Audit-Client Bid-Seeking Behavior: Modeling Private Negotiation versus Auctions

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SUMMARY

The purpose of this paper is to propose a comprehensive model of audit-clients' bid-seeking choice to solicit privately negotiated bids (i.e., one bidder) versus engaging in an auction (i.e., multiple competitive bidders) for audit services, and to investigate the outcomes of that model in terms of the likely number of bidders, audit fees, audit quality, and additional non-billed services. Investigating this issue is motivated by clients' frequent, yet seemingly anomalous, choice to select an auditor through negotiation rather than competitive bidding (e.g., Copley and Doucet 1993; Johnstone et al. 2003), and the recently reduced number of highest-quality audit firm providers (i.e., Andersen LLP's elimination from the market for audit services). Results from numerical examples show that equilibrium levels of service and equilibrium fees simultaneously increase with the efficiency of auditors, and there is a lower fee per unit of service as the efficiency of the auditor increases. Considering the client's perspective, our overall results illustrate conditions under which clients will choose auctions, negotiation, or a second-tier auditor, demonstrating the importance of unique contextual circumstances in audit-client bid-seeking behavior.

Key Words: auction, audit, competitive bidding, auction, negotiation, pricing, quality.

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INTRODUCTION

The literature on auctions and negotiation suggests that auctions will yield higher service quality and/or a lower price than negotiation (e.g., Spence 1975; White 1975; Leland 1977; McAfee and McMillan 1987; O'Keefe and Westort 1992; Bulow and Klemperer 1996). However, the limited empirical evidence on the extent of negotiation versus auctions in auditing and other contexts reports that a significant proportion of bid seekers choose negotiation (Ettredge and Greenberg 1990; Copley and Doucet 1993; Lusht 1996; Johnstone et al. 2003). Given the recently reduced number (from five to four, due to the collapse of Andersen LLP) of highest-quality providers of audit services, this phenomenon seems likely to continue or even intensify. Yet, there is relatively little research that addresses bid seekers' choice between negotiation and an auction.

Economists who have considered market participants' seemingly anomalous choice to use negotiation rather than an auction (e.g., McAfee and McMillan 1988; Harstad 1990; Wang 1993) cite the costs associated with setting up a bidding contest and dealing with multiple bidders as potential explanations for that choice. Two papers provide evidence on this issue in auditing. The first addresses the issue from a demand perspective, showing that audit clients' private-information revelation costs are associated with their decision to seek negotiated bids, whereas their dissatisfaction with a prior auditor over fees and service levels are associated with their decision to seek an auction (Adams et al. 2002). The second paper addresses the issue from a supply perspective, showing that auditors increase the quality of their bids (in terms of effort and intention to use industry specialist personnel) and reduce their audit fees when they are forced by clients to engage in an auction (Johnstone et al. 2003).

The purpose of this paper is to propose a comprehensive model of audit-clients' bid-seeking choice to seek negotiated bids (i.e., one bidder) versus engaging in an auction (i.e., multiple bidders) for audit services, and to investigate the outcomes of that model in terms of the likely number of bidders, audit fees, audit quality, and additional non-billed services. To our knowledge, this is the first model that encompasses both auctions and negotiated bids in one model, with negotiated bids viewed as a special case of auctions in which only one auditor is invited to bid. Using this analytical modeling approach, we are able to simultaneously investigate demand and supply perspectives in this decision setting, and provide an important theoretical foundation for future empirical research in this area.

Our model controls for important differences between the generic auction environment (e.g., sales of real estate, art, or businesses) and the auditing environment. First, the bid seeker in auditing (i.e., the audit client) is purchasing a service rather than selling an object. Second, audits often include non-billed services in the audit-service "package" (e.g., assignment of industry specialists, advice on improving internal controls, and advice on structuring financial accounting transactions), whereas auctions of objects do not contain such "add-ons". By incorporating these features into our models, we provide a significant contribution to the fundamental economics literature on auctions.

Results from numerical examples show that equilibrium levels of service and equilibrium fees simultaneously increase with the efficiency of auditors, and there is a lower fee per unit of service as the efficiency of the auditor increases. Considering the client's perspective, our overall results illustrate conditions under which clients will choose auctions, negotiation, or a second-tier auditor. For example, as a client's cost of requesting a bid increases or when the market for audit services contains auditors that are more inefficient, it is more likely that the client will choose negotiation, or that the client will request services from a second-tier auditor, rather than choose an auction. It is also more likely the client will request services from a second-tier auditor rather than choose negotiation as the cost of requesting a bid increases or when the market for audit services contains auditors that are more inefficient. Further, we find that when second-tier auditors' are able to provide sufficiently high utility and the cost of requesting a bid is high, the client will request services from a second-tier auditor.

We also find that when the range of auditor efficiency is increased, while preserving the overall mean efficiency in the market for audit services, we find an example illustrating that the client chooses an auction even as the cost of requesting a bid increases moderately. In contrast, when the range and standard deviation of auditor efficiency remains the same, while the overall mean efficiency in the market for audit services increases, we find an example illustrating that the client will choose negotiation rather than choose an auction, and will choose a second-tier auditor rather than choose negotiation.

MODEL

Our model allows two mechanisms by which a client selects an auditor: negotiations with one auditor or an auction with competing auditors. Furthermore, we allow the client to mix these two approaches as it sequentially selects the subset of the N first-tier auditors to interact with at each stage in its dynamic problem. As shown in Figure 1, for $N = 3,$ this results in four possible bid-seeking scenarios: (1) they may negotiate with individual auditors sequentially until they accept one of those bids, or (2) they may negotiate with an individual auditor, reject that bid, and then seek bids via an auction, one of which they will accept, or (3) they may engage in an auction, reject those bids, and then negotiate with an individual auditor whose bid they accept, or (4) they may engage in an auction only and accept one of those bids. As we note above, option 4, (i.e., an auction) might intuitively seem the most economically appealing choice, yet empirical evidence demonstrates the potential attractiveness of negotiation. We provide an analytic model below that attempts to determine the important determinants of, and outcomes associated with, the choice to use negotiation or to engage in an auction.

[Insert Figure 1 here]

We assume that the audit is valuable to the client. Specifically, if the auditor delivers a quantity of service, q, then the client's benefit is $V(q),$ with $V_q > 0$ and $V_{qq} < 0,$ where subscripts denote derivatives. This assumption is reasonable if q is viewed to be the level of services that the auditor provides. If q is instead interpreted to be the level of scrutiny in an audit, then the assumption might not be appropriate if the client could have negative private information about the firm that it hopes will not be publicly revealed by the audit. However, the more the audit reveals information that is news to both the client and the public, the more a higher q value can be expected to reduce uncertainty to all parties concerned about the prospects of the firm, which should increase firm value on average if any concerned parties are risk averse. So our assumption is appropriate the more that q measures the level of services and/or the more it measures the extent to which the audit reveals information previously unknown to all concerned parties. We also assume that the level of service is verifiable, so issues of contracting and enforcing q are not addressed in the paper.

The client incurs two costs. The first is the fee, f, that is paid to the winning auditor. The client also pays c per auditor that it deals with at each and every stage of the engagement exercise. Assuming that the total number of auditors that the client negotiates with and/or invites to bid is n, the client's utility function is $V(q) - f - nc$. Any costs associated with responding to the audit report are implicitly assumed to be captured in $V(\cdot)$.

While each of the N first-tier auditors can deliver q, each experiences a different cost according to its efficiency with this particular audit job. Specifically, with efficiency level θ_i, auditor i's ($i = 1, \ldots, N$) cost of providing service q_i is $C(q_i, \theta_i)$. We assume that $C_q > 0$, $C_\theta > 0$, $C_{qq} \geq 0$, and $C_{q\theta} > 0$. It is common knowledge that efficiency levels are independently and identically distributed, according to the cdf $G(\cdot)$, with support $[\underline{\theta}, \overline{\theta}]$. The most efficient auditor has (in)efficiency level $\underline{\theta}$, and the least efficient auditor has (in)efficiency level $\overline{\theta}$. Auditor i is initially uninformed about its efficiency level for the client, but can learn its realization θ_i at a cost $k \geq 0$.

We model a reduced form of negotiation in which the client randomly selects one of the auditors and makes a take-it-or-leave-it demand that the auditor provide a reserve utility r. The auditor must decide first whether to pay k to learn its efficiency level. That is, prior to learning its efficiency, the auditor needs its expected profits to exceed the cost k. If expected profits exceed k, then the auditor must next decide whether it can profitably deliver the client utility r. Given an efficiency level θ, this requires that a two-tuple (q,f) exists such that $V(q) - f = r$ and that $f - C(q,\theta) \geq 0$. The equality assures the auditor provides utility r to the client (at a point after the client has incurred cost c) and the inequality assures that the auditor with θ earns nonnegative profits (at a point after the auditor has incurred cost k). If the auditor does not submit a bid that provides r to the client, the client seeks a bid from another auditor.

In the case of competitive bidding, the client chooses the number of auditors to participate, as well as the reservation utility. These variables must be chosen so that each auditor earns an expected profit in the auction to justify learning its efficiency level at a cost of k. The auction is a first-price sealed-bid sale, bids are a two-tuple (q,f), and the client chooses the auditor offering the highest value of $V(q) - f$, assuming that value exceeds the reservation utility.

We have discussed negotiations and competitive bidding as two distinct mechanisms for selecting an auditor. However, within our model, negotiations are actually just a special case of competitive bidding when only one auditor is invited to bid. In this situation, any auditor who bids will simply meet the reservation utility.

We make two further assumptions about the engagement process. First, we suppose that there is a publicly-known minimum level $\underline{q}$ of audit service that is required. This is interpreted as the basic audit that is legally required for the client. Thus, auditors must bid at least $\underline{q}$, but they can also bid more, with the difference interpreted as additional non-billed services. Second, we assume that the client can guarantee itself a utility level of $\overline{u}$ through a second-tier auditor. We suppose that $\overline{u}$ is net of any costs associated with selecting, informing and negotiating with this auditor, and we do not model that process. The client has the option at any stage to shift from the first-tier auditor pool to select the second-tier auditor. If the client has exhausted the pool of first-tier auditors without selecting one, then it must select the second-tier auditor.

We start our analysis at the point that n auditors have entered the auction, so that n payments of k and c have been made by the auditor and client, respectively, and therefore can be viewed as sunk costs. Define the following two functions:

$$q(\theta) = \arg\max_{q \geq \underline{q}} \; V(q) - C(q, \theta), \qquad (1)$$

and

$$S(\theta) = V(q(\theta)) - C(q(\theta), \theta).$$

The function $q(\theta)$ is the efficient quality level for an auditor with θ, recognizing the need to satisfy the constraint on the minimum quality level (see the proof of Proposition 1). $S(\theta)$ is the maximum surplus possible between the client and an auditor with θ. We assume that $S(\underline{\theta}) > 0$, i.e., that the level of surplus is positive for at least the most efficient type of auditor. For an auditor to profitably provide a level of utility u to the client, it is necessary that the auditor's efficiency level satisfies $S(\theta) \geq u$. We now define:

$$\Theta(u) = \begin{cases} \overline{\theta} & \text{if } u \leq S(\overline{\theta}) \\ S^{-1}(u) & \text{if } S(\overline{\theta}) \leq u \leq S(\underline{\theta}) \\ \underline{\theta} & \text{if } u \geq S(\underline{\theta}) \end{cases}$$

Thus, $\Theta(u)$ is the highest efficiency type such that all values of θ less than $\Theta(u)$ can profitably deliver utility u to the client. More precisely, $S(\theta) \geq u$ if and only if $\theta < \Theta(u)$. There are two extreme cases. If $\Theta(u) = \overline{\theta}$, then all efficiency levels can profitably deliver utility u. If $\Theta(u) = \underline{\theta}$, though, then no auditor can profitably deliver utility u. We now analyze the properties of these three functions.

Lemma 1:

a) $q(\theta)$ is nonincreasing in θ on $[\underline{\theta}, \overline{\theta}]$.

b) $S(\theta)$ is strictly decreasing in θ on $[\underline{\theta}, \overline{\theta}]$.

c) $\Theta(u)$ is nonincreasing in u on R^1.

Equilibrium Bidding at Each Stage

Our model assumes that once the negotiation/bidding identifies an auditor willing to meet or exceed the reservation utility, then the auditor search problem ends. Our model also assumes that the client cannot return at a later stage in the game to any auditor from an earlier stage. Thus, if the negotiations/bidding to date have not selected an auditor then, going forward, the client is restricted to only those auditors remaining in the auditor pool. This means that an auditor that has been selected to participate in a particular stage is unconcerned that its bid might reveal information about its efficiency that could be used against it in a later stage. Therefore, when selected, an auditor effectively views itself to be in a single-shot negotiations/bidding game.

We now determine the equilibrium bidding strategy for one stage in the game given that $n \geq 1$ bidders are active and that the client has announced a reservation utility r that must be met before any auditor will be chosen. The equilibrium bidding strategy follows Che (1993) except for the addition of the constraint on bidding that $q \geq \underline{q}$. For $\theta \leq \Theta(r)$, and letting C_2 denote the derivative of C with respect to its second argument, we define

$$f(\theta) = C(q(\theta),\theta) + \int_{t=\theta}^{\Theta(r)} C_2(q(t),t)\left[\tfrac{1-G(t)}{1-G(\theta)}\right]^{n-1} dt. \qquad (2)$$

Given the auditor has efficiency level θ, the equilibrium fee consists of the cost of providing $q(\theta)$, plus a reasonable return.

The two elements of a bid, an audit service level and a fee, combine to provide a utility level for the client. The client selects the auditor offering it the highest utility, conditional upon that utility at least meeting the reservation utility. The equilibrium bidding strategy is now determined.

Proposition 1: Assume n auditors, each having learned their efficiency levels, and a reservation utility r announced by the client. The equilibrium bidding strategy is for auditor $i = 1,\ldots,n$ to bid the pair $(q(\theta_i), f(\theta_i))$ if $\theta_i \leq \Theta(r)$, and not to bid otherwise.

From (2), observe that auditor i with $\theta_i \leq \Theta(r)$, conditional on winning, has profit

$$f(\theta_i) - C(q(\theta_i),\theta_i) = \int_{t=\theta_i}^{\Theta(r)} C_2(q(t),t)\left[\frac{1-G(t)}{1-G(\theta_i)}\right]^{n-1} dt.$$

Therefore, auditor i with $\theta_i \leq \Theta(r)$ has unconditional expected profits of

$$\int_{t=\theta_i}^{\Theta(r)} C_2(q(t),t)[1-G(t)]^{n-1} dt. \qquad (3)$$

Since an auditor must pay k to learn its efficiency level, the maximum number of auditors willing to enter the auction, n_k, solves the following zero-profit condition:

$$\int_{\theta=\underline{\theta}}^{\Theta(r)} \int_{t=\theta}^{\Theta(r)} C_2(q(t),t)[1-G(t)]^{n_k-1} dt dG(\theta) - k = 0.$$

By a change in the order of integration, this reduces to:

$$\int_{t=\underline{\theta}}^{\Theta(r)} C_2(q(t),t)[1-G(t)]^{n_k-1}G(t)dt - k = 0. \qquad (4)$$

Client's Dynamic Problem: Formulation

We now turn to the client's dynamic problem. Given equilibrium bidding from Proposition 1, the client must decide at each stage how many auditors to invite and what reservation utility to set. The client can also at any stage shift to the backup second-tier auditor. The state of the client's dynamic problem is the size of the pool of potential auditors who have not yet been engaged in negotiations/bidding with the client. Let the state be represented by t and notice that t varies from N to 0. Let $U(t)$ be the client's expected utility optimally going forward from stage t, as $t = N,\ldots,0$. $U(t)$ implicitly assumes that none of the $N-t$ auditors that the client has already engaged in negotiations/bidding won the contract. Then $U(0) = \overline{u}$ since at $t = 0$ the client has exhausted the pool of N first-tier auditors and must go with the backup auditor. Let $G^{1:n}(\bullet) \equiv 1-(1-G(\bullet))^n$. Then $G^{1:n}(\bullet)$ is the cdf of $\theta^{1:n}$, where $\theta^{1:n} \equiv \min(\theta_1,\ldots,\theta_n)$, i.e., the lowest-order statistic. For $1 \le t \le N$,

$$U(t) = Max\left[\overline{u}, \left\{\begin{array}{c} \underset{r,n}{Max} \left\langle \int_{\theta=\underline{\theta}}^{\Theta(r)} [V(q(\theta)) - f(\theta)]dG^{1:n}(\theta) + U(t-n)(1-G^{1:n}(\Theta(r))) - nc \right\rangle \\ s.t. \quad 1 \le n \le t \\ \int_{t=\underline{\theta}}^{\Theta(r)} C_2(q(t),t)[1-G(t)]^{n-1}G(t)dt \ge k \end{array}\right\}\right]$$

To understand $U(t)$, notice that the client at state t must choose between the backup auditor, which offers a utility $\overline{u}$, and continuing to negotiate with first-tier auditors. If the client chooses the latter, then two further decisions must be made: the reserve utility, r, and the number of auditors to engage this stage, n. Notice both that n must be at least 1 but it cannot exceed t, the size of the remaining pool of auditors, and that the client incurs a cost nc with the choice of n auditors. Notice also that the choice of n and r must offer each of the n auditors sufficient expected profits this stage to recover their cost k of determining their efficiency level (see equation (4)). A further point to note is that if the client engages n auditors this stage without awarding the contract, then the client's expected utility going forward is $U(t-n)$. Finally, if the client selects $n = 1$, then the auction collapses to a negotiation in which the client proposes a take-it-or-leave-it utility to the auditor. For $n = 1$, it can be shown that $f(\theta)$ in (2) reduces to $V(q(\theta)) - r$. Thus, the auditor accepts the client's demand of utility r if and only if $\theta \leq \Theta(r)$, and does so by offering $q(\theta)$ and a fee of $V(q(\theta)) - r$, i.e., the auditor just meets the client's reservation utility demand.

The Perfect Bayesian Equilibrium is for the client to choose n, r, and when to shift to the backup auditor according to the dynamic programming problem, and for auditors to bid according to Proposition 1. Notice that neither the client's strategy nor any auditor's bidding strategy is affected by the observed history of the bidding in earlier stages.

Client's Dynamic Problem: Analysis

We now analyze the solution to this dynamic problem, beginning by identifying the optimal reservation utility. To do so, suppose that the client is at a particular stage in the game, has selected $n \geq 1$ auditors to compete at this stage for the contract (with the cost nc of engaging these auditors considered sunk at this point), and views its expected utility of going forward, in the event that no auditor agrees to meet the reserve utility this period, to be $\hat{u}$. Then the optimal reservation utility solves:

$$\underset{r}{Max} \int_{\underline{\theta}}^{\Theta(r)} [V(q(\theta)) \; - f(\theta)] dG^{1:n}(\theta) + \hat{u}(1 - G^{1:n}(\Theta(r))) \qquad (5)$$

$$s.t. \qquad \int_{t=\underline{\theta}}^{\Theta(r)} C_2(q(t),t)[1 - G(t)]^{n-1} G(t) dt \geq k$$

The following proposition solves for the optimal reservation utility.

Proposition 2: Let r_1 solve:

$$r = \hat{u} + C_2(q(\Theta(r)),\Theta(r)) \; \bullet \; \frac{G(\Theta(r))}{g(\Theta(r))}.$$

Let r_2 solve the constraint in (5) with equality. The optimal reserve is $r^* = \min(r_1, r_2)$.

Thus, if k is small enough, the optimal reserve exceeds $\hat{u}$. Furthermore, in this case, the optimal reservation utility is independent of the number of bidders, n, a well-established result (see Myerson (1981)). If k is sufficiently large that the constraint in (5) is violated, then the client must reduce its reservation utility. It may be that k is so large that the client must abandon the reservation utility altogether and/or expect fewer than n auditors to participate.

In our model, the client commits to rejecting any bid that does not exceed the reserve utility. This has a benefit and a cost for the client. The benefit is that the reserve utility puts pressure on the auditors to bid more aggressively. The cost of the reserve utility, however, is that it also exposes the client to the possibility that none of the bidders is willing to provide the reservation utility level, in which case the client has to go with the backup.

EXAMPLE

Let $V(q) = 2\sqrt{q}$, $C(q,\theta) = q\theta$, and θ be distributed uniformly on $[a,b]$. That is, the cdf of θ is $G(\theta) = \dfrac{\theta - a}{b - a}$ and the pdf $g(\theta) = \dfrac{1}{b-a}$.

Level of Service (q), **Reservation Utility** (r^*), **and Fee** (f)

To solve for the efficient level of service, q, we use equation (1), that is,

$$q(\theta) = \arg\max_{q \geq \underline{q}} \; 2\sqrt{q} - q\theta$$

Taking the derivative with respect to q and setting the result equal to zero, we have $1/\sqrt{q} - \theta = 0$, or $q(\theta) = 1/\theta^2$. Consequently, $V(q(\theta)) = 2/\theta$, $C(q(\theta),\theta) = 1/\theta$, and $C_2(q(\theta),\theta) = q(\theta) = 1/\theta^2$. We assume for purposes of this example that $q(\theta) \geq \underline{q}$ for all θ on $[a,b]$.

In order for the auditor to profitably provide the client's requested utility, r, the auditor requires profit $f - C(q,\theta) \geq 0$, subject to $V(q(\theta)) - f = r$. The condition that $V(q(\theta)) - f = r$ implies that $2/\theta - f = r$, or $f = 2/\theta - r$. Substituting into the auditor's profit condition, the auditor requires that $2/\theta - r - 1/\theta \geq 0$, or $\theta \leq 1/r$, in order to be willing to bid to supply reservation utility r to the client. This result corresponds to the requirement that $S(\theta) \geq r$, with $\Theta(r) = 1/r$ for $1/b \leq r \leq 1/a$, as shown below.

Recall that the maximum surplus possible between the client and an auditor with efficiency θ is $S(\theta) = V(q(\theta)) - C(q(\theta),\theta)$. In this example, $S(\theta) = 2/\theta - 1/\theta = 1/\theta$, so $S^{-1}(u) = 1/u$. Therefore,

$$\Theta(u) = \begin{cases} b & \text{if } u \leq 1/b \\ 1/u & \text{if } 1/b \leq u \leq 1/a \\ a & \text{if } u \geq 1/a \end{cases}$$

To derive r^*, the client's optimal reservation utility to request, we solve for $r^* = r_1$ as specified in Proposition 2, assuming $1/b \leq r \leq 1/a$:

$$r^* = \hat{u} + C_2(q(\Theta(r^*)), \Theta(r^*)) \bullet \frac{G(\Theta(r^*))}{g(\Theta(r^*))}$$

$$r^* = \hat{u} + r^{*2} \bullet \frac{\frac{1}{r^*} - a}{1}$$

$$r^* = \sqrt{\frac{\hat{u}}{a}}$$

Therefore, $\Theta(r^*(\hat{u})) = \sqrt{\frac{a}{\hat{u}}}$.

To derive the fee, f, we use equation (2), that is, for $\theta \leq \Theta(r)$,

$$f(\theta) = C(q(\theta), \theta) + \int_{t=\theta}^{\Theta(r)} C_2(q(t), t)\left[\frac{1-G(t)}{1-G(\theta)}\right]^{n-1} dt.$$

In this example, $1 - G(\theta) = 1 - \frac{\theta - a}{b - a} = \frac{b - \theta}{b - a}$. Therefore, for $\theta \leq \sqrt{\frac{a}{\hat{u}}}$,

$$f(\theta) = \frac{1}{\theta} + \int_{t=\theta}^{\sqrt{\frac{a}{\hat{u}}}} \frac{1}{t^2}\left[\frac{b-t}{b-\theta}\right]^{n-1} dt.$$

To continue the example, we assume $N = 2$, that is, there are only two possible top-tier auditors who may bid.

Auction

Suppose the client chooses $n = 2$ bidders. Then $\hat{u} = \overline{u}$ because the client can turn only to the backup auditor if neither bidder bids above the reservation utility $\sqrt{\frac{\hat{u}}{a}}$. The bid fee is

$$f(\theta) = \frac{1}{\theta} + \int_{t=\theta}^{\sqrt{\frac{a}{\overline{u}}}} \frac{1}{t^2}\left[\frac{b-t}{b-\theta}\right] dt$$

$$= \frac{1}{\theta} - \frac{b}{1-\theta}(b\sqrt{\frac{\overline{u}}{a}} + \ln(\sqrt{\frac{a}{\overline{u}}}) - \frac{b}{\theta} - \ln(\theta). \qquad (6)$$

The client's expected utility is

$$\int_{\theta=\underline{\theta}}^{\Theta(r)} [V(q(\theta)) - f(\theta)] dG^{1:n}(\theta) + \overline{u}(1 - G^{1:n}(\Theta(r))) - nc$$

$$= \int_{\theta=a}^{\sqrt{\frac{a}{\overline{u}}}} [\frac{2}{\theta} - \frac{1}{\theta} + \frac{b}{1-\theta}(b\sqrt{\frac{\overline{u}}{a}} + \ln(\sqrt{\frac{a}{\overline{u}}}) - \frac{b}{\theta} - \ln(\theta)] \bullet 2(\frac{b-\theta}{b-a})(\frac{1}{b-a}) d\theta + \overline{u}(\frac{b - \sqrt{\frac{a}{\overline{u}}}}{b-a}$$

$$= \frac{1}{(b-a)^2}[2b - 2(a(b\sqrt{\tfrac{\overline{u}}{a}} + \ln(\sqrt{\tfrac{a}{\overline{u}}})) + 2\ln(a) - \overline{u}(b - \sqrt{\tfrac{a}{\overline{u}}})^2] - 2c. \qquad (7)$$

Negotiation

Using backward induction, suppose the first negotiation failed. Then the client can immediately go to the backup utility of $\overline{u}$ or pay c and negotiate with the remaining auditor. In the latter case, using the same approach as earlier, $r^*(\overline{u}) = \sqrt{\tfrac{\overline{u}}{a}}$. This means that the client's expected utility going forward is

$$\hat{u} = \int_{\theta=\underline{\theta}}^{\Theta(r)} [V(q(\theta)) - f(\theta)]dG^{1:n}(\theta) + \overline{u}(1 - G^{1:n}(\Theta(r))) - c$$

with $n = 1$, $V(q(\theta)) - f(\theta) = r$, and $\Theta(r) = \frac{1}{r} = \sqrt{\tfrac{a}{\overline{u}}}$. Recall that

$G^{1:n}(\theta) = 1 - (1 - G(\theta))^n$, so for $n = 1$, $G^{1:n}(\theta) = 1 - (1 - G(\theta)) = G(\theta) = \frac{\theta - a}{b - a}$.

Therefore,

$$\hat{u} = \sqrt{\tfrac{\overline{u}}{a}}\left(\frac{\sqrt{\tfrac{a}{\overline{u}}} - a}{b - a}\right) + \overline{u}\left(\frac{b - \sqrt{\tfrac{a}{\overline{u}}}}{b - a}\right) - c$$

$$\hat{u} = \frac{1 + b\overline{u} - 2\sqrt{a\overline{u}}}{b - a} - c$$

and the utility demanded in the first round of negotiating is

$$r^*(\hat{u}) = \sqrt{\frac{\hat{u}}{a}} = \sqrt{\frac{1 + b\overline{u} - 2\sqrt{a\overline{u}}}{a(b - a)} - \frac{c}{a}}.$$

Therefore, the overall expected utility for the client is

$$r^*(\hat{u})G(\Theta(r^*(\hat{u}))) + \hat{u}(1 - G(\Theta(r^*(\hat{u})))) - c$$

$$= r^*(\hat{u})\left(\frac{\frac{1}{r^*(\hat{u})} - a}{b - a}\right) + \hat{u}\left(\frac{b - \frac{1}{r^*(\hat{u})}}{b - a}\right) - c.$$

Substituting $r^*(\hat{u})$ and $(\hat{u})$ into the expression above and simplifying yields

$$\frac{1}{b - a} - \frac{2\sqrt{a}}{(b - a)^{3/2}}\sqrt{1 + b\overline{u} - 2\sqrt{a\overline{u}} - c(b - a)} + \frac{b}{(b - a)^2}(1 + b\overline{u} - 2\sqrt{a\overline{u}} - c(b - a)) - c.$$

Auditors' Equilibrium Fees and Quantities

With these derivations for our example, we can illustrate equilibrium fees and quantities, as well as how changes in the parameters affect the equilibrium. Table 1 provides examples of equilibrium fees and quantities for various levels of auditor efficiency θ, when θ is distributed uniformly on [1,2]. The equilibrium level of service, $q(\theta)$, is $1/\theta^2$. Consistent with Lemma 1a, $q(\theta)$ decreases with θ. Moreover, the equilibrium levels of service and equilibrium fees simultaneously decrease with θ. That is, in response to a client's announced reservation utility r^*, less efficient (higher θ) auditors offer a lower level of service and also charge an accordingly lower fee. However, consistent with the notion that θ represents (in)efficiency, $f(\theta))/q(\theta)$ is increasing in θ—less efficient (higher θ) auditors charge more per unit of service than more efficient (lower θ) auditors. The properties of these functions shown in Table 1 are characteristic for various combinations of parameters in our example. In particular, the same properties hold for all the conditions in Table 2. The client's equilibrium reservation utility for the auction, $r_A^* = \sqrt{\frac{\bar{u}}{a}}$, is 0.6325 and the reservation utility for negotiation, r_N^*, is 0.7246, calculated from (8). The equilibrium fee $f(\theta)$ in (6) is calculated for $\theta \leq \Theta(r^*) = 1/r^*$, at which point the auditor's unconditional expected profit in (3) equals zero. Denoting the reservation utility for the auction by $r_A^*$and the reservation utility for negotiation r_N^*, $1/r_A^* = 1.58$ and $1/r_N^* = 1.38$. If the first round of negotiation fails, the client asks the second-round bidder for a reservation utility equal to the auction reservation utility. In this example, the unconditional expected profit for an auditor of type θ in the auction exceeds that in negotiation (where applicable) by 0.048. Table 2 provides examples of conditions that lead the client to prefer negotiation or the backup auditor. This example illustrates that equilibrium levels of service and equilibrium fees simultaneously increase with the efficiency of auditors, and there is a lower fee per unit of service as the efficiency of the auditor increases.

[Insert Tables 1 and 2 here]

Client's Optimal Decisions – Increasing *c*

Table 2 shows the client's optimal decisions for our example across a range of conditions, including the conditions assumed in Table 1. Columns A1 and A2 have the same conditions except that *c,* the client's cost for requesting a bid from each first-tier auditor, increases to 0.05 from 0.01. In both columns, the support of θ is [1,2] and $\bar{u}$ (the utility the client receives from using the backup auditor) is 0.4. The client's equilibrium reservation utilities, r_A* and r_N*, are computed as described in the previous paragraph. In column A1, the client prefers an auction (with two auditors, EU_A = 0.6041, computed from (7)) to sequential negotiation with only one auditor at a time (EU_N = 0.5909, computed from (9)). Moreover, using the backup auditor is the least preferred option. The preference between an auction and sequential negotiation reverses in column A2, with the increase in *c.* In all the columns in Table 2, the client's equilibrium reservation utility exceeds $\bar{u}$, the utility the client receives from using the backup auditor. With *k* (auditor *i*'s cost of determining θ_i) equal to the indicated values, the client will invite n = 2 auditors to bid if an auction is optimal.

This discussion illustrates that as a client's cost of requesting a bid increases, it is more likely that the client will choose negotiation, or that the client will request services from a second-tier auditor, rather than choose an auction. It is also more likely the client will request services from a second-tier auditor rather than choose negotiation as the cost of requesting a bid increases.

Client's Optimal Decisions – Increasing *b*

To illustrate the effect of increasing b, Columns B1 and B2 differ from A1 and A2, respectively, only in $b = 4$. This change increases the mean, range, and standard deviation of θ, where θ represents auditor inefficiency. Increasing b does not affect r_A* but does affect r_N*, because of its dependence on b; r_N* decreases from A1 to B1 and from A2 to B2, with corresponding increases in $1/r_N$*, the threshold inefficiency for auditors' willingness to bid to provide r_N*. Consequently, the client's expected utilities decrease with the exposure to less efficient auditors. The auction is less attractive to the client in B1 than in A1, but is still the most preferred option ($EU_A = 0.4649$ is the maximum expected utility). However, in B2, the client now prefers using the backup auditor ($EU_B = 0.4000$ is the maximum expected utility). Columns C1 and C2 increase b even further, to 8. Even with the lower cost (C1), the client now prefers negotiation to an auction ($EU_N = 0.4178$ is the maximum expected utility); in C2, the client still prefers the backup auditor.

This discussion illustrates that when the market for audit services contains auditors that are more inefficient, it is more likely that the client will choose negotiation, or that the client will request services from a second-tier auditor, rather than choose an auction. It is also more likely the client will request services from a second-tier auditor rather than choose negotiation when the market for audit services contains auditors that are more inefficient.

Client's Optimal Decisions – Increasing $\bar{u}$

To illustrate the effect of increasing $\bar{u}$, Columns D1 and D2 differ from A1 and A2, respectively, only in $\bar{u} = 0.6$. Increasing $\bar{u}$ increases both r_A* and r_N*, with corresponding decreases in $1/r_A$* and $1/r_N$*. Consequently, the client's expected utilities increase. The auction remains the most attractive to the client in D1, as in A1, and negotiation remains the most preferred option in D2, as in A2. Columns E1 and E2 increase $\bar{u}$ even further, to 0.8. Even with the lower cost (E1), the client now prefers negotiation to an auction (EU_N = 0.8022 is the maximum expected utility); in E2, the client now prefers the backup auditor (EU_B = 0.8000 is the maximum expected utility). Thus, we find that when second-tier auditors' are able to provide sufficiently high utility and the cost of requesting a bid is high, the client will request services from a second-tier auditor.

Client's Optimal Decisions – Preservation of the Mean Auditor Efficiency

Comparing columns A1 and A2 to F1 and F2 illustrates a case where *a* is decreased and *b* is increased to preserve the mean of θ at 1.5. This naturally increases the range and standard deviation of the distribution, and also provides more efficient auditors. As is intuitive, the client's expected utilities increase from A1 to F1 and from A2 to F2, enough so that an auction is now the preferred option even with the higher cost in F2 (EU_A = 0.5808). A similar comparison can be made between columns G and B, though with different results for the client's preferences because of the higher inefficiencies in G and B than in A and F. Thus, we find that when the range of auditor efficiency is increased, while preserving the overall mean efficiency in the market for audit services, the example illustrates that the client chooses an auction even as the cost of requesting a bid increases moderately.

Client's Optimal Decisions – Preservation of the Range and Standard Deviation of Auditor Efficiency

Comparing columns A1 and A2 to G1 and G2 illustrates a case where θ's range and standard deviation remain unchanged, though the mean increases *a* and *b* increased. Here, both r_A* and r_N* decrease from A1 to G1 and A2 to G2, with corresponding increases in $1/r_A$* and $1/r_N$*. Consequently, the client's expected utilities decrease. Moreover, the client's most preferred choice changes from the auction to negotiation from A1 to G1, and from negotiation to the backup auditor from A2 to G2. Thus, in contrast to the immediately preceding example, when the range and standard deviation of auditor efficiency remains the same, while the overall mean efficiency in the market for audit services increases, our example illustrates that the client will choose negotiation rather than choose an auction, and will choose a second-tier auditor rather than choose negotiation.

Client's Optimal Decisions – Multiple Changes to Assumptions

Finally, comparing columns E1 and E1 to F1 and F2 illustrates the complexity with multiple changes. The reservation utility r_A* = 0.8944 for all four columns, though r_N* decreases from E to F. θ's mean is unchanged, but the range and standard deviation increase from E to F. Here, the client prefers the auction in both F1 and F2, but prefers negotiation in E1 and the backup auditor in E2.

CONCLUSIONS

In this paper, we developed a model encompassing both auctions and negotiated bids with the institutional features of the auditor-client interaction in mind. We further contribute to theory development by incorporating bidding-related costs for both auditors and clients, and a constraint on the minimum service level required. We derived the auditor's equilibrium bidding strategy, that is, a (quantity, fee) two-tuple in response to the client's announced equilibrium reservation utility. Results from numerical examples show that equilibrium levels of service and equilibrium fees simultaneously increase with the efficiency of auditors, and there is a lower fee per unit of service as the efficiency of the auditor increases. From the client's perspective, our numerical examples demonstrate the importance of the client's cost of requesting a bid in understanding a client's choice to engage in negotiation, an auction, or to hire a second-tier auditor, which is consistent with prior literature. However, we also demonstrate the importance of the relative efficiency of available auditors in the market for audit services, and the nature of second-tier auditors in understanding audit-client bid-seeking behavior. Ultimately, our theoretical model and numerical examples help to underscore the complexities involved in audit-client bid-seeking behavior.

APPENDIX

Proof of Lemma 1:

a) Define $\tilde{q}(\theta) = \arg\max V(q) - C(q,\theta)$ and let numbered subscripts on functions denote derivatives with respect to the corresponding argument. Then $V_1(\tilde{q}(\theta)) - C_1(\tilde{q}(\theta),\theta) = 0.$ Therefore

$$\tilde{q}'(\theta) = \frac{C_{12}(\tilde{q}(\theta),\theta)}{V_{11}(\tilde{q}(\theta)) - C_{11}(\tilde{q}(\theta),\theta)} < 0.$$

It is easily seen that

$$\frac{d}{dq}(V(q) - C(q,\theta)) > 0 \text{ for } q < \tilde{q}(\theta).$$

Therefore,

$$q(\theta) = \begin{cases} \tilde{q}(\theta) & \text{if } \tilde{q}(\theta) \geq \underline{q} \\ \underline{q} & \text{otherwise} \end{cases}$$

Thus, $q(\theta)$ is nonincreasing.

b) Suppose $\theta_1 < \theta_2$. Then,

$$\begin{aligned} S(\theta_2) &= V(q(\theta_2) - C(q(\theta_2),\theta_2) \\ &< V(q(\theta_2) - C(q(\theta_2),\theta_1) \\ &\leq V(q(\theta_1) - C(q(\theta_1),\theta_1) \\ &= S(\theta_1). \end{aligned}$$

Thus, $S(\theta)$ is strictly decreasing.

c) Follows from (b) and the definition of $\Theta(u)$. ■

Proof of Proposition 1: We first demonstrate that any auditor i that elects to bid will offer $q(\theta_i)$. To see this, observe that auditor i's optimal way to provide the client any level of utility u solves the following problem:

$$\begin{gathered} Max\, f - C(q, \theta_i) \\ s.t.\ V(q) - f = u \\ q \geq \underline{q} \end{gathered}$$

Substituting the first constraint into the objective function gives (1). Notice both that $V(q) - C(q, \theta_i)$ is the surplus in the transaction between auditor i and the client and that auditors bid the efficient level of services. Finally, we see that $V_q(q(\theta)) - C_q(q(\theta), \theta) = 0$ or $q'(\theta) = 0$. The former case holds when $q(\theta) > \underline{q}$ and the latter holds when $q(\theta) = \underline{q}$. Thus, we have that:

$$[V_q(q(\theta)) - C_q(q(\theta), \theta)]\, q'(\theta) = 0. \qquad (A1)$$

We now determine the equilibrium fee. Suppose that auditors $i = 2, \ldots, n$ bid $f(\theta_i)$ if $\theta_i \leq \Theta(r)$ and do not bid otherwise. Now consider auditor 1 with θ_1. If auditor 1 bids, we have seen that it will offer $q(\theta_1)$. To analyze the fee that will be bid, suppose that the auditor demands $f(\tilde{\theta})$, i.e., we view the auditor's problem as deciding what efficiency level $\tilde{\theta}$ to mimic in the fee portion of the bid. (The equilibrium fee function will have the property that the optimal value of $\tilde{\theta}$ is θ_1.) Define:

$$t(\theta) = V(q(\theta)) - f(\theta). \qquad (A2)$$

Then, auditor 1's problem is:

$$\max\ (f(\tilde{\theta}) - C(q(\theta_1),\theta_1))\ \cdot (1 - G(t^{-1}(V(q(\theta_1))\ - f(\tilde{\theta}))))^{n-1}.$$

Differentiating the expression above with respect to $\tilde{\theta}$, setting it equal to zero, and setting $\tilde{\theta} = \theta_1$ gives the following differential equation for $f(\bullet)$:

$$1 - G(\theta_1) + (n-1)(f(\theta_1) - C(q(\theta_1),\theta_1))g(\theta_1)/t'(\theta_1) = 0 \qquad (A3)$$

From $(A2)$ and $(A1)$, we have

$$\begin{aligned} t'(\theta_1) &= V_q(q(\theta_1))q'(\theta_1) - f'(\theta_1) \\ &= C_q(q(\theta),\theta)\ q'(\theta) - f'(\theta_1). \end{aligned}$$

This allows us to rewrite (5) as:

$$f'(\theta_1) - \frac{(n-1)g(\theta_1)(f(\theta_1) - C(q(\theta_1),\theta_1))}{1 - G(\theta_1)} = C_q(q(\theta),\theta)q'(\theta).$$

Equation (2) solves this differential equation with the boundary condition that an auditor with θ such that $V(q(\theta)) - C(q(\theta),\theta) = r$ bids a fee so as to break even. Thus, the boundary condition is $f(\Theta(r)) = C(q(\Theta(r)),\Theta(r))$. ■

Proof of Proposition 2: The proof relies on showing two results: (1) The left-hand side of the constraint is nonincreasing in r; (2) The objective function is increasing for $r < r_1$ and decreasing otherwise. These two results together mean that r_1 is the optimal reserve if the constraint holds at r_1; otherwise, the reserve needs to be reduced to satisfy the constraint, and it will be optimal to choose r_2.

The first result holds because the integrand is strictly positive and $\Theta(r)$ is nonincreasing Lemma 1c. To show the second result, we begin by calculating the first derivative of the objective function in (4), recalling from (2) that $f(\cdot)$ is a function of r:

$$\left[V(q(\Theta(r))) - C(q(\Theta(r)),\Theta(r)) - \hat{u} - C_2(q(\Theta(r)),\Theta(r)) \cdot \frac{G(\Theta(r))}{g(\Theta(r))} \right] \cdot g^{1:n}(\Theta(r)) \cdot \Theta'(r).$$

From the definition of $\Theta(r)$, we have that:

$$r = V(q(\Theta(r))) - C(q(\Theta(r)),\Theta(r)). \qquad (A4)$$

Therefore the first derivative can be rewritten as:

$$\left[r - \hat{u} - C_2(q(\Theta(r)),\Theta(r)) \cdot \frac{G(\Theta(r))}{g(\Theta(r))} \right] \cdot g^{1:n}(\Theta(r)) \cdot \Theta'(r).$$

Notice that the first derivative equals zero at $r = r_1$. It is sufficient for r_1 to be a global maximum that $r - \hat{u} - C_2(q(\Theta(r)),\Theta(r)) \cdot \frac{G(\Theta(r))}{g(\Theta(r))}$ is increasing in r. (Recall that $\Theta'(r)$ is negative.) By the envelope theorem, differentiating (A4) with respect r gives:

$$C_2(q(\Theta(r)),\Theta(r)) = \frac{-1}{\Theta'(r)}.$$

This result together with $\theta = \Theta(r)$ makes our goal to show that $\Theta^{-1}(\theta) + \Theta^{-1\prime}(\theta)\frac{G(\theta)}{g(\theta)}$ is decreasing in θ. This requires that $(G(\theta))^2 \cdot \Theta^{-1\prime}(\theta)/g(\theta)$ is increasing in θ. Equivalently, this condition is that $(G(\theta))^2 \cdot C_2(q(\theta),\theta)/g(\theta)$ is increasing in θ. Sufficient for this condition is that both $G(\theta)/g(\theta)$ and $G(\theta) \cdot C_2(q(\theta),\theta)$ are increasing in θ. The first of these is a standard assumption. The second of these conditions deals with:

$$\frac{d}{d\theta} C_2(q(\theta),\theta) = C_{12}(q(\theta),\theta)q'(\theta) + C_{22}(q(\theta),\theta).$$

Thus, this second condition holds if $q'(\theta)$ is not too negative. ■

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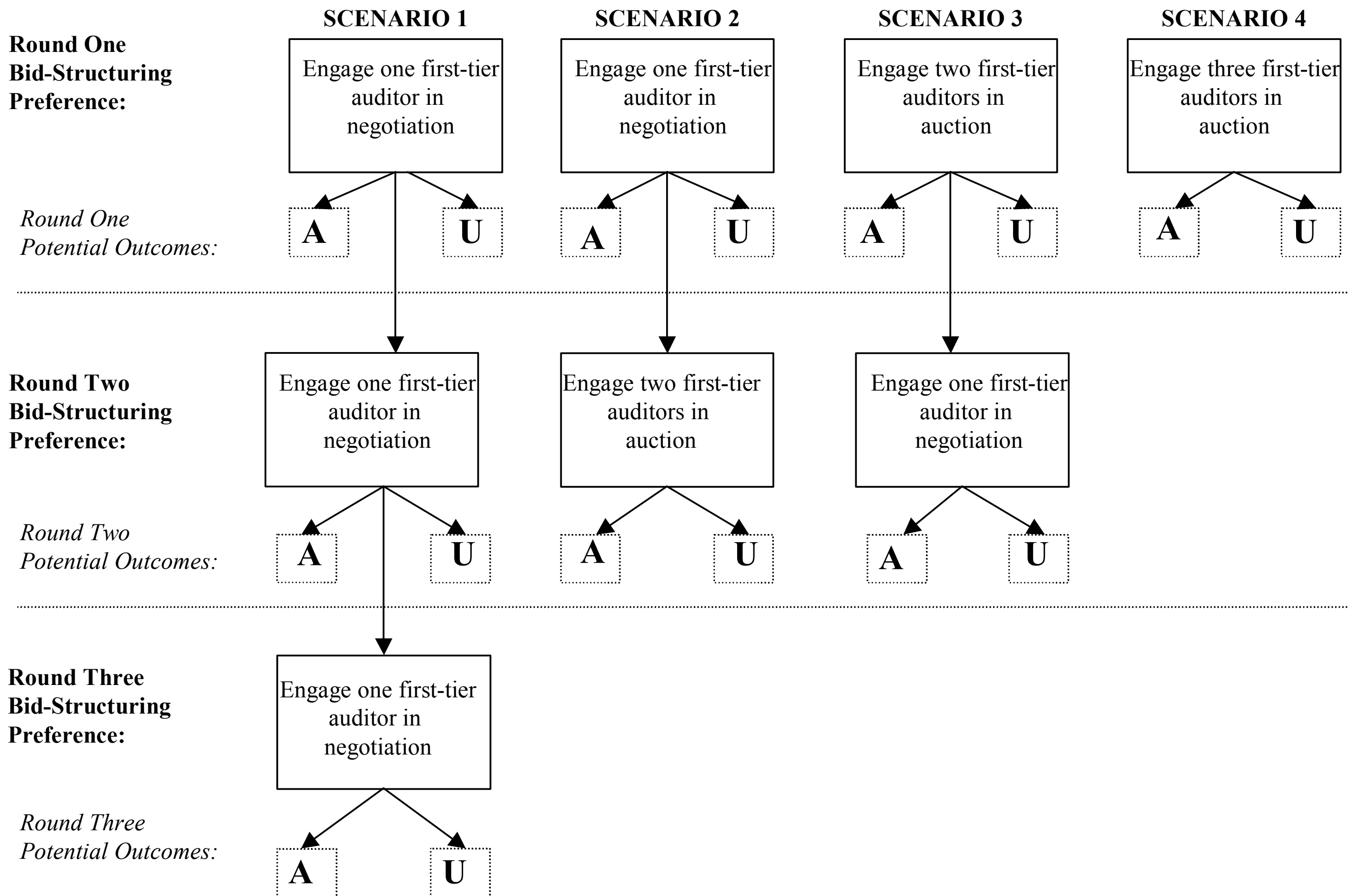
Figure 1
Negotiation vs. Auction, $N = 3$ first-tier auditors



Legend: A=accept first-tier auditor's bid; U=reject first-tier auditor's bid, and hire second-tier auditor

Table 1
Equilibrium Fees and Quantities
$a = 1$, $b = 2$, $c = 0.01$, and $\underline{\bar{u}} = 0.4$
$V(q) = 2\sqrt{q}$, $C(q,\theta) = q\theta$, $N=2$

		Auction			Negotiation		
θ	$q(\theta)$	$f(\theta)$	$\frac{f(\theta)}{q(\theta)}$	Auditor's Unconditional Expected Profit	$f(\theta)$	$\frac{f(\theta)}{q(\theta)}$	Auditor's Unconditional Expected Profit
1.00	1.000	1.277	1.277	0.277	1.229	1.229	0.229
1.10	0.826	1.121	1.356	0.190	1.067	1.291	0.142
1.20	0.694	0.991	1.427	0.126	0.930	1.340	0.078
1.30	0.592	0.880	1.488	0.078	0.811	1.371	0.029
1.40	0.510	0.784	1.537	0.042	N/A	N/A	N/A
1.50	0.444	0.698	1.571	0.016	N/A	N/A	N/A
1.58	0.400	0.632	1.581	0.000	N/A	N/A	N/A

Auditor efficiency θ is distributed uniformly on [1,2]. The equilibrium level of service, $q(\theta)$, is $1/\theta^2$. The client's equilibrium reservation utility is r^*; the reservation utility for the auction is 0.6325 and the reservation utility for negotiation is 0.7246. The equilibrium fee $f(\theta)$ in (2) is calculated for $\theta \leq \Theta(r^*) = 1/r^*$, at which point the auditor's unconditional expected profit in (3) equals zero. Denoting the reservation utility for the auction by r_A*and the reservation utility for negotiation r_N*, $1/r_A^* = 1.58$ and $1/r_N^* = 1.38$. In this example, the unconditional expected profit for an auditor of type θ in the auction exceeds that in negotiation (where applicable) by 0.048.

Table 2
Client's Expected Utilities with Auction, Negotiation, and Backup Auditor
$V(q) = 2\sqrt{q}$, $C(q,\theta) = q\theta$, $N=2$

	A1	**A2**	**B1**	**B2**	**C1**	**C2**	**D1**	**D2**	**E1**	**E2**	**F1**	**F2**	**G1**	**G2**
a	1	1	1	1	1	1	1	1	1	1	0.5	0.5	2	2
b	2	2	4	4	8	8	2	2	2	2	2.5	2.5	3	3
$\bar{u}$	0.4	0.4	0.4	0.4	0.4	0.4	0.6	0.6	0.8	0.8	0.4	0.4	0.4	0.4
c	0.01	0.05	0.01	0.05	0.01	0.05	0.01	0.05	0.01	0.05	0.01	0.05	0.01	0.05
r_A*	0.6325	0.6325	0.6325	0.6325	0.6325	0.6325	0.7746	0.7746	0.8944	0.8944	0.8944	0.8944	0.4472	0.4472
$\Theta(r_A*)$	1.5811	1.5811	1.5811	1.5811	1.5811	1.5811	1.2910	1.2910	1.1180	1.1180	1.1180	1.1180	2.2361	2.2361
r_N*	0.7246	0.6965	0.6596	0.6285	0.6398	0.6077	0.8005	0.7751	0.8951	0.8724	0.7367	0.7091	0.6334	0.6010
$\Theta(r_N*)$	1.3800	1.4358	1.5161	1.5911	1.5631	1.6456	1.2492	1.2901	1.1172	1.1462	1.3573	1.4103	1.5789	1.6640
k	0.1034	0.1034	0.0490	0.0490	0.0228	0.0228	0.0341	0.0341	0.0064	0.0064	0.0758	0.0758	0.0235	0.0235
EU_A	**0.6041**	0.5241	**0.4649**	0.3849	0.4177	0.3377	**0.6724**	0.5924	0.8014	0.7214	**0.6608**	**0.5808**	0.4006	0.3206
EU_N	0.5909	**0.5272**	0.4637	0.3910	**0.4178**	0.3413	0.6706	**0.6014**	**0.8022**	0.7274	0.6475	0.5771	**0.4020**	0.3337
EU_B	0.4000	0.4000	0.4000	**0.4000**	0.4000	**0.4000**	0.6000	0.6000	0.8000	**0.8000**	0.4000	0.4000	0.4000	**0.4000**
θ														
Mean	1.5	1.5	2.5	2.5	4.5	4.5	1.5	1.5	1.5	1.5	1.5	1.5	2.5	2.5
Range	1	1	3	3	7	7	1	1	1	1	2	2	1	1
Standard Deviation	0.289	0.289	0.866	0.866	2.021	2.021	0.289	0.289	0.289	0.289	0.577	0.577	0.289	0.289

Auditor efficiency θ is distributed uniformly on $[a,b]$. The client's utility from using a backup auditor is $\bar{u}$, and c is the client's cost for requesting a bid from each first-tier auditor.

Table 2, continued

The client's equilibrium reservation utility is r^*. The reservation utility for the auction is denoted by $r_A^*$and the reservation utility for negotiation is denoted by r_N^*. The equilibrium fee $f(\theta)$ in (2) is calculated for $\theta \leq \Theta(r^*) = 1/r^*$, and is used to calculate the client's expected utilities for using an auction or negotiation.

With k (auditor i's cost of determining θ_i) equal to the indicated values, the client will invite $n = 2$ auditors to bid if an auction is optimal. The client's optimal choice is indicated by expected utilities in boldface, where

EU_A = client's expected utility using an auction (i.e., multiple competitive bidders)
EU_N = client's expected utility using sequential negotiation (one bidder at a time)
EU_B = $\underline{u}$ client's expected utility using the backup auditor