

# WHAT JURIES CAN'T DO WELL: THE JURY'S PERFORMANCE AS A RISK MANAGER

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## I. INTRODUCTION

Can juries handle complex cases? One way to frame this question in behavioral science terms is to ask: What tasks can juries perform well and what tasks will they perform poorly? Our basic precept is that the legal system should ask juries to perform tasks that they are good at performing and should not require juries to carry out tasks that they cannot perform well.<sup>1</sup> A second guiding theme in our approach to the issue of jury competency is that the most relevant, most useful analyses of jury performance are based on empirical observations and data, not on rational analyses of hypothetical ideal situations.

A petit jury is a sample of non-expert lay people asked to reach majority or unanimous consensus answers to legal questions. In general terms, jurors are asked to perform one or more of the following tasks when they serve on criminal or civil juries: (1) factfinder, to piece together the puzzle of historical truth; (2) moralist, to represent and express the conscience of the community; (3) disciplinarian, to punish societally proscribed behaviors in a just and effective manner; and (4) accountant, to compensate a party who suffers harm, such that the degree of compensation is intended to make the injured party whole again. However, we often attribute other functions to the jury. For example, we expect that the prospect of a jury trial can induce parties to resolve disputes or bargain

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1. But see Cass R. Sunstein et al., *Assessing Punitive Damages (with Notes on Cognition and Valuation in Law)*, 107 YALE L.J. 2071 (1998).

charges and sentences rather than going to trial. From an even more elevated perspective, the jury is supposed to protect citizens from abuse by corrupt political officials, an overzealous prosecutor, or a prejudiced judge. The general acceptance of verdicts by the citizenry is promoted (but obviously not guaranteed) by the imprimatur of a decision made by a sample of citizens. Sometimes law and economics scholars depict the jury as governors of a pricing mechanism deliberately structured to control the behaviors of self-interested individuals in a societal market in which benefits and costs are distributed. And one can view the jury as a risk manager responsible for promoting an efficient and socially acceptable level of risk-taking behavior by society's citizens and corporations.<sup>2</sup>

Our assumption is that it is reasonable to conceive of some jury decisions as serving the function of controlling risky behavior. Thus, for example, when a jury is asked to consider exemplary or punitive damages to punish and deter members of society from engaging in conduct that is in reckless disregard of the risks to others, we view the judgment as involving social risk management. Thus we ask: Can the jury perform in a manner so that it serves as an effective societal risk manager? To avoid any pretense of suspense, we believe that this is an extremely difficult function that is often not performed effectively even by the best informed experts.<sup>3</sup> The jury is ill-informed and poorly equipped to perform this function. In our view, effective risk identification and management often requires the application of technical, statistical, and scientific analytic tools that cannot be effectively communicated to the unschooled layperson through expert testimony in adversarial procedures. Furthermore, although an effective risk management policy is founded on the detailed analysis of individual cases (for example, accidents and non-accidents), it requires an omnibus consideration of the distribution of cases, probabilities, benefits, and costs. In contrast, the tort jury trial focuses on a single case, sampled from only one of the four cells of a hypothetical risk analysis matrix: the too-few-precautions, harmful outcome cell.

We will rely on two reference points to determine the soundness of jury behavior. First, it is possible to compare the jurors' decision with what would be dictated under a correct interpretation of legal rules. Second, we will also analyze the performance of juries in comparison to the performance of a sample of judges. In particular, do judges perform more satisfactorily with respect to their handling of the risk of accident issues and their assignment of liability than do the mock jurors?

Our evaluation of juries will involve an assessment of their performance with respect to a hypothetical railroad accident situation. In particular, we focus on the legal institution of jury punitive damages decisions. We conceive of this

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2. See A. Mitchell Polinsky & Steven Shavell, *Punitive Damages: An Economic Analysis*, 111 HARV. L. REV. 869, 878-900, 955-56 (1998); W. Kip Viscusi, *The Social Costs of Punitive Damages Against Corporations in Environmental and Safety Tort*, 87 GEO. L.J. (forthcoming Oct. 1998).

3. STEPHEN G. BREYER, *BREAKING THE VICIOUS CIRCLE: TOWARD EFFECTIVE RISK REGULATION* (1993); W. KIP VISCUSI, *FATAL TRADEOFFS: PUBLIC AND PRIVATE RESPONSIBILITIES FOR RISK* (1992).

institution as justified primarily by the impact of the jury decisions to efficiently deter self-interested behaviors by individuals and (especially) corporations that callously produce grave risks for others.<sup>4</sup> Our focus is on the award of punitive damages against parties who are charged with engaging in unconscionably *reckless* conduct. Some prime examples would be environmental damage and product safety tort suits. We are not concerned here with awards of punitive damages to punish deliberately malicious conduct or to provide additional compensation to putatively under-compensated plaintiffs.<sup>5</sup> We nevertheless also have our doubts about the competency of the jury to serve as an effective disciplinarian in those types of decisions.

The issues that concern us have been raised by other observers. For example, Federal Circuit Judge Frank Easterbrook anticipated most of the arguments we will make in his concurring opinion in *Carroll v. Otis Elevator Co.*<sup>6</sup> In that case, a department store clerk was injured when an unidentified individual, probably a child, pressed the emergency stop button on an escalator. The focal issue for the jury concerned the foreseeability of misuse of the stop button and the potential for its bright red color, designed to make the button salient for quick action in an emergency, to attract children's attention. As Easterbrook wrote:

Why should escalator design be a question for juries?... Why then ask them to identify defects after the fact?... Because the expected costs of stops are small, designers make buttons easy to find and press to reduce the costs of the rarer, but much more serious, entanglements.... Come the lawsuit, however, the passenger injured by a stop presents himself as a person, not a probability. Jurors see today's injury; persons who would be injured if buttons were harder to find and use are invisible.... Often [the jurors] succeed in suppressing their habits and comparing the flesh-and-blood injury against potential losses; by and large the system resolves products liability cases sensibly. Yet no matter how conscientious jurors may be, there is a bias in the system. *Ex post* claims are overvalued and technical arguments are discounted in the process of litigation.<sup>7</sup>

Our present focus is on cases where the focal issue is the defendant's recklessness. These are cases where the liability decision requires the jury to provide a retrospective evaluation of the *ex ante* "foreseeable risk" and where *ex*

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4. For disagreement, see WILLIAM M. LANDES & RICHARD A. POSNER, *THE ECONOMIC STRUCTURE OF TORT LAW* 184-85 (1987); Sunstein et al., *supra* note 1, at 2081-85; Polinsky & Shavell, *supra* note 2, at 878-900; Marc Galanter & David Luban, *Poetic Justice: Punitive Damages and Legal Pluralism*, 42 AM. U. L. REV. 1393, 1425-28 (1993).

5. See, e.g., Peter Diamond, *Efficiency Effects of Punitive Damages* (Sept. 1997) (working paper) (unpublished manuscript on file with author, available at Dept. of Economics, Massachusetts Institute of Technology, Peter Diamond).

6. 896 F.2d 210 (7th Cir. 1990).

7. *Id.* at 215-16.

*post* overestimates of foreseeability can produce unjustified feelings of outrage and punitiveness.

## II. AN ORIGINAL EMPIRICAL STUDY OF JURY AND JUDGE DECISIONS

The courts are subject to a variety of potential irrationalities involving risk. Choices involving risk and uncertainty are notoriously difficult on a variety of dimensions. The most distinctive aspect of how the courts address risk is that this activity occurs after a harm has occurred. Since judicial actions occur after the damage has been inflicted rather than before, a critical concern is the extent to which people have systematic biases in dealing with risk on an *ex post* basis as opposed to making decisions involving the risk before the accident has in fact occurred. Here we will report on original empirical evidence involving the behavior of judges and mock jurors with respect to the same experimental instrument. It will then be possible to compare this performance to assess the relative biases of jurors as compared to judges.

We took a closer look at the hindsight effect in judgments of punitive damages in two empirical studies that provide an assessment of the magnitude of such effects in an environmental damage tort case. Our studies also allow us to compare hindsight effects in judgments by citizens eligible for jury duty and active judges. The judgment in which we were interested was presented to our hindsight subjects via typical instructions on liability for punitive damages:<sup>8</sup>

You may award punitive damages only if you find that the defendant's conduct

(1) was malicious; or

(2) manifested reckless or callous disregard for the rights of others.

Conduct is malicious if it is accompanied by ill will, or spite, or if it is for the purpose of injuring another.

In order for conduct to be in reckless or callous disregard of the rights of others, four factors must be present. First, a defendant must be subjectively conscious of a particular grave danger or risk of harm, and the danger or risk must be a foreseeable and probable effect of the conduct. Second, the particular danger or risk of which the defendant was subjectively conscious must in fact have eventuated. Third, a defendant must have disregarded the risk in deciding how to act. Fourth, a defendant's conduct in ignoring the danger or risk must have

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8. RONALD W. EADES, JURY INSTRUCTIONS ON DAMAGES IN TORT ACTIONS 97-153 (3d ed. 1993); *Jardel Co. v. Hughes*, 523 A.2d 518, 527-31 (Del. 1987). See Reid Hastie et al., *A Study of Juror and Jury Judgments in Civil Cases: Deciding Liability for Punitive Damages*, 22 LAW & HUM. BEHAV. 287 (1998).

involved a gross deviation from the level of care which an ordinary person would use, having due regard to all the circumstances.

Reckless conduct is not the same as negligence. Negligence is the failure to use such care as a reasonable, prudent, and careful person would use under similar circumstances. Reckless conduct differs from negligence in that it requires a conscious choice of action, either with knowledge of serious danger to others or with knowledge of facts which would disclose the danger to any reasonable person.

Two samples were used for this analysis. The mock-jurors consisted of 277 representative citizens who were recruited to participate in the analysis by a professional survey research firm.<sup>9</sup> The ninety-five judges who participated in the study were part of the 1997 program in law and economics run by the University of Kansas School of Law and Organizational Economics Center. The geographical locales represented in the judges' sample were quite diverse, including state judges throughout the country. The actual teaching of the programs where this survey was distributed was in Copper Mountain, Colorado, and Sanibel, Florida. The judges in this sample consisted of state court judges, including judges on state courts of appeal and state supreme courts. Judges filled out the survey and returned it by mail before participating in the educational program. They were told that discussion of the survey would be an important part of the curriculum in which they would be participating. The response rate was close to one-hundred percent.

Our experimental participants, both mock-jurors and judges, read the summary of a fact situation in which a railroad company operating freight trains along a section of track was ordered by the National Transportation Safety Board to stop operations until the track was improved. In foresight conditions, the participants were asked to decide if the railroad should be relieved of the order to stop operations. In hindsight conditions, the railroad had continued to operate legally (because the order had not gone into effect), an accident occurred that caused damage to a river and to the residents and businesses along the river, and the participants were asked to decide if the railroad should pay punitive damages (in addition to the compensatory damages that had already been assessed). Care was taken to align the instructions and the elements to be considered by the decision maker in the foresight and hindsight conditions.

The survey asked the participants to render verdicts (either on the request for relief from the order to stop operations or on liability for punitive damages), to rate their confidence in their verdicts, to estimate prospective or retrospective probabilities of the accident (under instructions to assume an *ex ante* perspective), to judge whether there is (was) a grave danger or risk of harm that is (was) a

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9. For details of the procedures, see Reid Hastie et al., *Juror Judgments in Civil Cases: Hindsight Effects on Liability Judgments* (1998) (unpublished technical report #376; available at Center for Research on Judgment and Policy, University of Colorado, and on file with author).

foreseeable and probable effect of the existing condition of the railroad tracks (again, with an *ex ante* perspective), and then to evaluate the quality of the decision made by a jury that allowed the railroad to continue operations. As noted in Table 1, we separated the participants into four groups: jury-eligible citizens in foresight and hindsight experimental conditions and judges, again in foresight and hindsight conditions.

Mock-jurors showed massive hindsight effects on all relevant measures, while judges showed trends in the direction of hindsight effects but of much smaller (usually statistically insignificant) magnitudes. For example, in hindsight 67% of mock-jurors decided against the defendant railroad (concluding the railroad was liable for punitive damages), while in foresight, only 33% decided against the railroad (concluding that the order to stop operations should be maintained), a difference that is statistically significant,  $\chi^2[1] = 29.18$ ,  $p < 0.0001$ . In contrast, 25% of judges decided against the railroad in hindsight, 15% against in foresight (a difference that is not statistically significant,  $\chi^2[1] = 1.78$ , n.s.). We do not intend to over-interpret the lack of "statistical significance" for verdict proportions for the sample of judges. The differences we observed for judges were smaller than for jurors (for example, a difference in anti-railroad verdicts of 0.10 versus 0.34 respectively) and, thus, we expect that there is truly a smaller hindsight effect in judges' decisions. However, the effect would almost certainly have been statistically significant for the judges' verdicts, if we had simply been able to study a larger sample of judges.

A similar pattern appears in the measures of prospective and retrospective probability of a serious accident, perception of the existence of a grave danger or risk, and ratings of the quality of the decision and the decision maker who might, hypothetically, decide to permit the railroad to continue operations: a large (statistically significant) foresight-hindsight difference for the mock-jurors and a small difference for judges. Although much smaller, the foresight-hindsight differences were deemed statistically significant for some of the judges' ratings, including the measures of probability of a serious accident ( $t[92] = 3.15$ ,  $p < 0.01$ ), perception of the existence of a grave danger or risk ( $t[92] = 3.76$ ,  $p < 0.001$ ), and the quality of the decision made by a jury that allowed the railroad to continue operations ( $t[92] = 2.96$ , 0.01).

Under most conditions the verdicts were related to risk perceptions. Table 2 summarizes the proportions of respondents deciding against the railroad grouped into quartiles according to their judgments of the probability that a serious accident would occur. The relationships are quite strong for all groups except for the judges making foresight, *ex ante* judgments. Since the rate of judgments against the railroad was so low for this group (fifteen percent overall), the assessment of a relationship between judgments and risk perceptions is insensitive.

The contrast between jurors' and judges' risk perceptions was not as stark, however, as the pattern of anti-railroad judgments. In the hindsight case, both citizens and judges predicted almost double the probability of a serious accident than they had in foresight. The absolute difference in the judges' probability assessments in the hindsight and foresight cases are, however, not as great as for

the jurors. Overall, the differences between judges and jurors in the risk probability assessments were not as strong as the differences in the pro-railroad judgments. One possible interpretation of these results is that there is a difference between judges and jurors not simply in the effect of hindsight on their risk beliefs, but also in terms of how they interpret the rule of law as it should apply to accident cases after the fact. As individual probability assessors, judges were also susceptible to hindsight bias problems. However, the judges' greater experience in making legal judgments made them less susceptible than the mock-jurors to hindsight biases.

Although our case materials were fictional and we cannot compare estimates of probabilities to actual relative frequencies or some other index of well-calibrated estimates, an internal consistency check is available in our experimental situation. We can relate the participants' verdicts to their probability estimates to see whether they are consistent with a standard for efficient deterrence promoted by assuming an economic framework for the judgments.<sup>10</sup> If deterrence is the sole basis for the decisions and we assume that the probability of detecting the harm is virtual certainty, the judgments of liability should be associated with probability estimates that are related to the amount of the loss (\$24 million in compensatory damages in our case) and the cost of precautions (the \$2.3 million cost to modify the railroad tracks). Judge Learned Hand proposed this formula as the basis for judgments of whether a defendant had breached the duty of reasonable care in decisions concerning negligence.<sup>11</sup> If an accident's cost multiplied by its probability of occurrence exceeds the cost of untaken precautions, then in the event of a mishap, the defendant should be judged at least negligent. For example, if a respondent estimated the probability of a serious accident to be .25, then the cost of the untaken precaution (\$2.3 million) should be less than  $.25 \times \$24$  million (the loss sustained in the accident) to justify deciding liability, much less warranting the award of punitive damages. In this example calculation, the expected loss would be \$6 million. The precaution should thus be taken (that is, \$6 million is greater than \$2.3 million; a shortcut test is to observe whether the respondent estimates the probability of an accident as greater than  $0.096$  ( $2.3 \text{ million}/24 \text{ million}$ )).

Examining whether in the view of the respondent the railroad was negligent is interesting, but negligence is not tantamount to meeting the more stringent conditions for the award of punitive damages. Indeed, a more detailed analysis of the assessed expected benefits of taking the safety precautions and the costs of these precautions indicates that simply violating the negligence test threshold was not sufficient for the sample of judges to award punitive damages. Table 3 summarizes the correlation of the benefit and cost calculations with the probability of ruling against the railroad. For the purposes of these calculations, the assessed benefits of the safety improvement consist of the individual judges' assessed probabilities of a serious accident multiplied by the \$24 million loss (compensatory damages) figure. This loss amount was known to the judges in the

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10. John P. Brown, *Toward an Economic Theory of Liability*, 2 J. LEGAL STUD. 323 (1973); RICHARD A. POSNER, *ECONOMIC ANALYSIS OF LAW* (4th ed. 1992).

11. *United States v. Carroll Towing Co.*, 159 F.2d 169 (2nd Cir. 1947); Mark F. Grady, *Untaken Precautions*, 18 J. LEGAL STUD. 139 (1989); Brown, *supra* note 10.

*ex post* scenario, but not in the *ex ante* scenario. The benefit-cost ratio simply gives the ratio of these expected costs to the cost of the repairs, which was \$2.3 million. The net benefit calculations in Table 3 give the difference between the expected benefits and the costs. The structure of the table organizes these responses in terms of different quartiles of the benefit-cost ratio range. For the first quartile, the benefit-cost ratio ranges from 0 to 1.04. Subsequent quartiles consider higher benefit-cost ratio amounts.

Consider first the results for the *ex post* scenario in Table 3, which is the sample for which the loss amounts were known. It is quite striking that for the half of the sample for whom the benefit-cost ratio was 3.6 or less, none of these judges took an anti-railroad position. For higher benefit-cost ratios of the upper two quartiles, approximately half of the judges ruled against the railroad. A benefit-cost spread must surpass negligence before the judges award punitive damages. In no case in which the benefit-cost ratio was not substantial (that is, less than 3.6) did a judge favor a punitive award.

The citizen, mock-jurors' judgments provide a further interesting test of whether the respondents' rulings were sensitive to benefit-cost factors. One group of citizens was presented case materials in which the amount of loss (compensatory damages) was relatively low (\$240,000) while another group was told the loss was high (\$24 million, the same loss amount that was presented to the judges). Benefit-cost statistics, like those calculated for the judges, are presented for the two groups of jurors in Table 3. First, there is no significant difference between the rates at which members of the two experimental groups, low versus high damages, ruled against the railroad (.66 versus .68 respectively). Second, the benefit-cost ratio is correlated with the probability of ruling against the railroad within each group (both series of values increase together in an orderly manner in Table 3). Focusing on the quartiles in Table 3 potentially provides a depiction of juror behavior that more closely parallels the judges than is in fact the case. The linkage of the benefit-cost ratios to the probability of ruling against the railroad is more telling. In the judges' hindsight case, no judge with an assessed benefit-cost ratio of below 3.65 ruled against the railroad. For the jurors' low damage case, all jurors with a benefit-cost ratio of at least 0.09 ruled against the railroad. However, for the juror's high damage case, only 26% ruled against the railroad when the benefit-cost ratio was 0.21–3.86, and it is not until the benefit-cost ratio reaches 8.87 that 100% of the jurors oppose the railroad. Different quartiles of jurors in the low and high damage scenarios are similarly disposed toward the railroad, but these attitudes are largely unaffected by differences in the scale of the damages in the two instances. As would be expected from the lack of differences in verdict rates between the low and high damages groups, the absolute value of the benefit-cost ratio is not related to verdicts between the two groups; the anti-railroad rulings are associated with tiny ratios in the low damages group and, in the high damages group, there are a substantial number of anti-railroad rulings (26%) even in the quartile of respondents with the lowest (less than 3.86) ratios. The economic calculations of costs and benefits suggest that judges have a sense of rationality in situations believed to create the most irrationality. In contrast, the citizen, mock-jurors do not appear to be sensitive to benefit-cost relationships.

### III. A REVIEW OF EMPIRICAL STUDIES OF LAY JUDGMENTS OF UNCERTAIN RISKS

Juries hate scientific evidence.

They think they won't be able to understand it so naturally they can't understand it. As soon as you step into the box you see a curtain of obstinate incomprehension clanging down over their minds. What they want is certainty. Did this paint particle come from this car body? Answer yes or no. None of those nasty mathematical probabilities we're so fond of.

If they hate scientific evidence they certainly hate arithmetic more. Give them a scientific opinion that depends on the ability to divide a factor by two-thirds and what do you get from counsel? "I'm afraid you'll have to explain yourself more simply, Mr. Middlemass. The jury and I haven't got a higher degree in mathematics, you know."<sup>12</sup>

The hindsight bias exhibited by jurors in the railroad case is not the only likely failing of lay judgments in accident cases. A survey of what is known about laypeople's judgments of risks provides many reasons to expect that retrospective judgments of recklessness, liability, and deterrence will be erratic and unreliable. First, *ex ante* decisions involving risk and uncertainty are notoriously difficult. Reasoning under uncertainty is much more difficult than under certainty and leads to many inconsistencies and inaccuracies.<sup>13</sup> These errors will affect the behavior of people on the street, in corporate offices, and in the jury box. Which of these many errors will apply to any particular decision depends heavily on the character of the decision, the manner in which the risk-relevant question is framed, and the pertinent background information and attitudes of the decision maker.

#### A. Irrational Responses to Small Probabilities and Premiums for Zero Risk

Many biases in risk perception stem from the fundamental nature of risk. A flood of empirical results and interpretations has demonstrated that people are not well-endowed to reason coherently about the probabilities of occurrence of individual events.<sup>14</sup> Studies of juries' competency in comprehending and applying probabilistic evidence have also concluded that jurors are very limited in this

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12. P. D. JAMES, DEATH OF AN EXPERT WITNESS at 96 (1977).

13. Amos Tversky & Daniel Kahneman, *Judgment Under Uncertainty: Heuristics and Biases*, 185 SCI. 1124 (1974); VISCUSI, *supra* note 3.

14. See, e.g., Tversky & Kahneman, *supra* note 13. Although they may reason more coherently about the frequencies, rather than probabilities, of classes of uncertain events, also see Leda Cosmides & John Tooby, *Are Humans Good Intuitive Statisticians After All? Rethinking Some Conclusions from the Literature on Judgment Under Uncertainty*, 58 COGNITION 1 (1996); Gerd Gigerenzer & Ulrich Hoffrage, *How to Improve Bayesian Reasoning Without Instruction: Frequency Formats*, 102 PSYCHOL. REV. 684 (1995).

regard and that, by and large, information about probabilities is often misunderstood and misused.<sup>15</sup>

For low probability events that have been called to people's attention, people usually overestimate the level of the risk. Small identified risks tend to be overestimated, and large identified risks tend to be underestimated.<sup>16</sup> There is also an "out of sight, out of mind" phenomenon in judgments of unidentified risks (for example, "...and all other factors that might lead to a failure of the shuttle launch"), such that unidentified events tend to be ignored or to be assigned underestimated probabilities.<sup>17</sup> To the extent that accidents and major catastrophes involve small probability events, the tendency will be to overestimate their likelihoods once these events are called to people's attention. In situations of complete ignorance of the risk, people will tend to underestimate the extent of the hazard.

One practical consequence of these habits of probability judgment for jury assessments of defendants' risk actions is that jurors will perceive relevant identified risks to be larger than they are. Defendants (for example, corporations) will attempt to avoid these risks more than they would and should if the risk levels were properly understood. Because juries make their judgments *ex post*, after an accident or catastrophe has occurred, the tendency will be to overestimate the likelihood of accidents involving small probabilities, reflecting the observed pattern of systematic biases in perception of risk. One consequence will be that parties, whose behavior is responsive to jury verdicts, will be motivated to adopt

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15. D. H. Kaye & Jonathan J. Koehler, *Can Jurors Understand Probabilistic Evidence?*, 154 J. ROYAL STAT. SOC'Y, SERIES A 75 (1991); Jonathan J. Koehler, *One in Millions, Billions, and Trillions: Lessons from People v. Collins (1968) for People v. Simpson (1995)*, 47 J. LEGAL ED. 214 (1997); Jonathan J. Koehler & Daniel N. Shaviro, *Veridical Verdicts: Increasing Verdict Accuracy Through the Use of Overly Probabilistic Evidence and Methods*, 75 CORNELL L. REV. 247 (1990); Brian C. Smith et al., *Jurors' Use of Probabilistic Evidence*, 20 LAW & HUM. BEHAV. 49 (1996); William C. Thompson, *Are Juries Competent To Evaluate Statistical Evidence?*, 52 LAW & CONTEMP. PROBS., Autumn 1989, at 9.

16. Sarah Lichtenstein et al., *Judged Frequency of Lethal Events*, 4 J. EXPER. PSYCHOL.: HUM. LEARNING MEMORY 551 (1978); Paul Slovic, *Perception of Risk*, 236 SCI. 280 (1987). This pervasive empirical relationship has been incorporated into theories of risk evaluation as an assumption about weighting of outcomes, see, for example, Daniel Kahneman & Amos Tversky, *Prospect Theory: An Analysis of Decision Under Risk*, 47 ECONOMETRICA 263 (1979); R. Duncan Luce, *Rank-Dependent, Subjective Expected-Utility Representations*, 1 J. RISK UNCERTAINTY 305 (1988); Amos Tversky & Daniel Kahneman, *Advances in Prospect Theory: Cumulative Representation of Uncertainty*, 5 J. RISK UNCERTAINTY 297 (1992); Elke U. Weber, *From Subjective Probabilities to Decision Weights: The Effect of Asymmetric Loss Functions on the Evaluation of Uncertain Outcomes and Events*, 115 PSYCHOL. BULL. 228 (1994), or as the result of a rational, but conservative Bayesian learning process, see, for example, VISCUSI, *supra* note 3.

17. HOWARD KUNREUTHER ET AL., *DISASTER INSURANCE PROTECTION: PUBLIC POLICY LESSONS* 235-43 (1978).

inefficiently high levels of precautionary actions. Overcoming this fundamental bias will be difficult, if not impossible, for juries to do.

A counterpart to the overestimation of small probabilities is that people will be willing to pay a premium for the certainty of obtaining "zero risk." Because people overestimate small probabilities, decreasing the risk from a small probability to zero will have a greater effect on the perceived risk reduction than would a risk decrease of the same magnitude that was not sufficient to reach zero. For example, studies of consumer valuations of risk reduction have indicated that reducing the risk of injury from household chemical products from 5/10,000 to zero has a much greater value to consumers than decreasing the risk level from 15/10,000 to 5/10,000.<sup>18</sup> The latter risk reduction is twice the size of the reduction offered that reached zero, but consumers valued it less. Economic predictions imply that people should have a diminishing willingness to pay for excessive reductions in risk, but in practice the last reduction in risk that reduces the level to zero has an extremely high subjective value. The appeal of zero risk leads government officials to declare that our food is "safe," rather than reporting that only a small number of Americans will be killed by food poisoning this year.<sup>19</sup>

We would expect this "zero risk mentality" to also influence jury behavior. To the extent that juries exhibit a certainty premium, they will value the complete elimination of risk by more than is warranted given its objective benefits in risk reduction. Similarly, departures from zero risk will be viewed as more grievous offenses than they are. Juries will inappropriately undervalue a party's efforts to reduce risk to a small, but still non-zero level. Again, this relationship arises because of the bias in the perception of risks; the overestimation of small probabilities in effect flattens the relationship between actual risks and perceived risks so that changes in perceived risk levels are less than changes in actual risk levels. People overestimate small risks and underestimate large risks. The subjective, perceived probability curve is flatter than the objective probability curve. Consequently, juries tend to underestimate the extent of the risk reduction a defendant has achieved and overestimate the importance of further risk reductions that may reach the zero risk level. Thus, juries will be unfairly biased against defendants in cases involving risk and uncertainty.

### ***B. Outcomes Versus Probabilities***

It is important to distinguish between probabilities and consequences. The probability of an event is the likelihood that it will occur; the payoff refers to the magnitude of its consequences. However, under many conditions, people seem to confuse the two components. For example, large losses can affect the perceptions of the preventability of an accident. However, the existence of substantial *ex post* losses does not imply that the *ex ante* probability was high or that this probability

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18. W. Kip Viscusi et al., *An Investigation of the Rationality of Consumer Valuations of Multiple Health Risks*, 18 RAND J. ECON. 465, 473-77 (1987).

19. See also BREYER, *supra* note 3, at 11-19, 39-42, on the "90:10 Principle" in risk reduction expenditures and the extreme wording of some government regulations, for example "The Delaney Clause," 21 U.S.C. § 348(c)(3)(A) (1994) (food additives).

was easy (or difficult) to manipulate through preventative actions. The correct test of whether a firm, sued for liability for an accident, took an efficient degree of care should be based on a comparison of whether the cost of the relevant precaution is less than the change in risk probability that would have resulted from the precaution multiplied by the expected amount of the loss. However, making such a judgment requires that juries be able to view the situation *ex ante*, before the accident, and to make the risk calculations uninfluenced by the knowledge that the accident has in fact occurred.

### *C. Irrational Responses to Novel Risks*

The particular character of the risk also plays an important role in perceptions and subjective evaluations. People overreact to risks associated with new technologies; to risks that represent increases from accustomed, status quo risk levels; to risks outside of their personal control; and to risks associated with highly publicized events.<sup>20</sup> What is notable is that all of these elements are likely to be present in the accidents and illnesses that are the focus of many cases that involve punitive damages and result in the most dramatic awards.

Consider, for example, litigation involving asbestos or other industrial chemicals, breast implants, or oil spills. Asbestos and other chemical (for example, Agent Orange) risks have been highly publicized, are outside of the control of the exposed individuals, and involve risks that workers were not fully cognizant of at the time they incurred the risk because of evolving scientific knowledge. Breast implants involve a new technology with novel risks that were not present before the advent of this technology, the women who received these transplants incurred risks that were outside of their personal control, and the risks have generated considerable publicity. The *Exxon Valdez* oil spill was a highly publicized event that was outside of the control of those who suffered the greatest losses and that resulted from the deployment of a new technology—drilling for and transporting oil in Alaska. Even though the character of each of these risks has its distinctive aspects—personal injury, financial loss, environmental damage—the biases against the defendants' behavior will be similar. People tend to overreact to the risk, manifested in excessive responses by the jury, which has been asked to play the role of a societal risk manager when judging liability and assessing damage awards.

### *D. Irrational Responses to Ambiguous Risks*

Another form of irrationality was illustrated dramatically in the well-known Ellsberg Paradox. People prefer a precisely understood probability of winning a prize to an equivalent ambiguous, uncertain chance of the same outcome. The counterpart to this effect in the case of losses is ambiguity aversion. Studies of attitudes towards ambiguous risks and uncertain environmental damage show that people prefer precisely understood risks of losses to more ambiguous prospects, even though the average probability of the losses has been carefully equated. For example, people would rather face a well-defined chance of an adverse

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20. See VISCUSI, *supra* note 3.

consequence of 2/1000, rather than a 50:50 chance that the chance is either 1/1000 or 3/1000.

This pattern of ambiguity aversion will make parties overly cautious in situations involving ambiguity, even more so than in situations with precisely estimated levels of risk. However, if a party is unfortunate enough to experience an adverse outcome, then juries will tend to be especially unforgiving when the *ex ante* risk was ambiguous. There is a bias against uncertain risks; people respond as if they were greater than they are. Given this bias, juries are likely to be excessively demanding when judging situations of uncertainty; they will view the risks incurred by a defendant as being greater, and hence judge behavior as more likely to have been reckless, because risks were uncertain. Thus, a paradox results: situations of ambiguity, in which precautionary behavior will be especially difficult because of the ill-defined character of the risks, should be judged by more lenient liability standards. But, to the contrary, juries will be inclined to be particularly harsh in situations of ambiguity and uncertainty.

#### *E. Prejudice Against Benefit-Cost Analysis*

One byproduct of juries' mistrust and confusion about probabilistic reasoning is an ingrained hostility towards rational, mathematical analyses of benefits and costs in the domain of risk. The adverse affect of this prejudice is to discourage companies and other risk-takers from doing the kinds of risk management analyses that have proven to be most effective. Ideally, the jury in its role as a risk manager should promote the rational analyses of risk and safety by the parties who may end up in litigation following adverse events. More specifically, the objective should be to maintain a sensible benefit-cost tradeoff. Safety improvements should be pursued so long as the expected benefits to society exceed the costs. These benefits considered should include factors in addition to financial consequences, such as considerations of health-risk reductions, environmental impact, and perhaps other non-market factors that are affected by the increased degree of care by corporations and other actors. The benefit-cost tradeoff simply requires that safety efforts be undertaken so long as they are in society's best interests.

As Judge Easterbrook has observed, companies incorporate such safety concerns in a manner that recognizes the pertinent tradeoffs.<sup>21</sup> Firms routinely perform cost-effectiveness analyses of their products and procedures. Such studies include accounts of the costs of injury and the costs of production. But, as Judge Easterbrook noted, the jury tends to take a very narrow view with a focus on the injured person in court, not on the invisible members of the rest of society who will be affected (often positively) by the defendant's response to tort liability outcomes. Thus, the defendants are likely to take a broader societal perspective on costs and benefits, while jurors focus on case specifics.

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21. Shirley Carroll v. Otis Elevator Co., 896 F.2d 210 (7th Cir. 1990). See also Max Boot, *Your Money or Your Life? That Depends*, WALL ST. J., Mar. 4, 1998, at A18.

Making precise assessments of costs and benefits of safety actions is often feasible through the application of the developing science of benefit-cost analysis. For example, Ford Motor Company and General Motors routinely make explicit calculations regarding the costs and benefits of providing various safety devices, such as shielded gas tanks, reinforcing struts, anti-skid brakes, etc. (for example, the Ford Pinto; the Oldsmobile Cutlass). Making such calculations appears to offend some jurors' sensibilities. Post-trial interviews with jurors provide evidence that the plaintiff's introduction of corporations' calculations and benefit-cost memos provokes hostility and punitive attitudes.<sup>22</sup> However, thinking about risks rigorously is exactly what organizations should do so that they can strike a reasonable balance between costs and benefits.<sup>23</sup> In the Ford Pinto case, we may end up believing that Ford's conclusions undervalued safety.<sup>24</sup> However, the company should be applauded for its efforts to grapple systematically with the cost and safety implications of its actions. Only by making these tradeoffs explicit can we learn from our experiences to make more sensible tradeoffs in the future.<sup>25</sup>

### *F. Hindsight*

A pitfall for juries making their decisions after the fact is that they may incorrectly assess a defendant's *ex ante* knowledge of the risk. With the benefit of hindsight, jurors may infer that the defendant had full information but simply did not care enough about safety to take more precautions. If a juror uses the post-accident reference point as the basis to determine how defendants should select their safety levels, a higher level of precaution will seem optimal than one based on the actual imperfect pre-accident state of knowledge. The *ex post* perspective in the courtroom will consequently overestimate the magnitude of the punitive damages necessary to align the incentives for the defendant with levels of punishment that are needed to produce efficient degrees of care. Ideally, a jury should evaluate a defendant's decision based on the degree of risk information available before the accident. But, as Judge Easterbrook noted, "The 'ex post' perspective of litigation exerts a hydraulic force that distorts judgment."<sup>26</sup> Hindsight biases lead to excessive penalties for defendants if juries overstate the defendants' degree of knowledge prior to the accident or other unfortunate event that resulted in a law suit.

Putting aside such hindsight biases may be difficult for a jury to do. It is likely that our capacities to make judgments under uncertainty were designed by

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22. Boot, *supra* note 21, at A18.

23. W. KIP VISCUSI, REFORMING PRODUCTS LIABILITY 112-13 (1991).

24. The Ford Company documents summarizing the risk calculations, originally E.F. Grush & C.S. Saundby, *Fatalities Associated with Crash-Induced Fires and Fuel Leakages*, (internal documents of Ford Motor Co., 1973), are reprinted in BRENT FISSE & JOHN BRAITHWAITE, *THE IMPACT OF PUBLICITY ON CORPORATE OFFENDERS* 41-54 (1983). See also Gary T. Schwartz, *The Myth of the Ford Pinto Case*, 43 RUTGERS L. REV. 1013 (1991).

25. Viscusi, *supra* note 2.

26. *Otis Elevator*, 896 F.2d at 215.

evolutionary selection to operate in a forward-looking, predictive fashion. Even today, few judgments demand retrospective, hindsight-free vision. However, one of the few of such socially important judgments is that required by our civil justice system when one party sues another for damages following an accident. Hindsight effects have been documented in almost every domain of everyday and professional judgment.<sup>27</sup> A few empirical studies have even explored hindsight effects on jurors' judgments and the implications of the phenomenon in legal decisions.<sup>28</sup>

An exemplary study of hindsight in judgments of liability was conducted by Kamin and Rachlinski.<sup>29</sup> They asked college students to judge negligence before and after a barge collided with a drawbridge causing damage to property along a river. In foresight, the participants were asked to decide if a city should hire a bridge operator during winter months when the danger of flooding was relatively low. In hindsight, the participants were presented with an accident that would certainly have been averted had an operator been hired and asked to judge retrospectively whether the city was negligent for not hiring the operator. In foresight only 24% of the participants chose to hire the operator, but in hindsight 57% believed the city should have hired the operator. The participants were also asked to estimate the probability that an accident would occur prospectively or

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27. Jay J. J. Christensen-Szalanski & Cynthia F. Willham, *The Hindsight Bias: A Meta-Analysis*, 48 ORG. BEHAV. HUM. DECISION PROCESS 147 (1991); Baruch Fischhoff, *Hindsight ≠ Foresight: The Effect of Outcome Knowledge on Judgment Under Uncertainty*, 1 J. EXPERIMENTAL PSYCHOL.: HUM. PERCEPTION PERFORMANCE 288 (1975); Scott A. Hawkins & Reid Hastie, *Hindsight: Biased Judgments of Past Events After the Outcomes Are Known*, 107 PSYCHOL. BULL. 311 (1990).

28. See, e.g., Hal R. Arkes, *Principles in Judgment/Decision Making Research Pertinent to Legal Proceedings*, 7 BEHAV. SCI. & L. 429 (1989); Hal R. Arkes & Cindy A. Schipani, *Medical Malpractice v. The Business Judgment Rule: Differences in Hindsight Bias*, 73 OR. L. REV. 587 (1994); Galen V. Bodenhausen, *Second-Guessing the Jury: Stereotypic and Hindsight Biases in Perceptions of Court Cases*, 20 J. APPLIED SOC. PSYCHOL. 1112 (1990); Jonathan D. Casper et al., *Cognitions, Attitudes and Decision-Making in Search and Seizure Cases*, 18 J. APPLIED SOC. PSYCHOL. 93 (1988); Jonathan D. Casper et al., *Juror Decision Making, Attitudes, and the Hindsight Bias*, 13 LAW & HUM. BEHAV. 291 (1989); Dorothy K. Kagehiro et al., *Hindsight Bias and Third-Party Consensors to Warrantless Police Searches*, 15 LAW & HUM. BEHAV. 305 (1991); Kim A. Kamin & Jeffrey J. Rachlinski, *Ex Post ≠ Ex Ante: Determining Liability in Hindsight*, 19 LAW & HUM. BEHAV. 89 (1995); Susan J. LaBine & Gary LaBine, *Determinations of Negligence and the Hindsight Bias*, 20 LAW & HUM. BEHAV. 501 (1996); Jeffrey J. Rachlinski, *A Positive Psychological Theory of Judging in Hindsight*, 65 U. CHI. L. REV. 571 (1998); Jennifer K. Robbenholt & Mark S. Sobus, *An Integration of Hindsight Bias and Counterfactual Thinking: Decision-Making and Drug Courier Profiles*, 21 LAW & HUM. BEHAV. 539 (1997); David B. Wexler & Robert F. Schopp, *How and When to Correct for Juror Hindsight Bias in Mental Health Malpractice Litigation: Some Preliminary Observations*, 7 BEHAV. SCI. & L. 485 (1989).

29. Kamin & Rachlinski, *supra* note 28.

retrospectively, and the estimates were significantly higher in hindsight than in foresight.

The experimenters also tested the efficacy of a warning from the judge to the mock-juror about potential hindsight effects:

As we all know, hindsight vision is always 20/20. Therefore it is extremely important that before you determine the probability of the outcome that did occur, you fully explore other possible alternative outcomes which could have occurred. Please take a moment to think of all the ways in which the event in question may have happened differently or not at all.<sup>30</sup>

But, this instruction had no appreciable effect on any judgments or ratings. Unfortunately, this result may be general. No general remedies are known for hindsight effects. Extensive experience in a domain of activity and training in the deliberate application of probability and risk analysis methods may be the only effective procedures. Neither of these countermeasures is a practical possibility to improve jury performance.

#### IV. CONCLUSION

Situations of risk and uncertainty pose considerable difficulties for individual decision makers and for government risk managers. It is not surprising that the courts would also have difficulties in this regard. Conceptualizing low probability events and making sensible benefit-cost tradeoffs is often a difficult task. Here we have summarized many of the potential pitfalls in dealing with risk and have demonstrated in detail how the problems of hindsight bias may contaminate jury decisions.

The results from the studies involving our original sample of judges and citizens indicate that judges were better able to deal with risk judgments made in hindsight than were the citizens. The mock-jurors were much more willing to levy punitive damages for a railroad accident case after the fact, while in the same situation before the accident occurred, similarly informed jurors did not believe that the proposed safety precaution should be adopted. In contrast, the judges expressed a more consistent view than did the jurors and were less likely to impose punitive sanctions. This difference in legal judgments, comparing jurors and judges, appears to be stronger than the analogous differences in risk assessments. This implies that it may be application of the rules of law, as opposed to perceptions of risk, that is differentially affected by hindsight biases in the two groups.

In terms of a policy direction, these results suggest that greater reliance on the authority of judges would improve judicial decision making. Policy measures that give judges the authority to set punitive damages and to influence the functioning of the judicial system with respect to risk decisions could potentially improve the quality of these outcomes. The present structure will not simply make

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30. *Id.* at 97.

random errors but will in fact impose a systematic bias by levying excessive penalties on companies for whom the accident lottery has turned out unfavorably.

The primary conclusion from our empirical study is that juries perform poorly when making the decisions required to assess liability for punitive damages.<sup>31</sup> Our empirical findings provide one more argument against the current form of punitive damages procedures: massive hindsight effects appeared in our *ex ante* versus *ex post* comparisons. This is no surprise given the prevalence of hindsight effects across all decision domains and their occurrence in similar judgments of liability under standards of negligence.<sup>32</sup> What is perhaps more informative is our finding that judges exhibit much smaller hindsight effects when asked to make identical judgments.

Our attitude about jury reform is conservative in that we do not advocate removing decisions from the jury unless strong evidence has been adduced showing that those decisions are made poorly. However, we also resist the tort-centric view that places as much societal discretion as possible in the realm of litigation. In the case of decisions involving evaluations of risk, especially where the judgment requires the decision maker to infer *ex ante* risk estimates from an *ex post* perspective, the typical juror appears to be subject to a massive hindsight bias. We also know of no practical methods that could be used to de-bias the juror in such a situation. Our conclusion is that we should change the nature of the requisite decision or assign the task to a different decision maker.

When someone claims that the jury is performing poorly, it is important to ask, "Compared to what?" Our sample of experienced trial-judges' liability decisions supports the recommendation that these hindsight-prone decisions be assigned to judges rather than jurors. The judges were much more consistent than the jurors in their decisions on the defendant railroad company's need to take safety precautions in our legal judgment scenarios. In foresight, 15% of the judges decided against the railroad's position, and in hindsight, 25% decided against the railroad, a trend in the direction of hindsight bias, but a much smaller difference than for jurors (33% against in foresight, 67% against in hindsight). Although judges are not perfect on this decision, they are much better than jurors.

It is interesting to ask what factors make judges less subject to hindsight effects than jurors. Our speculation is that several aspects of experience on the bench contribute to the superior performance of judges: judges see many cases in which the parties' risk assessments play a role, they see opposing sides many times, they see who wins, and they can observe which cases get overturned on appeal. All of these factors are likely to lead judges to be better informed, to reason in a more systematic manner, and to more fully consider both sides of the case than jurors. It is even possible that the performance of judges can be improved by adding information from professional risk analysis experts at trial, perhaps in the form of expert testimony.

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31. See Hastie et al., *supra* note 8.

32. *Id.*

An alternative to taking the decision away from the jury might be to recommend changes in the nature of the decision, the grounds for concluding punitive damages are warranted. For example, other commentators have suggested that hindsight effects might be ameliorated if the judgment is focused on the degree to which the defendant's alleged actions depart from a reasonable or customary standard of care, rather than on a reconstructed *ex ante* state of foreknowledge and intention.<sup>33</sup> However, without further empirical tests of alternate procedures, we are reluctant to speculate about what might "fix" the decision. For all we know, hindsight effects might also distort judgments focused on reasonable standards of care.

A final possibility would be to simply abolish punitive damages judgments of all kinds. This is the policy in four state jurisdictions, and the most relevant empirical evidence shows that the situation of safety and social costs due to various uncertain hazards and risks is no different in those states than in the other forty-six.<sup>34</sup> Perhaps it is a good time, given the substantial doubts we and others have raised about the quality of jury punitive damages judgments, to rethink the entire institution and to seriously explore the option of abolition and a shift to non-tort-centric risk management.

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33. Cf. Rachlinski, *supra* note 28.

34. Viscusi, *supra* note 2.

**Table 1**  
**Summary of Participants' Judgments**

Measures	Citizens		Judges	
	Foresight (n =102)	Hindsight (n =175)	Foresight (n =47)	Hindsight (n =47)
Verdicts (percent "anti-railroad")	33%	67%	15%	25%
Verdicts Scaled by Confidence (most confident pro-railroad: -100...+100: most confident anti-railroad)	-29.61	+31.07	-40.00	-30.85
Probability of a Serious Accident (0...1.00)	.34	.59	.20	.36
"Is (Was) There a Grave Danger or Risk?" ("No": 0...9: "Yes")	3.50	6.08	2.45	4.28
Rating of the Quality of Jury Decision to Allow the Railroad to Continue Operations (lowest: -3...+3: highest)	+0.96	-0.33	+1.73	+0.96
Rating of the Competency of Jury that Allowed the Railroad to Continue Operations (lowest: 0...100: highest)	66.55	53.00	64.06	54.89

**Table 2**

Correlation of Risk Perceptions with Probability of Ruling Against Railroad  
Judges, Foresight (47 observations)

Risk Perception Percentile Range	Probability Range	Probability of Ruling Against Railroad
00-21 (n=10)	0.00-0.05	0.10
22-55 (n=16)	0.10-0.10	0.13
56-76 (n=10)	0.15-0.20	0.30
77-100 (n=11)	0.25-0.95	0.09

t-statistic (for vs. against railroad) = 0.29, d.f. = 45, not significant

Judges, Hindsight (47 observations)

Risk Perception Percentile Range	Probability Range	Probability of Ruling Against Railroad
00-25 (n=12)	0.05-0.10	0.00
26-49 (n=11)	0.15-0.30	0.00
50-76 (n=13)	0.35-0.50	0.23
77-100 (n=11)	0.60-0.85	0.73

t-statistic (for vs. against railroad) = 5.76, d.f. = 45,  $p < .001$  confidence level

Jurors, Foresight (102 observations)

Risk Perception Percentile Range	Probability Range	Probability of Ruling Against Railroad
00-33 (n=34)	0.00-0.10	0.12
33-50 (n=17)	0.15-0.20	0.12
51-77 (n=28)	0.25-0.50	0.40
78-100 (n=23)	0.55-1.00	0.79

t-statistic (for vs. against railroad) = 5.97, d.f. = 100,  $p < .001$  confidence level

Jurors, Hindsight (175 observations)

Risk Perception Percentile Range	Probability Range	Probability of Ruling Against Railroad
00-28 (n=49)	0.02-0.37	0.26
29-53 (n=45)	0.40-0.60	0.53
54-83 (n=52)	0.65-0.80	0.89
84-100 (n=36)	0.85-1.00	1.00

t-statistic (for vs. against railroad) = 9.96, d.f. = 173,  $p < .001$  confidence level

**Table 3**

Correlation of Implicit Net Benefits and Benefit-Cost Ratios (B/C) with Probability of Ruling Against Railroad

Judges (Hindsight, 47 observations)

B/C Percentile Range	Net Benefit	B/C	Probability of Ruling Against Railroad
00-25 (n=12)	-1.10-0.10	0.52-1.04	0.00
26-49 (n=11)	1.30-4.90	1.57-3.13	0.00
50-76 (n=13)	6.10-9.70	3.65-5.22	0.23
77-100 (n=11)	12.10-18.10	6.26-8.87	0.73

Jurors, Low Damages (82 observations)

B/C Percentile Range	Net Benefit	B/C	Probability of Ruling Against Railroad
00-28 (n=23)	-2.29-2.20	.00-.04	0.22
29-53 (n=21)	-2.19-2.14	.04-.07	0.71
54-81 (n=23)	-2.13-2.11	.07-.08	0.91
82-100 (n=15)	-2.10-2.06	.09-.10	1.00

Jurors, High Damages (93 observations)

B/C Percentile Range	Net Benefit	B/C	Probability of Ruling Against Railroad
00-24 (n=23)	-1.82-6.58	0.21-3.86	0.26
25-50 (n=24)	7.30-12.10	4.17-6.26	0.54
51-77 (n=25)	13.30-16.90	6.78-8.35	0.84
78-100 (n=21)	18.10-21.70	8.87-10.44	1.00

