Expert Mining and Required Disclosure: Appendices

Jonah B. Gelbach†

APPENDIX A. A FORMAL MODEL OF EXPERT MINING WITHOUT DISCLOSURE

A. The General Setup

There are two parties, D and P. For i in $\{D, P\}$, the payoff function is $u_i(E_i, E_j)$, where $E_i = 0$ if party i does not present helpful expert testimony and $E_i = 1$ if she does (thus I assume away returns to having more than one expert testify to a helpful test result). In order to present expert testimony, i must hire at least one expert. Each expert whom i hires charges c_i, and each will run a single test. The probability that the test result will be helpful to the plaintiff is α under the null hypothesis that the defendant has not done anything that would create legal liability if detected. The probability that the test result will be helpful to the *defendant* is β under the alternative hypothesis that the defendant *has* done something that would create liability if detected. The test results are statistically independent across experts.

If the parties choose actions (E_D, E_P), then the plaintiff's payoff from the suit gross of all expert-related litigation costs will be

$$u_P(E_P, E_D) \equiv \omega_P(E_P, E_D)X_P - c_{P0}, \tag{1}$$

where ω_P is the plaintiff's subjective probability that she will win the case given the actions (E_P, E_D), X_P is the damage award the plaintiff expects to receive when she wins, and c_{P0} is the plaintiff's nonexpert litigation costs. If the plaintiff hires N_P experts, then her net payoff including expert-related litigation costs is

$$U_p(E_P, E_D) \equiv u_P(E_P, E_D) - C_P(n_P), \tag{2}$$

---

† Associate Professor, University of Pennsylvania Law School. I thank Steve Burbank, Richard Epstein, Anup Malani, David Marcus, Kathryn Spier, and Tobias Barrington Wolff for helpful comments and suggestions.

where $C_P(N_P) = N_P c_P$ is the plaintiff's expert-related litigation costs (I assume each expert costs the plaintiff c_P to hire). Since the defendant must pay damages when she loses, her payoff from the suit gross of all expert-related litigation costs will be

$$u_D(E_D, E_P) \equiv -[1 - \omega_D(E_D, E_P)]X_D - C_{D0}, \tag{3}$$

where ω_D is the defendant's subjective probability that she will win. The defendant's net payoff including expert-related litigation costs is

$$U_D(E_D, E_P) \equiv u_D(E_D, E_P) - C_D(n_D), \tag{4}$$

where $C_D(N) = N_D c_D$.

It will be useful to define the gross marginal return to i of presenting expert testimony given j's choice of whether to present expert testimony, that is, the increase in i's payoff without accounting for the cost of hiring the expert. This is

$$\delta_i(E_j) \equiv u_i(1, E_j) - u_i(0, E_j) = [\omega_i(1, E_j) - \omega_i(0, E_j)]X_i, \tag{5}$$

which shows us that the return to i of newly generating a helpful test result, given j's action E_j, depends on both (i) i's marginal subjective increase in win probability and (ii) i's belief about the stakes in the case.

I capture the plaintiff's subjective belief concerning the defendant's liability with the parameter λ_P, which is the plaintiff's subjective belief concerning the probability that a single test will yield a result suggesting liability.[1] I capture the defendant's subjective belief concerning the probability that a single test will yield a result suggesting the *absence* of liability using the analogous parameter λ_D.[2] I will assume that each party is certain about the defendant's normative liability, by which I mean the conclusion that a court would draw about the defendant's liability if the court were omniscient. Party certainty about normative liability means that party i believes either (i) that the defendant is definitely normatively liable or (ii) that the defendant is definitely *not* normatively liable. Thus, the parties do not subjectively

1 Thus, if the plaintiff is certain that the defendant is normatively liable, then $\lambda_P = \beta$, since then the plaintiff's belief about a useful test result corresponds to the test's actual power. If instead the plaintiff is certain that the defendant is *not* liable, then $\lambda_P = a$, since then the plaintiff's belief about a useful test result corresponds to the test's actual significance level.

2 If the defendant is certain that she is liable, then $\lambda_D = 1 - \beta$, since then a useful test result for the defendant is a false negative, whose probability of occurring is one minus the test's actual power. If instead the defendant is certain that she is *not* liable, then $\lambda_D = 1 - a$, since then a helpful result is a true negative, whose probability is one minus the test's actual significance level.

learn from the results of any expert testing; to be formal, they hold prior beliefs that place probability one on the defendant's normative liability, so they will not update their priors in response to observed test results.

Finally, the net return to i of hiring the marginal expert, given that no previously hired expert has found a helpful test result, is

$$\phi_i(E_j) \equiv \lambda_i \delta_i(E_j) - c_i, \tag{6}$$

which accounts for both (i) the fact that hiring the marginal expert yields the gross return δ_i only with probability λ_i and (ii) the fact that paying the expert witness who generates the helpful test result costs c_i.

B. Equilibrium with No Disclosure

Holding constant action E_j, observe that it will always be rational for party i to hire the marginal expert when $\phi_i(E_j) > 0$. When this condition is satisfied, party i will continue to hire experts until the first helpful test result, after which she will stop. This means that N_i is a random variable. Party i's subjective probability that $N_i = 1$ must be λ_i, since that is the probability that the first test will yield a helpful result. Her subjective probability that $N_i = 2$ is $\lambda_i(1-\lambda_i)$, since a helpful result will occur on the second draw from the expert distribution with probability λ_i, given that it has not occurred on the first draw. In general, for $k > 1$, i's subjective probability that $N_i = k$ will be $\lambda_i(1-\lambda_i)^{k-1}$. When the first expert to find a helpful result is the kth one hired, total expert costs will be kc_i, so total expected expert costs are

$$EC_i = \sum_{k=1}^{\infty} kc_i\lambda_i(1-\lambda_i)^{k-1} = c_i\lambda_i \sum_{k=1}^{\infty} k(1-\lambda_i)^{k-1}.$$

Because it can be shown[3] that the infinite sum in this expression equals $\left(\frac{1}{\lambda_i}\right)^2$, total expected costs from the test-until-successful strategy are $EC_i = \frac{c_i}{\lambda_i}$. Now denote $V_{i*}(E_j)$ as party i's

---

[3] We have $\sum_{k=1}^{\infty} k(1-\lambda_i)^{k-1} = -\sum_{k=1}^{\infty} \frac{d}{d\lambda_i}(1-\lambda_i)^k$. Since the derivative is a linear map, the latter sum equals $\frac{d}{d\lambda_i}[-\sum_{k=1}^{\infty}(1-\lambda_i)^k]$. The term in brackets can be rewritten as $[1-\sum_{k=0}^{\infty}(1-\lambda_i)^k]$, which equals $\left[1-\frac{1}{\lambda_i}\right]$, and the derivative of this function with respect to λ_i is $\left(\frac{1}{\lambda_i}\right)^2$.

net expected payoff from the test-until-successful strategy, given the other party's action, E_j. This payoff is

$$V_{i*}(E_j) \equiv u_i(1, E_j) - \frac{c_i}{\lambda_i}, \tag{7}$$

Party i's payoff if she does not hire any experts at all is simply

$$V_{i0}(E_j) \equiv u_i(0, E_j), \tag{8}$$

Therefore, given E_j, party i will present expert testimony, with probability one, if and only if[4]

$$V_{i*}(E_j) - V_{i0}(E_j) = \delta_i(E_j) - \frac{c_i}{\lambda_i} > 0, \tag{9}$$

This is equivalent to the condition $\phi_i(E_j) > 0$, that is, that the net return to hiring the marginal expert is positive.

For any fixed λ_i, this condition is always satisfied when either the gross marginal return to hiring an expert is sufficiently great or the cost of hiring the expert is sufficiently slight. Recalling that

$$\delta_i(E_j) = [\omega_i(1, E_j) - \omega_i(0, E_j)]X_i, \tag{10}$$

it follows that party i will present expert testimony if and only if i's subjective estimate of the stakes, X_i, exceeds the threshold value

$$X_i^* \equiv \frac{c_i}{\lambda_i} \times \frac{1}{\omega_i(1, E_j) - \omega_i(0, E_j)}. \tag{11}$$

The right-hand side will be finite provided that $\omega_i(1, E_j) \neq \omega_i(0, E_j)$. Thus, provided that presenting expert testimony has some impact on party i's subjective win probability, there always exists a level of subjective stakes, X_i, sufficiently great that i will find it optimal to follow the test-until-successful strategy, for any choice of j's action E_j. In other words, provided that expert testimony does something useful for a party, there always exist parameter values such that the test-until-successful strategy is dominant. It follows by symmetry that there is a dominant strategy equilibrium in which we will observe $E_i = 1$ and $E_j = 1$ with probability 1, regardless of the parties' subjective beliefs concerning the outcome of the test result (that is, regardless of the magnitudes of λ_i and λ_j).[5]

---

4 For convenience I ignore the knife-edge situation in which $V_{i*}(E_j) - V_{i0}(E_j) = 0$.

5 One detail that must be tidied up is to show that cases will be litigated rather than settled before an expert is hired. Assume that the test-until-successful strategy is dominant for each party, given that they litigate through trial. Then in the absence of settlement, the plaintiff's subjective payoff is $V_{P*}(E_D) \equiv \omega_P(1,1)X_P - c_{P0} - \frac{c_P}{\lambda_P}$, while the defendant's subjective payoff is $V_{D*}(E_P) \equiv -[1 - \omega_D(1,1)]X_D - c_{D0} - \frac{c_D}{\lambda_D}$. The standard condition for

APPENDIX B. A FORMAL MODEL OF EXPERT MINING WITH REQUIRED DISCLOSURE

Consider the following extended example, in which a plaintiff has sued a defendant for damages. Here are the key background facts I assume:

- The plaintiff is certain that her loss is the defendant's fault, and the defendant is just as certain that she did not cause the loss.[6]

- Each party believes that loss causation is determinative: if the case goes to trial, judgment will be entered for the party that convinces the fact finder to find in its favor on this issue.

- Expert reports are costly, as is trial litigation; trial litigation is more expensive with a testifying expert than without (for simplicity I assume that all cost parameters are symmetric across the parties). Thus the plaintiff would drop the suit if both were certain that the plaintiff would lose at trial. In addition, given stipulations the parties have made, each party believes with certainty that if the plaintiff wins a trial judgment, she will win a damage award X that is many multiples of the sum of (i) all trial costs and (ii) the cost of multiple expert reports. Thus: (a) it is credible that the plaintiff would try the case if she thought she would be likely enough to win and the defendant

settlement to be *in*feasible is that the plaintiff's subjective gain from litigation be greater than the defendant's subjective cost, that is,

$$\omega_P(1,1)X_P - c_{P0} - \frac{c_P}{\lambda_P} > [1-\omega_D(1,1)]X_D + c_{D0} + \frac{c_D}{\lambda_D},$$

which holds if and only if

$$\omega_P(1,1)X_P - [1-\omega_D(1,1)]X_D > (c_{D0}+c_{P0}) + \left[\frac{c_D}{\lambda_D} + \frac{c_P}{\lambda_P}\right].$$

Because c_{D0} and c_{P0} appear in this inequality but not in (6), and since the opposite is true of $\omega_P(0,1)$ and $\omega_D(0,1)$, it will be possible to find parameter values that satisfy both (6) and the inequality just above. For example, set $\omega_D(1,1) = \omega_P(1,1) = 1$, eliminating X_D from the litigation-condition inequality above. Now set $X_P = (c_{D0}+c_{P0}) + \left[\frac{c_D}{\lambda_D} + \frac{c_P}{\lambda_P}\right] + \varepsilon$ for any $\varepsilon > 0$, so that the litigation-condition inequality is satisfied. Finally, set both $\omega_D(0,1)$ and $\omega_P(0,1)$ equal to zero, so that $\delta_i = X_i$; this ensures $\delta_i > c_i$, so that (6) holds for each party. This completes the proof.

6 This assumption ensures that the parties will not update their own beliefs about loss causation after they view expert results.

refused to settle, and (b) the parties would settle if both were certain that the plaintiff would win at trial.

- The parties both believe that if the plaintiff did not have any expert evidence pointing to loss causation, then the plaintiff would fail to satisfy its burden of production, and the defendant would file and win a summary judgment motion.[7]

- The parties agree that the fact finder is a Bayesian who will (i) find for the plaintiff if its posterior probability that the defendant caused the plaintiff's loss exceeds one-half and (ii) find for the defendant otherwise. The parties also agree that the fact finder places prior probability of one-half on the event that the defendant caused the plaintiff's loss.

- The parties disagree, however, on the values of α and β on which the fact finder will base its posterior probability calculation.[8] The plaintiff believes that the fact finder will use $\alpha = 0.05$ (a 5 percent false positive rate) and $\beta = 0.6$ (implying a false negative rate of 40 percent), while the defendant believes the fact finder will use $\alpha = 0.4$ (a 40 percent false positive rate) and $\beta = 0.9$ (implying a false negative rate of 10 percent).

- The parties each believe that α and β actually take on the values they assume the fact finder will use.[9]

---

7 See FRCP 56(a).

8 Some form of disagreement or informational asymmetry among parties has long been recognized as the fundamental reason why trials occur, rather than settlements. See, for example, William M. Landes, *An Economic Analysis of the Courts*, 14 J L & Econ 61, 66–69 (1971); Richard A. Posner, *An Economic Approach to Legal Procedure and Judicial Administration*, 2 J Legal Stud 399, 417–20 (1973); John P. Gould, *The Economics of Legal Conflicts*, 2 J Legal Stud 279, 286 (1973); George L. Priest and Benjamin Klein, *The Selection of Disputes for Litigation*, 13 J Legal Stud 1, 4–6 (1984); Steven Shavell, *Any Frequency of Plaintiff Victory at Trial Is Possible*, 25 J Legal Stud 493, 500 (1996).

9 This assumption is entirely consistent with the parties' (opposing) certainty concerning loss causation—a party can be sure of something and also believe that a test of that proposition is less than certain to come out in that direction.

- Each party has to decide how many experts to hire without knowing how many the other party has hired.[10]

- Parties can have at most one expert testify,[11] and they must disclose how many experts they hired before trial.

- The plaintiff must present her case at trial first. This means that (a) the plaintiff must present expert testimony to avoid losing on a motion for judgment as a matter of law and (b) the defendant has the option of presenting no expert testimony, even if she actually has hired enough experts so that one has found helpful evidence.

- The parties know each other's beliefs.

Let the variable T_j in {0,1} indicate whether party *j* presents expert testimony at trial, and let N_j indicate the total number of experts that *j* hired, which will be revealed at trial if $T_j = 1$. Let π_j^* be party *j*'s assessment of the fact finder's posterior probability that the defendant caused the loss. It can be shown that when both parties present expert testimony,

$$\pi_j^*(N_d, N_p) = \frac{\beta_j^{N_d}(1-\beta_j)^{N_p}}{\beta_j^{N_d}(1-\beta_j)^{N_p} + \alpha_j^{N_d}(1-\alpha_j)^{N_p}}, \tag{12}$$

and when only the plaintiff presents expert testimony,

$$\pi_j^*(0, N_p) = \frac{\beta_j(1-\beta_j)^{N_p-1}}{\beta_j(1-\beta_j)^{N_p-1} + \alpha_j(1-\alpha_j)^{N_p-1}}. \tag{13}$$

I make the following further assumptions:

---

10 Under FRCP 26(a)(2)(D)(ii), a party has up to thirty days after receiving its adversary's testifying expert disclosures to disclose that it will call a rebuttal witness. Thus, this assumption is tantamount to assuming that it takes more than thirty days to recruit an expert and receive the expert's report.

11 Without this assumption, parties would sometimes have the incentive to engage in a different sort of expert mining—hiring additional experts even after at least one has found evidence helpful to them. Since I assume the parties believe the fact finder is Bayesian, a party might choose to produce multiple helpful signals in order to ensure against the possibility that the adversary did the same. Allowing such behavior would be interesting but would render the underlying game much too complicated for the scope of the present paper. In any case, the assumption can be motivated simply enough by the assumption that the judge allocates the parties only enough trial time to introduce a single expert.

- The parties will go to trial whenever they disagree on the outcome at trial, that is, when $\pi_d^*(T_d N_d, N_p) < \frac{1}{2} < \pi_p^*(T_d N_d, N_p)$.

- Parties who have not settled before discovery, but who agree postdiscovery that the defendant would win at trial, will settle for zero (that is, the plaintiff drops the case, and both parties avoid litigation costs). Parties who have not settled before discovery, but who agree postdiscovery that the plaintiff would win at trial, will settle for $X > 0$, (their common estimate of the damages the plaintiff would win at trial).

In addition, let σ_k be the strategy that a party hires up to k experts if experts 1 through $k - 1$ have failed to provide helpful evidence; thus, a party who uses σ_k with $k > 1$ is an expert miner. I claim that there are cost and damage-award parameter values such that it is a Nash equilibrium for the defendant to play σ_2 and for the plaintiff to play σ_2. More specifically, I claim the following results hold:

1) The *defendant* will believe the following:

a) The plaintiff will win whenever (i) the plaintiff presents expert testimony, (ii) the plaintiff has hired only one expert, and (iii) the defendant presents no expert testimony; in this event, the defendant believes the fact finder's posterior probability of loss causation is 0.69. (This can be shown by setting $j = d$ and inserting into equation (13) the values $\alpha_d = 0.4$, $\beta_d = 0.9$, and $N_p = 1$.)

b) The plaintiff will lose whenever (i) the plaintiff presents expert testimony, (ii) the plaintiff has hired two or more experts, and (iii) the defendant presents no expert testimony; in this event, the defendant believes the fact finder's posterior probability of loss causation is no greater than 3/11, which is less than 1/2. (This can be shown by setting $j = d$ and inserting into equation (13) the values $\alpha_d = 0.4$, $\beta_d = 0.9$, and $N_p = 2$. The result is a posterior probability of

3/11; since the right hand side of equation (13) is decreasing in N_p, the posterior probability is always less than this value when $N_p > 2$.)

c) The plaintiff will lose whenever (i) both parties present expert testimony, (ii) the plaintiff has hired one expert, and (iii) the defendant has hired either one or two experts; in this event, the defendant believes the fact finder's posterior probability of loss causation is 3/11 when the defendant has hired one expert and 81/177 when the defendant has hired two experts, and each probability is less than 1/2. (This can be shown by setting $j = d$ and inserting into equation (12) the values $\alpha_d = 0.4$, $\beta_d = 0.9$, $N_p = 1$, and $N_d \in \{1,2\}$.)

2) The *plaintiff* will believe the following:

a) The plaintiff will win whenever (i) the plaintiff presents expert testimony, (ii) the plaintiff has hired three or fewer experts, and (iii) the defendant presents no expert testimony. (This can be shown by setting $j = p$ and inserting into equation (13) the values $\alpha_p = 0.05$, $\beta_p = 0.6$, and $N_p = 3$, which yields a posterior probability of 0.68, and then observing that the posterior probability is decreasing in N_p.)

b) The plaintiff will win whenever (i) both parties present expert testimony, (ii) the plaintiff has hired two or fewer experts, and (iii) the defendant has hired one expert. (This can be shown by setting $j = p$ and inserting into equation (12) the values $\alpha_p = 0.05$, $\beta_p = 0.6$, $N_d = 1$, and $N_p = 2$, which yields a posterior probability of 0.68, and then observing that the posterior probability is decreasing in N_p.)

c) The plaintiff will win whenever (i) both parties present expert testimony, (ii) the plaintiff has hired five or fewer experts, and (iii) the defendant has hired two experts. (This can be shown by setting $j = p$ and inserting into equation (12) the values $\alpha_p = 0.05$, $\beta_p = 0.6$, $N_d = 2$, and $N_p = 5$, which yields a posterior probability of 0.66, and then observing that the posterior probability is decreasing in N_p.)

d) The plaintiff will lose whenever (i) only the plaintiff presents expert testimony, and (ii) the plaintiff has hired four or more experts. (This can be shown by setting $j = p$ and inserting into equation (12) the values $\alpha_p = 0.05$, $\beta_p = 0.6$, and $N_p = 4$, which yields a posterior probability of 0.47, and then observing that the posterior probability is decreasing in N_p.)

3) If the plaintiff plays strategy σ_3, then there are parameter values such that the defendant will play σ_2. If the defendant plays strategy σ_2, then there are parameter values such that the plaintiff's optimal strategy is to play σ_3. Thus there is a Nash equilibrium in which the defendant plays σ_2 and the plaintiff plays σ_3.

Proof of claim (3): The defendant believes the jury will use $\alpha_d = 0.4$, $\beta_d = 0.9$ to evaluate the posterior probability of loss causation, and the defendant also believes these are the correct values for α and β; in addition, the defendant believes the fact finder will use a prior value of one-half for the probability of loss causation. Let indicator variable T_j equal one when party $j \in \{d,p\}$ presents expert evidence, and zero otherwise.

The following table shows the parties' beliefs concerning who would win at trial given various values of N_d and N_p.

TABLE 1

		Party expected to win by:			
$N_d \times T_d$	$N_p \times T_p$	Defendant	Plaintiff	Does defendant think it's worth introducing expert evidence?	Will parties settle for *X*, will P drop suit, or will trial occur?
0	0 or 4	D	D	—	P drops
0 or 3	1	P	P	—	Settle for *X*
0–2	2–3	D	P	No: $T_d = 0$	Trial
1–2	1	D	P	Yes: $T_d = 1$	Trial

Now assume that the plaintiff plays strategy σ_3. Would it make sense for the defendant to hire a first expert? The Table above shows that if the defendant does not hire an expert, then she will decide to settle for *X* in the event that the plaintiff receives helpful evidence from the plaintiff's first expert. Because the defendant's subjective probability that this event will occur is a_d, the defendant stands to gain the gross amount $a_d X$ by hiring her first expert, because the defendant expects to win at trial if that expert testifies to finding helpful evidence—which would cost c_t. Thus a sufficient condition for it to make sense for the defendant to hire the first expert is for the probability-discounted net benefits of hiring a first expert, $a_d(X - c_t)$, to exceed the certain cost, *c*, of hiring the expert. So whenever *X* exceeds $c_t + c/a_d$, the defendant will choose to hire a first expert. Here, $a_d = 0.4$, so if *X* exceeds $c_t + 2.5c$ it will definitely make sense for the defendant to hire a first expert.

Would the defendant rationally hire a second expert if the first one didn't provide helpful evidence? A rational defendant's calculus in this situation is the same as in the situation of deciding whether to hire a first expert: (i) if the defendant has no helpful expert testimony and the plaintiff does, then the defendant will have to settle for X; (ii) the defendant's subjective probability of this event is still a_d; and (iii) the Table above shows that the defendant expects to win in the event that she presents helpful testimony from a second-hired expert and the plaintiff presents helpful testimony from a first-hired expert. Thus the defendant stands to gain at least $a_d(X - c_t)$ from hiring a second expert, which she can again do at a cost of c. We thus have the same sufficient condition on the damage level X for the defendant to find it worthwhile to hire the second expert.

Things are different with respect to the defendant's third-hired expert, however. The Table above shows that the defendant would not expect to win at trial if she presented helpful evidence from a third-hired expert against a plaintiff's helpful evidence from her own first-hired expert. Further, even if the defendant had obtained helpful evidence from a first- or second-hired expert, the defendant would be confident enough of her chances against a plaintiff presenting evidence from a second- or third-hired expert such that she would choose not to bear the costs of having her own expert testify. And since helpful evidence from a defendant's third-hired expert must be less useful to the defendant's case than would be helpful evidence from an earlier-hired expert, *a fortiori* the defendant would not present such evidence when the plaintiff presents her own evidence from a second- or third-hired expert. So a rational defendant will believe she has nothing to gain from hiring a third expert. Since it is costly to do so, she will choose not to.

In sum, I have established that if X is sufficiently great, when the plaintiff plays σ_3, the defendant here will find it worthwhile to hire a first expert, and to hire a second expert when the first expert's results are unhelpful, but not ever to hire a third expert. This is just a verbose way of stating that for the defendant, σ_2 is a best response to the plaintiff's choice to play σ_3.

Now consider the plaintiff's best response, when the defendant plays σ_2. Suppose first that the plaintiff does not hire any experts. Then her payoff will be 0, since she will drop the suit. Would it make sense for her to hire the first expert? The Table above shows that if the plaintiff receives helpful testimony from a first-hired expert, she will expect to gain a settlement (when the defendant has no helpful expert testimony) or to win at trial (when the defendant does have helpful expert testimony). With probability β_p the plaintiff receives helpful expert evidence, and even if she must pay for expert testimony at trial, she will expect to receive $X - c_t$. If she receives unhelpful evidence from the first-hired expert, she can always choose not to hire a second expert, so from the plaintiff's point of view it will always make sense to hire the first expert so long as $\beta_p(X - c_t)$ exceeds c, the cost of hiring the expert. This condition will be satisfied as long as X exceeds $c_t + c/\beta_p$. With $\beta_p = 0.6$, this condition will always be satisfied when the defendant's sufficient condition, discussed above, is satisfied.

Would the plaintiff hire a second expert, given that the first one provides unhelpful testimony? The Table above shows that the plaintiff will expect to go to trial and win whenever she has helpful evidence from a second-hired expert. As with the first-hired expert, a sufficient condition for the net return to hiring this second expert to be positive is that $\beta_p(X - c_t)$ exceeds c, so the plaintiff will hire a second expert. The same argument can be shown to work for hiring a third expert if the second one does not provide helpful evidence.

But it would not make sense for the plaintiff to hire a fourth expert, given that her third expert has not provided helpful evidence. By claim 1(b) above, even if the defendant had helpful expert testimony, she would not choose to present expert testimony against a plaintiff presenting testimony from a fourth-hired expert. And by claim 2(d), the plaintiff would expect to lose at trial if she presented expert testimony from a fourth-hired expert and the defendant presented no expert testimony. Consequently, hiring a fourth expert never pays off for the plaintiff, and since it is costly to do so, no rational plaintiff would.

Putting these results together establishes that when the defendant plays σ_2, it is a best response for the plaintiff to play σ_3, provided that the damage level X is sufficiently great.

This result establishes that when X is sufficiently great, σ_2-playing defendants and σ_3-playing plaintiffs are best-responders to each other. Thus I have established the existence of the claimed Nash equilibrium.