A Theory of Auditor-Client Match and Auditor Legal Liability*

Suil Pae
SKK Graduate School of Business
Sungkyunkwan University
(*acpae@skku.edu*)

This paper presents a model of imperfect auditing, in which firms differ in their benefits from an audit, and auditors differ in their personal wealth exposed to potential liability. The legal environment affects auditors' expected liability in the case of audit failure. The paper provides an equilibrium analysis of how the firms and auditors match each other in a given legal environment. The analysis reveals that the economy almost always suffers from efficiency losses. A change in the legal environment induces a change in the equilibrium auditor-client match because it influences auditors' supply of audit qualities, which in turn affects firms' auditor hiring decision. It is shown that a (second-best) socially optimal legal environment is the one in which auditor liability is neither too lenient nor too stringent. Indeed, in a socially optimal legal environment, the audit market is segmented in a way that high-quality auditors provide audits to firms that benefit more from auditing and low-quality auditors serve firms that benefit less from auditing. Finally, the paper discusses some empirical implications of the equilibrium auditor-client matching process.

Key words: Auditor legal liability, Auditor-client match

I. Introduction

Auditors' legal liability has been an issue of debates in past decades, and auditors have made proposals for reforming liability (see, e.g., Arthur Andersen & Co. et al. 1992; Elliott 1993; O'Malley 1993; Weinback 1993; Mednick and Peck 1994; Dennis et al. 1996). There also have been regulatory changes intending to discourage auditor litigation (see King and Schwartz 1997; Siliciano 1997; Cloyd et al. 1998;).[1] Such debates, proposals, and regulatory changes provide research opportunities. Kinney (1993, p. 357) notes, "… analytical models can establish the essence of rational behavior and outcomes implicit in the current environment and its alternatives." Several recent studies—such as Narayanan (1994), Dye (1995), Shibano (1996),

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1) Such changes/events include California Supreme Court's decision in *Bily v. Arthur Andersen & Co.* case in 1992 and the legislation of the Private Securities Litigation Reform Act of 1995. Also, California voters in 1995 defeated the Securities Litigation Initiative, Proposition 211, which would have created a more litigious legal environment in securities-related litigation. For more details about recent events, see Siliciano (1997) and Cloyd et al. (1998).

Schwartz (1997), Smith and Tidrick (1997), Chan and Pae (1998), Hillegeist (1999), and Lee et al. (1999)—have attempted to investigate the effects of alternative legal environments and regulatory policies.

This paper contributes to the auditor liability literature by presenting a model, in which firms (i.e., audit clients) exhibit heterogeneity in their benefit from audits. This feature of the model contrasts with prior studies, which typically consider a single representative client in their analysis. A consequence of the firms' heterogeneity is differential demands for audit qualities. Moreover, from auditors' standpoint, auditing different clients involves different risk of audit failure, which translates into a differential supply of audit qualities across clients. The model also captures auditors' heterogeneity in their personal wealth exposed to potential liability. Taken together, firms' and auditors' heterogeneity implies differential demand and supply of audit qualities. In this framework, I have two objectives. The first is to conduct an equilibrium analysis of how the firms and auditors match each other in a given legal environment, and use this analysis to investigate the impact of a change in the legal environment on the equilibrium auditor-client match and social efficiency. The second objective is to provide implications of the auditor-client matching process for empirical tests of auditor choice/change.

Auditor heterogeneity in this paper is similar to Dye (1995). However, all audit clients in Dye's model are *ex ante* identical. Furthermore, the equilibrium audit fees in his model are such that audits have the same net value to all clients even if audit qualities differ across auditors. As a result, clients are indifferent across different auditors, which appears rather unrealistic. In contrast, firms in my model obtain different equilibrium values across auditors, and hence, exhibit different preferences over auditors. In addition, as noted earlier, client heterogeneity has an implication for how auditors customize their audit strategy across clients. In sum, by explicitly recognizing the clients' and auditors' heterogeneity simultaneously, this paper offers an equilibrium analysis of auditor-client match.[2] As discussed below (and further in Section 6), this feature of the model has important implications for the empirical tests of auditor choice/change.

The model has the following elements (see Section 2 for the full details). There are two firms in an economy, where one firm benefits more from an audit of a given quality than the other firm (I label them a high- and

2) While several studies (e.g., Titman and Trueman 1986; Datar, Feltham, and Hughes 1991) explain why firms have differential demands for audit qualities, they do not consider auditors' rational behavior as economic agents and the issue of auditor legal liability.

low-benefit firm, respectively). Audits are imperfect in the sense that there is a positive probability of audit failure, an event that an auditor fails to provide a correct attestation to his client's financial statements. An auditor's liability in the case of audit failure is the minimum of his personal wealth and financial statement users' damages assessed by the court. The legal environment (including the prevailing liability regime, regulatory policies, audit standards, etc.) influences the court's damage assessment, which is a random variable. I call the entire legal environment a liability law and say that a liability law is more stringent if it increases auditors' expected liability. For simplicity, the model considers only two levels of auditor wealth. It is clear from the model description that, under any liability law, an auditor with larger wealth provides a higher-quality audit, i.e., an audit with a lower probability of audit failure. I thus call an auditor with large (small) wealth a high- (low-) quality auditor. A high-benefit firm hires either a high- or low-quality auditor, and a low-benefit firm has the same option. Hence, there are four possible combinations of auditor-client match.

I now explain main results. First, the paper shows that the high-benefit firm does not necessarily choose a high-quality auditor, and similarly, the low-benefit firm does not necessarily hire a low-quality auditor. The analysis reveals that the prevailing liability law is crucial to the equilibrium auditor-client match. To see the intuition, note that the supply of audit qualities hinges on the prevailing liability law because it determines auditors' expected liability. In addition, audits are fully priced in the competitive market, so that audit fees compensate auditors' direct cost of auditing and expected litigation risk. From an audit client's perspective, this means that when making an auditor hiring decision, it compares the full cost and benefit of differential audit qualities across auditors. The analysis shows that if the liability law is lenient, both the low- and high-benefit firms choose high-quality auditors. The reason is that while the low-quality auditor's audit is less expensive (relative to the high-quality auditor's audit), its quality is too low. On the other hand, if the liability law is stringent, both firms hire low-quality auditors. The intuition is that the high-quality auditor's audit is too expensive, whereas the quality of the low-quality auditor's audit is not too low but actually cost-effective given the benefits of both firms. When the liability law is intermediate in its stringency, audits are priced (relative to their qualities) in a way that the high-benefit firm chooses a high-quality auditor and the low-benefit firm hires a low-quality auditor. The analysis also shows that the case where the high- (low-) benefit firm hires a low- (high-) quality auditor does not occur in equilibrium if firms are sufficiently

heterogeneous in their benefit from an audit.

The paper's second main result relates to the efficiency implications of the equilibrium auditor-client match. I show that, in a given legal environment, the economy always suffers from an inefficient allocation of resources (except for some knife-edge cases). To explain why efficiency losses are inevitable, note that clients obtain heterogeneous benefits from audits. Hence, there would be no efficiency loss if, and only if, the equilibrium audit qualities were perfectly customized to the clients' needs. This could occur in equilibrium when the parameters representing the clients' benefit and auditors' wealth are such that the high- (low-) quality auditor provides the quality that maximizes the high- (low-) benefit firm's net benefit. While there are some cases in which this could occur, they are knife-edge cases in the sense that any perturbation of the parameters renders them impossible in equilibrium. An important implication of this result is that when audit clients and auditors are heterogeneous, no legal environment can eliminate the efficiency losses.

I then investigate the efficiency implications of a change in the liability law (i.e., a change in the legal environment). A change in the liability law affects the supply of audit qualities (because of its impact on auditors' expected liability), which in turn affects the firms' auditor hiring decision. Thus, a change in the liability law induces a change in the auditor-client match, thereby affecting the economy's allocative efficiency. I show that if the high-benefit firm does not choose the high-quality auditor and the low-benefit firm does not hire the low-quality auditor in a given legal environment, then it is always possible to alter the legal environment in a way that induces the high- (low-) benefit firm to match with the high- (low-) quality auditor and doing so improves social efficiency. I also show that a socially optimal liability law (which minimizes but not eliminates the efficiency losses) must be the one that is intermediate in its stringency.

Finally, I discuss some empirical implications of the analysis for auditor choice/change. Although there have been numerous studies attempting to find an association between a firm characteristic (which can be interpreted as the benefit parameter in my model) and audit quality, the results are rather inconclusive and mixed.[3] I offer explanations for why it may be difficult to find a clear-cut association between the firm characteristic and audit

3) For example, Francis and Wilson (1988), Johnson and Lys (1990), and DeFond (1992) document a positive association between their proxies of agency costs and audit quality, whereas Palmrose (1984), Simunic and Stein (1987), Beatty (1989), and Feltham, Hughes, and Simunic (1991) find no conclusive evidence in their tests of initial public offering firms' auditor choice.

quality. The key point is that firms match with auditors as a result of the demand and supply interaction. In particular, as noted earlier, the high- and low- benefit firms do not necessarily match with high- and low-quality auditors, respectively, in equilibrium. Thus, unless one carefully controls both the demand and supply sides, empirical tests of auditor choice/change (which often uses a cross-section time-series regression analysis) may have an inherent difficulty in finding conclusive evidence. For more details about this issue, I refer to Section 6, in which I also suggest some refinements of empirical tests such as client industry segmentation.

The rest of the paper is organized as follows. Section 2 presents the model. Section 3 provides a benchmark analysis. In Section 4, I derive the equilibrium auditor-client match. Then, in Section 5, I examine the efficiency implications of a change in the legal environment. Section 6 discusses regulatory and empirical implications of the analysis. Section 7 concludes the paper.

II. The Model

Consider a single-period model of imperfect auditing. All parties have risk-neutral preferences and a zero discount rate for their payoffs. To expand operations, firms raise capital from outsiders (e.g., investors and/or banks) in the competitive capital market, who require the firms' financial statements. Auditors provide a third-party attestation by issuing an audit report on whether a firm's financial statements fairly represent its current economic reality and future prospects according to GAAP, thereby affecting outsiders' perception of the firm. This perception influences the firm's contractual and operating efficiencies, because the amount of capital raised, the shares of equity in return for the capital (in the case of an equity contract) and/or the interest rate (in the case of a loan contract) depend on the outsiders' perception. The model intends to be general in the sense that it does not consider the specifics of firms' operations and financing contracts based on audit reports. Instead, denoting $q \geq 0$ to be audit quality measured by an auditor's unobservable effort, the model simply assumes that an audit client benefits more *ex ante* from a higher-quality audit. [4)]

Firms are heterogeneous in their benefit from an audit. For simplicity, I assume that there are two firms and an auditor can audit at most one client. Each firm has a benefit parameter $\theta \in \{\theta_H, \theta_L\}$, $0 < \theta_L < \theta_H < \infty$, which is observable. I refer to the firm whose

4) An underlying presumption here is that audits are a cost-effective mechanism to enhance the credibility of financial information; otherwise, there would be no demand for audits. The fact that audits have existed for more than 600

benefit parameter is θ as firm θ. When firm θ hires an auditor who provides an audit of quality q, its *ex ante* direct benefit equals $\theta b(q)$, where b is an increasing and concave function with $b(0) = 0$, $b'(q) \to \infty$ as $q \to 0$, and $b'(q) \to 0$ as $q \to \infty$. Since $\theta_L b(q) < \theta_H b(q)$ for any q, firm θ_H values an audit of quality q more than firm θ_L does.

Audit technology is identical across auditors. The direct cost of performing an audit of quality q equals $c(q)$, where c is an increasing and convex function with $c(0) = 0$, $c'(q) \to 0$ as $q \to 0$, and $c'(q) \to \infty$ as $q \to \infty$. Audits are imperfect in that there is a probability of audit failure, an event that an auditor fails to make a correct attestation to financial statements. Let $p(\theta, q)$ be the probability of audit failure given θ and q, where p satisfies $p_q < 0$, $p_{qq} > 0$, $p_\theta > 0$, and $p_{\theta q} < 0$ (subscripts denote partial derivatives). That is: (*i*) providing more audit effort (i.e., an increase in q) reduces the probability of audit failure at a decreasing rate; and (*ii*) auditing a firm that benefits more from an audit involves higher risk of audit failure, but θ's impact on p diminishes as q increases.[5] Audit failures expose auditors to legal liabilities, triggering litigation from financial statement users (i.e., investors/creditors). Let $\min\{D, w\}$ be an auditor's liability payment in the case of audit failure, where D is the court's assessment of financial statement users' damages and $w > 0$ is the auditor's personal wealth.

The court's assessment of damages, D, is a random variable distributed on a closed interval $[0, D^+]$ where $D^+ < \infty$. For simplicity, I represent the entire legal environment affecting the damage distribution—such as the prevailing liability regime, auditing standards, regulatory policies, etc.—by a real number $s \in (0, \infty)$ and call it liability law s. Let $G(D \mid s)$ be the distribution function of D

years even before they were mandated (see Watts and Zimmerman 1986) shows that audits create values. Many prior studies formally examine how audits improve contractual and operating efficiencies in a variety of settings. Datar, Feltham, and Hughes (1991) and Pae (1996) examine how audits improve contractual efficiencies in equity and credit markets, respectively. Shibano (1996) studies how audits mitigate the 'lemons problem' in Myers and Majluf (1984). Dye (1995), Schwartz (1997), and Chan and Pae (1998) examine how audits improve investors' resource allocation decision. While different studies define audit quality in different ways to customize their modeling needs, a common feature is that an increase in audit quality improves a client firm's *ex ante* welfare (i.e., the expected payoff *prior* to receiving an audit report). In that sense, one can view the benefit function in this model (which I specify below) as representing a firm's *ex ante* reduced-form value function. That is, it subsumes the equilibrium payoff that depends on the specifics of a firm's operations and financing contracts based on audit reports, which I suppress in the model.

5) For example, in the contexts of Dye (1995), Schwartz (1997), and Chan and Pae (1998), firm θ_H could represent a firm with a high *ex ante* probability of poor future prospects (relative to firm θ_L), so that auditing firm θ_H involves a higher risk of type-II error for a given level of q. One could also interpret firm θ_H as representing a firm with large residual agency costs (in the sense of Jensen and Meckling 1976). It is then reasonable to assume that the probability of audit failure is higher when auditing firm θ_H relative to firm θ_L, since firm θ_H's (pre-audit) financial statements are more likely to contain misstatements due to its manager's unresolved incentive problems.

under liability law s. I parameterize s in a way that: (*i*) $\partial G(D \mid s) / \partial s < 0$ for all D and s; and (*ii*) $G(D \mid s) \rightarrow 1$ for all D as $s \rightarrow 0$. The first implies that $E[D \mid s]$ increases with s; i.e., a higher s corresponds to a higher expected damage. In this sense, I say that liability law s is *more stringent* than liability law s' if, and only if, $s > s'$. The second condition states that $D \rightarrow 0$ with probability one as $s \rightarrow 0$, in which case auditors have no liability even in the case of audit failure.

Auditors in the economy have wealth either w_h or w_l where $0 < w_l < w_h < D^+$. Like in Dye's (1995) model, auditors' wealth is assumed observable. For each $w \in \{w_h, w_l\}$, there are sufficiently many auditors with wealth w, who are referred to as auditor w henceforth. Auditors competitively bid for an audit engagement. Even though the audit technology (as represented by c and p) is identical across auditors, their total expected cost of auditing is different because auditors differ in their wealth. Furthermore, the firm characteristic θ enters into the audit failure function p, implying that audit fees differ across firms. Following the convention of non-contingent audit fees, let $f(\theta, s, w)$ be the fee charged by auditor w to firm θ under liability law s.

The sequence of events is as follows. A representative regulator—referred to as a social planner throughout the paper—establishes a liability law s to maximize social surplus, which is defined by the sum of all parties' *ex ante* expected payoffs. An establishment of s includes any legislation of liability laws, enforcement of regulatory policies, audit standards, and so on, which influence the distribution of D as explained earlier. Next, each firm hires an auditor. Auditors choose audit quality and firms gain the direct benefit from auditing. At the end of the period, whether audit failure has occurred is known. In the case of audit failure, financial statement users file suits against the auditor, and the court assesses damage D. The auditor pays $\min\{w, D\}$ to plaintiffs, and the game is over. The model structure is common knowledge.[6)]

6) Three technical remarks on the specification of liability structure are in order. First, while it would be more precise to say that an auditor's wealth subject to liability risk is personal wealth plus the audit fee from an audit engagement, introducing the audit fee into the liability complicates the analysis significantly. For tractability, I follow Dye (1995) by assuming that only the personal wealth is exposed to potential liability. Second, like in Dye's model, one might assume that even though q is unobservable, it affects the damage distribution. In that case, it would be reasonable to assume that D is more likely to be small when q is high. I show in Appendix B that the paper's results remain qualitatively unchanged under a regularity condition, which is related to the cross partial derivative of the damage distribution function (with respect to q and s). Finally, while the social planner can choose any s at the beginning of the game, I assume that s must be uniform, i.e., she cannot choose different liability laws across auditors and clients. Otherwise, as shown in Section 4, it is trivial to achieve the first-best outcome of the model.

III. Social Surplus and the First-Best Case

Let $\theta \equiv (\theta_H, \theta_L)$ and $\boldsymbol{W} \equiv (w_h, w_l)$ be the vectors of benefit parameters and auditor wealth distribution in the economy, respectively. Then, $(\theta, s, \boldsymbol{W})$ characterizes the entire parameter space of the model. Suppose that firm θ hires auditor w at a non-contingent audit fee f under liability law s, and auditor w in turn provides an audit of quality q. Then, for any given f, firm θ's *ex ante* expected payoff is:

$$z = \theta b(q) - f + p(\theta, q)\lambda(s, w), \qquad (1)$$

where

$$\lambda(s, w) \equiv \int_D \min\{w, D\} dG(D \mid s). \qquad (2)$$

is auditor w's expected liability to financial statement users conditional on audit failure under liability law s. The last term in (1) follows because financial statement users' payoff from auditor litigation opportunity in the competitive capital market translates into an addition to the firm's *ex ante* payoff in its expected value.[7]

On the other hand, auditor w's expected payoff from this audit engagement is equal to $f - c(q) - p(\theta, q)\lambda(s, w)$, which is the difference between his payoff in the case of no audit (i.e., his wealth w) and the expected payoff from the audit.[8] Competition among auditors drives the audit fee down to the total expected cost of auditing, so that they breakeven. Hence, for any (θ, q, s, w), the equilibrium audit fee must be:

$$f = c(q) + p(\theta, q)\lambda(s, w), \qquad (3)$$

i.e., the audit fee consists of the direct cost of auditing and *ex ante* expected liability.[9]

Substituting (3) into (1) yields firm θ's *ex ante* equilibrium expected payoff when it hires auditor w under liability law s who

7) This directly follows from the fact that financial statement users' expected payoff equals zero in equilibrium. The precise mechanism, through which financial statement users' payoff from litigation against an auditor translates into the firm's *ex ante* payoff, depends on the nature of the transaction between the firm and financial statement users. For example, if a firm offers its equity to outside investors in return for capital, then the auditor's potential liability payment to the investors allows the firm to offer a smaller fraction of equity because of the audit's insurance value. Similarly, in the case of a loan contract, a low interest rate (and/or a small amount of collateral) would apply. Nonetheless, as noted earlier, specifying such a transfer mechanism is unnecessary for the purpose of this paper's analysis.

8) The expected payoff from the audit equals $f - c(q) + p(\theta, q)[\int_D (w - \min\{w, D\}) dG(D \mid s)] + [1 - p(\theta, q)]w = f - c(q) - p(\theta, q)\lambda(s, w) + w$.

9) See Simunic and Stein (1996) for an informal discussion of competitive audit pricing. They also provide some archival evidence that audits are not systematically mispriced, i.e., audit fees are adequate to compensate auditors' effort and litigation risk so that they earn a normal return. Also see Beatty (1993) and Pratt and Stice (1994) for evidence of auditor's pricing of litigation risk.

provides an audit of quality q:

$$z(\theta, q) = \theta b(q) - c(q). \quad (4)$$

Note that auditor w's *ex ante* expected liability, $p(\theta, q)\lambda(s, w)$, is a net wash (through the audit fee), and thus, it does not appear in (4). As a result, if $z(\cdot)$ depends on (s, w), the dependence must come though q's dependence on (s, w).

I now define social surplus. Since the capital and audit markets are competitive, financial statement users' and auditors' expected payoffs are zero, which I have already taken into account when computing firm θ's expected payoff in (4). Thus, social surplus equals the sum of two firms' expected payoffs. Formally, let liability law s and auditor wealth distribution $\boldsymbol{W}$ be given. Also let $q^{\dagger}(\theta, s, \boldsymbol{W})$ be the equilibrium audit quality for firm θ, when it hires an auditor given $(s, \boldsymbol{W})$. Note that $q^{\dagger}(\cdot)$ depends on $\boldsymbol{W}$ because firm θ may hire auditor w_h or w_l. Then, the equilibrium social surplus must be equal to:

$$SS(\theta, \boldsymbol{q}^{\dagger}(\theta, s, \boldsymbol{W})) \equiv z(\theta_H, q^{\dagger}(\theta_H, s, \boldsymbol{W})) + z(\theta_L, q^{\dagger}(\theta_L, s, \boldsymbol{W})) \quad (5)$$

where $z(\theta, q)$ is given by (4) and $\boldsymbol{q}^{\dagger}(\theta, s, \boldsymbol{W}) \equiv (q^{\dagger}(\theta_H, s, \boldsymbol{W}), q^{\dagger}(\theta_L, s, \boldsymbol{W}))$ is the vector of the equilibrium audit qualities given $(\theta, s, \boldsymbol{W})$.

In the remainder of this section, I consider a hypothetical case, referred to as the first-best case, in which audit quality q is *observable* and thus firms and auditors directly contract on q. From the above analysis, each firm $\theta \in \{\theta_H, \theta_L\}$ in the first-best case requires an auditor to provide q that maximizes $z(\theta, q)$ given in (4), and pays $f(q)$ given in (3) if and only if the auditor does so. I call such an audit quality the first-best audit quality for firm θ and denote it by $q^F(\theta)$. Then, it must be the value of q that solves:

$$c'(q) = \theta b'(q). \quad (6)$$

Differentiating (6) with respect to θ reveals that $q^F(\theta)$ increases with θ, i.e., $q^F(\theta_H) > q^F(\theta_L)$, implying that firm θ_H demands a higher-quality audit than firm θ_L does. Let:

$$z^F(\theta) \equiv z(\theta, q^F(\theta)) = \theta b(q^F(\theta)) - c(q(\theta))$$

be firm θ's maximized expected payoff in the first-best case, which increases with θ.

An immediate conclusion from the above analysis is that liability law s and auditor wealth distribution $\boldsymbol{W}$ are *irrelevant* to firms' auditor hiring decision in the first-best case. As such, auditors' heterogeneity and the stringency of the legal environment are irrelevant to social efficiency. Since $q^{\dagger}(\theta, s, \boldsymbol{W}) = q^F(\theta)$ maximizing $z(\theta, q)$, the social surplus given in (5) attains its maximum at $\boldsymbol{q}^{\dagger}(\theta, s, \boldsymbol{W}) = \boldsymbol{q}^F(\theta)$ where $\boldsymbol{q}^F(\theta) \equiv (q^F(\theta_H),$

$q^F(\theta_L))$ is the vector of the first-best audit qualities given $\boldsymbol{\theta}$. The first-best social surplus, $SS(\boldsymbol{\theta}, \boldsymbol{q}^F(\boldsymbol{\theta}))$, thus depends on $\boldsymbol{\theta}$ but independent of $(s, \boldsymbol{W})$. Of course, the first-best case is hypothetical because audit quality q is actually unobservable. As I show in the next section, the liability law and auditor wealth do matter when q is unobservable because they affect auditors' quality choice. Further, the benefit parameters affect the firms' auditor hiring decision and auditors' quality decision in a different way.

Ⅳ. The Second-Best Case

I now return to the original model, referred to as the second-best case, in which q is unobservable. Firms in the second-best case cannot induce the first-best audit qualities by writing a forcing contract directly contingent on q. Instead, once a non-contingent audit fee is set, auditors choose q to minimize their total expected cost of auditing (rather than maximizing their client's payoff). This suggests that efficiency losses arise. As noted earlier, liability law s plays an important role here because it affects auditors' incentives associated with audit quality, thereby affecting social efficiency. This is the central focus of the subsequent analysis.

4.1 Supply of Audit Qualities

Suppose that liability law s prevails and firm θ hires auditor w at a fixed audit fee f. Then, auditor w chooses q by solving:

$$\min_q c(q) + p(\theta, q)\lambda(s, w), \tag{7}$$

where $\lambda(s, w)$ is given in (2). Let $q^*(\theta, s, w)$ be a solution to (7). Then, it must be given by the value of q that solves the first-order condition for (7):

$$c'(q) = -p_q(\theta, q)\lambda(s, w). \tag{8}$$

Since $p_{\theta q} < 0$, we see that $q^*(\cdot)$ increases with θ for any given (s, w), i.e., $q^*(\theta_H, s, w) > q^*(\theta_L, s, w)$ for all (s, w). The intuition is that auditors have a stronger incentive to increase audit quality when they audit firm θ_H, which has a higher probability of audit failure. In addition, it is shown in Appendix A that the expected liability conditional on audit failure, $\lambda(s, w)$, increases with s and w. By applying this result to (8), we see that $q^*(\theta, s, w)$, increases with s and w for any given θ. Intuitively, when the liability law becomes more stringent (i.e., as s increases), the damage distribution shifts upward, thereby increasing $\lambda(s, w)$. This motivates auditors to increase audit quality to reduce the probability of audit failure. Similarly, auditor w_h has more wealth exposed to

liability risk and thus has a stronger incentive to avoid audit failure, relative to auditor w_l.

Comparing (8) with (6) reveals that auditor w's supply of audit quality differs from the first-best audit quality for firm θ in general. To be precise, auditor w under liability law s provides firm θ with $q^F(\theta)$ if, and only if, his marginal benefit of q evaluated at $q^F(\theta)$ equals firm θ's marginal benefit from it: i.e., when $[-p_q(\theta, q^F(\theta))\lambda(s, w)] = \theta b'(q^F(\theta))$ holds. In other words, $q^*(\theta, s, w) = q^F(\theta)$ if, and only if, (θ, s, w) satisfies:

$$\lambda(s, w) = \beta(\theta) \equiv \frac{\theta b'(q^F(\theta))}{-p_q(\theta, q^F(\theta))}. \qquad (9)$$

It is useful to view (9) as defining the set of auditor wealth w and liability law s that induces $q^F(\theta)$ in the second-best case. More specifically:

Definition 1:

(i) *For a given* (θ, w), *let* $s^F(\theta, w)$ *be the value of* s *that solves* $\lambda(s, w) = \beta(\theta)$.

(ii) *For a given* (θ, s), *let* $w^F(\theta, s)$ *be the value of* w *that solves* $\lambda(s, w) = \beta(\theta)$.

Given (9), the meanings of the above definitions are clear. $s^F(\theta, w)$ is a liability law under which auditor w provides the first-best audit quality $q^F(\theta)$. The second part is dual to the first part in that an auditor with wealth $w^F(\theta, s)$ provides the first-best audit quality $q^F(\theta)$ under liability law s. Since $\lambda(s, w)$ increases with s and w, it follows is that, for any given θ, $s^F(\theta, w)$ decreases with w and $w^F(\theta, s)$ decreases with s.

Proposition 1: *Suppose that liability law* s *prevails. Then, auditor* $w \in \{w_h, w_l\}$ *provides an audit quality that is higher than the first-best audit quality for firm* $\theta \in \{\theta_H, \theta_L\}$ *if, and only if,* w *is greater than* $w^F(\theta, s)$. *That is*:

$$q^*(\theta, s, w) > q^F(\theta) \text{ if, and only if, } w > w^F(\theta, s). \qquad (10)$$

I omit the proof since the result directly follows from the fact that $q^*(\theta, s, w)$ is strictly increasing in w, and that $q^*(\theta, s, w) = q^F(\theta)$ at $w = w^F(\theta, s)$. To see the intuition, consider firm θ and let s be given. From (9) and Definition 1, we see that auditor w provides the first-best quality for this firm if, and only if, $w = w^F(\theta, s)$. Any auditor with wealth less than $w^F(\theta, s)$ provides an audit of a quality lower than the first-best quality for firm θ, whereas the converse is true for any auditor with wealth more than $w^F(\theta, s)$. In essence, Proposition 1 shows that the prevailing liability law, auditor's wealth, and client firm's characteristic are all crucial to determining whether an audit service is too low or too high relative to the first-best quality.

4.2 Equilibrium Audit Qualities

In the previous section, I have examined a representative auditor's quality supply decision given (θ, s, w). I now investigate firms' auditor hiring decisions and derive the equilibrium audit qualities. First, consider the equilibrium audit fee in the second-best case. Note that if firm θ hires auditor w under liability law s, it can infer that this auditor will provide $q^*(\theta, s, w)$. Thus, we see from the analysis in Section 3 that the equilibrium audit fee charged by auditor w to firm θ under liability law s is:

$$\begin{aligned} f^*(\theta, s, w) &= c(q^*(\theta, s, w)) \\ &\quad + p(\theta, q^*(\theta, s, w))\lambda(s, w) \\ &= \min_q c(q) + p(\theta, q)\lambda(s, w). \end{aligned} \tag{11}$$

Using the envelope theorem along with $\lambda_s > 0$, $\lambda_w > 0$, and $p_\theta > 0$, it is easy to verify that $f^*(\theta, s, w)$ increases with θ, s, and w. That is: (*i*) auditor w_h's audit is more expensive than auditor w_l's audit under any legal environment; (*ii*) auditors charge higher fees when the liability law becomes more stringent; and (*iii*) auditors charge higher fees when they audit a firm with a higher probability of audit failure (i.e., when θ is high).

Next, consider the firms' auditor choice problem. From (4), we see that if firm θ hires auditor w under liability law s, its expected payoff is:

$$\begin{aligned} z(\theta, q^*(\theta, s, w)) &= \theta b(q^*(\theta, s, w)) \\ &\quad - c(q^*(\theta, s, w)). \end{aligned} \tag{12}$$

In contrast to the first-best case where liability law s and auditor's wealth w are irrelevant to the auditor hiring decision, (12) shows that s and w are crucial in the second-best case because they affect the firms' payoffs via $q^*(\theta, s, w)$. Formally, let $(\theta, s, \boldsymbol{W})$ be given, and recall that $q^\dagger(\theta, s, \boldsymbol{W})$ denotes the equilibrium audit quality for firm θ given s and $\boldsymbol{W}$ (see Section 3). Then, for each $\theta \in \{\theta_H, \theta_L\}$, we must have:

$$\begin{aligned} &q^\dagger(\theta, s, \boldsymbol{W}) = q^*(\theta, s, w_h) \quad \text{if} \\ &\quad z(\theta, q^*(\theta, s, w_h)) \geq z(\theta, q^*(\theta, s, w_l)); \\ &q^\dagger(\theta, s, \boldsymbol{W}) = q^*(\theta, s, w_l) \quad \text{if} \\ &\quad z(\theta, q^*(\theta, s, w_h)) < z(\theta, q^*(\theta, s, w_l)). \end{aligned}$$

That is, firm θ hires auditor w_h under liability law s if, and only if, its expected payoff from auditor w_h is greater than that from auditor w_l, and vice versa. Henceforth, I say that θ-w match occurs if firm θ hires auditor w.

Lemma 1: *Suppose that firm θ hires auditor w under liability law s. Then, its expected payoff, $z(\theta, q^*(\theta, s, w))$, increases with s and w if, and only if, $q^*(\theta, s, w) < q^F(\theta)$.*

Proof: All proofs not stated in the main

text are in Appendix A.

Lemma 1 follows because $z(\theta, q)$ attains its unique maximum at $q = q^F(\theta)$. To see the intuition, suppose $q^*(\theta, s, w) < q^F(\theta)$. Then, an increase in s motivates auditor w to provide a higher-quality audit (since $\lambda(s, w)$ increases), which enhances firm θ's expected payoff, $z(\theta, q^*(\theta, s, w))$. The same intuition applies to an increase in w. In contrast, if $q^*(\theta, s, w) > q^F(\theta)$, an increase in s (and/or w) exacerbates over-provision of audit quality, thereby making firm θ worse off.

Lemma 1 reveals some insights into the firms' auditor hiring decision. For example, consider firm θ_H and suppose that $q^*(\theta_H, s, w_h) \leq q^F(\theta_H)$ holds. Then, since $q^*(\theta_H, s, w_l) < q^*(\theta_H, s, w_h)$, it must be true that $z(\theta_H, q^*(\theta_H, s, w_h)) > z(\theta_H, q^*(\theta_H, s, w_l))$. Thus, firm θ_H hires auditor w_h, i.e., θ_H-w_h match occurs. On the other hand, consider firm θ_L and suppose that $q^*(\theta_L, s, w_l) \geq q^F(\theta_L)$. In this case, θ_L-w_l match occurs because, given that $q^F(\theta_L) \leq q^*(\theta_L, s, w_l) < q^*(\theta_L, s, w_h)$, firm θ_L obtains a higher expected payoff from auditor w_l than from auditor w_h, i.e., $z(\theta_L, q^*(\theta_L, s, w_l)) > z(\theta_L, q^*(\theta_L, s, w_h))$.

The above discussions, however, do not provide a complete characterization of auditor-client match. For instance, θ_H-w_h match may occur when $q^*(\theta_H, s, w_h) > q^F(\theta_H)$, and θ_L-w_l match may occur when $q^*(\theta_L, s, w_l) < q^F(\theta_L)$. Also, there are possibilities of θ_H-w_l and θ_L-w_h matches. The following definitions are useful to address the problem of client-auditor match completely.

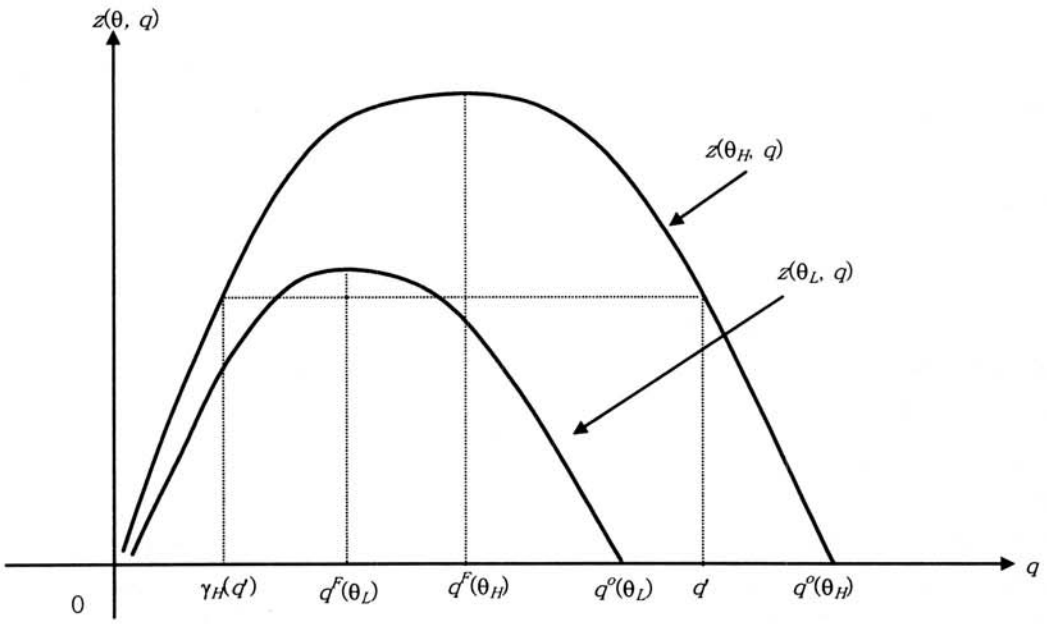
Definition 2:

(i) *For each* $\theta \in \{\theta_H, \theta_L\}$, let $q^o(\theta)$ *be the value of* q *that solves* $z(\theta, q) = 0$, *where* $z(\theta, q)$ *is given by* (4).

(ii) γ_H *is a function defined on the closed interval* $[q^F(\theta_H), q^o(\theta_H)]$ *such that:*
$z(\theta_H, \gamma_H(q)) = z(\theta_H, q)$ *for* $q \in [q^F(\theta_H), q^o(\theta_H)]$.

(iii) γ_L *is a function defined on the closed interval* $[0, q^F(\theta_L)]$ *such that:*
$z(\theta_L, \gamma_L(q)) = z(\theta_L, q)$ *for* $q \in [0, q^F(\theta_L)]$.

〈Figure 1〉 is a graphical illustration of Definition 2. Note that $q^o(\theta) > 0$ is well-defined for each $\theta \in \{\theta_H, \theta_L\}$ because $z(\theta, q)$ is a strictly concave function of q with its unique maximum at $q^F(\theta)$ and $z(\theta, q) \to 0$ as $q \to 0$ while $z(\theta, q) \to -\infty$ as $q \to \infty$. It is also easy to see that $q^o(\theta)$ increases with θ, i.e., $q^o(\theta_L) < q^o(\theta_H)$. Next, to explain γ_H, consider any $q \in [q^F(\theta_H), q^o(\theta_H)]$ in 〈Figure 1〉, say, q'. Then, one can find $\gamma_H(q')$ such that $z(\theta_H, \gamma_H(q')) = z(\theta_H, q')$. Similarly, using $z(\theta_L, q)$, one can define a function γ_L satisfying $z(\theta_L, \gamma_L(q)) = z(\theta_L, q)$ for $q \in [0, q^F(\theta_L)]$. The next lemma states some properties of γ_H and γ_L.



〈Figure 1〉 Graphical illustration of γ_H, γ_L, and $q^o(\theta)$ for $\theta = \theta_H, \theta_L$

Lemma 2:

(i) $\gamma_H(q) \leq q^F(\theta_H)$ *for all* $q \in [q^F(\theta_H), q^o(\theta_L)]$, $\gamma_H(q) \to q^F(\theta_H)$ *as* $q \to q^F(\theta_H)$, *and* $\gamma_H(q) \to 0$ *as* $q \to q^o(\theta_H)$.

(ii) $\gamma_L(q) \geq q^F(\theta_L)$ *for all* $q \in [0, q^F(\theta_L)]$, $\gamma_L(q) \to q^o(\theta_L)$ *as* $q \to 0$, *and* $\gamma_L(q) \to q^F(\theta_L)$ *as* $q \to q^F(\theta_L)$.

(iii) *Both* γ_H *and* γ_L *are decreasing functions of* q.

From Definition 2 and the fact that $z(\theta, q)$ attains its unique maximum at $q = q^F(\theta)$ for $\theta = \theta_H, \theta_L$, the results are straightforward and easy to verify in 〈Figure 1〉. With help of Lemma 2, I can completely characterize the firms' auditor hiring decision for any given liability law s, auditor wealth distribution $\boldsymbol{W}$, and the vector of benefit parameters $\boldsymbol{\theta}$.

Proposition 2: *Let* $(\boldsymbol{\theta}, s, \boldsymbol{W})$ *be given and let* $q^*(\theta, s, w)$ *be the supply of audit quality to firm* $\theta \in \{\theta_H, \theta_L\}$ *as characterized by* (8).

(i-a) *If* $q^*(\theta_H, s, w_h) \leq q^F(\theta_H)$, *then* θ_H-w_h *match occurs.*

(i-b) *If* $q^*(\theta_H, s, w_h) > q^F(\theta_H)$, *then* θ_H-w_h *match occurs if and only if* $q^*(\theta_H, s, w_l) < \gamma_H(q^*(\theta_H, s, w_h))$.

(ii-a) *If* $q^*(\theta_L, s, w_l) \geq q^F(\theta_L)$, *then* θ_L-w_l *match occurs.*

(ii-b) *If* $q^*(\theta_L, s, w_h) < q^F(\theta_L)$, *then* θ_L-w_l *match occurs if and only if* $q^*(\theta_L, s, w_h) > \gamma_L(q^*(\theta_L, s, w_l))$.

Since the discussion below Lemma 1 has explained the intuition behind parts (i-a) and (ii-a), I focus on parts (i-b) and (ii-b). Consider firm θ_H and suppose that $q^*(\theta_H, s, w_h) > q^F(\theta_H)$. Firm θ_H in this case may hire auditor w_h or w_l depending on the relative size of $q^*(\theta_H, s, w_h)$ and $q^*(\theta_H, s, w_l)$. To be precise, recall that when firm θ_H chooses an auditor, it compares $z(\theta_H, q^*(\theta_H, s, w_h))$ and $z(\theta_H, q^*(\theta_H, s, w_l))$. Function γ_H plays a key role here, determining whether firm θ_H is better off by hiring auditor w_h or w_l. To illustrate, return to Figure 1 and suppose that $q^*(\theta_H, s, w_h) = q'$. Since $q^*(\theta_H, s, w)$ increases with w, it must be true that $q^*(\theta_H, s, w_l) < q'$. The question is then how low the audit quality from auditor w_l is. Note that $z(\theta_H, q') > z(\theta_H, q^*(\theta_H, s, w_l))$ if, and only if, $q^*(\theta_H, s, w_l) < \gamma_H(q')$. Firm θ_H thus hires auditor w_h if $q^*(\theta_H, s, w_l) < \gamma_H(q')$, but it hires auditor w_l otherwise. Since q' is arbitrary, part (i-b) characterizes firm θ_H's auditor hiring decision completely when $q^*(\theta_H, s, w_h) > q^F(\theta_H)$. The main intuition is that even if $q^*(\theta_H, s, w_h)$ is too high for firm θ_H relative to $q^F(\theta_H)$, firm θ_H chooses auditor w_h if $q^*(\theta_H, s, w_l)$ is too low relative to $\gamma_H(q^*(\theta_H, s, w_h))$. In this sense, γ_H is a cutoff function determining firm θ_H's auditor hiring decision given the supply of audit qualities from auditor w_h and w_l.

The economics behind part (ii-b) is similar. Suppose that $q^*(\theta_L, s, w_l) < q^F(\theta_L)$. Since $q^*(\theta_L, s, w_l)$ in this case is too low relative to $q^F(\theta_L)$, firm θ_L may be better off by choosing auditor w_h unless $q^*(\theta_L, s, w_h)$ is not too high —recall that $q^*(\theta_L, s, w_h)$ is always higher than $q^*(\theta_L, s, w_l)$. Like γ_H in the case of firm θ_H, function γ_L is firm θ_L's cutoff function in its auditor hiring decision. That is, for any $q^*(\theta_L, s, w_l)$ $(< q^F(\theta_L))$, it is easy to verify that $z(\theta_L, q^*(\theta_L, s, w_l)) < z(\theta_L, q)$ for all $q \in (q^*(\theta_L, s, w_l), \gamma_L(q^*(\theta_L, s, w_l)))$. Thus, firm θ_L hires auditor w_h if $q^*(\theta_L, s, w_h) < \gamma_L(q^*(\theta_L, s, w_l))$, but otherwise it hires auditor w_l.

In sum, in contrast to the first-best case, both the auditor wealth distribution and liability law are critical to the equilibrium audit qualities in the second-best case because they affect the supply of audit qualities. The benefit parameters also affect the audit quality supply (through the audit failure function) and demand (through the firms' cutoff functions γ_H and γ_L). Thus, $(\theta, s, \boldsymbol{W})$ determines the vector of the equilibrium audit qualities, $\boldsymbol{q}^\dagger(\theta, s, \boldsymbol{W}) \equiv (q^\dagger(\theta_H, s, \boldsymbol{W}), q^\dagger(\theta_L, s, \boldsymbol{W}))$ where $q^\dagger(\theta, s, \boldsymbol{W}) = q^*(\theta, s, w)$ in the case of θ-w match for all $\theta \in \{\theta_H, \theta_L\}$ and $w \in \{w_h, w_l\}$.

V. Impact of Liability Laws on the Efficiency of Equilibrium

I now turn to the impact of liability laws on

the auditor-client match and its resulting efficiency implications. From Section 3 we know that social surplus equals the sum of the two firms' expected payoffs. Thus, the second-best equilibrium social surplus is:

$$SS(\theta, \boldsymbol{q}^{\dagger}(\theta, s, \boldsymbol{W})) = z(\theta_H, q^{\dagger}(\theta_H, s, \boldsymbol{W})) + z(\theta_L, q^{\dagger}(\theta_L, s, \boldsymbol{W})). \quad (13)$$

Given that the first-best audit qualities $\boldsymbol{q}^F(\theta) \equiv (q^F(\theta_H), q^F(\theta_L))$ maximize $SS(\theta, \boldsymbol{q})$, an important question from a social efficiency perspective is whether there exists a liability law that can achieve the first-best social surplus in the second-best case. If so, such a liability law would be a socially optimal liability law. The next proposition shows that $SS(\theta, \boldsymbol{q}^{\dagger}(\theta, s, \boldsymbol{W})) < SS(\theta, \boldsymbol{q}^F(\theta))$ almost surely for any parameter values.

Proposition 3: *The equilibrium social surplus given in* (13) *is lower than the first-best social surplus* (*except for knife-edge cases*).

That is, when audit quality is unobservable and thus it cannot be contracted upon, the economy almost always suffers from an inefficient allocation of resources. To prove the result, first consider what happens if $\beta(\theta_H) = \beta(\theta_L)$ holds where $\beta(\theta)$ is defined in (9). Recall that $\lambda(s, w) = \beta(\theta)$ in (9) defines $s^F(\theta, w)$, which is the liability law that induces auditor w to provide the first-best audit quality for firm θ. If β is independent of θ (i.e., $\beta(\theta_H) = \beta(\theta_L)$), then $s^F(\theta, w)$ too is independent of θ. This means that if the social planner chooses $s = s^F(\theta, w)$, it induces auditor w to provide the first-best audit qualities for *both* firms. This in turn induces both firms to hire auditor w to earn their first-best payoff, i.e., $z(\theta, q^F(\theta))$, and hence, $SS(\theta, \boldsymbol{q}^{\dagger}(\theta, s, \boldsymbol{W})) = SS(\theta, \boldsymbol{q}^F(\theta))$. While this is a special case in which the first-best outcome is achievable, note that $\beta(\theta_H) = \beta(\theta_L)$ holds for a measure-zero set of benefit parameters and audit failure/benefit functions (i.e., a knife-edge case). In particular, since the numerator of $\beta(\theta)$ always increases with θ,[10] $\beta(\theta_L) = \beta(\theta_H)$ requires that the denominator, $-p_q(\theta, q^F(\theta))$, must increase with θ and its change must precisely offset the numerator's change.[11] Clearly, the set of benefit parameters and audit failure/benefit functions satisfying these requirements has a zero measure. In this sense, I henceforth say that client firms are *generically heterogeneous* when $\beta(\theta_H) \neq \beta(\theta_L)$.

10) Since $q^F(\theta)$ is characterized by (6), totally differentiate (6) with respect to θ. Then, we have $c''(q^F(\theta))[dq^F(\theta) / d\theta] = b'(q^F(\theta)) + \theta b''(q^F(\theta))[dq^F(\theta) / d\theta]$. The left-hand side is strictly positive, so that the right-hand side must be strictly positive, which is equal to $d[\theta b'(q^F(\theta))] / d\theta$, i.e., the change in the numerator of $\beta(\theta)$.

11) That is, $\theta_H b'(q^F(\theta_H)) / \theta_L b'(q^F(\theta_L)) = p_q(\theta_H, q^F(\theta_H)) / p_q(\theta_L, q^F(\theta_L)) > 1$ must hold.

Continuing the proof for the case of $\beta(\theta_H) \neq \beta(\theta_L)$, suppose that auditors with wealth w_h serve both firms, i.e., $(\theta_H\text{-}w_h, \theta_L\text{-}w_h)$ prevails, and there is no efficiency loss. This means that $\lambda(s, w_h) = \beta(\theta_H)$ and $\lambda(s, w_h) = \beta(\theta_L)$. However, since $\beta(\theta_H) \neq \beta(\theta_L)$, we must have $\lambda(s, w_h) \neq \lambda(s, w_h)$, which is a contradiction. Similarly, it is impossible for $(\theta_H\text{-}w_l, \theta_L\text{-}w_l)$ to prevail with no efficiency loss. Next, suppose that $(\theta_H\text{-}w_h, \theta_L\text{-}w_l)$ prevails with no efficiency loss, i.e., auditor w_h provides $q^F(\theta_H)$ and auditor w_l provides $q^F(\theta_L)$. This can happen if, and only if, $\lambda(s, w_h) = \beta(\theta_H)$ and $\lambda(s, w_l) = \beta(\theta_L)$, which in turn requires that $(\boldsymbol{\theta}, s, \boldsymbol{W})$ must satisfy $w_h = w^F(\theta_H, s)$ and $w_l = w^F(\theta_L, s)$ simultaneously. However, this is a knife-edge case in the sense that any perturbation of the parameters renders the above conditions unsatisfied.[12] Finally, suppose that $(\theta_H\text{-}w_l, \theta_L\text{-}w_h)$ prevails with no efficiency loss. Then, $\lambda(s, w_l) = \beta(\theta_H)$ and $\lambda(s, w_h) = \beta(\theta_L)$ must hold. Again, this holds in a knife-edge case where $w_l = w^F(\theta_H, s)$ and $w_h = w^F(\theta_L, s)$. This competes the proof of Proposition 3.

Since Proposition 3 applies to any arbitrary liability law s, we can restate it as follows: If client firms are generically heterogeneous, then *no* liability law achieves the first-best outcome (except for knife-edge cases). Put differently, it is impossible for a social planner to setup a legal environment in a way to achieve the first-best outcome in the second-best case. As shown above, the key is that there exists an efficiency loss in *any* possible combinations of auditor-client match for given parameters $(\boldsymbol{\theta}, s, \boldsymbol{W})$. It is straightforward to extend this impossibility result to a more general setting in which θ and w take more than two values, respectively, and clients are generically heterogeneous. Except for the knife-edge case in which all values of θ and w satisfy $w = w^F(\theta, s)$ for some s, efficiency losses are inevitable.

I now shift the focus to how the social planner may improve the equilibrium social surplus by changing s. The focus is on how a change in s alters auditors' quality choice and firms' auditor hiring decision, which affects the equilibrium efficiency. To sharpen intuition, I restrict the analysis to the case in which the following conditions are met:

$$\beta(\theta_H) > \beta(\theta_L) \quad \text{for any given } \boldsymbol{\theta} = (\theta_H, \theta_L) \tag{14-1}$$

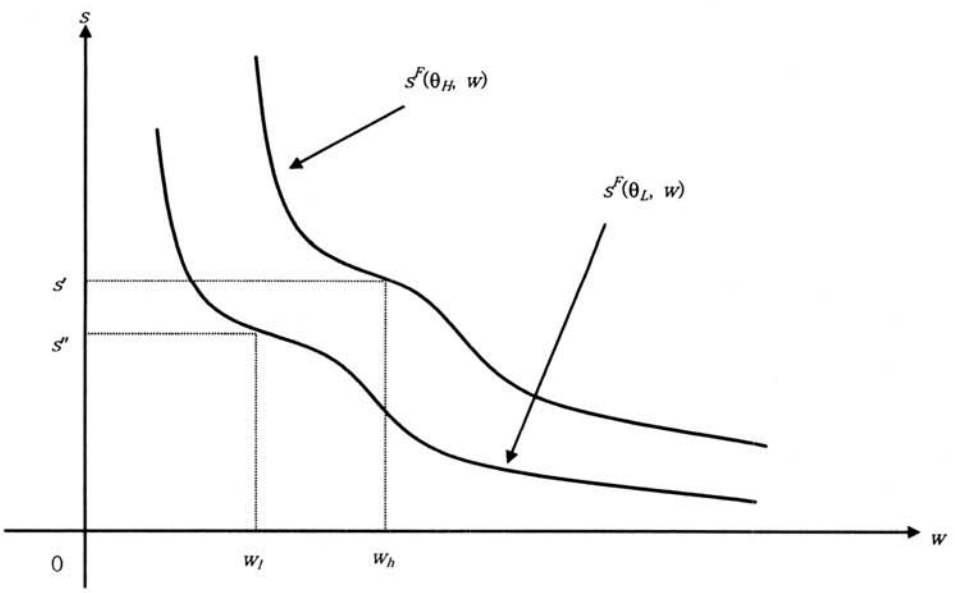
$$s^F(\theta_L, w_l) < s^F(\theta_H, w_h) \quad \text{for any given } \boldsymbol{W} = (w_h, w_l). \tag{14-2}$$

The intuition behind the first condition is that, for any auditor w, inducing the first-best audit quality for firm θ_H requires a

12) In other words, in the parameter space of $(\boldsymbol{\theta}, s, \boldsymbol{W})$, the set of parameters satisfying $w_l = w^F(\theta_L, s)$ and $w_h = w^F(\theta_H, s)$ has a zero measure.

larger expected liability in terms of a larger $\lambda(s, w)$, relative to the first-best audit quality for firm θ_L.[13] Since $\lambda(s, w)$ increases with s, (14-1) then implies that $s^F(\theta, w)$ increases with θ. In conjunction with the fact that $s^F(\theta, w)$ decreases with w, we now see that $s^F(\theta_H, w_l)$ is highest and $s^F(\theta_L, w_h)$ is lowest. However, it is not possible to rank-order $s^F(\theta_L, w_l)$ and $s^F(\theta_H, w_h)$ in general. Nonetheless, (14-2) holds for any $\boldsymbol{W}$ if firms are sufficiently heterogeneous in benefit parameters, i.e., if θ_H is sufficiently large relative to θ_L. To illustrate, I refer to 〈Figure 2〉 which depicts $s^F(\theta, w)$ for each $\theta = \theta_H$ and θ_L. Observe that $s^F(\theta_H, w) > s^F(\theta_L, w)$ for all w as implied by (14-1). Further, $s' = s^F(\theta_H, w_h) > s'' = s^F(\theta_L, w_l)$ as assumed in (14-2). If w_h is sufficiently large relative to w_l, this relation $s' > s''$ may not hold. However, for any given $\boldsymbol{W} = (w_h, w_l)$, if θ_H is sufficiently large relative to θ_L, the vertical distance between $s^F(\theta_H, w)$ and $s^F(\theta_L, w)$ becomes large so that $s' > s''$ holds. This is what condition (14-2) ensures.

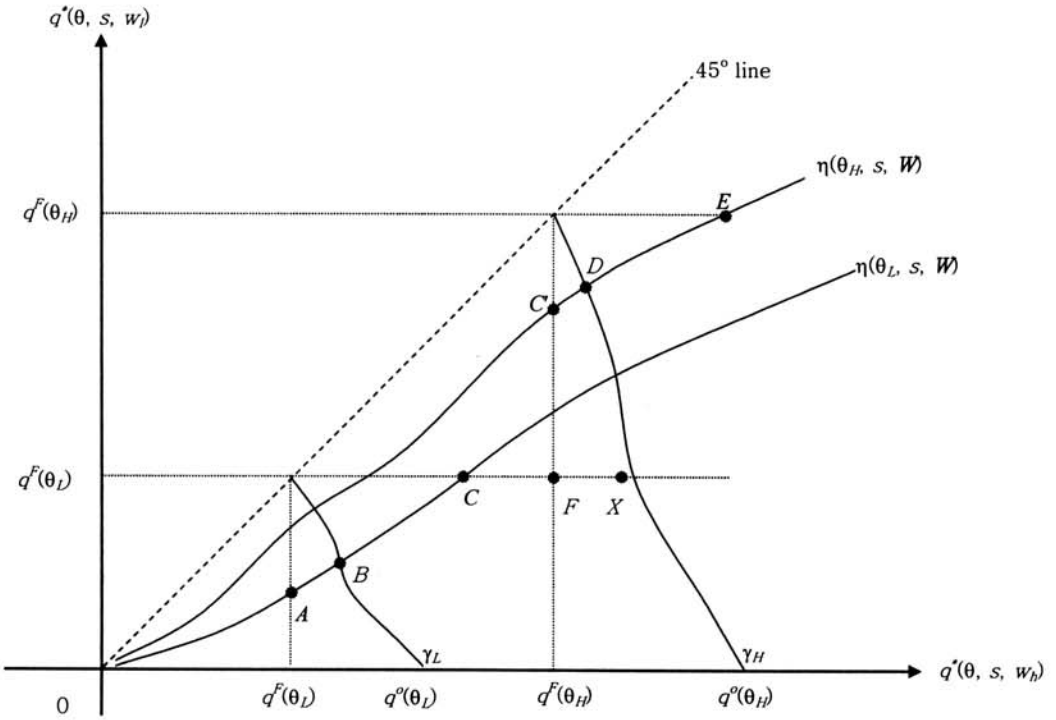
I next explain how a change in s induces a



Downward-sloping curves represent $s^F(\theta, w)$ for each $\theta = \theta_H, \theta_L$, which is implicitly defined by $\lambda(s, w) = \beta(\theta)$. Note that $s^F(\theta, w)$ is the liability law, under which auditor w provides the first-best audit quality $q^F(\theta)$.

〈Figure 2〉 Locus of $\lambda(s, w) = \beta(\theta)$

13) Given that the numerator of $\beta(\theta)$ increases with θ, a sufficient (but not necessary) condition for $\beta(\theta_H) > \beta(\theta_L)$ to hold is $p_q(\theta_L, q^F(\theta_L)) \leq p_q(\theta_H, q^F(\theta_H))$.



〈Figure 3〉 Equilibrium audit qualities when the liability law changes

change in the supply of audit qualities, and how this induced change translates into a change in the firms' auditor hiring decision. The horizontal and vertical axes in 〈Figure 3〉 represent the supply of audit quality from auditor w_h and w_l, respectively, for firm θ under liability law s. Denote $\boldsymbol{q}^*(\theta, s, \boldsymbol{W}) \equiv (q^*(\theta, s, w_h), q^*(\theta, s, w_l))$ to be the vector of audit qualities supplied to firm θ. Then, since $q^*(\theta, s, w_h) > q^*(\theta, s, w_l)$ for any θ and s, $\boldsymbol{q}^*(\theta, s, \boldsymbol{W})$ must be a vector *below* the 45-degree line for each θ. Fix $\theta = \theta_L$ and consider $\boldsymbol{q}^*(\theta_L, s, \boldsymbol{W})$. When s is sufficiently close to zero, $\boldsymbol{q}^*(\theta_L, s, \boldsymbol{W})$ converges to (0, 0) because there is no liability. As s increases, $\boldsymbol{q}^*(\theta_L, s, \boldsymbol{W})$ moves in a *northeast* direction since $q^*(\theta, s, w)$ increases with s for any w. In 〈Figure 3〉, $\eta(\theta_L, s, \boldsymbol{W})$ denotes a trajectory of $\boldsymbol{q}^*(\theta_L, s, \boldsymbol{W})$ for various levels of auditor liability laws, i.e., for different values of s. Similarly, $\eta(\theta_H, s, \boldsymbol{W})$ denotes a trajectory of $\boldsymbol{q}^*(\theta_H, s, \boldsymbol{W}) \equiv (q^*(\theta_H, s, w_h), q^*(\theta_H, s, w_l))$ for various levels of s.

To explain the vectors on two trajectories in 〈Figure 3〉, let s be given and consider a vector $\boldsymbol{q}^*(\theta_L, s, \boldsymbol{W})$ on $\eta(\theta_L, s, \boldsymbol{W})$ corresponding to

this s. A question then arises as to the location of vector $\boldsymbol{q}^*(\theta_H, s, \boldsymbol{W})$ on $\eta(\theta_H, s, \boldsymbol{W})$ for the same s. To answer this question, first recall that $q^*(\theta_H, s, w) > q^*(\theta_L, s, w)$ for any (s, w). Thus, we must have $\boldsymbol{q}^*(\theta_H, s, \boldsymbol{W}) >> \boldsymbol{q}^*(\theta_L, s, \boldsymbol{W})$, i.e., $q^*(\theta_H, s, w_h) > q^*(\theta_L, s, w_h)$ and $q^*(\theta_H, s, w_l) > q^*(\theta_L, s, w_l)$.[14]

Now consider vector A on $\eta(\theta_L, s, \boldsymbol{W})$ and let $s(A)$ be the liability law that induces A, that is, $A = \boldsymbol{q}^*(\theta_L, s(A), \boldsymbol{W})$. Since auditor w_h supplies the first-best quality $q^F(\theta_L)$ at A, it follows from Definition 1 that $s(A) = s^F(\theta_L, w_h)$. Similarly, we have $s(C) = s^F(\theta_L, w_l)$, $s(C') = s^F(\theta_H, w_h)$, and $s(E) = s^F(\theta_H, w_l)$. Note that (14-2) is equivalent to $s(C) < s(C')$, which plays an important role in determining the location of C. In particular, C must be to the *left* of the first-best audit qualities, denoted by vector F. To prove this, suppose that $\eta(\theta_L, s, \boldsymbol{W})$ passes through a vector that is to the *right* of F, say, X. In that case, we must have $s(X) = s^F(\theta_L, w_l)$ and $q^*(\theta_L, s(X), w_h) > q^F(\theta_H) = q^*(\theta_H, s(C'), w_h)$ where the last equality is due to the fact that $s(C') = s^F(\theta_H, w_h)$. Thus, $q^*(\theta_L, s(X), w_h) > q^*(\theta_H, s(C'), w_h)$ must hold. This implies that $s(X) > s(C')$ because $q^*(\theta, s, w)$ increases with θ and s. However, the last inequality is incompatible with (14-2).

Having explained the supply of audit qualities represented by two trajectories, I shift the focus to firms' auditor hiring decision. ⟨Figure 3⟩ also depicts γ_L and γ_H, which are the cutoff functions for each firm's auditor choice (Proposition 2). Given the properties of γ_L and γ_H (Lemma 2), it is easy to see that they are downward sloped.[15] Vectors B and D in Figure 3 denote the intersections of $\eta(\theta_t, s, \boldsymbol{W})$ and γ_t for $t = L, H$, respectively. Then, given the properties of trajectories as discussed above, we must have the following ordering of s corresponding to each vector in Figure 3:

$$s(A) < s(B) < s(C) < s(C') < s(D) < s(E). \quad (15)$$

Proposition 4: *Assume that* (14-1) *and* (14-2) *hold and let s be given. Then*:

(i) $(\theta_H\text{-}w_l, \theta_L\text{-}w_h)$ *does not occur in equilibrium.*

(ii) *If either* $(\theta_H\text{-}w_h, \theta_L\text{-}w_h)$ *or* $(\theta_H\text{-}w_l, \theta_L\text{-}w_l)$ *occurs under liability law s, there exists liability law* $s'(\neq s)$ *that induces* $(\theta_H\text{-}w_h, \theta_L\text{-}w_l)$ *and improves social efficiency in a Pareto superior way.*

14) For any vector $\boldsymbol{x} \equiv (x_1, x_2)$ and $\boldsymbol{y} \equiv (y_1, y_2)$, I write $\boldsymbol{x} >> \boldsymbol{y}$ if $x_i > y_i$ for all $i = 1, 2$. Similarly, I write $\boldsymbol{x} << \boldsymbol{y}$ if $x_i < y_i$ for all $i = 1, 2$.

15) Consider any point $q \in [q^F(\theta_H), q^o(\theta_H)]$ in the horizontal axis. Then, the height of $\gamma_H(q)$ is the value of function γ_H at q. As q becomes higher, $\gamma_H(q)$ must become lower and approach $q^o(\theta_H)$ (Lemma 2). Similarly, pick any point $q' \in [0, q^F(\theta_L)]$ in the vertical axis. Then, the height of $\gamma_L(q')$ measured along the horizontal axis is the value of function γ_L at q'. As q' becomes higher, $\gamma_L(q')$ must become lower and approach $q^F(\theta_L)$.

Part (i) states that it never happens that firm θ_H hires auditor w_l and firm θ_L hires auditor w_h under *any* liability law s. Part (ii) further states that whenever auditors with wealth w_h or w_l provide audits for both firms, it is always possible to alter the legal environment in a way that makes at least one firm strictly better off without making the other firm worse off. The proof is straightforward from Figure 3.

When liability law s is not very stringent in the sense of $s \in (0, s(B)]$, the supply of audit qualities for firm θ_L, $\boldsymbol{q}^*(\theta_L, s, \boldsymbol{W})$, must be on $0B$ of trajectory $\eta(\theta_L, s, \boldsymbol{W})$. From Proposition 2, $(\theta_L\text{-}w_h)$ prevails then. In addition, for any $s \in (0, s(B)]$, we must have $\boldsymbol{q}^*(\theta_H, s, \boldsymbol{W}) << C'$ on trajectory $\eta(\theta_H, s, \boldsymbol{W})$ because $\boldsymbol{q}^*(\theta_H, s, \boldsymbol{W}) << \boldsymbol{q}^*(\theta_H, s(C), \boldsymbol{W}) << C' = \boldsymbol{q}^*(\theta_H, s(C'), \boldsymbol{W})$. As a result, according to Proposition 2, firm θ_H also hires auditor w_h in this case. Taken together, $(\theta_L\text{-}w_h, \theta_H\text{-}w_h)$ prevails for all $s \in (0, s(B)]$. Next, suppose that liability law s is intermediate in the sense of $s \in (s(B), s(D)]$. While firm θ_L switches to auditor w_l in this case (since $\boldsymbol{q}^*(\theta_L, s, \boldsymbol{W}) >> B$ on $\eta(\theta_L, s, \boldsymbol{W})$), firm θ_H keeps auditor w_h (since $\boldsymbol{q}^*(\theta_H, s, \boldsymbol{W}) << D$ on $\eta(\theta_H, s, \boldsymbol{W})$). Therefore, $(\theta_H\text{-}w_h, \theta_L\text{-}w_l)$ prevails for all $s \in (s(B), s(D)]$. Finally, when liability law s is very stringent in the sense of $s \in (s(D), \infty)$, firm θ_H switches to auditor w_l and firm θ_L keeps auditor w_l. In summary, when (14-1) and (14-2) hold, $(\theta_H\text{-}w_l, \theta_L\text{-}w_h)$ cannot prevail under any s. This proves part (i).

I now prove part (ii). Let s be given. First, suppose that both firms hire auditor w_h. Then, given $\theta_L\text{-}w_h$ match, we must have $s \in (0, s(B)]$ here. As a result, $q^*(\theta_L, s, w_h) \leq q^*(\theta_L, s(B), w_h)$ and $q^*(\theta_H, s, w_h) \leq q^*(\theta_H, s(B), w_h) < q^*(\theta_H, s(C), w_h) < q^*(\theta_H, s(C'), w_h) = q^F(\theta_H)$. Now suppose that liability law s changes to $s(C)$. This will induce firm θ_L to switch to auditor w_l, who provides $q^F(\theta_L)$ under liability law $s(C)$. Thus, firm θ_L's welfare becomes strictly larger unless the previously given s equals $s(A)$. In addition, recall that $q^*(\theta_H, s, w_h) < q^F(\theta_H)$ for all $s \in (0, s(B)]$, i.e., firm θ_H hires auditor w_h, who provides a quality less than the first-best quality. When s changes to $s(C)$, auditor w_h increases the audit quality from $q^*(\theta_H, s, w_h)$ to $q^*(\theta_H, s(C), w_h)$. While $q^*(\theta_H, s(C), w_h)$ is still less than $q^F(\theta_H)$ (since $s(C) < s(C')$), this change strictly improves firm θ_H's welfare. Therefore, changing s to $s(C)$ leads to a Pareto improvement.

Next, suppose that both firms hire auditor w_l. Then, given $\theta_H\text{-}w_l$ match, it must be true that $s \in (s(D), \infty)$ in this case. Hence, $q^*(\theta_H, s, w_l) > q^*(\theta_H, s(D), w_l)$ and $q^*(\theta_L, s, w_l) > q^*(\theta_L, s(D), w_l) > q^*(\theta_L, s(C'), w_l) > q^*(\theta_L, s(C), w_l) = q^F(\theta_L)$. Now suppose that liability law s changes to $s(C')$. This change will induce firm θ_H to switch to auditor w_h, who provides $q^F(\theta_H)$ under liability law $s(C')$. Unless the previous s equals to $s(E)$, such a

switch strictly improves firm θ_H's welfare. Moreover, for all $s \in (s(D), \infty)$, we know that firm θ_L hires auditor w_l, whose audit quality exceeds the first-best level, i.e., $q^*(\theta_L, s, w_l) > q^F(\theta_L)$. The change of s to $s(C')$ induces auditor w_l to reduce the audit quality to $q^*(\theta_L, s(C'), w_l)$. While $q^*(\theta_L, s(C'), w_l)$ is still greater than $q^F(\theta_L)$, this change strictly improves firm θ_L's welfare. Therefore, we have a Pareto improvement. This proves part (ii).

An important corollary from part (ii) is that a socially optimal liability law, which I denote by s^*, must be the one that induces $(\theta_H - w_h, \theta_L - w_l)$. More specifically, for any given $(\theta, \boldsymbol{W})$, the social planner must choose s^* by solving:

$$\max_{s \in (0,\infty)} SS(\theta, \boldsymbol{q}^\dagger(\theta, s, \boldsymbol{W})). \tag{16}$$

In (16), the equilibrium audit quality vector, $\boldsymbol{q}^\dagger(\theta, s, \boldsymbol{W})$, enters into $SS(\cdot)$, which requires the social planner to take into account that both the auditors' quality supply decision and the firms' auditor hiring decision hinge upon s. As a function of liability law s, the equilibrium audit quality for each firm exhibits a discontinuity when the firm changes its auditor. For example, consider firm θ_L in Figure 3. As s increases from zero to $s(B)$, we know that $q^\dagger(\theta_L, s, \boldsymbol{W}) = q^*(\theta_L, s, w_h)$ so that the equilibrium audit quality for firm θ_L increases monotonically from zero to $q^*(\theta_L, s(B), w_h)$. However, recall that $q^\dagger(\theta_L, s, \boldsymbol{W}) = q^*(\theta_L, s(B), w_l)$ for all $s \in (s(B), \infty)$. Hence, at $s = s(B)$, $q^\dagger(\theta_L, s, \boldsymbol{W})$ discontinuously drops to $q^*(\theta_L, s(B), w_l)$, and increases with s. Similarly, the equilibrium audit quality for firm θ_H, $q^\dagger(\theta_H, s, \boldsymbol{W})$, exhibits a discontinuity at $s = s(D)$. In spite of the discontinuity of $q^\dagger(\theta, s, \boldsymbol{W})$, firm θ's equilibrium expected payoff, $z(\theta, q^\dagger(\theta, s, \boldsymbol{W}))$, is continuous in s for all $\theta \in \{\theta_H, \theta_L\}$. This is because firm θ is indifferent between replacing and keeping its auditor at the point where $q^\dagger(\theta, s, \boldsymbol{W})$ is discontinuous. (Recall that γ_H and γ_L are constructed in that way; see Definition 2.) Consequently, the equilibrium social surplus, $SS(\theta, q^\dagger(\theta, s, \boldsymbol{W}))$, is continuous in s.

Given the continuity of $SS(\cdot)$ in s and Proposition 4 (ii), a socially optimal liability law s^* exists. Moreover, $s^* \in (s(C), s(C'))$ must hold, so that $q^\dagger(\theta_H, s^*, \boldsymbol{W}) = q^*(\theta_H, s^*, w_h) < q^F(\theta_H)$ and $q^\dagger(\theta_L, s^*, \boldsymbol{W}) = q^*(\theta_L, s^*, w_l) < q^F(\theta_L)$. That is, the social planner must choose s^* in a way that the equilibrium audit quality for firm θ_H is less than its first-best quality while the equilibrium audit quality for firm θ_L is greater than its first-best quality. This result directly follows from the envelope theorem—i.e., a slight increase of s from $s(C) = s^F(\theta_L, w_l)$ improves social surplus whereas a slight decrease of s from $s(C') = s^F(\theta_H, w_h)$ improves social surplus. Intuitively, since the social surplus is the

sum of the two firms' expected payoffs, s^* law must balance its effect on both firms. However, it is worth emphasizing that s^* is a second-best optimum because the equilibrium audit qualities under liability law s^* do not achieve the first-best social surplus.

VI. Regulatory and Empirical Implications of the Analysis

As Siliciano (1997) notes, a legal system is dynamic in its nature and often exhibits a somewhat cyclical pattern—auditor liability is no exception.[16] After a significant increase in auditor litigation starting from mid 80s, public accountants claimed that auditor legal liability had been excessive, and they had sought changes in the legal environment (e.g., see Arthur Andersen & Co. et al. 1992, O'Malley 1993, Weinback 1993, Mednick and Peck 1994). Auditors' effort paid off; there were several recent events and changes in the legal environment intending to discourage auditor litigation (see fn. 1). This paper's analysis suggests that changing the legal system to reduce auditor liability might improve social welfare by inducing a more efficient allocation of resources.

To illustrate, suppose that firms and auditors in the present model are representative firms and auditors in the economy. Further suppose that (as often claimed by auditors) the liability prior to recent changes was excessive, which can be represented by a relatively high s. For example, let a liability law $s \in (s(C'), s(D))$ in ⟨Figure 3⟩ be given. This case corresponds to $(\theta_H - w_h, \theta_L - w_l)$ and both auditor w_h and w_l over-audit. A small reduction in auditor liability from this s alleviates over-provision of audit qualities, thereby improving the economy's resource allocation. However, reducing liability too much can lead to an undesirable equilibrium instead of enhancing social efficiency. For example, if the social planner makes the legal environment too lenient by choosing a very low s, then the resulting equilibrium might be the one in which auditors with wealth w_h provide audits for both firms. In ⟨Figure 3⟩, such a case would arise if s becomes lower than $s(B)$. The equilibrium social surplus after the change of s could be lower than the one before the change. This suggests that a *fine-tuning* of the legal environment is important. In particular, as shown earlier, socially optimal liability law s^* must belong to $(s(C), s(C'))$, so that it is neither too lenient nor too stringent.

16) Siliciano (1997) summarizes the trends in auditor liability under state laws, starting from *Ultrameres Corp. v. Touche, Niven & Co.* case at the New York Court of Appeals in 1931 to *Bily v. Arthur Andersen & Co.* case at the California Supreme Court in 1992. Also see Kothari et al. (1988), Lys (1993), and Cloyd et al. (1998).

In the remainder of this section, I discuss some empirical implications of the analysis. While a number of studies have examined the issue of auditor choice/change empirically, results are rather mixed and inconclusive. For example, Francis and Wilson (1988), Johnson and Lys (1990), and DeFond (1992) report a positive association between proxies of agency costs (e.g., diffusion of ownership, incentive contracts, growth opportunities, etc.) and audit quality. They develop hypotheses based on an agency-theory argument that firms with larger agency costs have a stronger incentive to choose a high-quality auditor to reduce agency costs (Jensen and Meckling 1976). On the other hand, Palmrose (1984), Simunic and Stein (1987), Beatty (1989), and Feltham, Hughes, and Simunic (1991) test IPO firms' auditor choice. However, they find no conclusive evidence on auditor-client match even though Datar, Feltham, and Hughes' (1991) theory implies a positive relation between the firm-specific risk and audit quality.

Empirical studies typically use a cross-sectional time-series regression to find an association between a firm characteristic and auditor choice/change. However, this paper suggests that it may be difficult to find a clear-cut association in general. To elaborate on this, recall that the benefit parameter in my model represents a firm characteristic that derives the firm's demand for a differentiated audit quality. For example, in light of the aforementioned studies, one can view firm θ_H as having large agency costs and/or a high firm-specific risk than firm θ_L. On the other hand, one can view auditor w_h as a higher-quality auditor relative to auditor w_l. It then follows that an empirical test of the association between the client characteristic and audit quality requires a careful control of the demand and supply sides of the auditor-client matching process.

To illustrate the supply side, I return to 〈Figure 3〉. Suppose that firms in the sample of an empirical study have a characteristic represented by θ_H and θ_L, and assume that the firm characteristic persists over the sample period. Given that the legal environment changes over time (see Kothari et al. 1988; Lys 1993; Siliciano 1997; Cloyd et al. 1998), we know that the firm characteristic may not match with audit quality for some sample period; that is, both firms may purchase audits only from auditor w_h or w_l. Consequently, unless a significant portion of the sample observations comes from the sample period in which $s \in (s(B), s(D))$, one would not find a significant positive association of the firm characteristic (i.e., the benefit parameter) and audit quality. This might be a reason for why changes in the legal environment over time introduce a confounding supply-side effect on the em-

pirical tests of auditor-client match.[17]

It is worth noting that controlling the demand side can mitigate the supply-side effect, thereby refining an empirical test of auditor-client match. In particular, to the extent that there is a cross-industry variation of demands for audit qualities (Craswell et al. 1995), partitioning sample firms by industries may help control the demand side. Moreover, industry segmentation may help document a pattern of changes in auditor-client match over time across industries. To be specific, return to 〈Figure 3〉 again and assume that there are two industries in the economy, indexed by $t = H, L$. Now suppose that one tests auditor-client match over a sample period in which s changes. Upon interpreting firm θ_t, $t = H, L$, as a representative firm in industry t, two empirical implications emerge.

First, if one focuses on the sample period in which s varies between $s(A)$ and $s(C)$ (i.e., the legal environment is relatively lenient), then the tendency of a positive association between the firm characteristic and audit quality is stronger in industry L relative to industry H. By a similar logic, if the legal environment in the sample period is relatively stringent in the sense of $s \in (s(C'), s(E))$, then there is a stronger tendency of a positive association between the firm characteristic and audit quality in industry H than L. Second, suppose that one considers a sufficiently long sample period in which the legal environment becomes gradually stringent so that s varies from $s(A)$ to $s(E)$. Then, the earlier discussion suggests that auditor switches first occur in industry L and then in industry H. In sum, segmenting client industries may help refine empirical tests of auditor-client match and extract evidence on a differing pattern of the auditor-client match across industries over time.

Ⅶ. Summary and Concluding Remarks

This paper presents a stylized model of imperfect auditing. Firms are heterogeneous in their benefit from an audit, thereby having differential demands for audit qualities. Auditors too exhibit heterogeneity in their wealth, thereby supplying differential audit qualities. In this framework, the main focus of analysis is on how firms and auditors match in equilibrium. I examine the impact

17) Simunic and Stein (1987) and Feltham, Hughes, and Simunic (1991) recognize that their lack of conclusive evidence may be driven by the supply-side effect the US legal environment. Clarkson and Simunic (1994) subsequently control the supply-side effect by considering firms in Canada where the legal environment is less severe and more stable relative to the US. Their findings are generally consistent with the predictions of Datar, Feltham, and Hughes (1991).

of a change in the legal environment on auditors' optimal quality choice, which in turn affects the firms' auditor hiring decision and thus the efficiency of equilibrium. A social planner's choice of a legal environment therefore has an efficiency implication. The analysis shows that the economy almost surely suffers from a misallocation of resources in any legal environment. While the first-best social efficiency may not be achievable in general, the paper also shows that an appropriate change in the legal system can improve the equilibrium efficiency; in fact, a (second-best) socially optimal legal environment is shown to be neither too stringent nor too lenient. The analysis suggests that recent changes in the auditor legal environment might have a positive impact on the equilibrium efficiency. The paper then discusses recent empirical studies on auditor choice/change, explaining why it may be difficult to find a strong association between firm characteristics and audit quality. The paper suggests that segmenting client firms across industries may help refine empirical tests of auditor choice/change and reveal a different pattern of auditor changes across industries.

I conclude the paper with remarks on two assumptions in the model and their implications for the socially optimal liability law. First, I assumed that auditors are risk-neutral. Suppose that auditors are risk-averse. In this case, given that their potential liability is uncertain, risk-averse auditors have a stronger incentive to increase audit quality in order to avoid audit failure. *Ceteris paribus*, this implies that the optimal liability law when auditors are risk-averse is less stringent, relative to the one in the risk-neutrality setting. To explain why, recall that the optimal liability law in the risk-neutrality setting is the one that induces over-auditing from auditor w_l and under-auditing from auditor w_h. Since risk-averse auditors now provide more audit efforts, the over-auditing problem is exacerbated while the under-auditing problem is alleviated. This shifts the social planner's focus to mitigating the severe over-auditing problem.

Second, I assumed that there is no legal cost in the litigation process. Suppose that financial statement users must bear some legal costs. Then, one can easily modify the current model by redefining an auditor's expected liability, $\lambda(s, w)$, to be the expected liability payment less the legal costs, i.e., $\lambda(w, s) \equiv E[\min\{w, D\} \mid s] - K$, where $K > 0$ is the legal costs. Clearly, the presence of legal costs weakens auditors' incentive to provide a high-quality audit because it reduces auditors' expected liability in the case of audit failure. Thus, the socially optimal liability law must be a more stringent one relative to the one in the case of no legal cost.

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〈Appendix A〉

Proof of the Properties of $\lambda(s, w)$:

$$\begin{aligned}\lambda(s, w) &= \int_D \min\{w, D\} dG(D \mid s) \\ &= \int_0^w \min\{w, D\} dG(D \mid s) + \int_w^{D^+} \min\{w, D\} dG(D \mid s) \\ &= \int_0^w D dG(D \mid s) + \int_w^{D^+} w dG(D \mid s) \;=\; w - \int_0^w G(D \mid s) dD\end{aligned}$$

where the last equality follows from integration by parts. Thus:

$$\frac{\partial \lambda(s,w)}{\partial w} = 1 - G(w \mid s) > 0 \text{ and } \frac{\partial \lambda(s,w)}{\partial s} = -\int_0^w \frac{\partial G(D \mid s)}{\partial s} dD > 0.$$

The first inequality follows because $G(D \mid s) \leq 1$ for all $D \in [0, D^+]$ and $w < D^+$, and the second inequality is due to $\partial G(D \mid s) / \partial s < 0$ for all D and s. ///

Proof of Lemma 1:

Fix θ and consider w. Then, from (12), note that:

$$\frac{\partial z(\theta, q^*(\theta, s, w))}{\partial w} = [\theta b'(q^*(\theta, s, w)) - c'(q^*(\theta, s, w))] \frac{\partial q^*(\theta, s, w)}{\partial w}.$$

Since $q^*(\theta, s, w)$ is increasing in w, $\partial z(\cdot) / \partial w$ has the same sign as that of $\theta b'(\cdot) - c'(\cdot)$. Since $z(\theta, q) = \theta b(q) - c(q)$ attains its unique maximum at $q = q^F(\theta)$, the result follows. The proof of the result that $\partial z(\cdot) / \partial s > 0$ if and only if $q^*(\theta, s, w) < q^F(\theta)$ is similar. ///

Proof of Lemma 2:

The properties of γ_t, $t = H, L$, stated in parts (i) and (ii) directly follow from the definitions of γ_t and the fact that $z(\theta, q)$ attains its unique maximum at $q^F(\theta)$ for each $\theta = \theta_H, \theta_L$. To prove part (iii), fix $q > q^F(\theta_H)$ and differentiate $z(\theta_H, \gamma_H(q)) = z(\theta_H, q)$ with respect to q. Then:

$$\frac{\partial z(\theta_H, \gamma_H(q))}{\partial \gamma_H} \frac{\partial \gamma_H(q)}{\partial q} = \frac{\partial z(\theta_H, q)}{\partial q}.$$

Since $\gamma_H(q) < q^F(\theta_H) < q$, it must be true that $\partial z(\theta_H, \gamma_H(q)) / \partial \gamma_H > 0$ and $\partial z(\theta_H, q) / \partial q < 0$ in the above equation. Hence, $\partial \gamma_H / \partial q < 0$ must hold. Next, consider $q < q^F(\theta_L)$ and differentiate $z(\theta_L, \gamma_L(q)) = z(\theta_L, q)$ with respect to q, which yields:

$$\frac{\partial z(\theta_L, \gamma_L(q))}{\partial \gamma_L} \frac{\partial \gamma_L(q)}{\partial q} = \frac{\partial z(\theta_L, q)}{\partial q}.$$

Since $q < q^F(\theta_L) < \gamma_L(q)$ here, $\partial z(\theta_L, \gamma_L(q)) / \partial \gamma_L < 0$ and $\partial z(\theta_L, q) / \partial q > 0$ must hold. As such, $\partial \gamma_L / \partial q < 0$ must hold. This proves part (iii). ///

Proof of Propositions 3 and 4:

See the main text. ///

〈Appendix B〉

This appendix explains how the paper's analysis may change if the audit quality, q, affects the damage distribution. Let $G(D \mid q, s)$ be the distribution function of D and let

$$\lambda(q, s, w) \equiv E[\min\{w, D\} \mid q, s] = \int_0 \min\{w, D\} dG(D \mid q, s) \tag{B.1}$$

be auditor w's expected liability loss conditional on audit failure. This is a counterpart of $\lambda(s, w)$ in (2). As in Dye (1995), assume that $G_q(D \mid q, s) > 0$ and $G_{qq}(D \mid q, s) < 0$, which implies that $\lambda(q, s, w)$ is decreasing and convex in q.

Since auditor w chooses an audit quality to minimize his total expected cost of auditing firm θ, $q^*(\theta, s, w)$ must be a solution to the following first-order condition:

$$c'(q) = -[p_q(\theta, q)\lambda(q, s, w) + p(\theta, q)\lambda_q(q, s, w)]. \tag{B.2}$$

By totally differentiating (B.2) with respect to w and θ (along with the second-order condition), it is easy to check that $q^*(\theta, s, w)$ increases with (θ, w). However, $q^*(\theta, s, w)$ in this case does not necessarily increase with s. In fact, one can verify that it increases with s if, and only if:

$$\lambda_{qs} < (-p_q / p)\lambda_s. \tag{B.3}$$

Since the right-hand side is positive, (B.3) holds always if the left-hand side is negative. However, note that:

$$\lambda_{qs}(q, s, w) = -\int_0^w \frac{\partial^2 G(D \mid q, s)}{\partial q \partial s} dD,$$

whose sign depends on the cross partial derivate of G, i.e., $G_{qs}(D \mid q, s)$.

It seems intuitively appealing to assume that G_{qs} satisfies (B.3), in which case a more stringent liability law (i.e., a higher s) induces a higher-quality audit for any (θ, w); otherwise, auditor w provides a lower-quality audit when the liability law becomes more stringent. Given (B.3), it is straightforward to verify that the paper's analysis follows through with no qualitative change. For example, the supply of audit qualities for firm θ, $\boldsymbol{q}^*(\theta, s, \boldsymbol{W}) \equiv (q^*(\theta, s, w_h), q^*(\theta, s, w_l))$, moves in a northeast direction as s increases because (B.3) ensures that $q^*(\theta, s, w)$ increases with s for any given (θ, w). Hence, the trajectory $\eta(\theta, s, \boldsymbol{W})$ for each θ in this case is similar to the one depicted in Figure 3. Also, following the logic in Section 4.1, one can define $s^F(\theta, w)$ to be the value of s that solves:

$$-[p_q(\theta, q^F(\theta))\lambda(q^F(\theta), s, w) + p(\theta, q^F(\theta))\lambda_q(q^F(\theta), s, w)] = \theta b'(q^F(\theta)). \tag{B.4}$$

That is, $s^F(\theta, w)$ is the liability law that induces auditor w to provide the first-best audit quality for firm θ. As in the main text, $s^F(\theta, w)$ decreases with w.

Given the relations established above, the analysis in the main text remains unchanged in a qualitative sense. Each firm θ makes its auditor hiring decision based on the cutoff function γ, as explained in Proposition 2, which has nothing to do with the damage distribution function G. Next, depending on whether $s^F(\theta, w)$ varies with θ, results similar to Proposition 3 follow. Finally, along with conditions that ensure an ordering of $s^F(\theta, w)$ similar to (15) (i.e., conditions corresponding to (14-1) and (14-2) in the main text), the efficiency implications of the auditor-client match and the impact of change in s on the equilibrium auditor-client match are all readily inferable from Proposition 4 in Section 5 with no qualitative change.

감사인의 법적책임과 감사인-피감사기업의 맷칭문제

배수일*

요 약

본 논문은 기업들이 감사로부터 얻는 효익이 상이하고 감사인들의 법적책임에 따른 개인적 지불능력이 상이한 경우를 상정하고, 이 경우에 있어서의 감사인과 피감사기업간의 맷칭문제를 불완전한 감사모델을 이용하여 연구하였다. 연구결과에 따르면 상이성에 따른 경제적 손실이 거의 언제나 불가피하게 발생됨을 알 수 있다. 감사인의 법적책임에 영향을 미치는 법률 환경의 변화는 감사인-피감사기업의 맷칭에 변화를 가져오게 되는데, 사회적으로 최적의 법률적 환경은 너무 극단적으로 엄격하지도 느슨하지도 않은 환경임을 보여주고 있다. 이러한 최적의 환경에서는 높은 (낮은) 질적 수준의 감사서비스를 제공하는 감사인이 감사로부터 얻는 효익이 큰 (작은) 기업을 감사하게 되는 형태의 감사인-피감사기업 맷칭이 이루어진다. 또한 본 논문은 감사인-피감사기업의 맷칭에 대한 실증적인 함의도 논의하고 있다.

주제어: 감사인의 법적책임, 감사인-피감사기업의 맷칭문제

* 성균관대학교