THE CHALLENGE OF PUNITIVE DAMAGES MATHEMATICS

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ABSTRACT

Proposals to provide juries with specific numerical instructions for setting punitive damages should bring greater rationality to punitive damages awards. This approach is tested using evidence from 353 jury-eligible citizens who applied these formulas to a series of legal cases. Few respondents assessed the correct values of punitive damages from the standpoint of deterrence. Anchoring effects of appeals by a plaintiff's lawyer or media coverage of similar awards lead respondents to abandon the punitive damages formula and set punitive damages based on the anchor. Minorities and the less well educated were particularly unwilling or unable to apply the recommended punitive damages formulas.

I. INTRODUCTION

A LONG-STANDING issue in the tort liability reform literature has been whether there is a need to impose greater structure on the determination of punitive damages.[1] Punitive damages awards are highly variable, posing potentially catastrophic outcomes on firms.[2] In the summer of 2000 we witnessed a $145 billion punitive damages award against the cigarette industry, topping the recent $4.8 billion punitive damages award in California in 1999

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[1] See Note, "Common Sense" Legislation: The Birth of Neoclassical Tort Reform, 109 Harv. L. Rev. 1765, 1769–82 (1996); Thomas C. Galligan, Jr., Augmented Awards: The Efficient Evolution of Punitive Damages, 51 La. L. Rev. 3, 6–14 (1990); Dan B. Dobbs, Ending Punishment in "Punitive" Damages: Deterrence-Measured Remedies, 40 Ala. L. Rev. 831, 853-63 (1989).

[2] See John Calvin Jeffries, Jr., A Comment on the Constitutionality of Punitive Damages, 72 Va. L. Rev. 139, 139 (1986); Peter Huber, No-Fault Punishment, 40 Ala. L. Rev. 1037, 1037 (1989) (emphasizing unpredictability); Stephen Daniels & Joanne Martin, Myth and Reality in Punitive Damages, 75 Minn. L. Rev. 1, 31–32 (1990).

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against General Motors.[3] Punitive damages awards have also been the subject of noteworthy recent Supreme Court decisions, although thus far the Court has offered no precise guidance as to how juries should set punitive damages awards.[4]

Recent experimental work by Daniel Kahneman, David Schkade, and Cass Sunstein highlights the basic source of the punitive damages variability problem.[5] What they have found in a series of carefully controlled experiments is that there is a broad consensus among jurors regarding the acceptability of different kinds of behavior. Thus, people do not have a great deal of difficulty in arriving at a consensus with respect to the appropriate societal norms that should be applied. The difficulty instead is that when people map these concerns into a punitive damages award, there is tremendous variability in setting these awards. Jurors, in effect, are rudderless as they attempt to quantify the punitive damages level associated with any given level of reckless behavior.

The intent of this paper is to explore potential solutions to the setting of punitive damages awards in a more rational fashion. This paper will not attempt to document the rationale for punitive damages reform. Nor will it examine the functions that punitive damages serve. Rather, the emphasis will be on exploring the recent proposal by A. Mitchell Polinsky and Steven Shavell to provide juries with a mathematical formula for establishing punitive damages levels. In particular, they have developed a model jury instruction to enable jurors to set punitive damages awards based on what they and many others believe are valid legal and economic principles.[6] By giving jurors a punitive damages formula that is linked to sound principles for punitive damages, it might be possible to eliminate the variability of punitive damages awards as well as the failure of actual jury awards to be based on

[3] For discussion of the cigarette industry verdict, see Marc Kaufman, Tobacco Suit Award: $145 Billion; Fla. Jury Hands Industry Major Setback, Washington Post, July 15, 2000, at A01. For discussion of the General Motors suit, see Andrew Pollack, $4.9 Billion Jury Verdict in G.M. Fuel Tank Case: Penalty Highlights Cracks in Legal System, N.Y. Times, July 10, 1999, at A7; and Ann W. O'Neill *et al.*, GM Ordered to Pay $4.9 Billion in Crash Verdict Liability, L.A. Times, July 10, 1999, at A1.

[4] See BMW of North America, Inc. v. Gore, 116 S. Ct. 1589, 1613, 517 U.S. 559 (1996); *id.* at 605 (Scalia, J., dissenting) (describing the Court's guideposts for assessing punitive damages as "provid[ing] no real guidance at all"); *id.* at 607 (Ginsburg, J., joined by Rehnquist, C.J., dissenting) (arguing that punitive awards are "an area dominantly of state concern"); see also TXO Prod. Corp. v. Alliance Resources Corp., 509 U.S. 443, 475 (1993) (O'Connor, J., dissenting) ("[T]he lack of clear guidance heightens the risk that arbitrariness, passion, or bias will replace dispassionate deliberation as the basis for the jury's verdict.").

[5] See Cass R. Sunstein, Daniel Kahneman, & David Schkade, Assessing Punitive Damages (with Notes on Cognition and Valuation in Law), 107 Yale L. J. 2071, 2153 (1998); Daniel Kahneman, David Schkade, & Cass R. Sunstein, Shared Outrage and Erratic Awards: The Psychology of Punitive Damages, 16 J. Risk & Uncertainty 49, 86 (1998); and David Schkade, Cass R. Sunstein, & Daniel Kahneman, Deliberating about Dollars: The Severity Shift, 100 Colum. L. Rev. 1139, 1175 (2000).

[6] See A. Mitchell Polinsky & Steven Shavell, Punitive Damages: An Economic Analysis, 111 Harv. L. Rev. 869, 962 (1998).

factors that should be most pertinent to establishing punitive damages levels. This influential article has already begun to receive attention as the most compelling available elucidation of the formal underpinnings of punitive damages.[7]

The punitive damages approach advocated by Polinsky and Shavell focuses principally on the observation that dates back to Jeremy Bentham that punishment levels should be related to the reciprocal of the probability of detection. For example, if the chance of detection is 50 percent, then the total penalty must be twice the value of the harm in order to create the proper incentives for deterrence on an expected value basis.[8]

A recent analysis by Sunstein, Schkade, and Kahneman explored two aspects of the Polinsky-Shavell proposal and did not find support for it.[9] Their first test of the approach consisted of a survey of jury-eligible citizens who considered cases in which there was a differing probability of detection. They found that changes in the probability of detection did not significantly influence the level of dollar awards. However, their experiment did not give participants a copy of the model instructions drafted by Polinsky and Shavell or describe the reciprocal probability rule for setting damages levels so as to generate optimal deterrence. The most that can be concluded from this portion of their study is that people do not intuitively generate the reciprocal probability formula for setting punitive damages independently.

Their second test of optimal deterrence policies was to present University of Chicago Law School students with two scenarios and to ask the degree to which they thought the optimal deterrence approach would be fair. One scenario involved the imperfect enforcement efforts of the Internal Revenue Service (IRS)—an agency that might not have been the object of respondent sympathy given its tax function. The other scenario involved a personal injury case in which there was the certainty of receiving full compensation, and there was no imperfect enforcement. The students were not sympathetic to using punitive damages to address the imperfect enforcement efforts of the IRS. This result is not consistent with the Polinsky-Shavell view, but it may be affected by the character of the imperfect enforcement and the agency involved. Limited budgetary resources, not taxpayer deceit, gave rise to the IRS's imperfect enforcement. Respondents also did not favor punishing the offending firm for their second case situation, in which there was perfect enforcement. This failure to award punitive damages is potentially consistent with the Polinsky-Shavell jury instructions.

The approach taken here is different. Rather than ask whether people can

[7] Perez v. Z Frank Oldsmobile, Inc., 223 F.3d 616, 621 (7th Cir. July 31, 2000) (Nos. 99-2742, 99-2854, 00-1701, & 00-1786, 2000 U.S. App. LEXIS 18281, at *7–8).

[8] See Jeremy Bentham, Principles of Penal Law, I The Works of Jeremy Bentham 365, 401–2 (John Bowring ed., Russell & Russell 1962) (1838–43).

[9] Cass R. Sunstein, David Schkade, & Daniel Kahneman, Do People Want Optimal Deterrence? 29 J. Legal Stud. 237, 254 (2000).

develop the Polinsky-Shavell tests independently or are supportive of the general methodological approach, this paper tests whether jury-eligible citizens can and will, in fact, apply the Polinsky-Shavell jury instructions. A sample of jury-eligible citizens considered a series of different case scenarios in which there was some nonzero probability that the environmental transgression would not be detected. They were then given the Polinsky-Shavell punitive damages instructions and asked to assess punitive damages for their case. This exercise consequently will provide a quite direct test of whether giving jurors an explicit formula for punitive damages will rationalize the process of setting punitive damages.

The results of this experimental test of the proposed punitive damages instructions were quite disturbing for those seeking a sound procedure for setting punitive damages awards. Very few of the 353 jury-eligible respondents in my sample carried out the basic elements of the deterrence calculation even though they had the assistance of a table that gave them multipliers for translating compensatory damages values into deterrence values. Respondents were very insensitive to changes in the probability of detecting a violation, which should have been the key concern for setting deterrence values based on law and economics principles. Likewise, respondents were not sensitive to the degree of stealthiness of the defendant's behavior, which should have been a pivotal factor influencing the punishment value for damages. What mattered instead was the role of various anchoring effects based on, for example, suggested values for damages by the plaintiff's attorney. But such anchoring effects should be completely eliminated if people adhered to the Polinsky-Shavell formula. The mathematical formulas for guiding jury behavior in this experiment consequently achieve none of the purported objectives of the approach and remain vulnerable to the same kinds of contaminating influences that could distort punitive damages awards under the current regime.

II. Model Jury Instructions

The jury instructions for punitive damages vary by jurisdiction and with the nature of the behavior involved in a particular case. Perhaps the most pertinent instruction for establishing a quantitative basis for punitive damages awards is that which details the factors that juries should consider when setting punitive damages awards: "It is within the discretion of the jury to award punitive damages. In deciding whether to award punitive damages and the amount of those damages should you decide to award them, you should consider the purposes of those damages as expressed to you in these instructions and you should take into consideration the character of the defendant's act, the degree or level of wrongdoing of that act, and the necessity of preventing similar wrongs in the future."[10]

[10] See Ronald W. Eades, Jury Instructions on Damages in Tort Actions 106 (4th ed. 1998).

Armed with such instructions, jurors have very little guidance as to the specific numerical measure of punitive damages that should be awarded, which is what the controlled experiments by Kahneman, Schkade, and Sunstein have demonstrated.[11]

In contrast, the punitive damages instructions provided as part of the model jury instructions by Polinsky and Shavell are quite precise. I tested the effect of these instructions based on an original experimental design. As part of my study, each respondent was presented with a copy of punitive damages instructions that are almost identical to those advocated by Polinsky and Shavell for cases in which the defendant is a firm. These instructions are presented here as Exhibit 1 in Appendix A.

As the instructions indicate, there are three parts to setting the level of punitive damages in the case of losses inflicted by firms, which is the focus of the experimental cases in my study design. The first component focuses on the deterrence amount for punitive damages. In situations of imperfect enforcement, the total penalty should equal the level of damages divided by the probability of detection. Thus, the punitive damages amount should equal this value less the amount of compensatory damages. Polinsky and Shavell summarize this formula in their article as follows: "This discussion suggests a simple formula for assuring that injurers will pay for the harms they cause: *the total damages imposed on an injurer should equal the harm multiplied by the reciprocal of the probability that the injurer will be found liable when he ought to be.*"[12] Indeed, more generally, Polinsky and Shavell believe that this should be the dominant concept used in setting punitive damages, although their article is stronger in this regard than are the jury instructions. More specifically, they characterize their overall finding regarding punitive damages as follows: "In summary, *punitive damages ordinarily should be awarded if, and only if, an injurer has a chance of escaping liability for the harm he causes.*"[13]

Consider the first component of the damages instructions pertaining to deterrence in Exhibit 1. These instructions give respondents an economic rationale for imposing a sanction that will provide for deterrence as the first section of the deterrence discussion. The second component of the deterrence discussion focuses on determining the probability that the defendant would have escaped detection. The third component provides respondents with a table for determining the appropriate amount of punitive damages from the standpoint of deterrence, which Polinsky and Shavell call the "base punitive damages amount." The fourth component emphasizes that this amount should not be adjusted for a variety of other factors, such as the role of litigation

[11] See Kahneman, Schkade, & Sunstein, *supra* note 5.

[12] See Polinsky & Shavell, *supra* note 6, at 889.

[13] See *id.* at 874.

costs. The question then asks respondents what the base punitive damages amount should be.

Part B of the instructions concerns punishment. The Polinsky and Shavell article is hesitant to recommend an explicit role for punishment in the case of corporate offenses, as punishment is more appropriate for individual actions in which the blameworthy parties can be identified. Indeed, the instructions provided to respondents to assist them in calculating the appropriate punishment value for the second section of the punitive damages determination emphasize some of these caveats, such as the importance of keeping in mind that compensatory damages have already been paid and will lead to some punishment already. The survey then asks respondents what their punishment value will be, which is the second component of punitive damages.

Part C of the instructions in Exhibit 1 asks respondents to determine the level of punitive damages. The instructions indicate some kind of averaging process in which the punitive damages amount should be between the deterrence answer and the punishment answer, though the weight need not be one-half. The character of the scenarios and how salient the deterrence and punishment objectives are within the context of these scenarios will determine what the appropriate weight should be.

Why these amounts should be averaged at all is not clear theoretically. For example, suppose that the appropriate deterrence value is $9.9 million, but the blameworthy employees have left the firm so that the punishment value is zero. Should the penalty necessarily be reduced below $9.9 million? Jurors reading these instructions may not be certain as to what the averaging process should entail.

What is clear from the inspection of the Polinsky-Shavell formulas in Exhibit 1 is that juries have a much more precise guide than existing instructions provide as to what their task should be in determining punitive damages. The instructions give them a rationale for the deterrence objective and an explicit mathematical formula for setting these deterrence values. The instructions then give them a discussion of the punishment objective but no explicit formula for setting punishment values. Finally, the instructions give them guidance with respect to setting the punitive damages level on the basis of their deterrence and punishment answers, and these instructions serve to bound the punitive damages amount by restricting it to be a value between the deterrence value and the punishment value.

These instructions raise a number of interesting issues with respect to jury performance that have yet to be addressed by previous research. Can and will juries successfully implement these formulas in carrying out the punitive damages assessment task? Setting punitive damages for deterrence and determining of the overall damages amount involve tasks in which there is an explicit way of determining whether juries are right or wrong in their efforts. To what extent will juries be able to handle the mathematical task correctly?

The punishment objective is more open-ended and less amenable to an explicit test of whether juries are behaving knowledgeably. Nevertheless, one can ascertain whether juries are responsive to the character of the behavior of the defendant and the other details of the case in setting the punishment amount, which is what one would expect if juries are behaving rationally.

If instructions are to be effective, then possibly extraneous aspects of the case should not impede jurors' ability to carry out the instructions. A phenomenon that has played a salient role in the literature is that of anchoring effects in which plaintiffs' attorneys present jurors with a dollar anchor that contaminates the deliberation process.[14] If in fact jurors adhere to the explicit mathematical formula specified in Exhibit 1, then that should greatly reduce the influence of anchoring effects and similar phenomena that would lead to the kinds of random punitive damages awards that might otherwise be observed. This hypothesis will be explored as an additional test of the efficacy of the instructions.

III. Study Design and Sample Characteristics

A. *Experimental Design*

The effect of the instructions was tested using a sample of jury-eligible adults who considered a legal case using these instructions. Each respondent considered one of five different scenarios involving the disposal of 12 drums of dangerous chemicals by an industrial chemical research firm. The nature of my experimental design is to present different subgroups of the sample with different scenarios and to compare the responses across the different experimental treatments. In each instance, respondents applied the Polinsky-Shavell formulas. By altering the characteristics of the scenario presented to the respondent, it is possible to assess the incremental effect of different aspects of the case on the performance of the jury instructions. Moreover, in every instance, it will also be possible to develop tests that ascertain whether in fact the respondents adhered to the Polinsky-Shavell formula. The text of the five different scenarios appears in Appendix B.

In addition to the scenarios in which respondents considered the Polinsky-Shavell formula, the experiment also included a sixth scenario for a group of 69 respondents who considered a case in which there was no such formula presented. These respondents had the more standard punitive damages formula guidance and considered a case that was identical to those considered by the Polinsky-Shavell formula sample except for a somewhat different damages amount. However, by rescaling the damages amount, it is possible

[14] Anchoring effects, which are well established in the psychology literature, have ramifications for jury behavior as well. See Reid Hastie, David A. Schkade, & John W. Payne, Judgments in Civil Cases: Hindsight Effects on Judgments of Liability for Punitive Damages, 23 Law & Hum. Behav. 455, 470 (1999).

TABLE 1

EXPERIMENTAL DESIGN FOR PUNITIVE DAMAGES TOXIC WASTE DUMPING SCENARIOS

Scenario	Probability of Detection	Character of Dumping	Anchoring Information
1	.25	Not stealthy	None
2	.01	Not stealthy	None
3	.01	Stealthy midnight dumping	None
4	.01	Stealthy midnight dumping	Plaintiff's attorney requests minimum penalty of $25 million, ideally $50 million
5	.01	Stealthy midnight dumping	Similar case in news with $50 million award reduced on appeal to $25 million

to make a direct comparison of the results as these scenarios were otherwise identical.[15]

Table 1 summarizes the experimental structure that was used. In scenario 1 there is a .25 probability that the illegal dumping will be discovered by the Environmental Protection Agency (EPA) inspector. The company was in fact caught and fined $100,000 to cover the additional water treatment costs. The respondents then had to determine the appropriate value of punitive damages. The other scenarios varied the character of the dumping and the probability of detection but not the damages amount.

By its very nature, the experimental design that I have constructed focuses on differences across the scenarios rather than the absolute levels of responses. As a consequence, factors that are common to each of the scenarios will tend to net out when making the comparisons. In each instance, people considered the scenarios as individuals, not as group. They also did not participate in an actual trial. However, these and other elements are common across all scenarios. The distinctive nature of the experiment is that by comparing the effects across different experimental treatments, it is possible to isolate whether there is in fact any responsiveness to the key aspects of the experimental design that are pertinent to assessing how individuals will apply the Polinsky-Shavell instructions.

The imperfect enforcement in scenario 1 did not arise from any stealth on the part of the manager responsible for the dumping. Rather, as the survey indicated, "[t]he manager knew that there was a 25 percent chance that the EPA inspector was going to be visiting the plant next week, and that if he did the dumping would be discovered." Thus, in this scenario, there is no attempt on the part of the shift manager to take an action that would decrease

[15] In particular, to achieve the rescaling, one simply multiplies the results for the conventional damages findings by a factor of five.

the probability of being caught, so the 25 percent chance of being caught could be viewed as an exogenous probability. For this scenario there was no anchoring information given by the plaintiff's attorney or from any other source.

With scenario 1 as with the other scenarios, it is possible to determine whether the respondents apply the implications of the Polinsky-Shavell instructions properly. In particular, is the deterrence value calculated accurately, and is the overall punitive damages amount some value that is bounded by the deterrence value and the punishment value?

Scenario 2 is in some ways identical to scenario 1, as the probability of detection below 1.0 arises from exogenous factors rather than the stealth of the dumping company. For scenario 2, the probability of detection is 1 percent. Based on the reciprocal probability rule for setting punitive damages, the appropriate level of punitive damages with a .25 probability of detection is three times the value of the damages inflicted, and for a .01 probability of detection, it is 99 times as great.[16] Thus, if the respondents were perfectly rational, then the deterrence value of punitive damages for scenario 2 should be 33 times as great as the assessed deterrence value of damages for scenario 1. It should be noted that the .25 probability of detection for scenario 1 lies between two probabilities in the punitive damages table appearing in Exhibit 1 (Table A1), which gives the appropriate value of damages if the probability of detection is 70 percent or 80 percent. Applying these values leads to a potential damages range from $233,000 to $400,000, whereas with a .01 probability of detection the appropriate damages amount for deterrence is $9.9 million. If one treats as correct any damages value in this range for scenario 1, then the appropriate ratio of damages for scenario 2 to that of scenario 1 should be in the range of 24.8–42.4 if respondents are applying the deterrence table properly.

In scenario 3 there is the same probability of detection as in scenario 2, but the scenario is altered so that the reason why there is a low probability of being caught is that the dumping firm engages in a stealthy midnight dumping to avoid detection. In particular, the chemical manager took the following precautions to avoid being detected: "To prevent being caught, his crew loaded the chemical drums onto unmarked trucks and dumped the chemicals in a rural stream at 3:00 A.M. The manager believed that this 'midnight dumping' would reduce the risk of getting caught to 1 in 100. Thus, there was a 99 percent chance of escaping any penalty. He decided that it was worth the gamble because it was the fastest way to get rid of the chemicals, and it was dangerous to keep the chemicals."

Giving respondents information regarding the stealthiness of the activity that led to the imperfect enforcement has two potential ramifications. First,

[16] Overall damages including compensatory damages should be four times as great as the loss with a .25 probability of detection and 100 times as great with a .01 probability.

if respondents do not apply the deterrence damages formula in situations in which the low probability of detection does not arise from stealthy behavior on the part of the company, then indicating that the dumping arose from evasive behavior may increase the credibility of the deterrence approach, thus overcoming some of the reluctance that people may have to use this formula.[17] The second ramification of stealthy behavior is that it makes the parties more appropriate targets for a high punishment value for punitive damages. In this example, we now have a shift manager who undertakes the deceitful act and who might be responsive to financial penalties levied on the company, so punitive damages in this instance may cause defendants to penalize their "*blameworthy employees* who engaged in reprehensible behavior," as the punishment instructions in Exhibit 1 indicate. By comparing the results for scenario 3 with scenario 2, it is possible to determine whether these two influences are operative.

Scenario 4 has the identical fact situation to scenario 3, except that there is an additional complication regarding a plaintiff's attorney request for a damages amount. In particular, the attorney suggests that the appropriate penalty would be $50 million and that the minimum penalty should be $25 million. Will such dollar values serve as an anchor that influences jury thinking? On the basis of the Polinsky-Shavell formula, calculating the deterrence value of punitive damages is a strictly mathematical exercise that should be independent of such anchoring effects. Similarly, the total punitive damages amount should lie between the deterrence values and the punishment values irrespective of such anchoring. However, the punishment value itself could potentially be influenced, and it may also be the case that juries do not properly respond to the jury instructions but instead are influenced by anchoring effects. Anchoring biases are a well-documented phenomenon in the literature, but past studies have not considered the efficacy of jury instructions that narrowly constrain jurors to behave in a way that should eliminate anchoring effects. By comparing the results for scenario 4 with those of scenario 3, it will be possible to assess whether anchoring does in fact have an influence.

Scenario 5 explores the influence of a different source that might produce anchoring. Instead of hearing the pleas of a plaintiff's attorney regarding appropriate damages levels, suppose that jurors have in fact read about penalties levied in similar cases elsewhere. Such information is frequently available to jurors, especially with respect to products for which there is a national line of litigation. How does this information affect the setting of punitive damages?

In scenario 5, what juries receive is information that they have read in a newspaper article describing a similar case in which the jury awarded punitive

[17] This reluctance was a central theme of the results of Sunstein, Schkade, & Kahneman, *supra* note 9.

TABLE 2

SAMPLE CHARACTERISTICS

	Mean	SD
Age	41.35	12.10
Female	.59	.49
White	.63	.48
Black	.13	.33
Hispanic	.20	.40
Other nonwhite races	.05	.21
High school	.13	.34
Some college	.32	.47
College graduate	.37	.48
Professional degree	.17	.38
Smoker	.16	.36
Seat belt user	.90	.30

NOTE.—The sample size is 353 for the respondents considering one of the scenarios 1–5.

damages of $50 million, but this amount was reduced on appeal to $25 million. As with the anchoring results in scenario 4, the question is whether this anchoring information based on publicity will alter the results when compared to those of scenario 3, which did not include any anchoring information. Moreover, there is an additional comparison of interest, which is whether anchoring information based on media coverage is more or less influential than the anchoring information arising from the pleas by the plaintiff's attorney. Thus, the comparison of the results of scenario 5 with those of scenario 4 will be of interest as well.

B. Sample Characteristics

The participants in this study consisted of 353 adult respondents, all of whom were jury-eligible citizens in the Austin, Texas, area. An additional 69 respondents considered a scenario not based on the Polinsky-Shavell formula. A marketing research firm contacted these respondents by phone and brought them to a central location in July 2000. Each respondent was paid $40 to complete a survey that was approximately 30 minutes in length. The demographic mix of the respondents for the five principal scenarios is summarized in Table 2. The average age is 41 years. The sample includes a good mix by gender (59 percent female) and race, as 13 percent are black, 20 percent are Hispanic, and 5 percent are other nonwhite races. The respondent education levels are concentrated among high school graduates and those who have had at least some college. The survey also ascertained whether the individual was a regular smoker and whether the respondent always used seat belts, as these variables may serve as proxies for attitudes toward risk bearing and may affect willingness to impose punitive damages.

The results discussed below will focus chiefly on the overall sample findings, although there will be an attempt to analyze differences across demographic groups as well. A later section of this article presents a multiple regression analysis that analyzes the independent influence of each of these demographic factors on the chief variables of interest.

Each participant recruited for my study was told that they would participate in an opinion study. The first page of the survey provided the following information to establish the legal context of the survey: "You will consider a series of legal case situations. You will be allowed as much time as you need to review the information. Please indicate your best judgment with respect to each question. In almost all instances there are no right or wrong answers. We are interested in your assessments, and people can feel differently about the cases." While most of the questions in the survey pertained to legal case situations, the final question contained a series of assessments regarding the size of different firms in the area. This question had no apparent relevance to legal matters although it was used in a separate analysis to explore the attitude of respondents to firms based on their size. Because this question was last in the survey, it should not affect the legal orientation of the previous questions.

Before considering the toxic dumping case in the Polinsky-Shavell punitive damages instructions, respondents also were given general instructions regarding their role in considering the case as well as a general instruction that would provide the standard type of legal rationale for punitive damages:

> Below you will consider a series of legal cases. In every instance, the trial jury has already ordered each defendant to pay compensatory damages as full compensation for the harm suffered by the plaintiff. We would like you to imagine that you are a member of the punishment jury. Your job is to decide whether and how much each defendant should be punished, in addition to paying compensatory damages.
>
> As a jury member, you are instructed to award punitive damages if a preponderance of the evidence shows that the defendants acted either maliciously or with reckless disregard for the welfare of others. Defendants are considered to have acted maliciously if they intended to injure or harm someone or their property. Defendants are considered to have acted with reckless disregard for the welfare of others if they were aware of the probable harm to others or their property but disregarded it, and their actions were a gross deviation from the standard of care that a normal person would use.

The overall structure of the survey consequently established a strong sense of the legal context that a typical juror would face in a real-world situation. Respondents were very much aware that they should treat the legal situation as if they were members of a jury. Moreover, they received a general background regarding the legal basis for punitive damages. They then considered the specific toxic dumping case scenario and, on the basis of the Polinsky-Shavell punitive damages instructions, established damages levels pertinent to the case. Notwithstanding these efforts to create a realistic experimental situation, it should nevertheless be noted that the assessed behavior is for an

TABLE 3

Accuracy of Deterrence Responses (by Percentage)

Scenario	Missing Responses	Deterrence Value Correct	Final Award in Range	Final Award in Range and Deterrence Correct
1	9	20	73	19
2	6	11	79	11
3	4	21	75	18
4	7	7	76	6
5	9	14	78	14
All	7	15	76	14

experimental context. In an actual case situation, respondents may take their task more seriously, which may possibly improve their performance.

IV. Experimental Results

How well did the respondents perform in carrying out the Polinsky-Shavell punitive damages instructions? The answer to this question depends on a variety of tests and comparisons involving the different scenarios.

Table 3 summarizes the overall statistics pertaining to the accuracy of the deterrence responses in terms of whether the respondents could successfully apply the mathematical formula in part A of the instructions. The statistics there pertain to the results for each of the versions of the survey as well as for the overall findings. The first column of statistics indicates the percentage of the sample for which responses were missing. A value of zero would not be considered missing, but overall about 7 percent of the sample simply drew a blank in terms of being able to solve the problem. Many simply put a question mark by the answer for calculating the deterrence amount or made some rough but unsuccessful attempts to begin a numerical calculation. The subsequent analysis in Section VI will indicate that these respondents were not random but, in fact, were concentrated among the groups whom one might expect to have some difficulty in carrying out the numerical calculations required. While the Polinsky-Shavell instructions generated a significant number of missing values that averaged 7 percent across all five of the experimental treatments, the case scenario in which respondents received conventional punitive damages instructions but not the Polinsky-Shavell formula had no missing values among the 69 respondents. Thus, a general lack of attention to the survey task within the context of my experiment does not appear to be the explanation for the missing values that were observed when respondents were asked to carry out the tasks outlined in the Polinsky-Shavell instructions.

The next column of statistics in Table 3 pertains to those who calculated the deterrence value correctly. For scenario 1, all responses between 233,000 (probability of escaping liability of 70 percent) and 400,000 (probability of escaping liability of 80 percent) were treated as correct. The overall average value of correct responses is 15 percent for all five scenarios, as this amount ranges from 7 percent for scenario 4 to 21 percent for scenario 3. Thus, only a small minority of the respondents can handle the key deterrence value calculation correctly.

Several differences are noteworthy. First, the introduction of stealthy behavior in scenario 3 as opposed to scenario 2 almost doubles the frequency with which respondents assess the correct value of punitive damages, which is $9.9 million based on the fact scenario. Stealthy behavior apparently increases the willingness of respondents to apply the deterrence damages formula.[18] The second noteworthy comparison is that the percentage of correct answers equal to 7 percent for scenario 4 is substantially below that for the equivalent scenario 3, where the only difference is that scenario 4 included an anchoring plea for a penalty by the plaintiff's attorney.[19] This anchoring plea led to the lowest percentage of correct calculations of punitive damages for deterrence for any of the scenarios in the table. In this situation in which there was a potential anchoring, respondents in effect ignored the mathematical table in assessing punitive damages. The anchoring effect of the media coverage of a related punitive damages case in scenario 5 also decreases the accuracy of respondents' application of the formulas when compared to the results in the parallel scenario 3, but to a lesser extent than does the plaintiff's attorney anchoring effect in scenario 4.

The fourth column of statistics in Table 3 pertains to whether the final award is in the appropriate range as dictated by the punitive damages instructions. In particular, the instructions specifically indicate that the punitive damages amount should be between the deterrence value and the punishment value. Roughly three-fourths of the sample gave responses that satisfied this requirement. Overall, 76 percent of the respondents gave a final punitive damages amount that was in the appropriate range. This task apparently is a relatively minor mathematical stumbling block when compared to the initial calculation of the deterrence value based on the reciprocal of the probability of detection.

The overall test for mathematical correctness is whether respondents calculated the deterrence value correctly and whether their final answer was also in the appropriate range. As the final column of statistics in Table 3 indicates, virtually all respondents who calculated the deterrence value correctly also gave a final punitive damages value that was in the correct range.

[18] The percentage of respondents with correct deterrence values is significantly different between scenarios 2 and 3 at the 89 percent level, two-tailed test, thus falling short of the usual standards of significance.

[19] The percentage of respondents with correct deterrence values is significantly different between scenarios 3 and 4 at the 95 percent level, two-tailed test.

TABLE 4

DISTRIBUTION OF RESPONSES TO DIFFERENT QUESTIONS (by Percentage)

Scenario	Deterrence Value Exceeds Punishment	Deterrence Value Equals Punishment	Deterrence Value Below Punishment
1	48	13	39
2	50	15	35
3	54	9	38
4	43	23	34
5	49	11	40
All	49	14	37

NOTE.—All percentage estimates are for sample excluding missing values.

Overall, 14 percent of the sample satisfied both of these mathematical tests. The low value was that only 6 percent of the respondents met these requirements for the anchoring scenario 4, as the effect of the anchor swamped the respondents in their efforts to apply the instructions.

The calculation of the punishment values as the second part of the punitive damages assessment process has less of a firm mathematical basis. However, one would expect the emphasis on punishment to increase with the stealthiness of the employee's actions. Table 4 presents a distribution of the relationship between the deterrence values and the punishment values assessed by respondents. In 49 percent of the cases the deterrence value exceeds the punishment value, and in 37 percent of the cases the deterrence value is below the punishment value. Overall, 14 percent of the respondents had equal values for both deterrence and punishment.

The key pair of results for testing the influence of stealthy behavior is the difference between scenario 2, in which the employees were not stealthy, and the otherwise identical scenario 3, in which there is stealthy midnight dumping. While 3 percent more respondents had punishment values exceeding deterrence values for scenario 3 as compared to scenario 2, an almost identical 4 percent of the respondents were more likely to have deterrence values exceeding punishment values. The main change was the decrease in the number of respondents giving equal values for both deterrence and punishment. Thus, there seems to be no apparent effect of stealthy employee behavior on the relative degree of punishment assessed by respondents, which is not what one would expect if respondents are following the punitive damages instructions.

Perhaps the most interesting outlier of the results in Table 4 consists of the findings for scenario 4, for which there is a high value of 23 percent of the respondents setting equal values for deterrence and punishment. This result is reflective of the strong influence of anchoring effects on both deterrence and punishment values, which will be examined in greater detail below.

Given the explicit nature of the jury instructions in Exhibit 1, the actual

TABLE 5

DISTRIBUTION OF DAMAGES VALUES

A. DETERRENCE VALUE

SCENARIO	MEDIAN	MEAN	95% CONFIDENCE INTERVAL Lower	95% CONFIDENCE INTERVAL Upper
1	355,500	2,904,242	−252,651	6,061,135
2	500,000	3,772,735	1,705,618	5,839,853
3 (full)	900,000	3,827,285	2,558,153	5,096,417
3 (trimmed)[a]	900,000	3,737,981	2,462,461	5,013,501
4	25,000,000	34,079,231	22,241,351	45,917,110
5	9,900,000	20,132,381	11,433,260	28,831,502

B. PUNISHMENT VALUE

SCENARIO	MEDIAN	MEAN	95% CONFIDENCE INTERVAL Lower	95% CONFIDENCE INTERVAL Upper
1	300,000	5,613,678	894,762	10,332,594
2	300,000	1,416,485	687,395	2,145,575
3 (full)	500,000	145,854,864	−140,383,180	432,092,907
3 (trimmed)[a]	500,000	2,411,553	1,506,967	3,316,139
4	25,000,000	29,186,615	21,995,760	36,377,471
5	10,000,000	16,371,905	10,916,862	21,826,947

C. FINAL PUNITIVE DAMAGES AWARD

SCENARIO	MEDIAN	MEAN	95% CONFIDENCE INTERVAL Lower	95% CONFIDENCE INTERVAL Upper
1	475,000	5,717,022	1,088,980	10,345,064
2	500,000	3,521,074	504,870	6,537,277
3 (full)	800,000	146,610,261	−139,606,574	432,827,096
3 (trimmed)[a]	800,000	3,178,059	2,001,817	4,354,301
4	26,000,000	34,844,000	26,621,790	43,146,210
5	12,650,000	22,295,476	14,177,745	30,413,207

[a] The trimmed sample excludes one respondent who assessed a $9.9 billion value for the punishment amount and the final punitive damages award.

level of damages assessed by respondents is of interest as well. Table 5 presents the distribution of damages values for each of the components of the damages calculation. Panel A of Table 5 presents the deterrence values for the survey versions.

For scenario 1, the correct value of damage is $300,000, but values of $233,000–$400,000 are permissible since the probability of escaping liability lies in a range of values in the deterrence calculation table in Exhibit 1. The median response of $355,500 is quite plausible, but the mean value is roughly an order of magnitude greater than is appropriate because of the influence of the high damage assessments.

For scenario 2 and in all subsequent surveys in which the probability of detection is 1 percent, the correct deterrence value based on Exhibit 1 is $9.9 million. Comparison of scenarios 1 and 2 provides a direct test of whether respondents are sufficiently sensitive to the change in the probability of detection, which decreases from 25 percent in scenario 1 to 1 percent in scenario 2, which leads to an optimal deterrence amount in scenario 2 that is 33 times greater than that in scenario 1, or a range of 24.8–42.4 times greater given the range of guidance provided by the values in the table in Exhibit 1. Notwithstanding the major difference in the probability of detection, the actual deterrence values assessed are only slightly different for these two scenarios. The median response in scenario 2 is $500,000, which is only 1.4 times as great as the median response in scenario 1, whereas it should have been much more than an order of magnitude greater. Similarly, the mean response is only 1.3 times as great, which also indicates a substantial insensitivity to the probability of detection. Quite simply, respondents are ignoring the guidance of the deterrence table and are not taking into account the differing value of the detection probability when setting the optimal deterrence amount.

The results for scenario 3 indicate a higher median value, but a mean value that is almost the same as scenario 2. For scenario 3, I report two sets of results. One set of results reports findings for the full sample of respondents. The second set of results omits one respondent who assessed $9.9 billion for both the punishment value and the final punitive damages award. This person is trimmed to eliminate the effect of this outlier on the punishment and deterrence values. The deterrence value responses for scenario 3 are greater than those for scenario 2 in terms of the median response, as the presence of stealthy behavior increases the deterrence value levied. However, on the basis of the punitive damages formula it should have no influence. This result suggests that the character of the behavior leading to the low probability of detection may increase respondents' willingness to apply the formula.

The anchoring effect in scenario 4 proves to be dominant. The plaintiff's attorney gives respondents a minimum award level of $25 million and a desired award of $50 million. This information increases the median assessed deterrence value to $25 million and the mean value to $34 million. Respondents, in effect, abandon the constraints imposed by the deterrence value table and base their judgments largely on the anchoring influence.

Matters are less bleak for the results for scenario 5, in which there is information from media coverage of a similar case. The deterrence value for the median respondent equals the correct deterrence value that should be assessed given the jury instructions. The influence of these media anchors consequently serves to boost the deterrence values levied so that the median respondent is at the correct value, although the mean damages assessed amount of $20 million is over double the correct deterrence value because of the influence of the media anchor information.

The punishment values levied by respondents in panel B of Table 5 follow a pattern quite similar to those for the deterrence values. It is noteworthy that the introduction of stealthy behavior for scenario 3 has only a very small effect on the median punishment value assessed. For the punishment values, the dominant influence that is apparent is the strong influence of the two anchoring scenarios. As with the deterrence values, the median damages value assessed for scenario 4 is $25 million, which is the minimum value that the plaintiff's attorney recommended as being acceptable.

The final punitive damages awards levied by respondents have median values that closely parallel the punishment values and the deterrence values. However, in three of the five scenarios, the final punitive damages award has a median value that lies outside of the median value range of the deterrence and punishment values, which is inconsistent with the general guidance given to setting punitive damages awards. The mean punitive damages awards are much greater. The highest value is for scenario 3 for the full sample of respondents to that scenario, as one respondent levied a $9.9 billion punitive damages award. This individual also answered the deterrence question correctly and had a final punitive damages award that was between the deterrence value and the punishment value, so it does not appear to be an error by the respondent, but rather a sense that the punishment value should be greatly boosted above the deterrence amounts.

Although the effect of the Polinsky-Shavell instructions may vary depending on the particular case context, the general influence in this particular instance appears to be to decrease the assessed value of punitive damages awards for scenarios in which there is no anchoring effect. The final punitive damages awards are $800,000 or less for scenarios 1, 2, and 3, which are lower than the amounts that were found in a sixth version of the survey in which respondents did not consider the Polinsky-Shavell punitive damages instructions but instead relied on more standard guidance.[20]

In the results thus far, the influence of the anchoring manipulations for scenarios 4 and 5 have been manifested in a variety of ways. A graphic illustration of their influence is to examine the number of respondents who gave the anchoring amounts as their deterrence values. Consider the results in Table 6 for scenarios 1–3, in which there is no anchoring component to the scenario. One percent of respondents assessed a $25 million deterrence award, 4 percent assessed a deterrence value between $25 million and $50 million, and no respondents assessed a $50 million deterrence value. For scenario 4, in which there is a plaintiff's attorney anchor, 20 percent assessed a $25 million deterrence value, 12 percent assessed a $50 million deterrence amount, and 17 percent assessed a value between these two extremes. Similar kinds of influences are apparent for the punishment value for scenario 4,

[20] More specifically, for a $20,000 damages value, respondents assessed punitive damages amounts of $1 million. If the damages value had been $100,000 as in the scenarios in this experiment and responses were scaled proportionately, the assessed punitive damages value would be $5 million. However, even the median assessed damages amount without such a proportional adjustment exceeds the assessed punitive damages using the Polinsky-Shavell formulas for scenarios 1, 2, and 3.

TABLE 6

EFFECT OF ANCHOR VALUES ON AWARDS (by Percentage of Sample)

	$25 Million	Between $25 Million and $50 Million	$50 Million
Scenario 1:			
Deterrence	0	0	0
Punishment	0	2	2
Final award	0	2	2
Scenario 2:			
Deterrence	0	4	0
Punishment	0	0	0
Final award	0	0	0
Scenario 3:			
Deterrence	1	0	0
Punishment	0	0	0
Final award	0	0	0
Scenario 4:			
Deterrence	20	17	12
Punishment	23	26	6
Final award	9	29	12
Scenario 5:			
Deterrence	5	6	10
Punishment	13	0	8
Final award	8	11	6

except that there is a shift of respondents from the anchoring amount of $50 million to some value between $25 million and $50 million when assessing punishment. The final award amount for scenario 4 is much more highly concentrated in the range between $25 million and $50 million than the previous responses.

Similar but much less dramatic anchoring effects are apparent for scenario 5, in which there is a media coverage anchor. Another notable difference is that no respondents assessed a punishment value between $25 million and $50 million, as there is a greater concentration at the two endpoint values. The final punitive damages levied often is $25 million or more, but the extent of the effect is not as great as for scenario 4. The media coverage manipulation continues to have less dramatic influences than does the plea from the plaintiff's attorney.

The role of anchors is but one manifestation of the failure of respondents to think seriously about their responses to each question and to give answers that are reflective of the jury instructions. An interesting related question is the extent to which respondents simply gave the same answer to each of the component punitive damage questions or whether they derived different answers based on the jury instructions. Giving the same answer to, for example, the deterrence question and the punishment question does not necessarily reflect an error in interpreting the instructions or a failure to attend to the survey task. However, if there was a consistent pattern in which respondents

TABLE 7

RELATION OF FINAL DAMAGES AND DAMAGES COMPONENTS

A. RELATION OF DAMAGES RESPONSES (Percentage of Sample[a])

	Scenario					
	All	1	2	3	4	5
Deterrence = punishment	14	13	15	9	23	11
Deterrence = final	17	11	26	10	23	14
Punishment = final	19	20	21	14	26	16
Deterrence = punishment = final	10	8	12	4	18	8

B. REGRESSION RESULTS FOR FINAL DAMAGES[b]

	Scenario					
	All	1	2	3	4	5
Deterrence value	.359*	.263*	−.018	.296*	.302*	.544*
	(.021)	(.129)	(.144)	(.084)	(.031)	(.036)
Punishment value	.821*	.728*	2.350*	.780*	.845*	.730*
	(.029)	(.085)	(.405)	(.122)	(.044)	(.053)
Adjusted R^2	.886	.746	.341	.762	.934	.957

NOTE.—Values in parentheses are standard errors.

[a] All percentage estimates are for the sample excluding missing values.

[b] The constant terms were never statistically significant and are consequently suppressed. The coefficients for the other variables are almost identical with and without a constant term. Estimates for scenario 3 are for the trimmed sample excluding one outlier.

* Statistically significant at the 95% confidence level, two-tailed test.

simply gave the same answer to each of the three punitive damages questions, it would suggest that they were not differentiating the separate concerns raised by the different components of the punitive damages instructions.

The findings in panel A of Table 7 indicate that such extreme uniformity of responses was not evident. There was, of course, some tendency to give the same answers across questions. For example, 14 percent of the sample had deterrence values equal to the punishment value, and 10 percent of the sample gave the same answer to each of the three questions. Alternative interpretations of my result might suggest that such uniformity reflects a failure of respondents to be adequately engaged in the survey. However, these uniform responses occurred in only a minority of the cases. Moreover, the Polinsky-Shavell formulas give no guidance that indicates that the punishment value should necessarily differ from the deterrence value. The greatest frequency of uniform responses across the questions occurs for scenario 4, which has the strong anchoring information based on the appeal by the plaintiff's attorney. For that survey, 18 percent of the sample gave the same answer to each of the three punitive damages questions, and approximately one-fourth of the sample gave an identical answer to at least two of the three punitive damages questions. Anchoring effects consequently serve to decrease the extent to which the subjects make distinctions across the punitive damages categories, which is another reflection of how they undermine the influence of the instructions. However, the majority of the subjects did not exhibit the extreme uniformity across all three categories.

How then do the respondents arrive at their final punitive damages figure? On the basis of the instructions given to them, the number should be between the two component punitive damages values. Thus, one can formulate what respondents did as being some kind of weighted average of their two responses, where these weights should sum to 1.0.

To test for these relationships, panel B of Table 7 reports the regression results in which the final punitive damages amount is regressed on the two component values—the deterrence value and the punishment value. No constant term is included in the regression because on a theoretical basis there should be no such value as the damages amount should be zero if both the deterrence value and the punishment value are also zero. The empirical estimates that included a constant term also indicated effects that were not statistically significant at the usual levels in every instance, and the coefficients on the remaining variables were not sensitive to the inclusion of a constant term. Whereas a coefficient of .5 on the deterrence value and the punishment value would indicate equal weighting of these two components, in every instance shown in panel B of Table 7 the punishment value has a greater weight.[21] The weight on the punishment value ranges from .7 for scenario 1 to a high of 2.4 for scenario 2, with an average across all surveys of .82. The deterrence value, which is purportedly the more important value from the standpoint of the Polinsky-Shavell framework, consistently receives a lower weight than does the punishment value and, in the case of scenario 2, plays no statistically significant role whatsoever in influencing the final damages value. These results indicate that the mathematical calculations that produced the first step of the punitive damages calculation, the deterrence value, were not in fact regarded as the most salient contributor to the respondents' assessment of punitive damages. Rather, it was the more nebulously characterized punishment value that proved to be most instrumental in setting the punitive damages awards.

A second observation is that respondents did not simply form some kind of weighted average of the two punitive damages values. Rather, in every instance the weights sum to a value more than 1.0, with an average across all survey versions of 1.17. There is consequently a tendency to not treat the deterrence values and punishment values as simple components of a weighted average when setting the overall punitive damages level. Rather, respondents engage in a much more explosive punitive damages calculation that boosts the overall level of punitive damages above what would result

[21] More specifically, based on the pertinent *F*-tests, one can always reject the hypothesis that the deterrence coefficient and punishment coefficient are identical.

from any simple weighting scheme. Appendix C provides more detailed statistical analysis of how scenario characteristics affect punitive damages.

V. Results for Synthetic Juries

Although individual responses may not always be correct, it could be that juries would perform much more successfully. The approach that I will take here will be to construct synthetic juries based on the individual responses. I will then analyze the median responses of these synthetic juries, which is generally believed to be indicative of likely jury behavior. Recent experimental work has shown that for punitive damages tasks, actual experimental juries lead to more extreme results than one would expect on the basis of the synthetic jury analyses.[22] Thus, experimental results in the literature suggest that putting people in a group situation does not eliminate or ameliorate the problems people have in setting punitive damages amounts. Rather, the opposite result appears to be the case, as group decisions often fare somewhat worse. Moreover, there is also experimental evidence indicating that when considering cases in a group context, there is also little adherence to instructions, so this aspect of jury performance may not be improved by group behavior either.[23] Consequently, the findings here may understate the extent to which juries will levy inordinately high punitive damages penalties.

Whether or not actual groups will be more extreme for my particular experimental context may, of course, differ from past studies. The Polinsky-Shavell formulas give jurors guidance for which there is, in fact, a correct answer. Conceivably, jurors who did the deterrence calculation correctly could convince others to adopt their approach, which is based on basic arithmetic rather than subjective judgments. In the absence of actual group interactions to explore such phenomena, I will focus on the role of synthetic juries, recognizing that actual jury groups could be more or less attentive to the damages instructions.

The procedure used was to construct 12-person juries by drawing a sample of 12 individuals at random with replacement from the sample set. For each scenario a total of 1,000 synthetic juries were constructed, thus providing a very large sample to enable one to make fairly precise judgments regarding the likely performance of such juries. In situations in which the sixth- and seventh-ranked jurors have differing damages amounts to any of the questions, the midpoint value of their responses served as the median value.

The first question to be addressed is whether the synthetic juries are more successful in correctly applying the deterrence value calculations. As it turns

[22] See Sunstein, Kahneman, & Schkade, *supra* note 5; Kahneman, Schkade, & Sunstein, *supra* note 5; Schkade, Sunstein, & Kahneman, *supra* note 5; and W. Kip Viscusi, Jurors, Judges, and the Mistreatment of Risk by the Courts, 30 J. Legal Stud. 107, 142 (2001).

[23] See Reid Hastie, David A. Schkade, & John W. Payne, A Study of Juror and Jury Judgments in Civil Cases: Deciding Liability for Punitive Damages, 22 Law & Hum. Behav. 287, 314 (1998).

TABLE 8

SYNTHETIC 12-PERSON JURIES WITH CORRECT VALUE FOR DETERRENCE DAMAGES AMOUNT

Scenario	Percentage Correct
1	74.3
2	.2
3	2.3
4	1.0
5	25.7

out, whether they are or not depends on whether the median respondent on an individual basis applied the formula correctly. The results in Table 8 provide a quite striking contrast in the relative performance of the juries and the individual respondents. For scenario 1, 74 percent of the juries gave a correct answer to the punitive damages deterrence value, as did 27 percent of the juries for scenario 5. In each instance, the median individual response to the deterrence question reported in Table 5 was in the correct range. Somewhat strikingly, for the other three survey versions, no more than 2 percent of any of these juries gave correct values for the deterrence questions. In these instances, the median respondent on an individual basis was not close to the correct deterrence value. For scenarios 2 and 3, the individual responses reported in Table 5 were at least an order of magnitude too low, and for the anchoring scenario 4, the median deterrence value was more than twice as great as the correct answer. Thus, in terms of jury performance, the general implication is that overall juries could perform more successfully if the median juror applies the deterrence formulas correctly, but if the median juror errs considerably, then the jury as a whole will not perform satisfactorily.

The actual values yielded by the synthetic juries appear in Table 9. The confidence intervals are very narrow for these responses because of the large sample of juries. In addition, there is no need to show what the results for scenario 3 would be with and without the one outlier respondent because this extreme value never influences the median damages assessment.

There is an extremely close parallel between the responses by the synthetic juries and the median values in Table 5. The deterrence values assessed in scenarios 1 and 2 differ by less than a factor of two, which is much less of an effect than should be expected given the differing probabilities of detection. As before, the deterrence value for scenario 3 is an order of magnitude too small, and the deterrence value for scenario 5, in which there is some anchoring influence, turns out to be correct. The extreme value remains the jury verdict for scenario 4, in which juries anchor on the $25 million figure.

This anchoring effect continues for the results in panel B, as the median

TABLE 9

SYNTHETIC JURY RESULTS WITH 1,000 12-PERSON JURIES FOR EACH SCENARIO

A. DETERRENCE VALUE				
			95% CONFIDENCE INTERVAL	
SCENARIO	MEDIAN	MEAN	Lower	Upper
1	350,000	368,298	353,419	383,177
2	650,000	723,880	672,375	775,384
3	945,000	1,594,120	1,469,270	1,718,969
4	25,000,000	23,768,150	23,303,441	24,232,859
5	9,900,000	9,831,294	9,444,227	10,218,361
B. PUNISHMENT VALUE				
			95% CONFIDENCE INTERVAL	
SCENARIO	MEDIAN	MEAN	Lower	Upper
1	364,500	449,535	426,526	472,544
2	325,000	401,700	384,026	419,374
3	550,000	812,525	766,771	858,279
4	25,000,000	24,903,100	24,566,105	25,240,095
5	10,000,000	10,226,230	9,877,432	10,575,028
C. FINAL AWARD VALUE				
			95% CONFIDENCE INTERVAL	
SCENARIO	MEDIAN	MEAN	Lower	Upper
1	525,000	596,078	566,689	625,466
2	500,000	658,037	627,459	688,616
3	837,250	1,176,194	1,109,498	1,242,891
4	27,500,000	28,492,725	28,041,468	28,943,982
5	13,500,000	13,736,375	13,287,342	14,185,408

jury generates a punishment value of $25 million. Indeed, there is little discrepancy throughout the table between the jury assessments of deterrence values and punishment values except that the punishment values are smaller than the deterrence values for scenarios 2 and 3.

The ultimate implications of the individual responses within the context of these synthetic juries are reflected in panel C of Table 9. The effects of the different manipulations on jury behavior appear in the damages values assessed. The anchoring scenario 4 yields the highest median verdict amount of $27.5 million, with a mean verdict that is quite similar, at $28.5 million. The next largest jury award is for the media anchoring scenario 5, which leads to a median award of $13.5 million and a similar mean final award value. Indeed, a noteworthy implication throughout this table is that the median jury award and the mean jury award tend to be very similar. Whereas the mean individual awards in Table 5 were generally considerably higher than the median award level for every damages response, once people are put within the context of a 12-person jury for which it is the median juror

TABLE 10

DEMOGRAPHIC DIFFERENCES IN THE ACCURACY OF THE DETERRENCE VALUE RESPONSES

	Correct	Incorrect or Missing	Incorrect
Age	38.60	41.84	41.91
Female	.44	.62*	.61*
White	.85	.60*	.61*
Black	.06	.14	.14
Hispanic	.06	.22*	.21*
Other nonwhite races	.04	.05	.04
High school	.02	.15*	.15*
Some college	.19	.35*	.35*
College graduate	.56	.33*	.34*
Professional degree	.23	.16	.16
Smoker	.15	.16	.15
Seat belt user	.90	.90	.90

* The value is significantly different from that in the value correct column at the 95% confidence interval, two-tailed test.

that drives the value, then there is a dramatic moderating influence on the award levels.

As before, the damages awards for scenarios 1–3 are considerably smaller. For scenarios 2 and 3, they are more than an order of magnitude smaller than would be suggested by the deterrence values calculated using the approach in Exhibit 1. The award levels assessed for scenarios 1 and 2 are so close that there appears to be almost no influence whatsoever of the change in the probability of detection from 25 percent to 1 percent. Respondents simply failed to incorporate this fundamental aspect of the case scenario into their assessments. Award levels rise a bit for scenario 3, in which there is stealthy behavior, as one would expect, but by far the greatest influence is the anchoring effects present in the final two scenarios.

VI. DEMOGRAPHIC DIFFERENCES

How well a set of jury instructions enables jurors to make punitive damages judgments depends on how the instructions perform on average for a sample and also on whether all segments of society can comprehend the instructions and make reliable judgments. Thus, a key issue is whether there is widespread ability and willingness to apply the instructions or whether there are narrowly defined segments of the population who do not adhere to the instructions.

On the basis of the previous results, the principal test for the accuracy of responses is whether the respondent calculated the deterrence value correctly in setting the base punitive damages amount dictated by the jury instructions in Exhibit 1. Table 10 provides a breakdown of the sample characteristics of those respondents who answered the deterrence value correctly, those who got the deterrence value incorrect or had missing data, and those who got the incorrect answer. As is evident, the demographic profile of the incorrect or missing group is almost identical to those who simply got the answer incorrect, so for simplicity I will focus on the incorrect or missing column and compare that to those who answer the question correctly.

Respondent age does not appear to be a particularly influential characteristic. There is no significant age difference in whether respondents answer the question correctly.

Gender, however, does appear to be more influential. Whereas 44 percent of the sample answering the question correctly were women, 62 percent of those giving incorrect or missing answers were female. This result may be reflective of a gender difference in mathematical skills, but it also may be indicative of a greater reluctance by female respondents to surrender their punitive damages judgment to a mathematical formula.

Two of the racial differences proved to be significant. Overall, 85 percent of the respondents who answered the deterrence value correctly were white, as compared to 60 percent who had incorrect or missing values. The opposing pattern is displayed by the Hispanic respondents, who constitute 6 percent of the correct respondents and 22 percent of the incorrect respondents. A similar but less dramatic pattern in exhibited by the black respondents.[24]

Educational levels proved to be pivotal. Only 2 percent of the sample giving correct answers had high school educations or less, as compared to 15 percent with incorrect answers. Respondents with some college also experienced particular difficulties in successfully completing the deterrence question. The main outlier in terms of overall performance was college graduates, who constituted 56 percent of those with correct answers and 33 percent of those with incorrect or missing answers. Respondents with professional degrees also tended to perform disproportionately well, though the differences are not significant across the different columns.

Although college graduates and those with professional degrees often completed the survey in a manner that followed the Polinsky-Shavell instructions, a considerable portion of this group did not carry out these instructions. As the statistics in the final column of Table 10 indicate, 50 percent of those who did not give correct deterrence values according to the Polinsky-Shavell formulas were either college graduates or professionals. Given the fact that these formulas required only simple multiplication, it would be difficult to make the case that these individuals were unable to carry out the basic arithmetic. A more compelling explanation is that many respondents were simply unwilling to carry out these instructions. This unwillingness is consistent with the similar reluctance to apply this approach on the part of Uni-

[24] The difference for the black respondents fell just shy of statistical significance at the 95 percent confidence level, two-tailed test.

TABLE 11

PROBIT REGRESSION OF PROBABILITY OF CORRECT ANSWERS, MARGINAL PROBABILITIES

Variable	Coefficient	Asymptotic SE
Age	−.003*	.001
Female	−.051	.034
Black	−.107*	.024
Hispanic	−.083*	.030
Other nonwhite races	−.064	.035
Some college	.148	.035
College graduate	.216*	.110
Professional degree	.319*	.166
Smoker	−.005	.043
Seat belt user	−.009	.057
Scenario 2	−.053	.036
Scenario 3	−.019	.041
Scenario 4	−.098*	.030
Scenario 5	−.047	.037

* Coefficient is significant at the 95% confidence level, two-tailed test.

versity of Chicago Law School students, who also did not find the reciprocal probability rule for setting punitive damages to be a sensible approach.[25]

Attitudes toward risk taking more generally do not appear to be consequential. Neither smoking status nor seat belt use influenced whether respondents answered the questions correctly.

These demographic results are instructive, but they reflect only the partial influence of each demographic factor considered separately without controlling for influences correlated with these variables. For example, different demographic groups may vary in terms of their educational levels, so minority status could be reflecting differences in education rather than differences in ethnic background more generally.

To analyze these influences, Table 11 provides a probit regression analysis of the probability that the respondent provided correct answers to the deterrence question. The coefficients for the estimates have been transformed so they have a quite direct interpretation in terms of marginal probabilities. For example, the coefficient for females of −.051 means that being a female decreases the probability of getting the correct answer by 5 percent. What is noteworthy about these results is that while many patterns closely parallel the results for the sample characteristic comparisons in Table 10, some are different.

Age now has a statistically significant influence that is negative. The magnitude of the effect is, however, small, as an increase of 10 years in age of the respondent decreases the probability of answering the deterrence question

[25] See Sunstein, Schkade, & Kahneman, *supra* note 9.

correctly by .03. Being female is not significant, as the overall influence found in Table 10 may be due to other factors correlated with gender, such as education.

Minority status also appears to be influential for the major groups represented in the sample. Black respondents have a probability that is .11 lower and Hispanic respondents have a probability that is .08 lower of answering the question correctly than that for the group that has been excluded from the regressions, white respondents. The point estimate for other nonwhite races is similar to that for Hispanics but is not statistically significant, perhaps because of the small sample size.

In analyzing education effects, the excluded categorical group consists of those who have had only some high school education or are high school graduates. The groups that have superior performance that is statistically significant are college graduates, who are 22 percent more likely to answer the deterrence question correctly, and those with professional degrees, who are 32 percent more likely to answer the deterrence question correctly. Educational differences matter even controlling for other background characteristics and respondent ethnicity.

Attitudes toward riskiness as reflected in smoking status and seat belt use are inconsequential. Because the survey consists of a mathematical task rather than being a question of whether punitive damages should be high or low, these risk attitude variables are not correlated with respondent performance.

The final set of variables in the analysis in Table 11 consists of indicator variables for each of the scenarios other than scenario 1, which serves as the reference point and basis of comparison. The only scenario variable that is statistically significant is that for scenario 4, as respondents are 9.8 percent less likely to handle the calculations correctly than they are for scenario 1. This result is consistent with the earlier findings that anchoring effects intrude on respondent performance and diminish the degree to which respondents take into account the jury instructions as opposed to the anchoring information.

The regression results in Table 12 explore the determinants of the damage award levels as a function of the same set of explanatory variables considered earlier. The damages award amounts do not appear to be greatly sensitive to either background characteristics or education levels. The strongest influence appears to be that of gender, as women assess a lower punishment value and a lower final award level than do men.

It is particularly interesting that the risk attitude variables are consequential in the damages value regressions in Table 12. People who wear seat belts while driving in cars make up those who are less willing to incur risks and less willing to violate seat belt use laws than are those who do not wear seat belts. This group of respondents consistently awards greater punitive damages in every case. The sign of this effect is in the expected direction. The magnitudes of the effect are also considerable. For total award levels, for example,

TABLE 12

REGRESSION OF DAMAGES AWARD VALUES ON PERSONAL CHARACTERISTICS

Variable	Deterrence Value	Punishment Value	Final Award
Constant	11.476*	13.227*	12.755*
	(.770)	(.899)	(.729)
Age	−.001	−.024	−.019
	(.012)	(.136)	(.011)
Female	−.244	−.830*	−.672*
	(.279)	(.325)	(.264)
Black	−.554	−.981*	−.532
	(.425)	(.496)	(.402)
Hispanic	.242	.094	.307
	(.368)	(.429)	(.348)
Other nonwhite races	−.122	−1.000	−.180
	(.706)	(.824)	(.668)
Some college	.182	.222	.336
	(.449)	(.524)	(.425)
College graduate	.368	.210	.580
	(.449)	(.524)	(.425)
Professional degree	.193	.889	.823
	(.526)	(.614)	(.498)
Smoker	.315	−.067	.066
	(.391)	(.456)	(.370)
Seat belt user	1.493*	1.050*	1.327*
	(.458)	(.534)	(.433)
Scenario 2	.323	−.400	−.054
	(.430)	(.502)	(.407)
Scenario 3	.800	.227	.544
	(.428)	(.500)	(.405)
Scenario 4	3.295*	3.285*	3.215*
	(.439)	(.512)	(.416)
Scenario 5	2.082*	1.894*	2.407*
	(.439)	(.513)	(.416)

NOTE.—The dependent variable is the natural logarithm of damages. Standard errors are in parentheses.

* Significant at the 95% confidence level, two-tailed test.

the coefficient implies that seat belt users will make damages awards that are 277 percent greater than those who do not use seat belts.

The final set of variables in the damages equations in Table 12 consist of the different scenarios, where once again the omitted category that serves as the reference point is scenario 1. Both scenario 4 and scenario 5 have large and statistically significant effects. The influence of the anchoring effects in each instance is almost identical in terms of their effect on deterrence values, punishment values, and final award levels for any given survey version. As before, the greater influence is for the plaintiff's attorney anchoring effects in scenario 4, though the media anchors are significant as well.

In the case of both answering the questions correctly and awarding damages, the survey information, particularly that pertaining to anchoring, proves to be influential. However, the role of demographic characteristics was quite different. Demographic factors in terms of background characteristics play a much greater role with respect to answering the questions correctly but do not have any net influence on the level of the various damages values in most instances. Instead, the additional demographic influence that comes into play in setting the level of punitive damages is the risk attitude variable pertaining to seat belt use.

One possible interpretation of the relative insensitivity of the damages awards to some demographic factors in Table 12 is that respondents were not devoting serious attention to the survey task. However, I disagree with this interpretation. Sometimes some variables are not statistically significant because there is no significant variation with such influences, not because the underlying experiment is weak. It is also clear from the results in Table 12 that there are several statistically significant influences for the different survey structures, especially those with anchoring components. In addition, gender, seat belt use, and to a lesser extent race were significant factors in driving damages awards. Moreover, the findings in Table 11 for whether the respondent calculated the optimal deterrence value correctly showed significant variation by race, education, and inclusion of anchoring information in the scenario. The large standard errors on some demographic variables are attributable in part to small sample sizes in particular categories.

VII. Conclusion

Can providing jurors with a detailed rationale and mathematical formula for setting punitive damages solve the problem of random and highly variable punitive damages awards? The experimental results reported here are not promising. Few respondents were able to make the key calculation pertaining to the optimal deterrence value for punishment. A much greater percentage carried out the second mathematical task of setting a total award value between the punishment value and the deterrence value, but even this straightforward exercise posed difficulties for a significant segment of the population. Respondents also were not sensitive to the probability of detection, which is the key parameter of importance in the law and economics perspective on punitive damages. Perhaps most troubling is that these difficulties are not random but are highly concentrated among particular demographic groups, specifically minorities and the less well educated.

The character of the experimental evidence demonstrated that people did not carry out the Polinsky-Shavell instructions in setting punitive damages. The experiment did not distinguish whether people were unable to implement these instructions or were unwilling to follow these instructions. There was clearly a significant minority of the population who found the basic multiplication tasks required too difficult. However, the large portion of college-educated and professional respondents who did not assess punitive damages levels consistent with the Polinsky-Shavell approach suggests that there is also a substantial problem in motivating individuals to apply the formulas. This reluctance is consistent with other evidence from University of Chicago Law School graduates that indicates that people simply do not find this approach a compelling or reasonable way to assess punitive damages amounts.

Matters of course may be somewhat different in actual jury contexts if these formulas were ever adopted. Actual jurors might be more conscientious in applying the instructions than in an experimental setting. However, seeking refuge in explanations that lie outside of any feasible experimental structure ignores the major strength of the experimental design. My study made it possible to distinguish the incremental effect of different aspects of the design, such as the probability of detection. Other features of the case and the experimental context were the same across all respondents. What these results demonstrate is that changes in the character of the cases simply do not have the kinds of effects on individual judgments that would be predicted if people followed the Polinsky-Shavell instructions.

Cases in the real world will not be abstractions but will include a wide variety of other kinds of information not included in the scenarios tested here. An example of this kind of information that was incorporated in the study design consisted of anchoring influences in terms of appeals by a plaintiff's attorney and media coverage of a related case. The character of the jury instructions should lead respondents to ignore such anchoring biases when setting the value of punitive damages for purposes of deterrence. However, this was not the case, as this supposedly extraneous information swamped the influence of the quite explicit jury instructions. Respondents in effect cast aside the formal guidance once presented with some other damage value anchor that they can use in setting the damages amount.

When going from individual performance to group performance, the driving factor is the performance of the median juror. In situations in which the median juror has sound judgment and is able to properly interpret the punitive damages instructions, the jury performance can be quite good—even much better than would be expected on the basis of the small minority of individual respondents who got the correct answer. However, if the median juror has a deterrence value assessment that is substantially off the mark, then the performance of group decision making in our simulated jury analysis was much worse than what would be expected on the basis of the individual results. Previous experimental research suggests that this kind of magnification of effects may be enhanced even more within the context of actual group deliberations. However, whether this magnification will occur with these particular jury instructions is not clear. There is a correct answer to the optimal deterrence amount, and this property of the instructions may improve group decisions.

These results do not imply that one can never devise jury instructions that will put punitive damages on sound footing. Nor do they imply that no form of instructions designed to promote optimal deterrence will ever succeed. However, they do highlight the challenging character of this task. Many respondents are simply reluctant or unable to carry out even the most basic mathematical calculations. Moreover, they appear quite willing to abandon the jury instructions when they have other rationales for setting punitive damages that they find to be either more convenient or more compelling.

The findings also highlight the potential of other kinds of reforms of punitive damages. Some observers have called for greater reliance on judges in setting punitive damages or the elimination of punitive damages for environmental and safety torts in which there is a strong government regulatory presence.[26] Unless some form of jury instructions can be devised to provide greater structure to the process of setting punitive damages, there will continue to be advocacy of more sweeping reform measures.

The experimental findings also have parallels with respect to other analyses of jury behavior. Even in situations involving fairly conventional jury instructions, there is little evidence that people pay attention to these instructions when deciding on punitive damages.[27] Thus, the criteria for maliciousness and reckless behavior tend to play a very small part in conventional jury deliberations and an even smaller role in the justifications that people give for punitive damages award decisions. The neglect of the Polinsky-Shavell jury instructions by my large sample of jury-eligible citizens is consistent with the performance of juries more generally.

APPENDIX A

Exhibit 1

In considering the imposition of punitive damages on the defendant, you should determine three dollar amounts: (A) an amount to accomplish deterrence; (B) an amount to accomplish punishment; (C) a final amount—your punitive damages award—between your answers for A and B.

A. Deterrence

1. Punitive damages fulfill the deterrence objective to the extent that they deliver a message and warning to the defendant and to other similarly situated firms to take appropriate steps to prevent harm in the future. But punitive damages will not fulfill the deterrence objective if they cause firms to take wasteful steps to prevent harm, if they cause the prices of products and services to rise excessively, or if they cause firms to withdraw socially valuable produces or services from the market.

2. To achieve the deterrence objective, your principal task is to estimate the likelihood that the defendant might have escaped having to pay for the harm for which it should be responsible. Thus, for example, if the harm was noticeable and likely

[26] See W. Kip Viscusi, The Social Costs of Punitive Damages against Corporations in Environmental and Safety Torts, 87 Geo. L. J. 285 (1998); and Sunstein, Kahneman, & Schkade, *supra* note 5.

[27] See Hastie, Schkade, & Payne, *supra* note 23.

TABLE A1

PUNITIVE DAMAGES MULTIPLIERS

Probability of Escaping Liability (%)	Punitive Damages Multiplier
0	.00
10	.11
20	.25
30	.43
40	.67
50	1.00
60	1.50
70	2.33
80	4.00
90	9.00
99	99.00

to lead to a lawsuit, your estimate of the likelihood of escaping liability would be relatively low. But if the harm might not have been attributed to the defendant, or if the defendant tried to conceal its harmful conduct, your estimate of the likelihood of escaping liability would be relatively high.

3. You should use the Table below [Table A1] to determine the punitive damages multiplier that corresponds to your estimated probability of escaping liability. Then multiply the compensatory damages amount by your punitive damages multiplier. The resulting number is the *base punitive damages amount.*

4. The base punitive damages amount should not be adjusted because of any of the following considerations:

a) reprehensibility of the defendant's conduct;
b) net worth, revenues, or profits of the defendant;
c) potential harm, that is, the harm that might have been caused by the defendant's conduct;
d) gain or profit that the defendant might have obtained from its harmful conduct;
e) litigation costs borne by the plaintiff;
f) components of harm that you did not include in compensatory damages;
g) whether the harm included personal injury.

What amount do you believe the base punitive damages amount should be?

____

B. PUNISHMENT

Punitive damages fulfill the punishment objective to the extent that they cause defendants to penalize their *blameworthy employees* who engaged in reprehensible behavior.

In considering punishment, you should keep in mind that the defendant's payment of compensatory damages already may lead to the punishment of blameworthy employees to some extent.

In considering how well the imposition of punitive damages will fulfill the punishment objective, you should also bear the following in mind:

a) the extent to which you believe blameworthy employees can be identified and penalized by the defendant. The easier this identification is, the higher should be the level of punitive damages.

b) the extent to which you believe that innocent parties will suffer as a result of the imposition of punitive damages on the defendant; such parties might include shareholders as well as customers, who may have to pay higher prices for the defendant's products or services. The more likely it is that innocent parties will be punished, the lower should be the level of punitive damages.

In the light of these considerations, you should determine the amount of punitive damages that you believe will accomplish proper punishment.

What amount of punitive damages do you believe the punishment amount be?

____

C. Determination of Punitive Damages

Punitive damages should be an amount between the amount that you found appropriate for the purpose of deterrence and the amount that you found appropriate for the purpose of punishment. If you attach greater importance to the deterrence objective, punitive damages should be closer to the amount that you found best to promote deterrence. If you attach greater importance to the punishment objective, punitive damages should be closer to the amount that you found best to promote punishment.

Using your estimates of the base punitive damages amount, the punishment amount, and your assessment of the company's behavior, what do you believe the punitive damages amount should be? Please write the amount of punitive damages you believe is appropriate in the blank below.

____

APPENDIX B

Scenario 1

The *Toxic Chemical Research Institute* develops new chemicals for industrial uses. As part of its operations, it generates concentrated amounts of highly toxic chemical wastes. Usually, a waste disposal company removes the waste to a safe landfill set aside for that purpose. However, owing to extremely adverse weather conditions, the landfill is temporarily closed. The company has 12 steel drums of dangerous chemicals that it is eager to remove from the plant before a major production run for its most important customer. There is no legal way to dispose of the chemicals quickly. The company decided instead to violate U.S. government rules for safe disposal of dangerous chemicals.

The shift manager, worried about the accumulating chemicals, decided that the easiest way to get rid of the chemicals would be to dump them in the stream behind the plant. The manager knew that there was a 25 percent chance that the EPA inspector was going to be visiting the plant next week and that if he did the dumping would be discovered. Thus, there was also a 75 percent chance of not getting caught. Despite the risk of getting caught, he told his crew that it was worth the gamble because it was the easiest way to get rid of the chemicals, and it was dangerous to keep the chemicals.

An EPA inspector did identify the spill and determine that *Toxic Chemical Research Institute* was responsible for it. No health hazard to humans occurred, but there was $100,000 in cost to the city owing to additional water treatment costs. The EPA fined the company $100,000 to cover these costs. The company paid this $100,000 amount.

The city is now seeking punitive damages to punish the company's behavior. Your task is to determine the amount of punitive damages to levy, if you believe punitive damages are warranted.

Below are the guidelines for determining these amounts, provided as part of the judge's instructions.

SCENARIO 2

The *Toxic Chemical Research Institute* develops new chemicals for industrial uses. As part of its operations, it generates concentrated amounts of highly toxic chemical wastes. Usually, a waste disposal company removes the waste to a safe landfill set aside for that purpose. However, owing to extremely adverse weather conditions, the landfill is temporarily closed. The company has 12 steel drums of dangerous chemicals that it is eager to remove from the plant before a major production run for its most important customer. There is no legal way to dispose of the chemicals quickly. The company decided instead to violate U.S. government rules for safe disposal of dangerous chemicals.

The shift manager, worried about the accumulating chemicals, decided that the easiest way to get rid of the chemicals would be to dump them in the stream behind the plant. The manager knew that there was a 1 percent chance that the EPA inspector would be visiting the plant next week and that if he did the dumping would be discovered. His best estimate is that there was only a 1 percent chance of being inspected, caught and penalized. Thus, there was a 99 percent chance of escaping any penalty. Despite the risk of getting caught, he told his crew that it was worth the gamble because it was the easiest way to get rid of the chemicals, and it was dangerous to keep the chemicals.

An EPA inspector did identify the spill and determine that *Toxic Chemical Research Institute* was responsible for it. No health hazard to humans occurred, but there was \$100,000 in cost to the city owing to additional water treatment costs. The EPA fined the company \$100,000 to cover these costs. The company paid this \$100,000 amount.

The city is now seeking punitive damages to punish the company's behavior. Your task is to determine the amount of punitive damages to levy, if you believe punitive damages are warranted.

Below are the guidelines for determining these amounts, provided as part of the judge's instructions.

SCENARIO 3

The *Toxic Chemical Research Institute* develops new chemicals for industrial uses. As part of its operations, it generates concentrated amounts of highly toxic chemical wastes. Usually, a waste disposal company removes the waste to a safe landfill set aside for that purpose. However, owing to extremely adverse weather conditions, the landfill is temporarily closed. The company has 12 steel drums of dangerous chemicals that it is eager to remove from the plant before a major production run for its most important customer. There is no legal way to dispose of the chemicals quickly. The company decided instead to violate U.S. government rules for safe disposal of dangerous chemicals.

The shift manager, worried about the accumulating chemicals, knew that if he dumped the chemicals nearby that his company would definitely be caught and punished. To prevent being caught, his crew loaded the chemical drums onto unmarked trucks and dumped the chemicals in a rural stream at 3:00 A.M. The manager believed that this "midnight dumping" would reduce the risk of getting caught to 1 in 100. Thus, there is a 99 percent chance of escaping any penalty. He decided that it was worth the gamble because it was the fastest way to get rid of the chemicals, and it was dangerous to keep the chemicals.

An EPA inspector did identify the spill and determine that *Toxic Chemical Research Institute* was responsible for it. No health hazard to humans occurred, but there was

$100,000 in cost to the city owing to additional water treatment costs. The EPA fined the company $100,000 to cover these costs. The company paid this $100,000 amount.

The city is now seeking punitive damages to punish the company's behavior. Your task is to determine the amount of punitive damages to levy, if you believe punitive damages are warranted.

Below are the guidelines for determining these amounts, provided as part of the judge's instructions.

Scenario 4

The *Toxic Chemical Research Institute* develops new chemicals for industrial uses. As part of its operations, it generates concentrated amounts of highly toxic chemical wastes. Usually, a waste disposal company removes the waste to a safe landfill set aside for that purpose. However, owing to extremely adverse weather conditions, the landfill is temporarily closed. The company has 12 steel drums of dangerous chemicals that it is eager to remove from the plant before a major production run for its most important customer. There is no legal way to dispose of the chemicals quickly. The company decided instead to violate U.S. government rules for safe disposal of dangerous chemicals.

The shift manager, worried about the accumulating chemicals, knew that if he dumped the chemicals nearby that his company would definitely be caught and punished. To prevent being caught, his crew loaded the chemical drums onto unmarked trucks and dumped the chemicals in a rural stream at 3:00 A.M. The manager believed that this "midnight dumping" would reduce the risk of getting caught to 1 in 100. Thus, there is a 99 percent chance of escaping any penalty. He decided that it was worth the gamble because it was the fastest way to get rid of the chemicals, and it was dangerous to keep the chemicals.

An EPA inspector did identify the spill and determine that *Toxic Chemical Research Institute* was responsible for it. No health hazard to humans occurred, but there was $100,000 in cost to the city owing to additional water treatment costs. The EPA fined the company $100,000 to cover these costs. The company paid this $100,000 amount.

The city is now seeking punitive damages to punish the company's behavior. Your task is to determine the amount of punitive damages to levy, if you believe punitive damages are warranted. In his closing statement, the plaintiff's attorney made the following arguments: "Your job as jurors is to impose a penalty which will make this corporation, and others, conduct their business in a way which protects the defenseless citizens of Texas who have no other way of getting the company to be responsible. This is your job. A penalty against this company has to be one that they will notice. It would not destroy this company or even cause them long-term financial harm to impose a penalty on them of $50 million, about 20 percent of their net worth, or about two and one-half times their annual profit. Certainly a minimum penalty should be 1 year's profit, about $25 million, so the range you may want to consider is between $25 million, about 1 year's profit, and $50 million. I don't think that anything less than $25 million would have much effect as far as deterring them and getting them to be more careful in their operations."

Below are the guidelines for determining these amounts, provided as part of the judge's instructions.

Scenario 5

The *Toxic Chemical Research Institute* develops new chemicals for industrial uses. As part of its operations, it generates concentrated amounts of highly toxic chemical wastes. Usually, a waste disposal company removes the waste to a safe landfill, set aside for that purpose. However, owing to extremely adverse weather conditions the landfill is temporarily closed. The company has 12 steel drums of dangerous chemicals that it is eager to remove from the plant before a major production run for its most important customer. There is no legal way to dispose of the chemicals quickly. The company decided instead to violate U.S. government rules for safe disposal of dangerous chemicals.

The shift manager, worried about the accumulating chemicals, knew that if he dumped the chemicals nearby that his company would definitely be caught and punished. To prevent being caught, his crew loaded the chemical drums onto unmarked trucks and dumped the chemicals in a rural stream at 3:00 A.M. The manager believed that this "midnight dumping" would reduce the risk of getting caught to 1 in 100. Thus, there is a 99 percent chance of escaping any penalty. He decided that it was worth the gamble because it was the fastest way to get rid of the chemicals, and it was dangerous to keep the chemicals.

An EPA inspector did identify the spill and determine that *Toxic Chemical Research Institute* was responsible for it. No health hazard to humans occurred, but there was $100,000 in cost to the city owing to additional water treatment costs. The EPA fined the company $100,000 to cover these costs. The company paid this $100,000 amount.

The city is now seeking punitive damages to punish the company's behavior. Your task is to determine the amount of punitive damages to levy, if you believe punitive damages are warranted. Before being placed on the jury you read about a similar case that took place in California. A jury there fined the company $50 million in punitive damages. However, the company appealed claiming the award was excessive. The punitive damages amount was reduced to $25 million by the appeals court in California. The company claimed that this amount was still too high and that it would continue to fight the award in court.

Below are the guidelines for determining these amounts, provided as part of the judge's instructions.

APPENDIX C

Statistical Appendix

A more detailed statistical analysis of the survey results indicates the respective roles of the scenario characteristics on the damages amounts selected. Table C1 presents a series of regressions in which the natural logarithm of the various damages amounts was regressed on characteristics of the case scenarios and various demographic factors. The four variations in the survey structure from the base scenario 1 were characterized by the following zero-one indicator variables: a variable for whether the probability of detection was low, a variable for whether the dumping activity was stealthy, a variable for the plaintiff's attorney anchoring effect, and a variable for the media anchor. These regression results consequently distinguish the incremental role of each case characteristic, holding constant other aspects for the survey version and demographic factors.

Equation (1) pertains to the deterrence damages value. While this amount should be extremely sensitive to the probability of detection, that value has no statistically significant influence. Similarly, stealthy behavior is inconsequential as well. What matters are the two anchoring manipulations. The plaintiff's attorney anchor boosts the deterrence value by over an order of magnitude, and the media anchor raises it by 260 percent. On the basis of the Polinsky-Shavell formula, these values should play no role, but the detection probability should.

Equation (2) in Table C1 presents the analogous equation for the punishment value. The results are very similar. The stealth of the defendant's behavior should be in-

TABLE C1

REGRESSION EQUATIONS FOR DETERMINANTS OF PUNITIVE DAMAGES LEVELS

Independent Variable	Deterrence (1)	Punishment (2)	Punishment (3)	Final Award (4)	Final Award (5)
Low probability of detection	.323	−.400	−.586	−.054	−.071
	(.430)	(.502)	(.437)	(.407)	(.223)
Stealthy behavior	.477	.627	.351	.598	.134
	(.422)	(.493)	(.430)	(.400)	(.218)
Lawyer anchor	2.495*	3.058*	1.616*	2.671*	.326
	(.422)	(.492)	(.452)	(.399)	(.234)
Media anchor	1.282*	1.667*	.926*	1.863*	.624*
	(.428)	(.499)	(.440)	(.405)	(.225)
ln(deterrence value)			.578*		.499*
			(.058)		(.034)
ln(punishment value)					.360*
					(.029)
Adjusted R^2	.226	.233	.419	.298	.792

NOTE.—All dependent variables are log values. Each equation also includes age, female, black, Hispanic, other nonwhite races, some college, college graduate, professional, smoker, seat belt user, and a constant term. Standard errors are in parentheses.

* The coefficient is significant at the 95% confidence level, two-tailed test.

fluential, but is not, and the anchor values play a very strong role in driving the punishment amounts.

Equation (3) reported in Table C1 adds the log of the deterrence value to the punishment equation. Doing so complicates the interpretation of the scenario characteristics, which have both a direct effect on punishment as well as an indirect effect through the deterrence value. Nevertheless, the patterns of influence for the scenario characteristic variables remain largely the same. Deterrence and punishment values are also related, as an increase in the deterrence value assessed by 10 percent will boost the punishment answer by 5.8 percent. The relationship between deterrence and punishment is strong and statistically significant, but less than a one-to-one relationship.

Given the similarity of the influences driving the deterrence and punishment values, one would expect the final damages amounts to be driven by similar factors. That indeed is the case. The probability of detection and the stealthiness of behavior are not significant influences, but the anchoring effects are in equation (4) reported in Table C1.

Once both the deterrence and punishment values are included in equation (5) in Table C1, the effect of the anchors diminishes, but the media anchor variable remains statistically significant. Much of the influence of anchors is through their effect on the deterrence and punishment values respondents used in arriving at their final punitive damages award. The weights on the deterrence and punishment values are .50 and .36. Thus, there is a substantial influence of each component. These results do not contradict the earlier findings that subjects set the final damages amount at more than a simple weighted average of the two values. Because of the inclusion of other variables related to the survey versions, such as anchoring influences, the findings in Table C1 are more appropriately interpreted as indicating the separate effect of the damages values, as distinguished from the role of demographic factors and case characteristics.