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**Eric Talley and Gudrun Johnsen**

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# Corporate Governance, Executive Compensation and Securities Litigation\*

Eric Talley<sup>†</sup> and Gudrun Johnsen<sup>‡</sup>

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## Abstract

It is generally accepted that good corporate governance, executive compensation and the threat of litigation are all important mechanisms for incentivizing managers of public corporations. While there are significant and robust literatures analyzing each of these policy instruments in isolation, their mutual relationship and interaction has received somewhat less attention. Such neglect is mildly surprising in light of a strong intuition that the three devices are structurally related to one another (either as complements or substitutes). In this paper, we construct an agency cost model of the firm in which corporate governance protections, executive compensation levels, and litigation incentives are all endogenously determined. We then test the predictions of the model using a firm-level data set including governance, executive compensation, and securities litigation variables. Consistent with our predictions, we find governance and compensation to be structural substitutes with one another, so that more protective governance structures tend to coincide with lower-powered incentives in executive contracts. Also consistent with our predictions, we find executive compensation and shareholder litigation appear to be structural complements to one another, so that higher powered incentives tend to catalyze more frequent litigation. In fact, we estimate that each 1% increase in the incentive component of a CEO's contract predicts 0.3% increase in the likelihood of a securities class action and a \$3.4 million dollar increase in expected settlement costs. In addition, the complementarity of executive compensation and litigation allows us to formulate new ways to test for the effects of legal reform, such as the Private Securities Litigation Reform Act of 1995. The results of our preliminary tests appear inconsistent with the claims of the statute's proponents that the PSLRA systematically discouraged non-meritorious litigation without burdening meritorious claims, particularly for firms with relatively low volatility.

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<sup>†</sup>USC Law School and RAND Corporation. Email: [etalley@law.usc.edu](mailto:etalley@law.usc.edu).

<sup>‡</sup>RAND Corporation. Email: [gudrun@rand.org](mailto:gudrun@rand.org)

# 1 Introduction

Most modern theories of corporate behavior turn critically on the foundational premise of managerial agency costs – the misaligned incentives that incubate in the interstices where ownership diverges from control.<sup>1</sup> No doubt a testament to the power of the agency cost approach, individual scholars from a multiplicity of disciplines routinely invoke it to motivate their own varied institutional inquiries. Corporate and securities law scholars, for example, consider how the threat of legal liability (through such doctrines as securities fraud or fiduciary duties) might tend to ameliorate managerial incentive problems.<sup>2</sup> Organizational scholars focus on how the corporate governance structure of firms (such as board composition, voting structure, and takeover defenses) may provide forms of direct oversight and concomitant managerial discipline.<sup>3</sup> Compensation scholars, in contrast, focus on how compensation schemes can motivate corporate fiduciaries to act “as if” they were in the shoes of shareholders.<sup>4</sup>

The underlying motivation behind this paper is the observation that each of above analytical foci, while informative on its own terms, is almost certainly incomplete when viewed in isolation. In other words, we begin with the premise that the “portfolio” of intrafirm incentive devices (including governance, compensation and litigation) can be best understood only if all its major components are viewed in conjunction with one another. This observation is based on both intuition and empirical observation. Empirically, it is clear that we observe each of the above incentive devices in everyday practice, suggesting that they tend to work as part of a larger mechanism for providing managerial incentives. Moreover, first principles would lead one to predict all three mechanisms to work simultaneously, since each plays a pivotal role at a slightly different context, and each likely exhibits decreasing returns. Corporate governance systems largely represent an *ex ante* command-and-control approach, constraining the authority of managers and inculcating more direct shareholder oversight of managerial conduct early on. Litigation, in contrast, is more squarely a source of *ex post* incentives, imposing liability on a manager when a judicial actor deems the manager’s prior conduct to have proximately caused a verifiable loss in firm value. Executive compensation stakes out somewhat of a middle ground, providing managers with rewards when various benchmark signals of value (such as earnings reports) are met, even though the firm’s ultimate return may remain concealed from view.

In theory, any of these devices, if operating perfectly, might be able to solve managerial agency cost problems completely. In reality, however, each suffers from drawbacks that ultimately limit its singular use. Direct oversight through

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<sup>1</sup>Jensen & Meckling (1976). Under the Jensen & Meckling definition, agency costs include problems of hidden actions, hidden information, influence costs, and the costs of implementing institutional structures to deal with them.

<sup>2</sup>Easterbrook & Fischel 1991.

<sup>3</sup>Gompers, Metrick & Ishii (2003). See also Graham, Litan & Sukhtankar (2002), who estimate of the GDP costs of accounting and governance scandals (framed by the Enron and Worldcom bankruptcies) at around \$40 billion.

<sup>4</sup>Jensen & Murphy 1990; Agrawal & Samwick 1999.

an invasive corporate governance structure, for example, may restrain managerial opportunism, but it does so by reducing organizational flexibility, introducing bureaucracy, and re-introducing the very monitoring cost that shareholders presumably hope to avoid by hiring a professional manager.<sup>5</sup> Litigation, as well, is frequently undermined by the fact that courts are admittedly poor arbiters in hindsight of managerial business decisions, thereby rendering them prone to errors that can both catalyze strike suits and dampen the deterrence value of litigation.<sup>6</sup> Finally, a number of costs also attend incentive pay, not the least of which is the fact that paying significant rents to managers necessarily forces non-managerial shareholders to reduce their own payoffs. Furthermore, while incentive pay can help motivate managers to work hard on behalf of increasing share price, it also provides an independent motivation for managers to mislead public investors about the firm's near-term prospects, so as to increase their remuneration and to preserve their prospective ability to extract private benefits of control. Given these limitations, it seems likely that each of the above devices is unlikely to serve as an independent panacea for corporate agency costs.<sup>7</sup>

Viewed against this context, it is perhaps mildly surprising that much of the existing literature tends to focus on various manifestations of intrafirm incentives in isolation, abstracting away from the general interactions that can complicate analysis. While understandable for reasons of analytical tractability, such neglect can prove problematic for a number of reasons: First, it may render faulty predictions by failing to account for feedback effects that echo against other institutional sub-structures. For example, a reform to securities fraud law (such as the significant reforms that took place in early 1996) may directly alter litigation behavior among participants, but it may also affect the manner in which executives are compensated or the intensity of shareholder oversight of the company through changes in the corporate governance regime. These changes may *themselves* have boomerang effects within the litigation market that deserve attention if one wishes to make predictions about the effect of reform. Relatedly, non-systematic inquiries can yield empirical findings that will be difficult (and sometimes even impossible) to interpret without greater understanding of the relevant interaction effects at play. And finally, myopic attention to a single institutional structure is likely to yield myopic policy prescriptions about how courts, regulators, firms or society in general should respond. In light of these problems, it is important for scholars to develop frameworks for thinking about mechanisms of incentive provision in a systemic fashion.

Our paper contributes to this systemic approach to managerial incentives in at least two respects, the first theoretical and the second empirical. First, we develop and analyze a game-theoretic model in which the corporate governance regime, incentive compensation for corporate fiduciaries, and securities litigation are all determined endogenously, each contributing independently to the panoply of incentives that shape managerial effort and disclosure. Within this

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<sup>5</sup>Arlen & Talley (2003).

<sup>6</sup>E.g., Romano (1991).

<sup>7</sup>Or, in more tech-headed vernacular, each device is likely to have decreasing returns, thereby implying that they will be used in combination.

framework, we show that compensation and corporate governance tend to be structural substitutes of one another, so that (all else held constant) more invasive corporate governance tends to minimize the necessity of significant incentive contracts (and vice versa). Moreover, compensation and securities litigation within our framework are predicted to be structural complements of one another, so that larger incentive compensation levels increase the expected incidence of litigation, as incentive compensation often provides a temptation to issue misleading corporate disclosures. At the same time, however, we demonstrate the difficulties that one might face in attempting to quantify these mutual relationships in “reduced” form. In particular, variations in a number of unobserved parameters can cause simultaneous responses in governance, compensation, and litigation that may generate apparent correlations that cut against their predicted structural relationships.

We then employ our theoretical predictions to inform empirical tests using a large data set that merges observations on governance, executive compensation and private securities class actions among publicly traded firms. The structural relationships predicted in our theoretical model appear largely to be borne out, as governance and incentive compensation operate as substitutes while incentive compensation and securities litigation operate as complements. Although these relationships appear manifest both in the absence and presence of statistical instruments derived to control for endogeneity problems, in nearly all cases the effect is both economically and statistically strongest in the presence of endogeneity controls (once again consistent with our predictions). Perhaps of particular interest, we estimate that each 1% increase in the fraction of a CEO’s contract devoted to medium- to long-term incentives (rather than short-term compensation) predicts a 0.3% increase in *expected* litigation and a \$3.4 million dollar increase in *expected* settlement costs. While these estimates are still preliminary, they appear significant both statistically and economically. In addition, the complementarity of executive compensation and litigation allows us to formulate new ways to test for the effects of legal reform, such as the Private Securities Litigation Reform Act of 1995. The results of our (also preliminary) tests appear to suggest that even if the PSLRA reduced frivolous litigation (as its proponents claim), it likely deterred meritorious litigation as well, and in such proportions as to swamp the deterring effects on non-meritorious suits.

In addition to these concrete results, the general framework developed here may also prove helpful in assessing the likely effects of current and forthcoming reforms in corporate and securities regulation. Indeed, the Sarbanes-Oxley Act of 2002 (or SOX) is notable precisely because it constitutes not only a reform to traditional securities fraud laws<sup>8</sup>, but it also has mandated significant changes

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<sup>8</sup>The Act, for example, extends the length of many statutes of limitation and imposes new certification requirements on CEOs that are likely to have the effect of facilitating hard evidence for pleading securities fraud. See 18 U.S.C. § 1350 (2003) (as added by § 906 of the Sarbanes-Oxley Act of 2002).

in both corporate governance structures<sup>9</sup> and executive compensation.<sup>10</sup> In order to understand the ultimate effects of these reforms, then, it is imperative that one comprehends the structural relationship between the constituent parts of SOX. Given that our analysis uncovers somewhat stronger structural relationships between governance, compensation and litigation than simple historical correlational analysis would suggest, there may be greater reason than many currently suggest to think that the SOX reforms are capable of having durable effects.

Because this paper aims to provide a systemic account of incentive mechanisms, the relevant literatures are perhaps too vast to give complete justice to here. In some ways, our study is closely affiliated with a few recent approaches to use executive compensation structures to predict corporate disclosure. Ke (2003), for example, finds that CEOs who hold more stock options and stocks are more likely to report longer strings of consecutive earnings increase, especially for firms whose stock prices are historically sensitive to earnings reports. A number of other studies contain similar findings.<sup>11</sup> In perhaps the most closely related paper to ours, Johnson, Ryan & Tian (2003) find that incentive-based compensation and the exercise of lucrative options is significantly more common in firms who are subject to SEC enforcement releases. This study complements theirs in coming to similar findings with private securities class action, but also differs in other ways. Indeed, our study not only formulates theoretical model to frame the interaction of executive compensation with other incentive mechanisms, but we also estimate one of the principal costs to misreporting (in the form of securities litigation settlements). Another strand of papers attempts to estimate the impact of the PSLRA on “meritorious” cases using litigation data (e.g., Johnson et al. 2000; 2002; Choi 2004). The results from these studies are not mutually consistent with one another, due perhaps to the difficulty in forming clean predictions about how the Reform Act should have affected observable litigation choices.<sup>12</sup> (We detail this difficulty in the theoretical section of this paper). Our analysis, in contrast, attempts to test for the effects of legal reform not by analyzing the observable changes in litigation activity directly, but rather in considering how the Reform Act was effectively “priced out” in executive compensation contracts.<sup>13</sup>

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<sup>9</sup>See, e.g., 15 U.S.C. § 78j-1(g) (2003) (prohibiting auditors from providing non-auditing services to clients); SOX § 301 (requiring each member of the audit committee of a listed company to be independent); NYSE Listing Requirements; Final Corporate Governance Rules (November 2003) (requiring majority board independence).

<sup>10</sup>See, e.g., SOX § 402. (as codified in 15 U.S.C. 78m (2003)), (prohibiting, subject to some limitations, personal loans made to any director or executive officer).

<sup>11</sup>E.g., Baker et al. (2002); Cheng and Warfield (2002); Myers and Skinner (2001).

<sup>12</sup>See, e.g., Bernardo et al. (2000).

<sup>13</sup>Helland (2004) analyzes the merits of securities class actions using reputations as a proxy for legitimate suits. He finds that, for the most part, securities fraud litigation appears to have little effect on future directorships of defendants. Only in the larger quartile of settlements, or in cases where the SEC has also brought an action does there appear to be much of a relationship. Our results, however, suggest that securities fraud litigation does have some interplay with other mechanisms of corporate governance – consistent with private class actions having some effect.

This remainder of this article proceeds as follows. Section 2 presents our theoretical model and derives the structural substitutability of compensation with corporate governance structures, as well as the structural complementarity of incentive compensation with securities litigation. We also demonstrate in this section some of the challenges for detecting these inter-relationships empirically. Section 3 turns to our empirical strategy for testing our framework, and estimates the magnitude of the substitutability and complementarity hypotheses described above. Section 4 concludes.

## 2 A Model of Governance, Compensation and Litigation

Because the relationship between governance, compensation and litigation is a complex one, a sound empirical strategy for measuring their mutual relationship virtually necessitates developing some sort of theory about their interrelationship. In this section of the paper, we do just that, considering more formally how corporate governance, executive compensation and securities litigation interact with one another in a game-theoretic framework of optimal organizational design. As noted in the introduction, it is often not clear on *a priori* grounds whether these incentive devices are properly seen as mutual complements, substitutes, or neither. The model presented below, therefore, attempts to formalize these concepts, and propose when, as a matter of prediction, each account will hold true.

In developing this theoretical framework, it is important that it capture certain features of the institutional environment. First, and most importantly, all three instruments (governance, compensation and litigation) must at least potentially have a role in shaping incentives. If one of them were systematically excluded from our analysis, we would be unlikely to uncover interesting mutual interrelationships between them. Second, each of these factors should enter in a theoretically distinct way. For example, implementing good corporate governance is perhaps best seen as a type of *ex ante* protection against future misfeasance, allowing shareholders (at some cost) to dampen the incentives that corporate fiduciaries might otherwise have to engage in self-serving behavior. Executive compensation, tends to work at an interim stage, rewarding executives when various benchmarks of anticipated performance are met (usually as reflected through stock price). Litigation, in contrast, operates *ex post*, when relatively reliable indicators of the firm's performance belie the earlier benchmarks. Finally, our model should allow for the endogeneity of institutional design, in particular the structure of the executive's contract and

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Bar-Gill and Bebchuk (2003) analyze a model of corporate misreporting. They argue that both incentive compensation and financing decisions may give managers an incentive to misreport. Their model treats the legal process as an exogenous environment, while ours actually models litigation endogenously. Moreover, their model does not consider the fact that compensation packages themselves are set endogenously, and instead simply assumes exogenous share holdings.

the nature of the firm’s governance structure. Companies are generally free to design these packages in a way that best maximizes expected firm value.<sup>14</sup>

## 2.1 Framework

Consider a business organization (or “firm”) owned by a risk-neutral Principal, denoted by  $B$  (and periodically referred to as “he”), representing a continuum of disaggregated shareholders. The principal is assumed unable (or unmotivated) to run the firm himself, and he therefore retains a risk-neutral agent, denoted by  $A$  (and periodically referred to as “she”), to manage the firm. We assume  $A$  possesses a stock of financial/reputational wealth given by  $W$ , and in addition can procure a reservation wage of  $\omega$  by contracting with one of the firm’s competitors.

The manager makes an unobservable choice about how to run the firm, which we denote by the variable  $e \in \{0, 1\}$ , and which corresponds to either “working hard” ( $e = 1$ ), or “shirking” ( $e = 0$ ). The net difference between the two is that hard work is relatively more costly to the manager, but it also yields a higher payoff to  $B$ . Explicitly, the manager always incurs a cost of  $c \geq 1$  to run the company while working hard, but shirking allows her to procure an additional benefit that would otherwise be unavailable, reducing her net cost to  $\hat{c} < c$ .

From the principal’s perspective,  $A$ ’s management choice matters because shirking increases the chances that  $B$  will obtain a low gross payoff ( $V_L$ ) instead of a high gross payoff ( $V_H > V_L$ ). The probability of each payoff type conditional decision is given by the following table. By assumption,  $p_1 > p_0$ .

	$\Pr\{V = V_L\}$	$\Pr\{V = V_H\}$
$e = 0$	$(1 - p_0)$	$p_0$
$e = 1$	$(1 - p_1)$	$p_1$

Throughout the analysis that follows, we shall impose the restriction that shirking is never optimal: that is, expected returns to high effort,  $(p_1 - p_0)(V_H - V_L)$ , are sufficiently large that the firm always prefers to incentivize the manager to work hard rather than allowing her to shirk.<sup>15</sup>

Thus far, our framework more or less resembles a conventional moral hazard model. To it, we now add elements pertaining both to governance and to securities fraud litigation. Let us first attend to corporate governance. In our view, a predominant benefit of implementing a “good” corporate governance regime is that it allows for more direct monitoring of the agent, putting shareholders in a better position to assess directly the executive’s activities and react thereto, thereby having the functional effect of reducing the attainable benefits from shirking. In this spirit, we suppose that the principal can choose the intensity

<sup>14</sup>Of course, companies generally are not free to contract out of securities fraud jurisprudence. The model developed below, therefore, treats the parameters of securities fraud litigation as exogenous, and the company designs compensation and governance structures in the shadow of such litigation.

<sup>15</sup>While relaxing this assumption is certainly feasible, the optimal contract and governance structure in that case is decidedly less interesting.



of the firm’s corporate governance structure, a choice we denote by the variable  $\kappa$ . Increasing  $\kappa$  – i.e., enhancing corporate governance protections – has the effect of dampening the benefits that  $A$  derives from shirking. In particular, we assume that under governance structure  $\kappa$ , the benefit from shirking is given by the function  $\theta(\kappa)$ , where  $\theta(0) > 0$ ,  $\theta(\infty) = 0$ ,  $\theta'(\kappa) < 0$ , and  $\theta''(\kappa) > 0$ . Consequently, the net cost associated with shirking reduces to  $\hat{c} = c - \theta(\kappa)$ . Although the properties above are all that are necessary for our results, we will put some structure on  $\theta(\kappa)$ , and assume that it has the following functional form:

$$\theta(\kappa) = \frac{c}{1 + \kappa} \quad (1)$$

While it dampens agency costs, installing a high level of corporate governance is not costless. Direct monitoring of management carries with it both an opportunity cost (of shareholders’ time) and a certain loss in organizational flexibility in the company. To reflect these costs, then, we assume that the firm faces a constant marginal cost of  $a$  of installing corporate governance, so that the total cost of governance system  $\kappa$  is given by  $a\kappa$ .

Now consider the effects of securities fraud. In a world where shareholders always learn the true state of the world (i.e.,  $V_H$  or  $V_L$ ) early on, securities fraud would never be a problem. Shareholders would simply wait for the state of the world to materialize, and compensate managers appropriately. In the real world, however, the “true” realization of  $V_i$  is hard for  $B$  to observe in the short term, either because it is not yet known, because it is knowable but prohibitively expensive to learn about, because it is highly diluted with other information about the company, and so forth. In such a situation, securities markets will often depend on managers’ representations about the health of the firm (in the form of earnings forecasts, MD&As, press releases, and so forth). And it is these representations, in turn, that can ignite future securities fraud claims. In this spirit, we assume that during the relevant time period that sets  $A$ ’s compensation, the true state of the world is generally not publicly known.<sup>16</sup> However, after the manager has chosen her effort level, she observes a signal about the firm’s prospective outcome, denoted by  $\gamma \in \{L, H\}$ . The signal is assumed to be unbiased, but imprecise. In particular, suppose the agent has expended effort level  $e$ , with associated success probability of  $p_e$ . With probability  $q$  the agent observes the true state of the world; but with probability  $(1 - q)$  the agent observes an uninformative signal. The conditional distribution of the agent’s signal, then, is given in the table below:

		True State	
		$V_L$	$V_H$
Conditional	$\Pr\{\gamma = L V_i\}$	$q + (1 - q)(1 - p_e)$	$(1 - q)(1 - p_e)$
Probability	$\Pr\{\gamma = H V_i\}$	$(1 - q)p_e$	$q + (1 - q)p_e$

<sup>16</sup>As detailed below, however, we shall also assume that the state of the world does become known with some probability, thereby raising the possibility of securities fraud litigation.

Note from the table that  $q \in [0, 1]$  is tantamount to the precision of the agent’s signal, so that we allow  $\gamma$  to range from being complete noise to completely informative. Also note that the unconditional probabilities of receiving signals  $L$  and  $H$  are  $(1 - p_e)$  and  $p_e$ , respectively; thus,  $\gamma$  is an unbiased signal about future outcomes.<sup>17</sup>

Critically, we assume that while  $\gamma$  is observable only to the manager, she makes a public disclosure about its content. She may choose to misrepresent the signal if, for example, her compensation package awards her with significant incentive compensation upon news of a good state of the world. On the other hand, she may choose to reveal truthfully if dishonesty imposes a significantly greater litigation risk on her. We therefore assume that  $B$  does not directly observe  $\gamma$ , but rather observe  $\hat{\gamma}$ , where  $\hat{\gamma} \in \{L, H\}$  denotes  $A$ ’s representations about the signal she has observed.<sup>18</sup> Should  $A$  contract with the firm, then, her compensation consists of the pair  $\{w, \sigma\}$ , where  $w$  represents a flat wage, and  $\sigma$  is a bonus payment that  $A$  receives if  $\hat{\gamma} = H$ .<sup>19</sup>

Once the agent has disclosed  $\hat{\gamma}$ , and received her compensation, there is a small (exogenous) probability  $\mu$  that the true state of the world will be revealed. In those situations where a low outcome has been revealed ( $V = V_L$ ) following an optimistic disclosure by  $A$  ( $\hat{\gamma} = H$ ), a possibility for a securities fraud suit exists. Mirroring the actual contours of securities fraud law, we assume that not all shareholders have standing to sue; rather, it is only those shareholders who purchased or sold shares during the period of the fraud who are able to file private securities fraud actions. In particular, we suppose that just after the manager’s disclosure, a proportion  $\rho$  of existing shareholders are forced to sell their shares for liquidity reasons. Under current law, the new owners of those sold shares have the right to bring private securities fraud litigation. The per-share damages such a suit for each suing plaintiff is presumed to be given by a parameter  $Ddx$ , so that the total damages at stake are equal to  $\rho D$ . We assume that this value is sufficiently “large” that it exceeds the manager’s resources for

<sup>17</sup>Moreover, the unbiasedness of the signal implies that the *reverse* conditional probabilities also match the conditional probabilities given in the table. And thus, the reverse conditionals are:

		Signal	
		$L$	$H$
Conditional	$\Pr\{V_L \gamma\}$	$q + (1 - q)(1 - p_i)$	$(1 - q)(1 - p_i)$
Probability	$\Pr\{V_H \gamma\}$	$(1 - q)p_i$	$q + (1 - q)p_i$

<sup>18</sup>In many situations (e.g., disclosure items that are not required but are subject to securities fraud provisions – such as earnings projections), the agent may have a third choice of not disclosing anything. Within our framework, however, such a decision is tantamount to disclosing a low state of the world, and we therefore treat it as such.

For more on the necessity of “soft” determinations for executive compensation, see Murphy & Oyer (2003).

<sup>19</sup>The reader will note that  $\sigma$  turns on  $A$ ’s disclosure  $\hat{\gamma}$  rather than the actual state of the world. Because the true state of the world is not generally known, incentive-based compensation decisions must necessarily be predicated on  $\hat{\gamma}$ . As will become apparent below, the incentives faced by the manager may further be distorted in the event that shareholders file securities fraud suits in those instances where the realized state of the world conflicts with the manager’s disclosure.

paying the award ( $W + w + \sigma$ ), so that damages in excess of the manager's resources must come (if at all) from the corporation.<sup>20</sup>

Should new shareholders decide to bring suit, the judicial process will determine liability. Although we do not model the litigation process as perfect (indeed, far from it), we do suppose that the process has at least some ability to distinguish between the two contexts in which a low state of the world might come about after an optimistic disclosure by the manager. They are as follows:

1. Truthful (but unlucky) reporting:  $\{V = V_L, \gamma = H, \hat{\gamma} = H\}$ . First, the agent may truthfully report a high signal, but the signal proves inaccurate. At the time the agent observes the signal (and reports it truthfully), the probability of this course of events is  $\mu(1 - q)(1 - p_i)$ . By definition, a lawsuit under these circumstances would be non-meritorious. We assume that such suits nonetheless prevail with probability  $\alpha_0 > 0$ .
2. Untruthful reporting:  $\{V = V_L; \gamma = L, \hat{\gamma} = H\}$ . The second context occurs when A commits fraud, covering up an accurate signal of  $\gamma = L$ . Contingent on learning the signal (and reporting it untruthfully), this situation occurs with probability  $\mu(q + (1 - q)(1 - p_i))$ . We assume that such suits win with probability  $\alpha_1 \geq \alpha_0$ .

The special case of  $\alpha_1 = \alpha_0$  corresponds to a situation in which courts are wholly incompetent, unable to discern between meritorious and frivolous suits. Conversely the special case of  $\alpha_1 = 1$  and  $\alpha_0 = 0$  corresponds to a situation in which courts are omniscient. We presume that an accurate description of the judicial system lies somewhere in between these two extremes, such that  $0 < \alpha_0 < \alpha_1 < 1$  (though our framework allows for all possibilities). We assume that each side bears costs of  $k$  should litigation occur, but that before trial occurs, they converge on perfect information about one another and thus the trial's likely outcome. Assuming they bargain Nash, they will settle at precisely the expected value for the suit.<sup>21</sup>

Collectively, the disclosure and litigation behavior of the parties constitute a continuation game which we denote by  $\Gamma(\delta_L, \delta_H, \pi)$ . The relevant strategies that comprise  $\Gamma$  are as follows. Upon observing the  $\gamma = L$ , we suppose that the Agent reports  $\hat{\gamma} = H$  with probability  $\delta_L$  and  $\hat{\gamma} = L$  with probability  $(1 - \delta_L)$ . Similarly, when A observes  $\gamma = H$ , he reports  $\hat{\gamma} = H$  with probability  $\delta_H$  and  $\hat{\gamma} = L$  with probability  $(1 - \delta_H)$ . Finally, when the shareholders observe a low

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<sup>20</sup>For example, one natural way to endogenize damages would be to presume per-share damages of

$$D = (2q - 1)(V_H - V_L) dx,$$

which corresponds to the difference in price between a firm in which the true signal is known to be  $\gamma = H$  and one in which the true signal is known to be  $\gamma = L$ .

<sup>21</sup>The alert reader will note that our assumption about settlement yields the same prediction as would a model of litigation with no litigation costs (beyond filing costs). We do not consider more elaborate (and less efficient) settlement processes in this model both for tractability and because virtually no securities class actions actually reach litigated outcomes. As such, this assumption seems warranted.

true realization, as well as a previous report of  $\hat{\gamma} = H$ , they file a lawsuit with probability  $\pi$ . We denote the set of equilibria to  $\Gamma$  as  $\mathcal{B}(\Gamma)$ .

We summarize the choice variables and parametric variables in a (relatively) concise table, as follows:

Var.	Var. Type	Description
$w$	Choice	Agent's wage
$\sigma$	Choice	Agent's incentive compensation upon reporting $\hat{\gamma} = H$
$\kappa$	Choice	Corporate governance protection installed within firm
$\delta_H$	Choice	Prob. that agent receiving signal $\gamma = H$ reports $\hat{\gamma} = H$
$\delta_L$	Choice	Prob. that agent receiving signal $\gamma = L$ reports $\hat{\gamma} = H$
$\pi$	Choice	Prob. that B sues when $\hat{\gamma} = H$ , and $V = V_L$ revealed
$e$	Choice	Agent's effort level
$p_1$	Parameter	Prob. of a high outcome with high effort
$p_0$	Parameter	Prob. of a high outcome with low effort
$\alpha_0$	Parameter	Prob. of a successful "false positive" plaintiff win
$\alpha_1$	Parameter	Prob. of a successful "true positive" plaintiff win
$V_H$	Parameter	Gross firm value in high state
$V_L$	Parameter	Gross firm value in low state
$W$	Parameter	Agent's initial financial/reputational capital or "wealth"
$\omega$	Parameter	Agent's outside opportunity wage
$c$	Parameter	Agent's cost of effort
$\gamma$	Hybrid	Signal received by Agent about future state of world
$q$	Parameter	Precision of signal $\gamma$
$\hat{\gamma}$	Choice	Agent's report about the value of $\gamma$
$\rho$	Parameter	Fraction of shares traded after A discloses $\hat{\gamma}$
$D$	Parameter	Damages awarded upon successful suit
$Y$	Parameter	Plaintiff cost of filing a lawsuit
$\mu$	Parameter	Probability that true $V_i$ is revealed to public investors

In order to facilitate later analysis, it will prove helpful to define the function  $R_A(\gamma)$ , which denotes the expected continuation payoff of the agent (in equilibrium) once she has received signal  $\gamma$ .

$$\begin{aligned} R_A(L) &= \delta_L \cdot [\sigma - \Pr\{V_L|\gamma = L\} \cdot \mu\pi\alpha_1(\sigma + W + w)] \\ &= \delta_L \cdot [\sigma - (q + (1 - q)(1 - p_i)) \cdot \mu\pi\alpha_1(\sigma + W + w)] \end{aligned} \quad (2)$$

$$\begin{aligned} R_A(H) &= \delta_H \cdot [\sigma - \Pr\{V_L|\gamma = H\} \cdot \mu\pi\alpha_0(\sigma + W + w)] \\ &= \delta_H \cdot [\sigma - (1 - q)(1 - p_i) \cdot \mu\pi\alpha_0(\sigma + W + w)] \end{aligned} \quad (3)$$

In addition, it will prove helpful to define the function  $R_{SH}(V_L)$ , which denotes the expected net payoffs of the plaintiff shareholders after the state of the world is revealed to be low following an optimistic report by the agent.

$$R_{SH}(V_L) = \pi [(\alpha_0 \cdot \Pr\{\gamma = H|V_L, \hat{\gamma} = H\} + \alpha_1 \cdot \Pr\{\gamma = L|V_L, \hat{\gamma} = H\}) \cdot \rho D - Y] \quad (4)$$

## 2.2 Organizational Design Problem

The organizational design task for the firm is to choose both a wage package  $\{w, \sigma\}$  and a governance level  $\kappa$  for the firm in a way that maximizes firm value, keeping in mind the underlying strategic incentives that the relevant players have (which are likely to be responsive to the organizational decisions the firm makes). Formally, the design problem is as follows<sup>22</sup>:

$$\begin{aligned} \max_{\{w, \sigma, \kappa\}} & \underbrace{V_L + p_1 (V_H - V_L)}_{\text{Firm's Gross Value}} - \underbrace{a\kappa}_{\text{Gov. Costs}} - \underbrace{w}_{\text{Wage}} - \underbrace{(p_1 \delta_H + (1 - p_1) \delta_L) \sigma}_{\text{Expected Incentive Pay}} \\ & \text{s.t.} \\ (IR) : & \alpha_1 (W + w + \sigma) \geq \alpha_1 (W + \omega + \sigma) \\ (IC) : & W + w - c + p_1 R_A(H) + (1 - p_1) R_A(L) \geq \\ & W + w - c + \frac{c}{1 + \kappa} + p_0 R_A(H) + (1 - p_0) R_A(L) \quad (*) \\ (EQ) : & \{\delta_L, \delta_H, \pi\} \in \mathcal{B}(\Gamma) \end{aligned}$$

Although the firm's objective is relatively straightforward, the three constraints deserve more mention. The individual rationality (*IR*) constraint states essentially that the agent must find it optimal to work at the firm regardless of the current state of the world. In particular, the agent must prefer working to quitting even in the worst case scenario where she has observed a pessimistic signal, issued an optimistic report, and a suit has been filed. The incentive compatibility (*IC*) constraint states that the firm's organizational structure must be such that the agent when working finds it optimal to work hard rather than to shirk. As noted above, we suppose throughout our analysis that the stakes for the firm are sufficiently high that it always finds incentivizing the agent to be optimal. Finally, the equilibrium (*EQ*) constraint requires that from the point at which A makes disclosure  $\hat{\gamma}$ , the actions of the parties must be part of a non-cooperative equilibrium. As noted above, the downstream litigation behavior of the parties is presumed to be outside of the realm of contracting (although the incentives provided by the firm's organizational choices may indirectly affect how downstream litigation plays out).

## 2.3 Analysis of Constraints

We begin by analyzing the effects of the three constraints noted above, and what they imply for the firm's feasible set of organizational choices.

<sup>22</sup>Note that this net payoff does not reflect the expected payoff to shareholders from securities fraud litigation. While it is possible to include such a component, doing so both adds significant complexity and may not be appropriate. Indeed, to the extent that securities fraud litigation results in damages paid by the firm (rather than the manager), damages are simply a transfer payment from incumbent to new shareholders, and are therefore welfare neutral in this context.

### 2.3.1 Individual Rationality Constraint (IR)

Typical of most of these sorts of problems, the (IR) constraint will turn out to be binding. Indeed, if it were not, an optimal solution to any agency problem with transferrable utility would be simply to sell the firm to the agent. Given that the agent is assumed to be liquidity constrained, that cannot occur in this context. Simplification of the (IR) constraint yields the following condition (which holds at equality when the (IR) constraint is binding):

$$w \geq \omega \tag{IR'}$$

In other words, the wage component of the agent's compensation package is set equal to her opportunity wage in the outside labor market. We shall impose this condition throughout what follows.

### 2.3.2 Incentive Compatibility Constraint (IC)

Now consider the incentive compatibility constraint. This constraint also turns out to be binding so long as incentivizing the agent to work hard is in the principal's interests. Simplifying the (IC) constraint yields the following condition (which also holds at equality when binding):

$$(p_1 - p_0) \cdot (R_A(H) - R_A(L)) \geq \frac{c}{1 + \kappa} \tag{IC'}$$

### 2.3.3 Equilibrium Constraint (EQ)

Finally, consider the equilibrium constraint. In particular, we wish to characterize the equilibrium behavior of the parties in the continuation game starting with the agent's receipt of the signal  $\gamma$ , and assuming that the agent's compensation package is such that he has previously participated and has not shirked. The equilibrium profile of the continuation game<sup>23</sup> can be summarized by a strategy profile  $\{\delta_L, \delta_H, \pi\}$  such that each respective strategy optimizes the payoffs (respectively) of the agent that has observed signal  $\gamma = H$  (hereinafter referred to as the "high type" agent), the agent that has observed the signal  $\gamma = L$  (hereinafter referred to as the "low type" agent), and the plaintiffs, who have only observed the reported signal  $\hat{\gamma}$  and the state of the world  $V$ .<sup>24</sup>

A modest but realistic parametric restriction on  $Y$  both simplifies our analysis and generates the most interesting and plausible family of equilibria. Explicitly, consider the following assumption about  $Y$  in what follows:

**Assumption 1**  $Y \in [Y_0, Y_1] = \left[ \rho D \alpha_0, \rho D \left( \frac{\alpha_1 \cdot (1-p_1(1-q)) + \alpha_0 \cdot (1-q)(1-p_1)}{(1-p_1(1-q)) + (1-q)(1-p_1)} \right) \right]$

<sup>23</sup>The discussion that follows generally employs the solution concept of bayesian perfect equilibrium, implementing refinements such as sequentiality, the intuitive criterion and divinity when numerous equilibria exist.

<sup>24</sup>Because the expected payoff for reporting  $\hat{\gamma} = H$  are larger for the agent who actually observes  $\gamma = H$ , we can constrain our attention to situations where  $\delta_H \geq \delta_L$ .

The intuitive content of Assumption 1 is relatively simple. It states that plaintiffs in securities fraud cases are always *at least potentially* on the extensive margin in formulating their filing strategy. In particular, filing costs are sufficiently low that a plaintiff would always wish to pursue litigation if he knew that the agent always made an optimistic report regardless of her true information (that is  $\delta_H = \delta_L = 1$ ). This corresponds to the condition that  $Y \leq Y_1$ . On the other hand, Assumption 1 states that filing costs are sufficiently high that the plaintiff would not pursue litigation if she believed fraud to be wholly absent from the system (that is  $\delta_L = 0$ ). This corresponds to the condition that  $Y \geq Y_0$ . Not only is this restriction plausible, but it also comports with our observations about the real world. Indeed, if  $Y < Y_0$ , every firm who experienced bad news would be sued (in reality, only about 7% are). Conversely, if  $Y > Y_1$ , no firm would ever be sued for securities fraud, which we also know not to be true.

Given optimal filing behavior of plaintiffs as specified above, and subject to Assumption 1, we are now in a position to solve for the agent's optimal disclosure strategy and fully characterize the equilibrium of the continuation game. Explicitly, there is a unique Bayesian perfect equilibrium to the litigation game which falls into one of two qualitative types, depending on the relative value of  $\sigma$ . The equilibrium of the litigation game is given in the following Proposition, whose proof can be found in the appendix:

**Proposition 1:** *Under Assumption 1, the unique equilibrium of the litigation game is given by:*

$$\{\delta_L^*, \delta_H^*, \pi^*\} = \begin{cases} \left\{ \left( \frac{\frac{Y}{D\rho} - \alpha_0}{\alpha_1 - \frac{Y}{D\rho}} \right) \frac{(1-p_1)(1-q)}{(1-p_1)(1-q)}, 1, \frac{\sigma}{\mu\alpha_1(1-p_1(1-q))(w+W+\sigma)} \right\} & \text{if } \sigma \leq \sigma_1 \\ \{1, 1, 1\} & \text{if } \sigma > \sigma_1, \end{cases} \quad (EQ')$$

$$\text{where } \sigma_1 \equiv \frac{\mu\alpha_1(1-p_1(1-q))}{1-\mu\alpha_1(1-p_1(1-q))} (w+W).$$

Proposition 1 states that the equilibrium of the litigation game turns crucially on the value of the agent's incentive compensation. When  $\sigma$  is relatively modest ( $\sigma \leq \sigma_1$ ), the unique equilibrium involves mixed strategies for both the low type agent and the litigating shareholders. Note that the probability of filing suit,  $\pi^*$ , increases in  $\sigma$  over this range, reflecting the fact that larger values of  $\sigma$  make securities fraud more tempting, and thereby increasing the chances of suit after a bad state of the world is revealed following an optimistic report.

Given the equilibrium stated in Proposition 1, it is relatively straight-forward to compute the equilibrium payoffs of the continuation game for each agent type. They are as follows (again, as judged from the point at which the actor moves).

$$\begin{aligned} R_A(L) &= \begin{cases} 0 & \Leftrightarrow \sigma \leq \sigma_1 \\ \sigma - (q + (1-q)(1-p_1)) \cdot \mu\alpha_1(\sigma + W + w) & \Leftrightarrow \sigma > \sigma_1 \end{cases} \quad (5) \\ R_A(H) &= \begin{cases} \sigma \left( 1 - \frac{\alpha_0}{\alpha_1} \cdot \frac{(1-p_1)(1-q)}{1-p_1(1-q)} \right) & \Leftrightarrow \sigma \leq \sigma_1 \\ \sigma - (1-q)(1-p_i) \cdot \mu\alpha_0(\sigma + W + w) & \Leftrightarrow \sigma > \sigma_1 \end{cases} \end{aligned}$$

Note from the agent's payoff functions that the effect of both the noisy observance of the outcome and of noisy litigation is that they jointly dilute the power of incentive compensation, so that the incremental payoff from a high signal is less than  $\sigma$ . This means that incentivizing the agent to expend high effort will be more costly than in a world where the true realized state of the world were always observable.<sup>25</sup>

## 2.4 Optimal Organizational Design

From the analysis above, it is now possible to restate (\*) to reflect the equilibrium strategy profiles in the litigation continuation game.

$$\begin{aligned} & \max_{\{w, \sigma, \kappa\}} V_L + p_1 (V_H - V_L) - a\kappa - w - (p_1 \delta_H + (1 - p_1) \delta_L) \sigma \quad (*) \\ & s.t. \\ & (IR') : \quad w = \omega \\ & (IC') : \quad \sigma \cdot (p_1 - p_0) \cdot \left(1 - \frac{\alpha_0}{\alpha_1} \cdot \frac{(1-p_1)(1-q)}{1-p_1(1-q)}\right) = \frac{c}{1+\kappa} \\ & (EQ') : \quad \{\delta_L, \delta_H, \pi\} = \{\delta_L^*, \delta_H^*, \pi^*\} \end{aligned}$$

Before presenting the actual terms of an optimal contract, simple analysis of the constraints yields some interesting findings about the ability of compensation, governance, and litigation to complement or substitute for each other. Note from the  $(IC')$  constraint that  $\sigma$  and  $\kappa$  always move in an inverse relation to one another. This suggests that at least when one holds other parameters constant, compensation and governance should be policy substitutes for one another: *ceteris paribus*, the more invasive a firm's corporate governance regime, the lower the power of the firm's incentive structure. Second, as noted briefly above,  $(EQ')$  implies that as  $\sigma$  increases, so does the probability of suit ( $\pi$ ) increases as well. In other words, as an executive's incentive compensation becomes more high-powered, so does the credibility of the litigation threat. This suggests that litigation and compensation are structural complements with one another – litigation is likely to play a larger disciplining role when incentive compensation is large. Combining  $(IC')$  and  $(EQ')$ , then, we immediately arrive at the conclusion that corporate governance and litigation are policy substitutes: the less invasive a firm's corporate governance regime, the greater the likelihood that the firm will face securities litigation as a form of ex post discipline. Note, however, that this last relationship occurs indirectly – as  $\mu$  affects  $\sigma$ , which in turn affects the likelihood of suit.

Analysis of this problem allows us to specify the terms of the optimal contract and corporate governance regime as a function of the fundamental parameters

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<sup>25</sup>We note also in passing that:

$$R_A(H) - R_A(L) = \begin{cases} \sigma \left(1 - \frac{\alpha_0}{\alpha_1} \cdot \frac{(1-p_1)(1-q)}{1-p_1(1-q)}\right) & \Leftrightarrow \sigma \leq \sigma_1 \\ \mu(\sigma + w + W) \cdot (\alpha_1 \cdot (1 - p_1(1 - q)) - \alpha_0 \cdot (1 - q)(1 - p_1)) & \Leftrightarrow \sigma > \sigma_1 \end{cases}$$

Thus, increasing  $\sigma$  has the effect of increasing incentives, but not by as much as it would if all information were revealed to the public and / or courts were perfectly accurate.



of the model. We state these terms in Proposition 2, whose proof can be found in the Appendix.

**Proposition 2:** *If Assumption 1 holds, and if  $\left(\frac{\omega+W}{\sqrt{c}}\right)$  is sufficiently large, the optimal contract and governance structure for the firm is unique and*

*is given by:*

$$\{w^*, \sigma^*, \kappa^*\} = \left\{ \omega, \sqrt{\frac{a\beta_1}{\beta_2}}, \sqrt{\frac{\beta_1\beta_2}{a} - 1} \right\}$$

*where*

$$\beta_1 = \frac{c}{(p_1 - p_0) \left( 1 - \frac{\alpha_0}{\alpha_1} \cdot \frac{(1-p_1)(1-q)}{1-p_1(1-q)} \right)}$$

$$\beta_2 = \left( p_1 + (1-p_1) \frac{\left( \frac{Y}{\rho D} - \alpha_0 \right)}{\left( \alpha_1 - \frac{Y}{\rho D} \right)} \cdot \frac{(1-p_1)(1-q)}{(1-p_1(1-q))} \right)$$

The conditions assumed to generate Proposition 2 are relatively mild and related to one another. First, as before, Assumption 1 implies that filing costs are in a sufficiently “moderate” range that litigation is neither totally absent nor ubiquitous. Second, the Proposition’s result is conditional on the executive’s disposable wealth being relatively large compared to the marginal cost of effort. The rationale behind this condition is that if the executive is close to judgment proof, the threat of litigation will have a relatively small deterrent effect, thereby necessitating enormous incentive contracts (which would once again ensure that litigation is ubiquitous).

Perhaps the more interesting aspects of Proposition 2 are the qualitative comparative statics that it generates, which will provide the basis for our empirical estimations in the next section. These comparative statics are in tabular form through Corollary 2.1:

**Corollary 2.1:** *In equilibrium, and under the terms of the optimal contract,*

the following comparative statics hold:

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
$X$	$\frac{\partial \kappa^*}{\partial X}$	$\frac{\partial \sigma^*}{\partial X}$	$\frac{\partial (w^* + \sigma^*)}{\partial X}$	$\frac{\partial w^*}{\partial X}$	$\frac{\partial \pi^*}{\partial X}$	$\frac{\partial \Pr\{Suit V_L\}}{\partial X}$	$\frac{\partial \Pr\{Suit\}}{\partial X}$	$\frac{\partial \delta_L^*}{\partial X}$
$p_0$	(+)	(+)	(+)	(0)	(+)	(+)	(+)	(0)
$p_1$	(-)	(-)	(-)	(0)	(-)	<i>Amb.</i>	<i>Amb.</i>	(-)
$\alpha_0$	<i>Amb.</i>	(+)	(+)	(0)	(+)	<i>Amb.</i>	<i>Amb.</i>	(-)
$\alpha_1$	<i>Amb.</i>	(-)	(-)	(0)	(-)	(-)	<i>Amb.</i>	(-)
$c$	(+)	(+)	(+)	(0)	(+)	(+)	(+)	(0)
$a$	(-)	(+)	(+)	(0)	(+)	(+)	(+)	(0)
$\omega$	(0)	(0)	(-)	(+)	(-)	(-)	(-)	(0)
$\bar{W}$	(0)	(0)	(0)	(0)	(-)	(-)	(-)	(0)
$D$	(+)	(-)	(-)	(0)	(-)	(-)	(-)	(-)
$\rho$	(+)	(-)	(-)	(0)	(-)	(-)	(-)	(-)
$Y$	(-)	(+)	(+)	(0)	(+)	(+)	(+)	(+)
$q$	<i>Amb.</i>	(+)	(+)	(0)	<i>Amb.</i>	<i>Amb.</i>	<i>Amb.</i>	(-)
$\mu$	(0)	(0)	(0)	(0)	(-)	(-)	(-)	(0)

Examination of the table from Corollary 2.1 reveals a number of interesting predictions. First, recall from the analysis of the constraints above that (a) executive compensation and corporate governance are structural substitutes while (b) executive compensation and litigation are structural complements, holding other variables constant. However, a simple correlational analysis of the three would not necessarily reveal this structural relationship. For example, if a significant component of variation across firms concerned differences in the success rates of their operational endeavors ( $p_0$  or  $p_1$ ), then strong corporate governance and significant incentive compensation would appear to have a positive (rather than negative) correlation. Identifying whether the posited structural substitutability of the two requires accounting for the endogenous effects of these (often unobserved) variables.

Second, the model predicts that the underlying incidence of fraud ( $\delta_L$ ) will increase as the plaintiff's filing costs increase, or as the plaintiff's claimable damages decrease. This makes sense, given that high filing costs and low damages make the plaintiff's threat of litigation less credible. Somewhat more interestingly, the incidence of fraud tends to decrease as the agent's signal becomes more precise, due to the fact that disappointed shareholders are more likely to attribute an unpleasant surprise to fraud rather than simple bad luck (see, e.g., Bernardo et al. (2000)). Finally, the underlying incidence of fraud decreases as the likelihood of liability from either a non-meritorious ( $\alpha_0$ ) or meritorious ( $\alpha_1$ ) suit increases. While the latter effect seems intuitive, the former is a bit surprising. The intuition behind it is that an increase in the chances for liability from a non-meritorious suit still encourages purchasing shareholders to file suit whenever  $V_L$  is revealed, since they do not know whether the defendant actually misreported at the time that they file. This greater litigiousness has a deterrent effect on the low-signal agent type, who is more responsive to litigation incentives.

Finally, an intriguing aspect of the table above is that it reveals how changes in legal doctrine might be measured not by looking at litigation activity alone (which is itself often fraught with indeterminacy), but rather by focusing elsewhere, and considering effects on complementary incentive structures. In particular, note from the table that changes in the liability parameters  $\alpha_1$  and  $\alpha_0$  have ambiguous effects on the predicted unconditional likelihood of class actions (column [7]). Thus, it is difficult to interpret whether any significant legal change has occurred strictly by examining post-reform propensities to litigate. On the other hand, executive compensation appears to increase unambiguously in  $\alpha_0$  and decrease unambiguously in  $\alpha_1$ . This makes relatively good sense, given that an increase in  $\alpha_0$  imposes a greater risk of liability even on a manager doing an honest job, thereby necessitating larger executive compensation, while an increase in  $\alpha_1$  allows shareholders to depend relatively more on ex post litigation as a deterrence mechanism, thereby reducing incentive compensation.

## 3 Testing the Model

### 3.1 Data

In order to employ our model empirically, it was necessary to assemble a data set that included firm-level observations on corporate governance, executive compensation, and securities litigation. The data set we use for our analysis is a firm level cross sectional unbalanced panel. It includes 12,840 observations on 2188 different firms during the period 1992-2002. 434 firms have only one record within the data set, but 265 firms would form a full panel, i.e. 11 measurements per firm. The data constitutes an inclusive merger of several data sets: In particular, CompuStat's ExecuComp data set, the Corporate Governance Provision data set of the Investor Responsibility Research Center (IRRC), and Securities Class Action Alert Service of Institutional Shareholder Services (ISS). In addition, we added industry-level data organized by NAICS (North American Industrial Classification System) number using Compustat's Price, Earnings and Dividends database. To acquire traded stock volumes per month we use Center for Research in Security Prices (CRSP's) database on securities price, return and volume.

#### 3.1.1 Executive Compensation Data

Standard & Poor's ExecuComp data set includes 159,141 observations on total compensation, and all of its components, of the top five executives from current or historical S&P 1500 firms from 1992 to 2002. The data set includes variables on total compensation, as well as short-term compensation such as salary, bonus and other annual payments. It also includes variables on long term compensation, which we define as incentive compensation, i.e. the sum of the current year aggregate value of the stock options granted to the executive during the year as valued by S&P's Black-Scholes methodology, the current year dollar value of restricted stocks granted during the year, the amount paid out to the executive

under the company's long term incentive plan (usually three year plans), and all other total pay. The ExecuComp data set is furthermore a data source for market price volatility and variables on the size of the company such as number of employees in a firm.

A representative summary of observations on executive compensation (for the year 2002) appear in the table below:

**INSERT TABLE 1 HERE**

In order to classify firms within the North American Classification System we merged CompuStat's Price, Earnings and Dividends data set by 6-digit CUSIP number, an identification number for each firm. No observations were lost during this merge and the data set comprised 118,141 observations.

The ExecuComp data set has multiple observations on CEO compensation each year, due to different exercise dates on different stock options granted each year. We aggregated those observations together into one measure, per CEO-year. About 41,000 observations were discarded for that purpose.

One of the more important variables for consideration in our problem will be the proportion of the chief executive's total compensation that consists of long-term incentive compensation  $\left(\frac{\sigma^*}{\sigma^*+w^*}\right)$ . The figure below presents a histogram of long-term compensation across all firms in our data set. Note from the figure that while there are a number of companies that pay either no incentive compensation or a small amount (around 9% of our sample), the distribution is otherwise evenly spread throughout all possible values, including over 4 % of firms in which the CEO's compensation consists of more than 90% incentive

compensation.

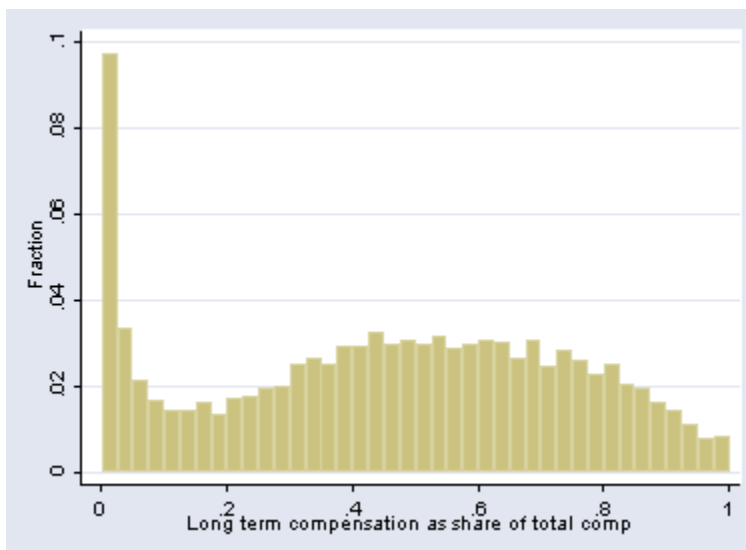


Figure 1

### 3.1.2 Corporate Governance

To capture corporate governance levels, we utilize a data set collected by the Investor Responsibility Research Center (IRRC), which includes detailed listings of corporate governance provision for individual firms published in Corporate Takeover Defenses. The data are derived from various public sources, such as corporate bylaws and charters, proxy statements and annual reports of firms from the Standard & Poor’s 500 index as well as annual lists of the largest corporations in the publication of Fortune, Forbes and Business Week. The IRRC sample holds 10,121 observations including measurements at the firm level over the years 1990, 1993, 1995, 1998, 2000 and 2002. When merging the ExecuComp data set with the IRRC, about 3,665 observations in the IRRC did not correspond to the ExecuComp data set, hence we were left with 39,255 observations.

Due to the gaps in the IRRC data set, we estimate the missing values in the years 1992,1994,1996,1997,1999 and 2001 with a linear interpolation, for all variables in the IRRC data set. Gompers et al. (2003) use this same data set to formulate a governance “index” by summing these variables, which give them a form of ranking from democratic on the low end to dictatorial on the high end. In order to facilitate interpretations, we reverse their order, so that lower index numbers are tantamount to those firms that would be thought of

conventionally as having “weak” corporate governance, and firms with higher indices corresponding to “strong” governance firms. This table provides the five number summary of the corporate governance index distribution over time.

**INSERT TABLE 2 HERE**

### **3.1.3 Securities Litigation**

The SCAA/SCAS database includes 3286 class actions, principally filed within federal court by private plaintiffs (though some SEC or state court cases manage to leak in and were dropped), against individual(s), a firm or multiple firms of which filing date occurs during the period January 1990 to March 2004. Class action litigation against multiple firms were broken up; hence each class action is held against one firm only in our data set, resulting in 3,783 cases against 3,083 different firms. If a firm was being sued multiple times in a single year, those suits were collapsed together in one suit per year per firm, where the sum of all settlement funds resulting from multiple suits within a year was recorded in a separate variable as well as the maximum settlement amount during the year. 361 observations were discarded due to multiple suits in a single year.

When merging the ExecuComp-IRRC data set with SCAS, 322 cases survived the merge. A total of 103 of these suits eventually procured settlements that exceeded \$1 million. Table 3 reports the number of firms who sued in each year of our data set for which we also have full information on governance and executive compensation. If same firm has been sued multiple times per year we only observe one suit per year per firm. The numbers are derived from our merged data set comprised of S&P’s ExecuComp, IRRC Corporate Governance Provision, and ISS Securities Class Action Services data set.

**INSERT TABLE 3 HERE**

While a number of features of securities litigation are worth independent consideration, a significant reform that took place in 1996 is perhaps worthy of particular mention. In December 1995, Congress overrode a presidential veto to enact the Private Securities Litigation Reform Act (PSLRA).<sup>26</sup> The Act, which became effective in January 1996, altered discernibly the substantive and procedural hurdles for filing a securities class action under federal law. Although the PSLRA’s procedural reforms were multi-faceted, virtually all of them had the intent and effect of advantaging securities fraud defendants relative to the status quo ante. For instance, the Act requires plaintiffs who seek money damages now to plead with particularity facts giving rise to a strong inference that the defendant acted with the required state of mind for the underlying offense (1934 Act § 21D(b)(2)). Moreover, most circuit courts have interpreted the Act as elevating the scienter requirement itself, and many now mandate that the plaintiff specifically allege and prove an extreme form of recklessness, and even

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<sup>26</sup>Private Securities Litigation Reform Act, Pub. L. No. 104-67, 109 Stat. 737 (1995) (codified in scattered sections of 15 U.S.C.)

a knowing state of mind in cases involving forward-looking statements within the Act’s safe-harbor provision.<sup>27</sup> Additionally, the PSLRA requires (among other things) a mandatory stay on all pre-trial discovery pending the resolution of any motions to dismiss.<sup>28</sup> A principal articulated purpose of the PSLRA was to reduce litigation rates by eliminating non-meritorious suits while leaving meritorious suits unaffected.<sup>29</sup> We shall return to the question of whether the Reform Act succeeded in its articulated goals below.

### 3.2 Testing the Model’s Predictions

One of the stronger predictions of the analytical model presented in Section 2 was that executive compensation and corporate governance are likely to be structural substitutes of one another, so that stronger corporate governance systems would predict weaker incentive schemes (and vice versa). At the same time, the model also predicts that executive compensation and litigation are likely to be structural complements, so that *ceteris paribus*, higher powered incentive schemes are likely to induce more frequent litigation.

Table 4 presents a simple pair-wise correlation matrix comparing each of these three measures. Note from the table that the predicted relationships appear to hold. As the table demonstrates, corporate governance score is negatively correlated to long-term incentive compensation, but positively correlated with later litigation.<sup>30</sup>

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<sup>27</sup>The Act imposes a “safe harbor” for any forward-looking projection that also conveys meaningful cautionary language about the potential lack of accuracy of such projections. This safe harbor applies regardless of whether the private action is brought the Securities Act of 1933 or the Securities Exchange Act of 1934. See 1933 Act § 27A; 1934 Act § 21E. As to cases not involving forward-looking statements, the exact quantum of scienter required has become an item of disagreement among the Circuit Courts. The Second and Third Circuits require that a plaintiff plead recklessness, but deem the test to be satisfied circumstantially if the plaintiff can allege with specificity that the defendant had a clear motive and opportunity to commit securities fraud. *Donald Press, et al. v. Chemical Investment Services Corp., et al.*, 166 F.3d 529 (2nd. Cir. 1999); *In Re: Advanta Corp. Securities Litigation*, 180 F.3d 525 (3rd Cir. 1999). This test was considered to be the most restrictive in the country before PSLRA, but now may be the weakest. The Sixth Circuit has adopted a more stringent test, requiring direct proof sufficient to create “a strong inference of reckless behavior” and disallowing circumstantial proof. *In Re: Comshare, Incorporated Securities Litigation*, 1999 WL 460917, Fed.Sec.L.Rep. 90,513. Finally, the Ninth Circuit has adopted the harshest test of all, also disallowing circumstantial proof and requiring that the plaintiff establish “deliberate or conscious recklessness.” *In Re: Silicon Graphics Inc. Securities Litigation*, 1999 WL 595194, Fed.Sec.L.Rep. P90,512, 99 Cal. Daily Op. Serv. 6339 (9th Cir. 1999).

<sup>28</sup>In addition to these reforms, the PSLRA also mandated proportional (rather than joint and several) liability for all but knowing violations of law, and mandated that courts conduct a “Rule 11” inquiry as a matter of course at the end of an action.

<sup>29</sup>See, e.g., H.R. Rep. 104-50, 104th Cong., 1st Sess. 16 (1995) (“H. Rep.”); Statement of Managers, “Private Securities Litigation Reform Act of 1995,” H.R. Rep. 104-369, 104th Cong. 1st Sess. at 31). Of particular importance to member of Congress was the degree to which securities litigation involved meritless claims. 141 Cong. Rec. H13699 (daily ed. Nov. 28, 1995) (“Statement of Managers”).

<sup>30</sup>The table considers suit within two years of the reporting date, given that the statute of limitations for most private rights of action in securities fraud run between one and three years.

#### INSERT TABLE 4 HERE

While these simple correlations are informative, they are somewhat misleading. Indeed, as Corollary 2.1 demonstrates, the predicted empirical relationship among the three variables of interest need not always square with their structural relationship. Thus, a more systematic approach is appropriate. Table 5 focuses on the relationship between corporate governance and executive compensation, considering various types of linear estimation. The first panel of the table estimates ordinary least squares and random effects models with incentive compensation as the dependant variable. The second panel treats corporate governance as the dependent variable, with the final model attempting to control for the endogeneity of incentive pay by using industry dummies, firm size and an executive's non-incentive salary as instruments for long-term incentive share.<sup>31</sup> Note that in all cases, incentive compensation and corporate governance have negative a relationship to one another, and always significant at least at the 10% level (or 5% level on a one tailed test). Moreover, it is notable that the strongest negative relationship between incentive pay and corporate governance emerges in the final model of the table, in which instruments are used to control for the endogeneity of executive compensation. This result is comfortably consistent with the predictions of the theoretical model, at least insofar as the relationship between governance and compensation is concerned.

#### INSERT TABLE 5 HERE

Turning to the predicted relationship between compensation and litigation, consider Table 6, which focuses on the likelihood of suit in any given year of the data set as a function of controls. To account for the fact that fraud (or alleged fraud) often takes some time for plaintiffs to uncover, and that plaintiffs face between one and three years after discovery to file suit, we use one year lags of incentive pay, volume, volatility, and size as regressors. We also introduce an indicator variable (After PSLRA) that takes on the value of 1 if the suit was filed after the promulgation of the Private Securities Litigation Reform Act of 1995. Panel A reports OLS regressions, for various event horizons. Panel B reports a linear probability model in which size and salary variables are used to instrument for incentive compensation. Panel C replicates Panel A but with a logit regression structure, and reports coefficients in odds ratios. Note that the coefficient on incentive compensation is positive and statistically significant in all specifications, and thus higher executive compensation predicts higher litigation rates. Moreover, the economic significance of this effect, while relatively mild in the OLS approach, grows tremendously in the IV specification. Indeed, in Panel B, the coefficient on Incentive Pay is consistently between .23 and .35, suggesting that each 1% increase in incentive compensation ratios leads

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<sup>31</sup>Recall from Corollary 2.1 that the executive's wage level was structurally unrelated to corporate governance but predictive of the executive's long-term incentive compensation ratio  $\left(\frac{\sigma^*}{\sigma^*+w^*}\right)$ . Thus, the model suggests this to be the best instrument for contending with endogeneity problems.



to approximately a 0.3% larger probability of suit. While this may appear small on first blush, it can add up – indeed, comparing the lowest decile of executive compensation packages to the highest, this translates to between an 18% and 28% larger likelihood of facing securities litigation.

Note also from the Table that the introduction of the PSLRA did not appear to have a significant independent effect on the likelihood of litigation. Indeed, the indicator variable for the post-PSLRA period rarely tests significant and is of generally small magnitudes. However, the cross product between this indicator and lagged volatility suggests that the PSLRA has had an effect of partially dampening the effects that volatility has on the incidence of litigation. (At the same time, this dampening effect appears to disappear when instruments are used for incentive compensation). The generally ambiguous effects of PSLRA as measured by litigation rates should not be terribly surprising in light of the fact that Corollary 2.1 [7] similarly predicts ambiguous effects on the unconditional probability of suit. Indeed, this ambiguity is precisely what makes measuring the effect of the reform by examining litigation activity itself a hazardous process.

#### **INSERT TABLE 6 HERE**

The apparently strong structural complementarity between incentive compensation and securities litigation induced us to consider one other specification, in which we attempt to use incentive compensation not to predict the incidence of suit, but rather to predict expected settlement value of securities fraud cases (if any) brought against companies within our data set. The next table considers such a specification, in which aggregate settlement value is the dependent variable. Note that since most of the firms within our data set are not sued, and some that are sued win dismissals (or non-cash settlements), our dependent variable is truncated at zero, corresponding with the point at which securities litigation is either unsuccessful or never pursued. This form of truncation makes a Tobit estimation appropriate, and two specifications are reported in Table 7. In both specifications, we employ two-stage estimation using our instruments to create predicted incentive pay, and then regress this prediction (and other regressors) on the truncated settlements. Our (still preliminary) results are surprisingly large. Overall, a 1% increase in the fraction of a CEO's pay that is comprised of incentive compensation leads to an increase in total settlement value of approximately \$3.4 million. The introduction of the PSLRA apparently mollified this effect, but came nowhere close to eliminating it.

#### **INSERT TABLE 7 HERE**

We are somewhat surprised at the economic significance of this effect, and robustness checks (still in process) may reveal the extent to which it is driven by anomalies within our data set (such as outliers). While some manipulations appear to reduce these estimates, they generally remain economically and statistically significant. The resilience of these estimates — at least thus far — is suggestive of the conclusion that executive compensation often comes with a cost – in this case the cost of increasing the probability of securities litigation

and the expected damages that emanate therefrom. Whether bearing this cost is optimal or not, it should be one that corporate boards should be aware of in structuring executive compensation.

### 3.2.1 An alternative test of the PSLRA

In addition to the direct insights that our model has spawned above, the realization that governance, compensation and litigation may be systematically linked suggests that there may be novel ways to exploit these interrelationships empirically. For example, it may be possible to use our framework to conduct an indirect test of a legal change, whose direct effects are difficult to discern. Returning to the Private Securities Litigation Reform Act, as noted in both the introduction and demonstrated in the foregoing subsection, the selection of suits for trial and filing often complicate empirical approaches for estimating the effects of the reform. After the passage of the Act, it is likely that the relevant players reacted in numerous ways, thereby conflating the theoretical predictions that one is capable of making. Going back to Corollary 2.1, for example, note that the unconditional probability of suit changes in ambiguous directions as the primary legal variables ( $\alpha_1$  and  $\alpha_0$ ) change, reflecting the feedback effects that such a shock has on fraud rates, filing rates, and organizational structure. Perhaps an alternative way, then, to understand the effect of the reform is to consider how it affected other dimensions of corporate behavior. In particular, note from Corollary 2.1 (column [3]) that the executive’s incentive compensation ratio,  $\frac{\sigma^*}{\sigma^* + w^*}$ , is strictly increasing in “false positives” due to non-meritorious suits ( $\alpha_0$ ), and strictly decreasing in “true positives” from truly meritorious suits ( $\alpha_1$ ). One of the putative goals of the Reform Act was to decrease frivolous litigation without affecting meritorious suits. Such a reform, then, would correspond to a decrease in  $\alpha_0$  with no corresponding change in  $\alpha_1$ . As such, the reform would be predicted to introduce a negative shock to executive incentive compensation ratios.

This is a testable implication, and in Table 8 we attempt to provide such a test. The Table presents various random-effects estimations in which incentive compensation constitutes the dependent variable. Among the control variables we include an indicator variable for the post-PSLRA period, and an interaction term between that indicator variable and the firm’s stock volatility. Note that the coefficient on the post-PSLRA variable is positive and significant, contrary to the predictions of our model if the representations about the reform act are presumed to be true. One interpretation of this finding is that the Act was over-inclusive: while it may have had the effect of discouraging frivolous litigation (reducing  $\alpha_0$ ), it also had the effect of discouraging meritorious litigation (reducing  $\alpha_1$ ). If the latter effect is stronger than the former, then it would be unsurprising to see the reported coefficient.

Note as well from Table 8 that the effects of the PSLRA appear to have depended on whether the stock at issue was a low or high volatility stock. The negative coefficient on the interaction term suggests that the act may have come closer to its intended effects for stocks that have high volatility. It is in those

situations that the stakes from a successful suit are likely to be the largest, thereby enhancing the incentive to file non-meritorious litigation. For lower volatility stocks, on the other hand, private litigation stakes are smaller, making litigation relatively more expensive for plaintiffs who do not have meritorious cases.

#### INSERT TABLE 8 HERE

Although not included in the table, the results of the table are robust to the inclusion of linear and quadratic time trends, which helps to control for the effects of unobserved variables that likely induced greater executive compensation levels in the 1990s. Even so, of course, it is difficult to tease out causal relationships from tables such as that above, and we are currently in the process of shoring up this result with other approaches that may be more suggestive of causality. Although not reported here in tabular form, we have estimated autoregressive specifications of the compensation equation to test whether passage of the PSLRA fails to “Granger” cause incentive structure.<sup>32</sup> Here we have found similar effects, rejecting the null hypothesis of no Granger causality, and similarly finding that effectiveness and lagged effectiveness of the PSLRA predicts increases in incentive compensation.<sup>33</sup> We are currently pursuing other methods of teasing out causality, such as inclusion of control group firms and joint dependent variable estimation, and will report on those tests in subsequent drafts.

## 4 Conclusion

In this paper we constructed an agency cost model of the firm to study how three central mechanisms of managerial incentives – corporate governance protections, executive compensation levels, and litigation endogenously interact with one another. The framework predicts that incentive pay and governance are likely to be structural substitutes with one another, while compensation and shareholder litigation are likely to be structural complements. We verified these predictions empirically, and then explored particular dimensions of them. In particular higher powered incentives appear to catalyze securities class action litigation. According to our estimates, each 1% increase in the incentive component of a CEO’s contract predicts a 0.3% increase in a class action filing and a \$3.4 million dollar increase in expected settlement costs. In addition, we used our framework to formulate a test for the effects of the Private Securities Litigation Reform Act of 1995. Our results appear inconsistent with the claims of the statute’s proponents that the PSLRA systematically discouraged frivolous litigation without burdening meritorious claims. However, after introduction of

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<sup>32</sup>E.g., Sims (1972).

<sup>33</sup>The null hypothesis of no Granger causality is rejected at all conventional p values. Interestingly, the lagged effects of PSLRA appear strongest two years out, suggesting that the effects of the Reform Act were the strongest after the passage of the Uniform Standards Act of 1998.

the PSLRA, the responsiveness of settlement costs to incentive compensation was dampened somewhat (by approximately 20%).

Although we have not explored the issue at length here, the framework developed in this paper may be of assistance to policy analysts attempting to predict the effects of new legal and regulatory reforms, such as the Sarbanes-Oxley Act of 2002. The SOX reforms have come under some degree of criticism for focusing on elements of corporate governance and executive compensation which historically have not been closely correlated with securities fraud. Our approach, however, would advise caution in leaping to such a conclusion. Indeed, an exogenous shock to all firm's governance structures or compensation schemes would affect incentives at the structural level (rather than reduced level). Consequently, the effects of such a shock may be significantly larger than historical analyses predict. This extension of our framework, however, is worthy of a paper all to itself, and we leave it to future work.

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## 6 Appendix

This appendix contains proofs of propositions above.

### 6.1 Proof of Proposition 1:

**Proposition 1:** *Under Assumption 1, the unique equilibrium of the litigation game is given by  $\{\delta_L^*, \delta_H^*, \pi^*\}$  where:*

$$\{\delta_L^*, \delta_H^*, \pi^*\} = \begin{cases} \left\{ \left( \frac{\frac{Y}{D\rho} - \alpha_0}{\alpha_1 - \frac{Y}{D\rho}} \right) (1-p_1)(1-q), 1, \frac{\sigma}{\mu\alpha_1(1-p_1(1-q))(w+W+\sigma)} \right\} & \text{if } \sigma \leq \sigma_1 \\ \{1, 1, 1\} & \text{if } \sigma > \sigma_1, \end{cases}$$

$$\text{where } \sigma_1 \equiv \frac{\mu\alpha_1(1-p_1(1-q))}{1-\mu\alpha_1(1-p_1(1-q))} (w+W).$$

Proof: Application of Bayes rule and the posited equilibrium path to  $R_B(V_L)$  generates the following lemma, which facilitates the proof of the Proposition:

**Lemma 1:** *When a low state of the world is revealed following A's report of  $\hat{\gamma} = H$ , the plaintiff's optimal filing strategy is given by:*

$$\pi(\delta_L, \delta_H) = \begin{cases} 1 & \text{if } Y < \rho D \left( \frac{\alpha_1 \cdot \delta_L \cdot (q+(1-q)(1-p_1)) + \alpha_0 \cdot \delta_H \cdot (1-q)(1-p_1)}{\delta_L \cdot (q+(1-q)(1-p_1)) + \delta_H \cdot (1-q)(1-p_1)} \right) \\ \{\pi \in (0, 1)\} & \text{if } Y = \rho D \left( \frac{\alpha_1 \cdot \delta_L \cdot (q+(1-q)(1-p_1)) + \alpha_0 \cdot \delta_H \cdot (1-q)(1-p_1)}{\delta_L \cdot (q+(1-q)(1-p_1)) + \delta_H \cdot (1-q)(1-p_1)} \right) \\ 0 & \text{if } Y > \rho D \left( \frac{\alpha_1 \cdot \delta_L \cdot (q+(1-q)(1-p_1)) + \alpha_0 \cdot \delta_H \cdot (1-q)(1-p_1)}{\delta_L \cdot (q+(1-q)(1-p_1)) + \delta_H \cdot (1-q)(1-p_1)} \right) \end{cases}$$

Now consider first the contingency where  $\hat{\gamma} = H$ , but the actual state of the world is later revealed to be  $V_L$ . As noted above, this outcome is assumed to be what generates securities litigation, and it can occur for two reasons: First, A might have observed  $\gamma = L$ , and but committed fraud (i.e.,  $\hat{\gamma} = H$ ), which she will do with probability  $\delta_L$ . Along the equilibrium path, the probability that this contingency occurs is:

$$\begin{aligned} \Pr\{V_L \text{ revealed}; \gamma = L, \hat{\gamma} = H\} &= \Pr\{\hat{\gamma} = H | \gamma = L, V_L \text{ revealed}\} \quad (6) \\ &\quad \times \Pr\{\gamma = L | V_L \text{ revealed}\} \\ &\quad \times \Pr\{V_L \text{ revealed}\} \\ &= \delta_L \cdot (q + (1-q)(1-p_i)) \cdot (1-p_1) \mu \end{aligned}$$

where  $i = 0, 1$  denotes whether the agent has previously shirked. Alternatively A might have observed  $\gamma = H$  and (truthfully) reported  $\hat{\gamma} = H$  with probability  $\delta_H$ , but is unlucky and the state of the world is revealed to be  $V_L$ . This contingency occurs with equilibrium probability:

$$\begin{aligned} \Pr\{V_L \text{ revealed}; \gamma = H, \hat{\gamma} = H\} &= \Pr\{\hat{\gamma} = H | \gamma = H, V_L \text{ revealed}\} \quad (7) \\ &\quad \times \Pr\{\gamma = H | V_L \text{ revealed}\} \\ &\quad \times \Pr\{V_L \text{ revealed}\} \\ &= \delta_H \cdot ((1-q)(1-p_1)) \cdot (1-p_1) \mu \end{aligned}$$

And thus:

$$\begin{aligned} \Pr \{V_L \text{ revealed}, \hat{\gamma} = H\} &= \Pr \{V_L \text{ revealed}; \gamma = L, \hat{\gamma} = H\} + \Pr \{V_L \text{ revealed}; \gamma = H, \hat{\gamma} = H\} \\ &= (1 - p_1) \mu \cdot [\delta_L \cdot (q + (1 - q)(1 - p_1)) + \delta_H \cdot (1 - q)(1 - p_1)] \end{aligned} \quad (8)$$

Using Bayes rule, then, the probability that the state  $\{V_L; \hat{\gamma} = H\}$  has been reached because of fraud (rather than bad luck) is:

$$\begin{aligned} \Pr \{\gamma = L | V_L \text{ revealed}, \hat{\gamma} = H\} &= \frac{\Pr \{V_L \text{ revealed}; \gamma = L, \hat{\gamma} = H\}}{\Pr \{V_L \text{ revealed}, \hat{\gamma} = H\}} \\ &= \frac{\delta_L \cdot (q + (1 - q)(1 - p_1))}{\delta_L \cdot (q + (1 - q)(1 - p_1)) + \delta_H \cdot (1 - q)(1 - p_1)} \end{aligned} \quad (9)$$

which results in liability with probability  $\alpha_1$ .

The (complementary) probability that the state has been reached by bad luck is

$$\frac{\delta_H \cdot (1 - q)(1 - p_1)}{\delta_L \cdot (q + (1 - q)(1 - p_1)) + \delta_H \cdot (1 - q)(1 - p_1)}, \quad (10)$$

which results in liability with probability  $\alpha_0$ . Consequently, the expected probability of liability is given by

$$\frac{\alpha_1 \cdot \delta_L \cdot (q + (1 - q)(1 - p_1)) + \alpha_0 \cdot \delta_H \cdot (1 - q)(1 - p_1)}{\delta_L \cdot (q + (1 - q)(1 - p_1)) + \delta_H \cdot (1 - q)(1 - p_1)} \quad (11)$$

and the expression in Lemma 1a simply discounts damages  $\rho D$  by this probability, comparing it to filing cost. QED

The intuition behind Lemma 1 is relatively straightforward. It essentially states that if, under the posited equilibrium, the expected value of the suit exceeds filing costs, shareholders will bring suit. If filing costs fall short of expected damages, then shareholders will never bring suit. Finally, if filing costs are exactly offset by expected damages, plaintiffs are indifferent between filing suit and doing nothing, and are therefore willing to play a mixed strategy. Holding the strategies of other players constant, shareholders are more likely to file suit when filing costs ( $Y$ ) becomes small, per capita damages ( $D$ ) grow large, the size of the class ( $\rho$ ) grows large, and the likelihood of litigation success against either a culpable or a honest agent ( $\alpha_1$  and  $\alpha_0$ , respectively) grows large.

Under assumption 1, it can never be the case that a low plaintiff type adopts a pure strategy of truthful revelation – because then the equilibrium probability of suit is zero, and it is profitable for the low type to deviate. Thus the only possibilities for equilibria are a partially mixed equilibrium and a pure strategy equilibrium in which all agent types report high and litigation always occurs. In the mixed strategy equilibrium, we can proceed to derive the appropriate conditions on  $\delta_L$  and  $\pi$  that give rise to indifference by those players. Letting  $Q = \left( \frac{q}{(1-q)(1-p_1)} + 1 \right) = \frac{1-p_1(1-q)}{(1-p_1)(1-q)}$ , the indifference condition for the plaintiffs is:



$$\frac{Y}{\rho D} = \frac{\alpha_1 \cdot \delta_L \cdot Q + \alpha_0}{\delta_L \cdot Q + 1} \quad (12)$$

And thus:

$$\delta_L = \frac{\left(\frac{Y}{D\rho} - \alpha_0\right) (1 - p_1) (1 - q)}{\left(\alpha_1 - \frac{Y}{D\rho}\right) (1 - p_1 (1 - q))} \quad (13)$$

The indifference condition for the low type agent is:

$$\begin{aligned} 0 &= \sigma - \Pr\{V_L|\gamma = L\} \mu \pi \alpha_1 \\ &= \sigma - (1 - p_1 (1 - q)) \mu \pi \alpha_1 (w + W + \sigma) \end{aligned} \quad (14)$$

And thus:

$$\pi = \frac{\sigma}{\mu \alpha_1 (1 - p_1 (1 - q)) (w + W + \sigma)} \quad (15)$$

However, this mixed equilibrium can exist only so long as  $\delta_L$  and  $\pi$  as specified above are in the interval  $(0, 1)$ . The condition on  $\sigma_1$  ensures that this will be the case.

## 6.2 Additional Continuation Equilibria

First, consider the remaining equilibria of the litigation game if one allows for the possibility that  $Y \notin [Y_0, Y_1]$ . It turns out that in addition to the three equilibria noted above, four other qualitative equilibria emerge.

### 6.2.1 Equilibrium 3: $\{\delta_L, \delta_H, \pi\} = \{0, 1, 0\}$

This equilibrium occurs whenever  $\sigma = 0$ . Sufficient conditions are therefore:

$$\begin{aligned} Y &\geq 0 \\ \sigma &= 0 \end{aligned}$$

In this region, by construction  $\sigma = 0$ . Consequently, the firm is unable to deter the agent from shirking, and the optimal contract is given by  $\{\omega, 0, 0\}$ . Because we have presumed that the optimal organizational structure is to induce high effort, this equilibrium is never consistent with an optimal contract.

### 6.2.2 Equilibrium 4: $\{\delta_L, \delta_H, \pi\} = \{0, 0, 1\}$

In this equilibrium, both the high and low signal receivers report a low signal. This occurs when the litigation threat is so grave that agents always want to sue whenever a low state occurs after a high outcome is reported – even in an equilibrium where the agent always tells the truth. In other words, the

agent is so scared of litigation that he misleads in a pessimistic way. Sufficient conditions for this equilibrium to obtain are<sup>34</sup>:

$$\begin{aligned} Y &< Y_0 = \alpha_0 D; \\ \sigma &< \sigma_0 = \frac{\mu(1-q)\alpha_0}{1-\mu(1-q)\alpha_0} (W+w) \end{aligned}$$

### 6.2.3 Equilibrium 5: $\{\delta_L, \delta_H, \pi\} = \{0, 1, 1\}$

This equilibrium occurs when low signal types are completely deterred, while high signal types tell the truth. In this equilibrium all suits are non-meritorious. Sufficient conditions for this equilibrium to obtain are:

$$\begin{aligned} Y &\leq Y_0 = \alpha_0 D \\ \sigma &\in [\sigma_0, \sigma_1] = \left[ \frac{\mu(1-q)\alpha_0}{1-\mu(1-q)\alpha_0} (W+w), \frac{\mu q \alpha_1}{1-\mu q \alpha_1} (W+w) \right] \end{aligned}$$

### 6.2.4 Equilibrium 6: $\{\delta_L, \delta_H, \pi\} = \{1, 1, 0\}$

In this equilibrium, the high and low signal agent make optimistic reports, and the plaintiffs never sue when a low state is revealed. In this equilibrium, the low signal agent type always commits fraud. This equilibrium can occur whenever filing costs are so high that a suit against A is unprofitable even when it's quite likely (bayesian posterior of  $q > \frac{1}{2}$ ) that the agent committed fraud. Sufficient conditions for this equilibrium to obtain are:

$$\begin{aligned} Y &> Y_1 = D(\alpha_1 q + \alpha_0(1-q)), \\ \sigma &> 0 \end{aligned}$$

Summarizing, shareholders never file suit even if they knew that A was committing fraud in h. Knowing this, it is easy to verify that A always commits fraud.

### 6.2.5 Summary

The table below summarizes all of the plausible equilibria  $\{\delta_L, \delta_H, \pi\}$  of the game, depending on the parameters. The numbers in brackets denote the equilibrium type as described above.<sup>35</sup>

<sup>34</sup>Notice that in this equilibrium, no agent-type sends signal  $\hat{\gamma} = H$ , and we must also specify off equilibrium beliefs for this equilibrium. It turns out, however, that any set of off-equilibrium conjectures justifies this equilibrium.

<sup>35</sup>There are some equilibria which we exclude for various reasons. For example, there is one in which  $\{\delta_L, \delta_H, \pi\} = \{0, \delta_H^{**}, \pi^{**}\}$ . But for this equilibrium to exist, however, it must be that  $Y = \alpha_0 D$ , which is not an interesting equilibrium because it requires exact equality on the litigation costs condition, which is unlikely to be met. Similarly, when  $Y \in [Y_0, Y_1]$  and  $\sigma < \sigma_0$ , there is another sequential equilibrium in which  $\{\delta_L, \delta_H, \pi\} = \{0, 0, 1\}$ . However, supporting this equilibrium requires that the plaintiff have off equilibrium beliefs that fail a divinity requirement. We therefore report only the one that survives such refinement.

	$Y < Y_0$	$Y \in [Y_0, Y_1]$	$Y > Y_1$
$\sigma = 0$	$\{0, 1, 0\}^{[1]}$	$\{0, 1, 0\}^{[1]}$	$\{0, 1, 0\}^{[1]}$
$\sigma \in (0, \sigma_0]$	$\{0, 0, 1\}^{[4]}$	$\left\{ \left( \frac{\frac{Y}{D} - \alpha_0}{\alpha_1 - \frac{Y}{D}} \right) \frac{(1-q)}{q}, 1, \frac{\sigma}{\mu q \alpha_1 (W+w+\sigma)} \right\}^{[3a]}$	$\{1, 1, 0\}^{[6a]}$
$\sigma \in [\sigma_0, \sigma_1]$	$\{0, 1, 1\}^{[5]}$	$\left\{ \left( \frac{\frac{Y}{D} - \alpha_0}{\alpha_1 - \frac{Y}{D}} \right) \frac{(1-q)}{q}, 1, \frac{\sigma}{\mu q \alpha_1 (W+w+\sigma)} \right\}^{[3b]}$	$\{1, 1, 0\}^{[6b]}$
$\sigma > \sigma_1$	$\{1, 1, 1\}^{[2b]}$	$\{1, 1, 1\}^{[2a]}$	$\{1, 1, 0\}^{[6c]}$

### 6.3 Proposition 2

**Proposition 2:** *If Assumption 1, and if  $\frac{(W+\omega)}{c}$  is sufficiently large, the optimal contract and governance structure for the firm are given by:*

$$\{w, \sigma, \kappa\} = \left\{ \omega, \sqrt{\frac{a\beta_1}{\beta_2}}, \sqrt{\frac{\beta_1\beta_2}{a}} - 1 \right\}$$

where

$$\beta_1 = \frac{c}{(p_1 - p_0) \left( 1 - \frac{(1-q)}{q} \cdot \frac{\alpha_0}{\alpha_1} \right)}$$

$$\beta_2 = \left( p_1 + (1 - p_1) \frac{\left( \frac{Y}{\rho D} - \alpha_0 \right)}{\left( \alpha_1 - \frac{Y}{\rho D} \right)} \cdot \frac{(1-q)}{q} \right)$$

Proof: We subdivide the proof into two sections, each concerning subregions of  $\sigma$ .

#### 6.3.1 Case 1: $\sigma \leq \sigma_1$ .

We begin our inquiry on the most interesting/plausible family of equilibria in which  $\sigma \leq \sigma_1$ . Recall that in this permutation, the constraints of the problem are given by:

$$w = \omega \tag{16}$$

$$\sigma = \left( \frac{c}{(p_1 - p_0) \left( 1 - \frac{(1-q)}{q} \cdot \frac{\alpha_0}{\alpha_1} \right)} \right) \cdot \frac{1}{1 + \kappa}$$

$$\{\delta_L^*, \delta_H^*, \pi^*\} = \left\{ \left( \frac{\frac{Y}{\rho D} - \alpha_0}{\alpha_1 - \frac{Y}{\rho D}} \right) \cdot \frac{(1-q)}{q}, 1, \frac{\sigma}{\mu q \alpha_1 (W + w + \sigma)} \right\}$$

Substituting these terms into our objective function allows us to restate the firm's problem as follows:

$$\max_{\sigma \in [0, \sigma_1]} \left\{ V_L + p_1 (V_H - V_L) - \omega - c - a \left( \frac{\beta_1}{\sigma} - 1 \right) - \beta_2 \sigma \right\} \quad (17)$$

where:

$$\begin{aligned} \beta_1 &= \frac{c}{(p_1 - p_0) \left( 1 - \frac{\alpha_0}{\alpha_1} \cdot \frac{(1-p_1)(1-q)}{1-p_1(1-q)} \right)} \\ \beta_2 &= \left( p_1 + (1-p_1) \frac{\left( \frac{Y}{\rho D} - \alpha_0 \right)}{\left( \alpha_1 - \frac{Y}{\rho D} \right)} \cdot \frac{(1-p_1)(1-q)}{(1-p_1(1-q))} \right) \end{aligned} \quad (18)$$

Maximizing yields:

$$\begin{aligned} w^* &= \omega \\ \sigma^* &= \sqrt{\frac{a\beta_1}{\beta_2}} \\ \kappa^* &= \sqrt{\frac{\beta_1\beta_2}{a}} - 1 \end{aligned}$$

### 6.3.2 Case 2: $\sigma > \sigma_1$ :

As above, first consider the various constraints under this permutation

$$\begin{aligned} w &= \omega \\ \sigma &= \left( \frac{c}{\mu \cdot (p_1 - p_0) \cdot (\alpha_1 \cdot (1 - p_1 (1 - q)) - \alpha_0 \cdot (1 - q) (1 - p_1))} \right) \\ &\quad \times \left( \frac{1}{1 + \kappa} \right) - (w + W) \\ \{\delta_L^*, \delta_H^*, \pi^*\} &= \{1, 1, 1\} \end{aligned} \quad (19)$$

which simplifies the firm's objective function to:

$$V_L + p_1 (V_H - V_L) - \omega - c - a\kappa - \frac{\beta_3}{1 + \kappa} + \beta_4, \quad (20)$$

where

$$\begin{aligned} \beta_3 &= \frac{c}{\mu \cdot (p_1 - p_0) \cdot (\alpha_1 \cdot (1 - p_1 (1 - q)) - \alpha_0 \cdot (1 - q) (1 - p_1))} \\ \beta_4 &= (w + W) \end{aligned} \quad (21)$$

First order conditions for maximization in  $\kappa$  imply:

$$\begin{aligned} w^{**} &= \omega \\ \sigma^{**} &= \sqrt{\frac{a}{\beta_3}} - \beta_4 \\ \kappa^{**} &= \sqrt{\frac{\beta_3}{a}} - 1 \end{aligned} \tag{22}$$

Interestingly, note that in this region there is a one-to-one tradeoff between incentive compensation and wage. Indeed, given that the agent always mis-reports and always claims the bonus in this region, there is no longer a unique compensation package, and instead it is a continuum of wage/incentive packages such that:

$$\sigma + w = \sqrt{\frac{a}{\beta_3}} - W$$

### 6.3.3 Uniqueness of Optimal Solution

Recall that by hypothesis  $\sigma^* \leq \sigma_1$ , and that  $\sigma^{**} > \sigma_1$ . In order to show uniqueness, then, it suffices to demonstrate that

$$\begin{aligned} \sigma^{**} &< \sigma^* \\ &\Leftrightarrow \\ \sqrt{\frac{1}{\beta_3}} - \sqrt{\frac{\beta_1}{\beta_2}} &< \frac{\beta_4}{\sqrt{a}} \end{aligned}$$

This is always true if the left hand side of the above expression is non-positive, which occurs when:

$$\begin{aligned} &\beta_1 \beta_3 > \beta_2 \tag{23} \\ \Leftrightarrow & \frac{c}{(p_1 - p_0) \left( 1 - \frac{\alpha_0}{\alpha_1} \cdot \frac{(1-p_1)(1-q)}{1-p_1(1-q)} \right)} \times \\ & \left( \frac{c}{\mu \cdot (p_1 - p_0) \cdot (\alpha_1 \cdot (1-p_1(1-q)) - \alpha_0 \cdot (1-q)(1-p_1))} \right) > (p_1 + (1-p_1) \delta_L) \end{aligned}$$

A sufficient condition for this expression to hold is if:

$$c \geq \min \{ (p_1 - p_0), \alpha_1, \sqrt{\mu} \} \tag{24}$$

which clearly holds for all  $c \geq 1$ .

Given that there is a unique solution, the question is whether it falls into  $[0, \sigma_1]$ , in which case the stated proposition must hold. We therefore ask under

what conditions the following is satisfied:

$$\begin{aligned}
\sigma &= \sqrt{\frac{a\beta_1}{\beta_2}} & (25) \\
&= \sqrt{\frac{a}{\left(p_1 + (1-p_1) \frac{\left(\frac{Y}{\rho D} - \alpha_0\right)}{\left(\alpha_1 - \frac{Y}{\rho D}\right)} \cdot \frac{(1-q)}{q}\right)} \frac{c}{(p_1 - p_0) \left(1 - \frac{(1-q)}{q} \cdot \frac{\alpha_0}{\alpha_1}\right)}} \\
&< \sigma_1 = \frac{\mu q \alpha_1}{1 - \mu q \alpha_1} (W + w)
\end{aligned}$$

Rearranging yields the condition:

Check to see if

$$\frac{(W + w)}{\sqrt{ac}} \geq \left[ \begin{aligned} &(p_1 - p_0) \left(1 - \frac{(1-q)}{q} \cdot \frac{\alpha_0}{\alpha_1}\right) \\ &\times \left(p_1 + (1-p_1) \frac{\left(\frac{Y}{\rho D} - \alpha_0\right)}{\left(\alpha_1 - \frac{Y}{\rho D}\right)} \cdot \frac{(1-q)}{q}\right) \end{aligned} \right]^{-\frac{1}{2}} \left( \frac{1 - \mu q \alpha_1}{\mu q \alpha_1} \right) \quad (26)$$

which is always satisfied if:

$$\frac{W + w}{\sqrt{ac}} \gtrsim (0.45) \quad (27)$$

**Table 1**  
**Descriptive Statistics of CEO Compensation in 2002**

The table below shows the five number summaries for the components of CEO compensation for a sample year of 2002. Total of 1420 CEOs are recorded in 2002. Our dataset has a total of 12,840 observations on 3312 different CEO's in 2020 different firms during the whole period 1992-2002. All calculations are based on the Standard and Poor's ExecuComp dataset and reported in thousands of dollars. Total compensation consists of short term and long-term compensation. Short-term compensation is defined as yearly salary, bonuses and other annual payment not identified as salary or bonus. Long term compensation consists of the value of restricted stocks granted during the fiscal year, determined at the date of the grant and the aggregate value of stock options granted issued during the fiscal year valued by S&P's using Black-Scholes method.

Payment Category (thousands of dollars)	Mean	Median	First Quantile	Third Quantile	Standard Deviation
CEOs (N= 1420)					
<b>Total Compensation</b>	5,071	2,720	1,270	5,907	7,409
Short term compensation	1,511	1,075	635	1,866	1,522
Salary	681	630	441	880	364
Bonus	760	381	46	976	1,222
Other annual	70	0	0	22	371
Long term compensation	3,557	1,361	358	3,999	6,760
Restricted stock granted	536	0	0	0	2,324
Stock options granted	2,681	952	103	2,965	5,559
Long term incentive plan payouts	176	0	0	0	819
All other	166	25	6	89	774
Long term share of total	51%	56%	30%	74%	29%

**Table 2**  
**Corporate Governance Index**

This table provides the five number summary of the corporate governance index distribution over time.

	1993	1995	1997	1999	2001
Governance index					
Minimum	8	8	8	7	7
Mean	14.4	14.5	14.3	14.8	14.5
Median	14	14.125	14	15	14.5
Maximum	22	22	22	21	21.5
Standard Deviation	2.81	2.75	2.66	2.67	2.55
Number of observations	888	1071	974	1164	1095
Number of firms					
25th percentile $\kappa \leq 13$	351	403	366	356	352
IQR $13 < \kappa \leq 16.667$	238	276	280	269	260
75th percentile $\kappa < 16.667$	672	790	777	855	867



**Table 3**  
**Securities Litigation**

This table shows how many firms were sued per year during the period represented by our dataset. If same firm has been sued multiple times per year we only observe one suit per year per firm. The numbers are derived from our merged dataset comprised of S&P's ExecuComp, IRRC Corporate Governance Provision, and ISS Securities Class Action Services dataset.

<b>Year</b>	<b>Law suit</b>	<b>Settlement &gt; \$1 Mil.</b>
1992	1	1
1993	8	7
1994	26	10
1995	35	16
1996	9	3
1997	16	11
1998	30	16
1999	40	13
2000	47	14
2001	34	7
2002	76	5
	322	103

**Table 4**

**Pair wise correlation between Corporate Governance, Incentive Pay and Securities Litigation**

This table shows the pair wise correlation between the Corporate Governance Index, Incentive Pay and Securities Litigation within the year or within the following two years, over the period 1992-2002. Corporate Governance Index takes values between 7-22, from weaker governance structure to a stronger one. Incentive pay is defined as the percentage that long term compensation counts for in the executive's total compensation, while long term compensation is defined as the sum of the dollar value of restricted stocks granted over the year, aggregate value of stock options granted during the year as valued using S&P's Black Scholes methodology, i.e. how much the option grant was worth at the time it was granted and the amount paid out to the executive under the firm's long term incentive plan. Firm sued in two years, is an indicator variable that takes value 1 if firm is being sued in current year or in the two years following.

	Corporate governance	Share of Incentive Pay in Total Compensation	Firm sued in two years
Corporate governance	1		
<i>Significance level</i>	.		
Incentive Pay	-0.064	1	
<i>Significance level</i>	0.0000		
Firm sued w/in 2 years	0.0263	0.1165	1
<i>Significance level</i>	0.0029	0.0000	.

**Table 5**  
**Substitutability of Incentive Pay and Corporate Governance**

This table shows the results of regression estimations of the relationship between incentive pay and corporate governance. Panel A treats incentive pay as a dependent variable in (1) an OLS estimation and (2) a generalized linear model with random effects at the firm level, and covariates being our corporate governance index, average monthly trading volume in units of 100, stock market price volatility used in calculating the Black Scholes values for options, and the size of the firm represented by the number of employees in thousands. Panel B treats corporate governance index as dependent variable, with volume and volatility as covariates. Model (4) uses manufacturing industry, salary and number of employees as instruments for incentive pay.

	<b>Panel A</b>		<b>Panel B</b>	
	<i>Dependent variable Incentive Pay</i>		<i>Dependent variable Corporate Governance Index</i>	
	(1) OLS	(2) Random effects	(3) Instrumental variables for Incentive Pay clustering at firm level	(4) Instrumental variables for Incentive Pay random effects at firm level
Corporate Governance Index	-0.0092 (0.0009)**	-0.0124 (0.0015)**		
Incentive Pay			-2.7248 (1.4312) <sup>†</sup>	-7.6938 (0.8871)**
Volume	8.58E-08 (4.76e-09)**	5.43E-08 (5.08e-09)**	3.63E-07 (1.44e-07)*	2.18E-07 (5.82e-08)**
Volatility	0.2704 (0.0142)**	0.2966 (0.0176)**	3.606 (0.4823)**	2.1889 (0.3277)**
Constant	0.4909 (0.0139)**	0.5283 (0.0223)**	14.4822 (0.5176)**	17.6551 (0.3185)**
Observations	11336	11336	11145	11145
R-squared	0.07		0.02	
Number of firms		2037		2020

Standard errors in parentheses    <sup>†</sup> signif. at 10%; \* signif. at 5%; \*\* signif. at 1%

**Table 6**

**Determinants of probability of private securities class action litigation during the period 1992-2002**

This table shows the regression estimation of the probability of a firm being sued in a certain year with respect to values of variables in the year before testing direct effect of the PSLRA. Panel A shows OLS estimation using a linear probability model of being sued in a current year with respect to incentive pay, volume, volatility and number of employees in a firm, the year before. The variable *After PSLRA* is a dummy variable indicating whether the suit year was after the promulgation of the PSLRA in January 1996. Panel B shows same estimations using salary level and an indicator of firms in manufacturing sector as instruments for incentive pay. Panel C shows estimation results on the same approach as in the first Panel using a logit specification. Model (1) is run on the entire dataset, where as Model (2) is run on a dataset excluding the year 1996. Model (3), (4) and (5) exclude the years 1996-1997, 1996-1998 and 1996-1999 respectively, in order to account for the transition period that may distort estimation on the effect that PSLRA may have had on litigations against public firms.

	<i>Panel A</i> <i>Linear Probability</i>					<i>Panel B</i> <i>Linear Probability with instrumental variables for incentive pay</i>					<i>Panel C</i> <i>Logit Regression - odds ratios</i>				
	(1) Including 1996	(2) Excluding 1996	(3) Excluding 1996-1997	(4) Excluding 1996-1998	(5) Excluding 1996-1999	(1) Including 1996	Excluding 1996	(3) Excluding 1996-1997	(4) Excluding 1996-1998	(5) Excluding 1996-1999	(1) Including 1996	(2) Excluding 1996	(3) Excluding 1996-1997	(4) Excluding 1996-1998	(5) Excluding 1996-1999
Lagged Incentive Pay	0.0255 (0.0066)**	0.0292 (0.0070)**	0.0348 (0.0076)**	0.0374 (0.0085)**	0.0348 (0.0096)**	0.2346 (0.0392)**	0.2661 (0.0457)**	0.2802 (0.0506)**	0.3125 (0.0599)**	0.3505 (0.0684)**	3.4903 (0.9331)**	3.7512 (1.0243)**	4.3413 (1.2398)**	4.3157 (1.2897)**	4.0026 (1.3001)**
Lagged Volume	3.77E-08 (4.05e-09)**	3.77E-08 (4.11e-09)**	3.85E-08 (4.18e-09)**	3.73E-08 (4.38e-09)**	3.28E-08 (4.66e-09)**	2.34E-08 (5.33e-09)**	2.14E-08 (5.71e-09)**	2.14E-08 (5.95e-09)**	1.96E-08 (6.44e-09)**	1.69E-08 (6.75e-09)**	1 (7.59e-08)**	1 (7.30e-08)**	1 (7.24e-08)**	1 (7.33e-08)**	1 (7.49e-08)**
Lagged Volatility	0.1087 (0.0298)**	0.1083 (0.0305)**	0.1062 (0.0312)**	0.1078 (0.0323)**	0.1172 (0.0337)**	0.0558 -0.0311	0.0493 -0.0328	0.0462 -0.034	0.0395 -0.0361	0.0316 -0.0374	34.1671 (33.3540)**	31.5783 (30.1756)**	29.4932 (28.0581)**	31.3367 (30.0602)**	33.8594 (32.8357)**
After PSLRA	0.0109 (0.0105)	0.0121 (0.011)	0.0145 (0.0116)	0.0235 (0.0125)	0.0317 (0.0134)*	-0.0134 (0.0116)	-0.0202 (0.0129)	-0.0247 (0.0143)	-0.0296 (0.0172)	-0.037 (0.0195)	1.2784 (0.5284)	1.4431 (0.5934)	1.6786 (0.699)	2.3665 (1.0121)*	2.6853 (1.2009)*
Lagged Volatility*After PSLRA	-0.0667 (0.0312)*	-0.0682 (0.0324)*	-0.0748 (0.0336)*	-0.0928 (0.0354)**	-0.1104 (0.0371)**	-0.062 (0.0322)	-0.0589 (0.0339)	-0.0574 (0.0352)	-0.0584 (0.0377)	-0.0587 (0.0397)	0.1567 (0.1621)	0.1335 (0.1363)*	0.0991 (0.1017)*	0.054 (0.0566)**	0.0424 (0.0458)**
Lagged Number of Employees	0.0001 (0.0000)**	0.0001 (0.0000)*	0.0001 0	0.0001 (0.0000)*	0.0001 (0.0000)*						1.0029 (0.0008)**	1.0026 (0.0008)**	1.0021 (0.0008)*	1.0022 (0.0008)*	1.0023 (0.0009)*
Constant	-0.0206 (0.0100)*	-0.0219 (0.0103)*	-0.0227 (0.0105)*	-0.0245 (0.0109)*	-0.0268 (0.0115)*	-0.077 (0.0151)**	-0.0862 (0.0168)**	-0.0904 (0.0182)**	-0.0998 (0.0207)**	-0.1108 (0.0229)**					
Observations	9485	8513	7561	6595	5486	9650	8663	7692	6709	5570	9485	8513	7561	6595	5486
Number of firms	1694	1689	1689	1664	1649	1709	1705	1705	1679	1666	1694	1689	1689	1664	1649

Standard errors in parentheses

\* significant at 5%; \*\* significant at 1%

**Table 7**  
**Incentive pay and class action settlements**

This table shows our predictions of a two stage Tobit regression on settlement fund sensitivity, of a successful class action cases, towards predicted values of incentive pay, average monthly stock volume traded, stock price volatility as used to calculate BS-option values over 60 months periods, the number of employees of the company in thousands, and indicator variable for the period after the Private Securities Litigation Reform Act took force. Other than this indicator variable, all others controls use one year lags.

	Two stage Tobit regression using fitted values for incentive pay	Two stage Tobit regression using fitted values for incentive pay
Predicted Incentive Pay (Lagged)	341,000,000 (1.52e+08)*	439,000,000 (1.62e+08)**
Pred. Inc. Pay X After PSLRA		-86,600,000 (3.10e+07)**
Volume (Lagged)	16.74634 (6.882141)*	17.93138 (6.906278)**
Volatility (Lagged)	9.65E+07 (3.95e+07)*	117,000,000 (4.18e+07)**
Firm Value (Lagged) (Black-Scholes)	1.80E+02 (422.2426).	210.3455 408.1461
# of employees (in 000s) (Lagged)	84,301.72 (80271.82).	80,193.84 (82228.31).
After PSRLA		-40484000 (31007000).
Constant	-536,000,000 (9.43e+07)**	-646,010,000 (9.2425e+07)**
Observations	9594	9594
Number of firms	1697	1697

Standard errors in parentheses

\* significant at 5%; \*\* significant at 1%

**Table 8**  
**PSLRA and Incentive Pay**

This table shows estimations on the effect PSLRA may have had on incentive pay. Dependent variable, incentive pay, is estimated with respect to the covariates; average monthly volume traded with firms' shares, market price volatility as used in calculating the Black- Scholes values for options, i.e. standard deviation volatility calculated over 60 months and size of the firm represented by the number of employees in thousands, CEO's annual salary and a dummy for firms in the manufacturing industry, with random effects at the firm level to count for repeated measure of the firm. (Other controls for salary level and industry dummies not reported).

	(1) Random effects at firm level including 1996	(2) Random effects at firm level excluding 1996-1997	(3) Random effects at firm level excluding 1996-1998	(4) Random effects at firm level excluding 1996-1999
Volume	0.00E+00 (0.0000)**	0.00E+00 (0.0000)**	0.00E+00 (0.0000)**	0.00E+00 (0.0000)**
Volatility	0.2677 (0.0367)**	0.26 (0.0372)**	0.2636 (0.0384)**	0.2665 (0.0393)**
After PSLRA	0.1332 (0.0125)**	0.1569 (0.0130)**	0.1968 (0.0144)**	0.1992 (0.0156)**
Volatility*After PSLRA	-0.0486 (0.0369)	-0.0809 (0.0379)*	-0.1378 (0.0401)**	-0.1376 (0.0416)**
Number of employees	0.0004 (0.0001)**	0.0003 (0.0001)**	0.0003 (0.0001)**	0.0003 (0.0001)**
Constant	0.2399 (0.0142)**	0.244 (0.0144)**	0.2398 (0.0151)**	0.2363 (0.0157)**
Observations	11145	10157	7953	6789
Number of gvkey	2020	2020	1953	1902

Standard errors in parentheses

\* significant at 5%; \*\* significant at 1%