Propositions 4**

The first order condition for the manager’s problem is \( H(\alpha, K, \beta, a) = 0 \), where
\[
H(\alpha, K, \beta, a) = \int_{x=K}^{\infty} (\alpha(x - K) - \beta(\rho(x) - x)^2) f_a(x|a) dx - c'(a).
\]
Denote \( y = y(x) \equiv \frac{2\beta(K-\mu(x))}{\alpha} \) for \( x > K \) for notational convenience. We have
\[
\frac{\partial H}{\partial K} = \alpha \int_{x=K}^{\infty} (-1)f_a(x|a)dx - \beta \int_{x=K}^{\infty} 2\left(\rho(x) - x\right) \frac{\partial \rho(x)}{\partial K} f_a(x|a)da
\]
\[
= -\alpha \int_{x=K}^{\infty} (1-e^y)f_a(x|a)dx.
\]
(37)

The first step is to prove that \( \frac{\partial H}{\partial K} < 0 \). It is equivalent to \( \int_{x=K}^{\infty} (1-e^y)f_a(x|a)dx > 0 \). Notice that \( F_a(\infty|a) = 0 \). By MLRP, for any \( a \), there exists a \( \hat{x}_a \in (0, \infty) \) such that \( f_a(x|a) < 0 \) for \( x < \hat{x}_a \) and \( f_a(x|a) > 0 \) for \( x > \hat{x}_a \).

If \( \hat{x}_a < K \), then \( f_a(x|a) > 0 \) for all \( x \geq K \). In addition, we have \( 1-e^y > 0 \) given that \( y < 0 \). Hence, \( \int_{x=K}^{\infty} (1-e^y)f_a(x|a)dx > 0 \) holds point-wise.

If \( \hat{x}_a > K \), then we have
\[
\int_{x=K}^{\infty} (1-e^y)f_a(x|a)dx
\]
\[
= \int_{x=K}^{\hat{x}_a} (1-e^{2\beta(K-\mu(x))})f_a(x|a)dx + \int_{x=\hat{x}_a}^{\infty} (1-e^{2\beta(K-\mu(x))})f_a(x|a)dx
\]
\[
> \left(1-e^{2\beta(K-\mu(\hat{x}_a))}\right) \int_{x=K}^{\hat{x}_a} f_a(x|a)dx
\]
\[
> 0,
\]
where the first inequality holds because \( \rho(x) \) increases in \( x \), and the second inequality follows because \( \int_{K}^{\infty} f_a(x|a)dx = F_a(\infty|a) - F_a(K|a) \geq 0 \) by MLRP.

Integrating by parts using (36), we have
\[
H(\alpha, K, \beta, a)
\]
\[
=F_a(x|a)(\alpha(x-K) - \beta(\rho(x) - x^2))|^{\infty}_{x=K} F_a(x|a) \left(\alpha - 2\beta(\rho(x) - x) \frac{\partial (\rho(x) - x)}{\partial x}\right) dx - c'(a)
\]
\[
= -\alpha \int_{x=K}^{\infty} F_a(x|a)(1-e^y)dx - c'(a).
\]
(39)

Therefore, we have
\[
\frac{\partial H}{\partial a} = -\alpha \int_{x=K}^{\infty} F_{aa}(x|a)(1-e^y)dx - c''(a).
\]
(40)

Because \( c''(a) > 0 \) by assumption and \( F_{aa}(x|a) \geq 0 \) by CDFC, the manager’s utility is concave in effort \( a \):
\[
\frac{\partial H}{\partial a} < 0.
\]
(41)
Therefore,
\[
\frac{\partial a^*}{\partial K} = -\frac{\partial H/\partial K}{\partial H/\partial a} < 0 \tag{42}
\]
as required.

The inequalities \(\frac{\partial a^*}{\partial \alpha} > 0\) and \(\frac{\partial a^*}{\partial \beta} > 0\) can be proved similarly.

Q.E.D.

Appendix B. Extensions

B.1 Naive Investors

Section 4.1 shows that with rational investors, the manager manipulates earnings only if the realized earnings are above the exercise price. Earnings manipulation increases in realized earnings and is bounded from above by \(\frac{\alpha}{2\beta}\). If investors are naive, they “blindly” believe the announced earnings and price the stock accordingly. Consider a case where the realized earnings are \(x\) and the manager announces \(x_R\). The manager’s third stage payoff is

\[
u^M(x, x_R) = \alpha \max\{x_R - K, 0\} - \beta (x_R - x)^2. \tag{43}\]

The first term is the total value of the options. The manager succeeds in fooling the investors so the stock price is equal to the earnings report. The second term is the penalty for earnings management.

For \(x_R \geq K\), the first order condition of (43) with respect to \(x_R\) yields

\[
\alpha - 2\beta(x_R - x) = 0. \tag{44}\]

Thus, we obtain \(x_R = x + \frac{\alpha}{2\beta}\) if \(x \geq K - \frac{\alpha}{2\beta}\).

On the other hand, \(x_R = x\) if \(x < K - \frac{\alpha}{2\beta}\) since when the earnings are sufficiently low, the penalty for misreporting dominates the benefit of the increased option value due to the boosted stock price. The manager then reports truthfully.

The manager starts manipulating earnings upwards by a constant of \(\frac{\alpha}{2\beta}\) when the realized earnings are slightly below the exercise price. Compared with the case of rational investors, the manager manipulates earnings more often and by a larger amount when the investors are
naive. In both cases, however, the manipulation occurs only if the stock options are in-the-money. Therefore, lowering the exercise price of the options intensifies earnings management regardless of whether the investors are rational or naive.

**B.2 Earnings Management Damages Firm Value Directly**

In reality, earnings management is costly to the firm as well as to the manager. For instance, to boost sales at the end of a quarter, the manager may reduce prices to an extent that damages firm value in the long run. Incorporating the damage of earnings management to firm value, investors maximize the intrinsic value of the firm when designing the ESO contract.

To incorporate the direct damage to the firm, we write the third stage payoff for the manager who observes $x$ and reports $x^R$ as

$$u^M(x, x^R) = \alpha \max \{ \varphi(x^R) - \gamma(x^R - x)^2 - K, 0 \} - \beta(x^R - x)^2,$$

where $\gamma \geq 0$ measures the severity of the damage of earnings management to firm value. The stock price is then given by $\varphi(x^R) - \gamma(x^R - x)^2$. In (45), the first term is the total value of the stock options, while the second term is the direct cost of earnings management to the manager.

All the results in the second and third stages sustain with this new formulation replacing $\beta$ with $\alpha \gamma + \beta$. Intuitively, the unit cost of earnings management to the manager is the sum of the direct cost to the manager $\beta$ and the reduction in the manager’s option value due to the damage to firm value $\alpha \gamma$.

**PROPOSITION 5** There is a unique separating equilibrium in the reporting stage given by

$$\varphi(x^R) = \rho^{-1}(x^R) = \begin{cases} 
    x^R & \text{if } x^R < K; \\
    x^R - \frac{\alpha}{2(\alpha \gamma + \beta)} + \frac{\alpha}{2(\alpha \gamma + \beta)}e^{2(\alpha \gamma + \beta)(K-x^R)} & \text{if } x^R \geq K.
\end{cases}$$

The equilibrium reporting function $\rho(x)$ strictly increases in $x$ for all $x \geq 0$. Moreover, both earnings management $\rho(x) - x$ and the manager’s payoff $u^M(x, \rho(x))$ strictly increase in $x$ for $x \geq K$.

Proposition 1 is a special case of Proposition 5 when $\gamma = 0$.

The expected earnings management, $eem$, is

$$eem = \int_{x=K}^{\infty} (\rho(x) - x) f(x|a) dx.$$
The expected cost of earnings management to the manager, $cem$, is

\[ cem = (\alpha \gamma + \beta) \int_{x=K}^{\infty} (\rho(x) - x)^2 f(x|a)dx. \]  

(48)

We have the following comparative statics:

**PROPOSITION 6** Both the expected earnings management and the expected cost of earnings management strictly decrease in the exercise price $K$, strictly increase in the number of ESO grants $\alpha$, strictly decrease in the stringency of the accounting standards $\beta$, and strictly decrease in the severity of the direct damage to the firm $\gamma$. Namely, $\frac{\partial eem}{\partial K} < 0$, $\frac{\partial eem}{\partial \alpha} > 0$, $\frac{\partial eem}{\partial \beta} < 0$, $\frac{\partial eem}{\partial \gamma} < 0$, $\frac{\partial cem}{\partial K} < 0$, $\frac{\partial cem}{\partial \alpha} > 0$, $\frac{\partial cem}{\partial \beta} < 0$, and $\frac{\partial cem}{\partial \gamma} < 0$ hold.

Proof. Similar to the Proof of Proposition 2.

In the second stage, the payoff function of the manager is given by

\[ U^M(\alpha, K, \gamma, \beta, a) = \int_{x=K}^{\infty} u^M(x, \rho(x)) f(x|a)dx - c(a) \]

\[ = \int_{x=K}^{\infty} \left( \alpha(x - K) - (\alpha \gamma + \beta) (\rho(x) - x)^2 \right) f(x|a)dx - c(a), \]  

(49)

The effect of higher effort is summarized as follows:

**PROPOSITION 7** The positive effect of higher effort on the value of stock options dominates its negative effect on the cost of earnings management. Namely, we have

\[ \frac{\partial}{\partial a} \int_{x=K}^{\infty} \alpha(x - K)f(x|a)dx > \frac{\partial}{\partial a} \int_{x=K}^{\infty} (\alpha \gamma + \beta)(\rho(x) - x)^2 f(x|a)dx. \]  

(50)

Proof. Similar to the proof of Proposition 3.

**PROPOSITION 8** The optimal effort $a^*$ strictly decreases in the exercise price $K$, strictly increases in the number of ESO grants $\alpha$, strictly increases in the stringency of the accounting standards $\beta$, and strictly increases in the severity of the damage to the firm $\gamma$. Namely, we have $\frac{\partial a^*}{\partial K} < 0$, $\frac{\partial a^*}{\partial \alpha} > 0$, $\frac{\partial a^*}{\partial \beta} > 0$, and $\frac{\partial a^*}{\partial \gamma} > 0$.

Proof. Similar to the proof of Proposition 4.
References


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245.


Perspectives*, 17, 49-70.

with Future Earnings”, *Journal of Accounting and Economics*, 36, 3-43.


Managerial Ownership and the Link between Ownership and Performance”, *Journal of 


Figure 1: Time Line of the Model
Figure 2: Separating Equilibrium
Figure 3: The Effect of Changing $K$ on the Reporting Strategy
Figure 4: The Effect of Changing $\alpha_2$ on the Reporting Strategy
Figure 5: Option Value vs. Cost of Earnings Management
Figure 6: The Effects of Improved Accounting Standards under Power Distribution
Figure 7: The Effects of Improved Accounting Standards under the Copula Distribution
Figure 8: The Effects of Improved Accounting Standards under Lognormal Distribution
Table 1: Descriptive Statistics

The descriptive statistics are based on 10,213 firm-years (1993-2003) used in the regressions of earnings management on the exercise price of ESOs. Compensation data are from Standard & Poor’s ExecuComp. Stock Options is the aggregate Black-Scholes value of stock options granted during the year (\(BLK_{VALUE}\)). Restricted Stock is the value of restricted stock granted during the year (\(RSTKGRNT\)). Bonus (\(BONUS\)) and Salary (\(SALARY\)) are self-explanatory. Total Compensation (\(TDC1\)) includes salary, bonus, other annual compensation, restricted stock, stock options granted, long-term incentive plan (LTIP), and all other compensation. Ownership is the percentage of the company’s shares owned by the CEO (\(SHROWN/SHRSOUT/1,000\)). \(RSRATIO\) is the value of restricted stock grants divided by the total stock-based compensation (\(RSTKGRNT/(RSTKGRNT+BLK_{VALUE})\)). Firm characteristics are taken from the Compustat Industrial Annual: Market Capitalization equals the close price of firm stock times the number of outstanding shares at the end of the fiscal year (Compustat item 25 * item 199); Book Value of Assets is total assets (item 6); Book-to-Market Assets is book value of assets (item 6) divided by market value of assets (book value of assets (item 6) less book value of common equity (item 60) plus market capitalization (item 25 * item 199)); Earnings are incomes before extra items (item 123); CFO/Lagged Assets is cash flows from operations (item 308) scaled by lagged assets (item 6), and Return is the annual return without dividends (annualized \(RET X\) in CRSP).

Panel A: Descriptive Statistics on CEO Compensation

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Median</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock Options (B-S Value) ($ Thousand)</td>
<td>10,167</td>
<td>2,091</td>
<td>622.3</td>
<td>4,145</td>
</tr>
<tr>
<td>Restricted Stock ($ Thousand)</td>
<td>10,213</td>
<td>238.2</td>
<td>0</td>
<td>862.3</td>
</tr>
<tr>
<td>Bonus ($ Thousand)</td>
<td>10,213</td>
<td>527.8</td>
<td>303.9</td>
<td>698.2</td>
</tr>
<tr>
<td>Salary ($ Thousand)</td>
<td>10,213</td>
<td>599.7</td>
<td>540.0</td>
<td>327.3</td>
</tr>
<tr>
<td>Total Compensation($ Thousand)</td>
<td>10,167</td>
<td>3,884</td>
<td>2,005</td>
<td>5,486</td>
</tr>
<tr>
<td>Ownership</td>
<td>10,055</td>
<td>2.83%</td>
<td>0.37%</td>
<td>0.062</td>
</tr>
<tr>
<td>(RSRATIO)</td>
<td>7,993</td>
<td>0.117</td>
<td>0</td>
<td>0.259</td>
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Panel B: Descriptive Statistics on Firm Characteristics

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<th>N</th>
<th>Mean</th>
<th>Median</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Capitalization ($ Million)</td>
<td>10,213</td>
<td>6,068</td>
<td>1,075</td>
<td>20,994</td>
</tr>
<tr>
<td>Book Value of Assets ($ Million)</td>
<td>10,213</td>
<td>3,958</td>
<td>964.3</td>
<td>10,546</td>
</tr>
<tr>
<td>Book-to-Market Assets</td>
<td>10,213</td>
<td>0.621</td>
<td>0.606</td>
<td>0.280</td>
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<tr>
<td>Earnings ($ Million)</td>
<td>10,213</td>
<td>177.9</td>
<td>40.61</td>
<td>1,010</td>
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<tr>
<td>CFO/Lagged Assets</td>
<td>10,213</td>
<td>0.111</td>
<td>0.112</td>
<td>0.121</td>
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<tr>
<td>Return</td>
<td>10,131</td>
<td>0.138</td>
<td>0.064</td>
<td>0.541</td>
</tr>
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</table>
### Table 2: Regression Fit Statistics of Discretionary Accruals

The statistics are based on 10,485 firm-year observations (1993-2003). Parameter estimates are averages from the 319 two-digit SIC-year regressions. The Z-statistic is \( Z = \frac{1}{\sqrt{N}} \sum_{j=1}^{N} \frac{t_j}{k_j - k_j}, \) where \( N \) is the number of SIC-year groups, \( t_j \) is the \( t \)-statistic for SIC-year \( j \), and \( k_j \) is the degrees of freedom for the corresponding \( t \)-statistic. Discretionary accruals are the residuals estimated using the modified Jones model across 319 two-digit SIC-year groups. All data are from Compustat Industrial Annual, and are scaled by beginning-year total assets (Compustat item 6). Formally, we use

\[
TA_{i,t} = \delta + \eta_1 (\Delta Sales_{i,t} - \Delta REC_{i,t}) + \eta_2 PPE_{i,t} + \epsilon_{i,t},
\]

where \( \Delta Sales_{i,t} \) is the change in sales (Compustat item 12) of firm \( i \) in year \( t \), \( \Delta REC_{i,t} \) is the change in accounts receivable (item 2), \( PPE_{i,t} \) is the level of gross property, plant and equipment (item 7), and total accruals are calculated by

\[
TA_{i,t} = \Delta [\text{current assets (4) - cash (1)}] - \Delta [\text{current liabilities (5) - debt included in current liabilities (34)}] - \text{depreciation and amortization (14)}.
\]

#### Panel A: Mean Coefficient Estimates for Accrual Models from 319 Two-Digit SIC-Year Regressions

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>( \Delta Sales - \Delta REC )</th>
<th>( PPE )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient</td>
<td>0.047</td>
<td>-0.035</td>
</tr>
<tr>
<td>( Z )-statistics</td>
<td>17.67</td>
<td>-16.71</td>
</tr>
<tr>
<td>% Positive</td>
<td>71.19</td>
<td>29.11</td>
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#### Panel B: Adjusted \( R^2 \) Across 319 Industry-Year Regressions

<table>
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</thead>
<tbody>
<tr>
<td>Mean</td>
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<tr>
<td>0.210</td>
</tr>
</tbody>
</table>

#### Panel C: Discretionary Accruals Scaled by Lagged Assets for 10,485 Firm-Year Observations

<table>
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<th>Distributional Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
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<tr>
<td>0.0014</td>
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</table>
The table presents the results of cross-sectional regressions of discretionary accruals on the ratio of the value of restricted stock grants to the total value of stock-based compensation ($RSRATIO$) over 10,213 firm-years (1993-2003). Formally, we use

$$DA_{i,t} = \delta \eta RSRATIO_{i,t-\tau} + \theta_1 SBCLEVEL_{i,t-\tau} + \theta_2 OWNERSHIP_{i,t} + \theta_3 BONUS_{i,t} + \theta_4 SALARY_{i,t} + \theta_5 TENURE_{i,t} + \theta_6 SIZE_{i,t} + \theta_7 BM_{i,t} + \theta_8 CFO_{i,t} + \theta_9 RETURN_{i,t} + \epsilon_{i,t},$$

where $DA_{i,t}$ is discretionary accruals scaled by lagged assets; $RSRATIO_{i,t-\tau}$ is the value of restricted stock ($\text{ExecuComp}\ RSTKGRNT_{i,t-\tau}$ divided by the total value of stock-based compensation ($\text{ExecuComp}\ RSTKGRNT_{i,t-\tau} + \text{BLK\ VALU}_{i,t-\tau}$); $SBCLEVEL_{i,t-\tau}$ is the total number of restricted stock ($2 \times RSTKGRNT_{i,t-\tau}/(PRCCF_{i,t-\tau} + PRCCF_{i,t-\tau-1})$) and stock options ($SOPTGRNT_{i,t-\tau}$) granted during the year as a percentage of the total number of outstanding shares ($1000 \times SHRSOUT_{i,t-\tau}$); $OWNERSHIP_{i,t}$ is the percentage ownership ($\text{SHROWN}/SHRSOUT/1,000$); $BONUS_{i,t}$ is bonus payments ($BONUS_{i,t}$) scaled by total compensation ($TDC_1$); $SALARY_{i,t}$ is salary payments ($SALARY_{i,t}$) scaled by total compensation ($TDC_1$), and $TENURE_{i,t}$ is the log of the number of years from becoming CEO ($\text{BECAMECE}_{i,t}$) to Dec. 31, 2004. We run five separate regressions with $\tau = 0, \ldots, 4$. $SIZE_{i,t}$ is the log of market value of assets ($\text{Compustat}\ item\ 6 - item\ 60 + item\ 25 \times item\ 199$); $BM_{i,t}$ is book value of assets ($item\ 6$) divided by market value of assets ($item\ 6 - item\ 60 + item\ 25 \times item\ 199$); $CFO_{i,t}$ is cash flows from operations ($item\ 308$) scaled by lagged assets ($item\ 6$), and $RETURN_{i,t}$ is the annual stock return without dividends (annualized $RETX$ in CRSP). P-values appear in parentheses below coefficient estimates.

<table>
<thead>
<tr>
<th>$\tau$</th>
<th>Intercept</th>
<th>$RSRATIO$</th>
<th>$SBCLEVEL$</th>
<th>$OWNERSHIP$</th>
<th>$BONUS$</th>
<th>$SALARY$</th>
<th>$TENURE$</th>
<th>$SIZE$</th>
<th>$BM$</th>
<th>$CFO$</th>
<th>$RETURN$</th>
<th>Observations</th>
<th>Adj. $R^2$</th>
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<tr>
<td>0</td>
<td>0.0242</td>
<td>0.0034</td>
<td>-0.6410</td>
<td>0.0126</td>
<td>0.0176</td>
<td>-0.0094</td>
<td>0.0017</td>
<td>-0.0002</td>
<td>-0.0173</td>
<td>-0.1095</td>
<td>-0.0027</td>
<td>7,447</td>
<td>0.047</td>
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<td></td>
<td>(0.000)</td>
<td>(0.195)</td>
<td>(0.000)</td>
<td>(0.444)</td>
<td>(0.001)</td>
<td>(0.059)</td>
<td>(0.140)</td>
<td>(0.662)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.046)</td>
<td>6.362</td>
<td>0.046</td>
</tr>
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<td>1</td>
<td>0.0136</td>
<td>0.0039</td>
<td>0.1036</td>
<td>0.0176</td>
<td>0.0196</td>
<td>-0.0071</td>
<td>0.0013</td>
<td>0.0009</td>
<td>-0.0190</td>
<td>-0.1111</td>
<td>-0.0045</td>
<td>6,362</td>
<td>0.046</td>
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<td></td>
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<td>(0.173)</td>
<td>(0.380)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.065)</td>
<td>(0.292)</td>
<td>(0.100)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.002)</td>
<td>5,266</td>
<td>0.044</td>
</tr>
<tr>
<td>2</td>
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<td>0.0071</td>
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<td>(0.813)</td>
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<td>(0.982)</td>
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<td>(0.527)</td>
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<td>(0.000)</td>
<td>(0.000)</td>
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<td>(0.000)</td>
<td>(0.020)</td>
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<td>(0.750)</td>
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<td>(0.237)</td>
<td>(0.026)</td>
<td>(0.612)</td>
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Table 4: Earnings Management and the Moneyness of ESOs

The table presents the results of cross-sectional regressions of discretionary accruals on the value-weighted average exercise price scaled by the average of the stock prices in the beginning and the end of the fiscal year (SWAK) over 10,213 firm-years (1993-2003). Formally, we use

$$DA_{i,t} = \delta + \eta SWAK_{i,t-\tau} + \theta_1 SBCLEVEL_{i,t-\tau} + \theta_2 OWNERSHIP_{i,t} + \theta_3 BONUS_{i,t} + \theta_4 SALARY_{i,t} + \theta_5 TENURE_{i,t} + \theta_6 SIZE_{i,t} + \theta_7 BM_{i,t} + \theta_8 CFO_{i,t} + \theta_9 RETURN_{i,t} + \varepsilon_{i,t},$$

where $SWAK_{i,t}$ is defined as:

$$SWAK_{i,t-\tau} = \frac{1}{(PRCCF_{i,t-1} + PRCCF_{i,t})/2} \sum_{j=1}^{m_{i,t-\tau}} \frac{EXPRIC_{i,t-\tau,j}}{RSTKGRNT_{i,t-\tau} + BLKVALU_{i,t-\tau}},$$

EXPRIC_{i,t-\tau,j} is the exercise price of stock options in the jth grant of firm i in year t - \tau; PRCCF_{i,t} is the close price of the company’s stock at end of the year; RSTKGRNT_{i,t-\tau} is the value of restricted stock granted during the year; BLKSHVALU_{i,t-\tau,j} and BLKVALU_{i,t-\tau} are the Black-Scholes value of options in the jth grant and all grants during the year, respectively. Control variables are as in Table 3. We run five separate regressions with \tau = 0, \ldots, 4. P-values appear in parentheses below coefficient estimates.

<table>
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<th>\tau = 2</th>
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<td>(0.0402)</td>
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</tr>
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<td>(0.375)</td>
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<td>(0.869)</td>
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<tr>
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<td>(0.008)</td>
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<td>(0.493)</td>
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<td>0.0014</td>
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<tr>
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<td>(0.012)</td>
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<td>3,335</td>
</tr>
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<td>0.049</td>
<td>0.048</td>
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