Appendix A - Proof for the equilibrium bids in the Post-SOX regime

The expected utility of the audit firm from the non-audit services auction (which the firm can participate in only if it lost or bypassed the audit auction) is given by (8) and thus we get

$$b^2_{POST}(x) = B^2 \tag{A1}$$

In equilibrium, since both auditors participated in the first auction, the probability of winning in auction 1 if the cost is x is $\left(1-F_1(x)\right)$. Thus, the overall expected payoff for the audit firm from the entire game if it decides to participate in auction 1 first, given that $c^1 = x$, is as follows:

$$u_{POST}(x) = \begin{cases} (1-F_1(x))\left(b^1 - \dfrac{4xK-K^2}{4x}\right) + F_1(x)\left[\displaystyle\int_0^{B^2}(B^2-z)f_2(z)dz\right], & \text{for } x > \dfrac{K}{2}, \\ (1-F_1(x))(b^1-x) + F_1(x)\left[\displaystyle\int_0^{B^2}(B^2-z)f_2(z)dz\right], & \text{for } x \le \dfrac{K}{2}. \end{cases} \tag{A2}$$

The first term in each component describes the case when the audit firm wins the first auction with bid $b^1(x)$ and the second one describes the case when the audit firm loses the audit auction but wins the non-audit services auction bidding B^2. Since we assume that there should be a winner in the audit auction, B^1_{POST} should be such that even an inefficient auditor would participate in the auditing auction. The assumption that in equilibrium there is a winner in auction 1 ensues in the situation in which the audit firm that bypasses auction 1 completely and participates directly in auction 2 faces no competitors in auction 2 and, as in (8), has the following payoff

$$U^2_{POST} = \int_0^{B^2} F_2(z)dz. \tag{A3}$$

Observe that (A3) is also the term we should plug into (A2) instead of $\int_0^{B^2} (b^2(z) - z)f_2(z)dz$. To have an equilibrium in which all of the auditors participate in the first auction, we utilize the incentive compatibility condition that for every $x \leq 1$ the expected payoff for any bidder when he participates in auction 1 is greater than or equal to the payoff when he skips it and participates in auction 2 directly. In other words, $u_{POST}(x) \geq u^2_{POST}(x)$. Thus,

$$u_{POST}(x) = \left(1 - F_1(x)\right)\left(b^1(x) - \frac{4xK - K^2}{4x}\right) + F_1(x)\int_0^{B^2} F_2(z)dz \geq u^2_{POST}(x) = \int_0^{B^2} F_2(z)dz \text{ , for } x > \frac{K}{2},$$

and

$$(1 - F_1(x))(b^1(x) - x) + F_1(x)\left[\int_0^{B^2} F_2(z)dz\right] \geq \int_0^{B^2} F_2(z)dz \text{ , for } x \leq \frac{K}{2}. \tag{A4}$$

Rearranging again gives

$$\begin{aligned} &b^1(x) - \frac{4xK - K^2}{4x} \geq \int_0^{B^2} F_2(z)dz \text{ , for } x > \frac{K}{2}, \\ &b^1(x) - x \geq \int_0^{B^2} F_2(z)dz \text{ , for } x \leq \frac{K}{2}. \end{aligned} \tag{A5}$$

We show that (A4) is satisfied (and minimizes the client's expenses) if

$$B^1_{POST} = K - \frac{K^2}{4} + \int_0^{B^2} F_2(z)dz. \tag{A6}$$

In this case, an auditor with $c^1 = 1$ participates in auction 1, and if he wins, his payoff is identical to the expected payoff associated with bypassing the audit auction and participating only in auction 2. By solving for equilibrium (A2) subject to constraint (A6) (again, it is equivalent to a first-price auction) and substituting (A1), we get (8).[9] Note that if $b^1(1) = B^1_{POST}$, then (A5) is satisfied. Considering the incentive compatibility constraint (A5), we can see that (A6) is bounded from below by $\int_0^{B^2} F_2(z)dz$ and obtains equality for $c^1 = 1$, which implies that (A4) indeed holds.

Appendix B - Proofs for the Propositions and the Corollary

Proof of Proposition 1

From (6,7,9) and (10) we find that the difference between the Post-SOX and Pre-SOX period with respect to the non-audit services is only (A3). Thus, the result follows immediately. ■

[9] Observe that the upper limit in the integral is 1 because we require that all types of auditors participate in the first auction. The constant in the solution is derived the same way as in the Pre-SOX setting.

Proof of Proposition 2

The bid for auditing in the Post-SOX case for $x > \frac{K}{2}$ as given in (9) is

$$b_{POST}^{1}(x) = K - \frac{K^2}{4x} + \frac{1}{(1-F_1(x))}\int_x^1 \left(\frac{K}{2y}\right)^2 (1-F_1(x))dy + \int_0^{B^2} F_2(z)dz \tag{B1}$$

The bid for auditing in the Pre-SOX case for $x > \frac{K}{2}$ as given in (6) is

$$b_{PRE}^{1}(x) = K - \frac{K^2}{4x} + \frac{1}{(1-F_1(x))}\int_x^1 \left(\frac{K}{2y}\right)^2 (1-F_1(x))dy. \tag{B2}$$

Taking the difference between the bids in the two settings yields:

$$\int_0^{B^2} F_2(z)dz > 0 \tag{B3}$$

Thus, $b_{POST}^{1} > b_{PRE}^{1}$ and the audit fee is higher for the client in the Post-SOX setting than the Pre-SOX one. The same arguments hold for $x \leq \frac{K}{2}$. ■

Proof of Corollary 1

The proof is straightforward because, as Propositions 1 and 2 demonstrate, the clients pay more to audit firms for both auditing and non-audit services.■

Proof of Proposition 3

Taking the difference between (7) and (10) for $x > \frac{K}{2}$ and $x \leq \frac{K}{2}$ we get

$$u_{POST}(x) - u_{PRE}(x) = \int_0^{B^2} F_2(z)dz - \int_0^{B^2} (1 - F_2(z))F_2(z)dz = \int_0^{B^2} F_2^2(z)dz > 0 \qquad \text{(B4)}$$

yielding the result in the proposition. ■