Adversarial Bias, Litigation, and the Daubert Test: An Economic Approach

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Abstract

The last few decades have seen a dramatic shift in the admissibility of expert testimony in American courtrooms from a *laissez-faire* approach to a strict standard for admissibility, often called the *Daubert* test. The implicit rationale behind such a stringent standard for admissibility is the trier of fact's vulnerability to *adversarial bias*, which many legal scholars and practitioners assume to be rampant. Employing a standard litigation model in the literature, I demonstrate that client–expert relationships may not always exhibit adversarial bias and that a litigant may voluntarily present neutral expert testimony under certain situations. I also show that a litigant is more likely to deploy hired guns if the litigation environment is more favorable to his cause. In particular, the burden of proof assignment and the court's prior belief are shown to influence adversarial bias.
Keywords: litigation game; evidence distortion; adversarial bias; *Daubert* test.
JEL: C72; D82; K41.

1 Introduction

Before the 1980s, courts were quite lenient toward expert testimony, allowing the trier of fact to decide the weight of the evidence if the evidence presented in the court was not compelling. Thus, the admissibility of expert testimony was not a major issue, and this approach allowed virtually all expert witnesses to testify on subject matter within their expertise.[1]

However, during the 1980s, there was considerable debate regarding the admissibility of expert testimony, especially owing to the rise of toxic tort litigation, which alleged that exposure to pharmaceuticals, pollutants, or other toxic substances (such as the herbicide Agent

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[1]See Kaye et al. (2010) for a discussion of the traditional rules for the admissibility of expert testimony.

Orange) caused cancer, birth defects or other ailments.[2] The cases often rested largely on testimony from experts who were hired by the litigants.[3] With the increasing number of experts providing causation theories that were often dubious but helpful to their clients, legal scholars and commentators began to worry about *adversarial bias* in client–expert relationships.[4]

Since then, the Supreme Court has made a series of important decisions, beginning with *Daubert v. Merrell Dow Pharms., Inc.*,[5] which set a strict standard for the admissibility of expert testimony. Federal Rule of Evidence 702 was eventually amended in 2000, requiring experts to pass a stringent reliability test, often called the *Daubert* test, to be qualified to give testimony in court. Rule 702 provides that expert testimony that would otherwise be helpful to the jury is admissible only when (*i*) the testimony is based on sufficient facts or data, (*ii*) the testimony is the product of reliable principles and methods, and (*iii*) the witness has applied the principles and methods reliably to the facts of the case.[6]

The history of the *Daubert* test suggests that the implicit rationale behind such a stringent standard for admissibility is the trier of fact's vulnerability to the existence of adversarial bias.[7] Proponents of the test argue that as parties to litigation have incentive to present expert testimony of dubious validity and as lay juries are incapable of discerning which side has the better case, the *Daubert* test can alleviate the problem of adversarial bias by providing attorneys with the opportunity to challenge whether the other side's proffered expert testimony is reliable.

Arguments for the *Daubert* test and adversarial bias invite the following theoretical inquiries from law and economics scholars: do client–expert relationships always exhibit adversarial bias? In other words, is it possible that litigants voluntarily present neutral, unbiased expert testimony? If so, under which situations will they do so?

[2] For discussions on these mass tort cases, see, for example, Angell (1997), Green (1998), Sanders (1998), and Schuck (1988).

[3] For example, the case brought by the Carmichaels against Kumho Tire Co. in 1993 rested largely on testimony from a tire failure expert. This case eventually led to the Supreme Court's decision in *Kumho Tire Co., Ltd. v. Carmichael*, 526 U.S. 137 (1999).

[4] For a discussion on adversarial bias, see, for example, Bernstein (2008). See also *Olympia Equip. Leasing Co. v. Western Union Telegraph Co.*, 797 F.2d 370 (7th Cir. 1986) ("It is thus one more illustration of the old problem of expert witnesses who are "often the mere paid advocates or partisans of those who employ and pay them, as much so as the attorneys who conduct the suit. There is hardly anything, not palpably absurd on its face that cannot now be proved by some so-called 'experts.'"); *E.I. du Pont de Nemours and Co., Inc. v. Robinson*, 923 S.W.2d 549 (Tex. 1995) ("[T]here are some experts who 'are more than willing to proffer opinions of dubious value for the proper fee.'").

[5] *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579 (1993). See also *Gen. Elec. Co. v. Joiner*, 522 U.S. 136 (1997) and *Kumho Tire Co., Ltd. v. Carmichael*, 526 U.S. 137 (1999).

[6] Given the radical shift toward a more stringent standard for the admissibility of expert testimony, many legal scholars and practitioners disagree with it. For example, after a recent review of *Milward v. Acuity Specialty Products Group, Inc.*, 639 F.3d 11 (1st Cir. 2011), the First Circuit reversed the district court's ruling excluding causation evidence in a toxic tort case, holding that relying on the weight of the evidence constitutes a reliable scientific methodology.

[7] Bernstein (2008) defines adversarial bias as "witness bias that arises because a party to an adversarial proceeding retains experts to advance its cause" and argues that the existence of adversarial bias justifies the application of the *Daubert* test in courts' decision-making.

The goal of this paper is to investigate these issues in a formal economic model, which is, to the best of my knowledge, the first attempt to do so in the literature. Employing a standard litigation model in the literature, I demonstrate that client–expert relationships may not always exhibit adversarial bias and that a litigant may voluntarily present neutral expert testimony under certain situations. I also show that a litigant is more likely to deploy hired guns if the litigation environment is more favorable to his cause. In particular, the burden of proof assignment and the court's prior belief influence a litigant's incentive to deploy hired guns in equilibrium.

The intuition behind a litigant's decision to voluntarily present neutral expert testimony is as follows. In equilibrium, the burden of proof is assigned to one party, and that party is required to present hard evidence for his cause to win at trial. If the litigant appoints a biased expert who is willing to distort evidence toward the cause of the litigant, the expert will suppress unfavorable evidence and reveal only favorable evidence to the court. However, employing such a biased expert is not beneficial for the litigant for two reasons. First, suppressing unfavorable evidence is not beneficial because the litigant with the burden of proof will lose at trial unless his expert reveals favorable evidence for his cause. Second, the litigant with the burden of proof is required to present hard evidence for his cause to win at trial. However, as evidence is assumed to be verifiable, an expert cannot fabricate favorable evidence. Thus, the frequency with which a biased expert presents favorable evidence at trial is equal to that with which an unbiased expert presents favorable evidence. Consequently, the litigant with the burden of proof is indifferent between a biased expert and an unbiased expert, and he may therefore voluntarily appoint an unbiased expert in equilibrium. Propositions 1 and 2 provide formal statements.

Somewhat surprisingly, despite the voluminous research articles and commentaries criticizing litigants' incentive to deploy hired guns,[8] the literature on expert evidence law has largely neglected the possibility that a litigant may voluntarily proffer unbiased expert testimony.[9]

[8] Krafka et al. (2002) report that the most serious problem perceived by judges regarding expert evidence is that "experts abandon objectivity and become advocates for the side that hired them." The partisan nature of expert testimony proffered by litigants has been widely criticized: see, for example, Langbein (1985) (describing "systematic distrust and devaluation of expertise" by the American people), Gross (1991) ("Experts whose incomes depend on testimony must learn to satisfy the consumers who buy that testimony; those who do not will not get hired"), Bernstein (2008) ("... attorneys can shop from an almost unlimited pool of expert witnesses"), Liptak (2008) (quoting Professor William R. Freudenburg, "The legal system and the scientific method ... co-exist in a way that is really hard on truth"), Mnookin (2008) ("... those witnesses who succeed in the marketplace for experts within our adversarial process will often not be those with the most knowledge or actual expertise in a particular area, but rather those whom parties believe will succeed in persuading the fact-finder"), Robertson (2010) ("Through selection, affiliation, and compensation biases, litigants make experts more favorable but less accurate compared to their base rates of accuracy in the real world"), and Haw (2012) ("If, out of one hundred experts, ninety-nine agree on a proposition, one side may call the outlier, and the other may call one of the heartland experts. This will make a real-world ratio of 99:1 appear, in the courtroom, closer to 1:1").

[9] Haw (2012) notes: "... most indictments of legal science start with the premise that expert witnesses are biased or untruthful."

Although some scholars argue that professional experts may have an incentive to render unbiased opinions owing to ethical concern or reputation,[10] eventually, the litigant or his attorney determines whether such unbiased testimony will be heard at court, and most legal scholars and commentators seem to downplay such a possibility.[11] Moreover, the relationship between litigation environments and a litigant's incentive to present unbiased testimony has not yet been addressed in the literature. Thus, this paper contributes to the literature on expert evidence law by presenting an uninvestigated mechanism through which litigation environments influence adversarial bias, along with policy implications.

The key feature of the main model is the evidence distortion and inference problem. A suitable economic model with which to analyze this problem is the persuasion-game framework presented by Milgrom (1981). Using a seller–buyer example as an illustration, he studies the ways in which a buyer draws inferences about a product's quality in the face of a seller's incentive to conceal evidence detrimental to the sale of the product. He shows that the equilibrium is characterized by "full revelation," in which the seller reveals all relevant evidence about the product. Extending his analysis, Milgrom and Roberts (1986) study decision-making under evidence distortion by competing litigants and confirm the robustness of the full revelation phenomenon. The reason for the full revelation of relevant information in these models is that the informed party (e.g., an expert in our context) always possesses some information. If this assumption is relaxed, that is, the informed party may not possess relevant information, then the party with the information advantage may distort the evidence in equilibrium, inducing the uninformed party (e.g., a court in our context) to draw an inference about the hidden evidence. See Shin (1998), Demougin and Fluet (2008), Kim (2014, 2015a), and references therein for this line of research in a litigation setting.[12] All these papers assume that litigants conceal unfavorable evidence whenever possible when presenting evidence to the trier of fact. I relax this assumption and study a litigant's incentive to choose between biased

[10] Sorrel (2007) reports: "When New York dermatopathologist A. Bernard Ackerman, MD, is called to testify as a medical expert witness, he refuses to know which side the lawyer represents. It is his way of remaining objective when he evaluates a case." Some experimental results present evidence showing that experts in a courtroom setting may render unbiased opinions. For example, Boudreau and McCubbins (2008) analyze experimentally the conditions under which competition between experts induces them to make truthful statements. They find that competition induces enough truth telling to allow jurors to improve their decisions, which provides some support for the game theoretic arguments raised by Milgrom and Roberts (1986) and Froeb and Kobayashi (1996), who suggest that competition between interested parties will lead to the revelation of truthful information.

[11] Bernstein (2013) notes: "The underlying problem critics identified is that attorneys seeking expert witnesses do not, and have no incentive to, pursue expertise wherever it leads. Rather, they search for an expert willing to support the litigant's position."

[12] These papers assume that the probability with which the expert observes the hidden evidence is common knowledge in the game. In contrast, in another work by Kim (2015b), this probability is not common knowledge; rather, the court must infer this probability during the fact-finding process before rendering its final verdict at trial. In this framework, Kim studies the benefits and costs of a stringent admissibility standard and finds the conditions under which dismissing low-quality experts through stringent standards increases the accuracy of judicial decisions.

and unbiased experts.

The remainder of this paper is organized as follows. Section 2 presents a simple model suitable for an analysis of adversarial bias. Section 3 solves the model and presents the main results, Propositions 1 and 2. Section 4 concludes with a discussion about extensions and implications of the main results.

2 An Economic Model for Adversarial Bias

Consider a legal dispute in which a defendant is brought to trial for allegedly inflicting harm on a plaintiff. For example, the defendant may be a firm accused of dispersing a toxic chemical into a river from which the plaintiff draws water. The truth, t, takes one of two possible values, $t \in \{h, l\}$, where $t = l$ indicates that the defendant is liable for the wrongdoing and $t = h$ indicates that he is in fact not liable despite the plaintiff's complaint. The court aspires to render a verdict that correctly identifies the truth: it seeks to uphold the plaintiff's cause if the defendant is truly liable, that is, $t = l$, and to uphold the defendant's cause if the defendant is in fact not liable, that is, $t = h$. More precisely, I assume that the court obtains a payoff of 1 from a correct decision and a payoff of 0 otherwise.[13] In contrast to the court's preference, the defendant always seeks to be exonerated from the charge of the alleged wrongdoing and thereby obtain a payoff of 1. The defendant obtains a payoff of 0 if he is found liable. The plaintiff faces a similar payoff structure: he obtains a payoff of 1 if his cause prevails and 0 otherwise.

If the court perfectly knows the truth regarding the defendant's liability, it can correctly differentiate a liable defendant from a non-liable one, thereby rendering a correct verdict. However, courts may err in rendering a verdict in reality because courts often have access to only a limited amount of information regarding a particular dispute. During an adversary proceeding, the case is presented, and evidence is revealed to the court, thereby inducing the court to form its own assessment regarding the hidden truth. The court's assessment is summarized by the prior belief, $\mu = P(t = h) \in (0, 1)$. A high value of μ indicates that the court believes that the defendant is not liable with a high probability based on all of the evidence presented and accumulated during the proceeding thus far. A low value of μ carries the opposite meaning.

An important form of information at trial is expert testimony proffered by the litigants.[14] As an expert is someone who is better equipped than a layperson through her "knowledge,

[13] This assumption implies that in the face of uncertainty regarding the truth, the court operates on *the preponderance of evidence standard*, that is, the court upholds the plaintiff's cause if the defendant is more likely to be liable than not, and vice versa.

[14] Although expert witnesses are selected and retained by the litigants in the current American legal system, many legal scholars have argued for a reform toward a centralized system for expert testimony, which would allow courts to appoint neutral experts. See Section 4.6 for a related discussion.

skill, experience, training, or education" (Federal Rule of Evidence 702) to perceive the truth in her specialized domain, her testimony can provide the court with valuable information about the dispute.[15] For instance, the accused firm in the example above may hire a chemistry professor to testify about the safety of the toxic chemical that the firm is accused of dispersing.

Although experts are presumably neutral to the case under consideration, willing to provide honest testimony without intentionally withholding any relevant evidence, an expert can be biased toward a litigant in the sense that their interests may be aligned. Such a situation may occur in reality because (i) experts' compensation is often tied to the litigation outcome and (ii) a litigant may retain experts who share the same opinions or views as the litigant's. As this paper aims to study the conditions under which a litigant prefers to retain an unbiased expert rather than a biased one, I assume that two types of expert exist: unbiased and biased experts.

Formally, there exists one hidden piece of evidence x that may take one of two possible values, $x \in \{H, L\}$, where $x = H$ is a piece of evidence supporting the claim that the defendant is not liable, that is, $t = h$, and $x = L$ supports the other cause. This hidden evidence can be uncovered by experts and revealed to the court. As an expert is knowledgeable but not perfectly informed about the dispute, I assume that an expert can observe the hidden evidence only with a positive probability. More precisely, the expert hired by the defendant (the plaintiff) observes x with probability $e_D \in (0, 1)$ ($e_P \in (0, 1)$).[16] This probability can be interpreted as the expert's level of skill or experience. As this probability increases toward 1, the expert is more likely to possess a relevant piece of information about the truth. I assume that evidence x is realized according to the conditional density, $P(H|h) = P(L|l) \equiv p > \frac{1}{2}$.

When called to testify to the court, the expert's testimony takes the following form: if the expert observed the evidence, she either reports it truthfully to the court or does not provide any evidence; in the latter case, the expert is intentionally withholding valuable evidence. If the expert could not observe the evidence, she cannot provide any evidence to the court, as fabricating evidence is not allowed in the courtroom.[17] If an expert does not reveal any evidence at trial, the court cannot obtain any explicit evidence from the expert. However, although the expert does not reveal any evidence, the court can still obtain implicit evidence about the truth: if the court employs Bayesian reasoning in assessing the expert's testimony, it can infer that the expert does not reveal any evidence under two possible circumstances, that is, either when the expert could not observe the hidden evidence or when the expert is

[15] Gross (1991) notes that experts testified in 86% of civil trials in a sample of California cases tried between 1985 and 1986.

[16] Thus, there are four possibilities: (i) both experts do not observe x, $(ii - iii)$ only one of the experts observes x, and (iv) both experts observe the same piece of evidence x. This is a standard modeling approach in the literature; see, for example, Shin (1998), Demougin and Fluet (2008), and Kim (2014).

[17] Thus, according to economics jargon, I assume that the information provided to the court is *hard*. Models with verifiable information seem reasonable in a trial setting in which falsifying evidence imposes large penalties on the party. For the *soft*-information approach to court decision-making, see Emons and Fluet (2009a,b).

suppressing a relevant piece of evidence. Thus, accounting for such motives of the expert, the court can extract some amount of information even when the expert reveals no hard evidence, which will be clarified in the subsequent analysis.

I assume that an unbiased expert truthfully reports her evidence to the court: if she observed the hidden evidence, she reports it to the court; if she could not observe it, she does not reveal any evidence. In contrast, a biased expert truthfully reveals only favorable evidence for her client: if the biased expert hired by the defendant observed $x = H$, the expert reports it to the court; if the expert observed evidence unfavorable to the defendant, $x = L$, the expert conceals it by not reporting any evidence. The expert also reveals no evidence if she could not observe any evidence. Thus, when a biased expert reveals no hard evidence, the court cannot ascertain whether she is suppressing valuable evidence or whether she could not observe the hidden evidence. The expert hired by the plaintiff exhibits similar behavior.[18]

The timeline is as follows. In period 1, the litigants simultaneously choose whether to retain a biased expert or an unbiased expert. The court cannot directly observe the litigants' choices and therefore cannot observe whether the expert proffered by a litigant is biased or not. In period 2, the retained experts have a chance to observe the hidden evidence, $x \in \{H, L\}$, and to testify to the court. In period 3, the court renders a verdict regarding whose cause should prevail after forming its final assessment by employing Bayes' rule. Finally, to avoid uninteresting cases, I assume $\mu \in (1-p, p)$.[19] The solution concept is the perfect Bayesian equilibrium, which is simply referred to as equilibrium.

3 Equilibrium Analysis

In this section, I derive the equilibria of the model. The analysis is divided into three steps. In the first subsection, I study the experts' behavior and the court's decision-making in periods 2 and 3, where the court takes the litigants' behavior as given. Because the court cannot observe the bias of the expert proffered by a litigant, it must form a belief regarding the litigant's choice of expert. Such a belief can be arbitrary in this step of the analysis, but eventually, it must be consistent with the litigants' actual behavior in the last step of the analysis, in which I derive the equilibria of the model. In the second subsection, using backward induction, I investigate the litigants' strategies in period 1. In this stage, a litigant chooses the type of his expert, with the other litigant's choice and the court's belief taken as given. Finally, in the third subsection, I derive the equilibria of the model, where I require the litigants' and the

[18] Rather than assuming an expert's behavior directly, one can derive such behavior as part of the equilibrium by specifying an expert's payoff structure. As such a generalization of the basic model is tedious and does not contribute to our understanding of the core mechanism in the model, I adopt a reduced form approach with respect to the experts' behavior as specified above.

[19] If the prior probability is outside this range, the hidden evidence cannot influence the court's decision because the court's prior assessment about the truth is too strong.

experts' behavior to be consistent with the court's belief and decision.

3.1 The Court's Belief and Decision

I analyze the model by first considering the experts' behavior and the court's belief and decision in periods 2 and 3, given the litigants' behavior. Because the court cannot directly observe the litigants' actions, it must form its belief about their actions. The court's belief about the probability that the defendant (the plaintiff) chose a biased expert is denoted by $\psi_D \in [0,1]$ ($\psi_P \in [0,1]$).

Suppose that hidden evidence x is revealed by any expert to the court. Then, the court's posterior belief is given by $\lambda(x) \equiv P(t = h|x)$. More precisely, using Bayes' rule, I have

$$\lambda(H) = \frac{\mu p}{\mu p + (1-\mu)(1-p)} > \frac{1}{2} \tag{1}$$

$$\lambda(L) = \frac{\mu(1-p)}{\mu(1-p) + (1-\mu)p} < \frac{1}{2} \tag{2}$$

where the inequalities follow because $\mu \in (1-p, p)$. Thus, the hidden evidence, if uncovered and revealed, influences the court's belief and decision. If evidence that is favorable to the defendant is revealed, the court upholds the cause of the defendant because the defendant is more likely not liable than liable, and vice versa.

What happens if no evidence is revealed by any expert? I denote by ϕ the situation in which no expert reveals evidence to the court. In this case, the court's posterior belief is denoted by $\lambda(\phi) \equiv P(t = h|\phi)$. More precisely, using Bayes' rule, I obtain $\lambda(\phi)$ by

$$\lambda(\phi) = \frac{\mu q_h}{\mu q_h + (1-\mu) q_l} \tag{3}$$

where

$$q_h = \underbrace{(1-e_D)(1-e_P)}_{(A)} + \underbrace{e_D(1-e_P)\psi_D(1-p)}_{(B)} + \underbrace{(1-e_D)e_P\psi_P p}_{(C)}$$

$$q_l = \underbrace{(1-e_D)(1-e_P)}_{(A')} + \underbrace{e_D(1-e_P)\psi_D p}_{(B')} + \underbrace{(1-e_D)e_P\psi_P(1-p)}_{(C')}$$

In the expressions above, q_h is the probability that, given $t = h$, no expert reveals evidence to the court. This probability is a sum of three terms. The first term (A) is the probability that both experts could not observe the hidden evidence. The second term (B) is the probability that only the defendant's expert observed the hidden evidence but did not reveal it: $e_D(1-e_P)$ is the probability that only the defendant's expert observed x; evidence distortion on the defendant's side occurs if the expert is a biased expert (with probability ψ_D); the defendant's

expert must have observed unfavorable evidence (i.e., $x = L$) because she conceals it, and the probability for the expert to observe such evidence is $P(x = L|t = h) = 1 - p$. The last term (C) is analogous to (B): this term is the probability that evidence manipulation occurs on the plaintiff's side. Combining these three possibilities, I obtain q_h. The other probability, q_l, can be similarly understood.

Thus, when no expert reveals evidence at trial, after forming its posterior belief $\lambda(\phi)$, the court upholds the defendant's cause if $\lambda(\phi) \geq \frac{1}{2}$ and upholds the plaintiff's cause if $\lambda(\phi) < \frac{1}{2}$. As differentiating these two cases is useful for the equilibrium analysis, I introduce the following definition:

Definition 1. *If the defendant's cause prevails in the absence of evidence at trial (i.e., $\lambda(\phi) \geq \frac{1}{2}$), the burden of proof is said to be on the plaintiff. If the plaintiff's cause prevails in the absence of evidence at trial (i.e., $\lambda(\phi) < \frac{1}{2}$), the burden of proof is said to be on the defendant.*

3.2 The Litigants' Strategies

In this subsection, using backward induction, I investigate the ways in which a litigant selects his own expert, with the other litigant's strategy and the court's belief taken as given.

Suppose that the defendant believes that the court's belief about the litigants' behavior is such that the burden of proof will be on the plaintiff, that is, $\lambda(\phi) \geq \frac{1}{2}$. Then, if the defendant selects a biased expert, his expected payoff is[20]

$$\begin{aligned} \pi_D^b &= (1 - \underbrace{e_P P(x = L)}_{(A)}) \times 1 \\ &= 1 - e_P(\mu(1-p) + (1-\mu)p) \end{aligned} \tag{4}$$

Under the defendant's current belief about the burden of proof assignment, he believes that he will lose at trial if and only if the plaintiff's expert can provide hard evidence against the defendant's cause, $x = L$. Such a belief arises because (i) if $x = H$ is revealed by any expert, the defendant wins at trial (as $\lambda(H) > \frac{1}{2}$), (ii) if no evidence is revealed by any expert, the defendant also wins (because the defendant believes that $\lambda(\phi) \geq \frac{1}{2}$), and (iii) the defendant loses under the revelation of $x = L$, which will only be revealed by the plaintiff's expert (both biased and unbiased). Thus, unless the plaintiff's expert observes $x = L$ (with probability (A)), the defendant wins at trial and obtains a payoff of 1, which provides us with the expected payoff in (4).

[20] The superscript b and the subscript D are used to denote the defendant's expected payoff with a biased expert, π_D^b. Notations for other expected payoffs can be similarly understood.

If the defendant selects an unbiased expert, his expected payoff is

$$\begin{aligned}\pi_D^u &= (1-(e_P+\underbrace{(1-e_P)e_D}_{(B)})P(x=L))\times 1 \\ &= 1-(e_P+(1-e_P)e_D)(\mu(1-p)+(1-\mu)p) \qquad (5)\end{aligned}$$

The expression above shows that the defendant is more likely to lose with an unbiased expert. Even when the plaintiff's expert cannot provide unfavorable evidence $x = L$, such evidence can still be provided by the defendant's unbiased expert with probability (B). This increased probability of the revelation of unfavorable evidence reduces the defendant's expected payoff, and therefore the defendant strictly prefers a biased expert to an unbiased expert if the defendant believes that the burden of proof will be on the plaintiff's side.

It is straightforward to show that the plaintiff's behavior is analogous: if the plaintiff believes that the burden of proof will be assigned to the defendant, the plaintiff strictly prefers a biased expert to an unbiased expert.

Now, suppose that the defendant believes that the burden of proof will be on the defendant himself, that is, $\lambda(\phi) < \frac{1}{2}$. Then, if the defendant selects a biased expert, his expected payoff is

$$\begin{aligned}\pi_D^b &= (\underbrace{e_D}_{(A)}+\underbrace{(1-e_D)(1-\psi_P)e_P}_{(B)})P(x=H)\times 1 \\ &= (e_D+(1-e_D)(1-\psi_P)e_P)(\mu p+(1-\mu)(1-p)) \qquad (6)\end{aligned}$$

where $1-\psi_P$ is the probability that the plaintiff selects an unbiased expert. Because the defendant believes that he bears the burden of proof, he wins at trial only when the revealed evidence is favorable to his cause. The evidence may be favorable to the defendant's cause in two cases. First, the defendant's expert observes and reveals $x = H$ at trial (with probability (A)). Second, although the defendant's expert could not observe the favorable evidence, the plaintiff's unbiased expert can truthfully reveal such evidence (with probability (B)). Adding these probabilities multiplied by a payoff of 1 from winning at trial provides us with the expression (6).

If the defendant chooses an unbiased expert instead, his expected payoff is equal to that with a biased expert, that is, $\pi_D^u = \pi_D^b$. The expected payoff remains unchanged for two reasons. First, a biased expert's evidence distortion is not beneficial to the defendant under the current burden of proof assignment (according to the defendant's belief). If a biased expert observed unfavorable evidence, $x = L$, she does not reveal it to the court; however, the defendant nevertheless loses at trial because regardless of whether the plaintiff's side

reveals[21] or does not reveal $x = L$ (leading to situation ϕ), the court upholds the plaintiff's cause. Second, to win at trial, the defendant's side is required to present hard evidence for his cause, $x = H$. However, because evidence is verifiable, an expert cannot fabricate favorable evidence. Thus, the frequency with which a biased expert presents favorable evidence at trial is equal to that with which an unbiased expert presents favorable evidence. Combining these two effects, I conclude that the choice of an expert does not affect the defendant's winning probability at trial; therefore, the defendant is indifferent between a biased expert and an unbiased expert.

It is again straightforward to demonstrate that the plaintiff's behavior is analogous: if the plaintiff believes that he bears the burden of proof, he is indifferent between a biased expert and an unbiased expert. These results are summarized in the following proposition:

Proposition 1. *If a litigant believes that he bears the burden of proof at trial, he is indifferent between a biased expert and an unbiased expert. Instead, if a litigant believes that the other party bears the burden of proof at trial, he strictly prefers a biased expert to an unbiased expert.*

3.3 The Equilibria of the Model

In this subsection, I find the equilibria of the model in which the litigants' and the experts' behavior are consistent with the court's belief and decision.

Suppose the court's belief is such that the burden of proof is on the plaintiff, that is, $\lambda(\phi) \geq \frac{1}{2}$. Then, according to Proposition 1, the defendant strictly prefers a biased expert to an unbiased expert, and the plaintiff is indifferent between the two types of experts. Therefore, given that the court's belief is against the plaintiff, the litigants' equilibrium strategies must be such that

$$\psi_D^* = 1 \text{ and } \psi_P^* \in [0, 1] \tag{7}$$

which implies that the defendant employs a pure strategy regarding his choice of expert and that the plaintiff uses a mixed strategy because he is indifferent between the two types of expert.

It remains to verify whether the equilibrium strategies in (7) are consistent with the court's belief under ϕ. Under (ψ_D^*, ψ_P^*) given in (7), the court's belief must satisfy the following conditions:

$$\begin{aligned}
\lambda^*(\phi) &= \frac{\mu q_h^*}{\mu q_h^* + (1-\mu) q_l^*} \geq \frac{1}{2} \\
q_h^* &= (1-e_D)(1-e_P) + e_D(1-e_P)(1-p) + (1-e_D)e_P\psi_P^* p \\
q_l^* &= (1-e_D)(1-e_P) + e_D(1-e_P)p + (1-e_D)e_P\psi_P^*(1-p)
\end{aligned}$$

[21] If the defendant's expert observed and suppressed $x = L$, the plaintiff's expert must have observed the same evidence (if she observed the evidence) because both experts have access to the same hidden evidence.

Simplifying the conditions above provides us with the following condition on ψ_P^*:

$$\psi_P^* \geq \frac{(1-2\mu)+(p-\mu)\frac{e_D}{1-e_D}}{(\mu-(1-p))\frac{e_P}{1-e_P}} \equiv f(\mu) \tag{8}$$

This condition provides us with a lower bound on ψ_P^* for the existence of the equilibrium in which the burden of proof is on the plaintiff. Such a condition for the existence of the equilibrium is intuitive. If the plaintiff's equilibrium strategy is such that he chooses a biased expert with a very small probability (i.e., small ψ_P^*), in the absence of evidence (i.e., under ϕ), the court's equilibrium "skepticism" about the plaintiff's expert testimony must be small because the plaintiff's expert is highly likely to be unbiased and truth-telling. Thus, the evidence distortion from the plaintiff's side is weighed less heavily in the court's belief formation, which reduces the court's equilibrium belief (i.e., small $\lambda^*(\phi)$). Therefore, a low level of ψ_P^* cannot be consistent with a high value of $\lambda^*(\phi)$, which requires condition (8) for the existence of the equilibrium.

Further investigation of the lower bound, $f(\mu)$, demonstrates that $f(\mu)' < 0$ and

$$f\left(\frac{1}{2}\right) = \frac{\frac{e_D}{1-e_D}}{\frac{e_P}{1-e_P}}$$

For example, if $e_D = e_P$ (i.e., the experts from both sides are equally likely to observe the hidden evidence), then $f\left(\frac{1}{2}\right) = 1$. In this case, if $\mu < \frac{1}{2}$, there is no equilibrium in which the burden of proof is on the plaintiff; if $\mu = \frac{1}{2}$, the plaintiff must choose a biased expert with probability 1 to sustain the equilibrium; and if $\mu > \frac{1}{2}$, the plaintiff is allowed to choose an unbiased expert with a positive probability in equilibrium. Thus, as the initial situation becomes more favorable toward the plaintiff (i.e., small μ), he appoints a biased expert with a higher frequency in equilibrium.

It is intuitive that the lower bound, $f(\mu)$, is decreasing in μ. If μ is small, before listening to expert testimony, the court believes that the defendant is highly likely to be liable. Thus, to place the burden of proof on the plaintiff in equilibrium, the plaintiff must appoint a biased expert sufficiently often (i.e., high $f(\mu)$) such that the court's skepticism about the plaintiff's expert testimony weighs heavily in its belief formation, which would thereby increase $\lambda^*(\phi)$ beyond $\frac{1}{2}$.

These results are summarized in the following proposition. As the analysis for the other equilibrium in which the burden of proof is placed on the defendant is analogous, I present the result without a proof.

Proposition 2. *There is a function*

$$f(\mu) = \frac{(1-2\mu) + (p-\mu)\frac{e_D}{1-e_D}}{(\mu-(1-p))\frac{e_P}{1-e_P}}$$

such that there is an equilibrium in which $\psi_D^* = 1$ *and* $\psi_P^* \in [0,1]$ *are the litigants' strategies and the burden of proof is on the plaintiff if and only if* $\psi_P^* \geq f(\mu)$*. Similarly, there is a function*

$$g(\mu) = \frac{(\mu-(1-p))\frac{e_P}{1-e_P} - (1-2\mu)}{(p-\mu)\frac{e_D}{1-e_D}}$$

such that there is an equilibrium in which $\psi_D^* \in [0,1]$ *and* $\psi_P^* = 1$ *are the litigants' strategies and the burden of proof is on the defendant if and only if* $\psi_D^* > g(\mu)$*.*

4 Discussion

4.1 Prespecified Burden of Proof

The foregoing analysis showed that the burden of proof was determined in equilibrium in the form of presumption against a party under the no-evidence event. In practice, the court may not have discretion and just follow prespecified rules (as a black letter law) in allocating the burden of proof between the litigants; for example, in criminal cases, the burden of proof is typically placed on the prosecution, which must prove that the defendant is guilty before a jury may convict him, where the failure to provide favorable evidence for prosecution leads to the defendant's win.

It turns out that my main result holds in this situation as well. Suppose the burden of proof is always on the plaintiff and the failure to provide evidence favorable for the plaintiff leads to the defendant's win; in other words, the court upholds the cause of the defendant under ϕ regardless of its belief, $\lambda(\phi)$. Observe that Proposition 1, which states the findings about the litigants' incentive, remains intact in this situation because what matters for the litigants is the court's decision, not the court's belief *per se*. Thus, according to Proposition 1, the defendant deploys a hired gun that only reveals $x = H$ whenever possible, and the plaintiff is willing to provide unbiased testimony. Moreover, the plaintiff can supply unbiased testimony without any constraint on his choice. To see this point more clearly, observe Proposition 2 demonstrates that the plaintiff cannot provide unbiased testimony too often in equilibrium because otherwise the no-evidence event could induce the court to rule in favor of the plaintiff, thereby disrupting the equilibrium. In contrast, if the court upholds the cause of the defendant under ϕ regardless of its belief, the plaintiff's choice of expert cannot influence the court's decision under ϕ, and therefore no constraint on the plaintiff's choice is necessary to sustain the equilibrium. Thus, my main result holds with added force in this situation.

4.2 Testable Implications

What are the testable implications for the result that litigants may have different incentive to deploy hired guns? One interesting avenue for empirical research is to investigate the extent to which the win rates of motions to dismiss raised by the litigants correlate with litigation environments.

In criminal cases, my main result predicts that the defendant presents biased expert testimony more often than the plaintiff because the burden of proof is typically on the plaintiff in those lawsuits. An empirical implication is that if biased expert testimony is more likely to be dismissed than unbiased testimony upon challenges from the opposing counsel, *ceteris paribus*, courts are more likely to strike the defendant's expert. In their study of criminal cases in appellate courts, Groscup et al. (2002) present some evidence suggesting experts proffered by the prosecution were more likely to be admitted than experts proffered by defendants: at the trial court level, prosecution experts were admitted 95.8% of the time, but defendant-appellant experts were admitted only 7.8% of the total number of times they were offered. This pattern was slightly less pronounced at the appellate level, with prosecution experts admitted 85.1% of the time and defense experts admitted 18.8% of the total number of times they were offered. A reason for this very large difference could be attributed to the fact that the focus rests on the cases appealed mostly by the defendant.

Slightly different figures are reported for civil cases by Dixon and Gill (2001) and Cooper (2015). Dixon and Gill find no statistically significant difference in the admission of expert testimony proffered by defendants and plaintiffs. Cooper reports a sizable difference in this variable, noting that the defendant's and plaintiff's *Daubert* motion win rates are 0.5 and 0.4 on average, respectively, which is opposite to the finding from criminal cases. However, *Daubert* motion win rates in his data set vary across the nature of suits: the plaintiff has a higher win rates for motions in real property, antitrust, and intellectual property suits, whereas the defendant has an edge in other types of suits. These different figures in civil cases could arise because of the different assignment of the burden of proof across jurisdictions in civil cases because, although the plaintiff is normally charged with the burden of proof, the defendant can be required to establish certain defenses.

Cooper also shows that for plaintiffs, unsuccessful *Daubert* motions are associated with a one-third lower win rate in subsequent litigation than successful motions, whereas there is no statistically measurable association between the outcome of defendants' *Daubert* motions and subsequent litigation outcomes. According to my model, supposing the burden of proof is on the plaintiff, the defendant deploys hired guns more often than the plaintiff; therefore, if the plaintiff's motion is unsuccessful, the judge's decision will be influenced by biased expert testimony proffered by the defendant, which would adversely affect the plaintiff's litigation outcomes. In contrast, even when the defendant's motion fails, it is possible that the plaintiff's

expert is neutral and truth-telling, and therefore the influence of expert testimony on the defendant's win rate at trial could be relatively neutral. It would be interesting to take a closer look at these issues in future studies.

4.3 Evidence Verifiability

The main analysis assumes that evidence supplied by the experts is verifiable, so they can hide unfavorable evidence but cannot fabricate favorable evidence.[22] Instead, if I allow experts to fabricate any evidence favorable for their clients' causes, an immediate consequence is that the value of information proffered by the experts in the fact-finding process decreases. In the main analysis, the presentation of favorable evidence leads to a sure win for the party that the evidence favors (i.e., the revelation of H leads to the defendant's win and vice versa), but this is not the case anymore because the information content of the presented evidence now depends on the court's belief about the litigants' choice of experts. For instance, even if the defense expert presents favorable evidence (i.e., H), the court may not rule in favor of the defense because the information value of H is very small if the court believes that the defense expert is highly likely to be a hired gun that fabricated favorable evidence.

It turns out that in the current framework, the falsifiable evidence assumption leads to the complete breakdown of the communication channel between the parties and the court, rendering the fact-finding process meaningless. To be more precise, assume that the evidence is not verifiable, so biased experts can concoct and present favorable evidence to the court. In such a situation, is it possible to sustain an equilibrium in which a litigant proffers unbiased testimony? Suppose the plaintiff appoints an unbiased expert in equilibrium. Then, the court admits any evidence proffered by the plaintiff's expert, considering it as accurate and objective information; moreover, under the no-evidence event, the court does not exercise any skepticism toward the plaintiff's silence because it believes that the plaintiff's expert is silent just because he does not possess any evidence. Such a belief formation process is beneficial for the plaintiff because less skepticism means a higher chance of winning under the no-evidence event.

Anticipating such a response by the court, the plaintiff, in the first place, has incentive to deviate to deploying a hired gun[23] because the plaintiff can raise his winning probability by having the biased expert fabricate favorable evidence, which will be taken as accurate and objective information under the equilibrium presumption held by the court. Thus, it is not possible to sustain an equilibrium in which a litigant proffers unbiased testimony when the evidence is not verifiable.

This discussion suggests that to maintain the quality of adversarial fact-finding processes,

[22] Although evidence is typically assumed to be verifiable in the litigation game literature, Emons and Fluet (2009a,b) study a litigation game where evidence fabrication is possible.

[23] This reasoning is feasible because the court cannot directly observe the bias of the expert.

it is imperative to accurately verify evidence proffered by parties and to impose large penalties on those who fabricated evidence. A neutral court-advisor could prove useful for this purpose,[24] particularly in case of forensic science evidence, as judges are often ill-prepared for evaluating pieces of evidence proffered by experts, although there could be a repercussion as discussed by Kim and Koh (2015).[25]

4.4 Juror Naivety

In the United States, jury trials are widely used in criminal cases and seen as a line of defense against the state's ability to inappropriately deprive individuals of life and liberty.[26] However, jury trials in civil cases have been criticized by many legal scholars and practitioners, especially when those cases involve complex scientific or statistical evidence proffered by experts because, as the argument goes, lay juries are ill-prepared to evaluate such complex evidence.[27] Thus, although I assume the fact-finder is Bayesian in the main analysis, in practice, she may not be able to use such a sophisticated reasoning. Moreover, juries are often instructed not to make a negative inference from a party's failure to testify. How does juror naivety influence the main results?

If the jurors cannot make a negative inference, their posterior belief under the no-evidence event ϕ is equal to the prior belief μ, that is, $\lambda(\phi) = \mu$. Then, according to Definition 1, the burden of proof is on the plaintiff if $\mu \geq \frac{1}{2}$ and on the defendant otherwise. If the burden of proof is on the plaintiff, Proposition 1 shows that the defendant deploys a hired gun whereas the plaintiff is willing to provide unbiased testimony, which can be shown to constitute an equilibrium. In fact, this constellation of litigant strategies constitutes an equilibrium regardless of the plaintiff's choice probability of unbiased experts,[28] and therefore the plaintiff is allowed to supply unbiased testimony more often in equilibrium under juror naivety.

[24] Federal Rule of Evidence 706 states that a judge may appoint court-advisors of his own selection. Yet, Rule 706 has been infrequently invoked since its enactment because many judges have been reluctant to appoint court-advisors out of concern that doing so will interfere with the adversarial process (Cecil and Willging, 1994). See Section 4.6 for a related discussion.

[25] Within a standard litigation game, Kim and Koh (2015) study the effect of court-advisors on the litigants' incentive to proffer evidence. They find that the court's appointment of court-advisors could reduce the litigants' incentive to supply evidence. In general, there have been numerous reform proposals suggesting that the judge appoint his own advisors, thereby enhancing the inquisitorial component in the American legal system. See Section 4.6 for references.

[26] The right to a jury trial is guaranteed by the Sixth Amendment for criminal trials. The Seventh Amendment guarantees this right for civil trials where the amount in controversy exceeds $20.

[27] See, for instance, Kalven and Zeisel (1966) and Simon (1975) for the controversy over the merits of using lay juries. In *Skidmore v. Baltimore and Ohio R.R.*, 116 F.2d 54 (1947), Judge Jerome Frank wrote: "While the jury can contribute nothing of value so far as the law is concerned, it has infinite capacity for mischief, for twelve men can easily misunderstand more law in a minute than the judge can explain in an hour." Dean Griswold of Harvard Law School argued (Guinther, 1988): "The jury trial at best is the apotheosis of the amateur. Why should anyone think that 12 persons brought in from the street, selected in various ways, for their lack of general ability, should have any special capacity for deciding controversies between persons?"

[28] The reasoning is similar to that in Section 4.1.

It is interesting to find that juror naivety could *increase*, rather than decrease, a litigant's incentive to supply unbiased testimony. However, it would be far-fetched to claim that this result is general because there could be many factors behind a litigant's behavioral response to juror naivety. Rather, this discussion suggests a mechanism, not considered in the literature, that juror naivety may correlate negatively with adversarial bias. It would be an interesting avenue for future research to study the relationship between these two important variables in more general settings.

4.5 Adversarial Bias and the *Daubert* Test

Contrary to public concerns about adversarial bias in American courtrooms, the main result suggests that a litigant may voluntarily appoint an unbiased truth-telling expert at trial. If a court, in applying the *Daubert* test, dismisses the testimony by such a truth-telling expert as inadmissible, it will discard a neutral piece of evidence that is beneficial for its decision-making process and will thereby reduce the accuracy of its final verdict. If the rationale behind the strict admissibility standard is the existence of adversarial bias as Bernstein (2008) argues, a litigant's voluntary appointment of truth-telling experts weakens the argument for the *Daubert* test in certain situations as suggested by the main results.

A policy implication is that courts could apply the *Daubert* test to a varying degree in each case. The model suggests that a positive association exists between the litigation environment and adversarial bias in that as the litigation environment becomes more favorable for a litigant, he is more likely to present biased expert testimony. In particular, the burden of proof assignment and the court's prior belief are shown to influence adversarial bias. As these results provide us with information regarding which party to litigation has a higher likelihood of buying hired guns, courts could utilize such information in each lawsuit and apply a more stringent admissibility test to one party than the other.

4.6 Centralized Institution

Many legal scholars and practitioners have long argued for a centralized system for expert testimony, which would allow judges to appoint neutral experts rather than require litigants to appoint their own experts. In particular, numerous reform proposals have suggested that courts should appoint their own experts, which would enhance the *inquisitorial* component of the American legal system.[29] Indeed, Gross (1991) describes the use of non-partisan experts

[29]For example, see Runkle (2001), who discusses the structure of the Court Appointed Scientific Experts program created by the American Association for the Advancement of Science in order to help judges obtain independent experts. See also Hillman (2002), Adrogue and Ratliff (2003), Kaplan (2006), Robertson (2010), and Kim (2015a), among others. Based on his experience as Judge Richard Posner's court-appointed economic expert, Sidak (2013) argues for the use of court-appointed neutral economic experts. Many reformers, most famously Hand (1901), argue that the appropriate remedy to adversarial bias (combined with inexpert juries) is increased reliance on court-appointed nonpartisan experts.

as "[t]he most frequently suggested reform." Kaye et al. (2010) also note that "from the later part of the nineteenth century to the present, the dominant proposed solution to the problems of adversarial experts has been to call for the use of non-adversarial experts, in order to create a nonpartisan source of expert knowledge."

A typical argument against such reform is as follows: as the current American legal system is inherently adversarial, establishing a centralized institution may create conflict in the operation of the legal system. My analysis provides another argument against the reform for a centralized system: if the purpose of establishing a centralized institution is to guarantee the existence of neutral experts in courtrooms, such an institution may not be worth the cost because neutral and unbiased voices remain heard under the current system to a certain extent. Thus, detailed cost–benefit analyses are called for to accurately assess the value of the reform.

4.7 The Exclusionary Rule

Daughety and Reinganum (2000a,b) argue that during the trial process, courts cannot purely follow a Bayesian approach because they are constrained by evidentiary rules along with other characteristics of the trial process. One of the evidentiary rules studied extensively in the law and economics literature is the exclusionary rule, whereby evidence pertaining to a propensity for the defendant to act a certain way should be discarded as inadmissible.[30] In a series of influential articles, Demougin and Fluet (2005, 2006, 2008) interpret the exclusionary rule in the civil context as imposing a "neutral" prior belief (i.e., $\mu = \frac{1}{2}$) on the court's decision-making, and they demonstrate that the exclusionary rule maximizes deterrence when it is used along with the preponderance of evidence standard.

My analysis suggests that if I follow Demougin and Fluet's interpretation of the exclusionary rule in the civil context, the rule may also affect adversarial bias. For example, suppose that the quality of the experts provided by the litigants is the same (i.e., $e_D = e_P$) and that the court's prior belief is favorable to the defendant (i.e., $\mu > \frac{1}{2}$). Then, the main analysis shows that in the equilibrium with the burden of proof on the plaintiff, the plaintiff may voluntarily appoint a neutral expert at trial. In this situation, the imposition of the exclusionary rule (which changes the court's prior belief to $\mu = \frac{1}{2}$) alters the litigants' incentives, inducing the plaintiff to buy hired guns for sure at trial (because $f\left(\frac{1}{2}\right) = 1$). On the other hand, if the court's prior belief was favorable to the plaintiff (i.e., $\mu < \frac{1}{2}$), the adoption of the exclusionary rule may support the existence of an equilibrium that is not possible without the rule. In the former situation, the exclusionary rule may exacerbate the adversarial bias problem at trial, and in the latter situation, the rule may be beneficial for society as it supports the existence of equilibrium outcomes.

[30] Schrag and Scotchmer (1994) analyze the deterrence justification for the dismissal of character evidence in criminal trials. Sanchirico (2001) provides a discussion on this issue.

References

Adrogue, S. and A. Ratliff (2003): "The Independent Expert Evolution: From the "Path of Least Resistance" to the "Road less Traveled?"," *Texas Tech Law Review*, 34, 843–897.

Angell, M. (1997): *Science on Trial: The Clash of Medical Evidence and the Law in the Breast Implant Case*, W. W. Norton & Company.

Bernstein, D. E. (2008): "Expert Witnesses, Adversarial Bias, and the (Partial) Failure of the Daubert Revolution," *Iowa Law Review*, 93, 451–489.

——— (2013): "The Misbegotten Judicial Resistance to the *Daubert* Revolution," *Notre Dame Law Review*, 89, 27–70.

Boudreau, C. and M. D. McCubbins (2008): "Nothing But the Truth? Experiments on Adversarial Competition, Expert Testimony, and Decision Making," *Journal of Empirical Legal Studies*, 5, 751–789.

Cecil, J. S. and T. E. Willging (1994): "Accepting *Daubert*'s Invitation: Defining a Role for Court-Appointed Experts in Assessing Scientific Validity," *Emory Law Journal*, 43, 995–1070.

Cooper, J. C. (2015): "Timing and Disposition of *Daubert* Motions in Federal District Courts: An Empirical Examination," Working Paper.

Daughety, A. F. and J. F. Reinganum (2000a): "Appealing judgments," *RAND Journal of Economics*, 31, 502–525.

——— (2000b): "On the economics of trials: adversarial process, evidence, and equilibrium bias," *Journal of Law, Economics, and Organization*, 16, 365–394.

Demougin, D. and C. Fluet (2005): "Deterrence versus Judicial Error: A Comparative View of Standards of Proof," *Journal of Institutional and Theoretical Economics*, 161, 193–206.

——— (2006): "Preponderance of Evidence," *European Economic Review*, 50, 963–976.

——— (2008): "Rules of Proof, Courts, and Incentives," *RAND Journal of Economics*, 39, 20–40.

Dixon, L. and B. Gill (2001): "Changes in the Standards for Admitting Expert Evidence in Federal Civil Cases Since the *Daubert* Decision," RAND Institute for Civil Justice.

Emons, W. and C. Fluet (2009a): "Accuracy Versus Falsification Costs: The Optimal Amount of Evidence under Different Procedures," *Journal of Law, Economics, and Organization*, 25, 134–156.

——— (2009b): "Adversarial versus Inquisitorial Testimony," Working Paper.

Froeb, L. and B. Kobayashi (1996): "Naive, Biased, Yet Bayesian: Can Juries Interpret Selectively Produced Evidence?" *Journal of Law, Economics and Organization*, 12, 257–276.

Green, M. D. (1998): *Bendectin and Birth Defects: The Challenges of Mass Toxic Substances Litigation*, University of Pennsylvania Press.

Groscup, J. L., S. D. Penrod, C. A. Studebaker, M. T. Huss, and K. M. O'Neil (2002): "The Effects of *Daubert* on the Admissibility of Expert Testimony in State and Federal Criminal Cases," *Psychology, Public Policy, and Law*, 8, 339–372.

Gross, S. R. (1991): "Expert Evidence," *Wisconsin Law Review*, 1113–1232.

Guinther, J. (1988): *The Jury in America*, New York: Facts on File Publications.

Hand, L. (1901): "Historical and Practical Considerations regarding Expert Testimony," *Harvard Law Review*, 15, 40–58.

Haw, R. (2012): "Adversarial Economics in Antitrust Litigation: Losing Academic Consensus in the Battle of the Experts," *Northwestern University Law Review*, 106, 1261–1305.

Hillman, T. (2002): "Using Court-Appointed Experts," *New England Law Review*, 36, 587–591.

Kalven, H. and H. Zeisel (1966): *The American Jury*, New York: Little, Brown.

Kaplan, L. A. (2006): "2005 Milton Handler Antitrust Review: Experts in the Courthouse: Problems and Opportunities," *Columbia Business Law Review*, 2006, 247–260.

Kaye, D. H., D. E. Bernstein, and J. L. Mnookin (2010): *The New Wigmore: A Treatise on Evidence - Expert Evidence*, Aspen Publishers, 2nd ed.

Kim, C. (2014): "Adversarial and Inquisitorial Procedures with Information Acquisition," *Journal of Law, Economics, and Organization*, 30, 767–803.

——— (2015a): "Centralized vs. Decentralized Institutions for Expert Testimony," Working Paper.

——— (2015b): "An Economic Rationale for Dismissing Low-Quality Experts in Trial," Working Paper.

Kim, C. and P. S. Koh (2015): "Court-Appointed Expert and Accuracy in Adversarial Litigation," Working Paper.

Krafka, C., M. A. Dunn, M. T. Johnson, J. S. Cecil, and D. Miletich (2002): "Judge and Attorney Experiences, Practices, and Concerns Regarding Expert Testimony in Federal Civil Trials," *Psychology, Public Policy, and Law*, 8, 309–332.

Langbein, J. H. (1985): "The German Advantage in Civil Procedure," *University of Chicago Law Review*, 52, 823–866.

Liptak, A. (2008): "One Footnote, a Debate Over the Tangles of Law, Science and Money," online at www.nytimes.com.

Milgrom, P. and J. Roberts (1986): "Relying on the Information of Interested Parties," *RAND Journal of Economics*, 17, 18–32.

Milgrom, P. R. (1981): "Good News and Bad News: Representation Theorems and Applications," *Bell Journal of Economics*, 12, 380–391.

Mnookin, J. L. (2008): "Expert Evidence, Partisanship, and Epistemic Competence," *Brooklyn Law Review*, 73, 587–611.

Robertson, C. T. (2010): "Blind Expertise," *New York University Law Review*, 85, 174–257.

Runkle, D. (2001): "Court Appointed Scientific Experts: A Demonstration Project of the American Association for the Advancement of Science," *Risk Decision and Policy*, 6, 139–143.

Sanchirico, C. W. (2001): "Character Evidence and the Object of Trial," *Columbia Law Review*, 101, 1227–1311.

Sanders, J. (1998): *Bendectin on Trial: A Study of Mass Tort Litigation*, University of Michigan Press.

Schrag, J. and S. Scotchmer (1994): "Crime and prejudice: The use of character evidence in criminal trials," *Journal of Law, Economics, and Organization*, 10, 319–342.

Schuck, P. H. (1988): *Agent Orange on Trial: Mass Toxic Disasters in the Courts*, Belknap Press.

Shin, H. (1998): "Adversarial and Inquisitorial Procedures in Arbitration," *RAND Journal of Economics*, 29, 378–405.

Sidak, J. G. (2013): "Court-Appointed Neutral Economic Experts," *Journal of Competition Law and Economics*, 9, 359–394.

Simon, R. J. (1975): *The Jury System in America: A Critical Overview*, California: Sage Publications.

Sorrel, A. L. (2007): "In Search of Truthful Testimony: Scrutinizing Expert Witnesses," online at www.amednews.com.