Whistle Blowing and CEO Compensation: The *Qui Tam* Statute

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Abstract

A purported dark side to powerful equity-based incentives is that they may induce a CEO to manipulate stock prices. With this in mind, recent theoretical models predict that firms will grant more equity-based compensation to their CEOs when the detection of any information manipulation is more likely. We provide confirming empirical evidence using three different tests. First, we use the *qui tam* statute as an experimental setting to test this prediction. This statute gives whistle blowers in the healthcare industry large financial incentives to reveal corporate fraud. Controlling for characteristics that might vary between the healthcare and other industries, we find that the proportion of equity-based compensation to total annual compensation is around 9% higher in the healthcare industry. Second, as third parties, such as the press, focus their investigative efforts towards large firms, we use an indicator variable to identify the largest firms in our sample and find that these firms are granted more equity-based compensation than others firms. Third, we use the passage of the Private Securities Litigation Reform Act (PSLRA) as an exogenous shock that increased the frequency of meritorious lawsuits. We find that equity-based compensation increased significantly after the passage of PSLRA. Using a difference-in-difference specification, we document that the effect of PSLRA on equity-based compensation is more pronounced for the healthcare industry and for the largest firms. The collective evidence appears consistent with theoretical models that predict that the detection likelihood of information manipulation affects the structure of CEO compensation.

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1. Introduction

Recent theoretical models (e.g., Goldman and Sleazak (2006), Peng and Roell (2008), Crocker and Slemrod (2007), Laux and Laux (2009)) examine the equilibrium relation between equity-based CEO compensation and information manipulation. While more equity-based compensation may induce better strategic decisions and greater effort, it might also encourage the manager to manipulate information to artificially inflate the stock price, especially if the likelihood of being detected is low. These theories predict that shareholders trade off these countervailing forces by weighing the pros and cons of granting equity-based compensation. A key untested prediction from these models is that CEOs should be granted more equity-based compensation when information manipulation is more likely to be detected, as the costs of granting such compensation are lower. This study seeks to empirically test this prediction.

To capture cross-sectional differences in the probability of detection of information manipulation, we use three different proxies and find consistent evidence across all three measures. Broadly speaking, our proxies include an industry-classification measure, a firm-specific characteristic and an exogenous shock. Each of these measures is associated with an environment in which information manipulation is more likely to be detected, and therefore suggest that, shareholders can rely on steeper equity-based incentives with fewer fears of negative side effects arising.

As our first proxy, we use the *qui tam* statute as an experimental setting. *Qui Tam* ("He who sues on behalf of the king as well as for himself") is a provision of the Federal Civil False Claims Act that allows a private individual or "whistleblower", with knowledge of past or present fraud on the federal government, to sue on behalf of the government to recover stiff civil

penalties.² In a comprehensive study of corporate fraud, Dyck, Morse and Zingales (2008) highlight the role of whistleblowers such as employees in revealing corporate fraud due to their access to inside information. Highlighting the effectiveness of the *qui tam* statute, Dyck et al. (2008) and Bowen, Call and Rajgopal (2009) find that the healthcare industry, where the government accounts for a significant portion of revenues, has the highest proportion of employee whistle blowers. Using the healthcare industry as a proxy for the higher probability of fraud detection, we examine differences in equity-based compensation between the healthcare industry and other industries. We find strong evidence that CEOs in the healthcare industry have a higher proportion of equity-based compensation to total annual compensation than other industries. Controlling for several characteristics that affect equity-based compensation, we find that the ratio of equity-based compensation to total annual compensation is 9% higher in the healthcare industry as compared to other industries.

Second, following studies such as Miller (2006), Bowen et al. (2009) and Dyck et al. (2008) who find that external monitors such as the press focus their investigative efforts towards large firms, we use an indicator variable that captures the largest decile of firms in our sample as another proxy for a high probability of detection of information manipulation. We find that the largest firms are granted more equity-based compensation (but not cash-based compensation) than other firms. Our empirical specifications include a linear control for firm size and thus document an incremental “large-firm” effect on equity-based compensation. We interpret these results as suggesting that the higher probability of fraud detection in large firms increases the amount of equity-based compensation that they are granted.

Third, we use the passage of the Private Securities Litigation Reform Act (PSLRA) as an exogenous shock to the probability of detection of information manipulation. The advantage of

² See <http://www.quitamonline.com/index.html> for more details about the *Qui Tam* statute.

this setting is that the exogenous shock (in addition to our inclusion of industry fixed effects) helps assuage concerns that differences in equity-based compensation between the healthcare industry and other industries, or between the largest firms and other firms, might be driven by unobservable factors. As prior studies, such as Johnson, Nelson and Pritchard (2007), find that PSLRA increased the incidence of meritorious lawsuits, we expect firms to grant more equity-based compensation after the passage of PSLRA. Consistent with our predictions, we find that the passage of PSLRA increased the proportion of equity-based compensation to total annual compensation. Further, using a difference-in-difference specification, we find that the effect of the passage of PSLRA on equity-based compensation is more pronounced for the healthcare industry than other industries. Moreover, the passage of the PSLRA has a pronounced effect on increases in equity-based compensation for large firms relative to other firms. Overall, we interpret the above collective evidence as being consistent with theoretical models that predict that firms grant more equity-based compensation when a high probability of detection of information manipulation reduces the costs of granting such compensation.³

Our results are robust to several sensitivity tests. First, we examine whether our results are driven by regulated industries. Dyck et al. (2008) and Bowen et al. (2009) entertain the possibility that the higher frequency of whistle blowing in the healthcare industry might be on account of heightened moral sensitivity in these “sensitive” industries. We examine how equity-based compensation varies between regulated and unregulated industries and find no evidence that regulated industries have higher equity-based compensation than others. Further, when we

³ If firms with a higher probability of detection of information manipulation are the ones where these irregularities are more likely to be revealed *ex-post*, one could argue that our results are due to reverse causality, i.e., more equity-based compensation leading to a greater incidence of information manipulation. We do not expect this argument to explain our findings for two reasons. First, recent studies such as Armstrong, Jagolinzer and Larcker (2009) use more refined econometric methods such as propensity score matching and find no evidence of a positive association between CEO equity incentives and accounting irregularities. Second, managers’ motive to manipulate information stems from short-term incentives such as selling shares or exercising options. However, we document an association between the probability of information manipulation and stock option grants which have longer vesting periods.

include both the healthcare and regulated industries, the positive relation between equity-based compensation and healthcare industries persists, while there is no relation between regulated industries and equity-based compensation. Second, we find a positive association between new-economy firms as defined in Murphy (2003) and our “large-firm” proxy for the high probability of detection of information manipulation. As Ittner, Lambert and Larcker (2003) and Murphy (2003) document that new economy firms are associated with more equity-based compensation, we ensure that our results are not being driven by new-economy firms. Third, to ensure that the relation between equity-based compensation and the healthcare (large-firm) indicator is not due to serial correlation, we estimate a cross-sectional regression with only one observation per industry (firm) and find consistent results. These results also provide assurance that the statistical significance of our main results is not overstated due to the large number of observations in the sample.

Finally, we examine how the passage of the Sarbanes-Oxley Act (SOX) in 2003 affects our results. As SOX was implemented with an aim to correcting the state of financial reporting and the oversight of the reporting process, we expect it to have improved the probability of detection of information manipulation and thus the extent of equity-based compensation. While we find consistent evidence that the passage of SOX is associated with increases in equity-based compensation for all firms, we find only mixed evidence that the effect of SOX is pronounced for firms with a high ex-ante level of detection of information manipulation. In particular, while SOX increases equity-based compensation more for the largest firms, there is no incremental effect on the healthcare industry relative to other industries.

The main contribution of our study is to empirically examine recent theoretical models that predict that equity-based compensation is higher when the detection of information

manipulation is more likely. This is an important issue as it speaks to the question of the optimality of CEO compensation contracts (see also Dai, Jin and Zhang (2009)). Our evidence appears to support the theoretical predictions of recent models, such as Goldman and Slezak (2006), and the views of Bushman and Smith (2001) by suggesting that equilibrium equity-based CEO compensation is optimally set after considering the tradeoffs between inducing effort and reducing information manipulation.

2. Motivation

In the wake of accounting scandals of the likes of Enron and WorldCom, many academics, numerous regulators and the media in general have blamed equity-based compensation for these acts of information manipulation. Such manipulation includes earnings management, accounting restatements, accounting fraud, and class action lawsuits (Ball (2009)).⁴ At the heart of it, equity-based compensation has been accused of encouraging managers to indulge in myopic acts aimed at maintaining stock prices and earnings at artificially high levels in the near term.

The implication that regulators, the media and some academics draw from these findings is that managerial compensation plans should be altered. For example, in his monetary policy report to Congress on July 16, 2002, Alan Greenspan states that “the highly desirable spread of shareholding and options among business managers perversely created incentives to artificially inflate reported earnings in order to keep stock prices high and rising. This outcome suggests that the options were poorly structured, and consequently, they failed to properly align the long-term

⁴ For studies in earnings management, see Bergstresser and Philippon (2006) Cheng and Warfield (2005), Gao and Shrieves (2002), and Ke (2001); for accounting re-statements see Burns and Kedia (2006), Cheng and Farber (2008), Efendi et al (2004), Armstrong, Jagolinzer and Larcker (2009), and Richardson, Tuna and Wu (2002); for accounting fraud see Erickson, Hanlon and Maydew (2006), Dechow, and Sloan and Sweeney (1996); and for class action lawsuits see Denis, Hanouna and Sarin (2006), and Peng and Roell (2008).

interests of shareholders and managers”. Jensen (2003) argues that current compensation schemes are responsible for causing managers to take actions that “game the system” and destroy shareholder value, and thus should be changed. Put more forcefully, Coffee (2005) identifies stock options as the best explanation for the rise in accounting scandals in the late 1990s and early 2000s.

There are certainly others who express skepticism at these interpretations. In particular, Bushman and Smith (2001) discuss the effect of observed incentive contracts on earnings management behavior and note that “this research begs the question of why these contracts exist in the first place. Are the observed contracts at these firms not optimal? After all, any incentives for earnings management could be mitigated by offering flat wage contracts...An economic answer to these questions must fully consider the equilibrium from which the empirical observations are drawn.” In response to this charge, recent theoretical models (e.g., Goldman and Slezak (2006), Peng and Roell (2008), Crocker and Slemrod (2007), Laux and Laux (2009)) examine the equilibrium relation between equity-based incentives and information manipulation.⁵

2.1. Equity-based compensation and detection of information manipulation

Goldman and Slezak (2006) point out that existing models do not consider how the potential for manipulation might affect equilibrium contracts. They present a model where the manager exerts effort that positively affects output, but they also allow for the possibility that she can also indulge in misrepresentation. Shareholders determine the optimal level of stock-based compensation by trading off the benefits of higher effort with the costs of greater manipulation.

⁵ We focus on the model of Goldman and Slezak (2006) as it examines how equity-based incentives vary with the probability of detection of information manipulation. Their model is also directly testable and serves as the focus of our study.

In equilibrium, stock-based compensation is higher for firms where the probability of detection is greater. The intuition is that the greater probability of detection reduces manager's incentives to indulge in information manipulation, thereby reducing the costs of equity-based compensation.⁶ The main objective of our study is to empirically test this proposition and therefore, our first hypothesis is:

H1: Firms grant more equity-based compensation when the probability of detection of information manipulation is higher.

While measuring the extent of equity-based pay is relatively straightforward, our study requires empirical proxies for the detection probability of information manipulation. We turn to these proxies next.

2.2. Passage of the Private Securities Litigation Reform Act (PSLRA)

We use the passage of the Private Securities Litigation Reform Act (PSLRA) in 1995 as an exogenous shock that increased the occurrence of meritorious lawsuits (see Nelson, Johnson and Pritchard (2007)). Using this (seemingly natural) experiment as a setting to examine the influence of detection of information manipulation on equity-based compensation helps assuage concerns about correlated omitted variables (Ball (2008)). If the probability of detection of information manipulation increases equity-based compensation, then we expect the passage of PSLRA to increase equity-based compensation as this law increased the likelihood that corporate fraud will be detected and litigated against. This leads us to our second hypothesis:

⁶ This is akin to Fischer and Verrecchia (2000) who find that the extent of managerial bias in reporting is decreasing in the costs of the bias, which in turn increases the information content of earnings.

H2: Ceteris paribus, equity-based compensation is higher after the passage of the Private Securities Litigation Reform Act (PSLRA).

2.3. The Sarbanes-Oxley Act (SOX)

We examine how the passage of the Sarbanes-Oxley Act (SOX) affects the relation between the probability of detection of information manipulation and equity-based compensation. SOX was instituted as a response to the spate of accounting scandals at the start of the century and sought to improve the quality of financial information reported by firms. We expect the passage of SOX to increase equity-based compensation as the probability of detection of corporate fraud is expected to be higher in the post-SOX period. This leads us to our third hypothesis:

H3: Equity-based compensation is higher after the passage of the Sarbanes Oxley (SOX) Act.

3. Research design

In this section, we first describe the empirical proxies, motivate our control variables, present our regression specifications and follow that with a description of our sample.

3.1. Detection of information manipulation

In addition to the passage of the PSLRA Act and the SOX Act that serve as exogenous shocks, we use two different proxies to measure high probability of detection of information manipulation. The first is based on industry classification and the second is based on firm size.

3.1.1. *Healthcare dummy (HCARE)*

Dyck, Morse and Zingales (2008) perform a comprehensive analysis of corporate fraud cases between 1996 and 2004, and document the importance of the *qui tam* statute in the whistle-blowing incentives of insiders. They find that a majority of cases where insiders such as employees are whistleblowers of corporate fraud come from the healthcare industry, where the government accounts for a significant portion of revenues. Similarly, in a detailed analysis of whistle-blowing cases, Bowen, Call and Rajgopal (2009) show that several cases where employees are whistleblowers are from the healthcare industries. Following these studies, we use the healthcare industry as our first proxy for high probability of detection of information manipulation. We create an indicator variable (*HCARE*) that takes the value of 1 for firms that belong to the healthcare industry, and 0 for all other firms. Following Dyck et al. (2008), we define industries that are in the drug, drug proprietaries and druggists sundries (SIC 5122), and healthcare providers (8000-8099) as belonging to the healthcare industry.

3.1.2. *Large firms (LARGE)*

Prior studies (e.g., Miller (2006), Bowen et al. (2009), Dyck et al. (2008)) find that fraud detectors such as the media focus their attention primarily on large firms where the payoffs from their investigative efforts are the largest. We use large firms as our second proxy for the high probability of detection of information manipulation. To do so, we define an indicator variable *LARGE* that is set to 1 for the largest decile of market value of equity. While the regression already includes annual sales (*SALES*), which controls for size, the indicator *LARGE* examine whether there is an incremental effect for the largest firms in the sample. We ensure that *SALES* and *LARGE* are not highly correlated and thus include both variables in the specification.

Omitting *SALES* would not allow *LARGE* to capture the effect that is incremental to the linear effect of firm size.

3.1.3. *Passage of the Private Securities Litigation Reform Act (PSLRA)*

Naturally, it is possible that differences in CEO compensation structure between the healthcare and other industries, or between the largest firms and others, are explained by other unobservable characteristics that differ between these groups. In addition, it is likely that the financial incentives implied by the *qui tam* statute or the higher visibility of large firms increase the number of frivolous lawsuits brought about by whistleblowers. While Dyck, Morse and Zingales (2008) find that the healthcare industry is associated with fewer dismissed lawsuits, it is possible that our results might be affected by these confounding factors. To assuage these concerns, we use the passage of PSLRA as an exogenous shock that increased the incidence of meritorious lawsuits. As per hypothesis H2, we expect the passage of PSLRA to increase equity-based compensation.

To test H2, we define an indicator variable *PSLRA* that takes the value of 1 for years after 1995, and 0 for all years before (and including 1995). If the passage of PSLRA increased equity-based compensation, we would expect a positive coefficient on *PSLRA*. Further, we examine whether the passage of *PSLRA* has a greater effect on the healthcare industry compared to the other industries. Similarly, we examine whether the PSLRA Act has a pronounced effect on large firms relative to other firms. To do so, we use a difference-in-difference estimation (see Bertrand and Mullainathan (1999, 2003) for an illustration) by interacting *PSLRA* with *HCARE* and with *LARGE*. As the effect of PSLRA on equity-based compensation is expected to be pronounced for the healthcare industry and for large firms, we expect the coefficient of *PSLRA*HCARE* and

*PSLRA***LARGE* to be positive. Another advantage of the difference-in-difference estimation is that it allows us to include industry fixed effects (see Bertrand, Duflo and Mullainathan (2004)) that control for time-invariant differences between the healthcare and other industries, further quelling concerns about correlated omitted variables. As the industry fixed effects (which we define at the four-digit SIC code level) subsume *HCARE*, we drop it from the estimation.

3.2. *CEO compensation*

We define total annual compensation (*TOTALCOMP*) as the sum of salary, bonus, restricted stock grants, option grants and all other annual compensation. We examine two components of total compensation – the cash-based component (*CASHCOMP*) defined as the sum of salary and bonus; and equity-based compensation (*EQCOMP*) defined as the sum of the Black-Scholes value of options grants and restricted stock grants. We use the log values of *CASHCOMP* and *EQCOMP* to mitigate the influence of outliers. We also examine the ratio of equity-based compensation to total compensation (*EQRATIO*).

3.3. *Multivariate regressions*

In this section, we discuss variables related to managerial compensation used in prior studies and incorporate them in a multivariate regression to ascertain whether the explanatory power of *HCARE* and of *LARGE* is incremental to that of these characteristics.

3.3.1. *Firm level determinants*

As prior studies find that the investment opportunity set affects stock-based compensation (e.g., Clinch (1991), Smith and Watts (1992), Gaver and Gaver (1993), and Baber

et al (1996)), we follow Ittner et al. (2003) and include four variables to capture the investment opportunity set – the market-to-book ratio (*MB*), the ratio of research and development expenses to sales (*R&D*), the ratio of advertising expenses to sales (*ADVT*) and the log of firm age defined as the number of years the firm exists on Compustat (*LN_AGE*). Consistent with prior studies, we expect a positive coefficient on *MB*, *R&D* and *ADVT*, and a negative coefficient on *LN_AGE*. As is standard, we control for firm size using the log of total sales (*SALES*). As prior studies present conflicting arguments for the relation between firm size and equity-based compensation, we merely include it as a control without making a directional prediction (see Aggarwal and Samwick (1999) and Core and Guay (2002)). Following Ittner et al, we use leverage (*LEV*) to capture monitoring by debt holders and expect a negative relation with *EQRATIO*.

We use both accounting (*ROA*) and stock price (*RET*) based measures to capture prior performance. *RET* represents the prior year's annual stock return. We also include stock return volatility (*RETVOL*) to capture features of the operating environment. Studies such as Prendergast (2000, 2002) argue that firms rely more on stock-based incentives in riskier environments where it is more difficult to monitor the manager's actions. On the other hand, studies such as Demsetz and Lehn (1985), Lambert and Larcker (1987), Aggarwal and Samwick (1999) and Garvey and Milbourn (2003) argue that greater stock return volatility captures more noise in the output measure and firms should therefore reduce stock-based incentives (see Dai et al. (2009) who use an event-study approach to shed more light on this question). We therefore do not make a directional prediction for *RETVOL*. As studies argue that cash-constrained firms rely more on stock-based compensation (e.g., Yermack (1995), Core and Guay (1999, 2001)), we include the ratio of cash on hand to total assets (*CASH*) and free cash flows (*FCF*) defined as

cash flow from operations less capital expenditures scaled by total assets to capture the incentive to conserve cash.

Following Petersen (2009), we estimate the regressions with year indicators and standard errors clustered by industry (defined at the 2 digit SIC code level). The year indicators control for common shocks, which could cause cross-sectional correlation in the errors. The industry-level clustering of standard errors corrects for the possibility of serial correlation attributable to unobserved industry effects. All variables have been defined as of the beginning of the year.

3.3.2. *Effect of HCARE on cash-based and equity-based compensation*

The empirical specifications we employ are:

$$\begin{aligned} CASHCOMP_{i,t+1} = & \alpha_0 + \alpha_1 HCARE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 R \& D_{i,t} + \alpha_4 ADVT_{i,t} + \alpha_5 SALES_{i,t} \\ & + \alpha_6 LEV_{i,t} + \alpha_7 RET_{i,t} + \alpha_8 RETVOL_{i,t} + \alpha_9 ROA_{i,t} + \alpha_{10} CASH_{i,t} \\ & + \alpha_{11} FCF_{i,t} + \alpha_{12} AGE_{i,t} + \sum YEAR + \varepsilon_{i,t} \end{aligned} \quad (1)$$

$$\begin{aligned} EQCOMP_{i,t+1} = & \alpha_0 + \alpha_1 HCARE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 R \& D_{i,t} + \alpha_4 ADVT_{i,t} + \alpha_5 SALES_{i,t} \\ & + \alpha_6 LEV_{i,t} + \alpha_7 RET_{i,t} + \alpha_8 RETVOL_{i,t} + \alpha_9 ROA_{i,t} + \alpha_{10} CASH_{i,t} \\ & + \alpha_{11} FCF_{i,t} + \alpha_{12} AGE_{i,t} + \sum YEAR + \varepsilon_{i,t} \end{aligned} \quad (2)$$

$$\begin{aligned} EQRATIO_{i,t+1} = & \alpha_0 + \alpha_1 HCARE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 R \& D_{i,t} + \alpha_4 ADVT_{i,t} + \alpha_5 SALES_{i,t} \\ & + \alpha_6 LEV_{i,t} + \alpha_7 RET_{i,t} + \alpha_8 RETVOL_{i,t} + \alpha_9 ROA_{i,t} + \alpha_{10} CASH_{i,t} \\ & + \alpha_{11} FCF_{i,t} + \alpha_{12} AGE_{i,t} + \sum YEAR + \varepsilon_{i,t} \end{aligned} \quad (3)$$

where *CASHCOMP*, *EQCOMP* and *EQRATIO* are cash-based compensation, equity-based compensation and the ratio of equity-based to total compensation respectively.

3.3.3. *Effect of LARGE on cash-based and equity-based compensation*

We estimate the following empirical specifications:

$$\begin{aligned}
CASHCOMP_{i,t+1} = & \alpha_0 + \alpha_1 LARGE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 R \& D_{i,t} + \alpha_4 ADVT_{i,t} + \alpha_5 SALES_{i,t} \\
& + \alpha_6 LEV_{i,t} + \alpha_7 RET_{i,t} + \alpha_8 RETVOL_{i,t} + \alpha_9 ROA_{i,t} + \alpha_{10} CASH_{i,t} \\
& + \alpha_{11} FCF_{i,t} + \alpha_{12} AGE_{i,t} + \sum YEAR + \varepsilon_{i,t}
\end{aligned} \tag{4}$$

$$\begin{aligned}
EQCOMP_{i,t+1} = & \alpha_0 + \alpha_1 LARGE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 R \& D_{i,t} + \alpha_4 ADVT_{i,t} + \alpha_5 SALES_{i,t} \\
& + \alpha_6 LEV_{i,t} + \alpha_7 RET_{i,t} + \alpha_8 RETVOL_{i,t} + \alpha_9 ROA_{i,t} + \alpha_{10} CASH_{i,t} \\
& + \alpha_{11} FCF_{i,t} + \alpha_{12} AGE_{i,t} + \sum YEAR + \varepsilon_{i,t}
\end{aligned} \tag{5}$$

$$\begin{aligned}
EQRATIO_{i,t+1} = & \alpha_0 + \alpha_1 LARGE_{i,t} + \alpha_2 MB_{i,t} + \alpha_3 R \& D_{i,t} + \alpha_4 ADVT_{i,t} + \alpha_5 SALES_{i,t} \\
& + \alpha_6 LEV_{i,t} + \alpha_7 RET_{i,t} + \alpha_8 RETVOL_{i,t} + \alpha_9 ROA_{i,t} + \alpha_{10} CASH_{i,t} \\
& + \alpha_{11} FCF_{i,t} + \alpha_{12} AGE_{i,t} + \sum YEAR + \varepsilon_{i,t}
\end{aligned} \tag{6}$$

3.4. Sample

As our measure of the detection of information manipulation is based on industry and firm-specific classifications, the sample is based on all firms with compensation data in ExecuComp, accounting data on Compustat and stock price data on CRSP. The final sample comprises of 20,831 firm-year observations for 2,722 unique firms between the years 1992 and 2007.

Descriptive statistics are presented in Panel A of Table 1. The annual total compensation for the CEO for the sample is around \$4 million, of which \$1.2 million is from salary and bonus and \$2.3 million is from stock option grants and restricted stock grants. These statistics compare closely with those found in recent studies (e.g., Jayaraman and Milbourn (2009)). The average proportion of equity-based compensation to total annual compensation (*EQRATIO*) is 39%. Firms from the healthcare industry form 2% of our sample. Our sample is comprised primarily of large firms, which is typical of firms in the Execucomp database. In particular, the median firm in the sample has annual sales of around \$1.14 billion and has existed on Compustat for 20 years.

4. Empirical Results

4.1. Univariate evidence

Panel B of table 1 presents differences in firm-characteristics between the healthcare industry ($HCARE=1$) and all other industries ($HCARE=0$). Figures in bold indicate that the means (or medians) are significantly different between the two groups at the 5% level or better. The data reveal some interesting patterns. While the average total compensation for CEOs in the healthcare industry is higher than for those in other industries (\$5.07 million versus \$4.02 million), these differences come entirely from equity-based compensation. Mean (median) cash compensation for the healthcare industry is \$1.198 million (\$0.866 million) compared with \$1.207 million (\$0.9 million) for all other industries, which is not significantly different between the two groups. On the other hand, mean equity-based compensation is \$3.4 million in the healthcare industry as compared to \$2.3 million for other industries.

While these preliminary differences are consistent with our predictions, they should be interpreted cautiously as there are significant differences between the healthcare industries and other industries along other dimensions. For example, healthcare firms are more levered, have higher growth opportunities (based on medians), have greater stock return volatility, hold more cash and have more free cash flows. However, it is pertinent to note that one important determinant of compensation structure viz., firm size is not significantly different between the healthcare and the non-healthcare groups.

4.2. Multivariate evidence

Table 2 presents results of the multivariate regressions (1) – (3). The coefficient on $HCARE$ is positive and significant in Model 1, suggesting that healthcare industries are

associated with more cash-based CEO compensation. Consistent with hypothesis H1, the coefficients on *HCARE* are positive and significant in Models 2 and 3, suggesting that both the level of equity-based compensation and the proportion of equity-based compensation to total compensation are higher for firms in the healthcare industry. The coefficient on *HCARE* in model 2 is 0.786, which suggests that equity-based compensation is higher by 12% in the healthcare industry relative to other industries. Similarly, the coefficient of 0.091 in model 3 indicates that the ratio of equity-based compensation to total compensation is higher by 9.1% in the healthcare industry relative to other industries.

4.2.1. *Effect of LARGE on cash-based and equity-based compensation*

Results based on using the *LARGE* indicator as the measure of the probability of detection of information manipulation (equations (4) to (6)) are presented in table 3. The coefficient of *LARGE* is positively and significantly related to *EQCOMP* and *EQRATIO*. This suggests that the largest firms in the sample that are more susceptible to investigative efforts of the media and other external monitors regarding corporate fraud pay their CEOs more equity-based compensation.⁷ It is important to point out that the relation between equity-based compensation and *LARGE* is incremental to the linear relation between equity-based compensation and firm size, as captured by the positive coefficient on *SALES*. In contrast to the results for equity-based compensation, there is no relation between *LARGE* and *CASHCOMP*, suggesting that the largest firms do not have incrementally higher cash-based compensation, after controlling for firm size.

⁷ Our results are unchanged if we include *HCARE* as an additional determinant in the empirical specification.

4.2.2. Effect of PSLRA on cash-based and equity-based compensation

Results of the passage of PSLRA on cash-based compensation, equity-based compensation and the ratio of equity-based compensation to total annual compensation are presented in Models (1) to (3) of Panel A of Table 4. The coefficient of *PSLRA* is positive and significant in all three specifications, indicating that the passage of PSLRA increased both cash compensation as well as equity-based compensation but increased the latter more than the former. Thus, these results are consistent with hypothesis H2.⁸

Panel B of Table 4 presents the results of the difference-in-difference specification. As we expect PSLRA to have a pronounced effect for firms with a high ex-ante probability of detection of information manipulation, we expect the relation between *HCARE* and equity-based compensation and that between *LARGE* and equity-based compensation to be pronounced after the passage of PSLRA.⁹ In other words, we expect the coefficients on the interactions of *PSLRA* and *HCARE*, and of *PSLRA* and *LARGE* to be positive and significant with respect to *EQCOMP* and *EQRATIO*. We do not, however, expect such a relation to hold with respect to *CASHCOMP*.

Consistent with hypothesis H2, the coefficient on the interaction of *PSLRA* and *HCARE* is positive and significant in models (2) and (3), indicating that the passage of PSLRA increased equity-based compensation and the ratio of equity-based compensation to total compensation more in the healthcare industry than other industries. On the other hand, the coefficient on *PSLRA*HCARE* is insignificant in model (1) indicating that *PSLRA* had no incremental impact on cash-compensation of the healthcare industry relative to other industries. Similarly, the coefficient on *PSLRA*LARGE* is positive and significant when *EQCOMP* and *EQRATIO* are the

⁸ We interpret the positive relation between *PSLRA* and *EQRATIO* as evidence consistent with our predictions. However, one could argue that the positive relation between *PSLRA* and *CASHCOMP* suggests that PSLRA increased the occurrence of frivolous lawsuits and that CEOs are now being compensated for this higher risk. The results of the difference-in-difference specification, discussed below, help rule out this alternate interpretation.

⁹ For the tests in this section, we define *LARGE* based on market values before the passage of PSLRA.

dependent variables (models (5) and (6)), while it is insignificant when *CASHCOMP* is the dependent variable (model (4)). These results suggest that the passage of PSLRA increased equity-based compensation but not cash-based compensation more for large firms than other firms. The fact that PSLRA affects equity-based compensation more in the healthcare industry and for large firms, but does not affect cash-based compensation, is strong evidence that our results appear to be due to the higher probability of detection of corporate fraud in the healthcare industry and for large firms. In addition, it also suggests that the passage of PSLRA resulted in an exogenous increase in the effectiveness of this mechanism.

5. Robustness tests

In this section, we examine several robustness tests of our results.

5.1. Regulated industries

Dyck et al. (2008) and Bowen et al. (2009) raise the possibility that the relation between healthcare and whistle blowing might have nothing to do with financial incentives, but rather with heightened moral sensitivity in these regulated or more “sensitive” industries. While Dyck et al. (2008) rule out this possibility in their setting, we examine whether the relation between *HCARE* and equity-based compensation might be driven by regulated industries. To do so, we follow Dyck et al. (2008, pp. 37) and define an indicator variable *REGU* to capture regulated industries (healthcare, financials (SIC 6000-6999), transportation equipment (SIC 3700-3799), transportation, communications, electric, gas and sanitary services (SIC 4000-4999)). We examine the relation between *REGU* and cash-based compensation and also equity-based compensation. The results of these tests are presented in Table 5.

Columns (1) to (3) include only *REGU*, while columns (4) to (6) include *HCARE* and *LARGE* in addition to *REGU*. The coefficient on *REGU* is insignificant in models (1) to (3), suggesting that regulated industries are no different from other industries in the amount of either cash-based compensation or of equity-based compensation. Further, when *HCARE* and *LARGE* are introduced in the specification, the coefficient on *REGU* remains insignificant in columns (4) and (5) and becomes negative and significant when *EQRATIO* is the dependent variable. On the other hand, the coefficients on *HCARE* and *LARGE* remain positive and significant, consistent with the prior results. Thus, the higher equity-based compensation awarded to healthcare CEOs or to the CEOs of the largest firms in the sample is not on account of regulatory effects.

5.2. New economy firms

Using survey data, Ittner, Lambert and Larcker (2003) highlight that new-economy firms rely more on stock-based compensation than old economy firms. Murphy (2003) extends and confirms the Ittner, et al result to all ExecuComp firms. In unreported tests, we find a positive association between *LARGE* and Murphy's (2003) classification of new-economy firms (SIC codes (3570, 3571, 3572, 3576, 3577, 3661, 3674, 4812, 4813, 5045, 5961, 7370, 7371, 7372, and 7373). We, therefore, examine whether our results merely re-state the new economy firms result in Ittner, et al (2003) and Murphy (2003). To do so, we first include an indicator to capture new economy firms (*NEW*) as used in Murphy (2003) as an additional independent variable. Second, we include *HCARE* and *LARGE* in addition to *NEW* to examine whether new economy firms drive our results. Panel B of Table 5 presents results of these tests.

The first three columns present results with only *NEW*, while the next three include *HCARE* and *LARGE* in addition to *NEW*. The coefficient on *NEW* in column (3) is positive and

significant, indicating that new economy firms are associated with a greater proportion of equity-based compensation to total compensation than other firms, consistent with Ittner et al. (2003) and Murphy (2003). Results from column (6), which include all three variables, indicate that *HCARE* and *LARGE* continue to be positively and significantly related to *EQCOMP* even in the presence of *NEW*. We thus conclude that our results are not driven by the new economy firms finding of Ittner et al. (2003) and Murphy (2003).

5.3. Cross-sectional regressions

To ensure that our inferences are not confounded by possible serial correlation or that our statistical significance of our results is not overstated due to the large number of observations in the sample, we examine a cross-sectional regression that uses only one observation. In particular, we use the average value of all observations in each industry (firm) to examine the cross-sectional relation between *HCARE* (*LARGE*) and equity-based compensation. Panel C of Table 5 presents results of these regressions. The number of observations for the industry-level sample is 383, while that for the firm-level sample is 2,722.

The coefficient on *HCARE* is positive and significant in models (2) and (3), but insignificant in model (1), suggesting a robust relation between the healthcare industry and equity-based compensation but not cash-based compensation. Similarly, the coefficient of *LARGE* is insignificantly related to cash-based compensation, but positively and significantly related to equity-based compensation and the proportion of equity-based compensation to total compensation. Our results are thus robust to using a cross-sectional regression that assuages

concerns about serial correlation or due to overstated statistical significance due to the large sample size.¹⁰

6. The Sarbanes-Oxley Act (SOX)

According to hypothesis H3, we expect SOX to increase equity-based CEO compensation. In addition to examining the independent effects of SOX, we also examine whether SOX has an incremental effect on equity-based compensation in the healthcare industry and for large firms. SOX introduced several provisions in order to better protect the interests of whistleblowers. For example, it made it unlawful for companies to take negative action against employee-whistleblowers, provided greater protection from discrimination and established a hotline enabling whistle-blowers to report anonymously (*Economist* 2006).

The above results are presented in Table 6. Columns (1) to (3) include an indicator variable (*SOX*) to denote the post-Sarbanes Oxley period (i.e., years 2004 and later). The coefficient on *SOX* is positive and significant in all three specifications, suggesting that the passage of SOX is associated with increases in both cash-based compensation as well as equity-based compensation, but the rate of increase in the latter is greater. Thus, the evidence suggests that the passage of SOX is associated with increases in the proportion of equity-based compensation to total compensation, consistent with hypothesis H3.

Columns (4) to (6) include interaction terms of *SOX* both with *HCARE* and with *LARGE* to examine the incremental effects of *SOX* on the healthcare industry and on large firms. The coefficient on *SOX*HCARE* is insignificantly related to equity-based compensation and to the proportion of equity-based compensation to total compensation. Hence, there is no evidence that

¹⁰ We do not include both *HCARE* and *LARGE* in the same specification because the individual cross-sectional regressions are estimated at the industry-level and firm-level respectively.

SOX has any differential impact on equity-based compensation in the healthcare industry compared with other industries. On the other hand, the coefficient on $SOX * LARGE$, where $LARGE$ is defined as firms with the highest decile of market value in the pre-SOX period, is positive and significant in the $EQCOMP$ as well as the $EQRATIO$ specifications. This suggests that SOX increased the probability of detection of information manipulation in the largest firms more than in other firms and thus resulted in a pronounced increase in equity-based compensation for large firms. Overall, there is strong evidence that the passage of SOX increased equity-based compensation for all firms but only mixed evidence that it had a pronounced effect on firms with a high ex-ante probability of detection of information manipulation.

7. Conclusion

This study uses three distinct proxies to test the prediction from recent theoretical models that firms will grant more equity-based incentives when the probability of detection of information manipulation is high. First, we use the *qui tam* statute which provides whistle-blowers large financial incentives for exposing corporate fraud in cases where the government is associated. Prior studies such as Bowen et al. (2009) and Dyck et al. (2008) find that the healthcare industry, where the government accounts for a significant portion of revenues, has a preponderance of *qui tam* related whistle-blowing cases.

We examine differences in equity-based CEO compensation between the healthcare and other industries to test whether a higher probability of detection of information manipulation is related to the proportion of equity-based compensation to total annual compensation. We find strong evidence that CEOs in the healthcare industry are granted more equity-based compensation than that of all other industries. Second, we use large firms as the second measure

of a high probability of detection of information manipulation and find that large firms are offered more equity-based compensation (but not more cash-based compensation) than other firms, after including a linear control for firm size. Third, we use the passage of the Private Securities Litigation Reform Act (PSLRA) as an exogenous shock to the probability of detection of information manipulation. As PSLRA increased the incidence of meritorious lawsuits, we expected, and find consistent evidence, that the passage of PSLRA increased equity-based CEO compensation. We use a difference-in-difference specification and find that PSLRA increased the proportion of equity-based compensation to total compensation more in the healthcare industry than other industries and for large firms relative to other firms. These results are robust to controlling for industry fixed effects and thus assuage concerns that our results might be driven by unobservable differences between the healthcare and other industries.

We also examine changes in equity-based compensation after the passage of the Sarbanes-Oxley Act of 2003, which was initiated in response to the spate of accounting scandals. We find that the passage of the Act increased the proportion of equity-based CEO compensation to total compensation, but find only mixed evidence that this Act had a pronounced effect on firms that have the higher likelihood of detection of information manipulation.

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Table 1: Descriptive statistics

Panel A: Overall sample

The sample comprises of 20,831 firm-year observations and covers the period from 1992 to 2007. *TOTALCOMP* indicates total annual compensation defined as the sum of salary, bonus, restricted stock grants, option grants and all other annual compensation. *CASHCOMP* denotes cash-based compensation defined as the sum of salary and bonus. *EQUITYCOMP* is equity-based compensation defined as the sum of restricted stock grants and options grants. *HCARE* denotes firms in the healthcare industry (SIC codes 8000-8099 and 5122). *MB* represents the market-to-book ratio defined as the market value of total assets divided by the book value of total assets. *R&D* indicates the ratio of research and development expenses to total sales. *ADVT* is the amount of advertising expenses per dollar of sales. Missing values of *R&D* and *ADVT* have been set to zero. *SALES* denotes the log value of total sales. *LEV* measures leverage which is defined as total debt divided by total assets. *RET* is the stock return for the prior year. *RETVOL* is stock return volatility as computed by ExecuComp. *ROA* denotes profitability and is defined as earnings before extraordinary items scaled by total assets. *CASH* is the amount of cash and cash equivalents per dollar of assets. *FCF* denotes free cash flows measured as cash flow from operations less capital expenditures divided by total assets. *AGE* captures the log of firm age defined as the number of years that the firm exists on Compustat.

Variable	N	Mean	Median	Std. dev.	Min	Max
<i>TOTALCOMP</i>	20,831	4,042.964	2,100.744	5,415.455	198.206	32,640.020
<i>CASHCOMP</i>	20,831	1,198.393	867.000	1,106.621	52.000	7,042.000
<i>EQUITYCOMP</i>	20,831	2,281.487	771.549	4,115.480	0.000	25,486.740
<i>HCARE</i>	20,831	0.020	0.000	0.141	0.000	1.000
<i>MB</i>	20,831	2.016	1.552	1.345	0.790	8.461
<i>R&D</i>	20,831	0.044	0.000	0.111	0.000	0.823
<i>ADVT</i>	20,831	0.009	0.000	0.022	0.000	0.129
<i>SALES</i>	20,831	7.113	7.035	1.541	3.281	10.907
<i>LEV</i>	20,831	0.221	0.208	0.177	0.000	0.764
<i>RET</i>	20,831	0.213	0.127	0.554	-0.737	2.878
<i>RETVOL</i>	20,831	0.493	0.358	0.460	0.067	2.978
<i>ROA</i>	20,831	0.053	0.053	0.101	-0.401	0.340
<i>CASH</i>	20,831	0.137	0.060	0.171	0.000	0.746
<i>FCF</i>	20,831	0.033	0.035	0.089	-0.299	0.274
<i>AGE</i>	20,831	2.942	2.996	0.761	1.099	4.025

Panel B: Comparison of characteristics between non-whistle blowers ($HCARE=0$) and whistle blowers ($HCARE=1$)

The sample comprises of 20,831 firm-year observations and covers the period from 1992 to 2007. *TOTALCOMP* indicates total annual compensation defined as the sum of salary, bonus, restricted stock grants, option grants and all other annual compensation. *CASHCOMP* denotes cash-based compensation defined as the sum of salary and bonus. *EQCOMP* is equity-based compensation defined as the sum of restricted stock grants and options grants. *HCARE* denotes firms in the healthcare industry (SIC codes 8000-8099 and 5122). *MB* represents the market-to-book ratio defined as the market value of total assets divided by the book value of total assets. *R&D* indicates the ratio of research and development expenses to total sales. *ADVT* is the amount of advertising expenses per dollar of sales. Missing values of *R&D* and *ADVT* have been set to zero. *SALES* denotes the log value of total sales. *LEV* measures leverage which is defined as total debt divided by total assets. *RET* is the stock return for the prior year. *RETVOL* is stock return volatility based on five years' annual returns. *ROA* denotes profitability and is defined as earnings before extraordinary items scaled by total assets. *CASH* is the amount of cash and cash equivalents per dollar of assets. *FCF* denotes free cash flows measured as cash flow from operations less capital expenditures divided by total assets. *AGE* captures the log of firm age defined as the number of years that the firm exists on Compustat.

Variable	<i>HCARE=0</i>			<i>HCARE=1</i>		
	N	Mean	Median	N	Mean	Median
<i>TOTALCOMP</i>	20,407	4,021.563	2,093.836	424	5,073.022	2,716.836
<i>CASHCOMP</i>	20,407	1,198.195	866.042	424	1,207.942	900.000
<i>EQUITYCOMP</i>	20,407	2,258.774	762.485	424	3,374.673	1,454.343
<i>MB</i>	20,407	2.014	1.549	424	2.097	1.752
<i>R&D</i>	20,407	0.044	0.000	424	0.007	0.000
<i>ADVT</i>	20,407	0.009	0.000	424	0.004	0.000
<i>SALES</i>	20,407	7.115	7.036	424	7.018	6.924
<i>LEV</i>	20,407	0.220	0.208	424	0.248	0.233
<i>RET</i>	20,407	0.212	0.127	424	0.268	0.152
<i>RETVOL</i>	20,407	0.488	0.356	424	0.702	0.505
<i>ROA</i>	20,407	0.053	0.053	424	0.059	0.061
<i>CASH</i>	20,407	0.137	0.060	424	0.122	0.054
<i>FCF</i>	20,407	0.033	0.035	424	0.049	0.047
<i>AGE</i>	20,407	2.952	3.045	424	2.446	2.398

Table 2: Relation between healthcare dummy (*HCARE*) and CEO compensation

The dependent variables in models (1), (2) and (3) are cash-based compensation defined as the sum of salary and bonus (*CASHCOMP*), equity-based compensation defined as the sum of restricted stock grants and options grants (*EQCOMP*) and the ratio of equity-based compensation to total compensation (*EQRATIO*). *HCARE* denotes firms in the healthcare industry (SIC codes 8000-8099 and 5122). *MB* represents the market-to-book ratio defined as the market value of total assets divided by the book value of total assets. *R&D* indicates the ratio of research and development expenses to total sales. *ADVT* is the amount of advertising expenses per dollar of sales. Missing values of *R&D* and *ADVT* have been set to zero. *SALES* denotes the log value of total sales. *LEV* measures leverage which is defined as total debt divided by total assets. *RET* is the stock return for the prior year. *RETVOL* is stock return volatility as computed by ExecuComp. *ROA* denotes profitability and is defined as earnings before extraordinary items scaled by total assets. *CASH* is the amount of cash and cash equivalents per dollar of assets. *FCF* denotes free cash flows measured as cash flow from operations less capital expenditures divided by total assets. *AGE* captures the log of firm age defined as the number of years that the firm exists on Compustat. All regressions include year fixed effects. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively. The values in parentheses under the coefficients denote robust standard errors that have been clustered at the industry level.

	(1)	(2)	(3)
	<i>CASHCOMP</i>	<i>EQCOMP</i>	<i>EQRATIO</i>
Const.	4.175*** (.111)	-1.140*** (.345)	-.054* (.032)
<i>HCARE</i>	.122** (.061)	.786*** (.131)	.091*** (.013)
<i>MB</i>	-.015 (.013)	.130*** (.036)	.021*** (.004)
<i>R&D</i>	.697*** (.201)	4.229*** (.472)	.389*** (.064)
<i>ADVT</i>	1.368** (.554)	-1.737 (2.340)	-.153 (.224)
<i>SALES</i>	.295*** (.013)	.715*** (.042)	.049*** (.004)
<i>LEV</i>	.221** (.095)	.116 (.326)	-.003 (.029)
<i>RET</i>	.053*** (.013)	.120*** (.041)	.009** (.004)
<i>RETVOL</i>	-.023 (.021)	.142 (.103)	.033*** (.008)
<i>ROA</i>	.863*** (.153)	-.287 (.447)	-.100** (.048)
<i>CASH</i>	.052 (.147)	.139 (.347)	.088** (.038)
<i>FCF</i>	.256* (.132)	.544 (.673)	.018 (.071)
<i>AGE</i>	.043 (.030)	-.165 (.115)	-.045*** (.010)
Year effects	Y	Y	Y
Obs.	20831	20831	20831
<i>R</i> ²	.416	.129	.126

Table 3: Relation between large firms dummy (*LARGE*) and CEO compensation

The dependent variables in models (1), (2) and (3) are cash-based compensation defined as the sum of salary and bonus (*CASHCOMP*), equity-based compensation defined as the sum of restricted stock grants and options grants (*EQCOMP*) and the ratio of equity-based compensation to total compensation (*EQRATIO*). *LARGE* is an indicator variable that denotes firms in the largest decile of market value of equity. *MB* represents the market-to-book ratio defined as the market value of total assets divided by the book value of total assets. *R&D* indicates the ratio of research and development expenses to total sales. *ADVT* is the amount of advertising expenses per dollar of sales. Missing values of *R&D* and *ADVT* have been set to zero. *SALES* denotes the log value of total sales. *LEV* measures leverage which is defined as total debt divided by total assets. *RET* is the stock return for the prior year. *RETVOL* is stock return volatility as computed by ExecuComp. *ROA* denotes profitability and is defined as earnings before extraordinary items scaled by total assets. *CASH* is the amount of cash and cash equivalents per dollar of assets. *FCF* denotes free cash flows measured as cash flow from operations less capital expenditures divided by total assets. *AGE* captures the log of firm age defined as the number of years that the firm exists on Compustat. All regressions include year fixed effects. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively. The values in parentheses under the coefficients denote robust standard errors that have been clustered at the industry level.

	(1)	(2)	(3)
	<i>CASHCOMP</i>	<i>EQCOMP</i>	<i>EQRATIO</i>
Const.	4.181*** (.114)	-.743** (.339)	-.008 (.032)
<i>LARGE</i>	.0002 (.043)	.403*** (.136)	.046*** (.015)
<i>MB</i>	-.015 (.013)	.116*** (.035)	.019*** (.004)
<i>R&D</i>	.686*** (.202)	4.037*** (.441)	.367*** (.062)
<i>ADVT</i>	1.337** (.555)	-2.255 (2.276)	-.213 (.212)
<i>SALES</i>	.296*** (.014)	.668*** (.040)	.043*** (.003)
<i>LEV</i>	.225** (.095)	.163 (.320)	.003 (.029)
<i>RET</i>	.053*** (.013)	.117*** (.040)	.009** (.004)
<i>RETVOL</i>	-.020 (.021)	.162 (.103)	.036*** (.008)
<i>ROA</i>	.857*** (.152)	-.269 (.435)	-.098** (.046)
<i>CASH</i>	.050 (.147)	.088 (.343)	.083** (.039)
<i>FCF</i>	.264** (.131)	.614 (.651)	.026 (.068)
<i>AGE</i>	.041 (.030)	-.184 (.115)	-.047*** (.010)
Year effects	Y	Y	Y
Obs.	20831	20831	20831
<i>R</i> ²	.416	.129	.126

Table 4: Effect of the Private Securities Litigation Reform Act (*PSLRA*) on CEO compensation

Panel A: Main effects

The dependent variables in models (1), (2) and (3) are cash-based compensation defined as the sum of salary and bonus (*CASHCOMP*), equity-based compensation defined as the sum of restricted stock grants and options grants (*EQCOMP*) and the ratio of equity-based compensation to total compensation (*EQRATIO*). *PSLRA* is an indicator variable that denotes firm-years after the passage of the Private Securities Litigation Reform Act (PSLRA) of 1995. *MB* represents the market-to-book ratio defined as the market value of total assets divided by the book value of total assets. *R&D* indicates the ratio of research and development expenses to total sales. *ADVT* is the amount of advertising expenses per dollar of sales. Missing values of *R&D* and *ADVT* have been set to zero. *SALES* denotes the log value of total sales. *LEV* measures leverage which is defined as total debt divided by total assets. *RET* is the stock return for the prior year. *RETVOL* is stock return volatility as computed by ExecuComp. *ROA* denotes profitability and is defined as earnings before extraordinary items scaled by total assets. *CASH* is the amount of cash and cash equivalents per dollar of assets. *FCF* denotes free cash flows measured as cash flow from operations less capital expenditures divided by total assets. *AGE* captures the log of firm age defined as the number of years that the firm exists on Compustat. All regressions include year fixed effects. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively. The values in parentheses under the coefficients denote robust standard errors that have been clustered at the industry level.

	(1)	(2)	(3)
	<i>CASHCOMP</i>	<i>EQCOMP</i>	<i>EQRATIO</i>
Const.	4.056*** (.113)	-1.726*** (.328)	-.104*** (.027)
<i>PSLRA</i>	.362*** (.048)	1.999*** (.134)	.196*** (.012)
<i>MB</i>	-.018* (.009)	.084*** (.031)	.014*** (.003)
<i>R&D</i>	.632*** (.130)	3.037*** (.482)	.243*** (.039)
<i>ADVT</i>	.796** (.397)	-.155 (1.792)	-.103 (.170)
<i>SALES</i>	.304*** (.012)	.761*** (.043)	.053*** (.004)
<i>LEV</i>	.208*** (.052)	.191 (.214)	.017 (.020)
<i>RET</i>	.053*** (.009)	.130*** (.034)	.012*** (.004)
<i>RETVOL</i>	-.013 (.017)	.077 (.092)	.022*** (.007)
<i>ROA</i>	.824*** (.140)	-.215 (.378)	-.093** (.037)
<i>CASH</i>	-.006 (.100)	.128 (.388)	.064* (.035)
<i>FCF</i>	.136 (.091)	.042 (.449)	-.020 (.044)
<i>AGE</i>	.067*** (.016)	-.046 (.062)	-.029*** (.005)
Year effects	Y	Y	Y
Industry effects	Y	Y	Y
Obs.	20831	20831	20831
<i>R</i> ²	.514	.2	.208

Panel B: Difference-in-difference effects

The dependent variable in models (1) and (4) is cash-based compensation (*CASHCOMP*), in models (2) and (5) is equity-based compensation (*EQCOMP*) and in models (3) and (6) is the ratio of equity-based compensation to total compensation (*EQRATIO*). *PSLRA* denotes the passage of the Private Securities Litigation Reform Act (PSLRA) of 1995. *HCARE* denotes firms in the healthcare industry. *LARGE* is an indicator variable that denotes firms in the largest decile of market value of equity as defined before the passage of PSLRA. *MB* represents the market-to-book ratio defined as the market value of total assets divided by the book value of total assets. *R&D* indicates the ratio of research and development expenses to total sales. *ADVT* is the amount of advertising expenses per dollar of sales. Missing values of *R&D* and *ADVT* have been set to zero. *SALES* denotes the log value of total sales. *LEV* measures leverage which is defined as total debt divided by total assets. *RET* is the stock return for the prior year. *RETVOL* is stock return volatility as computed by ExecuComp. *ROA* denotes profitability and is defined as earnings before extraordinary items scaled by total assets. *CASH* is the amount of cash and cash equivalents per dollar of assets. *FCF* denotes free cash flows measured as cash flow from operations less capital expenditures divided by total assets. *AGE* captures the log of firm age defined as the number of years that the firm exists on Compustat. All regressions include year fixed effects. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively. The values in parentheses under the coefficients denote robust standard errors that have been clustered at the industry level.

	(1)	(2)	(3)	(4)	(5)	(6)
	<i>CASHCOMP</i>	<i>EQCOMP</i>	<i>EQRATIO</i>	<i>CASHCOMP</i>	<i>EQCOMP</i>	<i>EQRATIO</i>
Const.	4.056*** (.113)	-1.729*** (.328)	-.104*** (.027)	4.104*** (.118)	-1.563*** (.343)	-.093*** (.029)
<i>PSLRA</i>	.362*** (.048)	1.993*** (.135)	.196*** (.012)	.366*** (.052)	1.895*** (.127)	.179*** (.012)
<i>PSLRA*HCARE</i>	.017 (.019)	.402*** (.095)	.021*** (.006)	.020 (.020)	.434*** (.090)	.025*** (.006)
<i>LARGE</i>				.056 (.045)	-.191 (.169)	-.048*** (.017)
<i>PSLRA*LARGE</i>				.027 (.044)	.398** (.200)	.054*** (.018)
<i>MB</i>	-.018* (.009)	.083*** (.031)	.014*** (.003)	-.018* (.009)	.082*** (.030)	.014*** (.003)
<i>R&D</i>	.632*** (.130)	3.036*** (.482)	.243*** (.039)	.621*** (.131)	3.020*** (.485)	.244*** (.039)
<i>ADVT</i>	.796** (.397)	-.156 (1.792)	-.104 (.170)	.727* (.405)	-.262 (1.777)	-.099 (.165)
<i>SALES</i>	.304*** (.012)	.762*** (.043)	.053*** (.004)	.298*** (.013)	.753*** (.046)	.054*** (.004)
<i>LEV</i>	.208*** (.052)	.194 (.214)	.017 (.020)	.213*** (.051)	.200 (.214)	.017 (.020)
<i>RET</i>	.053*** (.009)	.129*** (.034)	.012*** (.004)	.053*** (.009)	.129*** (.034)	.011*** (.004)
<i>RETVOL</i>	-.013 (.017)	.077 (.092)	.022*** (.007)	-.013 (.017)	.077 (.092)	.023*** (.007)
<i>ROA</i>	.824*** (.140)	-.213 (.378)	-.093** (.037)	.825*** (.140)	-.210 (.379)	-.093** (.037)
<i>CASH</i>	-.006 (.100)	.129 (.387)	.064* (.035)	-.012 (.102)	.120 (.385)	.065* (.035)
<i>FCF</i>	.136 (.091)	.039 (.449)	-.020 (.044)	.141 (.091)	.051 (.450)	-.020 (.044)
<i>AGE</i>	.067*** (.016)	-.046 (.062)	-.029*** (.005)	.065*** (.016)	-.052 (.061)	-.029*** (.005)
Year effects	Y	Y	Y			
Industry effects	Y	Y	Y			
Obs.	20831	20831	20831	20831	20831	20831
<i>R</i> ²	.514	.2	.208	.514	.2	.208

Table 5: Robustness tests

Panel A: Relation between regulated industries (*REGU*) and CEO compensation

The dependent variable in models (1) and (4) is cash-based compensation (*CASHCOMP*), in models (2) and (5) is equity-based compensation (*EQCOMP*) and in models (3) and (6) is the ratio of equity-based compensation to total compensation (*EQRATIO*). *REGU* indicates firms in regulated industries. *HCARE* denotes firms in the healthcare industry (SIC codes 8000-8099 and 5122). *LARGE* is an indicator variable that denotes firms in the largest decile of market value of equity. *MB* represents the market-to-book ratio defined as the market value of total assets divided by the book value of total assets. *R&D* indicates the ratio of research and development expenses to total sales. *ADVT* is the amount of advertising expenses per dollar of sales. Missing values of *R&D* and *ADVT* have been set to zero. *SALES* denotes the log value of total sales. *LEV* measures leverage which is defined as total debt divided by total assets. *RET* is the stock return for the prior year. *RETVOL* is stock return volatility as computed by ExecuComp. *ROA* denotes profitability and is defined as earnings before extraordinary items scaled by total assets. *CASH* is the amount of cash and cash equivalents per dollar of assets. *FCF* denotes free cash flows measured as cash flow from operations less capital expenditures divided by total assets. *AGE* captures the log of firm age defined as the number of years that the firm exists on Compustat. All regressions include year fixed effects. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively. The values in parentheses under the coefficients denote robust standard errors that have been clustered at the industry level.

	(1)	(2)	(3)	(4)	(5)	(6)
	<i>CASHCOMP</i>	<i>EQCOMP</i>	<i>EQRATIO</i>	<i>CASHCOMP</i>	<i>EQCOMP</i>	<i>EQRATIO</i>
Const.	4.175*** (.101)	-1.036*** (.348)	-.040 (.033)	4.172*** (.101)	-.659* (.349)	.004 (.032)
<i>REGU</i>	.020 (.093)	-.213 (.248)	-.031 (.021)	.010 (.100)	-.318 (.239)	-.044** (.018)
<i>HCARE</i>				.115 (.110)	1.032*** (.224)	.124*** (.018)
<i>LARGE</i>				-1.00e-05 (.041)	.446*** (.145)	.052*** (.015)
<i>MB</i>	-.014 (.012)	.125*** (.037)	.020*** (.004)	-.015 (.012)	.104*** (.035)	.018*** (.004)
<i>R&D</i>	.699*** (.191)	4.015*** (.479)	.360*** (.060)	.703*** (.189)	3.907*** (.482)	.348*** (.062)
<i>ADVT</i>	1.387*** (.511)	-2.472 (2.237)	-.254 (.218)	1.391*** (.507)	-2.830 (2.195)	-.296 (.210)
<i>SALES</i>	.295*** (.014)	.720*** (.043)	.049*** (.004)	.295*** (.015)	.666*** (.041)	.043*** (.003)
<i>LEV</i>	.219*** (.084)	.196 (.284)	.008 (.026)	.219*** (.084)	.222 (.283)	.011 (.025)
<i>RET</i>	.053*** (.012)	.126*** (.039)	.010** (.004)	.053*** (.012)	.129*** (.040)	.010** (.004)
<i>RETVOL</i>	-.019 (.019)	.147 (.100)	.034*** (.008)	-.022 (.018)	.122 (.098)	.031*** (.008)
<i>ROA</i>	.864*** (.149)	-.394 (.418)	-.115** (.045)	.866*** (.150)	-.328 (.416)	-.107** (.044)
<i>CASH</i>	.048 (.145)	.152 (.350)	.091** (.038)	.051 (.145)	.138 (.336)	.089** (.036)
<i>FCF</i>	.264** (.132)	.596 (.648)	.024 (.067)	.257* (.133)	.552 (.635)	.019 (.066)
<i>AGE</i>	.041 (.031)	-.184* (.111)	-.047*** (.009)	.043 (.030)	-.166 (.104)	-.045*** (.008)
Year effects	Y	Y	Y	Y	Y	Y
Industry effects	Y	Y	Y	Y	Y	Y
Obs.	20831	20831	20831	20831	20831	20831
<i>R</i> ²	.416	.128	.126	.416	.131	.131

Panel B: Relation between new-economy firms (*NEW*) and CEO compensation

The dependent variable in models (1) and (4) is cash-based compensation (*CASHCOMP*), in models (2) and (5) is equity-based compensation (*EQCOMP*) and in models (3) and (6) is the ratio of equity-based compensation to total compensation (*EQRATIO*). *NEW* indicates new economy firms as defined in Murphy (2003). *HCARE* denotes firms in the healthcare industry (SIC codes 8000-8099 and 5122). *LARGE* is an indicator variable that denotes firms in the largest decile of market value of equity. *MB* represents the market-to-book ratio defined as the market value of total assets divided by the book value of total assets. *R&D* indicates the ratio of research and development expenses to total sales. *ADVT* is the amount of advertising expenses per dollar of sales. Missing values of *R&D* and *ADVT* have been set to zero. *SALES* denotes the log value of total sales. *LEV* measures leverage which is defined as total debt divided by total assets. *RET* is the stock return for the prior year. *RETVOL* is stock return volatility as computed by ExecuComp. *ROA* denotes profitability and is defined as earnings before extraordinary items scaled by total assets. *CASH* is the amount of cash and cash equivalents per dollar of assets. *FCF* denotes free cash flows measured as cash flow from operations less capital expenditures divided by total assets. *AGE* captures the log of firm age defined as the number of years that the firm exists on Compustat. All regressions include year fixed effects. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively. The values in parentheses under the coefficients denote robust standard errors that have been clustered at the industry level.

	(1)	(2)	(3)	(4)	(5)	(6)
	<i>CASHCOMP</i>	<i>EQCOMP</i>	<i>EQRATIO</i>	<i>CASHCOMP</i>	<i>EQCOMP</i>	<i>EQRATIO</i>
Const.	4.184*** (.115)	-1.106*** (.342)	-.051* (.030)	4.186*** (.119)	-.796** (.342)	-.017 (.031)
<i>NEW</i>	-.133*** (.044)	.215 (.193)	.058*** (.020)	-.130*** (.044)	.230 (.185)	.060*** (.019)
<i>HCARE</i>				.101* (.061)	.833*** (.129)	.102*** (.013)
<i>LARGE</i>				.008 (.045)	.396*** (.133)	.044*** (.015)
<i>MB</i>	-.014 (.012)	.130*** (.037)	.021*** (.004)	-.015 (.012)	.113*** (.035)	.019*** (.004)
<i>R&D</i>	.737*** (.151)	4.074*** (.464)	.359*** (.048)	.742*** (.152)	4.026*** (.470)	.354*** (.049)
<i>ADVT</i>	1.354** (.537)	-1.963 (2.320)	-.183 (.219)	1.373*** (.533)	-2.069 (2.290)	-.193 (.214)
<i>SALES</i>	.299*** (.013)	.711*** (.041)	.048*** (.003)	.298*** (.014)	.662*** (.041)	.042*** (.003)
<i>LEV</i>	.207** (.094)	.167 (.326)	.008 (.028)	.205** (.094)	.169 (.321)	.008 (.027)
<i>RET</i>	.052*** (.013)	.121*** (.041)	.010** (.004)	.052*** (.013)	.121*** (.040)	.010** (.004)
<i>RETVOL</i>	-.007 (.020)	.138 (.103)	.030*** (.008)	-.009 (.020)	.122 (.103)	.028*** (.008)
<i>ROA</i>	.835*** (.155)	-.284 (.428)	-.094** (.046)	.841*** (.156)	-.195 (.433)	-.084* (.045)
<i>CASH</i>	.123 (.145)	.009 (.350)	.055* (.034)	.122 (.145)	-.024 (.346)	.052 (.033)
<i>FCF</i>	.291** (.136)	.551 (.665)	.012 (.067)	.285** (.135)	.514 (.655)	.007 (.067)
<i>AGE</i>	.034 (.030)	-.170 (.120)	-.044*** (.010)	.036 (.030)	-.154 (.118)	-.042*** (.010)
Year effects	Y	Y	Y	Y	Y	Y
Industry effects	Y	Y	Y	Y	Y	Y
Obs.	20831	20831	20831	20831	20831	20831
<i>R</i> ²	.418	.128	.128	.419	.13	.132

Panel C: Cross-sectional regressions

The dependent variable in models (1) and (4) is cash-based compensation (*CASHCOMP*), in models (2) and (5) is equity-based compensation (*EQCOMP*) and in models (3) and (6) is the ratio of equity-based compensation to total compensation (*EQRATIO*). *HCARE* denotes firms in the healthcare industry (SIC codes 8000-8099 and 5122). *LARGE* is an indicator variable that denotes firms in the largest decile of market value of equity. *MB* represents the market-to-book ratio defined as the market value of total assets divided by the book value of total assets. *R&D* indicates the ratio of research and development expenses to total sales. *ADVT* is the amount of advertising expenses per dollar of sales. Missing values of *R&D* and *ADVT* have been set to zero. *SALES* denotes the log value of total sales. *LEV* measures leverage which is defined as total debt divided by total assets. *RET* is the stock return for the prior year. *RETVOL* is stock return volatility as computed by ExecuComp. *ROA* denotes profitability and is defined as earnings before extraordinary items scaled by total assets. *CASH* is the amount of cash and cash equivalents per dollar of assets. *FCF* denotes free cash flows measured as cash flow from operations less capital expenditures divided by total assets. *AGE* captures the log of firm age defined as the number of years that the firm exists on Compustat. All regressions include year fixed effects. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively. The values in parentheses under the coefficients denote robust standard errors that have been clustered at the industry level.

	(1)	(2)	(3)	(4)	(5)	(6)
	<i>CASHCOMP</i>	<i>EQCOMP</i>	<i>EQRATIO</i>	<i>CASHCOMP</i>	<i>EQCOMP</i>	<i>EQRATIO</i>
Const.	3.959*** (.193)	1.483** (.751)	.193*** (.073)	4.656*** (.083)	1.193*** (.351)	.159*** (.032)
<i>HCARE</i>	.040 (.109)	.463* (.253)	.084*** (.032)			
<i>LARGE</i>				.059 (.044)	.476*** (.160)	.041*** (.014)
<i>MB</i>	-.020 (.047)	.410*** (.157)	.054*** (.015)	-.069*** (.016)	.119** (.061)	.025*** (.006)
<i>R&D</i>	.137 (.408)	4.415** (1.913)	.331* (.190)	.865*** (.152)	4.411*** (.610)	.397*** (.063)
<i>ADVT</i>	1.498 (1.319)	-5.945 (4.981)	-.182 (.462)	1.844*** (.461)	-3.792* (2.217)	-.349* (.193)
<i>SALES</i>	.307*** (.026)	.463*** (.086)	.034*** (.008)	.283*** (.010)	.628*** (.040)	.040*** (.004)
<i>LEV</i>	.833*** (.191)	.674 (.672)	.010 (.073)	.197*** (.076)	.604** (.308)	.058** (.028)
<i>RET</i>	-.075 (.208)	.934 (.910)	-.006 (.071)	.178*** (.045)	.433* (.222)	.031 (.020)
<i>RETVOL</i>	-.069 (.143)	.620 (.452)	.080** (.041)	-.034 (.029)	.050 (.135)	.025** (.013)
<i>ROA</i>	.840 (1.092)	-6.234** (3.005)	-.695** (.282)	.470** (.206)	-1.800** (.903)	-.205** (.090)
<i>CASH</i>	1.357*** (.510)	-2.016 (1.316)	-.050 (.128)	-.042 (.111)	.354 (.453)	.115*** (.042)
<i>FCF</i>	.538 (.794)	4.929* (2.903)	.172 (.274)	.928*** (.207)	2.064** (.927)	.094 (.088)
<i>AGE</i>	.102** (.049)	-.147 (.174)	-.058*** (.015)	.023 (.015)	-.301*** (.061)	-.055*** (.006)
Year effects	Y	Y	Y	Y	Y	Y
Industry effects	Y	Y	Y	Y	Y	Y
Obs.	383	383	383	2722	2722	2722
<i>R</i> ²	.545	.19	.236	.457	.168	.187

Table 6: Effect of the Sarbanes Oxley Act (*SOX*) on CEO compensation

The dependent variable in models (1) and (4) is cash-based compensation (*CASHCOMP*), in models (2) and (5) is equity-based compensation (*EQCOMP*) and in models (3) and (6) is the ratio of equity-based compensation to total compensation (*EQRATIO*). *SOX* denotes the post Sarbanes Oxley Act (*SOX*) period. *HCARE* denotes firms in the healthcare industry (SIC codes 8000-8099 and 5122). *LARGE* is an indicator variable that denotes firms in the largest decile of market value of equity as defined before the passage of *SOX*. *MB* represents the market-to-book ratio defined as the market value of total assets divided by the book value of total assets. *R&D* indicates the ratio of research and development expenses to total sales. *ADVT* is the amount of advertising expenses per dollar of sales. Missing values of *R&D* and *ADVT* have been set to zero. *SALES* denotes the log value of total sales. *LEV* measures leverage which is defined as total debt divided by total assets. *RET* is the stock return for the prior year. *RETVOL* is stock return volatility as computed by ExecuComp. *ROA* denotes profitability and is defined as earnings before extraordinary items scaled by total assets. *CASH* is the amount of cash and cash equivalents per dollar of assets. *FCF* denotes free cash flows measured as cash flow from operations less capital expenditures divided by total assets. *AGE* captures the log of firm age defined as the number of years that the firm exists on Compustat. All regressions include year fixed effects. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively. The values in parentheses under the coefficients denote robust standard errors that have been clustered at the industry level.

	(1)	(2)	(3)	(4)	(5)	(6)
	<i>CASHCOMP</i>	<i>EQCOMP</i>	<i>EQRATIO</i>	<i>CASHCOMP</i>	<i>EQCOMP</i>	<i>EQRATIO</i>
Const.	4.181*** (.110)	-1.101*** (.346)	-.050 (.032)	4.017*** (.117)	-1.655*** (.352)	-.100*** (.028)
<i>SOX</i>	.507*** (.064)	1.803*** (.183)	.162*** (.015)	.448*** (.044)	1.627*** (.146)	.144*** (.013)
<i>SOX*HCARE</i>				-.062** (.025)	.058 (.148)	.007 (.006)
<i>SOX*LARGE</i>				-.074** (.038)	.405*** (.142)	.037*** (.014)
<i>LARGE</i>				-.013 (.042)	-.094 (.156)	-.011 (.014)
<i>MB</i>	-.015 (.013)	.131*** (.037)	.021*** (.004)	-.017* (.010)	.086*** (.031)	.015*** (.003)
<i>R&D</i>	.686*** (.202)	4.157*** (.452)	.381*** (.062)	.646*** (.125)	3.003*** (.492)	.240*** (.040)
<i>ADVT</i>	1.337** (.557)	-1.936 (2.320)	-.176 (.220)	.816** (.398)	-.174 (1.757)	-.104 (.166)
<i>SALES</i>	.296*** (.013)	.716*** (.041)	.049*** (.004)	.310*** (.013)	.756*** (.051)	.053*** (.004)
<i>LEV</i>	.225** (.095)	.138 (.325)	.00003 (.029)	.204*** (.051)	.193 (.217)	.017 (.020)
<i>RET</i>	.053*** (.013)	.119*** (.040)	.009** (.004)	.052*** (.009)	.133*** (.034)	.012*** (.004)
<i>RETVOL</i>	-.020 (.021)	.159 (.103)	.035*** (.008)	-.013 (.017)	.079 (.091)	.023*** (.007)
<i>ROA</i>	.857*** (.152)	-.320 (.439)	-.104** (.047)	.821*** (.142)	-.227 (.371)	-.095*** (.036)
<i>CASH</i>	.050 (.147)	.127 (.349)	.087** (.039)	-.0001 (.101)	.114 (.388)	.063* (.035)
<i>FCF</i>	.264** (.132)	.594 (.667)	.024 (.070)	.133 (.090)	.051 (.449)	-.020 (.044)
<i>AGE</i>	.041 (.030)	-.182 (.116)	-.047*** (.010)	.067*** (.016)	-.045 (.062)	-.029*** (.005)
Year effects	Y	Y	Y	Y	Y	Y
Industry effects	N	N	N	Y	Y	Y
Obs.	20831	20831	20831	20831	20831	20831
<i>R</i> ²	.416	.128	.124	.514	.2	.208