THE EFFICIENCY OF COMPARATIVE NEGLIGENCE

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U NTIL recently it has been thought that a negligence rule (with or without a contributory negligence defense) is economically efficient while a comparative negligence rule is not.[1] Haddock and Curran[2] and Cooter and Ulen[3] have corrected this misconception, arguing that it is possible to design an efficient comparative negligence rule. Cooter and Ulen have argued further that a comparative negligence rule is superior to a negligence rule when injurers and victims bear risk and there is evidentiary uncertainty.[4]

[1] The original argument was made by John Prather Brown, Toward an Economic Theory of Liability, 2 J. Legal Stud. 323 (1973). Gary T. Schwartz has argued for comparative negligence while conceding at one point its inefficiency. See Gary T. Schwartz, Contributory and Comparative Negligence: A Reappraisal, 87 Yale L. J. 697 (1978). An excellent review of the growth of comparative negligence statutes and their diversity among states is given in Robert Cooter & Thomas Ulen, The Economic Case for Comparative Negligence, N.Y.U. L. Rev. (in press).

[2] David Haddock & Christopher Curran, An Economic Theory of Comparative Negligence, 14 J. Legal Stud. 49 (1985).

[3] Cooter & Ulen, *supra* note 1. Richard A. Posner, An Economic Analysis of Law 156–57 (3d ed. 1986), acknowledges the fact that comparative negligence can be efficient but objects to comparative negligence nevertheless, arguing that because of higher administrative costs comparative negligence can serve only an insurance function. Posner's analysis fails to take into account the robustness of a comparative negligence rule against imperfections in information about damages and costs of care.

[4] In the Cooter-Ulen model all injurers and victims are identical but are uncertain about the standard of care. In such a world, injurers will take excessive care whether under a negligence or a comparative negligence statute. However, Cooter argues that the tendency

This paper supports the Cooter-Ulen conclusion and makes the case for comparative negligence even stronger. It builds on previous arguments concerning comparative negligence by relaxing the assumption that injurers (and victims) are identical. More important, this paper drops the restrictive assumption that the court can monitor individual behavior so as to establish specific standards of care for individual cases.

This paper shows that a comparative negligence rule can improve on a negligence rule when the standard of care is the same for all injurers and when injurers differ in their costs of taking care. When the costs of care vary among injurers (and victims), it will generally no longer be efficient for all parties to meet the care standard. A comparative negligence rule will allow injurers (and victims) to vary their levels of care: the rule thereby helps to increase economic efficiency.

The argument presented here applies when both the comparative negligence and the negligence rules use identical standards of care. In this case, comparative negligence will apportion damages between injurers and victims when both parties fail to meet their negligence standards. But a comparative negligence rule can also be designed to take into account the possibility that juries may opt to apportion damages in a more extensive set of accident situations by using implicit standards of care that are different from those used under a negligence rule.

To see how the standard might be changed, consider a situation in which an injurer meets the negligence standard of care. The jury, however, wishes to have the injurer compensate the victim for a portion of the victim's losses. To do so, the jury might implicitly set a higher standard of care and find the injurer to be negligent only to award in damages an amount less than the actual accident damages. This result mimics a comparative negligence rule in apportioning damages between the two parties.[5] We will see that there are conditions under which this implicit use of a comparative negligence rule, as well as the more traditional application of comparative negligence, can increase economic efficiency.

The paper is organized as follows. Section I sets the stage for the comparative negligence analysis by arguing that a negligence rule is diffi-

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toward excessive care will be less under his version of the comparative negligence rule. The case of uncertain standards is also treated in Mark F. Grady, A New Positive Economic Theory of Negligence, 92 Yale L. Rev. 799 (1983). Grady, like Cooter and Ulen, argues that there will be excessive care under a negligence rule but goes on to propose a modified negligence rule in which a "cost-benefit" rule is applied. Both the Cooter and Ulen and the Grady papers differ from this paper, which assumes that standards are uncertain but that costs of care vary among individuals.

[5] Thus the argument in this paper applies not only to a comparative negligence rule but also to a rule in which the injurer is strictly liable, but for less than the victim's accident costs.

cult to apply when injurers vary substantially in their ability to take care. The question addressed is whether juries follow the letter of the law in evaluating negligence standards when a defense of contributory negligence is available. I argue that the problem of monitoring injurer care levels is sufficiently serious to make it unlikely that jury-determined standards of care will vary in response to individual injurer (or victim) characteristics. In Section II the argument for comparative negligence is developed in the case in which there is a fixed level of victim care that all victims are required to comply with. This known level of care serves as the basis for the injurer's calculations. (The argument applies as well to the victim's choice of care when the injurer's level of care is fixed and known by the victim.) In particular, it is shown that when injurers are identical a negligence rule and a comparative negligence rule achieve the same efficient outcome. Section III describes a set of circumstances under which a comparative negligence rule can improve on a negligence rule. An example illustrating the advantage of a comparative negligence rule is given in Section IV. Some concluding and qualifying comments are made in Section V.

I. CHOOSING THE STANDARD OF CARE

A negligence rule directs both potential injurers and victims to meet a legal standard of care that involves taking as much precaution as would any reasonable person under the circumstances. A party who does not meet the legal standard of care is deemed to be at fault, with the relation between the legal standard and the actual level of care being an important determinant of which damages are causally attributable to the defendant's breach of duty and, hence, recoverable.

The efficient, or first-best, standard of care is the level of care that minimizes the sum of the cost to both injurers and victims of taking care and the expected cost of accidents. Both the cost of care and the cost of accidents are likely to vary substantially in individual cases. Some injurers and victims will find it easier to take care than will others. For example, individuals with slower reflexes or concentration may be forced to drive more slowly than individuals with quicker reflexes, thus adding to their travel time. On the other hand, some victims will suffer substantially greater harm than will others. For example, the harm to a musician associated with an injury to the hand may be greater than the harm to a law professor.

Courts, however, often find it both difficult and costly to measure variations in costs of care and accident costs.[6] For one thing, the cost of taking

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[6] This issue is discussed in Steven Shavell, An Economic Analysis of Tort Law (in press).

care may depend on circumstances that are difficult to monitor. For another, the monetary value of the harm caused by injuries can be highly subjective and, therefore, difficult to evaluate accurately.

From the reasonable-man perspective, the standard of care should reflect society's view about the likely costs and damages given the circumstances of the accident. The standard of care is a community norm based on what is expected of a large number of injurers and victims. Furthermore, injurers and victims are usually unacquainted prior to the accident, and costs of care and of harm that each bears are not easily determined by each other or by the courts. Therefore, it is appropriate to assume that both prospective injurers and the court are likely to base their decisions on the reasonable or typical costs associated with the accident. As a result, it is important to analyze legal rules in a framework in which costs and tastes vary among individuals but in which the legal standard of care does not. In such a world, the negligence rule no longer achieves a first-best outcome.

A comparative negligence rule can improve on the negligence rule when it is limited to those cases in which both parties fail to meet the applicable standard of care. But the argument can be extended further. As noted in the introduction, the law may require juries to determine which party bears all the monetary costs of the accident. Still, juries may take it on themselves to apportion damages in situations in which one or both parties would meet the negligence standard of care.[7] If a relatively high level of care implicitly governs both injurers and victims, the standard would be met only by those few individuals with relatively low costs of taking care.

Under this expanded version of the comparative negligence rule, the allocation of damages between the injurer and the victim can be made directly by looking at the extent to which each party deviates from some relatively high level of care and the marginal value that the trier of fact places on those deviations. Because the number of cases litigated and the cost of litigation per case may change under this comparative negligence regime, a final evaluation will require an empirical analysis.

II. Negligence and Comparative Negligence from the Injurer's Perspective

The discussion begins with a brief analysis of the rules of negligence and comparative negligence when injurers and victims are identical and victims' care levels are fixed and known by injurers. In the following

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[7] For a discussion of this issue, see Schwartz, *supra* note 1.

section, I illustrate how a rule of comparative negligence can improve on a negligence rule when the injurers' costs of care vary.

Let the level of care chosen by the injurer (who is risk neutral) be given by x and his constant unit cost of care by c_X. The fixed level of victim care (which may be zero) is given by y. While the particular choice of victim care is not important for the analysis of the next two sections, the heuristic argument is easier to follow if it is assumed that victims' care levels meet the negligence standard y^*. The probability of avoiding an accident that generates damages, d, is given by $p(x, y^*)$, which is assumed to increase with care taken by the injurer (that is, $p_X > 0$).[8]

Under a negligence rule, a standard of care, x^*, is specified that is chosen to be the level of care that minimizes the sum of the costs of care of the injurer ($c_X x$) and accident costs $[1 - p(x, y^*)]d$. If the injurer takes care, $x < x^*$, the injurer is negligent and pays d, and if $x \geq x^*$, the injurer is not negligent and pays nothing.[9] Brown, among others,[10] has shown that the negligence rule is efficient since the injurer initially faces the full costs of his actions and chooses to meet the standard of care.[11] A rule of strict liability, in which the injurer compensates the victim for all losses incurred, generates an efficient outcome as well since the injurer faces the full costs of his actions irrespective of the care level taken. However, a rule of comparative negligence can also generate an efficient outcome if the rule for compensation is appropriately defined.

This argument can best be illustrated graphically. Figure 1 shows the differences between damages to be paid by the injurer ex post (after the accident has taken place) under negligence and comparative negligence rules. With the negligence rule, the injurer is required to pay damages, d, whenever his level of care is less than x^*, the efficient level of care. For higher levels of care, there is no payment from injurer to victim. Under the comparative negligence rule, the injurer pays damages, d, when care is less than a prescribed amount, x_L, which is below the efficient level of care. For higher levels of care, the amount of damages paid falls propor-

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[8] This particular choice of y applies to the generalized version of the comparative negligence rule. If the injurer believes that the victim will take a level of care different from y^* (say, a lower level of care that would make the victim negligent under a traditional negligence rule), then $p(x, y)$ will also differ, as will the choice of parameters for the comparative negligence rule.

[9] The argument would be essentially the same were the negligence rule to allow a contributory negligence defense.

[10] See Brown, *supra* note 1; and Cooter & Ulen, *supra* note 1.

[11] The argument holds on the assumption that the injurer takes the victim's care level to be y^*. Likewise, the victim would have to take the injurer's care level to be x^*, with the result a Nash equilibrium. I omit these details to simplify the presentation.
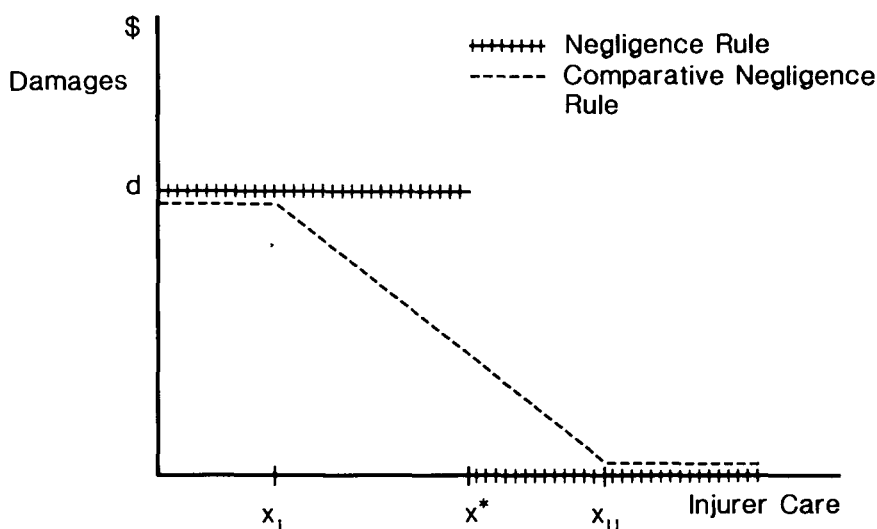
FIGURE 1

tionately until a relatively high level of care, x_U, is reached. When care is greater than or equal to the level x_U, there is no payment from injurer to victim. The lower and upper limits of care, or, equivalently, the absolute value of the slope, s_X, of the line and the upper limit, x_U, are chosen so that the injurer will be induced to choose the level of care, x^*, that minimizes the costs of care and accident damages.[12]

Figure 2 illustrates the incentives faced ex ante (before the accident) by the injurer under such a rule. Figure 2a shows the total costs and benefits associated with the negligence and comparative negligence rules, while Figure 2b shows the marginal costs and benefits. In Figure 2a the curve describing the total expected damages from the accident can be viewed alternatively as the total benefit curve since it measures the aggregate benefit associated with a reduction in accident costs. The sum of the costs
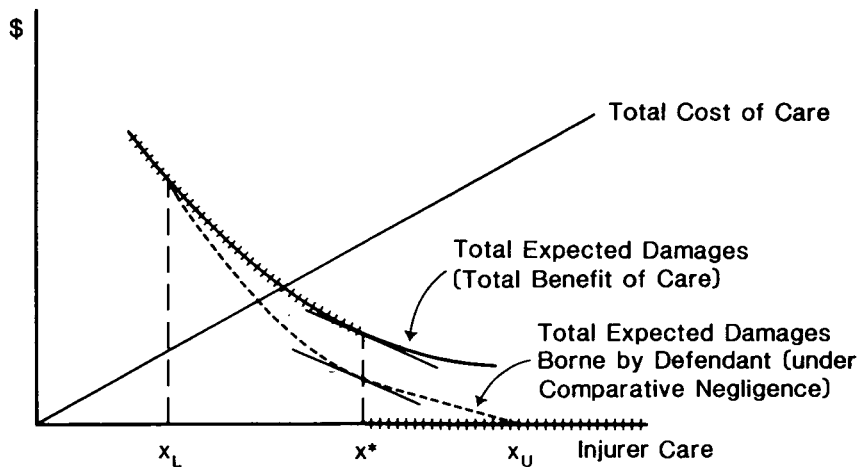
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[12] The injurer's first-best level of care, x^*, is determined by the first-order condition $p_X(x, y^*)d = c_X$. When the slope s_X, which is equal in absolute value to $d/(x_U - x_L)$, and the upper limit x_U are taken as given by the injurer, he will choose to minimize
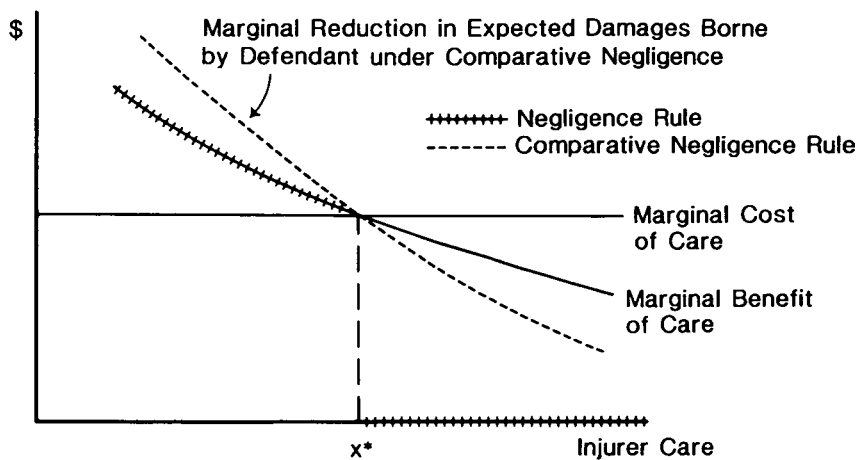
$$c = c_X x + [1 - p(x, y^*)]s_X(x_U - x).$$

The first-order condition is

$$c_X = s_X\{(x_U - x)p_X(x, y^*) + [1 - p(x, y^*)]\}.$$

The choices of s_X and x_U are made so that this first-order condition is satisfied when $x = x^*$. (The appropriate second-order conditions must hold as well.)

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Total Cost of Care

Total Expected Damages
(Total Benefit of Care)

Total Expected Damages
Borne by Defendant (under
Comparative Negligence)

x_L x^* x_U Injurer Care

a

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Marginal Reduction in Expected Damages Borne
by Defendant under Comparative Negligence

++++++++ Negligence Rule
------- Comparative Negligence Rule

Marginal Cost
of Care

Marginal Benefit
of Care

x^* Injurer Care

b

FIGURE 2

of care and accident costs is minimized when the absolute value of the slopes of the total benefit and total cost curves are equal.

The equivalent argument can be made in terms of marginal costs and benefits rather than totals. In Figure 2b the efficient level of care is given by the point at which the marginal benefit of care is equal to the marginal cost of care.

Under a negligence rule, the injurer pays d when negligent and zero otherwise. In terms of ex ante incentives, the expected damages to be paid by the injurer are $[1 - p(x, y^*)]d$, so that the benefit of an additional dollar of care is a reduction of $p_X(x, y^*)d$ (in absolute value) in damages to be paid up to the point at which care equals x^* and zero thereafter. In terms of Figure 2a, the total damages paid follows the total expected damage curve until x^* is reached, after which damages paid drops to zero. Correspondingly, marginal damages paid follows the cross-hatched line, equal to the marginal reduction in expected accident costs for care less than x^* and zero thereafter. Clearly, under a negligence rule the marginal benefit of taking care is greater than the marginal cost for care levels less than x^* and is less than the marginal cost for levels greater than x^*.[13]

The rule for comparative negligence must be chosen so that the sum of the total costs of care and expected damages are minimized at x^*, or, equivalently, that the marginal cost of care equals the marginal benefit at x^*. For care levels that are below x_L, the injurer pays the entire damage amount to the victim. Then, as care increases to the level x_U, the amount paid falls to zero. This is reflected in Figure 2a by the dotted curve, which measures the total expected damages borne by the defendant under a comparative negligence rule. The curve touches the total expected damages curve at x_L and falls to zero at x_U. It is drawn so that its slope is equal in magnitude to the slope of the total cost curve at x^*.

In terms of marginal incentives under the comparative negligence rule, the marginal reduction in expected accident costs is greater than the marginal cost of care for care levels below x^* and is less than the marginal cost for care levels above x^*, as illustrated in Figure 2b.[14]

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[13] I am implicitly assuming that $p_{XX} < 0$.

[14] In Figure 2b the marginal reduction in expected accident costs is given by

$$s_X\{p_X(x_U - x) + [1 - p(x, y^*)]\}.$$

The slope of this function is given by

$$s_X[p_{XX}(x_U - x) - 2p_X].$$

On the assumption that the probability of avoiding an accident is increasing with care but with diminishing returns (that is, $p_X > 0$ and $p_{XX} < 0$), the slope is always negative as shown in the figure.

Under both the negligence rule and the comparative negligence rule, the injurer faces the correct marginal incentives at the efficient level of care. Notice, however, that the marginal expected damages paid differs from the marginal expected accident costs when the injurer is selecting a level of care that is not at the efficient level under a comparative negligence rule.

Under a negligence rule, the decision to be negligent implies that the injurer faces the correct marginal expected damage function in making his choice of care level. Under the comparative negligence rule, the marginal penalty faced by the injurer is greater than the marginal expected damages for all levels of care below the efficient level. However, for care levels greater than the efficient level of care, the marginal penalty under the comparative negligence rule is more likely to approximate the true marginal expected damages than is the negligence rule (whose marginal penalty is zero). It is the relation between the true marginal expected damages of the accident and the marginal penalties faced under both rules that helps us to understand the argument in the next section concerning the efficiency of the comparative negligence rule when the court cannot determine individual-specific standards of care.[15] To sum up, the negligence rule generates an efficient outcome by imposing a very sharp penalty (on the margin) for those not meeting the standard. The comparative negligence rule also allows for an efficient outcome but does so by imposing a continuous, less sharp marginal penalty for those not meeting the standard of care. Either rule can be constructed to be efficient in a model with identical injurers and victims. It will be seen, however, that, in a model with nonidentical injurers and victims, the ability of the comparative negligence rule to more closely approximate the entire range of the expected marginal damage function can make it more efficient than a negligence rule with the sharp cutoff at x^*.

[15] Haddock & Curran, *supra* note 2, and Cooter & Ulen, *supra* note 1, define comparative negligence rules that have the identical standards of care but allow shared damages if both the injurer and the victim deviate from their standard of care. They show that, if the penalty that each party must face on the margin as he deviates from the standard of care is appropriately set, each will have the incentive to meet the standard of care. Injurers and victims will choose the same levels of care as they would under a negligence rule, with the result economically efficient. The important insight that underlies the determination of the appropriate sharing rule under comparative negligence is that efficient behavior is achieved so long as, for each party, the marginal cost of care is less than or equal to the marginal expected damages for levels of care just below the efficient level and greater than or equal to the marginal expected damages for levels of care above the efficient level. The negligence rule achieves this result, but so does the appropriately chosen comparative negligence rule.

III. Comparative Negligence with Varying Costs of Care

The model used in this section allows costs of care to vary among individuals while taking into account the fact that the court is not able to measure costs accurately.[16] In this situation neither a comparative negligence rule nor a negligence rule will be fully efficient in the sense of achieving the lower level of social cost that could be achieved were the standard of care under any negligence rule to be specified on an individual basis. This section describes the advantage of a comparative negligence rule over a negligence rule in this "second-best" world.

A useful place to begin is to notice in Figure 1 that, as the goal x_U is moved toward the care level x^*, the slope of the damage function under comparative negligence increases in absolute value. In fact, when $x_U = x^*$ and the slope is infinite, the comparative negligence rule and the negligence rule become equivalent. As a result, the comparative negligence rule can be viewed as a more general form of a negligence rule in which the two care levels, x_L and x_U (or, equivalently, the slope of the damage function and the level x_U), can be used in place of the single instrument x^* to affect the behavior of the injurer.

The addition of a second policy instrument cannot lower efficiency and may increase it. Therefore, the interesting questions become when and to what extent the comparative negligence rule can increase efficiency in cases in which injurers' costs of care vary. These questions are answered first by describing how the standard of care would be determined under a negligence rule and then by showing how a comparative negligence rule might improve on the negligence rule in this setting.

Assume that the unit cost of care of injurers is distributed randomly and is represented by $c_X(\epsilon)$, where ϵ is a symmetrically distributed random variable. Injurers are assumed to know their own costs of care, but the court uses only the median of the known distributions to determine if the injurer is negligent. It is easy to show that the first-best solution under a negligence rule would set each injurer's standard of care to equate the marginal cost of care, $c_X(\epsilon)$ to the marginal benefit of care $p_X(x, y^*)d$. However, the court is limited under a negligence rule to setting a community-based standard of care, x^*, that is independent of ϵ.

If the victims' levels of care are truly fixed, then the "second-best" standard, x^*, under a negligence rule could be set sufficiently high to ensure that all injurers would be negligent. This would transform the negligence rule into a rule of strict liability, and an efficient result would

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[16] The argument also applies when damages vary among individuals. This possibility has been removed from the discussion to simplify the presentation.

be obtained. However, with varying victim costs of care (and, more generally, varying damages), the standard of care must balance all potential sources of costs, making the strict liability outcome inefficient (since victims would take too little care in general). Therefore, I will continue to focus on the comparison between a negligence and a comparative negligence rule and exclude the possibility of achieving a first-best outcome with a rule of strict liability.

An illustration of how the second-best negligence rule would work is given in Figure 3. The marginal benefit and marginal cost curves have been redrawn from Figure 2b. An individual whose marginal cost of care is equal to the median cost of care would face a negligence standard, x^*, if the efficient level of care were to be chosen. However, an individual whose marginal cost of care is unusually low would face a higher negligence standard, x_N. When the injurer chooses x^* under the second-best negligence standard (thereby choosing to take a socially insufficient level of care), social costs are greater than would be incurred in a first-best world. The increased social cost is given by area ABC in Figure 3.

However, the same individual facing a comparative negligence rule will choose a level of care, x_{CN}, that involves less care than is efficient. But the deviation from the optimum will be smaller than under the negligence rule as will the increment in social costs when the first-best outcome is the point of comparison. In the comparative negligence case, the additional social cost is given by area EDC, which is contained in the negligence triangle, ABC. An equivalent argument can be given when the individual's marginal cost of care is greater than the median.

When there is a wide distribution of costs of care, the analysis becomes more complex, but the spirit of the argument is the same. Figure 4 describes what the care choices might be under a negligence rule. Injurers are assumed to choose $x(\epsilon)$, a care level that depends on their particular marginal cost of care in a situation in which there is a community-wide standard of care, x^*.

In Figure 4a, all injurers are assumed to meet the standard of care, and all victims are assumed to choose their levels of care efficiently. As a result, the distribution of care levels chosen by the injurers is a spiked distribution centered at the community norm, x^*. While all individuals choose the same care level, the first-best optimum is not achieved because standards of care do not vary among individuals. In particular, the social costs under the negligence rule are greater than the social costs that would be achieved in the first-best world because injurers with relatively high costs of care are encouraged to take more care than would be efficient, while injurers with relatively low costs of care are encouraged to take correspondingly less care.
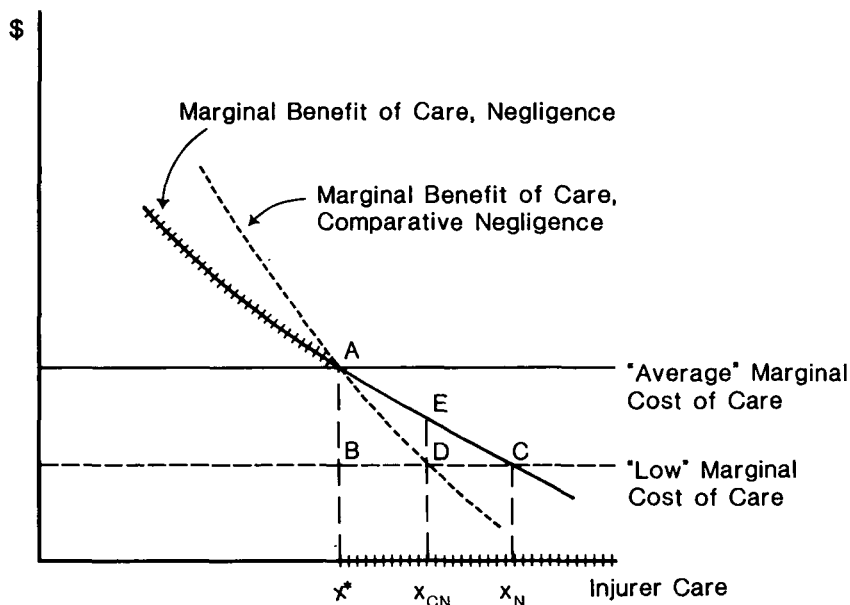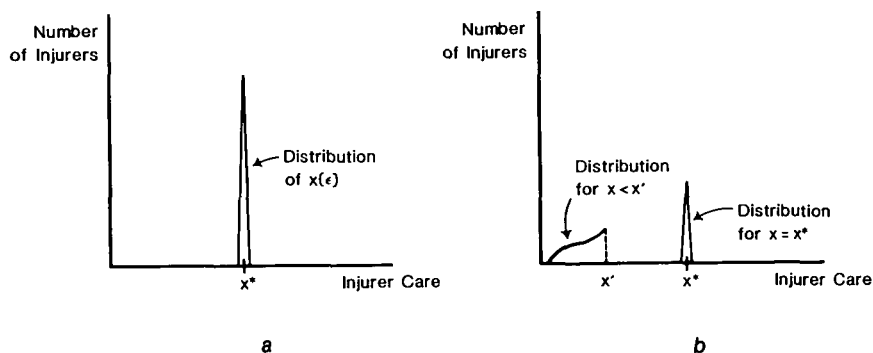
FIGURE 3

FIGURE 4

Not all injurers will choose to take care equal to the community norm under a negligence rule. Some may find it advantageous to take care less than x^*, since the savings in costs of care may outweigh the expected damage payments. Specifically, an injurer will choose to be negligent if the gain associated with a substantial reduction in care outweighs the liability, that is, if

$$c_X(\epsilon)(x^* - x) > [1 - p(x, y^*)]d.$$

Care levels will vary among those potential injurers choosing to be negligent, again depending on the individual's marginal cost of care. Figure 4*b* illustrates this second possibility in which not all individuals choose to meet the standard of care. The result is that there is a distribution of care levels below a critical value, x', and a spiked distribution at x^*.

Now consider the comparative negligence rule in this second-best world. A comparative negligence rule can improve on a negligence rule by allowing injurers to deviate slightly (rather than substantially) from the standard of care x^* (and correspondingly for victims). The optimum rule is one that chooses values for x_L and x_U, which minimize the costs of care and accident costs subject to the constraint that individual injurers and victims act in their self-interest.

Figure 5 provides one illustration of the different outcomes that arise under negligence and comparative negligence rules. The distribution of care levels under a negligence rule is given by the cross-hatched curves and the distribution under a comparative negligence rule by the dotted curve. Because the injurer faces a lower penalty for making small deviations from the standard x^* under a comparative negligence rule than he would face under a negligence rule, the distribution of care levels under comparative negligence includes some individuals with care below x^* and some with care above x^*.

As a general rule this distribution will not be segmented, as the distribution is under the negligence rule (shown in Figure 5). Comparative negligence can lead to an improvement in efficiency relative to the negligence rule because those with relatively high costs of care will be selecting lower care levels and thereby will move closer to the first-best optimum, while those with relatively low costs of care will be choosing higher levels of care.
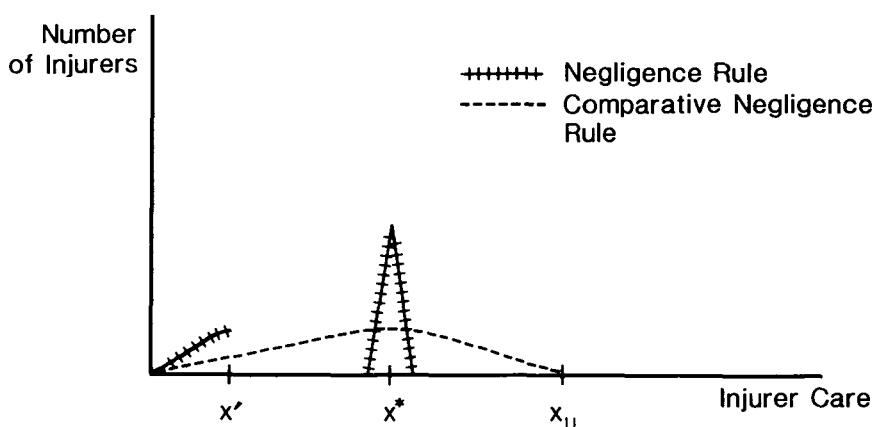

FIGURE 5

The continuous marginal expected damage function under the comparative negligence rule leads to a continuous distribution of care levels, while the discontinuous marginal expected damage function under the negligence rule leads to a discontinuous distribution of care. This discontinuous distribution marks the inability of the negligence rule to allow individuals to make small adjustments to differences in their own circumstances.

The extent to which the comparative negligence rule can come close to the first-best optimum depends on the extent to which the marginal expected penalty function faced by the injurer approximates the marginal expected damage associated with the accident. The search for a second-best comparative negligence rule involves the search for an appropriate marginal expected penalty function (that is, the choice of x_L and x_U).[17]

There is no set of unique values for the lower and upper care levels that achieves an efficient outcome under a comparative negligence rule.[18] The choice of values must be made so that the injurer and victim face the

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[17] The argument made here is similar in spirit to the analysis of prices and standards in the environmental literature. With uncertainty about costs and benefits, neither a standard nor a fee is fully efficient. The choice among the two in the environmental case depends on the slopes of the relevant marginal cost and marginal benefit curves. For details, see Martin Weitzman, Prices vs. Quantities, 41 Rev. Econ. Stud. 477 (1974); and Gary W. Yohe, Should Sliding Controls Be the Next Generation of Pollution Controls? 15 J. Pub. Econ. 251 (1981). For a similar application that includes a discussion of liability rules, see Michelle T. White & Donald Wittman, A Comparison of Taxes, Regulation, and Liability Rules under Imperfect Information, 12 J. Legal Stud. 413 (1983).

[18] In general, the comparative negligence rule can be specified by the care goals x_U and y_U and (fixed) sharing fractions s_X and s_Y such that ex ante the injurer expects his share of the accident costs (if there is an accident) to be

$$0 \quad \text{if } x \geq x_U,$$

$$s_X(x_U - x) \quad \text{if } x_L < x < x_U,$$

and

$$1 \quad \text{if } x \leq x_L.$$

Likewise, the victim bears the following fraction of the accident costs:

$$0 \quad \text{if } y \geq y_U,$$

$$s_Y(y_U - y) \quad \text{if } y_L < y < y_U,$$

and

$$1 \quad \text{if } y \leq y_L.$$

These sharing rules describe not what the plaintiff pays to the victim ex post but rather the expected payments ex ante. For total damages to be allocated properly, the sharing fractions must be defined so that

$$s_X(x_U - x) + s_Y(y_U - y) = 1.$$

The proof that with the proper choice of instruments the comparative negligence rule will generate efficient behavior is similar to the proof that a negligence rule is efficient.

appropriate marginal incentives at x^* and y^* just as they do under a negligence rule.[19]

One complication with the comparative negligence rule is the necessity of assuring that the parties face not only the appropriate incentives ex ante but also that the damages are appropriately allocated ex post.[20] For instance, if the injurer acted under the assumption that the victim would choose care level y^* but the victim actually took less care, the injurer would pay less ex post then he expected to pay ex ante.[21]

An example may help to clarify the principle underlying the proposed comparative negligence rule. Assume that the driver of a car, the potential injurer, is driving at or below the speed limit, the upper care level set for the injurer. (This level of care might differ from the negligence standard, which allows the driver a ten-mile-per-hour leeway before negligence is deemed to have occurred.) The upper care level for the potential victim, a pedestrian, is to walk across the street only when there is a well-defined crosswalk.

If the driver heeds the speed limit, the driver will know ex ante that he bears no liability, and the victim will receive no compensation, just as under the traditional negligence rule. Now assume that the driver drives at either five, ten, or fifteen miles per hour above the speed limit. Under

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[19] The choice of instruments is sufficiently flexible so that the damages could be shared when both parties choose to take care at the efficient level of care (or the injurer could be held to be not liable for damages). For a related but general discussion of the moral hazard problem that might arise when one or both parties are partly insured against the risk of an accident or loss, see Lawrence Blume, Daniel L. Rubinfeld, & Perry Shapiro, The Taking of Land: When Should Compensation Be Paid? 99 Q. J. Econ. 71 (1984).

[20] More accurately, the sharing fractions should be defined so that ex ante

$$s_X(x_U - x^*) + s_Y(y_U - y^*) = 1,$$

where x^* and y^* represent the expected or anticipated levels of care of the injurer and victim, respectively. While this condition will hold ex ante, it will not necessarily hold ex post. Therefore, actual damages should be allocated so that the injurer pays

$$\frac{s_X(x_U - x)}{s_X(x_U - x) + s_Y(y_U - y)}$$

percent of the damages, and the victim pays the rest. Note also that there is a mathematical difficulty that arises if both the injurer and the victim choose levels of care greater than x_U and y_U, respectively. Then, according to the sharing rule, no damages would be paid by either party. This is unlikely to be a practical problem given that the upper levels are chosen to be substantially greater than the efficient levels of care. It is also not a theoretical problem because boundary conditions can be defined so that one party always pays damages. These technical details are omitted.

[21] In the extreme, if an accident occurred when the injurer chose a level of care less than x_L and the victim less than y_L (the victim's lower level of care), then ex ante both parties would expect to bear the full cost of the accident. Ex post, however, the costs could be split by the parties.

the comparative negligence rule, the damages that he pays will increase with his speed (as will the probability that an accident occurs). The actual damages paid by the injurer after the accident will also depend on the care taken by the victim. If the victim crosses inside a crosswalk, the injurer will pay all damages. Otherwise, the costs of the accident will be shared by both the victim and the injurer. Thus the comparative negligence rule provides a rule for apportioning damages when one or both parties are negligent.[22] The actual ex post allocation of damages is less important from the economic point of view than the incentives that the parties face ex ante. With the appropriate ex ante incentives, the driver (and the pedestrian) can choose to take the efficient level of care.

IV. AN EXAMPLE

A better understanding of the ability of a comparative negligence rule to improve on a negligence rule can be demonstrated with a specific example. The comparison benchmark is the social cost (costs of care and expected accident costs) associated with a negligence rule in which the standard of care is individual specific. The (second-best) social cost can then be evaluated when the standard of care under a negligence rule is set at the community norm (which is chosen as the median of all the individually optimal standards of care). Finally, the (second-best) social cost can be calculated for a comparative negligence rule in which there are identical upper care levels and shares for all injurers and victims.

Assume that the probability that an accident occurs is given by $1 - p(x, y) = e^{-(x+y)}$. This function ranges in value from one, when both x and y are equal to zero, to zero, when the sum of x and y becomes infinitely large. The effect of an increase in one unit of care is to reduce the probability of an accident by $-dp(x, y)/dx = e^{-(x+y)}$. The second derivative of $p(x, y)$ with respect to x is negative, a result that is consistent with a diminishing marginal productivity of care.

Assume also that the injurers' costs of care are given by a random variable that is uniformly distributed on the interval [1, 3]. For victims, the cost of care is assumed to be equal to two. The damage level, d, is also fixed and equal to 10. Under these assumptions the first-best levels of care must satisfy $x(\epsilon) + y = \ln[d/c(\epsilon)]$. The community norm, the care level that each party expects the other to meet, is taken to be $x^* = y^* = \ln(d/2)/2$ and is equal to the care taken by the median injurer and by all victims.

Under the first-best negligence rule, injurers' care is then given by

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[22] It may or may not increase the number of cases in which the injurer is potentially liable for damages, depending on how the share goal is determined.

$\ln(d/c)/2$. Under the second-best negligence rule, injurers' care is given by $\ln(d/2)/2 = .805$. Finally, under a comparative negligence rule, the values of the shares and the upper levels of care were chosen so that the appropriate marginal conditions hold at x^* and so that the expected marginal damage function closely approximates the expected marginal accident cost function. One set of parameter values that achieves this purpose is given by

$$s_X = .554, \quad x_U = 1.61,$$

and

$$s_Y = .446, \quad y_U = 2.05.$$

It is easy to check that, under this comparative negligence rule, injurers and victims facing costs of care of two will choose the efficient level of care of .805. The levels of care chosen under each legal rule for a selected sample of values of the cost of care are given in Table 1.

The level of care to be chosen when care levels vary by injurer is given in the second column. In this particular case, the expected accident cost, given in the third column, increases with the cost of care: but the pattern could change with a different $p(x, y)$ function.

Under the second-best negligence rule in this example, all injurers choose to meet the standard of care regardless of their individual costs. This is illustrated in the fourth and fifth columns, in which the level of care .805 (with expected accident costs of two) is selected irrespective of the injurers' costs of care. The second-best negligence rule leads to inefficiency because too little care is taken by those injurers with low costs of care, and too much care is taken by those with high costs.

The comparative negligence rule, on the other hand, allows individuals to sort themselves by selecting their own care levels. The sixth column illustrates the fact that under the comparative negligence rule the level of care chosen varies inversely with the cost of care just as with the first-best negligence rule. However, the linear sharing rule does not allow for a first-best outcome to be achieved since those injurers with higher-than-average costs take too little care (relative to the first-best rule), and those with lower than average care take too much care.[23]

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[23] In this particular example, the advantage of a comparative negligence rule over the second-best negligence rule is not great ($.09/5.13 = 2$ percent). However, the advantage would be larger if the example were expanded to allow for variable victims' costs of care. More generally, the advantages of the comparative negligence rule are greatest when there is a wide distribution of costs of care and the marginal benefit of care is sensitive to the level of care taken.

TABLE 1

A. Costs of Care and Expected Accident Costs under Alternative Legal Rules

Cost of Care(c)	First-best Negligence Rule		Second-best Negligence Rule		Comparative Negligence Rule	
	Care(x)	Accident Costs	Care(x)	Accident Costs	Care(x)	Accident Costs
1.0	1.151	1.414	.805	2.000	1.230	1.307
1.2	1.549	1.549	.805	2.000	1.122	1.455
1.4	.983	1.673	.805	2.000	1.029	1.598
1.6	.916	1.789	.805	2.000	.946	1.736
1.8	.857	1.898	.805	2.000	.872	1.869
2.0	.805	2.000	.805	2.000	.805	2.000
2.2	.757	2.097	.805	2.000	.743	2.127
2.4	.714	2.189	.805	2.000	.686	2.251
2.6	.673	2.281	.805	2.000	.633	2.374
2.8	.636	2.367	.805	2.000	.583	2.496
3.0	.601	2.451	.805	2.000	.538	2.611

B. Comparison of Legal Rules

	Injurer-Care Expenditures	Victim-Care Expenditures	Accident Costs	Total Cost
First-best negligence rule	1.524*	1.610	1.973	5.107
Second-best negligence rule	1.610	1.610	2.000	5.220
Comparative negligence rule	1.534†	1.610	1.984	5.130

* Calculated exactly by integration over the entire [1, 3] range.
† Approximated using the ten intervals for the cost of care given above.

V. Concluding Comments

A properly designed comparative negligence rule has been shown to increase economic efficiency relative to a negligence rule when injurers' and victims costs of care vary. The comparative negligence rule can be distinguished in several ways from the classical negligence rule. First, a negligence rule allows the court to utilize two variables to affect policy, the standard of care (for each party), and the level of damages. A comparative negligence rule adds a third control variable, the rule for sharing or apportioning damages. The third control variable (properly determined) can lead to an improvement in economic welfare.

Second, the comparative negligence rule can be designed so that the costs of the accident are shared between the two parties in situations in which neither party would be negligent under a traditional negligence rule. By setting an upper standard against which the share of damages is

to be measured, the court eliminates the discontinuity associated with the legal standard of care under the negligence rule (that is, damages paid by the injurer vary continuously with the level of care taken). And the upper level of care can be set sufficiently high so that only those injurers and victims with relatively low costs of care and/or an ability to reduce marginal expected accident costs substantially will be entirely free of liability.

The sharing rule is defined so that all other injurers and victims can "sort themselves out," with high-cost-of-care individuals bearing more of the cost of the accident than low-cost individuals. In general, the comparative negligence rule allows both injurers and victims to adjust their levels of care based on their individual knowledge about their own costs of care, while a negligence rule requires all individuals to choose the same care level.

It might be interesting to speculate for a moment about the relatively recent shift from negligence to comparative negligence in the United States. If the shift were to have arisen because of an increased variability (among potential injurers and victims) in the costs of care and an increased range of potential accident costs, this shift could involve an increase in economic efficiency since a comparative negligence rule is particularly beneficial when it is appropriate for care levels to vary substantially among individuals.

Finally, any firm conclusion about the merits of a comparative negligence rule must take into account the costs of litigation. In general, a move to comparative negligence increases the probability that a plantiff will receive an award but lowers ex ante the expected award to be received. Whether the expected returns to litigation and therefore the probability that suits will be filed will increase or decrease would depend on the particular form that the comparative negligence rule took. One could argue, in addition, that the effort to apportion fault under any comparative negligence doctrine will involve more jury time than under a negligence rule. Finally, one might expect that the more complex the rule, the more substantial the "errors" that might be the result of the jury decision-making process.

Without empirical evidence, it is difficult to assess the importance of these arguments. It does seem clear, however, that a less complex form of comparative negligence rule than the one proposed in this paper—even one that apportioned damages according to shares that are determined on the basis of broad classifications rather than on individual case characteristics—could avoid substantial litigation and administrative costs.[24] To

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[24] A more thorough review of the cost arguments and the history of negligence rules that apportion damages is given in Cooter & Ulen, *supra* note 1. Epstein argues (building on an old admiralty law) for a fixed formula (such as a fifty-fifty split) for allocating losses in

the extent that the standards under a comparative negligence rule are not well understood and therefore are less hard edged than the negligence rule standards, administration costs could increase, and the door could be opened for an abuse of discretion within the legal system.

The purpose of this paper is to suggest that comparative negligence rules can be more efficient than negligence rules, so that serious consideration ought to be given to alternative forms that these rules might take. Clearly, an empirical study that compared the litigation and administrative costs of alternative liability rules would provide a valuable contribution, as would a theoretical paper that determined the optimal form of the negligence rule when litigation and administration costs appeared explicitly in the social cost function.[25] It is unclear, however, whether the incorporation of litigation costs will alter the force of the arguments made here since the common law has moved toward a system of comparative negligence despite the alleged increase in litigation costs.

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products liability cases on the grounds that the system will be more predictable and administrative costs lower. See Richard A. Epstein, Modern Products Liability Law 134–37 (1980). See also John Fleming, Report to the Joint Committee of the California Legislature on Tort Liability on the Problems Associated with American Motorcycle Association v. Superior Court, 30 Hastings L. Rev. 1465 (1979). It should be noted, however, that a fixed allocation rule will generally lead to an inefficiently low level of care as Brown, *supra* note 1, argued.

[25] One recent attempt to incorporate litigation costs in a model of private civil litigation is A. Mitchell Polinsky & Daniel L. Rubinfeld, The Welfare Implications of Costly Litigation for the Level of Liability, 17 J. Legal Stud. (in press).