

# **The Impact of PCAOB Type of Regulations on Auditors under Different Legal Systems\***

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### **Abstract:**

This paper analyzes the impact of PCAOB type of regulatory oversight on auditors under different legal regimes. Our analyses suggest that regulatory oversight does not improve audit quality of all auditors, but it can improve the overall audit quality of an audit market by incentivizing high cost and low ability auditors to exit the market, and by allowing medium cost efficiency and ability auditors to commit to higher audit effort. The improvement of overall audit quality is not necessarily beneficial to investors because regulatory oversight can induce over-investment in audit effort if auditing standards are too tough. However, when the legal regime is weak, regulatory oversight can improve social surplus by incentivizing auditors to comply with standards that are closer to the first-best. Additionally, regulatory oversight can substitute for a weak legal system in disciplining auditors if regulatory penalty is sufficiently high, but the effect of the legal system on the composition of auditors in the markets is not substitutable by regulatory oversight. Our results enhance understanding of the complex relation between regulatory oversight and audit markets, and provide policy implications for regulators.

**JEL classification:** M42, M48

**Keywords:** Regulatory oversight, auditing standards, audit quality, social surplus

# **The Impact of PCAOB Type of Regulations on Auditors under Different Legal Systems**

## **1 Introduction**

In order to protect investors and the public interest, the Public Company Accounting Oversight Board (PCAOB) was established by the U.S. Congress to oversee the audits of public companies. It replaces self-regulation to help restore investors' confidence in capital markets. The PCAOB sets auditing standards and inspects audit firms. It has investigative authority to identify serious audit deficiencies and has disciplinary authority to impose sanctions for those deficiencies.

In the U.S., auditors face enforcement from a strong legal system before the establishment of the PCAOB. What incremental effect on auditors can the regulatory oversight have over the legal system? In many countries (e.g. China, Japan and India) the legal system which auditors face is weak, so an interesting question is whether regulatory oversight can compensate for a weak legal system in ensuring audit quality. In sum, the primary purpose of this study is to analyze the impact of the PCAOB type of regulatory oversight on auditors under different legal systems, including audit quality, the structure of the audit market, social surplus, and audit fees.

The key difference we consider between the PCAOB type of regulatory oversight and legal system is as follows. When audit quality is lower than the required standard, liability damages are only incurred in the case of audit failure, which depends on the audit quality. In contrast, regulatory penalty depends on an exogenous likelihood of investigation, which is independent of audit quality. This difference leads to the variation in audit quality via the change in the auditing standards.

Our analyses show that regulatory oversight does not change the behavior of high quality (cost efficient and higher ability) auditors. It allows medium quality auditors to commit to higher

audit effort and incentivize low quality auditors to exit the market. However, the improvement of audit effort is not necessarily beneficial to investors unless auditing standards are properly set. If the underlying auditing standards are too tough (i.e., higher than the first-best effort choice desired by investors), an auditor will comply with the standards as long as the standards are not tougher than the maximum standards with which she will comply under regulatory oversight. This is because an auditor has a higher expected loss resulting from noncompliance with auditing standards if there were no regulatory oversight. Thus, although regulatory oversight improves audit effort, it reduces social surplus in this case. However, when the legal regime is weak, regulatory oversight can improve social surplus by incentivizing auditors to comply with standards that are closer to the first-best auditing standards.

Regulatory oversight will increase the audit fees of auditors who switch from noncompliance to compliance as well as auditors remaining noncompliant. The audit fees of auditors who remain compliant with the standards are the same under the two regimes. The auditors who remain noncompliant will demand higher fees to compensate for the increased expected costs for noncompliance effort arising from the penalty imposed by regulators under regulatory oversight.

Regulatory oversight can substitute for a legal system in ensuring high quality audits if the regulatory penalty is sufficiently high, but it has differential impact on the composition of auditors in audit markets than the legal system. For example, a legal system can allow some high cost auditors with low audit effort to stay in the market, since these auditors will exert a positive level of effort to reduce the likelihood of audit failure even if they do not comply with auditing standards. Under regulatory oversight, high cost auditors will provide zero effort and can only earn negative surplus, and thus cannot stay in the market. Moreover, the legal system can allow

some high ability auditors to stay in the market, since these auditors have low likelihood of audit failure by exerting nonzero noncompliance effort due to their high detection ability. Under regulatory oversight, when auditing standards are very tough, high ability auditors will exert zero noncompliance effort, because it is too costly for them to comply with standards and once audit effort is less than the standards, the entire regulatory penalty will be imposed onto the auditors. The surplus earned by auditors exerting zero effort is negative, and thus they cannot stay in the market. Additionally, when the standards are not too tough, high ability auditors are able to commit to compliance effort under regulatory oversight because it is more cost efficient than providing noncompliance zero effort and these auditors are able to earn non-negative surplus.

This paper makes the following contributions. First, to the best of our knowledge, this is the first theoretical study directly analyzing the impact of imposing penalty through regulatory investigations on auditors' behavior and audit market. Existing literature analyzes how other mechanisms, such as legal liability, loss of future engagement, contingent fees, reputation loss, affect auditor behavior (Antle 1982; Bagnoli, Penno, and Watts 2001; Bockus and Gigler 1998; Corona and Randhawa 2010; Dye, Balachandran and Magee 1990; Hillegeist 1999; Lu and Sapiro 2009; Melumad and Thoman 1990; Narayanan 1994; Newman, Patterson, and Smith 2001; Rothenberg 2015; Skinner and Srinivasan 2012). Laux and Stocken (2013) examine the influence of accounting standards and regulatory enforcement on reporting quality and investment efficiency. Our paper provides unique insights on the dynamic relation between regulatory oversight, legal systems, and audit markets. For example, we show that if the legal system is sufficiently stringent, then regulatory oversight will not improve investors' welfare. When the legal system is weak, regulatory oversight can help ensure high quality audits if

regulatory penalty is sufficiently high. However, regulatory oversight cannot substitute for the legal system in terms of its impact on audit markets.

Our paper demonstrates the important role of auditing standards. That is, the incremental effect of regulatory oversight over a legal system on investors' welfare and audit quality is affected by auditing standards. Regulatory oversight is beneficial to investors through the improvement of audit quality and audit market structure, if the auditing standards are properly set. Therefore, our paper adds to the literature on auditing standards (Dye 1993, Knechel 2013, Ye and Simunic 2013).

In addition, our paper offers new empirical predictions and provides a theoretical framework to explain several existing empirical findings. According to review papers by Abernathy, Barnes, Stefaniak (2014), DeFond and Zhang (2014), Knechel, Krishnan, Pevaner, Shefchik, Velury (2013), researchers are just beginning to examine the effectiveness of the PCAOB's functions, i.e., registration, standard-setting, inspection, and enforcement, but the number of studies in this area is relatively small (e.g., Bronson, Hogan, Johnson, and Ramesh 2011; Doogar, Sivadasan, and Solomon 2010). Our paper provides additional empirical predictions that can strengthen the conclusions drawn from this research. For example, whether regulatory oversight can improve investors' welfare is affected by auditing standards. Furthermore, our predictions on market structure change are consistent with the findings in DeFond and Lennox (2011) that most of the small audit firms in their sample exited the market shortly after the passage of the Sarbanes-Oxley Act (SOX), which established the PCAOB, and the exiting auditors were of lower quality. We provide the underlying economic reasons as to why this occurs. Regulatory oversight can incentivize inefficient or lower ability auditors to exit

the market and allow participating auditors to commit to higher audit effort because the regulatory penalty increases auditors' cost of providing lower effort.

Finally, our paper contributes to the analytical auditing literature on the interaction between auditors and clients, and thus the audit market structure, by considering auditor differentiation in cost efficiency and detection ability. This differs from most of the prior research (Newman, Patterson, and Smith 2005, Zhang 2007, Zhang and Thoman 1999 etc.).

We present our model and benchmark analysis in the next section. We analyze the impact of regulatory oversight on auditors under a strong legal system in Section 3. Section 4 considers a weak legal system. Section 5 describes empirical implications and Section 6 concludes.

## 2 Model

### 2.1 Setup

Our model's timeline resembles that in Dye (1995). An entrepreneur seeks to sell a firm to outside investors, perhaps for lifecycle reasons.<sup>2</sup> If investors purchase the firm, they must invest  $\$I$  in order for the firm's project to generate a payoff. A good project will generate a payoff of  $R$  and a bad project will generate a payoff of zero. Investors and the entrepreneur share the prior belief that the probability of a good project is  $\beta$ .<sup>3</sup> We assume that the  $\beta > I / R$  so that, absent an audit, investors will pay the no-audit price  $p_n = \beta R - I$  and invest in the project.

If the entrepreneur hires an auditor, he must pay a fee  $F$ , which we will determine later, and the auditor will exert effort  $a \in [0, 1]$  to generate a signal about the project's type. The

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<sup>2</sup> Our analysis can be extended to the setting where an auditor considers a portfolio of clients. The main inferences are the same. This firm can be considered as an average client of the auditor.

<sup>3</sup> The assumption of a shared prior simplifies the analysis by removing the ability of investors to sue the entrepreneur in the event of a bad project. If the entrepreneur has private information about the project and if it later fails, then investors have cause to sue the entrepreneur to recover their investment. Also, the entrepreneur can use the auditor choice to signal his type (Titman and Trueman, 1986). The tensions that determine auditor behavior remain largely unchanged.

auditor chooses effort to maximize her payoff. The auditor incurs cost  $\frac{1}{2}\mu a^2$  for effort  $a$ . We first analyze the case when  $\mu$  is the same for all auditors and then discuss when  $\mu$  is different and auditors' participation in the audit market. We assume that the auditor reports truthfully with the detection probabilities:

$$P(\text{Good signal} \mid \text{Good project}) = 1, \quad P(\text{Bad signal} \mid \text{Bad project}) = a, \quad (1)$$

where  $a \in [0, 1]$ . We refer to an undetected bad project as an 'audit failure,' which occurs with probability  $1 - a$ .<sup>4</sup>

The sequence of events is as follows:

- Entrepreneur chooses whether to hire auditor for fee  $\$F$
- If hired, auditor exerts effort  $a$  and generates a report.
- Investors choose whether to buy the firm and, if so, invest  $\$I$  in its project.
- If there is regulatory oversight, then with probability  $\gamma$ , the regulator inspects the auditor and if  $a < s$ , the auditor fails the investigation and suffers a cost  $d$ .
- Payoffs are realized, and investors sue auditor for  $\$D$  in the event of an audit failure.

## 2.2 *Enforcement from the legal system*

In this section, we solve for audit effort under the benchmark case when there is no regulatory oversight. We assume that investors sue the auditor if the project is bad and the auditor certified it was good (i.e., an audit failure).<sup>5</sup> The courts will resort to auditing standards to determine the due care level and possible auditor negligence. We denote the audit standard as an input level  $s$  and term it as the toughness of the standards as in Ye and Simunic (2013). In

<sup>4</sup> Here we assume assurance equals audit effort. It is important to note, as discussed in Knechel (2013), effort is not the same as assurance, though it is reasonable to presume that assurance increases with more effort. Using a more general functional form will significantly complicate the analysis, without bringing further insights.

<sup>5</sup> Following prior literature (Dye 1993, Ye and Simunic 2013, etc.), managers' liability is not analyzed in the paper.



other words, the standard specifies audit procedures, but not necessarily the effectiveness of those procedures for a given auditor. It is the level of effort required by auditing standards. We model the court-based standard as assigning liability for damages  $D < I$  if  $a < s$  and zero otherwise.<sup>6</sup> The auditor's choice of whether to comply with the standard ( $a \geq s$ ) depends on the costs and the expected liability from audit failure.

The entrepreneur's expected audit price  $p_a$  is the following, where investors hold rational expectations that the auditor will exert effort  $a = \hat{a}$ :<sup>7</sup>

$$\begin{aligned} E[p_a] &= \underbrace{\beta(R - I)}_{\text{Good project}} - \underbrace{(1 - \hat{a})(1 - \beta)I}_{\text{Invest in undetected bad project}} + \underbrace{1_{\hat{a} < s}(1 - \hat{a})(1 - \beta)D}_{\text{Sue for undetected bad project}} \\ &= p_n + \underbrace{\hat{a}(1 - \beta)I}_{\text{Avoid investment in bad project}} + \underbrace{1_{\hat{a} < s}(1 - \hat{a})(1 - \beta)D}_{\text{Sue for undetected bad project}}. \end{aligned} \quad (2)$$

The firm will hire the auditor if the fee  $F$  is sufficiently low ( $F < E[p_a] - p_n$ ), where  $p_n$  is the price without an audit. If the firm hires the auditor, the auditor chooses effort taking the non-contingent fee  $F$  as given:

$$\max_a F - \underbrace{1_{a < s}(1 - a)(1 - \beta)D}_{\text{Suit for undetected bad project}} - \underbrace{\frac{1}{2}\mu a^2}_{\text{Effort cost}}. \quad (3)$$

The entrepreneur and investors anticipate the optimization (3) when determining their conjecture  $\hat{a}$  of auditor effort.

<sup>6</sup> Deng, Melumad, and Shibano (2012) show increasing auditor liability decreases the audit failure rate and the cost of capital for new projects, but it decreases the level of new profitable investments. Regulatory penalty resulting from regulatory oversight is not the same as the increased liability. This paper analyzes the incremental effects and substitution effects of regulatory oversight, and compares the effects of regulation with the effects of legal systems on audit markets.

<sup>7</sup> Because investors will not purchase the firm if the audit reveals a bad project, the price of the firm is zero in the event of a bad signal and  $E[p_a] = E[p_a | \text{Good signal}]P(\text{Good signal})$  where  $P(\text{Good signal}) = 1 - (1 - \beta)\hat{a}$ .

### 2.2.1 First-best effort

The combined surplus from the audit is the following, which reflects that litigation is a transfer between the firm and the auditor that does not contribute to the surplus:

$$\text{Surplus from audit} = \underbrace{a(1-\beta)I}_{\text{Avoid investment in bad project}} - \underbrace{\frac{1}{2}\mu a^2}_{\text{Effort cost}}. \quad (4)$$

The corresponding first-best effort level  $a_{fb}$  satisfies:

$$a_{fb} = \frac{(1-\beta)I}{\mu} \quad (5)$$

and yields the following surplus:

$$\text{Surplus}_{fb} = \frac{(1-\beta)^2 I^2}{2\mu}. \quad (6)$$

The first-best effort level is decreasing in costs  $\mu$ .

### 2.2.2 Second-best effort

The auditor cannot commit *ex ante* to a specific effort level, but selects effort to optimize (3). The auditor's effort will either be an interior effort choice or the auditing standard  $s$ . The auditor will never exert effort greater than  $s$  because that would do nothing to reduce expected liability, but would increase audit costs. We denote an interior effort choice, derived from the first-order condition for (3), by  $a_{nc} = \frac{(1-\beta)D}{\mu}$ , which is less than the first-best effort choice because the auditor's liability is less than the investment in the project ( $D < I$ ).<sup>8</sup> The following observation summarizes the auditor's effort choice:

<sup>8</sup> This assumption is to exclude the unrealistic case of achieving first-best through noncompliance.

**Observation 1** *The auditor complies with standards  $s$  if  $s \leq \bar{s}$  where*

$$\bar{s} = \sqrt{\frac{2(1-\beta)D}{\mu} - \left(\frac{(1-\beta)D}{\mu}\right)^2}, \text{ otherwise, she does not comply with the standards and exerts}$$

$$\text{effort } a_{nc} = \frac{(1-\beta)D}{\mu}.$$

### 2.2.3 Optimal auditing standards and equilibrium audit effort

We compare  $\bar{s}$  with the first best effort to determine the optimal standards. If

$$\bar{s} \geq a_{fb} = \frac{(1-\beta)I}{\mu}, \text{ then we can set } s = \frac{(1-\beta)I}{\mu} \text{ and the audit effort equals } s = \frac{(1-\beta)I}{\mu}. \text{ If}$$

$$\bar{s} < a_{fb} = \frac{(1-\beta)I}{\mu}, \text{ then we set } s = \bar{s} > a_{nc} \text{ and the audit effort is } s = \bar{s}.$$

**Observation 2** *If  $D \geq \frac{\mu - \sqrt{\mu^2 - (1-\beta)^2 I^2}}{1-\beta}$ , the first best effort can be obtained by setting*

*standard to be  $s = \frac{(1-\beta)I}{\mu}$ . If  $D < \frac{\mu - \sqrt{\mu^2 - (1-\beta)^2 I^2}}{1-\beta}$ , audit effort is less than the first best.*

This observation implies that if the damage award is not sufficiently large, then the audit effort is not optimal, which leaves room for improvement. This is often the case in practice, as auditors have limited liability.<sup>9</sup> In the next subsection, we analyze whether regulatory oversight can help improve audit effort.

<sup>9</sup> A sufficiently high  $D$  cannot be set to always ensure first best audit effort. It makes the first best effort achievable, but the standards must be set at some specific levels to achieve the first best effort. For example, if the standards are very low, auditors will comply with the low standards and do not exert first best effort, even if the damage award is very high.

### ***3. Enforcement from both the legal system and regulatory oversight***

This section solves for audit effort under regulatory oversight. Auditors face enforcement from two sources: court systems and regulatory monitors (e.g., Mookherjee and Png 1992). We model regulatory monitors as the potential for inspection and enforcement, independent of whether or not there is an audit failure. For example, the PCAOB (post the Sarbanes-Oxley Act of 2002 (SOX)) reviews and investigates auditors' compliance with auditing standards on an ongoing basis. These reviews and investigations occur whether or not an audit failure occurs. Such regulatory oversight has effective enforcement in contrast to self-regulation. For example, Anantharaman (2012) found that firms that chose their own peer reviewers tended to receive peer review opinions that were more favorable than their subsequent PCAOB reports.

#### **3.1 Uniform auditors**

We assume that both the courts and regulators apply the same set of auditing standards for determining the sufficiency of an audit. With probability  $\gamma$ , the regulator inspects the auditor.<sup>10</sup> If  $a < s$ , the auditor fails the investigation and suffers a cost  $d$ .<sup>11</sup> The investigation does not depend on the presence of an audit failure. Thus, the regulatory penalty is not a simple addition to the damage payment determined by courts. However, if audit failures trigger investigations, any related penalties could be added into the expected court-imposed costs without any substantive change to the model. Thus, the investigation can occur any time after the audit is

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<sup>10</sup> "The PCAOB conducts regular, periodic inspections of hundreds of those firms, but not all of those firms. It should not be assumed or expected that a firm registered with the PCAOB is, or necessarily will be, inspected by the PCAOB." <http://pcaobus.org/Inspections/Pages/InspectedFirms.aspx>

<sup>11</sup> For example, sanctions imposed by the PCAOB may include suspension or revocation of a firm's registration, suspension or bar of an individual from associating with a registered public accounting firm, and civil money penalties. The Board may also require improvements in a firm's quality control, training, independent monitoring of the audit work of a firm or individual, or other remedial measures. (<http://pcaobus.org/Enforcement/Pages/default.aspx>).

completed. The auditor's choice of whether to comply with the standard ( $a \geq s$ ) depends on the costs and likelihood of being investigated and the expected liability from audit failures.

The entrepreneur's expected audit price  $p_a$  is the same as equation (2). The firm will hire the auditor if the fee  $F$  is sufficiently low ( $F < E[p_a] - p_n$ ). If the firm hires the auditor, the auditor chooses effort taking the non-contingent fee  $F$  as given:

$$\max_a F - \underbrace{1_{a < s}(1-a)(1-\beta)D}_{\text{Suit for undetected bad project}} - \underbrace{1_{a < s}\gamma d}_{\text{Failed inspection}} - \underbrace{\frac{1}{2}\mu a^2}_{\text{Effort cost}}. \quad (7)$$

The entrepreneur and investors anticipate the optimization (7) when determining their conjecture  $\hat{a}$  of auditor effort.

### 3.1.1 First-best effort

The combined surplus from the audit is the same as equation (4), which reflects the fact that litigation is a transfer between the firm and the auditor and the regulatory penalty is a transfer between the auditor and the regulator that do not contribute to the surplus. The

corresponding first-best effort level  $a_{fb} = \frac{(1-\beta)I}{\mu}$  is the same as equation (5) and the surplus

Surplus<sub>fb</sub> =  $\frac{(1-\beta)^2 I^2}{2\mu}$  is the same as equation (6).

### 3.1.2 Second-best effort

Similar to the derivation of second-best effort in the previous subsection, the auditor selects effort to optimize (7). The auditor's effort will either be an interior effort choice or the regulatory standard  $s$ . The interior effort choice, derived from the first-order condition for (7),

remains to be  $a_{nc} = \frac{(1-\beta)D}{\mu}$ , but the cut-off point of standards is changed. The following

observation summarizes the auditor's effort choice:

**Observation 3** *The auditor complies with standards  $s$  if  $s \leq \bar{s}_R$  where*

$$\bar{s}_R = \sqrt{\frac{2(1-\beta)D}{\mu} - \left(\frac{(1-\beta)D}{\mu}\right)^2} + \frac{2\gamma d}{\mu}, \text{ otherwise, she does not comply with the standards and}$$

$$\text{exerts effort } a_{nc} = \frac{(1-\beta)D}{\mu}.$$

Comparing  $\bar{s}_R$  with  $\bar{s}$  yields  $\bar{s}_R > \bar{s}$ . Hence, if  $D < \frac{\mu - \sqrt{\mu^2 - (1-\beta)^2 I^2}}{1-\beta}$ , that is,

$$\bar{s} < a_{fb} = \frac{(1-\beta)I}{\mu}, \text{ by imposing regulatory oversight, the auditor will comply with the standards}$$

rather than not to comply.

### 3.1.3 Comparison

In this subsection, we analyze the incremental effect of regulatory oversight on auditors over legal systems.

**Proposition 1** (i) *Regulatory oversight can improve audit effort if  $\bar{s} < s \leq \bar{s}_R$ . (ii) The social surplus from an audit is better with regulatory oversight than without it if the toughness of*

*auditing standards is in the range of  $\bar{s} < s = \frac{(1-\beta)I}{\mu} \leq \bar{s}_R$ .*

Under regulatory oversight, the highest standards which an auditor will comply with ( $\bar{s}_R$ ) is tougher than that under no regulatory oversight ( $\bar{s}$ ). If the toughness of the standards is between these two levels, i.e.,  $\bar{s} < s \leq \bar{s}_R$ , then audit effort is improved from  $a_{nc}$  to  $s$  under regulatory oversight. If the toughness of the standards is less than the highest standards with which auditors will comply under no regulatory oversight, i.e.,  $s \leq \bar{s}$ , then audit effort is  $s$  under both regimes. If the toughness of the standards is tougher than the highest standards with which an auditor will comply under regulatory oversight, i.e.,  $s > \bar{s}_R$ , then audit effort is  $a_{nc}$ .

under both regimes. Therefore, regulatory oversight can improve audit effort if auditing standards is within this range  $\bar{s} < s \leq \bar{s}_R$ . Otherwise, regulatory oversight does not affect audit effort.

Under the second and third scenario, the surplus is the same with or without regulatory oversight because the level of audit effort is the same. Under the first scenario  $\bar{s} < s \leq \bar{s}_R$ , the social surplus is improved to the maximum if the toughness of the standards is the first-best effort. This is because an auditor will comply with the standards  $s = \frac{(1-\beta)I}{\mu}$ , which is greater than  $a_{nc}$  and maximizes the surplus. However, regulatory oversight may reduce social surplus if the standards are too tough.

**Corollary 1** *Regulatory oversight can reduce social surplus if  $s \in \left( \frac{(1-\beta)I}{\mu}, \bar{s}_R \right]$  and  $\bar{s}_R \geq \frac{(1-\beta)I}{\mu}$ .*

Observation 2 shows that the optimal auditing standards are less than or equal to  $\frac{(1-\beta)I}{\mu}$  (i.e.,  $s \leq \frac{(1-\beta)I}{\mu}$ ) depending on the value of damage award  $D$  under no regulatory oversight. If damage award is sufficiently large, then regulatory oversight will not improve social surplus.

Corollary 1 highlights the importance of this condition  $s \leq \frac{(1-\beta)I}{\mu}$  under regulatory oversight.

If the standards are tougher than  $\frac{(1-\beta)I}{\mu}$  and weaker than  $\bar{s}_R$ , though regulatory oversight improves audit effort, it reduces the social surplus. The intuition is that under regulatory oversight, the auditor has higher expected loss resulting from noncompliance of auditing

standards than that under no regulatory oversight, and thus, she will comply with a tougher standard, even if the standard is tougher than the first-best. Our analysis, therefore, suggests that an overly stringent combination of regulatory oversight and auditing standards can impair social surplus, though this combination can improve audit quality.

Assume the regulator's objective is to maximize social surplus. If the regulator can choose the standards toughness and the regulatory penalty, then it can induce auditors to exert the first best effort by setting the standards to be the first best, and penalty greater than a cutoff point

such that  $s \leq \bar{s}_R$ . The cutoff point is 
$$\frac{(1-\beta)^2(I^2 + D^2) - 2\mu(1-\beta)D}{2\gamma\mu}.$$

### 3.2 *Auditors differ in cost efficiency*

The above analysis assumes all auditors/audit firms are the same in an audit market. Audit firms can improve operation efficiency through an increase in their operational scale. A larger operation allows for a better allocation of resources, sharing of knowledge, and intra-firm networking (Fung, Gul, and Krishnan 2012). Hence, audit firms with economies of scale have lower audit cost and are therefore more efficient. Audit markets typically consist of auditors with various cost efficiencies. In this section, we hold the firm attributes  $(\beta, R, I)$  constant, but allow for the possibility of a varying auditor attribute,  $\mu$ ; that is, auditors differ in cost efficiencies. A lower  $\mu$  indicates higher cost efficiency. We also hold the auditing standards  $s$ , the legal penalty  $D$ , and expected regulatory penalty  $\gamma d$  constant. A firm that receives a surplus  $K$  from an audit is:

$$K = \hat{a}(1-\beta)I + 1_{\hat{a} < s}(1-\hat{a})(1-\beta)D - F, \quad (8)$$



where the conjectured action  $\hat{a}$  and the fee depend on the auditor's characteristics  $\mu$  and  $F$  is the fee paid by the firm. The lowest fee is the total cost of the audit and the highest fee is  $\hat{a}(1-\beta)I + 1_{\hat{a}<s}(1-\hat{a})(1-\beta)D$ . From expression (7), the auditor's payoff is the following, where  $\hat{a}$  denotes the effort that maximizes (7), holding the fee  $F$  fixed:

$$U_a = \underbrace{\hat{a}(1-\beta)I - \frac{1}{2}\mu\hat{a}^2}_{\text{Social surplus}} - \underbrace{1_{\hat{a}<s}\gamma d}_{\text{Penalty}} - \underbrace{K}_{\text{Firm's surplus}}. \quad (9)$$

The market will consist of auditors where the surplus (9) is nonnegative, with  $K$  determined by some set of marginal auditors having zero surplus ( $U_a = 0$ ), where audit fee equals auditor's total cost and the firm extract all the surplus. Hence,  $K \in \left[0, \hat{a}(1-\beta)I - \frac{1}{2}\mu\hat{a}^2 - 1_{\hat{a}<s}\gamma d\right]$ .

An auditor will only participate in the market if she can earn a nonnegative surplus. The auditor's surplus depends on its attributes  $\mu$  and the effort to which it can credibly commit, as given by Observation 3. The expressions of  $\bar{s}_R$ ,  $a_{fb}$ , and  $a_{nc}$  are the same as the previous section, but they are functions of  $\mu$  in this subsection and vary for auditors with different cost efficiencies.

The following proposition summarizes the auditors' effort and participation in the audit market:

**Lemma 1** Auditors with cost  $\mu \in \left[\underline{\mu}, \min\left(\bar{\mu}, \frac{2(1-\beta)I}{s}\right)\right]$ , where

$$\underline{\mu} = \frac{(1-\beta)D + \gamma d - \sqrt{((1-\beta)D + \gamma d)^2 - (s(1-\beta)D)^2}}{s^2} \text{ and}$$

$$\bar{\mu} = \frac{(1-\beta)D + \gamma d + \sqrt{((1-\beta)D + \gamma d)^2 - (s(1-\beta)D)^2}}{s^2} \text{ participate in the audit market with}$$

effort  $s^{12}$ . Auditors with cost  $\bar{\mu} < \mu \leq \frac{(1-\beta)^2 D(2I-D)}{2\gamma d}$  participate in the audit market with

effort  $a_{nc}$  if  $s \geq \frac{2\gamma d}{(1-\beta)^2 D(2I-D)} \sqrt{\frac{(1-\beta)^2 D(2I-D)((1-\beta)D + \gamma d)}{\gamma d} - (1-\beta)^2 D^2}$ , otherwise

no auditors will participate in the market with noncompliance effort.

This lemma shows that if the standards are tough, auditors must have a cost  $\mu$  lower than

$\frac{(1-\beta)^2 D(2I-D)}{2\gamma d}$  to participate in the market. Among these auditors, auditors with  $\mu$  higher

than  $\min\left(\bar{\mu}, \frac{2(1-\beta)I}{s}\right)$  will choose noncompliance and other auditors with  $\mu$  lower than

$\min\left(\bar{\mu}, \frac{2(1-\beta)I}{s}\right)$  will comply with the standards; if standards are low, no auditors will

participate in the market with noncompliance effort and all of the participating auditors will comply with the standards.

Next we analyze the incremental effect of regulatory oversight on audit quality, social surplus, and audit fees. Lemma 1 implies that regulatory oversight incentivizes more inefficient auditors who do not comply with the standards to exit the market, because the cut-off point of audit cost  $\mu$  decreases in regulatory oversight. Additionally, depending on the toughness of the standards, regulatory oversight will induce as many, if not more, auditors who participate in the market to comply with the standards  $s$ . Proposition 2 summarizes the finding.

<sup>12</sup> Our proof shows  $\mu \geq \underline{\mu}$  must be true. This is because auditors with very high cost efficiency (very low per unit cost  $\mu$ ) would exert effort greater than one, which is not allowed in the current setting. Noncompliance occurs among auditors with low efficiency (high per unit cost  $\mu$ ). Such auditors face a relatively high likelihood of audit failure and, thus, the payment of damages  $D$ ; however, their compliance costs exceed their expected litigation payments under noncompliance.

**Proposition 2** *Regulatory oversight causes high cost auditors with low audit quality to exit the market. It allows more auditors to provide higher audit quality in the market if*

$$s > \frac{4ID}{4I^2 + D^2} .$$

Inefficient auditors with noncompliance effort will not be able to break-even under regulatory oversight due to the regulatory penalty, and thus, they have to exit the market. Auditors with reasonable cost efficiency are able to commit to compliance effort because their compliance costs are lower than or equal to the noncompliance costs. The regulatory penalty increases the noncompliance costs. When standards are weak, the range of auditors who comply with the standards is the same under the two regimes.

Does the improvement of audit quality directly result in an increase in social surplus? The logic of Proposition 1 and Corollary 1 applies to the audit market where auditors vary in cost efficiency as well. Regulatory oversight causes a higher proportion of auditors to comply with the standards. If the compliance effort determined by the toughness of the standards generates higher social surplus than the noncompliance effort, then regulatory oversight improves the overall social surplus. This is because the surplus provided by the group of auditors who switch from noncompliance to compliance is increased by regulatory oversight. Additionally, the portion of noncompliance auditors in the market may be reduced by regulatory oversight. On the other hand, regulatory oversight introduces a higher cut-off point of the standards with which an auditor will comply. If the standards are tougher than the first-best effort of these auditors, they will exert effort higher than their first-best, which will reduce the social surplus. We summarize the finding in Corollary 2.

**Corollary 2** *Regulatory oversight can improve social surplus if standards are properly set, but it can reduce the surplus generated by auditors who switch from noncompliance to*

*compliance if standards are tougher than their first-best effort, in a market where auditors vary in cost efficiency.*

Turning to the impact of regulatory oversight on audit fees, we find that it differs according to auditors' behavior under the two regimes. To compare the audit fees under regulatory oversight with those under no regulatory oversight, we need to keep the relative bargaining power between auditors and firms constant. The change of audit fees maps directly from the change of audit costs. We summarize the results in the following corollary.

**Corollary 3** *The audit fees of auditors who remain in compliance with auditing standards are the same under the two regimes. The fees of auditors who switched from noncompliance to compliance and those remaining noncompliant are higher under regulatory oversight than under no regulatory oversight.*

Since auditing standards are the same under the two regimes, the auditors who comply with auditing standards will have the same total cost, and thus, their fees will not change. The auditors choose noncompliance effort because the noncompliance cost is less than compliance cost. Hence, the audit fees compensating for the compliance cost will be higher than those for the noncompliance cost. Regarding auditors who remain noncompliant, their audit fees increase under regulatory oversight because the noncompliance cost is increased due to regulatory penalty.

### **3.3 Auditors differ in detection ability**

Prior auditing literature suggests that auditors differ in providing audit quality, such as Big N versus non-Big N auditors or city-level industry specialist auditors vs. non-specialist auditors (Craswell, Francis, and Taylor 1995). Thus, in this section, we analyze an audit market in which

auditors vary in their audit ability (i.e., the ability to detect a bad project in the model).

Specifically, we hold the firm attributes  $(\beta, R, I)$  and auditor cost  $\mu$  constant, but allow for the possibility of varying auditor detection ability  $t$ . The detection probabilities are revised to:

$$P(\text{Good signal} \mid \text{Good project}) = 1, \quad P(\text{Bad signal} \mid \text{Bad project}) = ta, \quad (10)$$

where  $ta \in [0,1]$  and  $t > 0$ . In contrast to  $\mu$  which represents the efficiency of an audit, the  $t$  captures the effectiveness of an audit. It represents the ease with which auditors can meet the exogenous standards. The detection probability is affected by this parameter and audit effort. We also hold the auditing standards  $s$ , the legal penalty  $D$  and expected regulatory penalty  $\gamma d$  constant. A firm that receives a surplus  $K$  from an audit will pay a fee  $F$  equal to:

$$F = t\hat{a}(1 - \beta)I + 1_{\hat{a} < s}(1 - t\hat{a})(1 - \beta)D - K, \quad (11)$$

where the conjectured action  $\hat{a}$  and the fee depend on the auditor's characteristics  $t$ . The auditor's payoff is the following, where  $\hat{a}$  denotes the effort that maximizes her payoff, holding the fee  $F$  fixed:

$$U_a = \underbrace{t\hat{a}(1 - \beta)I}_{\text{Social surplus}} - \underbrace{\frac{1}{2}\mu\hat{a}^2}_{\text{Penalty}} - \underbrace{1_{\hat{a} < s}\gamma d}_{\text{Penalty}} - \underbrace{K}_{\text{Firm's surplus}}. \quad (12)$$

The market will consist of auditors where the surplus (12) is nonnegative, with  $K$  determined some set of marginal auditors having zero surplus ( $U_a = 0$ ) and

$$K \in \left[ 0, t\hat{a}(1 - \beta)I - \frac{1}{2}\mu\hat{a}^2 - 1_{\hat{a} < s}\gamma d \right].$$

Similar to the analysis on audit cost in the previous section, an auditor will only participate in the market if she can earn a nonnegative surplus. The audit firm's surplus depends on its attributes  $t$  and the effort to which it can credibly commit. The expressions of

$$\bar{s}_R = \sqrt{\frac{2(1-\beta)D}{\mu} - \left(\frac{t(1-\beta)D}{\mu}\right)^2 + \frac{2\gamma d}{\mu}}, \quad a_{fb} = \frac{t(1-\beta)I}{\mu}, \quad \text{and} \quad a_{nc} = \frac{t(1-\beta)D}{\mu}$$

$t$  in this subsection and vary for auditors with different detection abilities.

The following lemma summarizes the auditors' effort and participation when auditors differ in detection ability:

**Lemma 2** *Auditors with detection ability  $\frac{\mu s}{2(1-\beta)I} \leq t \leq \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} + \frac{2\gamma d}{\mu} - s^2}$  participate in the audit market with effort  $s$  if  $0 < s \leq \sqrt{\frac{8I^2((1-\beta)D + \gamma d)}{\mu(D^2 + 4I^2)}}$ , and otherwise no*

*one participates in the market with effort  $s$ . Auditors with detection ability*

$$t > \max\left(\frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} + \frac{2\gamma d}{\mu} - s^2}, \sqrt{\frac{2\mu\gamma d}{D(2I-D)(1-\beta)^2}}\right) \text{ participate in the audit market}$$

*with effort  $a_{nc}$ .*

The intuition of this lemma is that auditors with high detection ability will have low likelihood of audit failure even if they exert less effort than those auditors with low detection ability. Therefore, their expected liability payment is low, and it is more cost efficient for them to exert effort less than the standards.

Next, we analyze the impact of regulatory oversight on audit quality, social surplus, and audit fees when auditors vary in their detection abilities. Lemma 2 implies that regulatory oversight allows a higher ability auditor to commit to compliance effort because the regulatory penalty shifts the cut-off points to the right and only higher ability auditors are able to stay in the market with a noncompliance effort. Proposition 3 summarizes the finding.

**Proposition 3** *Regulatory oversight can help the relatively high ability auditors commit to compliance effort or incentivize lower ability auditors who do not comply with the standards to exit the market.*

Regulatory oversight increases the expected costs for noncompliance effort and thus, the total cost of noncompliance will be greater than the compliance cost for the auditors with high detection ability. Therefore, these auditors will switch to compliance under regulatory oversight. When standards are very tough, the lower ability auditors will not comply with the standards because it is too costly to comply, but they also have higher likelihood of an audit failure, and thus higher expected liability than higher ability auditors. Regulatory oversight magnifies this tension. Therefore, the lower ability auditors will not be able to break even in the market and will have to exit the market under regulatory oversight.

Again regulatory oversight can improve social surplus if the toughness of the standards is properly set. Proposition 3 shows that more auditors are able to switch from noncompliance to compliance effort under regulatory oversight. Since the noncompliance effort is always less than the compliance effort, the social surplus can be improved if the standards are set such that the compliance effort generates higher surplus than the noncompliance effort. Additionally, the noncompliance effort of higher ability auditors is higher than the noncompliance effort of lower ability auditors. Regulatory oversight incentivizes the auditors who remain in the market to be of relatively high ability, thus improves the audit effort and social surplus. On the other hand, regulatory oversight introduces a higher cut-off point of the standards with which an auditor will comply. If the standards are tougher than the first-best effort of the auditors, these auditors will exert effort higher than their first-best, which will reduce the social surplus. Corollary 2 is carried through here and we summarize it in Corollary 4.

**Corollary 4** *Regulatory oversight can improve social surplus if standards are properly set, but it can reduce the surplus generated by auditors who switch from noncompliance to compliance if standards are tougher than their first-best effort, in a market where auditors vary in detection ability.*

Lastly, similar to Corollary 3, we find the audit fees of auditors who remain compliant with regulatory oversight are the same under regulatory oversight as those under no regulatory oversight. The fees of auditors who switch from noncompliance to compliance and those remaining noncompliant are higher under regulatory oversight than under no regulatory oversight. Additionally, regulatory oversight allows some low ability auditors to enter the market and comply with the standards and thus, their fees are increased as well. We summarize the impact of regulatory oversight on audit fees in the following corollary.

**Corollary 5** *The average audit fees in the market are increased by regulatory oversight.*

#### **4. Weak legal systems (Enforcement only from regulatory oversight)**

##### **4.1 Uniform auditors**

The previous section analyzes the incremental effect of regulatory oversight jointly with a legal system. In this section, we consider the case when auditors face enforcement from only one source: regulatory monitors. In other words, the legal regime is so weak that the legal penalty is zero. We solve audit effort under this regime and compare it with the regime when auditors face enforcement only from legal systems as described in section 2.2.

The auditor's expected payoff is revised to

$$\max_a F - \underbrace{\frac{1}{2} \mu a^2}_{\text{Effort cost}} - \underbrace{1_{a < s} \gamma d}_{\text{Regulatory penalty}} . \quad (13)$$



Similar to the effort choice discussed in section 2.2.2, the auditor will never exert effort greater than  $s$  because that would do nothing to reduce the regulatory penalty, but would increase audit costs. We denote an interior effort choice, derived from the first-order condition for (13), by  $a_{nc} = 0$ , because the regulatory penalty does not vary with audit effort. The following observation summarizes the auditor's effort choice:

**Observation 4** *The auditor complies with standards  $s$  if  $s \leq \bar{s}_a$  where  $\bar{s}_a = \sqrt{\frac{2\gamma d}{\mu}}$ ,*

*otherwise, she does not comply with the standards and exerts effort  $a_{nc} = 0$ .*

This observation suggests that regulatory oversight can cause less audit effort than legal system when auditing standards are too tough for an auditor to comply. Under the enforcement from only the legal system, an auditor will provide nonzero effort, since she can reduce the probability of audit failure by exerting nonzero effort, and thus reduce expected legal liability. But under regulatory oversight, the auditor exerts zero effort, since additional effort will only increase cost without reducing the expected regulatory penalty.

Recall that Observation 2 implies that if the damage award is sufficiently large, then the social surplus is maximized and regulatory oversight does not provide incremental benefits over enforcement through a legal system. However, countries, such as China, Japan, India and others have weak legal systems where damage award size is nearly zero when audit failures occur. Can regulatory oversight be a substitute for an effective legal system in inducing socially optimal effort? Can it substitute for a weak legal system in inducing a higher effort? We summarize the answers in the following observation.

**Observation 5** *Regulatory oversight can substitute for a legal system in inducing first-best effort if the regulatory penalty is sufficiently high, i.e.,  $\gamma d \geq \frac{(1-\beta)^2 I^2}{2\mu}$ . If regulatory penalty is*

$\gamma d \in \left[ (1-\beta)D - \frac{(1-\beta)^2 D^2}{2\mu}, \frac{(1-\beta)^2 I^2}{2\mu} \right)$ , then regulatory oversight can substitute the legal

system and induce higher audit effort (i.e., closer to first best) and social surplus than the legal system.

Observation 5 implies that no matter how ineffective a legal system in a country, as long as

the regulatory penalty is sufficiently high (i.e.,  $\gamma d \geq \frac{(1-\beta)^2 I^2}{2\mu}$ ), regulatory oversight can

substitute for the legal system in achieving the first best audit effort and maximizing social

surplus. If a country's legal system is weak  $D \leq \frac{\mu - \sqrt{\mu^2 - (1-\beta)^2 I^2}}{1-\beta}$ , as long as the regulatory

penalty is greater than  $(1-\beta)D - \frac{(1-\beta)^2 D^2}{2\mu}$ , then regulatory oversight can substitute for the

legal system and induce higher audit effort than the legal system. This observation implies that

the audit regulator can structure its use of penalties to achieve its objectives.

#### **4.2 Auditors vary in cost efficiency**

The proof of Proposition 2 shows that for all levels of  $s$ , all noncompliance auditors can

stay in the market and earn a non-negative surplus when they face enforcement only from a legal

system. When auditors face enforcement from both regulatory oversight and a legal system,

more inefficient auditors are incentivized to exit the market because they can't earn a non-

negative surplus by exerting noncompliance effort due to the additional cost of regulatory

penalty when they do not comply with the standards. In this section, we solve for audit effort

under the enforcement from regulatory oversight and analyze the impact of regulatory oversight

on audit market composition in comparison with a legal system.

**Lemma 3** *When auditors face enforcement only from regulatory oversight, auditors with cost  $\mu \leq \min\left(\frac{2\gamma d}{s^2}, \frac{2(1-\beta)I}{s}\right)$  will participate in the market and comply with the standards.*

*High cost auditors are not able to stay in the market.*

High cost auditors are not able to provide compliance effort, since it is too costly for them. Their surplus is negative when providing noncompliance zero effort, and thus, they are not able to participate in the audit market.

Next, we compare the auditor composition under regulatory regime ( $\gamma d > 0$  and  $D = 0$ ) with legal system regime ( $\gamma d = 0$  and  $D > 0$ ) and summarize the comparison in the following proposition.

**Proposition 4** *If regulatory penalty substitutes for damage award, then inefficient auditors who would have exerted nonzero noncompliance effort will exit the market. Regulatory oversight can allow auditors with slightly higher costs into the market with compliance effort if*

$$\frac{4ID}{4I^2 + D^2} < s \leq \frac{\gamma d}{(1-\beta)I} \text{ or if } s > \frac{\gamma d}{(1-\beta)I} \text{ and } \gamma d > \frac{(1-\beta)D}{2} \left(1 + \sqrt{1-s^2}\right).$$

A legal system can allow some high cost auditors with low audit effort to stay in the market, since these auditors will exert positive level of effort to reduce the likelihood of audit failure even if they do not comply with standards. Under regulatory oversight, high cost auditors will provide zero effort and can only earn negative surplus, and thus cannot stay in the market. Moreover, the impact of regulatory oversight on audit market composition is affected by auditing standards. If the standards are weak, the range of auditors who comply with the standards is the same under regulatory oversight, but the high cost auditors who do not comply with the standards are incentivized to exit the market. If the standards are moderate, regulatory oversight not only incentivizes high cost auditors to exit the market, but also allows some medium cost

auditors to participate in the market with compliance effort. If the standards are tough, then the size of the regulatory penalty affects the market composition. When the regulatory penalty is high, high cost auditors will have to exit the market, and medium cost auditors participate in the market with compliance effort, because the regulatory penalty increases the noncompliance cost. When the regulatory penalty is low, then the regulatory oversight requires low cost auditors with high quality to stay in the market because only these auditors are able to earn nonnegative profit.

### 4.3 Auditors vary in detection ability

The proof of Proposition 3 shows that when the standards are not too low, regulatory oversight allows more low ability auditors to enter into the market and comply with the standards, though an increase in damage award has no such impact. In this section, we solve for audit effort under the enforcement from regulatory oversight and analyze the impact of regulatory oversight on audit market composition in comparison with a legal system in a market where auditors are differentiated in detection ability.

**Lemma 4** *If  $s > \bar{s}_a = \sqrt{\frac{2\gamma d}{\mu}}$ , no auditors will participate in the market. If  $s \leq \bar{s}_a = \sqrt{\frac{2\gamma d}{\mu}}$ ,*

*only auditors with detection ability  $\frac{\mu s}{2(1-\beta)I} \leq t$  participate in the audit market with effort  $s$ .*

If standards are tough, no auditors will comply with standards and none of them can earn a nonnegative profit, so there will be no auditors in the market. If standards are less tough, then lower ability auditors will not be able to earn a nonnegative profit by complying with the standards and have to exit the market.

Next, we compare the auditor composition under regulatory regime with legal system regime and summarize the comparison in the following proposition.

**Proposition 5** *If regulatory penalty substitutes for damage award, then regulatory oversight can allow higher ability auditors into the market with compliance effort when standards are not very tough. When standards are tough, the legal system allows the higher ability auditors to stay in the market with noncompliance effort and no auditors can stay in the market when there is only regulatory oversight.*

The legal system can allow some high ability auditors to stay in the market, since these auditors have low likelihood of audit failure by exerting nonzero noncompliance effort due to their high detection ability. Under regulatory oversight, when the standards are very tough, high ability auditors will exert zero noncompliance effort, because it is too costly for them to comply with standards and once audit effort is less than the toughness of standards  $s$ , the entire regulatory penalty will be imposed onto the auditors. The surplus earned by auditors exerting zero effort is negative, and thus they cannot stay in the market. Moreover, when standards are not too tough, high ability auditors are able to commit to compliance effort under regulatory oversight because it is more cost efficient than providing noncompliance zero effort and these auditors are able to earn non-negative surplus.

## **5. Empirical implications**

We present our model's empirical predictions and relate them to the extant empirical evidence on the PCAOB regulatory oversight in this section.

### **5.1 Audit Market**

Our theoretical analysis generates the following predictions: in a market where auditors are differentiated in cost efficiency, (1) regulatory oversight causes some inefficient auditors who do not comply with auditing standards to exit the market; (2) regulatory oversight allows more

auditors who participate in the market to comply with the standards if the standards are within a particular range, and otherwise oversight does not affect the compliance behavior of these auditors in the market (Proposition 2). Additionally, in a market where auditors differ in detection ability, regulatory oversight can help the relatively high ability auditors commit to compliance effort or incentivize lower ability auditors who do not comply with the standards to exit the market (Proposition 3).

The existing studies support our prediction regarding the structural change in an audit market. For example, Read, Dasaratha, and Raghunandan (2004) find that 47 small audit firms ceased performing SEC audits because of the PCAOB, increased professional liability insurance costs, and increased scrutiny by the SEC. DeFond and Lennox (2011) find 49% of small audit firms stopped auditing SEC registrants and deregistered with the PCAOB from 2001 to 2008. These firms were more likely to avoid AICPA peer reviews, failed to comply with PCAOB rules, and received more severe peer review or inspection reports.

Our analyses provide economic reasons as to why we observe these empirical results. Specifically, high cost auditors with low audit quality will not be able to break-even under regulatory oversight due to the regulatory penalty, and thus, they have to exit the market. Moreover, when standards are very tough, the lower ability auditors will not comply with the standards because it is too costly to comply, but they also have higher likelihood of an audit failure, and thus higher expected liability than higher ability auditors. Regulatory oversight increases the expected costs for noncompliance effort and magnifies this tension. Therefore, the lower ability auditors will not be able to break even in the market and will have to exit the market under regulatory oversight.

## 5.2 Audit quality and surplus

The exit of some audit firms from a market is not necessarily detrimental. Proposition 1 (i) predicts that regulatory oversight can improve the overall audit quality of an audit market, though it does not improve audit quality of all auditors. In a market with only one type of auditor, regulatory oversight induces higher audit quality because the expected penalty is higher under regulatory oversight than under no regulatory oversight, and thus, it is less costly for an auditor to comply with the standards than to choose noncompliance. In a market where auditors vary in cost efficiency, there are more auditors who comply with the standards and some less efficient auditors who do not comply with the standards exit the market, and therefore, the overall audit quality is improved. This prediction is consistent with DeFond and Lennox (2011)'s finding that clients of exiting auditors receive higher quality auditing from successor auditors.

Our paper provides explanations for the improvement of audit quality under regulatory regimes. In a market where auditors vary in detection ability, auditors with relatively high ability are able to commit to higher effort due to regulatory oversight. In addition, if the standards are very tough, only high ability auditors can stay in the market, because they can achieve high probability of detection with low effort. The lower ability auditors cannot survive, since it is too costly for them to comply with the standards and the probability of detection provided by them is too low to reach the level of reasonable assurance if they do not comply with the standards.

Turning to the impact on social surplus, Proposition 1 (ii), Corollary 2, and Corollary 4 show that regulatory oversight can improve social surplus if auditing standards are properly set. Corollary 1 indicates that the surplus can be reduced by regulatory oversight if standards are too tough. These predictions suggest that capital market reaction to regulatory oversight can be positive or negative depending on the toughness of a standard.

### **5.3 Audit Fees**

Corollary 3 demonstrates that the impact of regulatory oversight on audit fees depends on the type of auditor. We should observe an increase in audit fees for auditors who switch from noncompliance to compliance effort, which can be proxied by an increase in effort reacting to inspection reports or PCAOB sanctions. Hence, we predict there is a fee increase after the auditor receives inspection reports which identify audit deficiencies after PCAOB sanctions. But there is no audit fee change for auditors who remain compliant with standards under the two regimes. Additionally, audit fees increase for auditors who remain noncompliant. In sum, our analysis suggests the average audit fees in the market are increased by regulatory oversight. Thus, we can test whether there is an average fee increase after the PCAOB regime shift after controlling for other confounding effects.

### **5.4 Regulatory oversight substituting weak legal systems**

In countries, such as China, Japan, India and others, auditors face little litigation risk and low legal penalties. Observation 5 suggests that regulatory oversight can substitute for a legal system in ensuring high quality audits if the regulatory penalty is sufficiently high. Moreover, compared with the legal system, regulatory oversight can allow auditors with slightly higher costs into the market with compliance effort and can allow higher ability auditors into the market with compliance effort if standards are reasonable (Proposition 4 and Proposition 5).

## **6. Conclusions**

We develop a theoretical model to show how regulatory oversight can affect auditor under different legal systems. Our analysis suggests that regulatory oversight does not improve the audit quality of all auditors, but it can improve the overall audit quality of an audit market.



Moreover, the improvement of overall audit quality is not necessarily beneficial to investors. Proper setting of auditing standards is important in ensuring a positive impact of regulatory oversight on social welfare. Furthermore, regulatory oversight has a potentially great impact on the audit market structure. Specifically, it causes some inefficient or lower ability auditors to exit the market. Lastly, the impact of regulatory oversight on audit fees depends on the type of the auditor. For example, audit fees remain unchanged for auditors who remain compliant with auditing standards under the two regimes, but increases for auditors who remain noncompliant or switch from noncompliance to compliance with auditing standards. Moreover, regulatory oversight can substitute for a legal system in ensuring high quality audits if the regulatory penalty is sufficiently high, but it has differential impact on audit market structure than does a legal system.

Our research extends the theoretical auditing literature on the impact of regulatory oversight on audit quality and on the dynamic relation between regulatory oversight, legal systems, and auditing standards. It provides timely policy implications for regulators. For example, regulatory oversight can improve the overall audit quality in an audit market, though it does not improve all auditors' quality. Regulatory oversight reduces investors' welfare if auditing standards are too tough, because auditors will over-invest in effort. Moreover, our model provides a theoretical framework that can explain some existing empirical findings and provides predictions that can be tested empirically.

We next discuss several issues relating to our model assumptions. First, we assume auditors are independent and focus on audit effort in determining compliance with auditing standards. Considering auditors' reporting decisions does not affect our inferences regarding the impact of regulatory oversight on audit effort. To induce the auditor to compromise her

independence, the incremental payoff must be greater than expected liability for the misreporting auditor. Under this scenario, when the auditor chooses her effort, she is only concerned about the expected liability if she reports independently, since the client will fully compensate the auditor for any liability that may arise from a non-independent report after audit effort has been chosen and audit evidence is collected. The client will trade-off this cost and benefit to decide whether to induce the auditor to compromise her independence. Investors will be able to unravel this client-auditor reporting strategy under a rational expectations equilibrium. We conjecture that the impact of regulatory oversight on auditor independence is through clients, not necessary on auditors directly. Second, we assume auditing standards are precise and do not consider the (realistic) case of vagueness in the auditing standards. However, including vagueness of auditing standards will not affect the main inferences of the paper. Third, we assume the cost of maintaining the regulatory oversight is insignificant. Such cost will reduce surplus by a fixed amount. The analysis on auditors remain largely unchanged. If the cost of maintaining regulatory oversight is significant, then whether the surplus is improved by regulatory oversight will depend on the trade-off between the benefits from audit effort change and the cost of maintaining the oversight. Lastly, the amount of regulatory penalty may decrease in effort. Considering this condition will affect the magnitude of the regulatory impact. The nature of our results will not be affected by this consideration.

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## Appendix Proofs

### Proof of Observation 1

The auditor chooses compliance versus noncompliance by comparing the total cost of each option.

Total cost of compliance is  $\frac{1}{2}\mu s^2$ . The total cost of noncompliance is

$\frac{1}{2}\mu a_{nc}^2 + (1 - a_{nc})(1 - \beta)D$ , where  $a_{nc} = \frac{(1 - \beta)D}{\mu}$ . Hence, the auditor will comply with the

standards if  $\frac{1}{2}\mu s^2 \leq \frac{1}{2}\mu \left(\frac{(1 - \beta)D}{\mu}\right)^2 + (1 - \frac{(1 - \beta)D}{\mu})(1 - \beta)D$ . Simplifying this expression

yields  $s \leq \bar{s}$  where  $\bar{s} = \sqrt{\frac{2(1 - \beta)D}{\mu} - \left(\frac{(1 - \beta)D}{\mu}\right)^2}$ .

□

### Proof of Observation 2

Solving  $\bar{s} \geq a_{fb} = \frac{(1 - \beta)I}{\mu}$ , where  $\bar{s} = \sqrt{\frac{2(1 - \beta)D}{\mu} - \left(\frac{(1 - \beta)D}{\mu}\right)^2}$ , yields

$D \geq \frac{\mu - \sqrt{\mu^2 - (1 - \beta)^2 I^2}}{1 - \beta}$ . (Note that  $\bar{s} \geq a_{fb} = \frac{(1 - \beta)I}{\mu}$  generates

$\frac{\mu - \sqrt{\mu^2 - (1 - \beta)^2 I^2}}{1 - \beta} \leq D \leq \frac{\mu + \sqrt{\mu^2 - (1 - \beta)^2 I^2}}{1 - \beta}$ , but because all effort must be less than or

equal to 1,  $a_{nc} = \frac{(1 - \beta)D}{\mu} \leq 1$  and  $D \leq \frac{\mu}{1 - \beta} < \frac{\mu + \sqrt{\mu^2 - (1 - \beta)^2 I^2}}{1 - \beta}$ . Therefore, by definition,

$D < \frac{\mu + \sqrt{\mu^2 - (1 - \beta)^2 I^2}}{1 - \beta}$ . And if  $D \geq \frac{\mu - \sqrt{\mu^2 - (1 - \beta)^2 I^2}}{1 - \beta}$  then  $\bar{s} \geq \frac{(1 - \beta)I}{\mu}$  and the auditor

will comply with any standards  $s$  that is less than or equal to  $\bar{s}$ . Hence, we can set and the

auditor exerts effort equal to the first-best. Otherwise, if  $D < \frac{\mu - \sqrt{\mu^2 - (1-\beta)^2 I^2}}{1-\beta}$ , then

$\bar{s} < \frac{(1-\beta)I}{\mu}$  and the highest standard the auditor will comply with is  $\bar{s}$ , which is as close to the first-best effort as possible. If we set standards higher than  $\bar{s}$ , then the auditor will not comply and exert  $a_{nc} < \bar{s}$ .

□

### Proof of Observation 3

Following the same procedures as in Observation 1, the auditor chooses compliance versus noncompliance by comparing the total cost of each option.

Total cost of compliance is  $\frac{1}{2}\mu s^2$ . The total cost of noncompliance is

$\frac{1}{2}\mu a_{nc}^2 + (1-a_{nc})(1-\beta)D + \gamma d$ , where  $a_{nc} = \frac{(1-\beta)D}{\mu}$ . Hence, the auditor will comply with

the standards if  $\frac{1}{2}\mu s^2 \leq \frac{1}{2}\mu \left( \frac{(1-\beta)D}{\mu} \right)^2 + (1 - \frac{(1-\beta)D}{\mu})(1-\beta)D + \gamma d$ . Simplifying this

expression yields  $s \leq \bar{s}_R$  where  $\bar{s}_R = \sqrt{\frac{2(1-\beta)D}{\mu} - \left( \frac{(1-\beta)D}{\mu} \right)^2 + \frac{2\gamma d}{\mu}}$ .

□

### Proof of Proposition 1

Since  $\frac{2\gamma d}{\mu} > 0$ , the  $\bar{s}_R > \bar{s}$ , that is, the maximum standards the auditor will comply with is

increased by regulatory oversight. Hence audit effort is improved from  $a_{nc}$  to  $s$  if  $\bar{s} < s \leq \bar{s}_R$  with

regulatory oversight. If  $s \leq \bar{s}$ , the audit effort is  $s$  under both regimes. If  $s > \bar{s}_R$ , then audit effort is  $a_{nc}$  under both regimes. Therefore, regulatory oversight can weakly improve audit effort.

According to Observation 2, if  $D \geq \frac{\mu - \sqrt{\mu^2 - (1-\beta)^2 I^2}}{1-\beta}$  and  $s = \frac{(1-\beta)I}{\mu}$ , then the social

surplus is maximized. There is no need for regulatory oversight. If regulatory oversight is

imposed, audit effort is still  $a = s = \frac{(1-\beta)I}{\mu}$ , since  $s = \frac{(1-\beta)I}{\mu} < \bar{s}_R$ . If

$D < \frac{\mu - \sqrt{\mu^2 - (1-\beta)^2 I^2}}{1-\beta}$ , then  $\bar{s} < \frac{(1-\beta)I}{\mu}$ . Without regulatory oversight, the maximum audit

effort is  $s \leq \bar{s} < \frac{(1-\beta)I}{\mu}$  and the social surplus  $s(1-\beta)I - \frac{1}{2}\mu s^2$  is less than maximum

$$\text{Surplus}_{\beta} = \frac{(1-\beta)^2 I^2}{2\mu}.$$

Under regulatory oversight,  $\bar{s}_R = \sqrt{\frac{2(1-\beta)D}{\mu} - \left(\frac{(1-\beta)D}{\mu}\right)^2 + \frac{2\gamma d}{\mu}}$ . The regulators can set

$\gamma d$  such that  $\bar{s}_R \geq \frac{(1-\beta)I}{\mu}$  and set  $s = \frac{(1-\beta)I}{\mu}$ . Since  $s = \frac{(1-\beta)I}{\mu} \leq \bar{s}_R$ , the auditor will

comply with the standards  $s = \frac{(1-\beta)I}{\mu}$ , which is greater than  $a_{nc}$ , and the social surplus is

improved to maximum.

In summary, the social surplus from an audit is weakly better with regulatory oversight than without it if auditing standards are properly set.

□

### Proof of Corollary 1



The auditor will comply with any standards that are less than  $\bar{s}_R$ . If  $\bar{s}_R \geq \frac{(1-\beta)I}{\mu}$  and the standard  $s \in \left( \frac{(1-\beta)I}{\mu}, \bar{s}_R \right]$ , then the auditor will still comply with the standards and exert effort greater than the first-best. Since the social surplus is maximized at  $a = \frac{(1-\beta)I}{\mu}$ , any effort greater than it will reduce the surplus.

□

### Proof of Lemma 1

A firm would like to maximize its surplus  $K \in \left[ 0, \hat{a}(1-\beta)I - \frac{1}{2}\mu\hat{a}^2 - 1_{\hat{a}<s}\gamma d \right]$ . Its  $K$  is maximized if it hires the most efficient auditor who exerts her first-best effort. The firm may not be able to get the maximum surplus, since the other option the firm has is to hire less efficient auditor. The most efficient auditor will then charge audit fee based on its competitor rather than its own cost. She can bargain with the firm to share the surplus. Hence, there exists a marginal auditor who earns zero profit and offers the firm zero surplus. The market clears so that each firm has an auditor.

The auditing standards  $s$ , the legal penalty  $D$  and expected regulatory penalty  $\gamma d$  are all constant, that is, are not auditor specific. If the exogenous  $s$  is less than or equal to  $\bar{s}_R$ , then an auditor with cost  $\mu$  will comply with the standards and exert effort equal to  $s$ .

$$\text{Solving } s \leq \bar{s}_R = \sqrt{\frac{2(1-\beta)D}{\mu} - \left(\frac{(1-\beta)D}{\mu}\right)^2 + \frac{2\gamma d}{\mu}} \text{ generates } \mu \in [\underline{\mu}, \bar{\mu}] \text{, where}$$

$$\underline{\mu} = \frac{(1-\beta)D + \gamma d - \sqrt{((1-\beta)D + \gamma d)^2 - (s(1-\beta)D)^2}}{s^2} \text{ and}$$

$\bar{\mu} = \frac{(1-\beta)D + \gamma d + \sqrt{((1-\beta)D + \gamma d)^2 - (s(1-\beta)D)^2}}{s^2}$ . All other auditors will not comply with

the standards. By the definition of audit effort, that is, all  $0 \leq a \leq 1$ , we have  $\frac{(1-\beta)D}{\mu} \leq 1$  and

$s \leq 1$ , therefore  $\mu \geq \frac{(1-\beta)D}{s^2} (1 - \sqrt{1-s^2})$  must be true. Moreover,

$\frac{(1-\beta)D}{\mu} (1 - \sqrt{1-s^2}) > \frac{(1-\beta)D + \gamma d - \sqrt{((1-\beta)D + \gamma d)^2 - (s(1-\beta)D)^2}}{\mu}$ , because  $s^2 > 0$ .

Therefore,  $s^2 \geq \frac{(1-\beta)D + \gamma d - \sqrt{((1-\beta)D + \gamma d)^2 - (s(1-\beta)D)^2}}{\mu}$ , that is, it must be true that

$\mu \geq \underline{\mu} = \frac{(1-\beta)D + \gamma d - \sqrt{((1-\beta)D + \gamma d)^2 - (s(1-\beta)D)^2}}{s^2}$ . Hence, the auditors who comply

with the standards must have costs  $\mu < \bar{\mu} = \frac{(1-\beta)D + \gamma d + \sqrt{((1-\beta)D + \gamma d)^2 - (s(1-\beta)D)^2}}{s^2}$ .

For those who comply, the maximum firm surplus is  $K_\mu = s(1-\beta)I - \frac{1}{2}\mu s^2$ .  $K_\mu \geq 0$

yields  $\mu \leq \frac{2(1-\beta)I}{s}$ . The auditors who participate in the market and comply with auditing

standards  $s$  must have cost  $\mu \in \left[ \underline{\mu}, \min\left(\bar{\mu}, \frac{2(1-\beta)I}{s}\right) \right]$ . If  $s \geq \frac{4I((1-\beta)D + \gamma d)}{4(1-\beta)I^2 + (1-\beta)D^2}$ , then

$\bar{\mu} \leq \frac{2(1-\beta)I}{s}$ . Otherwise, the reverse is true. We denote  $\frac{4I((1-\beta)D + \gamma d)}{4(1-\beta)I^2 + (1-\beta)D^2}$  by  $s_u$ .

For those who do not comply with the standards and exert effort  $a_{nc} = \frac{(1-\beta)D}{\mu}$ , the

maximum firm surplus is  $K_\mu = a_{nc}(1-\beta)I - \frac{1}{2}\mu a_{nc}^2 - \gamma d$ .  $K_\mu \geq 0$  yields  $\mu \leq \frac{(1-\beta)^2 D(2I-D)}{2\gamma d}$ .

Therefore, the auditors who participate in the market and do not comply with auditing standards

$s$  must have cost  $\bar{\mu} < \mu \leq \frac{(1-\beta)^2 D(2I-D)}{2\gamma d}$ . The standards  $s$  must satisfy

$$\bar{\mu} \leq \frac{(1-\beta)^2 D(2I-D)}{2\gamma d}, \text{ which yields}$$

$$s \geq \frac{2\gamma d}{(1-\beta)^2 D(2I-D)} \sqrt{\frac{(1-\beta)^2 D(2I-D)((1-\beta)D + \gamma d)}{\gamma d} - (1-\beta)^2 D^2}, \text{ and otherwise, no}$$

auditors will participate in the market with noncompliance effort. Denote

$$\frac{2\gamma d}{(1-\beta)^2 D(2I-D)} \sqrt{\frac{(1-\beta)^2 D(2I-D)((1-\beta)D + \gamma d)}{\gamma d} - (1-\beta)^2 D^2} \text{ by } s_h.$$

To summarize, there are two scenarios depending on the exogenous parameter  $\gamma d$ , that is  $s_u \leq s_h$  or  $s_u > s_h$ . The range of auditors who participate in the market and comply with the standards versus auditors who participate in the market with noncompliance effort is as follows:

Given $s_u \leq s_h$	
$0 < s \leq s_u$	$\mu < \frac{2(1-\beta)I}{s}$ participate and comply; $\emptyset$ participate and do not comply
$s_u < s \leq s_h$	$\mu < \bar{\mu}$ will participate and comply; $\emptyset$ participate and do not comply
$s > s_h$	$\mu < \bar{\mu}$ will participate and comply; $\bar{\mu} < \mu \leq \frac{(1-\beta)^2 D(2I-D)}{2\gamma d}$ participate and do not comply.

$$\text{where } s_u = \frac{4I((1-\beta)D + \gamma d)}{4(1-\beta)I^2 + (1-\beta)D^2},$$

$$s_h = \frac{2\gamma d}{(1-\beta)^2 D(2I-D)} \sqrt{\frac{(1-\beta)^2 D(2I-D)((1-\beta)D + \gamma d)}{\gamma d} - (1-\beta)^2 D^2},$$

$$\bar{\mu} = \frac{(1-\beta)D + \gamma d + \sqrt{((1-\beta)D + \gamma d)^2 - (s(1-\beta)D)^2}}{s^2}.$$

Given $s_u > s_h$
-------------------

$0 < s \leq s_h$	$\mu < \frac{2(1-\beta)I}{s}$ participate and comply; $\emptyset$ participate and do not comply
$s_h < s \leq s_u$	$\mu < \frac{2(1-\beta)I}{s}$ will participate and comply; $\bar{\mu} < \mu \leq \frac{(1-\beta)^2 D(2I-D)}{2\gamma d}$ participate and do not comply
$s > s_u$	$\mu < \bar{\mu}$ will participate and comply; $\bar{\mu} < \mu \leq \frac{(1-\beta)^2 D(2I-D)}{2\gamma d}$ participate and do not comply.

The main difference between the above two cases is whether there are more auditors who exist in the market with noncompliance effort. This difference is affected by the regulatory penalty, legal penalty, and the amount of investment (i.e., whether  $s_u$  is greater than or less than  $s_h$ ).

□

### Proof of Proposition 2

The cut-off point of auditors who participate in the market and do not comply with the

standards  $\frac{(1-\beta)^2 D(2I-D)}{2\gamma d}$  is a decreasing function of regulatory oversight. When  $\gamma d = 0$ ,

auditors with any cost can participate in the market with noncompliance effort. Thus, regulatory oversight incentivizes some inefficient auditors (i.e.,  $\mu > \frac{(1-\beta)^2 D(2I-D)}{2\gamma d}$ ) to exit the market.

Next, we consider the impact of regulatory oversight on auditors who participate in the market with compliance effort. If there is no regulatory oversight, solving

$$s \leq \bar{s}_\mu = \sqrt{\frac{2(1-\beta)D}{\mu} - \left(\frac{(1-\beta)D}{\mu}\right)^2} \text{ generates}$$

$\frac{(1-\beta)D}{s^2} (1 - \sqrt{1-s^2}) \leq \mu \leq \frac{(1-\beta)D}{s^2} (1 + \sqrt{1-s^2})$ . All other auditors will not comply with the

standards. By the definition of audit effort, that is, all  $0 \leq a \leq 1$ , we have  $\frac{(1-\beta)D}{\mu} \leq 1$  and

$s \leq 1$ , therefore  $\mu \geq \frac{(1-\beta)D}{s^2} \left(1 - \sqrt{1-s^2}\right)$  must be true. Hence, the auditors who comply with

the standards must have costs  $\mu \leq \frac{(1-\beta)D}{s^2} \left(1 + \sqrt{1-s^2}\right)$ .

For those who comply, the maximum firm surplus is  $K_\mu = s(1-\beta)I - \frac{1}{2}\mu s^2$ .  $K_\mu \geq 0$

yields  $\mu \leq \frac{2(1-\beta)I}{s}$ . The auditors who participate in the market and comply with auditing

standards  $s$  must have cost  $\mu \in \left[ \frac{(1-\beta)D}{s^2} \left(1 - \sqrt{1-s^2}\right), \min \left( \frac{(1-\beta)D}{s^2} \left(1 + \sqrt{1-s^2}\right), \frac{2(1-\beta)I}{s} \right) \right]$ .

If  $s \geq \frac{4ID}{4I^2 + D^2}$ , then  $\frac{(1-\beta)D}{s^2} \left(1 + \sqrt{1-s^2}\right) \leq \frac{2(1-\beta)I}{s}$ . Otherwise, the reverse is true.

For those who do not comply (i.e.,  $\mu > \frac{(1-\beta)D}{s^2} \left(1 + \sqrt{1-s^2}\right)$ ), the maximum firm surplus

is  $K_\mu = a_{nc}(1-\beta)I - \frac{1}{2}\mu a_{nc}^2$ , where  $a_{nc} = \frac{(1-\beta)D}{\mu}$ . Algebraic transformation shows  $K_\mu \geq 0$

for all  $\mu$ .

In summary, without regulatory oversight, if  $s \geq \frac{4ID}{4I^2 + D^2}$ , then

$\frac{(1-\beta)D}{s^2} \left(1 - \sqrt{1-s^2}\right) \leq \mu \leq \frac{(1-\beta)D}{s^2} \left(1 + \sqrt{1-s^2}\right)$  will participate in the market with effort  $s$

and  $\mu > \frac{(1-\beta)D}{s^2} \left(1 + \sqrt{1-s^2}\right)$  will participate in the market with effort  $a_{nc}$ ; if  $s < \frac{4ID}{4I^2 + D^2}$ ,

then  $\frac{(1-\beta)D}{s^2} \left(1 - \sqrt{1-s^2}\right) \leq \mu \leq \frac{2(1-\beta)I}{s}$  will participate in the market with effort  $s$  and

$\mu > \frac{(1-\beta)D}{s^2} \left(1 + \sqrt{1-s^2}\right)$  will participate in the market with effort  $a_{nc}$ . Other auditors with cost

$\frac{2(1-\beta)I}{s} < \mu \leq \frac{(1-\beta)D}{s^2} \left(1 + \sqrt{1-s^2}\right)$  will comply with standards but can only provide negative

surplus to the firm, and thus will not be hired and have to exit the market.

Since  $\frac{4ID}{4I^2 + D^2} < \frac{4I((1-\beta)D + \gamma d)}{4(1-\beta)I^2 + (1-\beta)D^2}$ , there are three regions to consider when we

compare the cut-off points of  $\mu$  who comply with standards without regulatory oversight versus with regulatory oversight.

Range of $s$	Range of $\mu$ Without regulatory oversight	Range of $\mu$ With regulatory oversight
$s > \frac{4I((1-\beta)D + \gamma d)}{4(1-\beta)I^2 + (1-\beta)D^2}$	$\mu \leq \frac{(1-\beta)D}{s^2} \left(1 + \sqrt{1-s^2}\right)$	$\mu \leq \bar{\mu}$
$\frac{4ID}{4I^2 + D^2} < s \leq \frac{4I((1-\beta)D + \gamma d)}{4(1-\beta)I^2 + (1-\beta)D^2}$	$\mu \leq \frac{(1-\beta)D}{s^2} \left(1 + \sqrt{1-s^2}\right)$	$\mu \leq \frac{2(1-\beta)I}{s}$
$0 < s \leq \frac{4ID}{4I^2 + D^2}$	$\mu \leq \frac{2(1-\beta)I}{s}$	$\mu \leq \frac{2(1-\beta)I}{s}$

$$\text{where } \bar{\mu} = \frac{(1-\beta)D + \gamma d + \sqrt{((1-\beta)D + \gamma d)^2 - (s(1-\beta)D)^2}}{s^2}$$

First, we consider  $s > \frac{4I((1-\beta)D + \gamma d)}{4(1-\beta)I^2 + (1-\beta)D^2}$ . Algebraic comparison shows

$\frac{(1-\beta)D}{s^2} \left(1 + \sqrt{1-s^2}\right) < \bar{\mu}$ . Thus, auditors with cost  $\mu \in \left[\frac{(1-\beta)D}{s^2} \left(1 + \sqrt{1-s^2}\right), \bar{\mu}\right]$  who would

have not complied with standards without regulatory oversight will comply with the standards under regulatory oversight.

Second, if  $\frac{4ID}{4I^2 + D^2} < s \leq \frac{4I((1-\beta)D + \gamma d)}{4(1-\beta)I^2 + (1-\beta)D^2}$ , regulatory oversight can still improve

audit effort by allowing more auditors with cost  $\mu \in \left[ \frac{(1-\beta)D}{s^2} \left( 1 + \sqrt{1-s^2} \right), \frac{2(1-\beta)I}{s} \right]$  to

comply with the standards, since  $\frac{(1-\beta)D}{s^2} \left( 1 + \sqrt{1-s^2} \right) \leq \frac{2(1-\beta)I}{s}$  if  $s \geq \frac{4ID}{4I^2 + D^2}$ .

Third, if the standards is low (i.e.,  $0 < s \leq \frac{4ID}{4I^2 + D^2}$ ), then regulatory oversight will not

affect the range of auditors who participate and comply with auditing standards. This is because

$\frac{2(1-\beta)I}{s}$  is not affected by regulatory oversight.

Recall that under regulatory oversight, audit market and audit effort are shown in two cases

depending on the relative magnitude of  $s_u$  and  $s_h$ , where  $s_u = \frac{4I((1-\beta)D + \gamma d)}{4(1-\beta)I^2 + (1-\beta)D^2}$ ,

$s_h = \frac{2\gamma d}{(1-\beta)^2 D(2I-D)} \sqrt{\frac{(1-\beta)^2 D(2I-D)((1-\beta)D + \gamma d)}{\gamma d} - (1-\beta)^2 D^2}$ . To further illustrate

the overall impact of regulatory oversight on auditor participation in the market and auditors'

effort, we consider the case when  $s_u < s_h$ . The comparison given  $s_u \geq s_h$  is similar. Denote

$\frac{4ID}{4I^2 + D^2}$  by  $s_{u0}$ , and  $\frac{(1-\beta)D}{s^2} \left( 1 + \sqrt{1-s^2} \right)$  by  $\bar{\mu}_0$ . We have the following (we omitted the

lower bound  $\underline{\mu}$  since it is automatically satisfied by the constraint of  $a$ , i.e.,  $a \leq 1$ ):

	Range of $s$	Effort	Range of $\mu$ no regulatory oversight	Range of $\mu$ regulatory oversight
1	$0 < s \leq s_{u0}$	$s$	$\mu \leq \frac{2(1-\beta)I}{s}$ $\left( \frac{2(1-\beta)I}{s} < \mu \leq \bar{\mu}_0 \right)$ provides negative $K$ , can	$\mu \leq \frac{2(1-\beta)I}{s}$

			not participate in the market)	
		$a_{nc}$	$\mu > \bar{\mu}_0$	$\emptyset$
2	$s_{u0} < s \leq s_u$	$s$	$\mu \leq \bar{\mu}_0$	$\mu \leq \frac{2(1-\beta)I}{s}$
		$a_{nc}$	$\mu > \bar{\mu}_0$	$\emptyset$
3	$s_u < s \leq s_h$	$s$	$\mu \leq \bar{\mu}_0$	$\mu \leq \bar{\mu}$
		$a_{nc}$	$\mu > \bar{\mu}_0$	$\emptyset$
4	$s > s_h$	$s$	$\mu \leq \bar{\mu}_0$	$\mu \leq \bar{\mu}$
		$a_{nc}$	$\mu > \bar{\mu}_0$	$\bar{\mu} < \mu \leq \frac{(1-\beta)^2 D(2I-D)}{2\gamma d}$

where  $\bar{\mu} = \frac{(1-\beta)D + \gamma d + \sqrt{((1-\beta)D + \gamma d)^2 - (s(1-\beta)D)^2}}{s^2}$ .

Row 1 in the above table shows the range of auditors who comply with the standards is not affected by regulatory oversight, but the inefficient auditors who do not comply with the standards are incentivized to exit the market. Row 2 and 3 show that regulatory oversight allows some inefficient auditors (i.e.,  $\bar{\mu}_0 < \mu \leq \frac{2(1-\beta)I}{s}$ ) to comply with the standards and incentivizes more inefficient auditors to exit the market. Row 4 also indicates regulatory oversight allows some inefficient auditors (i.e.,  $\bar{\mu}_0 < \mu \leq \bar{\mu}$ ) to comply with the standards and incentivizes more inefficient auditors to exit the market.

To sum up, regulatory oversight incentivizes more inefficient auditors who do not comply with the standards to exit the market. It can also allow more auditors who participate in the market to comply with the standards  $s$ .

□

### Proof of Corollary 2



Auditors with cost  $\mu \in \left( \bar{\mu}_0, \min \left( \bar{\mu}, \frac{2(1-\beta)I}{s} \right) \right]$  switch from  $a_{nc}$  to  $s$  where  $a_{nc} < s$

under regulatory oversight. The social surplus generated by them can be improved if standards

are properly set (i.e.,  $s \leq a_{fb} = \frac{(1-\beta)I}{\mu}$ ), since the surplus  $a(1-\beta)I - \frac{1}{2}\mu a^2$  is increasing in the

$a$  as long as  $a \leq a_{fb} = \frac{(1-\beta)I}{\mu}$ . Regulator can set  $s$  such that for  $\mu \in \left( \bar{\mu}_0, \min \left( \bar{\mu}, \frac{2(1-\beta)I}{s} \right) \right]$ ,

$s \leq a_{fb} = \frac{(1-\beta)I}{\mu}$  and the surplus is increased by regulatory oversight. If  $s > a_{fb}$ , the surplus due

to complying with standards tougher than first-best may be less than the surplus generated by

noncompliance effort (i.e.,  $s(1-\beta)I - \frac{1}{2}\mu s^2 < a_{nc}(1-\beta)I - \frac{1}{2}\mu a_{nc}^2$ ), and thus result in a

reduction in surplus. To illustrate, we consider the case of  $s_{u0} < s \leq s_u$  where auditors with cost

$\mu \in \left( \bar{\mu}_0, \frac{2(1-\beta)I}{s} \right]$  will switch from noncompliance to compliance effort under regulatory

oversight. The expression  $s \leq a_{fb} = \frac{(1-\beta)I}{\mu}$  yields  $\mu \leq \frac{(1-\beta)I}{s}$ . It is straight forward to see that

$\frac{(1-\beta)I}{s} < \frac{2(1-\beta)I}{s}$ . The surplus provided by all  $\mu \in \left( \bar{\mu}_0, \frac{(1-\beta)I}{s} \right]$  will increase because the

compliance effort  $s$  is less than the first best effort  $a_{fb}$  for these auditors. The surplus generated

by  $\mu \in \left( \frac{(1-\beta)I}{s}, \frac{2(1-\beta)I}{s} \right]$  will decrease if  $ts(1-\beta)I - \frac{1}{2}\mu s^2 < ta_{nc}(1-\beta)I - \frac{1}{2}\mu a_{nc}^2$  and will

otherwise increase, because the compliance effort  $s$  is greater than the first best effort  $a_{fb}$ .

□

### Proof of Corollary 3

To compare the audit fees under regulatory oversight with those under no regulatory oversight, we need to keep the relative bargaining power between auditors and firms constant. Here we demonstrate the case when firms keep the entire surplus. The analysis of other cases carries through following the same steps. If we keep the relative bargaining power between the firm and auditor constant, then the change of audit fees maps directly from the change of audit costs.

For those auditors who remain compliance under regulatory oversight, their audit fees are  $\frac{1}{2}\mu s^2$ , which are the same as the fees without regulatory oversight.

For those auditors who switched from noncompliance to compliance, their audit fees are  $\frac{1}{2}\mu s^2$  under regulatory oversight and  $(1 - a_{nc})(1 - \beta)D + \frac{1}{2}\mu a_{nc}^2$  under no regulatory oversight,

where  $a_{nc} = \frac{(1 - \beta)D}{\mu}$ . Since these auditors have costs  $\mu > \frac{(1 - \beta)D}{s^2} (1 + \sqrt{1 - s^2})$ , we have

$\frac{1}{2}\mu s^2 > (1 - a_{nc})(1 - \beta)D + \frac{1}{2}\mu a_{nc}^2$ . Therefore, their audit fees increase by regulatory oversight.

For those auditors who remain noncompliance under regulatory oversight, their audit fees are  $(1 - a_{nc})(1 - \beta)D + \gamma d + \frac{1}{2}\mu a_{nc}^2$  with regulatory oversight and  $(1 - a_{nc})(1 - \beta)D + \frac{1}{2}\mu a_{nc}^2$

without regulatory oversight. Since  $(1 - a_{nc})(1 - \beta)D + \gamma d + \frac{1}{2}\mu a_{nc}^2 > (1 - a_{nc})(1 - \beta)D + \frac{1}{2}\mu a_{nc}^2$ ,

the audit fees are higher for these auditors with regulatory oversight than those without.

□

## Proof of Lemma 2

Similar to the proof of Lemma 1, the marginal auditor earns zero payoff and the firm receives zero surplus. Keep in mind that the auditing standards  $s$ , the legal penalty  $D$ , expected regulatory penalty  $\gamma d$ , and audit cost  $\mu$  are all constant, that is, are not auditor specific.

If the exogenous  $s$  is less than or equal to  $\bar{s}_R$ , then an auditor with detection ability  $t$  will comply with the standards and exert effort equal to  $s$ .

$$\text{Solving } s \leq \bar{s}_R = \sqrt{\frac{2(1-\beta)D}{\mu} - \left(\frac{t(1-\beta)D}{\mu}\right)^2 + \frac{2\gamma d}{\mu}} \text{ generates}$$

$$0 < t \leq \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} + \frac{2\gamma d}{\mu} - s^2}. \text{ All other auditors will not comply with the standards,}$$

because their detection ability is so high such that the likelihood of audit failure is low and thus expected liability payment is low and it is more cost efficient for them to reduce effort.

For those who comply, the maximum firm surplus is  $K_t = ts(1-\beta)I - \frac{1}{2}\mu s^2$ .  $K_t \geq 0$  yields

$$t \geq \frac{\mu s}{2(1-\beta)I}. \text{ The auditors who participate in the market and comply with auditing standards } s$$

must have a detection ability  $\frac{\mu s}{2(1-\beta)I} \leq t \leq \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} + \frac{2\gamma d}{\mu} - s^2}$ . In order for this

condition to exist, we need  $\frac{\mu s}{2(1-\beta)I} \leq \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} + \frac{2\gamma d}{\mu} - s^2}$ , which yields

$$0 < s \leq \sqrt{\frac{8I^2((1-\beta)D + \gamma d)}{\mu(D^2 + 4I^2)}}. \text{ Thus, if } s > \sqrt{\frac{8I^2((1-\beta)D + \gamma d)}{\mu(D^2 + 4I^2)}}, \text{ there will be no auditors who}$$

participate in the market and comply with the standards.

For those who do not comply with the standards ( $t > \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} + \frac{2\gamma d}{\mu} - s^2}$ ) and

exert effort  $a_{nc} = \frac{t(1-\beta)D}{\mu}$ , the maximum firm surplus is  $K_t = ta_{nc}(1-\beta)I - \frac{1}{2}\mu a_{nc}^2 - \gamma d$ .

$K_t \geq 0$  yields  $t \geq \sqrt{\frac{2\mu\gamma d}{D(2I-D)(1-\beta)^2}}$ . Therefore, the auditors who participate in the market and

do not comply with auditing standards  $s$  must have a detection ability

$t > \max\left(\frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} + \frac{2\gamma d}{\mu} - s^2}, \sqrt{\frac{2\mu\gamma d}{D(2I-D)(1-\beta)^2}}\right)$ . Comparing

$\frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} + \frac{2\gamma d}{\mu} - s^2}$  with  $\sqrt{\frac{2\mu\gamma d}{D(2I-D)(1-\beta)^2}}$  generates

$\frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} + \frac{2\gamma d}{\mu} - s^2} > \sqrt{\frac{2\mu\gamma d}{D(2I-D)(1-\beta)^2}}$  if

$0 < s < \sqrt{\frac{2(1-\beta)D(2I-D) + 4\gamma d(I-D)}{\mu(2I-D)}}$ .

To summarize, there are two scenarios depending on the exogenous parameter  $\gamma d$ . Denote

$\sqrt{\frac{8I^2((1-\beta)D + \gamma d)}{\mu(D^2 + 4I^2)}}$  by  $s_1$  and  $\sqrt{\frac{2(1-\beta)D(2I-D) + 4\gamma d(I-D)}{\mu(2I-D)}}$  by  $s_2$ . If

$\gamma d((2I-D) - 4(D^2 + 4I^2)(I-D)) < 2D^3(1-\beta)(2I-D)$ , then  $s_1 < s_2$ . Otherwise, the reverse

is true. The range of auditors who participate in the market and comply with the standards versus

auditors who participate in the market with noncompliance effort is as follows:

Given $s_1 < s_2$	
$0 < s \leq s_1$	$\frac{\mu s}{2(1-\beta)I} \leq t \leq \bar{t}_R$ participate and comply; $t > \bar{t}_R$ participate and do not comply
$s_1 < s \leq s_2$	$\emptyset$ will participate and comply; only $t > \bar{t}_R$ participate and do not comply

$s > s_2$	$\emptyset$ will participate and comply; only $t > \sqrt{\frac{2\mu\gamma d}{D(2I-D)(1-\beta)^2}}$ participate and do not comply,
-----------	---

$$\text{where } \bar{t}_R = \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} + \frac{2\gamma d}{\mu} - s^2}.$$

Given $s_1 > s_2$	
$0 < s \leq s_2$	$\frac{\mu s}{2(1-\beta)I} \leq t \leq \bar{t}_R$ participate and comply; $t > \bar{t}_R$ participate and do not comply
$s_2 < s \leq s_1$	$\frac{\mu s}{2(1-\beta)I} \leq t \leq \bar{t}_R$ participate and comply; $t > \sqrt{\frac{2\mu\gamma d}{D(2I-D)(1-\beta)^2}}$ participate and do not comply
$s > s_1$	$\emptyset$ will participate and comply; only $t > \sqrt{\frac{2\mu\gamma d}{D(2I-D)(1-\beta)^2}}$ participate and do not comply

Comparing these two cases yields whether there are more auditors comply with the standards depending on the regulatory penalty, legal penalty, and the amount of investment.

□

### Proof of Proposition 3

If there is no regulatory oversight, solving  $s \leq \bar{s}_\mu = \sqrt{\frac{2(1-\beta)D}{\mu} - \left(\frac{t(1-\beta)D}{\mu}\right)^2}$  generates

$0 < t \leq \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} - s^2}$ . Hence, auditors with detection ability within this range will

comply with the standards. All other auditors (i.e.,  $t > \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} - s^2}$ ) will not

comply with the standards.

For those who comply, the maximum firm surplus is  $K_t = ts(1-\beta)I - \frac{1}{2}\mu s^2$ .  $K_t \geq 0$  yields

$t \geq \frac{\mu s}{2(1-\beta)I}$ . The auditors who participate in the market and comply with auditing standards  $s$

must have a detection ability  $\frac{\mu s}{2(1-\beta)I} \leq t \leq \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} - s^2}$ . In order for this

condition to exist, we need  $\frac{\mu s}{2(1-\beta)I} \leq \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} - s^2}$ , which yields

$0 < s \leq \sqrt{\frac{8I^2(1-\beta)D}{\mu(D^2 + 4I^2)}}$ . Thus, if  $s > \sqrt{\frac{8I^2(1-\beta)D}{\mu(D^2 + 4I^2)}}$ , there will be no auditors who participate in

the market and comply with the standards. Denote  $\sqrt{\frac{8I^2(1-\beta)D}{\mu(D^2 + 4I^2)}}$  by  $s_0$ .

Therefore, without regulatory oversight, if  $0 < s \leq s_0$ , then auditors with ability

$\frac{\mu s}{2(1-\beta)I} \leq t \leq \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} - s^2}$  will participate in the market and comply with the

standards and  $t > \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} - s^2}$  will participate in the market, but exert

noncompliance effort  $a_{nc}$ ; if  $s > s_0$ , then only auditors with ability

$t > \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} - s^2}$  will participate in the market with noncompliance effort (i.e., no

one will participate and comply with the standards).

Comparing the regions of auditors participating in the market under regulatory oversight versus under no regulatory oversight, we have the following two cases. Note that  $s_0 < s_1$  and

$$s_0 < s_2, \text{ where } s_0 = \sqrt{\frac{8I^2(1-\beta)D}{\mu(D^2 + 4I^2)}}, s_1 = \sqrt{\frac{8I^2((1-\beta)D + \gamma d)}{\mu(D^2 + 4I^2)}}, \text{ and}$$

$$s_2 = \sqrt{\frac{2(1-\beta)D(2I-D) + 4\gamma d(I-D)}{\mu(2I-D)}}.$$

Case One: Given  $s_1 < s_2$ , we obtain

	Range of $s$	Effort	Range of $t$ no regulatory oversight	Range of $t$ regulatory oversight
1	$0 < s \leq s_0$	$s$	$\frac{\mu s}{2(1-\beta)I} \leq t \leq \bar{t}$	$\frac{\mu s}{2(1-\beta)I} \leq t \leq \bar{t}_R$
		$a_{nc}$	$t > \bar{t}$	$t > \bar{t}_R$
2	$s_0 < s \leq s_1$	$s$	$\emptyset$	$\frac{\mu s}{2(1-\beta)I} \leq t \leq \bar{t}_R$
		$a_{nc}$	$t > \bar{t}$	$t > \bar{t}_R$
3	$s_1 < s \leq s_2$	$s$	$\emptyset$	$\emptyset$
		$a_{nc}$	$t > \bar{t}$	$t > \bar{t}_R$
4	$s > s_2$	$s$	$\emptyset$	$\emptyset$
		$a_{nc}$	$t > \bar{t}$	$t > \sqrt{\frac{2\mu\gamma d}{D(2I-D)(1-\beta)^2}}$

$$\text{where } \bar{t}_R = \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} + \frac{2\gamma d}{\mu} - s^2} \text{ and } \bar{t} = \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} - s^2}.$$

Row 1 and 2 in the above table shows the range of auditors who comply with the standards is increased by regulatory oversight, because  $\bar{t} < \bar{t}_R$ . Row 2 also shows regulatory oversight allows more low ability auditors (i.e.,  $\frac{\mu s}{2(1-\beta)I} \leq t \leq \bar{t}$ ) into the market and comply with the standards. Row 3 indicates regulatory oversight shifts the cut-off point to the right, that is, auditors need higher detection ability to exert noncompliance effort and participate in the market. Lower detection ability auditors are incentivized to exit the market by regulatory oversight. Since the noncompliance effort increases in the detection ability, the overall audit quality/effort is increased by regulatory oversight.

If  $s > \sqrt{\frac{2(1-\beta)D(2I-D)+4\gamma d(I-D)}{\mu(2I-D)}}$ , then  $\bar{t}_R < \sqrt{\frac{2\mu\gamma d}{D(2I-D)(1-\beta)^2}}$ . Since  $\bar{t} < \bar{t}_R$ ,

we have  $\bar{t} < \sqrt{\frac{2\mu\gamma d}{D(2I-D)(1-\beta)^2}}$ . Therefore, Row 4 also suggests that regulatory oversight

shifts the cut-off point to the right, that is, auditors need higher detection ability to exert noncompliance effort.

Case Two: Given  $s_1 > s_2$ , we obtain

	Range of $s$	Effort	Range of $t$ no regulatory oversight	Range of $t$ regulatory oversight
1	$0 < s \leq s_0$	$s$	$\frac{\mu s}{2(1-\beta)I} \leq t \leq \bar{t}$	$\frac{\mu s}{2(1-\beta)I} \leq t \leq \bar{t}_R$
		$a_{nc}$	$t > \bar{t}$	$t > \bar{t}_R$
2	$s_0 < s \leq s_2$	$s$	$\emptyset$	$\frac{\mu s}{2(1-\beta)I} \leq t \leq \bar{t}_R$
		$a_{nc}$	$t > \bar{t}$	$t > \bar{t}_R$
3	$s_2 < s \leq s_1$	$s$	$\emptyset$	$\frac{\mu s}{2(1-\beta)I} \leq t \leq \bar{t}_R$
		$a_{nc}$	$t > \bar{t}$	$t > \sqrt{\frac{2\mu\gamma d}{D(2I-D)(1-\beta)^2}}$
4	$s > s_1$	$s$	$\emptyset$	$\emptyset$
		$a_{nc}$	$t > \bar{t}$	$t > \sqrt{\frac{2\mu\gamma d}{D(2I-D)(1-\beta)^2}}$

where  $\bar{t}_R = \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} + \frac{2\gamma d}{\mu} - s^2}$  and  $\bar{t} = \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} - s^2}$ .

Comparing to Case One, we find only Row 3 is different. Here, more participative auditors are able to comply with the standards and some low ability auditors are incentivized to exit the market.

To sum up, overall, regulatory oversight can help auditors with relatively high detection ability to commit to compliance effort or incentivize lower ability auditors to exit the market.

□



### Proof of Corollary 4

Auditors with ability  $t \in (\bar{t}, \bar{t}_R]$  switch from  $a_{nc}$  to  $s$  and  $a_{nc} < s$  under regulatory oversight. The social surplus generated by them is improved, since the surplus  $ta(1-\beta)I - \frac{1}{2}\mu a^2$  is increasing in the  $a$  as long as  $a \leq a_{fb} = \frac{t(1-\beta)I}{\mu}$ . Since  $a_{nc} < s$ , a switch from noncompliance effort to compliance  $s$  will increase the surplus. Regulator can set  $s$  such that for  $t \in (\bar{t}, \bar{t}_R]$ ,  $s \leq a_{fb} = \frac{t(1-\beta)I}{\mu}$  and the surplus is increased by regulatory oversight. If  $s > a_{fb}$ , the surplus due to complying with standards tougher than first-best may be less than the surplus generated by noncompliance effort (i.e.,  $ts(1-\beta)I - \frac{1}{2}\mu s^2 < ta_{nc}(1-\beta)I - \frac{1}{2}\mu a_{nc}^2$ ), and thus result in a reduction in surplus. To illustrate, we consider the following cases. The expression  $s \leq a_{fb} = \frac{t(1-\beta)I}{\mu}$  yields  $t \geq \frac{s\mu}{(1-\beta)I}$ . If  $\frac{s\mu}{(1-\beta)I} > \bar{t}_R$ , then the surplus generated by them  $t \in (\bar{t}, \bar{t}_R]$  will increase if  $ts(1-\beta)I - \frac{1}{2}\mu s^2 > ta_{nc}(1-\beta)I - \frac{1}{2}\mu a_{nc}^2$  and will otherwise decrease, because the compliance effort  $s$  is greater than the first best effort  $a_{fb}$ . If  $\frac{s\mu}{(1-\beta)I} < \bar{t}$ , then the surplus provided by all  $t \in (\bar{t}, \bar{t}_R]$  will increase because the compliance effort  $s$  is less than the first best effort  $a_{fb}$  for these auditors.

□

### Proof of Corollary 5

Similar to the proof of Corollary 3, we demonstrate the case when firms keep all the surplus.

For those auditors who remain compliance under regulatory oversight, their audit fees are  $\frac{1}{2}\mu s^2$ , which are the same as the fees without regulatory oversight.

For those auditors who switched from noncompliance to compliance ( $t \in (\bar{t}, \bar{t}_R]$ ), their audit fees are  $\frac{1}{2}\mu s^2$  under regulatory oversight and  $(1 - ta_{nc})(1 - \beta)D + \frac{1}{2}\mu a_{nc}^2$  under no

regulatory oversight, where  $a_{nc} = \frac{t(1 - \beta)D}{\mu}$ . Since these auditors have costs  $t > \bar{t}$ , we have

$\frac{1}{2}\mu s^2 > (1 - ta_{nc})(1 - \beta)D + \frac{1}{2}\mu a_{nc}^2$ . Therefore, their audit fees increase by regulatory oversight.

The low ability auditors (i.e.,  $\frac{\mu s}{2(1 - \beta)I} \leq t \leq \bar{t}$  or  $\frac{\mu s}{2(1 - \beta)I} \leq t \leq \bar{t}_R$ ) who enter into the market because of regulatory oversight are able to charge audit fees for their services.

Comparing to no entry at all, their fees are increased under regulatory oversight.

For those auditors who remain noncompliance under regulatory oversight (i.e.,  $t > \sqrt{\frac{2\mu\gamma d}{D(2I - D)(1 - \beta)^2}}$  or  $t > \bar{t}_R$ ), their audit fees are  $(1 - ta_{nc})(1 - \beta)D + \gamma d + \frac{1}{2}\mu a_{nc}^2$  with

regulatory oversight and  $(1 - ta_{nc})(1 - \beta)D + \frac{1}{2}\mu a_{nc}^2$  without regulatory oversight. Since

$(1 - ta_{nc})(1 - \beta)D + \gamma d + \frac{1}{2}\mu a_{nc}^2 > (1 - ta_{nc})(1 - \beta)D + \frac{1}{2}\mu a_{nc}^2$ , the audit fees are higher for these

auditors with regulatory oversight than those without.

In sum, the average audit fees are increased by regulatory oversight, since regulatory oversight either increase or do not affect fees for the auditors in the market.

□

**Proof of Observation 4:**

The auditor chooses compliance versus noncompliance by comparing the total cost of each option.

Total cost of compliance is  $\frac{1}{2}\mu s^2$ . The total cost of noncompliance is  $\frac{1}{2}\mu a_{nc}^2 + \gamma d$ ,

where  $a_{nc} = 0$ . Hence, the auditor will comply with the standards if  $\frac{1}{2}\mu s^2 \leq \gamma d$ . Simplifying this

expression yields  $s \leq \bar{s}_a$  where  $\bar{s}_a = \sqrt{\frac{2\gamma d}{\mu}}$ .

□

### Proof of Observation 5:

If  $\bar{s}_a = \sqrt{\frac{2\gamma d}{\mu}}$  is greater than or equal to the first-best effort, then standards setters can

choose  $s = a_{fb}$  and the auditor will comply with it. Solving  $\bar{s}_a = \sqrt{\frac{2\gamma d}{\mu}} \geq \frac{(1-\beta)I}{\mu}$  yields

$\gamma d \geq \frac{(1-\beta)^2 I^2}{2\mu}$ . Therefore, if regulatory penalty is sufficiently high i.e.,  $\gamma d \geq \frac{(1-\beta)^2 I^2}{2\mu}$ , then

regulatory oversight can substitute legal system in inducing a welfare maximizing effort.

If  $\gamma d < \frac{(1-\beta)^2 I^2}{2\mu}$ , then we compare  $\bar{s}_a$  with  $\bar{s}$  to see if regulatory oversight has different

impact on audit effort than legal system. The expression  $\bar{s}_a \geq \bar{s}$  yields

$\gamma d \geq (1-\beta)D - \frac{(1-\beta)^2 D^2}{2\mu}$ . Thus, if  $\gamma d \in \left[ (1-\beta)D - \frac{(1-\beta)^2 D^2}{2\mu}, \frac{(1-\beta)^2 I^2}{2\mu} \right)$ , then

regulatory oversight can induce a higher effort that is closer to first best than the legal system.

Otherwise, the opposite is true.  $(1-\beta)D - \frac{(1-\beta)^2 D^2}{2\mu} \leq \frac{(1-\beta)^2 I^2}{2\mu}$  generates  $\bar{s} \leq a_{fb} = \frac{(1-\beta)I}{\mu}$

and  $D \leq \frac{\mu - \sqrt{\mu^2 - (1-\beta)^2 I^2}}{1-\beta}$ . Standard setters set  $s = \bar{s}_a$  and audit effort equals  $s = \bar{s}_a$ . Social

surplus is improved if audit effort is closer to the first-best.

□

### Proof of Lemma 3:

Solving  $s \leq \bar{s}_a = \sqrt{\frac{2\gamma d}{\mu}}$  generates  $\mu \leq \frac{2\gamma d}{s^2}$ . All other auditors will not comply with the

standards. Hence, the auditors who comply with the standards must have costs  $\mu \leq \frac{2\gamma d}{s^2}$ .

For those who comply, the maximum firm surplus is  $K_\mu = s(1-\beta)I - \frac{1}{2}\mu s^2$ .  $K_\mu \geq 0$

yields  $\mu \leq \frac{2(1-\beta)I}{s}$ . The auditors who participate in the market and comply with auditing

standards  $s$  must have cost  $\mu \leq \min\left(\frac{2\gamma d}{s^2}, \frac{2(1-\beta)I}{s}\right)$ . If  $s \geq \frac{\gamma d}{(1-\beta)I}$ , then  $\frac{2\gamma d}{s^2} \leq \frac{2(1-\beta)I}{s}$ .

Otherwise, the reverse is true. We denote  $\frac{\gamma d}{(1-\beta)I}$  by  $s_{u1}$ .

For those who do not comply with the standards and exert effort  $a_{nc} = 0$ , the maximum firm surplus is  $K_\mu = -\gamma d < 0$ . Therefore, no auditors will be able to participate in the market with a noncompliance effort.

To summarize, there are two scenarios depending on the exogenous parameter  $\gamma d$  and auditing standards  $s$ . When there is no damage payment and only regulatory oversight, only

auditors with cost  $\mu \leq \min\left(\frac{2\gamma d}{s^2}, \frac{2(1-\beta)I}{s}\right)$  will participate in the market and comply with the standards. No participative auditors will exert noncompliance effort.

□

### Proof of Proposition 4

The proof of Proposition 2 shows an auditor's effort under only legal system without regulatory oversight is as follows.

If  $s \geq \frac{4ID}{4I^2 + D^2}$ , then  $\mu \leq \frac{(1-\beta)D}{s^2}(1 + \sqrt{1-s^2})$  will participate in the market with effort  $s$  and  $\mu > \frac{(1-\beta)D}{s^2}(1 + \sqrt{1-s^2})$  will participate in the market with effort  $a_{nc} = \frac{(1-\beta)D}{\mu}$ ; if  $s < \frac{4ID}{4I^2 + D^2}$ , then  $\mu \leq \frac{2(1-\beta)I}{s}$  will participate in the market with effort  $s$  and  $\mu > \frac{(1-\beta)D}{s^2}(1 + \sqrt{1-s^2})$  will participate in the market with effort  $a_{nc}$ . (we omitted the lower bound  $\underline{\mu}$  since it is automatically satisfied by the constraint of  $a$ , i.e.,  $a \leq 1$ .)

Denote  $\frac{4ID}{4I^2 + D^2}$  by  $s_{u0}$ , and  $\frac{(1-\beta)D}{s^2}(1 + \sqrt{1-s^2})$  by  $\bar{\mu}_0$ . Recall we denote  $\frac{\gamma d}{(1-\beta)I}$  by  $s_{u1}$ .

If  $s_{u0} \leq s_{u1}$ , we have the following:

	Range of $s$	Effort	Range of $\mu$ $\gamma d = 0$ and $D > 0$	Range of $\mu$ $\gamma d > 0$ and $D = 0$
1	$0 < s \leq s_{u0}$	$s$	$\mu \leq \frac{2(1-\beta)I}{s}$	$\mu \leq \frac{2(1-\beta)I}{s}$
		$a_{nc}$	$\mu > \bar{\mu}_0$	$\emptyset$
2	$s_{u0} < s \leq s_{u1}$	$s$	$\mu \leq \bar{\mu}_0$	$\mu \leq \frac{2(1-\beta)I}{s}$

		$a_{nc}$	$\mu > \bar{\mu}_0$	$\emptyset$
3	$s > s_{\mu 1}$	$s$	$\mu \leq \bar{\mu}_0$	$\mu \leq \frac{2\gamma d}{s^2}$
		$a_{nc}$	$\mu > \bar{\mu}_0$	$\emptyset$

Note that  $a_{nc} = \frac{(1-\beta)D}{\mu}$  if  $\gamma d = 0$  and  $D > 0$  and  $a_{nc} = 0$  if  $\gamma d > 0$  and  $D = 0$ .

Row 1 in the above table shows the range of auditors who comply with the standards is not affected by regulatory oversight, but the inefficient auditors who do not comply with the standards are incentivized to exit the market. If  $s_{u0} < s \leq s_{u1}$ , then  $\bar{\mu}_0 < \frac{2(1-\beta)I}{s}$ . Thus, Row 2 shows that regulatory oversight not only incentivizes more inefficient auditors to exit the market, but also allows some less efficient auditors (i.e.,  $\mu \in \left( \bar{\mu}_0, \frac{2(1-\beta)I}{s} \right)$ ) to participate in the market with compliance effort. Row 3 shows that when standards are very tough (i.e.,  $s > s_{\mu 1}$ ), regulatory oversight not only incentivizes more inefficient auditors to exit the market, but also requires auditors with higher efficiency to participate in the market with compliance effort if

$\gamma d < \frac{(1-\beta)D}{2} \left( 1 + \sqrt{1-s^2} \right)$  (i.e.,  $\bar{\mu}_0 > \frac{2\gamma d}{s^2}$ ). If  $\gamma d > \frac{(1-\beta)D}{2} \left( 1 + \sqrt{1-s^2} \right)$ , then regulatory

oversight allows some less efficient auditors (i.e.,  $\mu \in \left( \bar{\mu}_0, \frac{2\gamma d}{s^2} \right)$ ) to participate in the market

with compliance effort and incentivizes those very inefficient auditors (i.e.,  $\mu > \frac{2\gamma d}{s^2}$ ) to exit the market.

If  $s_{u0} > s_{u1}$  we obtain similar results, as shown from the following:

	Range of $s$	Effort	Range of $\mu$ $\gamma d = 0$ and $D > 0$	Range of $\mu$ $\gamma d > 0$ and $D = 0$
1	$0 < s \leq s_{u1}$	$s$	$\mu \leq \frac{2(1-\beta)I}{s}$	$\mu \leq \frac{2(1-\beta)I}{s}$
		$a_{nc}$	$\mu > \bar{\mu}_0$	$\emptyset$

2	$s_{u1} < s \leq s_{u0}$	$s$	$\mu \leq \frac{2(1-\beta)I}{s}$	$\mu \leq \frac{2\gamma d}{s^2}$
		$a_{nc}$	$\mu > \bar{\mu}_0$	$\emptyset$
3	$s > s_{\mu 0}$	$s$	$\mu \leq \bar{\mu}_0$	$\mu \leq \frac{2\gamma d}{s^2}$
		$a_{nc}$	$\mu > \bar{\mu}_0$	$\emptyset$

Again  $a_{nc} = \frac{(1-\beta)D}{\mu}$  if  $\gamma d = 0$  and  $D > 0$  and  $a_{nc} = 0$  if  $\gamma d > 0$  and  $D = 0$ .

Row 1 in the above table shows the range of auditors who comply with the standards is not affected by regulatory oversight, but the inefficient auditors who do not comply with the standards are incentivized to exit the market. If  $s_{u1} < s \leq s_{u0}$ , then  $\bar{\mu}_0 \geq \frac{2(1-\beta)I}{s} > \frac{2\gamma d}{s^2}$ . Thus, when standards are moderate, regulatory oversight not only incentivizes more inefficient auditors to exit the market, but also only requires auditors with higher efficiency to participate in the market with compliance effort.

If  $s > s_{\mu 0}$ , then  $\bar{\mu}_0 < \frac{2(1-\beta)I}{s}$ , and  $\frac{2(1-\beta)I}{s} > \frac{2\gamma d}{s^2}$ . Depending on the exogenous variables  $\gamma d$ ,  $D$ , and  $I$ ,  $\bar{\mu}_0$  can be greater than or less than  $\frac{2\gamma d}{s^2}$ .

□

#### Proof of Lemma 4

If the exogenous  $s$  is less than or equal to  $\bar{s}_a = \sqrt{\frac{2\gamma d}{\mu}}$ , then an auditor with detection ability  $t$  will comply with the standards and exert effort equal to  $s$ .

Solving  $s \leq \bar{s}_a = \sqrt{\frac{2\gamma d}{\mu}}$  yields that all auditors with detection ability  $t$  will comply with the standards if  $s \leq \bar{s}_a = \sqrt{\frac{2\gamma d}{\mu}}$ .

For those who comply, the maximum firm surplus is  $K_t = ts(1 - \beta)I - \frac{1}{2}\mu s^2$ .  $K_t \geq 0$  yields  $t \geq \frac{\mu s}{2(1 - \beta)I}$ . The auditors who participate in the market and comply with auditing standards  $s$  must have a detection ability  $\frac{\mu s}{2(1 - \beta)I} \leq t$ . Other lower ability auditors will not be able to earn a non-negative profit by complying with the standards and have to exit the market.

If  $s > \bar{s}_a = \sqrt{\frac{2\gamma d}{\mu}}$ , then all auditors will not comply with standards and exert effort  $a_{nc}$

zero. The maximum firm surplus is  $K_t = ta_{nc}(1 - \beta)I - \frac{1}{2}\mu a_{nc}^2 - \gamma d = -\gamma d < 0$ . Thus, in this case, no auditors will participate in the market.

□

### Proof of Proposition 5

The proof of proposition 3 shows that if auditors only face one level of enforcement, i.e., legal system, then we obtain the following.

if  $0 < s \leq s_0$ , where  $s_0 = \sqrt{\frac{8I^2(1 - \beta)D}{\mu(D^2 + 4I^2)}}$ , then auditors with ability

$\frac{\mu s}{2(1 - \beta)I} \leq t \leq \frac{\mu}{(1 - \beta)D} \sqrt{\frac{2(1 - \beta)D}{\mu} - s^2}$  will participate in the market and comply with the

standards and  $t > \frac{\mu}{(1 - \beta)D} \sqrt{\frac{2(1 - \beta)D}{\mu} - s^2}$  will participate in the market, but exert

noncompliance effort  $a_{nc}$ ; if  $s > s_0$ , then only auditors with ability



$t > \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} - s^2}$  will participate in the market with noncompliance effort (i.e., no one will participate and comply with the standards).

Comparing the regions of auditors participating in the market under only regulatory oversight versus under only legal system, we have the following two cases.

Case One: Given  $\bar{s}_a > s_0$  (i.e.,  $\gamma d > \frac{4I^2(1-\beta)D}{D^2 + 4I^2}$ ), where  $\bar{s}_a = \sqrt{\frac{2\gamma d}{\mu}}$  and

$s_0 = \sqrt{\frac{8I^2(1-\beta)D}{\mu(D^2 + 4I^2)}}$ , we obtain

	Range of $s$	Effort	Range of $t$ $D > 0, \gamma d = 0$	Range of $t$ $D = 0, \gamma d > 0$
1	$0 < s \leq s_0$	$s$	$\frac{\mu s}{2(1-\beta)I} \leq t \leq \bar{t}$	$\frac{\mu s}{2(1-\beta)I} \leq t$
		$a_{nc}$	$t > \bar{t}$	$\emptyset$
2	$s_0 < s \leq \bar{s}_a$	$s$	$\emptyset$	$\frac{\mu s}{2(1-\beta)I} \leq t$
		$a_{nc}$	$t > \bar{t}$	$\emptyset$
3	$s > \bar{s}_a$	$s$	$\emptyset$	$\emptyset$
		$a_{nc}$	$t > \bar{t}$	$\emptyset$

where  $\bar{t} = \frac{\mu}{(1-\beta)D} \sqrt{\frac{2(1-\beta)D}{\mu} - s^2}$ .

This table shows with only regulatory oversight, no auditors will exert zero noncompliance effort and participate in the market. Row 1 shows regulatory oversight can allow higher ability

auditor to comply with standards. Since  $s_0 < s \Rightarrow \bar{t} < \frac{\mu s}{2(1-\beta)I}$ , Row 2 shows auditors with

lower ability (i.e.,  $\bar{t} < t < \frac{\mu s}{2(1-\beta)I}$ ) will exit the market and again allows higher ability

auditors to comply with standards. Row 3 indicates that when standards are very tough, even

higher ability auditors will exit the market under only regulatory oversight. The legal system, however, allows the higher ability auditors stay in the market with noncompliance effort.

$$\text{Case Two: } \bar{s}_a < s_0 \text{ (i.e., } \gamma d < \frac{4I^2(1-\beta)D}{D^2+4I^2}\text{), where } \bar{s}_a = \sqrt{\frac{2\gamma d}{\mu}} \text{ and } s_0 = \sqrt{\frac{8I^2(1-\beta)D}{\mu(D^2+4I^2)}}.$$

The analysis is very similar.

	Range of $s$	Effort	Range of $t$ $D > 0, \gamma d = 0$	Range of $t$ $D = 0, \gamma d > 0$
1	$0 < s \leq \bar{s}_a$	$s$	$\frac{\mu s}{2(1-\beta)I} \leq t \leq \bar{t}$	$\frac{\mu s}{2(1-\beta)I} \leq t$
		$a_{nc}$	$t > \bar{t}$	$\emptyset$
2	$\bar{s}_a < s \leq s_0$	$s$	$\frac{\mu s}{2(1-\beta)I} \leq t \leq \bar{t}$	$\emptyset$
		$a_{nc}$	$t > \bar{t}$	$\emptyset$
3	$s > s_0$	$s$	$\emptyset$	$\emptyset$
		$a_{nc}$	$t > \bar{t}$	$\emptyset$

When the standards are weak, as shown in Row 1, regulatory oversight can allow higher ability auditor to comply with standards. However, when standards are tough, legal regime allows more auditors staying in the market.

□