1998

The Social Costs of Punitive Damages Against Corporations in Environmental and Safety Torts

W. Kip Viscusi

ARTICLES

The Social Costs of Punitive Damages Against Corporations in Environmental and Safety Torts

W. KIP VISCUSI*

INTRODUCTION

Perhaps more than any other aspect of the judicial system, punitive damages have come to symbolize the problems of our nation's courts. Punitive damages awards are often substantial—running into the millions, and in rare cases, the billions of dollars. These awards are also highly variable. Often there is no clear-cut basis to predict the likely size of the punitive damage award, even knowing the compensatory damages amount. The high stakes and high variability of punitive damage awards are of substantial concern to companies, as punitive damages may pose a catastrophic threat of corporate insolvency. Punitive damages' high stakes raise legitimate concerns for legal reformers, in light of the general belief that juries lack sufficiently well-defined guidelines and expertise to set punitive awards reliably.

In her dissenting opinion in *Pacific Mutual Life Insurance Co. v. Haslip*, Justice O'Connor eloquently summarized the current deficiencies in the Court's handling of punitive damage awards:

> Punitive damages are a powerful weapon. Imposed wisely and with restraint, they have the potential to advance legitimate state interests. Imposed indiscriminately, however, they have a devastating potential for harm. Regrettably, common-law procedures for awarding punitive damages fall into the latter category. States routinely authorize civil juries to impose punitive damages without providing them any meaningful instructions on how to do so. Rarely is a jury told anything more specific than 'do what you think best.'. . .
>
> In my view, such instructions are so fraught with uncertainty that they defy rational implementation. Instead, they encourage inconsistent and unpredictable results by inviting juries to rely on private beliefs and personal predilections. Juries are able to target unpopular defendants, penalize unorthodox or controversial views, and redistribute wealth. Multimillion dollar losses are inflicted on a whim. While I do not question the general legitimacy of punitive damages, I see a strong need to provide juries with standards to constrain their discretion so that they may exercise their power wisely, not

* John F. Cogan, Jr. Professor of Law and Economics, Harvard Law School. My research was supported by the Harvard University Olin Center for Law, Economics, and Business; the Sheldon Seevak Research Fund; and a grant from the EXXON Corporation.

capriciously or maliciously. The Constitution requires as much.[1]

The usual approach to evaluating legal rules such as those pertaining to punitive damages is to assess their performance in well-defined hypothetical scenarios. If there is a problem with how these legal rules might perform in different accident contexts, then the solution is to tinker with the structure of the rule so that it will continue to perform well in situations in which it is effective, while at the same time eliminating the problems that arise in other contexts where it performs less satisfactorily. This kind of thought process provided the impetus for the tort liability reforms enacted in response to the 1984-1986 liability insurance crisis.[2] Yet, even though punitive damages reforms were often at the forefront of liability reforms adopted by various states in the mid to late 1980s, dissatisfaction with courts' assessment of punitive damages continues.

Accordingly, the approach taken in this article is a more fundamental one. Rather than focusing solely on isolated examples of extreme punitive damages excess, I suggest that we reassess whether punitive damages serve any constructive role at all. In doing so, I adopt a methodology that differs from the usual hypothetical case study approach that dominates the law and economics literature. The usual stylized liability problem formulations implicitly assume empirical relationships that may not in fact exist. In particular, they assume that punitive damages serve a valuable deterrent function. Moreover, they assume that juries will apply punitive damages to narrowly defined economics problems, whereas juries in practice may apply punitive damages more broadly. Prior reform efforts have invariably resulted not in subtle tinkering with punitive damages formulas according to economists' prescriptions, but rather in the imposition of some kind of cap or limit on punitive damages. This article goes beyond those reform efforts to ask whether punitive damages should be abolished altogether for corporations in environmental and safety torts.

The methodological approach I use is based not on hypothetical economic problems but rather on a societal benefit-cost approach of the type typically used to assess other social policies, such as government regulations: On balance, do punitive damages generate more benefits to society than costs? Even after a wave of tort liability reform measures, there is still widespread dissatisfaction with the role of punitive damages in our legal system. It is instructive to ask whether these adverse effects are so great that punitive damages do not pass a benefit-cost test. Put somewhat differently, would society's welfare be improved if we eliminated punitive damages as a legal instrument? This article will

1. Pacific Mut. Life Ins. Co. v. Haslip, 499 U.S. 1, 45-46 (1991) (O'Connor, J., dissenting) (granting juries "unchanneled, standardless discretion" with regard to punitive damages violates constitutional "safeguard" under the Due Process Clause).

2. For a detailed assessment of the performance of different aspects of the tort liability system along these lines, see generally AMERICAN LAW INSTITUTE, ENTERPRISE RESPONSIBILITY FOR PERSONAL INJURY: REPORTERS' STUDY (1991) [hereinafter AMERICAN LAW INSTITUTE].

explore that question in the context of corporate actions affecting risk and environmental safety.

My reform prescription that we abolish punitive damages in this context would seem to contradict the plausibly constructive role that punitive damages may play in selected instances. However, the kind of fine tuning of punitive damages to narrowly defined circumstances that law and economics scholars envision[3] is required to ensure a constructive role for punitive damages does not account for how juries actually behave. Moreover, none of the state reforms of punitive damages have incorporated subtle economic criteria for awarding and setting punitive damages. Rather, they have all focused on very simple approaches, such as damages caps.[4]

The overriding issue that must be addressed before abolishing punitive damages is whether doing so will eliminate a constructive force for the promotion of safety and the protection of the environment. Because no existing study adequately addresses this issue, this article presents the most comprehensive empirical assessment to date of the effects of punitive damages. This task is facilitated by the fact that four states already have liability regimes in which punitive damages are not awarded. Have these states performed worse on any reasonable measure of safety, as one would expect, if punitive damages do in fact have a deterrent effect?

Any assessment of the desirability of punitive damages requires a thorough assessment of whether they serve any constructive deterrent function.[5] Part I of this article examines possible measures of the efficacy of punitive damages and fails to find any systemic differences in the safety and environmental performance between states with punitive damages and states without them. Thus, there is no deterrence benefit that justifies the chaos and economic disruption inflicted by punitive damages.

Part II defines the context of the corporate risk decisions that are the subject of this study. How do corporations make risk decisions, and what factors, including legal rules, influence them? Punitive damages can influence these risk decisions by increasing the financial sanctions for adverse outcomes of risky decisions. However, if experience shows that punitive damages awards are unpredictable or unlikely, there will be less deterrence.

Part III reviews the conceptual rationales for punitive damage that have been offered in the law and economics literature. These conceptual rationales all deal with highly specialized circumstances, which often involve refined economic

---

3. For a comprehensive law and economics perspective, see A. Mitchell Polinsky & Steven Shavell, *Punitive Damages: An Economic Analysis*, 111 HARV. L. REV. 869 (1998).

4. For a review of medical malpractice reforms, see W. Kip Viscusi & Patricia Born, *Medical Malpractice Insurance in the Wake of Liability Reform*, 24 J. LEGAL STUD. 463 (1995). For a general review of limits on punitive damages, see RICHARD L. BLATT ET AL., PUNITIVE DAMAGES: A STATE-BY-STATE GUIDE TO LAW AND PRACTICE (1991).

5. Unpredictability may lead to effects other than simply less deterrence for risk-related decisions. Unpredictibility can also alter incentives for actions that do not reduce risk, leading to inefficient incentive effects depending on the character of the penalties firms expect to be imposed.

judgments likely to be beyond a jury's competence. Consequently, the absence of a measurable deterrent effect of punitive damages is not surprising. Moreover, market forces and regulatory incentives are more powerful and more appropriate means to provide the necessary deterrence incentives.

The absence of any positive record of accomplishment for punitive damages does not, however, imply that they are benign or inconsequential. Part IV examines some of the concrete economic harms that occur when indiscriminate legal sanctions are levied without a sound economic basis.

If punitive damages are so problematic, why have they resisted meaningful reform? Part V explores these issues, tracing the difficulties to various kinds of incorrect approaches to risk decisions embodied in jury behavior and societal reactions to risk more generally. Part VI concludes the paper with a proposal to eliminate punitive damages for corporate risk and environmental decisions.

I. PUNITIVE DAMAGES HAVE NO SIGNIFICANT DETERRENT EFFECT

The linchpin for any economic argument in support of punitive damages is their role in deterring risky behavior. Section IIIB explores the stated economic bases for punitive damages, all of which hinge on an assumed empirical relationship between punitive damages and corporate risk decisions.

The rationale for such a linkage is straightforward. Punitive damages increase the penalty on the firm after an accident or adverse environmental outcome. When the firm calculates the costs of increased safety against the expected costs associated with adverse risk outcomes, the potential for punitive damages will boost expected costs of risky outcomes, making precautions more attractive.

While this deterrence relationship is not controversial, the linkages in practice may not be so clearly consequential. Suppose that juries award punitive damages and set their amount in a completely random and capricious manner.[6] Under this extreme assumption, there will be no linkage between the expected punitive damages costs and the firm's risk action.[7] Consequently, the existence of a deterrent effect depends on whether punitive damages awards follow the prescriptions touted by legal scholars or the more random patterns asserted by punitive damages critics. Exploring the deterrence linkages will help resolve which of the opposing viewpoints about jury behavior is correct.

If all states had the same punitive damages regimes and if these did not vary over time, it would be impossible to assess their influence. Fortunately, a natural experiment already exists. Four states—Michigan, Nebraska, New Hampshire and Washington—do not permit punitive damages.[8] Thus, these four states already have in place the liability regime that I recommend. Is there any

6. For a critique of the predictability of punitive damages, see George L. Priest, *Punitive Damages Reform: The Case of Alabama*, 56 LA. L. REV. 825 (1996).

7. If the pattern of desired awards is not predictable, firms could respond by eliminating all sources of risk. Since products cannot be made risk-free, such responses often take the form of withdrawing from markets altogether or not putting risky new products on the market.

8. *See* BLATT ET AL., *supra* note 4.

evidence that these states fare worse with respect to risk than the states that do permit punitive damages?

Punitive damages regimes of course differ in character. Criteria for punitive damages awards may differ in terms of the statutory requirements or nature of the conduct that must be present for punitive awards to be pertinent.[9] There also may be punitive damages caps and limits on insurability. The analysis below assesses the average effect of these punitive damages regimes as compared to the no-punitive-damages states.

The nature of the statistical tests is twofold. First, this part analyzes the average risk levels for states with and without punitive damages. Is there a significant difference in performance that reflects evidence of a deterrent effect of punitive awards? Such patterns may not, however, be fully informative, as the states may differ in other ways, such as income levels and industry mix. The second set of tests provided in the Appendix consists of multivariate regression results that explicitly control for these differences. The implications of these more refined statistical tests mirror the overall mean across state comparisons: there is no evidence of a significant deterrent effect of punitive damages.

A. TOXIC CHEMICAL ACCIDENTS

Accidents involving toxic chemicals are local in character and should be quite responsive to differences in states' financial incentives. Because these accidents are relatively infrequent, Table 1 presents two measures of toxic chemical accidents over the 1988-1992 period. The total number of chemical accidents in the top panel was 34,000 over that period. As indicated in the bottom panel of Table 1, the number of toxic chemical accidents involving injury and death was just over 2000. In each case the accident rate per 100,000 population was lower for the four states without punitive damages than for the rest of the country. The calculations in the table of accident rates per capita account for differences in state size. Other adjustments, such as accident rates based on a measure of industrial activity, also show no effect from punitive damages. There is no statistically significant difference between the states with and without punitive damages in terms of the risk level.

States with punitive damages are not, however, a homogeneous group. An important difference pertains to whether corporations in those states can insure against punitive damages. Some states permit insurance, other states explicitly prohibit insurance, and a third group of states have not resolved whether to allow insurance. If insurance premiums adjust to reflect the higher expected costs when punitive damages are permitted, then any deterrent effect of punitive damages should be similar irrespective of their insurability. One might hypothesize, however, that if there is less than full responsiveness of insurance rates to

9. *See id.* at 118; *id.* at 112 (1993 pocket part) (noting that in New Hampshire there are limited statutory circumstances under which punitive damages can be awarded).

Table 1

Environmental Risk Differences in States with and without Punitive Damages

	Accidents	Population (1,000s)	Accidents/ Population (100,000s)	t-statistic
TOXIC CHEMICAL ACCIDENTS, 1988-1992				
States without punitive damages:				
Michigan	869	9,418	9.2	
Nebraska	163	1,604	10.2	
New Hampshire	112	1,114	10.1	
Washington	594	5,147	11.5	
Four state totals	1,738	17,283	10.1	
States with punitive damages:				
Other 46 states and DC	32,162	237,727	13.5	0.76
States with insurable punitives	11,382	68,213	16.7	0.96
States with uninsurable punitives	15,334	141,930	10.8	0.34
States with uncertain insurance rules regarding punitives	5,558	28,698	19.4	2.26**
TOXIC CHEMICAL ACCIDENTS INVOLVING INJURY OR DEATH, 1988-1992				
States without punitive damages:				
Michigan	50	9,418	0.53	
Nebraska	17	1,604	1.06	
New Hampshire	14	1,114	1.26	
Washington	42	5,147	0.82	
Four state totals	123	17,283	0.71	
States with punitive damages:				
Other 46 states and DC	2,016	237,727	0.85	0.74
States with insurable punitives	559	68,213	0.82	0.70
States with uninsurable punitives	1,199	141,930	0.84	0.60
States with uncertain insurance rules regarding punitives	272	28,698	0.95	1.89**

Note: The t-statistic tests the weighted mean accident rate for the four states which do not award punitive damages against the weighted mean for the states in the category described.

For sources, see Table 6A, *infra*.

risk levels, the effect of punitive damages should be greater when insurance is not permitted.

The results in Table 1 do not indicate any incentive role for the insurability status. States with no punitive damages permitted have a toxic chemical accident rate of 10.1 per 100,000 population, which is below the rate of 10.8 for states with uninsurable punitives, where these differences are not statistically significant. States with insurable punitives and uncertain insurance have higher, not lower, risk levels than the states without punitive damages, where these differences are statistically significant for the states with uncertain insurability of punitives. None of the effects in Table 1 indicate a deterrent role of punitive damages in reducing toxic chemical accidents.

B. TOXIC CHEMICAL RELEASE RISKS

A related set of risk measures consists of four environmental outcome measures developed by the United States Environmental Protection Agency (EPA) as part of its Toxic Release Inventory database. These environmental risks are also local in character, so they should be subject to regional differences in financial incentives—to the extent that punitive damages exert a deterrent effect.

Analyzing the EPA toxic chemical release data is of interest for two reasons. First, the government's statistics on handling toxic chemicals provide an instructive measure of the safety of companies' handling of dangerous chemicals. If punitive damages have a deterrent effect, they should promote safer chemical practices. Second, the Toxic Release Inventory database itself may give rise to litigation, including lawsuits that lead to punitive damages. One prominent such case was a fear-of-cancer case in California, *Potter v. Firestone Tire & Rubber Co.*[10] Using data derived from Toxic Release Inventory reports and other government risk management data, plaintiffs who lived near a landfill sued Firestone, which was responsible for some chemicals dumped at that site.[11] The California Supreme Court allowed such claims in a negligence action provided that the plaintiffs met certain conditions, such as proving that the fear flowed from their personal knowledge of the risk.[12] The four measures examined in Table 2 are among the principal indices of toxic releases compiled by the EPA, which monitors manufacturing facilities in the United States that handle substances designated by the EPA as toxic. The EPA requires facilities to file forms that report on activities directed at reducing the amount of toxic releases from a given source.

The first panel of toxic release statistics in Table 2 pertains to the number of facilities that reduced their discharges. The fraction of facilities reducing their discharges is 0.36 in the no-punitive-damages states and 0.36 for the country as a whole. Reported source reductions, as measured by the number of facilities reporting source reductions, do not vary with the presence of punitive damages. The analysis of facilities reporting toxic release reductions indicates no significant differences even when the insurability status of punitive damages is recognized. The proportion of facilities reducing discharges is 0.36 for the no-punitive-damages states and also 0.36 for the states with insurable punitives, the states with uninsurable punitives, and the states with uncertain legal status regarding punitive damages. These levels are virtually identical irrespective of the punitive damages regime.

Facilities may, however, have multiple sources of toxic releases, leading to

10. 863 P.2d 795 (Cal. 1993).

11. *See "Cancerphobia" Cases Pose Threat to State's Businesses, Attorney Claims*, 16 Chem. Reg. Rep. (BNA) 1159 (Sept. 25, 1992).

12. *See* Eric S. Fisher, Potter v. Firestone *and the Infliction of Emotional Distress*, 30 TORT & INS. L.J. 1071, 1072 (1995).

the filing of multiple forms per facility. The second panel in Table 2 presents analogous discharge reduction statistics using the number of forms as the unit of analysis rather than the number of facilities. This measure consequently adjusts for facility-related differences in the scale of potentially polluting activities. The no-punitive-damages states once again do not exhibit a significant difference in source reductions. The fraction of forms reflecting source reductions is 0.27 for the no-punitive-damages states and 0.25 for the entire country. Whereas the no-punitive-damages states had a fraction—0.27—of forms reporting discharges, each of the three punitive-damages-insurance state groupings had a lower (statistically insignificant) proportion of such reductions. The no-punitive-

Table 2

Reductions in Surface Water Discharges in States with and without Punitive Damages (SWD)

FACILITIES REPORTING REDUCTIONS, IN TOXIC RELEASE INVENTORY (TRI)

	# TRI Facilities	Number of Facilities Reducing Discharges	Proportion of Facilities Reducing Discharges	t-statistic
States without punitive damages:				
Michigan	969	337	0.348	
Nebraska	180	60	0.333	
New Hampshire	129	51	0.395	
Washington	332	134	0.404	
Four state totals	1,610	582	0.361	
States with punitive damages:				
Other 46 states and DC	21,837	7,864	0.360	0.08
States with insurable punitives	7,375	2,651	0.359	0.13
States with uninsurable punitives	12,487	4,507	0.361	0.04
States with uncertain insurance rules regarding punitives	2,104	758	0.360	0.08

FORMS REPORTING REDUCTIONS IN DISCHARGES

	# TRI Forms	Number of Forms Reducing Discharges	Proportion of Forms Reducing Discharges	t-statistic
States without punitive damages:				
Michigan	3,747	996	0.266	
Nebraska	540	134	0.248	
New Hampshire	362	83	0.229	
Washington	1,035	319	0.308	
Four state totals	5,684	1,532	0.270	
States with punitive damages:				
Other 46 states and DC	74,737	18,897	0.253	0.63
States with insurable punitives	25,679	6,147	0.239	1.28
States with uninsurable punitives	40,962	10,754	0.263	0.23
States with uncertain insurance rules regarding punitives	8,458	2,079	0.246	0.91

Table 2 Continued

REDUCTION IN SURFACE WATER DISCHARGES

	Percent reduction in SWD, 1988-1992	Percent reduction in SWD, 1990-1992	t-statistic, 1988-1992	t-statistic, 1990-1992
States without punitive damages:				
Michigan	34.9	8.4		
Nebraska	-43.7	9.8		
New Hampshire	85.9	70.9		
Washington	70.3	68.0		
States with punitive damages:				
Four state totals	66.0	62.6		
Other 46 states and DC	9.5	-45.7	2.15**	3.12***
States with insurable punitives	-3.3	-56.6	4.36***	4.61***
States with uninsurable punitives	54.6	12.7	0.54	2.66***
States with uncertain insurance rules regarding punitives	-159.0	-268.1	3.61***	4.62***

REDUCTION IN TOTAL RELEASES

	Percent reduction in total releases, 1988-1992	Percent reduction in total releases, 1990-1992	t-statistic, 1988-1992	t-statistic, 1990-1992
States without punitive damages:				
Michigan	26.2	19.0		
Nebraska	31.2	25.0		
New Hampshire	54.6	29.0		
Washington	40.3	36.8		
four state totals	32.0	24.4		
States with punitive damages:				
Other 46 states and DC	35.2	14.0	0.41	1.35*
States with insurable punitives	26.9	8.4	0.58	1.87**
States with uninsurable punitives	40.3	21.5	1.45*	0.53
States with uncertain insurance rules regarding punitives	44.6	13.9	1.29	1.29

Note: The t-statistic tests the weighted mean for the four states which do not award punitive damages against the weighted mean for the states in the category described.

** Significant at the 95 percent confidence level.

*** Significant at the 99 percent confidence level.

For sources, see Table 6A, *infra*.

damages states perform almost identically to the various punitive-damages-insurance regimes with respect to forms reporting reductions in discharges.

The third panel in Table 2 focuses on the percent reduction in surface water discharges, which are measured in terms of pounds of toxic pollutants released. Statistics appear for two time periods, 1988-1992 and 1990-1992. The percent reductions in the no-punitive-damages states are 66% in 1988-1992. Each of these discharge reduction amounts is significantly below that of the other states, and the magnitude of the discrepancy is substantial. This statistically significant difference between punitive damages states and the no-punitive-damages states is the better performance of no-punitive-damages states with respect to water discharges of toxic chemicals. The comparison of the percent reduction in surface water discharges in the no-punitive-damages states with the various punitive-damages-insurance regimes indicates that the no-punitive-damages states had the highest such reductions. This reduction value is significantly different from that in all three punitive-damages-insurance status regimes. These statistically significant efforts provide no evidence of a deterrent role of punitive damages. To the extent that the superior performance of the no-punitive-damages states is due to other economic factors, the statistical analysis in the Appendix controls for such influences.

The final panel in Table 2 considers the percent reduction in total toxic releases. This category encompasses surface water discharges, underground injection, releases to land, fugitive or nonpoint air emissions, and stack or point air emissions. The no-punitive-damages states are not significantly different from the punitive damages states from 1988-1992 and perform significantly better than the punitive damages states from 1990-1992. The reduction in total chemical releases is significantly lower in the no-punitive-damages states from 1988-1992 as compared to states with uncertain status for punitive damages insurance. The larger chemical reductions in states with uninsurable punitives from 1988-1992 seems to be due to the early years in that time period because there is no statistically significant difference from 1990-1992. The Appendix will analyze other causative factors as well.

C. ACCIDENTAL FATALITY RATES

Accidental fatality rates per person in different states also should reflect any deterrent effect of punitive damages. If punitive damages lead firms to choose safer risk levels, the accident rates should be higher in the four states that do not permit punitive awards.

The first set of accidental deaths in Table 3 pertains to medical misadventures, which consists of complications and misadventures of surgical and medical care. To the extent that medical malpractice punitive damages awards have a deterrent effect, these rates should be higher in the states that do not have punitive damages. The medical misadventure death rate is 0.89 per 100,000

population in the no-punitive states, which is not significantly different from states that recognize punitive damages. The overall United States death rate average is a bit higher than in the no-punitive damages-states, or 1.00 death per 100,000. These differences are the opposite of what one would expect if punitive damages deterred dangerous behavior. More refined analyses of medical misadventures by insurance status indicates that these rates are higher in states in which punitive damages are insurable and lower in states in which the insurability status of punitive damages is uncertain. As in the case of the toxic release results, some differences such as this will occur on a random basis. What is clear is that there is no consistent pattern of a deterrent effect of punitive damages.

Table 3

Accidental Death Rates in States with and without Punitive Damages

	Deaths	Population (1,000s)	Deaths/Population (100,000s)	t-statistic
MEDICAL MISADVENTURE DEATHS				
States without punitive damages:				
Michigan	82	9,537	0.860	
Nebraska	20	1,639	1.220	
New Hampshire	14	1,148	1.220	
Washington	42	5,448	0.771	
Four state totals	158	17,772	0.889	
States with punitive damages:				
Other 46 states and DC	2,459	245,117	1.003	0.58
States with insurable punitives	892	71,043	1.256	1.87**
States with uninsurable punitives	1,367	144,949	0.943	0.29
States with uncertain insurance rules regarding punitives	213	30,273	0.704	2.03**
TOTAL DEATHS				
States without punitive damages:				
Michigan	2,906	9,538	30.468	
Nebraska	591	1,639	36.059	
New Hampshire	288	1,148	25.087	
Washington	1,722	5,448	31.608	
Four state totals	5,507	17,773	30.985	
States with punitive damages:				
Other 46 states and DC	85,931	245,117	35.057	1.09
States with insurable punitives	29,857	71,043	42.027	2.85***
States with uninsurable punitives	46,813	144,949	32.296	0.51
States with uncertain insurance rules regarding punitives	9,548	30,273	31.540	0.17

Note: The t-statistic tests the weighted mean death rate for the four states which do not award punitive damages against the weighted mean for the states in the category described.

For sources, see Table 6A, *infra*.

Table 4

Insurance Performance Differences between States with and without Punitive Damages

	Premiums ($1,000)	Population (1,000)	Premiums/Population	t-statistic
TOTAL INSURANCE				
States without punitive damages:				
Michigan	$9,870,463	9,538	$1,035	
Nebraska	$1,738,960	1,639	$1,061	
New Hampshire	$1,198,307	1,148	$1,044	
Washington	$4,745,126	5,447	$871	
Four state totals	$17,552,856	17,772	$988	
States with punitive damages:				
Other 46 states and DC	$245,607,234	245,117	$1,002	0.18
States with insurable punitives	$65,288,517	71,043	$919	1.02
States with uninsurable punitives	$150,312,113	144,949	$1,037	0.60
States with uncertain insurance rul	$31,150,917	30,273	$1,029	0.44
MEDICAL MALPRACTICE				
States without punitive damages:				
Michigan	$193,836	9,538	$20	
Nebraska	$21,783	1,639	$13	
New Hampshire	$20,696	1,148	$18	
Washington	$97,863	5,447	$18	
Four state totals	$334,178	17,772	$19	
States with punitive damages:				
Other 46 states and DC	$5,637,691	245,117	$23	0.79
States with insurable punitives	$1,420,860	71,043	$20	0.24
States with uninsurable punitives	$3,768,674	144,949	$26	1.08
States with uncertain insurance rul	$575,187	30,273	$19	0.11
PRODUCT LIABILITY				
States without punitive damages:				
Michigan	$74,587	9,538	$7.82	
Nebraska	$14,351	1,639	$8.76	
New Hampshire	$8,336	1,148	$7.26	
Washington	$38,312	5,447	$7.03	
Four state totals	$135,586	17,772	$7.63	
States with punitive damages:				
Other 46 states and DC	$2,024,666	245,117	$8.26	0.54
States with insurable punitives	$481,672	71,043	$6.78	0.96
States with uninsurable punitives	$1,295,844	144,949	$8.94	1.11
States with uncertain insurance rules regarding punitives	$255,807	30,273	$8.45	0.76

The second measure in the bottom panel of Table 3, which pertains to all causes of accidental death, is the overall death rate. Once again, the rates are somewhat lower in the states without punitive damages, 31.0 versus 35.1. However, this difference is statistically insignificant. The only statistically significant difference in the total accidental death results is the higher rate in states with insurable punitive damages, as compared to the no-punitive damages states. States with punitive damages are not safer.

Table 4 Continued

OTHER LIABILITY				
States without punitive damages:				
Michigan	$760,467	9,538	$80	
Nebraska	$141,883	1,639	$87	
New Hampshire	$88,891	1,148	$77	
Washington	$369,689	5,447	$68	
Four state totals	$1,360,930	17,772	$77	
States with punitive damages:				
Other 46 states and DC	$20,589,828	245,117	$84	0.57
States with insurable punitives	$4,759,881	71,043	$67	0.80
States with uninsurable punitives	$13,335,308	144,949	$92	1.24
States with uncertain insurance rules regarding punitives	$2,603,478	30,273	$86	0.90

Note: The t-statistic tests the weighted means for the four states which do not award punitive damages against the weighted mean for the states in the category described.

For sources, see Table 6A, *infra*.

D. INSURANCE PREMIUM DIFFERENCES

A final set of measures of the risk-averting effects of punitive damages are insurance premium levels. Punitive damages are often uninsurable under standard insurance policies. Moreover, eighteen of the forty-six states that allow punitive damages explicitly prohibit insurance of punitive damages assessed directly against an insured for its own actions.[13] However, if punitive damages deter firms from making risky decisions, the risk levels should decline, lowering the associated premium levels.

To the extent that insurers are willing to provide coverage of punitive damages, states that permit punitive damages would have higher insurance premiums. Overall, there is no net significant relationship borne out in the results below, irrespective of the punitive damages regime or the insurability of punitive damages. Table 4 presents four different insurance premium measures—total insurance premiums, medical malpractice premiums, product liability premiums, and other liability premiums. To adjust for state size, the third column of statistics puts each of these measures in terms of the premium per 1000 residents in the state. The results are consistent in all four cases. The per capita insurance premium is the same or lower for the average of the four states that do not recognize punitive damages. Moreover, in every instance, there is no statistically significant difference between the four no-punitive-damages states and the rest of the country. These results hold true as well when the comparison is between states with no punitive damages and each of the three insurability regimes.

Using insurance premiums as a proxy for risk levels has the same general implications as do fatality rates: There is no evident effect of punitive awards. This result is notable because it encompasses two somewhat different conse-

13. *See* BLATT ET AL., *supra* note 4, at 77.

quences of accidents. Accidental deaths involve fatalities for which the monetary loss does not fully capture the social welfare costs. In contrast, insurance premiums abstract from all non-monetary effects and address only the financial consequences of risk. The fact that neither measure indicated a decrease in risk resulting from punitive awards suggests that a broad range of risk-related actions are insensitive to the deterrent effect of punitive damages.

E. WHITHER THE DETERRENT EFFECT?

If punitive damages do in fact provide deterrence through their financial penalties on risky actions, states with punitive damages should exhibit superior performance in some risk dimension. The comprehensive analysis presented here is more extensive than any previous empirical assessment in the literature. It addresses accidental fatalities from various sources, a variety of insurance premium measures, chemical accident data, and toxic chemical discharge statistics. Moreover, it distinguishes states based on the insurance status of punitive damages. States with punitive damages exhibit no safer risk performance than states without punitive damages. The statistically significant differences observed follow no clear pattern and would occur by chance given the large number of statistical tests for differences relative to the four states without punitive damages. It is instructive to review these statistically significant differences, as they have no consistent relation to any particular punitive damages-insurance regime. In Table 1, states with uncertain insurance status had higher, not lower, levels of toxic chemical accidents and toxic chemical accidents involving injury. In Table 2, three of the punitive damages groupings (all such states, states with insurable punitive damages, states with uninsurable punitives, and states with uncertain punitives insurability) performed worse in terms of the percent reduction in surface water discharges. For the reduction in total chemical releases, states without punitives performed better from 1990-1992 and the same from 1988-1992. States with uninsurable punitives performed better from 1988-1992, but not from 1990-1992. States with uninsurable punitives performed worse over the 1990-1992 period, but not significantly so. However, these toxic release results are not corroborated by any of the other three toxic release variables analyzed. The final set of statistically significant differences is shown in Table 3, which indicates higher medical misadventure deaths and total accidental death rates for states with insurable punitives and lower medical misadventure death rates when the insurability of punitive damages is uncertain.

These statistically significant differences display no consistent direction or pattern. The more detailed multivariate analysis in the Appendix largely eliminates these effects. Moreover, the differences all involve refined categorizations of the punitive-damages-insurance regimes. None of the differences pertain to the overall comparison of states without punitive damages and states that recognize punitive damages. As is especially apparent in the insurance results in Table 4, punitive damages do not have a significant deterrent effect. Conse-

quently, moving to a no-punitive-damages liability regime would sacrifice little of the deterrence sought by the tort liability system.

The above results are consistent with the views expressed by punitive damages critics, who observe that random and unpredictable awards will not have a deterrent effect. Further examination below of the circumstances that some scholars have identified as potential areas where punitive damages could serve a productive role will reveal some of the reasons for this lack of efficacy. The set of such circumstances is both narrowly defined and involves judgments that are likely beyond a jury's competence.

II. PRINCIPLES FOR CORPORATE RISK DECISIONS

A. THE NATURE OF RISK TRADEOFFS

A conceptual reference point for assessing the role of punitive damages for corporate, environmental, and safety torts is to begin with the underlying corporate actions themselves. How should corporations conceptualize risky decisions, and what guidelines should govern responsible behavior? What is the institutional context for these acts that gives rise to the environmental and safety damages? What criterion should be applied in assessing the social desirability of corporate acts? In the usual parlance of economics, the initial question is whether there is some kind of market failure whereby private incentives alone would create inadequate incentives for safety. If there is such a failure, one should then ask whether compensatory damages and government regulations suffice, or whether punitive damages are needed to augment these awards to create appropriate incentives for safety. What do we mean by an appropriate level of safety?

The standard economic theory of punitive damages and incentives casts the analysis within a highly stylized situation of certainty.[14] Does the economic value of the definite harm resulting from an action exceed the benefits? The task then becomes setting a damage amount so that the company recognizes the full costs of its actions and exercises an appropriate degree of care in its activities. These formulations are overly simplistic, however, because they neglect potential risks that affect corporate actions and the linkage of the company's behavior to the societal effects. Particularly with product and environmental risks, the adverse repercussions of corporate actions usually stem not from deliberate corporate acts, but from acts that may generate adverse societal effects with some probability less than one. Indeed, most real catastrophes have very remote possibilities of occurrence. To understand fully what legal sanctions may be appropriate when corporate decisions generate social harms, it is necessary to explicitly account for the tradeoffs inherent in corporate risk decisionmaking.

---

14. *See* Robert D. Cooter, *Punitive Damages for Deterrence: When and How Much?*, 40 ALA. L. REV. 1143 (1989). Any uncertainty in Cooter's analysis arises with respect to enforcement error, not corporate decisions.

In situations of risk and uncertainty, the appropriate comparison is between the costs of the safety action and the value of the expected benefits. If the expected benefits to society of greater safety exceed the expected costs to the company, decisions to invest in safety are efficient. Similarly, it is not socially worthwhile to make safety investments when the expected societal benefits are exceeded by the costs once all social consequences are fully recognized and valued. One may, nevertheless, wish to compensate those who suffer the damages costs, even if the risk level is efficient, but this is a distributional and fairness issue, and is thus outside the scope of this article.

The test for whether safety incentives are adequate requires that one weight the value of the harms that might occur by the probability that the harms will occur.[15] Comparing the actual loss of the accident event with the costs of safety precautions may create a very misleading assessment of the economic desirability of precautions. Losses must be weighed by their probability of occurrence, which may be quite small. If the probability of the accident is very low, the expected losses (that is, the loss multiplied by its probability) will likewise be reduced and substantial precautions will not be warranted. To the extent that juries operating after the fact focus on the actual loss that has occurred, rather than the expected loss before the risky action, errors in jury behavior will be particularly great when the probabilities involved are small and the stakes involved are high.

Consider the following example. Suppose that there is one chance in a million that there will be a catastrophic loss of $3 billion, which is a figure not unlike the total social value of the loss of life in a major plane crash. We will assume this amount represents the full economic value of preventing the crash, not just the earnings loss. The company could eliminate this risk of an accident by an expenditure of $10,000. Is it worth it? The expected accident costs without the safety precaution equal the probability of 1/1,000,000 multiplied by the $3 billion loss, for a total expected loss of $3000. This figure is far below the $10,000 amount of additional safety costs. From a benefit-cost standpoint, there is no economic efficiency justification for additional care. However, if juries focus on the value of the loss alone, failing to weight it by the probability, then the comparison after the accident will be between the $3 billion loss and the $10,000 in safety expenditures. Precautions not only appear warranted, but failing to take precautions now appears to be reckless and irresponsible given the differences in the orders of magnitude involved. The first major prerequisite for thinking sensibly about corporate risk decisions is that the comparison should be between safety costs and expected incremental benefits of these expenditures at the time of the corporate action, not the consequences after the fact when the outcome is known.

15. By the same logic, rare punitive damages awards, even large ones, will not promote safety, just as periods when the risk of acquiring HIV/AIDS was low did not lead to extensive precautions. *See* Tomas J. Philipson, *Optimism about AIDS is Premature*, WALL ST. J., Feb. 4, 1998, at A22.

B. TRADEOFFS ARE NECESSARY EVEN WHEN RISKS ARE UNCERTAIN

That the risks are uncertain or may not be precisely known does not displace the need to compare the costs and expected benefits of greater safety. We may know, for example, that smoking cigarettes is risky, but not whether the lifetime mortality risk is 1/6 or 1/3. However, these judgments should be based on the state of the information at the time of the corporate action, not after the fact. Such uncertainty involving the need to make judgments with only incomplete information available are quite common in punitive damages contexts.

Even when the firm has substantial knowledge, it may not know the exact probability of adverse outcomes. In the McDonald's coffee cup case,[16] the company had more information about the risk than in most liability contexts but still was not perfectly knowledgeable. In that case, a woman received a $160,000 award for compensatory damages and a $2.7 million award for punitive damages after spilling hot coffee on her lap. The punitive damages award was reduced by the court from its initial jury award level to $480,000, and ultimately McDonald's settled the case out of court for an undisclosed amount.

How should McDonald's have thought about the temperature selection decision? At least to a certain degree, higher coffee temperatures enhance the flavor and keep the coffee warmer longer, which is a benefit to customers. Increased temperatures, however, may also pose a risk of scalding, particularly in instances in which the consumer is not careful.

McDonald's had two sources of information regarding the risk.[17] First, it controlled the temperature of the coffee and required that it be served at temperatures from 180 to 190 degrees Fahrenheit. Skin burn rates increase exponentially at temperatures above 140 degrees Fahrenheit. If the company had reduced the temperature of the coffee, it could have converted a situation of known risks to one in which there was a certainty of no injury. However, for most commercially viable coffee temperatures, there would be at least some risk of burn injury. The question is how substantial this risk would be.

A key issue is that McDonald's cannot monitor the extent of consumer carelessness. How often will purchasers from their drive-through window put the coffee on their lap or between their knees while driving? Preventing all such injuries from careless use of a hot product sets the risk level too low and is thus inefficient. Given the consumer desirability of hot coffee and McDonald's desire to accommodate consumer preferences, the ideal temperature for coffee should not be so tepid that no burns would result. The fact that coffee is hot is well known and readily monitorable once the customer holds the cup. The appropriate approach to the liability issue is to ask whether McDonald's struck an appropriate balance between costs and benefits, recognizing the effects for the

16. *See* Liebeck v. McDonald's Restaurants, P.T.S., Inc., No. CV-93-121419, 1995 WL 360309 (D.N.M. Aug. 18, 1994).

17. For a detailed discussion of the information available to McDonald's, see S. Reed Morgan, *McDonald's Burned Itself*, LEGAL TIMES, Sept. 19, 1994, at 26.

entire market and the reasonable judgments McDonald's could make; the liability issue should not focus solely on the situation for the individual plaintiff who was harmed or that individual's possibly idiosyncratic carelessness.

Although McDonald's could not monitor all such behavior, it did have some consumer reports of injuries. Using such information, as well as scientific evidence on temperatures that lead to scalding and burns, one could then pose the coffee safety issue in the following manner: Reducing the temperature of the coffee would decrease the expected number of injuries; one would want to weight the value of these injuries to account for not only the monetary losses but also the value of any health effects to the injured individuals. If, however, the coffee temperature is lowered, the company will presumably lose profits because of decreased coffee sales. There may also be diminished welfare to consumers, including those who still purchase the coffee, because of the more tepid coffee temperature. From an economic efficiency standpoint, McDonald's should lower the temperature of the coffee so long as the reduction in the expected costs to the injured consumers exceeds the expected benefits both to the consumers and the company from hot coffee. Indeed, in a subsequent coffee burn case, Judge Frank Easterbrook posed the tradeoff in exactly this manner.[18]

The appropriate assessment should consequently be from the standpoint of the entire market, taking into account the preferences of all consumers and the injuries to all consumers. The issue is not what temperature makes sense for consumers who drive with coffee on their lap because McDonald's cannot distinguish its customers based on their level of care. The typical focus of court cases, however, is not on the market choice but on consumers who have experienced isolated injuries which often have a small associated probability of occurrence. Court cases by their very nature focus on individuals, whereas regulation and legislation is better suited to dealing with markets. Preventing such injuries would involve substantial costs across a product line to make the necessary improvements for a mass-marketed product.

Matters become more complex when there is uncertainty regarding the risk probability. Even safety experts may sharply disagree on such probabilities. A dramatic example of uncertainty is with respect to scientific debates over the "doomsday rock." Some astronomers have hypothesized that a large asteroid will someday hit the earth and have catastrophic consequences, a phenomenon that captured the fantasy of Hollywood scriptwriters in 1998.[19] Scientists from Cornell University, who have sought government funding to support a research program for rockets to divert or destroy such asteroids, estimated our risk of death as being as high as 1/6000.[20] An arguably more realistic assessment of the risk from a consensus group of scientists estimates the individual risk of death

18. *See* McMahon v. Bunn-O-Matic Corp, No. 97-4131, 1998 WL 351294 (7th Cir. July 2, 1998).

19. *See* ARMAGEDDON (Touchstone Pictures 1998); DEEP IMPACT (Paramount Pictures and Dreamworks L.L.C. and Amblin Entertainment 1998).

20. *See* William J. Broad, *Asteroids, a Menace to Early Life, Could Still Destroy Earth*, N.Y. TIMES, June 18, 1991, at C1.

from the doomsday rock as 1/2,000,000.[21] This broad range of scientific judgment reflects the extent of our ignorance regarding the magnitude of the risk and the presence of substantial uncertainty.

Such divergences of opinion are not restricted to extraterrestrial battles. Similar kinds of uncertainties are present with respect to highly litigated products such as breast implants. The Food and Drug Administration (FDA) banned silicon breast implants from the market, citing the presence of substantial hazards, whereas the American Medical Association continued to issue press releases indicating that the risks appeared to be small.[22] The most recent scientific evidence fails to indicate a significant risk, though risks that do not lead to signature diseases, such as the mesothelioma risk from asbestos, are often difficult to link to product exposures.[23] These uncertainties have not impeded the courts from awarding punitive damages to women with breast implants.

Our inability to pinpoint risk levels was also evident in the case of "low" risks from British beef. Scientists in England faced uncertainties in 1996 about the risks of "mad cow" disease from eating British beef. Estimates of the ultimate fatalities from Creutzfeldt-Jakobs disease range from 500 to 500,000 deaths in Britain.[24] This enormous gap in the estimated level of risk provides little information to make sound judgments about the consequences of beef consumption for the British.

Another extreme example of persistent uncertainty is the catastrophe involving TWA Flight 800.[25] Even after months of investigation, it is not entirely clear whether the cause of the accident was a bomb, a missile, or a mechanical failure. The determination of the cause of the accident has a potentially significant impact on TWA's ultimate liability. Moreover, even if the accident occurred due to some kind of structural failure, unless the cause of that failure can be identified, the appropriate precaution warranted would not be known. The result has been that TWA has adopted a more diffuse set of safety reforms—increased airline security and efforts to decrease the risk of explosion for fuel tanks.

Information gathered over time can be helpful but not always definitive. Recent problems encountered with automobile airbags indicate that even for some safety-related products with substantial opportunities for gathering safety data, it may take time for knowledge to develop. Automobile companies can learn about the properties of airbags through crash tests as well as through

---

21. *See The Threat from Space*, ECONOMIST, Sept. 11, 1993, at 13.

22. For a summary of the debate between the American Medical Association's Council on Scientific Affairs claiming that there is no convincing evidence that breast implants caused health problems and the Commissioner of the Food and Drug Administration, see John Schwartz, *FDA and AMA Clash on Breast Implants*, WASH. POST, Dec. 1, 1993, at A4.

23. *See* MARCIA ANGELL, SCIENCE ON TRIAL: THE CLASH OF MEDICAL EVIDENCE AND THE LAW IN THE BREAST IMPLANT CASE 90-110 (1996).

24. *See Mad Cows and Englishmen*, ECONOMIST, Mar. 30, 1996, at 25.

25. *See* Robert W. Hahn, *The Cost of Antiterrorist Rhetoric*, 19 REGULATION 51, 51-57 (1996); *see also* Matthew L. Wald, *April 5-11: Rewiring Urged*, N.Y. TIMES, Apr. 12, 1998, at S4.

market experience. Because fatalities caused by airbags are a relatively rare event—with about fifty estimated fatalities to date[26]—the risk consequences of airbags and the particular risks they pose to children, small adults, and the elderly were not immediately apparent. Moreover, evidence on the benefits of airbags is based on engineering model projections rather than tallies of actual lives saved. Mirroring juries' tendency to focus on the harm caused in the individual case rather than on the defendant-corporation's pre-accident risk-benefit assessment, the public has responded with greater concern for the identified lives lost than the more hypothetical estimated lives saved.

Problems posed by continuing uncertainties plague even the most expert risk assessors. The consequences of mistaken judgments are particularly severe in zero-infinity problems, that is, those situations in which either there is no loss or the loss is catastrophic. A recent financial catastrophe affected the most venerable insurance institution, Lloyd's of London. Lloyd's persistently underestimated the scope of the asbestos litigation, for which it served as a major reinsurer. Lloyd's 1982 worst-case scenario of the total number of asbestos cases that would emerge was 81,000. The company later developed an assesment of the total number of claims, updating its estimate to 180,000 in 1990.[27] These estimates remained considerably below the American Bar Association's estimate of the litigation level, which was 340,000 claims in 1990.[28] The outcome for Lloyd's is that it has thus far survived, but it has had to undergo a major reorganization along with the imposition of substantial losses upon many Lloyd's "names."

The occurrence of substantial losses in this as well as other zero-infinity contexts does not necessarily imply that the decisions themselves were bad. The appropriate reference point for judging these decisions is whether they were sound at the time when they were made, not whether the decisionmaker was unlucky. The high losses that occurred are simply a reflection of the nature of the stakes and the risks involved. In the case of Lloyd's, the possibility of catastrophic losses arose from the positively correlated nature of mass toxic tort lawsuits. Rather than incurring a series of independent and identically distributed risks, it encountered many highly correlated risks that imposed considerable losses once juries found the asbestos firms liable.[29] Corporations likewise engage in high stakes decisions—whether it be a small risk of environmental disaster or a hazard from a mass marketed consumer product that could injure

26. *See Car Safety for the Irresponsible*, ECONOMIST, Nov. 30, 1996, at 29.

27. *See* Nicholas Sinfield, *Asbestos—Human or Natural Disaster?* (1994) (paper presented at the Stanford University Conference on Social Treatment of Catastrophic Risk) (on file with author).

28. For further discussion of the evolving scientific knowledge regarding asbestos, see W. Kip Viscusi, *Alternative Institutional Responses to Asbestos*, J. OF RISK AND UNCERTAINTY 147 (1996) and the references contained therein.

29. A recent award in a Florida asbestos case levied a $31 million punitive damages penalty on Owens Corning Fiberglas Corp. *See* Ballard v. Owens-Corning Fiberglas Corp., No. CL-93-1087-AD (Fl. Cir. Ct. Jan. 21, 1997) (verdict) (discussed in 25 Prod. Safety & Liab. Rep. (BNA) 103 (Jan. 31, 1997)).

thousands. The appropriate reference point for judging such risk decisions is whether they were prudent given their expected consequences. A zero risk ideal will not be feasible.

C. RISK BALANCING IN PERSONAL DECISIONS

We cannot blame all hazards on corporate actions and bad decisions. Moreover, corporations are not unique in making tradeoffs involving risk that may not produce perfect safety. Risks are an inescapable part of our daily lives. The sources of risks that increase one's annual death risk by 1 in a 1,000,000 include the following: drinking a half a liter of wine, living two days in New York or Boston (air pollution), traveling ten minutes by bicycle, traveling 150 miles by car, eating forty tablespoons of peanut butter, or eating 100 charcoal broiled steaks.[30] Although we might wish to reduce the risks in our life, few of us would be willing to give up all of our daily activities, many of which generate risks. We make risk tradeoffs every day, and corporations must engage in a similar balancing.

The infeasibility of attaining a zero-risk outcome stems from the fact that the cost of risk reduction increases as the level of the risk declines.[31] Because achieving risk reductions gets increasingly more expensive as we improve our levels of safety, at some point it is desirable to stop our quest for reducing one type of risk and use our resources for greater risk reduction elsewhere. Sources of personal risks include smoking, failure to use seatbelts, lack of exercise, and poor diets. Even the most disciplined safety-minded consumers indulge in some risky activities. Travel is inherently risky, whether by plane or by car. To the extent that we drive smaller, fuel-efficient cars, we incur greater risks. Cars that resembled tanks would be safer, but more expensive and more cumbersome to operate. Our daily lives are not governed by a single-minded commitment to safety but by the need to strike a reasonable balance between safety and other concerns, such as our desire to travel or occasional enjoyment of a decadent dessert. The task of the legal system is to provide incentives for corporations to strike an appropriate balance using appropriate societal values for the benefits of improved safety as our guide.

D. ECONOMIC RESOURCES ARE LIMITED

Consider what would happen if we did not attempt to strike such a reasonable balance but instead sought to achieve zero risks at any cost. Suppose, for example, that all societal resources were devoted to accident reduction. Even if we spent all our money for this purpose, the United States economy would only

30. *See* Richard Wilson, *Analyzing the Daily Risks of Life*, TECH. REV., Feb. 1979, at 45.

31. For an example of the rising marginal costs of risk reduction, see W. KIP VISCUSI, RISK BY CHOICE: REGULATING HEALTH AND SAFETY IN THE WORKPLACE (1983). Also see the discussion below of Justice Breyer's 90-10 principle, *infra* note 38 and accompanying text.

have enough resources to spend less than $60 million per accidental fatality.[32] These expenditures would leave us nothing to spend on food, cancer prevention, environmental quality, medical care, or many other worthwhile expenditures. There are limits as to how much safety we can efficiently achieve and, accordingly, on the amounts we should spend. In some cases, government regulations have cost more than $60 million per fatality. Some, such as the Occupational Safety and Health Administration (OSHA) formaldehyde standard, cost in the billions. Such expenditure levels on risk prevention are not possible across the board since incurring them would bankrupt the economy.

Notably, even in the areas that have been the targets of major government regulation, we are not risk-free. After more than a quarter of a century of risk and environmental regulation, substantial hazards remain.[33] We are safer than before, in part because of society's greater affluence, but we are not risk-free. On average, we continue to face an annual risk of motor-vehicle accidents of 1/5000, an annual risk of job accidents per worker of just under 1/10,000, an annual risk of death and injury in a home accident of 1/11,000, and an annual risk of an aviation accident of 1/250,000.[34] The continued existence of these risks does not necessarily imply that regulatory agencies have been remiss. Rather, they indicate that zero risk levels are unachievable.

Perhaps the main exception to the infeasibility of the quest for attaining zero risk is the Delaney Clause.[35] Under this clause, the FDA prohibits all food additives that pose any risk of cancer. More specifically, the Delaney Clause states that "no additive shall be deemed to be safe if it is found to induce cancer when ingested by man or animal, or if it is found, after tests which are appropriate for the evaluation of the safety of food additives, to induce cancer in man or animal."[36] Despite this zero-risk ideal for food additives, considerable natural and synthetic sources of cancer risk remain in our diets. Natural carcinogens include chemicals contained in apples, pears, broccoli, basil, alcohol, peanut butter, coffee, lettuce, and a wide variety of other staples of very healthy diets.[37] There are also risks that arise from human action, ranging from pesticide residues to saccharin as an artificial sweetener. Moreover, how much we eat and the character of what we eat, such as the consumption of fatty foods, have profound implications for the riskiness of our diet. Even substantial vigilance and dietary planning will not result in a risk-free diet.

---

32. This calculation is discussed further in W. KIP VISCUSI, FATAL TRADEOFFS: PUBLIC AND PRIVATE RESPONSIBILITIES FOR RISK (1992).

33. In addition to accident risks cited below, there are also other hazards such as a risk of homicide, risks of morbidity and mortality from air pollution, risks of skin cancer from ultraviolet radiation, and risks of being killed by an airbag, among many other hazards.

34. *See* W. KIP VISCUSI, SMOKING: MAKING THE RISKY DECISION 24 (1992). These data in turn are based on data drawn from NATIONAL SAFETY COUNCIL, ACCIDENT FACTS (various years).

35. 21 U.S.C. § 348(c)(3)(A) (1994).

36. *Id.* The statutory language for color additives is identical. *See* 21 U.S.C. § 379e(b)(5)(B) (1994).

37. *See* Bruce N. Ames et al., *Ranking Possible Carcinogenic Hazards*, 236 SCIENCE 271, 271-80 (1987); Lois S. Gold et al., *Rodent Carcinogens: Setting Priorities*, 258 SCIENCE 261, 263 (1992).

E. ELIMINATING RISK BECOMES INORDINATELY COSTLY

The exorbitant costs of reducing risks to a zero level is reflected in what Justice Breyer refers to as the "90-10 principle." He gives the example of the Superfund program:

> Let me provide some examples. The first comes from a case in my own court, *United States v. Ottati & Goss*, arising out of a ten-year effort to force cleanup of a toxic waste dump in southern New Hampshire. The site was mostly cleaned up. All but one of the private parties had settled. The remaining private party litigated the cost of cleaning up the last little bit, a cost of about $9.3 million to remove a small amount of highly diluted PCBs and "volatile organic compounds" (benzene and gasoline components) by incinerating the dirt. How much extra safety did this $9.3 million buy? The forty-thousand-page record of this ten-year effort indicated (and all the parties seemed to agree) that, without the extra expenditure, the waste dump was clean enough for children playing on the site to eat small amounts of dirt daily for 70 days each year without significant harm. Burning the soil would have made it clean enough for the children to eat small amounts daily for 245 days per year without significant harm. But there were no dirt-eating children playing in the area, for it was a swamp. Nor were dirt-eating children likely to appear there, for future building seemed unlikely. The parties also agreed that at least half of the volatile organic chemicals would likely evaporate by the year 2000. To spend $9.3 million to protect non-existent dirt-eating children is what I mean by the problem of "the last 10 percent."[38]

In practice, the drop-off in the efficacy of hazardous waste cleanup expenditures may be even steeper. Justice Breyer hypothesized that the government spreads 90% of its resources to eliminate the last 10% of the risk. Put somewhat differently, it eliminates 90% of the risk by the most effective 10% of its expenditures. In practice, the initial expenditures are even more effective than Justice Breyer conjectured, as the Superfund program achieves over 99% of its risk reduction with the first 5% of the total cleanup expenditures that it requires for the hazardous waste sites.[39] However, the essential point of Justice Breyer's example is certainly correct. The initial large risk reductions come the cheapest. As we spend more money to reduce risk, it becomes increasingly expensive to achieve risk reductions. Indeed, Breyer's hypothesis that eliminating the last 10% of the risk costs us 90% of our risk reduction dollar is not an unrealistic indicator of the dramatic declines in the efficacy of risk reducing expenditures. Because of this rapid drop-off in the efficiency of risk reduction expenditures, it is imperative to ask how much safety is really desirable. And, whether other uses of the money would produce more safety benefits.

---

38. STEPHEN BREYER, BREAKING THE VICIOUS CIRCLE 11-12 (1993).

39. *See* W. Kip Viscusi and James T. Hamilton, *Cleaning up Superfund*, PUB. INTEREST, Summer 1996, at 52-60. Both public and private parties contribute to these expenditures.

F. RANDOM EVENTS AND IMPERFECT CORPORATE CONTROL LIMIT RISK REDUCTION

Failure to recognize the limits of risk-reducing expenditures often leads to unrealistic goals. When the Occupational Safety and Health Act was passed, legislators predicted dramatic declines in job risks would result from the bill.[40] Similarly, projections of the efficacy of seatbelts in reducing motor vehicle fatalities greatly overstated the extent of the improvement that occurred.[41] The ideal of perfect safety has proven to be an illusory goal.

One source of limits to improving safety is that both people and technology matter. Companies cannot simply select a risk-free technology. Even very safe technologies do not eliminate all sources of risk. Most government regulatory efforts have focused on technological improvements, such as improved guarding on machines and passive restraint systems for cars, rather than making people more safety conscious. Influencing the actions of the individuals who also may contribute to risk is sometimes a concern as well, particularly with respect to hazard warnings. However, it is difficult to eliminate all risky behaviors.

Furthermore, increases in safety technology may make it less imperative for people to take protective action, thus impeding safety improvements. Since seatbelts make cars safer, it becomes less important for drivers to exercise care.[42] In addition, people may overestimate the efficacy of technological improvements to safety and fail to take the appropriate level of care. In my analysis of safety caps, I show that people are often lulled into a false sense of security by treating child safety caps as being risk-free, leaving containers with such caps around the house and exposed to children.[43] The mechanism underlying this effect was the subject of a more thorough exploration with respect to cigarette lighters. There is evidence that parents believe that safety mechanisms for cigarette lighters dramatically improve their safety. This improvement in safety characteristics decreases parents' concerns about the location of the lighter and the exposure of children to cigarette lighters.[44]

Overall statistics suggest that worker actions may be quite prominent sources of risk. Pilot error is responsible for 85% of all airplane accidents.[45] From 45-88% of workers' compensation cases involve accidents in which worker behavior played a contributory role.[46] A study by OSHA found that the majority

40. *See* VISCUSI, *supra* note 32.

41. *See* Sam Peltzman, *The Effects of Automobile Safety Regulation*, 83 J. POL. ECON. 677, 679 (1975) (arguing that auto safety regulation has not affected the highway death rate).

42. *See id.* This is the classic problem of moral hazard.

43. For a summary of this evidence, see VISCUSI, *supra* note 32.

44. *See* W. Kip Viscusi & Gerald O. Cavallo, *The Effect of Product Safety Regulation on Safety Precautions*, 15 RISK ANALYSIS 917, 921 (1994).

45. *See* W. KIP VISCUSI, REFORMING PRODUCTS LIABILITY 8 (1991).

46. Some of the substantial role of worker behavior stems from false reporting of accidents. Over a five-year period, 200 Chicago Transit Authority employees accounted for 1200 injury claims. This high concentration of injuries suggest possible fraud or misrepresentation, not simply that these workers are riskier. For further discussion, see VISCUSI, *supra* note 32, at 178.

of deaths of deep sea divers in the North Sea could be traced to worker behavior rather than inadequacies in technology.[47]

What these results mean for company behavior is that consumers and workers are often major contributors to accidents and that technology changes alone will not eliminate risk. The policy levers that can be most readily manipulated by a corporation are changes in product design, changes in the technology of the workplace, and similar technological improvements. Corporations have much more difficulty altering human behavior. Consumers take actions on a decentralized basis. How they use a product cannot be monitored by a corporation. A company can provide hazard warnings, as McDonald's now writes "HOT! HOT!" across the top of its coffee cups. In the case of very potent risks, there can be requirements of safety training, such as the certified pesticide applicators requirement for using dangerous pesticides and the requirement that a motor-vehicle license be obtained before driving a car. However, a corporation cannot deploy safety managers to accompany consumers while they are using products because of the decentralized nature of this activity. Juries may ignore this lack of control as one jury did when it awarded $25 million in punitive damages to the heirs of a woman who drove around a lowered railroad-crossing gate and was killed.[48]

Decentralized decisions do not, however, imply no corporate control. Profit centers within organizations provide localized incentives. Indeed, if inefficiencies escalated with respect to firm size, the large firm in the economy would be the least profitable. Large firms, which are the safest in terms of accident records for workers on the job, would face the greatest financial risk.[49]

Worker behavior is an intermediate case. Companies can establish guidelines for worker behavior and can also control worker behavior more readily than consumer behavior. However, companies cannot continuously monitor the safety-related behaviors of all workers. Supervisors may be able to observe whether protective equipment is being worn and other visible indicators of safety when production is in a group context. However, the difficulty of eliminating all unsafe behaviors is reflected in the continued dominance of worker actions as a contributory cause of job accidents. Just as companies cannot entirely control risk because they cannot entirely control consumers, workers are at risk in part because they do not have complete control over coworkers' actions.

Thus, in large corporations, random errors arise both for technological performance and worker behavior. In the case of technologies, firms have organiza-

47. *See* VISCUSI, *supra* note 45, at 11.

48. *See* Wightman v. Courail, No. E-97-001, 1997 WL 614962 (Ohio App. Sept. 30, 1997). The trial judge reduced the punitive damages award to $15 million, and an Ohio appellate court affirmed the award.

49. This greater safety is due in part to the stronger merit rating of workers' compensation premiums for large firms. However, if employers in large firms were not responsive to incentives, no such influence would be observed. *See* Michael J. Moore & W. Kip Viscusi, *Promoting Safety Through Workers' Compensation*, 20 RAND J. OF ECON. 4, 499-515 (1989).

tional control over the choice of technology but not over all aspects of its performance. Equipment runs the risk of failing just as the Challenger space shuttle ran the risk of a booster rocket exploding. Similarly, firms can prescribe behavior for workers, but unless they incur inefficiently high levels of monitoring costs some risk of worker failure remains.

The bureaucratic nature of corporate decisionmaking introduces an aspect of uncertainty into risk decisions. The difficulties in maintaining corporate control, and in recognizing the difference between central decisions by a corporation and decentralized mistaken actions within a corporation, are reflected in the American Law Institute's recommended principles guiding the award of punitive damages: "An enterprise should be liable for punitive damages only when there is clear and convincing evidence of reckless disregard for the safety of others in the decisions made by management officials or other senior personnel."[50]

As the potential independent causes of an accident proliferate, the culpability for not taking a particular precaution decreases. Companies faced with risk situations in which multiple independent causes combine will have a cloudier notion of the likely consequences of safety improvements than in well-defined risk situations. From the standpoint of corporate decisionmaking, the multiplicity of possible risk sources and the absence of a sound understanding of the risk level tend to mute the perceived efficacy of precautionary actions. Before the accident, the appropriate precaution is less clear-cut than after the fact.

Furthermore, in some cases, substantial uncertainties may remain even after the accident, as in the case of the crash of TWA Flight 800. Whether the extensive security requirements enacted after such accidents produce benefits exceeding the substantial costs and delays imposed on passengers depends in large part on the likelihood of such accidents in the future.

III. PUNITIVE DAMAGES ARE NOT NEEDED FOR DETERRENCE

A. COMPENSATORY DAMAGES ARE GENERALLY ADEQUATE FOR DETERRENCE

The assessment of risk measures in Part I failed to reveal any deterrent effect of punitive damages; on a practical level, punitive awards do not enhance safety. This Part addresses a somewhat different issue; that is, even if punitive damages did enhance deterrence, is there any need for them to augment the safety incentives provided by compensatory awards?

For a large class of circumstances, compensatory damages alone provide adequate deterrence. Consider a case in which all accident costs are financial or involve monetary equivalents. In the case of nonmonetary losses such as environmental damage, the economic assumption is that from the standpoint of those who are injured, this loss can be translated into a fixed amount of money. In such circumstances, both strict liability and negligence rules create efficient

50. 2 AMERICAN LAW INSTITUTE, *supra* note 2, at 264 (1991) (discussing the merits and disadvantages of ceilings and multipliers).

levels of safety.[51] In particular, the financial incentives facing the injurer will be adequate to ensure appropriate levels of deterrence.

From an efficiency standpoint then, there is no rationale for additional sanctions. Penalties that go beyond those needed to create an efficient level of safety will produce safety benefits that are not commensurate with the costs being incurred, and these costs in turn will lead to higher prices and other adverse economic effects. Policies for which the benefits to society are exceeded by the costs are not in our net national interest.

Although punitive damages are not generally warranted, there are some narrowly defined circumstances in which analysts have suggested that they could play a potentially constructive role. The discussion below will outline the circumstances that have been identified in which punitive damages can potentially promote more efficient levels of safety. I will then assess the importance of these circumstances and compare these potential benefits of punitive damages with the adverse effects that punitive damages generate.

Table 5

Theoretical Factors Triggering the Pertinence of Punitive Damages

FACTOR	PROBLEM	SOLUTION
Enforcement Error	Probability that harm will go undetected and/or unpunished.	Multiply compensatory damages by the reciprocal of the enforcement probability.
Gap between Compensatory Damages for Adequate Deterrence	Optimal compensation from insurance standpoint provides inadequate deterrence.	Impose a fine, regulatory penalty, or use punitive damages as a deterrence penalty.
Malicious Intent	Party causing accident derives enjoyment from inflicting harm that may affect value of loss to victim. Usually not relevant for corporate behavior.	Increase damages to offset such enjoyment.

B. POTENTIAL TRIGGERS OF PUNITIVE DAMAGES[52]

Any efficiency-based rationale for going beyond compensatory damages to assess a punitive award requires that conditions other than those in the standard economic loss model be met. Table 5 summarizes the three situations in which, theoretically, punitive damages may be relevant—enforcement error, a gap between compensatory damages and the deterrence value, and malicious intent. Satisfying at least one of the criteria is a prerequisite for having apotentially

51. *See, e.g.*, A. MITCHELL POLINSKY, AN INTRODUCTION TO LAW AND ECONOMICS (2d ed. 1989).
52. *See* Polinsky & Shavell, *supra* note 3, for a more detailed review of these principles.

sound basis for awarding punitive damages regarding certain corporate acts or actions which might have had probabilistic elements.

The first of the three hypothesized justifications for punitive damages is an enforcement error. Suppose the compensatory damage amount would have provided optimal deterrence, as with monetary harms. However, if an enforcement error creates the probability that the corporation will not suffer this sanction, then there is a rationale for increasing the damages level if tort liability is the only source of financial incentives for safety. A series of authors have shown that compensatory damages provide appropriate deterrence in a situation of imperfect enforcement after the compensatory amount has been multiplied by the reciprocal of the probability that the sanction will be imposed.[53] This formulation ensures that the expected penalty facing the firm equals the optimal deterrence value, taking into account the probability that it will not be levied.

One should, however, be careful in interpreting this underenforcement rationale since courts do limit the extent of liability to exclude many cases of remote risks for which enforcement is difficult. For maritime cases, the circle of harm is limited to those directly affected by the accident.[54] Transaction costs would escalate if all indirect effects were taken into account because the ramifications of any favorable or adverse event throughout the economy are extensive.[55] Moreover, it is not clear that accidents create net indirect losses. Damages paid by companies will also stimulate the economy through a variety of indirect efforts, so for symmetry purposes, it is inappropriate to penalize companies for indirect losses without crediting them for the indirect benefits generated by the damage payment. Similarly, benefit-cost analysis for government regulations do not include indirect effects because other expenditures likewise would have indirect consequences.

Even if one acknowledges the role of enforcement error in muting the effect of compensatory damages on incentives, this factor may not be particularly pertinent for corporate risk decisions. The usual example of an enforcement error problem is midnight dumping of toxic chemicals. Creating environmental hazards in this manner is explicitly designed to evade enforcement. If there is some probability the polluter will not be caught, compensatory damages will lead to expected sanctions that are less then what is needed for efficient deterrence. Thus, it would seem that additional sanctions in the form of punitive damages would be needed to create appropriate incentives.

However, the tort liability system is not the only institutional actor. The

53. *See* Cooter, *supra* note 14, and the references contained therein.

54. *See* Robbins Dry Dock & Repair Co. v. Flint, 275 U. S. 303, 307-08 (1927) (Holmes, J.) (holding that tortfeasor is not liable to person other than person injured merely because injured person was under contract with such other person unknown to tortfeasor).

55. For a more recent discussion of economic rationales for limiting the scope of liability, see *Barber Lines A/S v. M/V Dona Maru*, 764 F.2d 50, 52-54 (1st Cir. 1985).

Resource Conservation and Recovery Act[56] (RCRA) imposes sanctions for reckless disposal of hazardous wastes, such as the midnight dumping example. Thus, in addition to potential compensatory damages, other societal mechanisms exist to promote safety and environmental quality. As will be indicated below in the discussion of the role of regulation more generally, much of the belief in the need for stringent punitive damages stems from a tort-centric perspective that ignores the role of such other societal institutions.

For the most part, corporate actions do not follow the clandestine nature of midnight dumping. McDonald's, for example, could not disavow that it had sold the coffee that spilled on the unfortunate woman's lap. The manufacturers of Ford Pintos and GMC trucks likewise could not evade enforcement because the identities of these vehicles were apparent, and the mass-produced nature of the products led to risks that were well known and highly publicized.[57] Moreover, the fact that there may be underenforcement for some classes of behavior does not imply that this rationale for punitive damages can be used for corporate acts in which there is no significant enforcement error.

Even if there is a situation with enforcement error and no regulatory incentives, it is not clear that juries can make sensible judgments on this issue. The analytic task for jurors is extremely complex. In a court case, there presumably is no enforcement error: the firm has been identified. The jury must consequently make an enforcement error judgment across an entire market or set of activities. This task is nontrivial even if no other courts will award punitive damages. However, if other cases involving the risky behavior also might generate punitive damages, then incentives will be too great if punitive damages are set in each case by a jury which is assuming that no other punitive damages will be awarded. In practice, punitive damages in one jurisdiction often lead to efforts to obtain punitive damages in similar cases, which in turn may lead the defendant to settle such cases out of court even if the case is not litigated. Juries have no reliable basis for anticipating the snowball effect of their punitive damages award on other court awards. Failure to recognize the potential ramifications of a punitive award will lead to excessive deterrence.

A second potential role of punitive damages arises when the appropriate deterrence values of damage and efficient compensation amounts differ. This situation pertains to the character of the accident rather than the size of the loss. In particular, does the accident do more than simply lower welfare as would losing a fixed sum of money? Does it, for example also impede our ability to enjoy spending money on consumption activities? This situation may occur for severe health effects such as brain damage, which impedes an accident victim's ability to derive well-being from a court award. Accidents that cause fatalities or severely disabling injuries are also prime examples. In these instances, compen-

56. 42 U.S.C. §§ 6901-92 (1988).

57. GM also had internal analyses documenting its risk analysis. *See* E.C. Ivey, *Value Analysis of Auto Fuel*, GM Memorandum (June 29, 1973) (on file with author).

satory damages amounts may not provide adequate deterrence because the value of preventing irreplaceable health losses, such as in the case of death, goes beyond the monetary sums involved.

The implicit deterrence value of life associated with preventing a small risk of death ranges from $3-$7 million per statistical life, with the midpoint value of $5 million.[58] Court awards for compensatory damages after fatalities are typically well below that amount. Compensatory damages are intended to ease the financial burdens of the survivors rather than to restore the well being of the deceased or provide efficient deterrence. In contrast, punitive damages could serve a deterrence function that goes beyond the compensation function to reflect the value to society of preventing the risky outcome.

Using punitive damages for deterrence is not ideal, however, as it provides compensation to accident victims or their estates that exceeds the optimal insurance value of their loss. Punitive awards for nonmonetary losses are not in consumers' interest because they will, in effect, pay for the unwanted insurance provided by these damages through higher product prices.[59] People will be forced to pay for a level of tort liability insurance beyond what they would buy on their own in a world of perfect insurance markets.

Government fines and regulatory penalties are superior mechanisms to punitive damages because they create incentives without overinsurance. As will be documented below, the market sanction is $3-$7 million for each fatality. When job markets for employment risks or product markets for consumption risks function effectively, they will transmit incentives for safety through higher wages for risky jobs and lower prices for hazardous products. If operative, this economic mechanism will meet the deterrence objective, and the courts can focus on their compensatory role. Even if market incentives fall short, imperfect market incentives when coupled with compensatory damages may generate incentives for safety that may be adequate or possibly even too great. That punitive damages are not in widespread use for wrongful death actions may indicate that neglect of safety is typically not so extreme in most cases that punitive financial penalties are needed.

The third situation in which there may be a trigger for punitive damages is malicious behavior, as in intentional torts. The enjoyment that parties derive from inflicting harm may well be viewed as a socially unacceptable component of the behavior. As indicated in Table 5, such concerns seem more pertinent to personal actions than corporate ones. A punitive damages amount that offsets the injurer's enjoyment from causing the accident will establish the additional incentives needed for the appropriate degree of care.[60] Given the scope of

58. *See* VISCUSI, *supra* note 32, at 73.

59. *See* VISCUSI, *supra* note 45.

60. *See* Peter Diamond, *Efficiency Effects of Punitive Damages*, Department of Economics, Massachusetts Institute of Technology Working Paper No. 97-17 (Sept. 1997); Peter Diamond, *Integrating Punishment and Efficiency Concerns in Punitive Damages for Reckless Disregard of Risks to Others*,

actions considered in this article—corporate environmental and safety torts—this rationale for punitive damages is not pertinent.

If the compensatory damage amount imposed on the company creates appropriate incentives, then there is no role for punitive damages. When this condition is not met, one of the three potential triggers of punitive damages must be present for there to be any role for a punitive award. In environmental and safety torts, however, the malicious intent concern is largely irrelevant, so the principal factors that could trigger punitive damages are enforcement error and deterrence for health effects. In most situations of corporate acts, enforcement error is not a major concern or is beyond a jury's competence. Indeed, such judgments would be quite difficult to make even for sophisticated legal scholars. Compensation for health losses to promote deterrence provides overinsurance. Whether punitive damages have a constructive role in such contexts depends in large part on the other societal incentive mechanisms in place. The subsequent discussion explores why, put simply, corporations will not completely ignore safety in the absence of tort liability.

What are the broader ramifications of this review of the theoretical underpinnings of punitive damages? The theoretical case for punitive damages is restricted to narrowly defined circumstances for which, as I have demonstrated, the rationale for punitive damages is not compelling. This rather shaky theoretical foundation may in fact help explain why in practice punitive damages have not proven to be an effective deterrent. Punitive damages can, at best, play a limited role in specific contexts likely to be beyond a jury's expertise, such as making complicated statistical judgments regarding the size of the enforcement error based on a case when the defendant has in fact been identified. Indeed, it is noteworthy that the articles supporting punitive damages do not give any actual case examples where juries have made awards in line with the theoretical ideal but instead focus on hypothetical case studies in which the author attempts to bring to bear more clarity than has yet been evident in our court system. The court's performance has produced no demonstrable safety benefits.

C. MARKET FORCES PROMOTE SAFETY

How juries make the assessment that the firm has been sufficiently remiss to warrant punitive damages is unclear. Juries may fail not only in their thinking about the expected benefits of greater safety but also in their analysis of the costs of accidents to the firm. In thinking about the adequacy of corporate incentives, it should be recognized that the court system is not the only institution that affects corporate behavior. Unfortunately, most of the legal literature suffers from a tort-centric perspective in which the courts are the only social institution at work. The courts are not the only safety incentive mechanism in place. For firms that sell risky products in the market or hire workers

---

Department of Economics, Massachusetts Institute of Technology Working Paper No. 97-19 (Oct. 1997).

into risky jobs, there may be a market response to risky activity, such as an unwillingness to fly ValuJet after a crash. Indeed, economists' estimates of the implicit value of life are based on observed wage premiums for risky jobs and higher prices now commanded by safer products in the market. These substantial market premiums are in the range of $3-$7 million per statistical life.[61]

The source of these values is analysis of compensating differentials for risk, controlling for various aspects of the worker's job. It is useful to provide some sense of the nature of these studies, which in turn indicates the prevalence of these market incentives for risk.[62] There have been numerous studies of compensating differentials that workers receive for hazardous jobs in the United States as well as in many other countries, such as Australia and Japan. The basic idea of these studies is to analyze statistically the wage premium workers receive for added risk on the job. The typical worker in the United States faces an annual job-related fatality risk of 1/10,000.[63] In return, the worker receives an average wage premium of $500, where this amount has been estimated by controlling statistically for other aspects of the worker and the job. On average, 10,000 workers would receive a total of $5 million (10,000 workers times $500 per worker) in return for the one expected statistical death among them. Thus, the value of a statistical life is $5 million.

It is important to understand what this number means. It is not the value a person must receive to be indifferent between certain death and life. No amount of money may suffice. Nor is it the value that one would purchase in a life insurance policy. Desired compensation for one's heirs will be much less. Rather, it simply reflects the risk-money tradeoff from the standpoint of prevention. This amount would be pertinent for setting punitive damages from a deterrence standpoint if compensatory damages were deducted and the firm otherwise completely ignored safety. However, even in this case, such an award would provide overinsurance. Consumers, for example, would not want to purchase products with such a punitive damages insurance policy attached to it.

In addition to these money-risk tradeoffs in prices and wages, there are other economic mechanisms that may foster safety. Consumers may boycott the product. There also may be stock market repercussions that either embody these reputational effects or reflect additional reassessment by investors of the value of the firm in the wake of these accidents.[64]

The courts, at least implicitly, recognize other financial consequences that affect corporate incentives. The degree of reprehensibility of the corporation's behavior and the divergence between the corporate action and the appropriate degree of care are typically among the factors to be considered in the setting of

61. For review of this evidence, see VISCUSI, *supra* note 32.

62. For a comprehensive review, see *id.* at 59-73.

63. *See id.* at 52-53, tbl.4-1.

64. For review of the evidence on the stock market repercussions of liability suits, see evidence as presented in W. Kip Viscusi & Joni Hersch, *The Market Response to Product Safety Litigation*, 2 J. REG. ECON. 3, 213-30 (1990).

punitive damages. However, the assumption that it is only the courts that provide incentives after an accident establishes an unrealistic reference point. Some corporations conceivably may set their safety level at zero. But rampant neglect of safety is uncommon, even in situations in which there is no anticipation of liability. This phenomenon shows that other societal mechanisms foster safety incentives. Government regulations check systematic neglect of safety. There will also be market penalties for unsafe products, as well as reputational costs.

D. GOVERNMENT REGULATION PROVIDES ADDITIONAL INCENTIVES FOR SAFETY

Airplane crashes generate stock market losses that average $50 million per life lost.[65] Government sanctions may impose costs on firms when there are regulatory violations. To capture appropriately the incentive structure that should be designed for punitive damages, it is also essential to take into consideration the incentives provided through these other institutional actors. Otherwise, firms will be penalized multiple times by separate social institutions, each of which is generating incentives to decrease risk.

Companies' incentives for safety come from a variety of sources. For marketed products, consumers respond to a perceived increase in risk by being willing to pay less for products declared to be hazardous, such as the Audi 2000 brakes or alar in apples. Notably, the Ford Pinto was dropped from Ford's product line not long after the Ford Pinto litigation.[66]

In addition to the value of court awards, companies also suffer stock price diminutions and adverse publicity that may impose costs well beyond the court awards themselves. A detailed study of the effects of tort liability publicity on the value of firms indicates that these effects were often substantial, and in many cases exceeded the actual awards themselves.[67] Furthermore, stock price effects are suffered not only by corporate officers but also by stockholders not involved in the decision.

In considering the risk-reduction incentives facing companies, it is worthwhile to recognize that there are multiple institutional actors that generate such incentives. The market and the courts are two such social institutions, but a variety of government regulations are at work as well. Airplane safety is subject to Federal Aviation Administration (FAA) rules, air traffic controllers' actions, and government inspections. Cigarettes bear congressionally mandated warn-

---

65. *See* Ivy E. Broder, *The Cost of Accidental Death: A Capital Market Approach*, 3 J. RISK & UNCERTAINTY 1, 51-63 (1990).

66. *See* VISCUSI, *supra* note 45, at 111-13. More generally, for evidence on the price premium commanded by safer cars, see Mark K. Dreyfus & W. Kip Viscusi, *Rates of Time Preference and Consumer Valuations of Automobile Safety and Fuel Efficiency*, 38 J.L. & ECON. 79 (1995).

67. For a series of estimates of the stock price effects for product liability events published in the Wall Street Journal as well as all of the major events associated with the Agent Orange litigation, see Viscusi & Hersch, *supra* note 64, at 213-30. Also see the study of airplane crash stock price effects by Ivy Broder, *supra* note 65.

ings and are subject to stringent advertising restrictions. They also are the focus of a proposed $368.5 billion legislative package. In the case of prescription drugs, the FDA not only sets the standards for testing the drugs but also, in effect, writes the warning language that accompanies all new prescription drugs.[68] For oil tankers in sensitive inland waterways like Prince William Sound, regulation by the state and federal government, actions by the Coast Guard, performance of escort tugboats, and other actions not under corporate control affect accident prevention as well as reaction after a spill has occurred.

The existence of government regulations that specify standards of corporate behavior often can serve as a reference point for efficient corporate actions.[69] The legislative mandates of regulatory agencies are often quite restrictive. Typically, they require that firms provide a greater level of safety than would be efficient from an economic standpoint.[70] The cost per statistical life saved by these efforts is often well beyond $5 million. Due to the influence of restrictive legislative mandates, agencies often set these standards based on risk alone, not risk-cost tradeoffs. As a consequence, an American Law Institute panel recommended that well-defined government regulatory requirements should afford a regulatory compliance defense against punitive damages.[71]

The courts do not currently rule out punitive damages in cases of regulatory compliance. In one particularly egregious case, a company was penalized $210 million for a chemical spill that was within EPA standards and took no land out of agricultural use.[72]

Although the Supreme Court has not yet recognized a regulatory compliance defense to punitive damages, it has recognized the importance of government regulations and the character of corporate behavior. In *BMW of North America, Inc. v. Gore*,[73] the Supreme Court observed:

> There is no evidence that BMW acted in bad faith when it sought to establish the appropriate line between presumptively minor damage and damage requiring disclosure to purchasers. For this purpose, BMW could reasonably rely on state disclosure statutes for guidance. In this regard, it is also significant that there is no evidence that BMW persisted in a course of conduct after it had been adjudged unlawful on even one occasion, let alone repeated occasions. . . . In an absence of a history of non-compliance with known statutory requirements, there is no basis for assuming that a more modest sanction would not have been sufficient to motivate full compliance

68. *See* Richard M. Cooper, *Drug Labeling and Products Liability: The Role of the Food and Drug Administration*, 41 FOOD, DRUG, COSMETIC L.J. 233, 236 (1986).

69. *See* VISCUSI, *supra* note 45, at 124-28; AMERICAN LAW INSTITUTE, *supra* note 2.

70. For examples of such excessive levels of safety, see VISCUSI, *supra* note 43 at 118-24.

71. *See* 2 AMERICAN LAW INSTITUTE, *supra* note 2, at 110. For a stronger advocacy of a regulatory compliance defense against all liability, see W. Kip Viscusi et al., *Deterring Inefficient Pharmaceutical Litigation: An Economic Rationale for the FDA Regulatory Compliance Defense*, 24 SETON HALL L. REV. 1437 (1994).

72. *See* Wilhite v. Rockwell Int'l Corp., 93-CI-00158 (Ky. Cir. Ct. June 24, 1996).

73. 517 U.S. 559 (1996).

> with the disclosure requirement imposed by the Alabama Supreme Court in this case.[74]

This recognition of the importance of regulatory compliance is in no way inconsistent with the Court's ruling in the *Medtronic* case.[75] In that case the Court ruled that the preemption provisions for medical devices did not preclude lawsuits against defective products. The product in question had never been explicitly reviewed by the FDA, but instead was a variant of a similarly marketed product. Moreover, the nature of the FDA review process for medical devices is not as rigorous as for prescription drugs.[76]

The United States Supreme Court made clear the narrow limitations that should pertain to a regulatory compliance preemption defense: "Moreover federal requirements must be 'applicable to the device' in question, and, according to the regulations, pre-empt state law only if they are 'specific counterpart regulations' or 'specific' to a 'particular device.' "[77] A regulatory compliance defense is certainly desirable but does not go far enough. Punitive damages are not warranted even in situations of regulatory noncompliance, as there are regulatory sanctions that can establish financial incentives for care.

The advantages of government regulations go beyond simply establishing well-defined standards of behavior and safe harbors for corporate action. Regulatory agencies often serve an informational role, both for research and for data gathering. The National Highway Traffic Safety Administration (NHSTA) pools information on the number of motor vehicle deaths, assisting companies in assessing risks. NHTSA, for example, kept a running tally of the number of deaths potentially related to gas tank placement.[78] More recently, it has developed statistics on the lives saved and lives lost due to air bags. A central data analysis of this type is often instructive because regulatory agencies may be able to identify trends in comparative riskiness of products or may be able to pool information regarding similar products to identify risks more precisely than would be possible using information available to the company alone. Regulatory activities also can serve a coordinating role. One such role is to standardize the meaning of hazard warning language, as in the case of the FDA warning language for prescription drugs marketed by different companies.[79]

There are additional advantages to regulation as well. The process of formulating regulations can provide a forum for the reconciliation of competing interests, such as public access to a product of reasonable cost versus concerns with

---

74. *Id.*, at 579, 584-85.

75. Medtronic, Inc. v. Lohr, 518 U.S. 470 (1996) (finding that the Medical Device Amendments do not completely preempt state causes of action).

76. *See* W. Kip Viscusi, *Regulatory Reform and Liability for Pharmaceuticals and Medical Devices*, *in* ADVANCING MEDICAL INNOVATION (Thomas Lenard & Henry Miller eds.) (forthcoming).

77. *Medtronic*, 518 U.S. at 472.

78. *See* Gary T. Schwartz, *The Myth of the Ford Pinto Case*, 43 RUTGERS L. REV. 1013, 1030 (1991).

79. *See* VISCUSI, *supra* note 45, at 150.

safety. There can also be a debate over the merits of the technical issues, bringing to bear a specialized expertise of regulatory officials rather than lay jurors, who may have less specialized knowledge and may be more prone to perceptional biases.

The character of the *ex post* regulatory compliance defense is forward looking. On a retrospective basis, looking back to the situation before the accident, the sole emphasis is on compensatory damages. However, after the accident, companies would be subject both to compensatory damages and detailed government regulations that would emerge after the accident based on the information that the accident provided. Compliance with these regulations would ensure efficient operating behavior for the matters addressed by the regulation, which is the ultimate objective of punitive damages that are levied from a deterrence standpoint. A violation of these guidelines would be subject to regulatory penalties, creating necessary incentives for compliance.

E. DYNAMIC RISK MANAGEMENT PROMOTES SAFETY

Even without tort liability or regulatory sanctions, there are often strong incentives for companies to change their behavior after a major accident or a catastrophe. A major impetus for increased precautions is that the accident itself often conveys substantial information about the presence of the risk. Once the accident has occurred the company will be aware of the need for greater care, and regulatory agencies may also establish new guidelines for risk actions by the firm. Because the risk management process is a dynamic process even without additional financial incentives provided by the courts, companies will often have the incentive to alter their behavior once the risk becomes apparent.

An important source of learning is through actual events. Auto companies can observe the frequency with which GM truck gas tanks catch fire upon side impact. Pharmaceutical companies receive reports of adverse reactions to drugs that they can use to assess product risks. Similarly, companies can learn about risks after major catastrophes, such as a major oil spill or the Challenger disaster.

The difference across these cases is in terms of the sample size involved and the relationship of the sample size to the probability. For mass marketed automobiles and pharmaceutical products, there is usually a very large sample size. In contrast, major catastrophes tend to involve much smaller probabilities and often are more idiosyncratic events. Learning that the O-rings of the Challenger shrank in cold weather can help reduce the risk of catastrophes from an identical cause in the future, but there have not been enough trials of space shuttle launches to make it possible to identify all such possible risks of explosion with precision. Catastrophes consequently may be informative with respect to the particular risk that caused a single accident, but may not provide information to make judgments for all causes that might generate similar risks in the future.

Catastrophes are usually not anticipated because risks of substantial losses

are usually small. The wide swings in risk estimates that arise because of the unanticipated character of catastrophes are exemplified in the Challenger disaster experience. Before the Challenger disaster, NASA officials estimated that the chance of such a disaster was one flight in 100,000.[80] After the Challenger disaster, the agency estimated the risk of such a catastrophic accident as one flight in seventy-eight. A single adverse event led NASA officials to raise their probability estimates by a factor of 1000.

Part of the shift no doubt was due to the information conveyed by the event, indicating the limits of technology. However, an additional consequence of the catastrophe was to increase the credibility of officials within NASA who had higher risk assessments. Even before the Challenger disaster, some NASA engineers[81] had estimated the risk of catastrophe as one flight in 100 and one Air Force study indicated that the risk of a booster failure was one flight in thirty-five.[82]

The Challenger episode reflects the difficulties of risk assessment within the context of large organizations. Different people within the organization have different perspectives on the risk and weigh this information differently. The working engineers placed the greatest weight on the likely failure rates of the booster rockets, whereas more senior NASA officials placed greater weight on the unblemished record of success that they had experienced to date.[83]

The Challenger incident epitomizes the difficulties involved in situations of uncertainty coupled with low probability catastrophic events. There may be widely disparate estimates of the risk, and this range of estimates may be particularly great in the case of large organizations that have officials with quite different perspectives. After a catastrophe occurs, the higher risk assessors may be vindicated, but even if the catastrophe had not occurred it may still have been the case that the high risk assessors were correct but there simply had not been enough launches to experience the catastrophic event. Another possibility is that the low assessors were correct, and we were simply unlucky.[84]

Part of the dynamic risk response is a change both in regulatory standards and legislative requirements. As the risk of thousands of cancers related to asbestos became better known, society responded in a variety of ways. The courts levied damages and firms reorganized under bankruptcy laws. OSHA tightened its regulations to a cost in excess of $100 million per case of cancer prevented, as did the EPA. The result was a regulatory response and a wave of overreaction

---

80. *See* William J. Broad, *High Risk of New Shuttle Disaster Leads NASA to Consider Options*, N.Y. TIMES, Apr. 9, 1989, at A1, A24.

81. *See* DIANE VAUGHN, THE CHALLENGER LAUNCH DECISION 274 (1996).

82. *See* Stuart Diamond, *Study of Rockets by Air Force Said Risks Were 1 in 35*, N.Y. TIMES, Feb. 11, 1986, at A1, A24. The U.S. Air Force estimate was prepared by the rain safety people at the Air Force's launch facility used by NASA. These officials had more experience with solid-propellant boosters.

83. *See* VAUGHN, *supra* note 81, at 274.

84. A branch of statistics known as Bayesian decision theory provides detailed guidelines for incorporating such risk information. *See, e.g.*, HOWARD RAIFFA, DECISION ANALYSIS: INTRODUCTORY LECTURES ON CHOICES UNDER UNCERTAINTY (1968).

that followed a period of inadequate regulation. This experience, while extreme, is not unique. Adverse events and major accidents generate a substantial amount of information conveyed by the accident that will lead to diverse governmental and private responses.

IV. PUNITIVE DAMAGES CAUSE ECONOMIC HARM

A. PUNITIVE DAMAGES DISCOURAGE BENEFIT-COST TRADEOFFS

If punitive damages are simply ineffective and caused no adverse consequences, they should be eliminated. However, their overall performance may be even worse than simply failing to foster constructive safety incentives; random and unpredictable punitive damages may in fact cause concrete economic harms.

One example of such an adverse consequence is that punitive damage awards discourage companies from doing the kinds of risk management analyses of benefits and costs that are in society's interest but may offend jurors' sensitivities. Ideally, tort liability and the other societal mechanisms for promoting safety should encourage companies to strike a reasonable balance between risk and cost. Safety improvements should be pursued only so long as the expected benefits to society exceed the costs. These benefits are not only financial. Monetary measures of risk and benefit should also include society's willingness to pay for the health-risk reductions or the environmental improvements that will take place because of the increased degree of care by the corporation. Thus, the benefit-cost tradeoff simply requires that safety efforts be undertaken so long as they are in society's best interest.

Who should be responsible for making such judgments? Should it be the company, with its extensive knowledge of the cost characteristics of the product and the market consequences? As Judge Easterbrook has observed, companies regularly incorporate such safety concerns in a manner that recognizes the pertinent tradeoffs. Firms routinely perform cost-effectiveness analyses of their products. Such studies include recognition of the costs of injury and the costs of production.[85] Judge Easterbrook notes that the jury perspective tends to be incomplete, as the jury focuses on the effects on the injured person in court, not on the invisible members of the rest of society who will be affected by the corporate response to tort liability outcomes. Thus, companies are more likely to take the societal perspective on costs and benefits, whereas jurors tend to focus on the case specifics.

Making precise assessments of the costs and benefits of safety actions is often feasible for large corporations. Ford Motor Company, for example, was able to explicitly calculate the costs and benefits of eliminating a safety hazard for the

85. *See* Carroll v. Otis Elevator Co., 896 F.2d 210, 215 (7th Cir. 1990) (Easterbrook, J., concurring) (engineers design escalators to "minimize the sum of construction, operation, and injury costs").

Ford Pinto.[86] General Motors similarly analyzed the costs and benefits of fuel-fed fires.[87] Making such calculations may offend some jurors' sensitivities, but thinking rigorously about risks and costs is exactly what we would like companies to do so that they can strike a reasonable balance between risks and costs. Ford's calculations indicated the costs and risk associated with different gas tank locations for the Ford Pinto. Although these estimates have been widely touted by plaintiffs' lawyers as representing calculations undertaken by Ford with respect to the risk of gas tank explosion upon rear impact, a more recent assessment suggests that these calculations pertained not to the risks associated with rear impact, but rather with the risk of explosion of the gas tank due to vehicle roll-over.[88] Moreover, the analytical context appears to have been a prospective regulatory action, not an effort to escape liability. Regardless of which particular type of accident to which the calculations pertain, Ford had extensive quantitative information for such types of explosion risks, which it could use to assess the risks and the consequences of altering the product design. Simply making such calculations, however, led to substantial criticism of Ford's behavior.[89]

The nature of these calculations was as follows. Relocating the gas tank would cost Ford $11 per car or truck, which for 12.5 million cars and light trucks creates a total cost of over $137.5 million. Ford calculated that moving the gas tank would prevent 180 burn deaths valued at $200,000 per death, 180 serious burn injuries valued at $67,000 per injury, and 2100 burned vehicles valued at $700 per vehicle. Based on Ford's estimates, the value of the risk reduction benefits was only $49.6 million—far less than the $137.5 million in costs. A more appropriate valuation of the risk to life and health using a deterrence value of life of $5 million, rather than average court awards, leads to assessed safety benefit values of $1.4 billion, or roughly an order of magnitude greater than the costs.[90] Whether Ford's decision was in error also depends on the potential design benefits from the rear gas tank location, which was common for hatchbacks. Only by making such a calculation can we assess whether the company made the right tradeoff and, if not, how much it fell short.

Ford clearly erred in such calculations by undervaluing safety. However, the company should be applauded for its efforts to at least grapple systematically with the cost and safety implications of its actions. Indeed, in the wake of this experience, we now know how Ford erred in its value of the safety benefits. In

86. For a detailed presentation of these calculations, *see* VISCUSI, *supra* note 45, at 111-13.

87. *See* E.C. Ivey, *Value Analysis of Auto Fuel Fed Fire Related Fatalities*, GM Memorandum (June 29, 1973) (on file with author).

88. *See* VAUGHN, *supra* note 81, at 1013.

89. *See* BRENT FISSE & JOHN BRAITHWAITE, THE IMPACT OF PUBLICITY ON CORPORATE OFFENDERS 44 (1983).

90. These calculations are summarized in detail in VISCUSI, *supra* note 45, at 111-13. These calculations are based on a 1973 internal Ford Company report by E.S. Grush & C.S. Saundby, *Fatalities Associated with Crash-induced Fires and Fuel Leakages*, *reprinted in* FISSE & BRAITHWAITE, *supra* note 89, at 44.

other cases, the error might be an overassessment of costs or a failure to adequately assess risks. By making these tradeoffs explicit we can better learn from our experiences and make more sensible risk tradeoffs in the future. If, however, courts create a chilling atmosphere for analysis in which explicit tradeoffs are prevented because of the alleged immorality of considering the inevitable tradeoff between cost and safety, then we will suppress the type of systematic thinking about risk that, in the long run, could enhance our safety much more than clandestine, qualitative decisionmaking.

In the punitive damages award in the Ford Pinto case, there is no evidence that the courts considered the value of market sanctions. It is likely, however, that market incentives for safety would be considerable. Gas tank fires and explosions are visible and highly dramatic events, especially when "re-enacted" by news organizations. After such accidents, companies will suffer substantial adverse publicity costs that create powerful incentives to make products safer even without any court-imposed penalties. Thus, even if Ford erred before the accident occurred, one would expect the market to generate powerful incentives for safety once the accidents were publicized.

B. PUNITIVE DAMAGES PROMOTE COUNTERPRODUCTIVE SPENDING AND WASTEFUL PRECAUTIONS THAT MAY LEAD TO INCREASED RISK

A possible defense of punitive damages might be that additional safety incentives, even if unpredictable, certainly can do no harm and might have some protective benefit. In this view, our task is presumably to promote safety at any cost without worrying about benefit-cost concerns. The danger of such an approach is not simply that it offends economists' quest for policies that pass an efficiency test in which benefits exceed the costs, but rather that by imposing punitive damages in an attempt to promote zero risks, we may actually not be reducing risk levels at all.

The search for zero risk levels is counterproductive. Spending inordinate amounts of money to achieve the last reductions of risk once risks have reached a reasonably safe level is more than simply a waste of resources. It diverts these funds from other productive uses. Such other uses also may have offered safety benefits and favorable health effects so that diverting resources to wasteful expenditures involves real health costs.

Judge Williams of the United States Court of Appeals for the District of Columbia has correctly observed that because of this diversion of resources, there may be the loss of a statistical life every time the United States government spends an inordinate amount on regulatory efforts. He suggested that expenditures in the vicinity of $10 million per statistical life have no net beneficial effects because these funds otherwise could have had a greater effect in reducing risk by paying for better food, medical care, housing, and other life-extending consumption items.[91] Although some statistical estimates suggest

91. *See* International Union, UAW v. OSHA, 938 F.2d 1310, 1326 (D.C. Cir. 1991) (Williams, J.,

that expenditures around $10 million could in fact lead to the loss of a statistical life, my estimates, which use an approach that avoids the statistical complications of disentangling the causality involving income and mortality, suggest that a more appropriate reference point is $50 million.[92] What this estimate means is that every time we spend $50 million or more to eliminate an expected death, there is the loss of a statistical life because we divert resources from other worthwhile mortality-reducing purposes.

The nature of this risk-risk effect may seem surprising, but its underlying economic principle is captured in the following example. Suppose that some risk prevention is no more safety-enhancing than digging ditches and filling them back up again. Such efforts do nothing to promote safety, but people may be injured in the process. Moreover, if we had devoted the ditch digging resources to a standard bundle of consumer items, including items such as medical care, some lives could have been saved. Saving that $50 million, instead of spending it on endeavors that promise little or no return, produces greater overall health, because the greater affluence that results allows us to spend more on the types of goods and services that will promote our health.

C. PUNITIVE DAMAGES DISCOURAGE INNOVATION

Punitive damages are the quintessential mechanism for generating a large tort liability award. In the absence of punitive damages, the court award will be restricted to the much more modest damage amount. Do such high awards bolster the incentives for safety or do they have some adverse repercussions?

Most assessments of this question have focused on anecdotal evidence. To address this issue more systematically, Michael Moore and I[93] developed a large database that included measures of innovation by industry for a large sample of firms. These innovations included new patents, new product introductions, and other measures that would provide reliable indicators of the degree to which the industry was undertaking the kinds of activities that would lead to the economic progress that has enhanced our lives and well-being. At low and modest levels of damages, court awards have the constructive effect that supporters of the liability system have long discussed. In particular, modest levels of damages foster innovation and product changes that bolster our level of safety. Thus, a modest award level has a constructive effect in leading firms to undertake the kinds of product modifications and new product introductions that will reduce our risks.

Once the damage levels become very high, however, the effect is counterpro-

---

concurring).

92. *See* W. Kip Viscusi, *Mortality Effects of Regulatory Costs and Policy Evaluation Criteria*, 25 RAND J. ECON. 94 (1994). The approach I use is to explicitly link the implicit value of saving a statistical life with the value that leads to the loss of a statistical life through regulatory expenditures. For further discussion, see W. Kip Viscusi, *Regulating the Regulators*, 63 U. CHI. L. REV. 1423 (1996).

93. Michael Moore & W. Kip Viscusi, *Product Liability, Research and Development, and Innovation*, 101 J. POL. ECON. 161, 161-84 (1993).

ductive. High damage levels suppress innovation across the board. Firms in effect stop innovating because of the substantial penalty that they suffer for new and uncertain product introductions, as opposed to better established technologies. Once damages become excessively high, either product development will stagnate or firms will withdraw from the market altogether. Such withdrawal has been experienced in the United States private aircraft industry's production of private planes. [94]

A more prominent case in point is the effect of punitive damages on vaccines. Vaccines are vital to our physical well-being. Unfortunately, some people suffer side effects from vaccines, which create substantial liability burdens on the affected firms. The wave of litigation against vaccine producers led to a more than 50% reduction in the number of manufacturers of vaccines since 1968.[95] Presently, single-product monopolies are the producers of many major vaccines, including those for polio, mumps, measles, rabies, and rubella. In much the same way, many pediatric vaccines are now produced only by a single-product supplier, as other firms have exited the market.[96] The substantial increase in vaccine prices, far above the overall inflation rate, can also be traced to the rising role of liability costs.[97] In the usual economic context, a higher price means that fewer people will buy the product. The same is true of vaccines—as the cost of vaccines has increased, the rate of immunization in the United States has decreased.[98]

These economic harms are concrete and demonstrable. However, they have largely been ignored because punitive damages discussion has focused on punishment of corporations. The discussion should focus instead on what financial incentive we should provide to corporations to promote safety, recognizing that we benefit from corporate activity in many ways that are fundamental to our lives. Unfortunately, litigation, particularly in the case of severe losses that prompt punitive damages, tends to focus on the narrow context of the individual case rather than the broader effect on corporate incentives and the economy as a whole.

The high stakes punitive damages lottery can be influential even when punitive damages are not awarded. The threat of punitive damages can have a chilling effect on corporate behavior. A widely publicized recent case involves the Cabbage Patch doll, which chewed off the hair of a nine-year-old girl. The

---

94. *See* VISCUSI, *supra* note 45, at 8.

95. A general discussion of these issues appears in AMA Board of Trustees, *Impact of Product Liability on the Development of New Medical Technology*, 137 PROC. House of Delegates 79-91 (1988).

96. This effect is discussed in *Vaccine Injury Compensation: Hearing on H.R. 1780, H.R. 4777, and H.R. 5184 Before the Subcomm. on Health and the Env't of the House Comm. on Energy and Commerce*, 99th Cong. 115 (1986).

97. *See* AMA Board of Trustees, *supra* note 95, at 7. Further discussion appears in Gina Colata, *Litigation Causes Huge Price Increases in Childhood Vaccines*, 232 SCIENCE 1339 (1986).

98. This effect is discussed in Sara Rosenbaum, *Rationing Without Justice: Children and the American Health System*, 140 U. PA. L. REV. 1859, 1867-68 (1992).

company received substantial adverse publicity and the girl's parents filed suit asking for a $25 million punitive damages award.[99] In another alleged risk injury, an audience member at a New York performance of *Cats* filed a suit asking for $6 million in punitive and compensatory damages because one of the cats in the show (Rum Tum Tiger) asked her to dance, sat on her lap, and mussed up her hair.[100] Seemingly ridiculous claims for punitive damages can have chilling economic effects. Even if there are ultimately no jury punitive damages in such instances, the unpredictability of juries and the threat of punitive damages due to past punitive damages awards in other seemingly frivolous cases may lead firms to settle out of court to avoid the risk of a major financial penalty.

V. WHAT AILS THE SYSTEM?

Why do courts have difficulty making sound judgments regarding risk actions and associated punitive damages? Is jury error likely to be especially great for punitive damages as compared to, for example, compensatory damages? Does the risk assessment context create additional difficulties? Even if juries do not err more when assessing punitive damages, the larger stakes will make punitive damages a more pressing concern. However, juries' ability to make sound judgments on corporate risk actions is likely to be severely limited.

Decisions involving risk and uncertainty are notoriously difficult. People often make systematic mistakes in such situations because these situations impose much greater demands on the decisionmaker than choices involving certainty.[101] These errors in perception and decisions will affect the behavior of individuals within organizations as well as juries' perspective on accident cases. Which of the many errors in perception and decision will be pertinent depends in large part upon the character of the risk decision and the informational context.

A. OUTCOMES VERSUS PROBABILITIES

An important distinction exists between probabilities and consequences. The probability is the likelihood that the event will occur; the consequence represents the magnitude of the loss in an accident situation. A basic difficulty is that people may confuse the two components.[102] High losses, for example, might erroneously affect perceptions of the preventability of the accident. The existence of a substantial loss *ex post* does not, however, imply that the *ex ante* probability that the loss would have occurred was large or that this probability

99. *See* 25 Prod. Safety Liab. Rep. (BNA) 45-47 (Jan. 17, 1997).

100. *See* Bruce Weber, *Suit Says 'Cats' Character was Much Too Frisky*, N.Y. TIMES, Feb. 1, 1997, at A21-22. The cat who inflicted these alleged damages is no longer with the show.

101. For a review of some of these problems, see W. KIP VISCUSI, RATIONAL RISK POLICY (1998).

102. In general, jurors have difficulty assessing the magnitude of punitive damages. *See* Daniel Kahneman et al., *Shared Outrage and Erratic Awards: The Psychology of Punitive Damages*, 16 J. RISK & UNCERTAINTY 1, 47-84 (1998).

could have been manipulated significantly through preventive actions. Thus, the correct test of whether the firm took an efficient degree of care is whether the cost of the precaution was less than the change in the risk probability that would have resulted from the precaution, multiplied by the size of the accidental loss.[103] Making such a judgment requires, however, that juries take themselves back in time, before the accident, and make a risk judgment untainted by knowledge that the accident has in fact occurred.

B. HINDSIGHT BIAS[104]

A pitfall for juries operating after the fact is that they may incorrectly assess the firm's knowledge of the risk. With the benefit of hindsight they may infer that the company also had full information but simply did not care enough about safety to invest in a greater level of protection. Firms, however, lack the clairvoyant powers implicit in the common assumption that they should have anticipated all possible accidents.

Using the post-accident information as the yardstick for determining how companies should select their safety levels, a higher level of safety precautions will seem optimal compared to what one would have chosen based on the more imperfect information available before the accident occurred. The retrospective approach in the courtroom, consequently, will overstate the magnitude of the punitive damages required to align the incentives of the firm with those needed to produce efficient degrees of care. Hindsight bias of juries consequently leads to excessive penalties on firms when juries overstate the firm's degree of knowledge prior to the accident.

Ideally, a jury should assess the corporation's decision based on the degree of risk information available. Judging corporate behavior based on subsequent information rather than on that available at the time of the safety action will lead to an overstatement of the behavior's reprehensibility. Judge Easterbrook notes that juries are more prone to problems of hindsight bias than corporations, which are more likely to focus correctly on the prospective effects of actions. As Judge Easterbrook observes: "The 'ex post' perspective of litigation exerts a hydraulic force that distorts judgment."[105]

Putting aside such hindsight biases is inherently difficult for juries. What was the state of information at the time of the decision, and will the jury use this as the reference point? After the fact, if an accident has occurred, the retrospective accident probability will be 1.0. However, the appropriate reference point for assessing whether the firm has met its obligations is whether it made the

103. For fuller articulation of the risk-utility formulation, *see* VISCUSI, *supra* note 45. This concept has its roots in the "Learned Hand Formula." A company is liable if the cost of precaution is less than the probability of accident multiplied by the size of the loss. *See* United States v. Carrol Towing Co., 159 F.2d 169 (2d Cir. 1947).

104. For a fuller analysis, see REID HASTIE ET AL., A STUDY OF JUROR AND JURY JUDGMENTS IN CIVIL CASES: HINDSIGHT EFFECTS ON LIABILITY JUDGMENTS (1998).

105. Carroll v. Otis Elevator Co., 896 F.2d 210, 215 (7th Cir. 1990) (Easterbrook, J., concurring).

appropriate *ex ante* risk tradeoff given the available information and the economically feasible set of corporate protective actions. These corporate actions include both changes in technology and operating procedures that could affect human behavior.

C. IRRATIONAL RESPONSE TO SMALL PROBABILITIES AND PREMIUMS FOR ZERO RISK

Many potential biases in risk perception stem from the character of the risk. For low probability events that have been called to their attention, people usually overestimate the level of the risk.[106] Small *identified* risks tend to be overestimated, while very large risks often are underestimated. To the extent that accidents and major catastrophes involve small probabilities, there will be a tendency to overestimate their likelihood once these possibilities are called to people's attention. Whereas when people are completely unaware of the risk, they may underestimate the extent of the hazard.[107]

The practical consequences of this effect for jury assessments of corporate risk actions is that people will perceive identified risks as having a higher probability of an accident than was the case *ex ante*. Companies consequently will attempt to avoid these risks more than they would if the risk levels were properly understood. After the fact, the hazards will be identified. Since juries operate on an *ex post* basis, there will be a tendency of juries to over-assess the likelihood of accidents involving small probabilities, reflecting the observed systematic pattern of biases regarding the level of the risk. Overcoming this bias may be difficult for juries to do.

A corollary to this overestimation of small probabilities is that people will be willing to pay a premium for the certainty of getting to a situation of zero risk.[108] Since people overestimate small probabilities, decreasing the risk from a small probability to zero will have a greater effect on the perceived risk reduction than a risk decrease of the same magnitude that did not reach zero. Studies of consumer valuation of risk reduction, for example, have indicated that reducing the risk of injury from household chemical products from 5/10,000 to zero has a much greater perceived value to consumers than decreasing the risk level from 15/10,000 to 5/10,000.[109] The latter risk decrease represents twice the risk decrease associated with zero risk, but consumers value it less. Whereas economic predictions would indicate that people should have a diminishing willingness to pay for successive reductions in risk, in practice consumers place an excessively high value on the last reduction in risk that decreases

106. *See* BARUCH FISCHHOFF ET AL., ACCEPTABLE RISK (1981).

107. *See* HOWARD KUNREUTHER ET AL., DISASTER INSURANCE PROTECTION: PUBLIC POLICY LESSONS (1978).

108. In practice there are few activities that are truly zero risk, though some components may have negligible risks.

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

the risk to zero. The appeal of zero risk leads government officials to declare that our food is "safe" rather than indicating, for example, that only a small number of Americans will be killed by food poisoning this year.

This perceptional bias may also influence jury behavior. To the extent that juries also exhibit a certainty premium, they will value elimination of the risk by a company by more than is warranted given the extent of the risk reduction. Similarly, departures from zero risk will be viewed as more grievous offenses than they are. Juries will not appropriately value the company's efforts to reduce the risk to a small, but nevertheless nonzero amount. This latter relationship arises because the bias in risk perceptions in terms of overestimating small probabilities in effect flattens the relationship between actual risks and perceived risks so that the public perceives a smaller reduction in risk than has actually occurred.[110] Figure 1 illustrates this relationship for mortality risks. People overestimate small risks and underestimate large risks. The perceived probability curve is flatter than the actual probability curve, that is, the 45-degree line. Juries consequently underestimate the extent of the risk reduction a company has achieved and overestimate the importance of further risk reductions to a zero risk level. The underestimation of corporate risk-reduction efforts leads to jury bias against corporate defendants in cases involving risk and uncertainty.

D. IRRATIONAL RESPONSE TO NOVEL RISKS

The character of a risk also plays an important role. People tend to overreact to risks associated with new technologies, risks that represent increases from accustomed risk levels, risks outside of their personal control, and risks associated with highly publicized events.[111] People may also confuse probabilities and outcome amounts, rating the probability as higher if the loss is severe.[112]

What is quite striking is that almost all of these elements will be present in many punitive damages cases involving accidents or illnesses. Consider, for example, litigation involving breast implants and asbestos. Breast implants involve a new technology which presents new risks. The women who received these implants incurred risks that were then outside of their personal control. These risks have also generated considerable publicity. Asbestos risks likewise have been highly publicized, are outside of the control of the exposed individual, and involve risks that workers were not fully cognizant of when they incurred the risk because of evolving scientific knowledge. People tend to overreact to such risks, producing excessive responses by juries in their role of assessing liability and punitive damages.

---

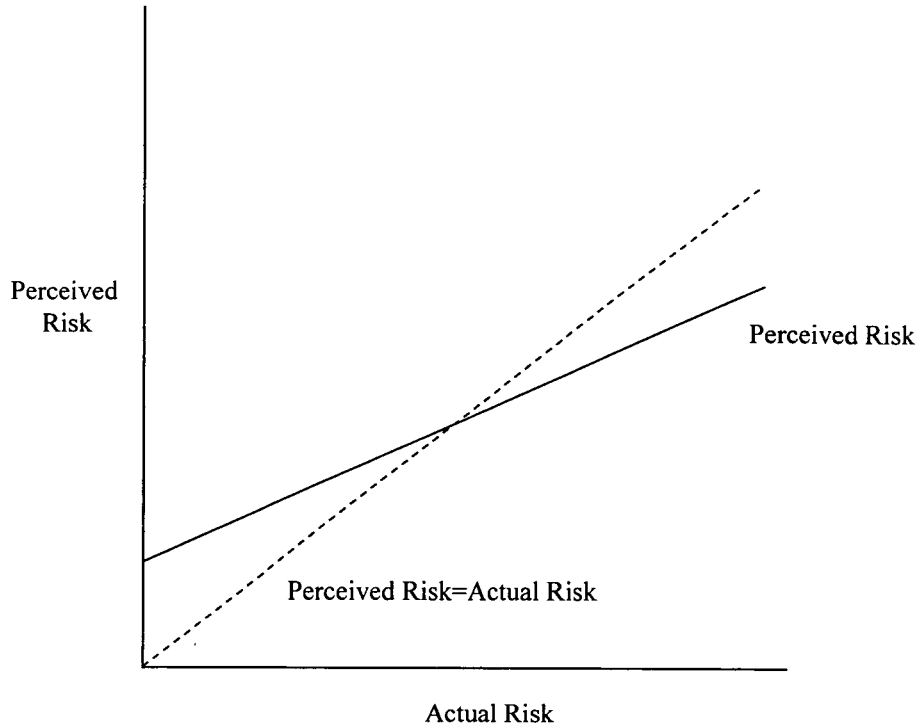
110. *See* VISCUSI, *supra* note 32.

111. For documentation of these phenomena, see FISCHHOFF ET AL., *supra* note 106; VISCUSI, *supra* note 32; W. KIP VISCUSI ET AL., 4 U.S. DEP'T OF THE INTERIOR, EVALUATION OF ENVIRONMENTAL IMPACT, FINAL ENVIRONMENTAL IMPACT STATEMENT PROPOSED TRANS-ALASKA PIPELINE 471 (1972).

112. *See* ANIL GABA & W. KIP VISCUSI, INDIVIDUAL DIFFERENCES IN SUBJECTIVE RISK THRESHOLDS, 44 MGMT. SCI. 801 (1998).

Figure 1

Relation between Perceived and Actual Risk Levels



E. IRRATIONAL RESPONSE TO UNCERTAIN RISKS

A final form of irrationality that is potentially influential is the well-known Ellsberg paradox.[113] People prefer a precisely understood chance of winning a prize to an equivalent "soft" probability that is uncertain. There is a counterpart to this effect in the case of losses. Studies of individual attitudes toward ambiguous risks and environmental damage indicate that people are ambiguity averse.[114] Precisely understood risks of adverse outcomes are preferred to more ambiguous uncertainties of an adverse environmental outcome even though the average probability of an adverse outcome is the same in each instance. For example, people would rather face a known chance of an adverse consequence of 2/1000 rather than a 50/50 chance that the risk is either 1/1000 or 3/1000.

This pattern of ambiguity aversion will tend to make companies more cautious in situations of ambiguity than they might be in situations of known

113. *See* Daniel Ellsberg, *Risk, Ambiguity, and the Savage Axioms*, 75 Q.J. ECON. 643 (1961).

114. *See* W. Kip Viscusi et al., *Communication of Ambiguous Risk Information*, 31 THEORY & DECISION 159 (1991); *see also* W. Kip Viscusi & Wesley A. Magat, *Bayesian Decisions with Ambiguous Belief Aversion*, 5 J. RISK & UNCERTAINTY 371 (1992). The latter language is from *BMW of North America, Inc. v. Gore*, 517 U.S. 559 (1996).

risk. However, if they are unfortunate enough to experience an adverse outcome despite their precautions, juries are likely to be particularly unforgiving. Juries are particularly likely to be excessively demanding in situations of uncertainty to the extent that they treat the risks incurred by the company as being greater because they are uncertain. Thus, we are led to a perhaps paradoxical result. Situations of uncertainty, in which precautionary behavior will be particularly difficult for companies because of the absence of well-defined risks, should have more lenient liability standards. The tendency, however, for people (and thus juries), to overestimate uncertain risks means that they will treat corporate defendants particularly harshly in situations of uncertain risk.

Again, the basic difficulty that arises with respect to this and other errors in jury behavior is that jurors are not acting as fully rational risk decisionmakers before the fact, but rather as critics with quite different information after the fact. From this external reference point, jurors cannot distinguish between judgments that are rational regarding precautions, but that may be in error, and malicious acts. The result may be jury anger with a company's performance that leads to a punitive sanction.

VI. REFORMING PUNITIVE DAMAGES

A. THE LIMITATIONS OF PUNITIVE DAMAGES CEILINGS

Current punitive damages reform efforts have been largely preoccupied with the search for an elusive ideal ratio of punitive damages to compensatory damages. Punitive damages have been the subject of a variety of state-level punitive damages reforms that have either established punitive damages caps or set ratios between punitive damages and compensatory awards.[115] Patricia Born and I have shown that damages caps have been the most effective liability reforms.[116] However, punitive damages ceilings and multipliers have a seemingly arbitrary element in that there is no apparent basis for setting such quantitative guidelines.[117] Moreover, caps may be counterproductive by serving as an anchor, setting a target for juries to meet.[118]

The United States Supreme Court has indicated that the extent of the punitive damages amount should be related to the compensatory damages level, but has resisted strict numerical formulas. In upholding the punitive damages award in

115. For a summary of these various reforms, see Alexander Volokh, *Punitive Damages and Environmental Law: Rethinking the Issues*, 213 Reason Foundation Policy Study 20 n.91 (1996), especially Table 6. Similar punitive damages reforms have been considered by Congress, though no Federal punitive damages reform has been enacted.

116. *See* Viscusi & Born, *supra* note 4.

117. For discussion of the merits and disadvantages of ceilings and multipliers, see 2 AMERICAN LAW INSTITUTE, *supra* note 2, at 258-59.

118. *See* Michael Saks et al., *Reducing Variability in Civil Jury Awards*, 21 L. & HUM. BEHAV. 243 (1997).

Pacific Mutual Life Insurance Co. v. Haslip, the Court concluded: "We are aware that the punitive damages award in this case is more than 4 times the amount of compensatory damages.... While the monetary comparisons are wide and, indeed, may be close to the line, the award here did not lack objective criteria."[119] In *TXO Production Corp. v. Alliance Resources Corp.*, the Court upheld an award that was more than 526 times the compensatory damages amount:

> In support of its submission that this award is 'grossly excessive,' TXO places its primary emphasis on the fact that it is over 526 times as large as the actual damage awards.... While petitioner stresses the shocking disparity between the punitive award and the compensatory award, that shock dissipates when one considers the potential loss to respondents, in terms of reduced or eliminated royalty payments, had petitioner succeeded in its illicit scheme.[120]

In *BMW of North America, Inc. v. Gore*, the Court overturned a punitive damages award that was 1000 times as large as the compensatory damages amount, but the Court did not overturn the award because it exceeded some numerical guideline for propriety: "As in *Haslip*, we are not prepared to draw a bright line marking the limits of a constitutionally acceptable punitive damages award."[121] Rather, the problem was that the award did not reflect the reprehensibility of the conduct of BMW or the level of damages needed to provide the appropriate corporate incentives.

The legal reform advocated here goes beyond any punitive damage formulas or caps. All such efforts are arbitrary. Their underlying impetus is that punitive damages are out of control and that we need some means to impose discipline. Picking a cap of $1 million has no more economic justification than any other target number, whether $500,000 or $5 million.

If a legal policy instrument is fundamentally flawed, the solution is to eliminate it rather than to restrict the harm it creates. Rather than set arbitrary ceilings on punitive damages, an approach that better addresses the net social costs of punitive damages is to abolish them altogether. Doing so will sacrifice no significant deterrence and will eliminate all of the punitive damages ills that have motivated the arbitrary cutoffs on punitive awards.

B. A PROPOSAL TO ABOLISH PUNITIVE DAMAGES

Do punitive damages pass a benefit-cost test? Put somewhat differently, is there any basis whatsoever for believing that the benefits derived from punitive damages exceed the wide range of costs generated by punitive awards? The

119. Pacific Mut. Life Ins. Co. v. Haslip, 499 U.S. 1 (1991).
120. TXO Prod. Corp. v. Alliance Resources Corp., 509 U.S. 443, 459-64 (1993).
121. BMW of N. Am., Inc. v. Gore, 517 U.S. 559, 585 (1996).

benefits side of the ledger indicates no significant gains to society. Compensatory damages do serve an essential role in a wide variety of instances by compensating victims and providing incentives for deterrence. Abolishing punitive damages would not diminish the current role of compensatory damages; such awards would still meet the needs of accident victims and create incentives for deterrence.

The main theoretical exceptions to the adequacy of compensatory damages for deterrence involve a fairly narrow range of circumstances. Concerns about punishing malicious behavior are pertinent mostly to individual action, and only rarely to corporate risk decisions. Similarly, enforcement error is not a salient problem for corporate actions, which are typically readily identifiable in the case of the large-scale losses for which punitive damages might be awarded. Punitive damages for corporate decisions have traditionally played a role in major catastrophes or other cases of substantial individual loss, and in these instances the identity of the corporation is usually well known. Moreover, assessing the enforcement error probability entails intractable statistical judgments likely beyond any jury's competence.

The final instance in which punitive damages might be warranted is for outcomes such as fatalities in which incentives beyond monetary equivalents are needed to create adequate deterrence. However, punitive damages in such instances create inefficiencies. They provide excessive insurance to society, by awarding accident victims a damages payment much larger than they need and more than the victims would voluntarily choose if given the option of purchasing an individual insurance policy for such losses. Punitive damages are also rarely awarded in the case of outcomes such as fatalities because corporations seldom completely ignore safety concerns even though they may occasionally fall short of an adequate level of safety. Compensatory damages awards, regulatory sanctions, and market-based penalties can bolster incentives in this instance.

The costs of punitive damages are well established. Punitive damages are highly uncertain and constitute a dangerous lottery for firms engaged in potentially risky lines of corporate activity. As a society, we want to encourage risk-taking, such as the development of new pharmaceutical products and new lines of commerce. In the absence of such progress, our standard of living will fall, with attendant adverse effects on our health. Excessive punitive damages awards depress innovation and create excessive incentives for safety that may in fact increase the risks we face.

The widespread dissatisfaction with the role of punitive damages in the liability system is well established. This dissatisfaction has continued despite more than a decade of state-level punitive damages reform efforts. These reforms invariably constrain the level of punitive damages rather than provide more subtle guidance to juries about when punitive damages are warranted based upon concerns raised in the law and economics literature. The reason

why the legislative reforms have been unable to provide such guidance is that there is simply no well-defined set of circumstances in which a compelling case for punitive damages exists. For this reason, I propose that punitive damages awards be eliminated for corporate risk and environmental decisions.

Would such a proposal leave us only with compensatory damages? From a tort-centric perspective, tort law, of course, is the principal source of incentives for corporate behavior. However, corporations operate in a much broader environment than the tort system. Corporations deal in markets, which generate powerful incentives for safety. The workers who are hired and who bear risks on the job are hired in a market. Similarly, the products the corporation sells go to consumers who themselves respond to risk levels. Public reactions and the adverse repercussions that result after major corporate transgressions will generate additional losses to the firm that bolster these financial incentives.

Governmental institutions also impose a wide variety of regulatory requirements that influence corporations' risk and environmental decisions. These regulations typically impose more stringent requirements than a person would select to meet an efficient level of safety. Moreover, agencies can impose regulatory penalties even when there is no accident, thus making it possible to create incentives in a broader range of circumstances. Consequently, corporations operating within a regime of government regulations consequently should not be exposed to punitive damages. If a company's actions violate a regulation, then we can rely upon the sanctions imposed by regulatory agencies to foster the appropriate safety incentives. Because compensatory damages would augment these regulatory sanctions, as would any market responses, there would be powerful incentives for safety, even for regulatory violators, without the imposition of punitive damages.

Even at a hypothetical level, making a case for punitive damages is hard. With some effort, scholars can construct hypothetical examples of situations meriting punitive awards such as those involving enforcement error. Even for narrowly defined hypothetical cases there is no empirical evidence whatsoever that juries can make reliable judgments on the subtle statistical and economic issues involved. Moreover, there is a wealth of empirical evidence documenting the difficulties people have in judging risky actions—biases that typically will be prejudicial to corporate defendants.

The legal policy choice does not permit us to have omniscient juries apply tightly circumscribed punitive damages rules generated by highly specialized economic models. If punitive damages remain a potential form of damages, there is no reason to believe that juries will perform more satisfactorily in the future than they have after a decade of punitive damages reform.

Punitive damages taint the integrity of our judicial system. Legal observers such as Supreme Court Justice O'Connor have recognized the randomness of

jury behavior.[122] Punitive damages generate no statistically significant deterrent effects, but the unpredictable chance of catastrophic losses can generate substantial harm. If one were to apply the usual tools of policy analysis pertinent to judging government expenditure programs and regulations, the required policy test would be simple. Do punitive damages create more good for society than harm? Punitive damages clearly fail any conceivable test of efficacy. The most sensible legal reform is to abolish punitive damages for corporate safety and environmental tort.

APPENDIX: STATISTICAL ANALYSIS OF DETERRENCE EFFECTS

Tables 1-4 presented comparison of various mean-risk measures for states with and without punitive damages. These states may, of course, differ in more dimensions than punitive damages. This section presents more detailed multivariate regression analysis counterparts that control statistically for the effect of punitive damages given a variety of other variables, such as the industry mix. For ease of comparison, the regression table numbering in the Appendix follows that in the text. The results mirror those in the simpler means tests, and in some respects are even stronger. Punitive damages have no significant effect in generating deterrence for any of the safety measures considered. Some of the beneficial deterrent effects in the analysis of the means no doubt is attributable to other economic influences.

Table 1A focuses on the total number of chemical accidents and the total number of such accidents involving injury and death. These regressions control explicitly for the size of the population, the number of manufacturing employees per capita household income, and the Republican presidential vote. However, they also include measures of the extent of chemical industry activity, including the number of employees in the chemical industry, the oil and gas extraction industry, and oil refining. While a variety of these industry mix variables are consequential as predictors of chemical accidents, states with no punitive damages do not perform differently in any significant manner. The omitted punitive damages variable is for states with no punitive damages permitted. These states consequently serve as the reference point for assessing the role of punitive damages in all the subsequent regressions. The main question to be addressed is whether there is evidence of a deterrent effect in any of the three punitive damages regime states for which insuring punitive damages is permitted, states where such insurance is not permitted, and states where the status of such insurance has yet to be resolved.

The regression analysis in Table 1A for toxic chemical accidents will follow the same general pattern as all subsequent analyses. I will first estimate a single model including the three punitive damages variables and a state scale measure

122. *See* Pacific Mut. Life Ins. Co. v. Haslip, 499 U.S. 1, 45-6 (1991) (O'Connor, J., dissenting).

such as population. The equation will then be expanded to include other variables of potential influence, such as those reflecting industry mix and political factors. The results for toxic chemical accidents in Table 1A do not indicate any significant influences for any of the three punitive damages-insurance regimes.

Table 1A

Regression Results for 1988-1992 Toxic Chemical Accidents and Toxic Chemical Accidents Involving Injury or Death

Variable	Toxic Chemical Accidents		Toxic Chemical Accidents Involving Injury or Death	
Intercept	-239.009	492.084	-16.213	2.268
	(303.400)	(407.554)	(17.228)	(23.303)
Population	1.45×10^{-4}***	2.91×10^{-5}	9.75×10^{-6}***	1.86×10^{-6}
	(0.14×10^{-4})	(2.22×10^{-5})	(0.80×10^{-6})	(1.27×10^{-6})
State has punitives, but ambiguously insurable punitives indicator	427.263	-30.197	14.916	2.892
	(359.881)	(180.016)	(20.435)	(10.293)
State has insurable punitives indicator	301.412	42.918	11.796	2.906
	(313.636)	(152.688)	(17.809)	(8.730)
State has uninsurable punitives indicator	-51.666	12.525	5.952	14.836
	(319.234)	(154.400)	(18.127)	(8.828)
Manufacturing Employees		0.603*		0.076***
		(0.336)		(0.019)
Per Capita Household Income		-0.015*		-0.0003
		(0.008)		(0.0005)
Republican Presidential Vote (1992 %)		3.856		0.312
		(5.533)		(0.316)
Chemical Employees (SIC 28)		-2.083		-0.726***
		(2.715)		(0.155)
Oil and Gas Extraction Employees (SIC 13)		-2.722		-1.305***
		(3.172)		(0.181)
Oil Refining Employees (SIC 291)		157.272***		12.896***
		(18.723)		(1.071)
$\bar{R}^2$	0.687	0.931	0.771	0.949

Note: standard errors in parentheses. Employment figures are in thousands.

*Significant at 90% confidence level.
**Significant at 95% confidence level.
***Significant at 99% confidence level.

The toxic release regression results in Table 2A present analyses of the determinants of facilities reporting toxic discharges, forms reporting toxic discharges, forms reporting toxic discharges, reduction in surface water discharges, and reduction in total releases. The other variables include measures from earlier equations as well as toxic facilities per capita. In some cases the

explanatory power of the regressions is very low. Since the object of the estimation is to test whether punitive damages matter, not to predict these toxic releases, the absence of a strong predictive relationship for the some of the toxic discharge variables is not a major concern. The toxic release regressions also fail to indicate a deterrent role of punitive damages. For the most part, the three punitive damages regimes have no significant effect. There are no significant effects in Panel A. The only exception in Panels A, B, and C of Table 2A is that with respect to the total percent reduction in surface water discharges there is one significant effect, which goes in the opposite direction needed for a deterrent effect, as it indicates less of a reduction in discharges when there are punitives, but they are not insurable. However, in the fuller version of the statistical model there is no such influence. Panel C of Table 2A includes no statistically significant insurance variable effects. Overall, the punitive damages regime states do not differ in any significant manner for the Toxic Release Inventory data.

Table 2A

Regression Results for Toxic Release Inventory

Panel A: Sites Reporting Source Reduction Activities in 1992

Variable	Percent of Facilities Reporting Reduction Activities		Percent of Forms Reporting Reduction Activities	
Intercept	0.364***	0.602***	0.278***	0.531***
	(0.032)	(0.114)	(0.033)	(0.107)
State has punitives, but ambiguously insurable punitives indicator	-0.014	0.025	-0.022	-0.027
	(0.040)	(0.038)	(0.041)	(0.036)
State has insurable punitives indicator	0.0028	0.047	-0.031	-0.024
	(0.0360)	(0.034)	(0.037)	(0.032)
State has uninsurable punitives indicator	0.0021	0.024	0.005	0.022
	(0.0341)	(0.031)	(0.035)	(0.029)
TRI facilities per 100,000 population		-0.012**		-0.014***
		(-0.005)		(0.004)
Manufacturing employees per 100,000 population		$1.98e^{-5}$**		$2.38e^{-5}$***
		($0.82e^{-5}$)		($0.77e^{-5}$)
Household Income per capita		$-2.87e^{-6}$		$-2.74e^{-6}$
		($2.08e^{-6}$)		($1.96e^{-6}$)
Republican Presidential Vote (1992 %)		-0.0053***		-0.006***
		(0.0018)		(0.002)
$\bar{R}^2$	0.009	0.314	0.042	0.435

Note: standard errors in parentheses. Observations weighted by state population.

For sources, see Table 6A, *infra*.

*Significant at 90% confidence level.
**Significant at 95% confidence level.
***Significant at 99% confidence level.

Panel B: Changes in Surface Water Discharges Reported in 1992 Toxic Release Inventory

Variable	Percent Reduction in Surface Water Discharges from 1988 to 1992		Percent Reduction in Surface Water Discharges from 1990 to 1992	
Intercept	38.399	-127.897	27.540	-84.428
	(100.480)	(415.575)	(87.515)	(350.535)
State has punitives, but ambiguously insurable punitives indicator	-197.371	-152.063	-204.937*	-145.391
	(125.638)	(140.004)	(109.426)	(118.017)
State has insurable punitives indicator	-13.735	44.804	-12.954	50.666
	(111.757)	(123.456)	(97.982)	(104.669)
State has uninsurable punitives indicator	-16.762	8.755	-31.050	0.228
	(106.050)	(113.921)	(92.366)	(95.976)
TRI facilities per 100,000 population		-3.138		-3.660
		(16.793)		(14.156)
Manufacturing employees per 100,000 population		0.014		0.019
		(0.030)		(0.025)
Household Income per capita		0.007		0.0057
		(0.008)		(0.0064)
Republican Presidential Vote (1992 %)		-4.291		-5.718
		(6.637)		(5.593)
$\overline{R}^2$	0.043	0.014	0.076	0.092

Note: standard errors in parentheses. Observations weighted by state population.

For sources, see Table 6A, *infra*.

*Significant at 90% confidence level.
**Significant at 95% confidence level.
***Significant at 99% confidence level.

Table 3A presents a series of two sets of regressions for which the dependent variables are the per capita fatality rates from medical misadventures and all accidents. In each case, the first regression reported includes only an intercept and a set of indicator or dummy variables for whether the state permits punitive damages and their insurability status. The second set of regression also includes the per capita manufacturing employees to control for industry mix, the per capita household income to control for wealth effects, and the percent Republican presidential vote in 1992 to control for political influences. The medical misadventures equation also includes the number of physicians per capita.

In none of the equations in Table 3A is there evidence that punitive damages reduce risk. The only statistically significant influence is that the total accidental death rate is higher in the states with insurable punitive damages, which is the opposite of a deterrence relationship.

Table 4A presents analogous regression results for the per capita value of different insurance premiums, which are the counterpart of the mean estimates in Table 2. As before, the four measures are the per capita values of total insurance premiums, medical malpractice premiums, product, and other liability

Panel C: Changes in Total Toxic Releases Reported in 1992 Toxic Release Inventory

Variable	Percent Reduction in Total Toxic Releases from 1988 to 1992		Percent Reduction in Total Toxic Releases from 1990 to 1992	
Intercept	31.207***	6.568	25.222***	40.997
	(8.304)	(31.959)	(7.035)	(27.138)
State has punitives, but ambiguously insurable punitives indicator	10.171	5.762	-12.522	-7.808
	(10.384)	(10.767)	(8.797)	(9.143)
State has insurable punitives indicator	-4.109	-2.050	-10.937	-3.028
	(9.236)	(9.494)	(7.831)	(8.062)
State has uninsurable punitives indicator	9.449	7.506	-1.068	1.843
	(8.765)	(8.761)	(7.425)	(7.439)
TRI facilities per 100,000 population		0.752		-1.481
		(1.291)		(1.097)
Manufacturing employees per 100,000 population		-0.0025		0.0022
		(0.0023)		(0.0019)
Household Income per capita		0.0012**		$2.13e^{-4}$
		(0.0006)		($4.97e^{-4}$)
Republican Presidential Vote (1992 %)		-0.122		-0.764*
		(0.510)		(0.433)
$\overline{R}^2$	0.101	0.167	0.097	0.175

Note: standard errors in parentheses. Observations weighted by state population.

For sources, see Table 6A, *infra*.

*Significant at 90% confidence level.
**Significant at 95% confidence level.
***Significant at 99% confidence level.

premiums. The explanatory variables parallel those included in Table 3A. All three of the punitive damages variables in Table 4A are statistically significant. To the extent that punitive damages have a deterrent role, the risk levels and the premium amounts should be lower in the punitive damages states. The competing effect is that the prospect of punitive damages may boost premium levels for any given level of risk. However, it is not states with insurable punitive damages that have higher premium rates but the other two punitive damages state groupings.

For reference, Table 5A summarizes the means and standard deviation of the variables used, and Table 6A provides the data sources.

Table 3A

Regression Results for Accidental Death Rates Per Capita

Variable	Medical Misadventures		All Accidental Deaths	
Intercept	0.952***	-0.447	30.836***	52.919***
	(0.219)	(0.908)	(3.335)	(9.607)
State has punitives, but ambiguously insurable punitives indicator	-0.367	-0.396	0.821	-1.595
	(0.274)	(0.279)	(4.170)	(3.250)
State has insurable punitives indicator	0.352	0.201	11.027***	6.185**
	(0.244)	(0.251)	(3.709)	(2.885)
State has uninsurable punitives indicator	0.045	-0.048	0.271	-1.228
	(0.231)	(0.234)	(3.520)	(2.666)
Manufacturing Employees per 100,000 population		2.92×10^{-5}		-4.79×10^{-4}
		(2.60×10^{-5})		(3.04×10^{-4})
Household Income per capita		-1.34×10^{-5}		-8.40×10^{-4}***
		(1.59×10^{-5})		(1.76×10^{-4})
Republican Presidential Vote (1992 %)		0.029*		0.298*
		(0.015)		(0.149)
Physicians per capita		0.0029**		
		(0.0013)		
$\bar{R}^2$	0.184	0.231	0.366	0.645

Note: standard errors in parentheses.

For sources, see Table 6A, *infra*.

*Significant at 90% confidence level.
**Significant at 95% confidence level.
***Significant at 99% confidence level.

Table 4A

Insurance Premium Regression Results

Panel A: Total Insurance and Medical Malpractice Insurance Premiums

Variable	Total Insurance Premiums		Medical Malpractice Premiums	
Intercept	983.739***	345.809	18.856***	-9.403
	(81.761)	(272.208)	(5.800)	(18.403)
State has punitives, but ambiguously insurable punitives indicator	45.089	1.719	0.196	-6.242
	(101.765)	(83.369)	(7.219)	(5.636)
State has insurable punitives indicator	-64.696	-26.772	1.033	-2.586
	(90.825)	(75.165)	(6.443)	(5.082)
State has uninsurable punitives indicator	52.910	2.484	6.666	-0.970
	(86.323)	(70.190)	(6.124)	(4.745)
Manufacturing Employees per 100,000 population		-0.011		-0.0011**
		(0.008)		(0.0005)
Household Income per capita		0.012**		-3.15×10^{-4}
		(0.005)		(3.23×10^{-4})
Republican Presidential Vote (1992 %)		1.408		0.478
		(4.478)		(0.303)
Physicians per 100,000 population		1.200***		0.149***
		(0.396)		(0.027)
$\bar{R}^2$	0.060	0.429	0.024	0.461

Note: standard errors in parentheses.

*Significant at 90% confidence level.
**Significant at 95% confidence level.
***Significant at 99% confidence level.

Panel B: Product Liability and Other Liability Premiums

Variable	Product Liability Premiums		Other Liability Premiums	
Intercept	7.654***	0.588	76.514***	77.122*
	(1.156)	(3.180)	(12.519)	(41.161)
State has punitives, but ambiguously insurable punitives indicator	0.792	2.517**	9.396	14.078
	(1.439)	(1.068)	(15.582)	(13.831)
State has insurable punitives indicator	-0.871	0.657	-9.487	5.526
	(1.284)	(0.951)	(13.907)	(12.315)
State has uninsurable punitives indicator	1.284	2.161**	15.036	17.342
	(1.221)	(0.880)	(13.217)	(11.390)
Manufacturing Employees per 100,000 population		4.93×10^{-4}***		7.43×10^{-5}
		(1.00×10^{-4})		(129.24×10^{-5})
Household Income per capita		1.98×10^{-4}***		0.0019**
		(0.58×10^{-4})		(0.0008)
Republican Presidential Vote (1992 %)		-0.105**		-1.794***
		(0.050)		(0.641)
$\bar{R}^2$	0.127	0.558	0.144	0.380

Note: standard errors in parentheses.

*Significant at 90% confidence level.
**Significant at 95% confidence level.
***Significant at 99% confidence level.

Table 5A Summary of Variables Means (Std. Deviations)

Variable	Mean	Std. Dev.
Employees in Manufacturing Sector, 1992 (1,000s)	358.078400	383.595900
Employees in the Oil and Gas Extraction Industry (SIC 13), 1996 (1,000s)	5.464706	21.851420
Employees in the Oil Refining Industry (SIC 291), 1996 (1,000s)	1.109804	4.374529
Employess in the Chemicals and Allied Products Industry (SIC 28), 1996 (1,000s)	19.664710	24.921650
Indicator which equals 1 for states without punitive damages	0.078431	0.271524
Indicator which equals 1 for states with insurable punitive damages	0.470588	0.504101
Indicator which equals 1 for states with uninsurable punitive damages	0.352941	0.482640
Indicator which equals 1 for states with uncertain insurance of punitives	0.117647	0.325396
Medical Malpractice Premiums, per capita (1995)	21.494960	11.611970
Medical Misadventures Deaths Per 100,000 Population, 1994	1.103261	0.519397
Motor Vehicle Accident Deaths Per 100,000 Population, 1994	17.868230	5.744419
Other Liability Premiums, per capita (1995)	83.748800	35.775910
Per Capita Employees in Manufacturing Sector, 1992	0.065000	0.026700
Per Capita Household Income, 1994	32,440.040000	4,851.375000
Proportion of TRI Facilities Reporting Reduction Activities	0.366000	0.090010
Proportion of TRI Forms Reporting Reduction Activities	0.259706	0.069365
Percent Reduction in Surface Water Discharges from 1988 to 1992	(65.743860)	454.705200
Percent Reduction in Surface Water Discharges from 1990 to 1992	(43.913040)	380.355500
Percent Reduction in Total Toxic Releases from 1988 to 1992	33.526780	25.755110
Percent Reduction in Total Toxic Releases from 1990 to 1992	16.880070	17.135410
Physicians Per 100,000 Population, 1994	219.568600	79.608360
Population, 1995	5,154,699.000000	5,741,453.000000
Product Liability Premiums, per capita (1995)	7.800801	2.622146
Ratio of TRI facilities to 1995 population in thousands	0.090300	0.042000
Republican vote in 1992 Presidential Election	37.668630	6.419486
Total Accidental Deaths Per 100,000 Population, 1994	38.127320	8.818885
Total Insurance Premiums, per capita (1995)	1,005.691000	199.321900
Toxic Chemical Accidents Involving Injury or Death, 1988-1992	41.941180	60.336200
Toxic Chemical Accidents, 1988-1992	664.705900	908.791800

Table 6A

Data Sources for Statistical Analysis

Data	Source
Total accident deaths and medical misadventures deaths (per 100,000 population)	NATIONAL SAFETY COUNCIL, ACCIDENT FACTS 26-27 (1997).
Employees in the chemicals and allied products industry (SIC 28), employees in the oil and gas extraction industry (SIC 13), and employees in the oil refining industry (SIC 291) for 1996.	*State and Area Employment, Hours and Earnings,* Bureau of Labor Statistics, 1997 (on-line searchable series catalog, http://146.142.4.24/cgi-bin/dsrv?sa).
Employees in Manufacturing Sector during 1992.	U.S. BUREAU OF THE CENSUS, STATISTICAL ABSTRACT OF THE UNITED STATES: 1996, at 740 tbl. 1213 (116th ed. 1996).
Manufactures Summary for 1992.	U.S. BUREAU OF THE CENSUS, STATISTICAL ABSTRACT OF THE UNITED STATES: 1996, at 740 tbl. 1213 (116th ed. 1996).
Per Capita Household Income for 1994.	U.S. BUREAU OF THE CENSUS, STATISTICAL ABSTRACT OF THE UNITED STATES: 1996, at 465 tbl. 716 (116th ed. 1996).
Money Income of Households (median income, by state, in constant 1994 dollars: 1984 to 1994).	U.S. BUREAU OF THE CENSUS, STATISTICAL ABSTRACT OF THE UNITED STATES: 1996, at 465 tbl. 716 (116th ed. 1996).
Physicians per 100,000 population for 1994.	U.S. BUREAU OF THE CENSUS, STATISTICAL ABSTRACT OF THE UNITED STATES: 1996, at 124 tbl. 181 (116th ed. 1996).
Active nonfederal physicians and nurses, by state, for 1994.	U.S. BUREAU OF THE CENSUS, STATISTICAL ABSTRACT OF THE UNITED STATES: 1996, at 124 tbl. 181 (116th ed. 1996).
1995 population	U.S. BUREAU OF THE CENSUS, STATISTICAL ABSTRACT OF THE UNITED STATES: 1996, at 28 tbl. 27 (116th ed. 1996).
Resident population, states, for 1970-1995.	U.S. BUREAU OF THE CENSUS, STATISTICAL ABSTRACT OF THE UNITED STATES: 1996, at 28 tbl. 27 (116th ed. 1996).
Republican vote in 1992 presidential election.	U.S. BUREAU OF THE CENSUS, STATISTICAL ABSTRACT OF THE UNITED STATES: 1996, at 271 tbl. 435 (116th ed. 1996).
Popular vote cast for president, by political party, states, for 1988 and 1992.	U.S. BUREAU OF THE CENSUS, STATISTICAL ABSTRACT OF THE UNITED STATES: 1996, at 271 tbl. 435 (116th ed. 1996).
Surface water discharges and total toxic releases in 1988, 1990, 1992.	U.S. ENVIRONMENTAL PROTECTION AGENCY OFFICE OF POLLUTION PREVENTION AND TOXICS, 1992 TOXICS RELEASE INVENTORY (TRI) PUBLIC DATA RELEASE 196-204 tbl. 3-12.A (1994).
Toxic chemical accidents and toxic chemical accidents involving injury or death for the period 1988-1992.	JOEL A. TICKNER & HILLEL GRAY, ACCIDENTS DO HAPPEN: TOXIC CHEMICAL ACCIDENT PATTERNS IN THE UNITED STATES 5 (1994).
Toxic release inventory (TRI) Facilities, TRI forms filed, TRI facilities and forms reporting source reduction activities by state.	ENVIRONMENTAL PROTECTION AGENCY OFFICE OF POLLUTION PREVENTION AND TOXICS, 1992 TOXICS RELEASE INVENTORY (TRI) PUBLIC DATA RELEASE 136-37 tbl. 2-13 (1994).
Insurance premium data.	INSURANCE INFORMATION INSTITUTE, THE FACT BOOK 1997: PROPERTY/CASUALTY INSURANCE FACTS 34-35 (1996).