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DOES UNCERTAINTY CALL FOR COMPARATIVE NEGLIGENCE?

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Abstract

The comparative negligence rule promoted as being both more just and more efficient than the traditional contributory negligence doctrine has come into dominance in American tort law. This paper questions one of the main efficiency-based arguments put forward in support of the rule – that, in the presence of judicial error, comparative negligence is generally superior. The analysis shows that this argument is invalid. This conclusion weakens the efficiency basis for current proposals to expand the reach of the comparative fault principle within tort law and beyond.

Keywords: Comparative Negligence, Evidentiary Uncertainty.

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I. Introduction

The comparative negligence rule, and more generally the principle of comparative fault, is sweeping through the law of torts, and beyond. Through statutory intervention or judicial innovation, the traditional common law doctrine of contributory negligence has been gradually pushed aside.[1] And the march of comparative fault continues.[2] However, the outcome of the campaign is not yet clear.[3] Various tort doctrines, which operate as a complete bar to liability,

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[1] See Victor E. Schwartz, COMPARATIVE NEGLIGENCE, § 1-1 (3rd edition, 1994); Henry Woods & Beth Deere, COMPARATIVE FAULT, § 1:11 (3rd edition, 1996); and Christopher Curran, *The Spread of the Comparative Negligence Rule in the United States*, 12 Int'l Rev. L. & Econ. 317 (1992). *See* also Guido Calabresi and Jeffrey O. Cooper, *New Directions in Tort Law (1995 Monsanto Lecture Valparaiso University School of Law)*, 30 Val. U. L. Rev. 859 (1996), the Restatement (Third) of Torts: Products Liability, § 17 (1998) and the Restatement (Third) of Torts: Apportionment of Liability (1999). Alabama, Maryland, North Carolina, Virginia, and the District of Columbia still consider contributory negligence to be a complete bar to recovery. *See* the Restatement (Third) of Torts: Apportionment of Liability, § 7, comment a (1999). Civil law countries have generally adopted a comparative negligence rule. *See* Schwartz, *id*, § 1-3(a), and Woods & Deere, *id*, § 1:9. England has adopted a comparative negligence rule in the Law Reform (Contributory Negligence) Act of 1945, 8 & 9 Geo. VI, c. 28. *See* Schwartz, *id*, § 1-3(b), and Woods & Deere, *id*, § 1:9.

[2] To improvise on Ernest Turk, *Comparative Negligence on the March*, 28 Chi.-Kent L. Rev. 189 (1950). *S*ee also Schwartz, *id*, § 1-1.

[3] *See*, e.g., John C. Moorhouse, Andrew P. Morriss and Robert Whaples, *Law & Economics and Tort Law: A Survey of Scholarly Opinion*, 62 Alb. L. Rev. 667 (1998); Donald Wittman,

still claim important ground on the tort law landscape.[4] Moreover, in the realms of products liability[5], apportionment of liability among multiple tortfeasors[6] and even contract law[7], battles between comparative fault and traditional less flexible liability rules are currently being fought. Finally, even where comparative fault

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Daniel Friedman, Stephanie Crevier & Aaron Braskin, *Learning Liability Rules*, 26 J. Legal Stud. 145 (1997); Omri Ben-Shahar, *A Unified Economic Theory of Comparative Negligence*, mimeo, Tel-Aviv University (1996); Stuart Low & Janet Kiholm Smith, *Decisions to Retain Attorneys and File Lawsuits: An Examination of the Comparative Negligence Rule in Accident Law*, 24 J. Legal Stud. 535 (1995); Cynthia Loehr, *Note: Tort Law - The Doctrine of Independent Intervening Cause Does Not Apply in Cases of Multiple Acts of Negligence - Torres v. El Paso Electric Company*, 30 N.M. L. Rev. 325 (2000).

[4] *See*, e.g., Paul T. Hayden, *Butterfield Rides Again: Plaintiff's Negligence as Superseding or Sole Proximate Cause in Systems of Pure Comparative Responsibility*, 33 Loy. L.A. L. Rev. 887 (2000), Christopher Dove, *NOTE: Dumb as a Matter of Law: The "Superseding Cause" Modification of Comparative Negligence*, 79 Tex. L. Rev. 493 (2000), Schwartz, *supra* note 1, ch. 4 and Woods & Deere, *supra* note 1, ch. 5. Other relevant doctrines include the assumption of risk doctrine and the open and obvious danger doctrine. *See*, e.g., James P. End, *Comment: The Open and Obvious Danger Doctrine: Where Does It Belong in Our Comparative Negligence Regime?* 84 Marq. L. Rev. 445 (2000), Schwartz, *supra* note 1, ch. 9, and Woods & Deere, *supra* note 1, ch. 5. *See* also the discussion regarding user misconduct doctrines in note 5, *infra.*

[5] In the realm of products liability, various user misconduct doctrines, e.g. misuse, modification, alteration, assumption of risk and contributory negligence, still operate as a total bar to liability. *See* the Restatement (Third) of Torts: Products Liability (1998), § 2, comment p (definition of product defect), § 15, comment b (causation) and § 17, comment c (defenses); David G. Owen, Products Liability: *User Misconduct Defenses*, 52 S.C. L. Rev. 1 (2000) ("the traditional plaintiff misconduct defenses often still operate in their conventional form as a total bar to liability."); Schwartz, *id*, ch. 11 ; and Woods & Deere, *id* note 1, ch. 14. The move from strict liability to negligence-based liability (*see* the Restatement (Third) of Torts: Products Liability (1998), § 2, comment d, and George W. Conk, *Is there a Design Defect in the Restatement (Third) of Torts: Products Liability?* 109 Yale L. J. 1087 (2000)) is of special interest in the present context.

[6] *See* the Restatement (Third) of Torts: Apportionment of Liability (1999), and Frank J. Vandall, *A Critiques of the Restatement (Third), Apportionment as It Affects Joint and Several Liability*, 49 Emory L. J. 565 (2000). *See* also Schwartz, *id*, ch. 16, and Woods & Deere, *id*, ch. 13.

[7] *See*, e.g., John B. Phillips, *Out with the Old: Abandoning the Traditional Measurement of Contract Damages for a System of Comparative Faul*t, 50 Ala. L. Rev. 911 (1999), Ariel Porat, *The Contributory Negligence Defence and the Ability to Rely on the Contract*, 111 L. Q. Rev. 228 (1995), and Ariel Porat, *Contributory Negligence in the Law of Contracts: Toward A Principled Approach*, 28 U. British Colum. L. Rev. 141 (1994).

has allegedly prevailed, powerful remnants of contributory negligence often remain.[8]

It appears that the inclination towards comparative fault rests on solid theoretical ground. But, does it? The comparative negligence rule has been promoted as being both more just and more efficient than the contributory negligence doctrine.[9] Leaving the undoubtedly important justice-based arguments for another day, the present analysis questions one of the main efficiency-based arguments put forward in support of the comparative negligence rule.

Economic analysis of tort law has demonstrated that in a world free from uncertainty several liability rules can lead to efficient care-taking by both the injurer and the victim.[10] Moreover, without uncertainty neither the injurer nor the victim would ever be found negligent by mistake. And, without a negligent victim (and a negligent injurer for that matter) the distinguishing features of the comparative negligence rule – as compared to the simple negligence rule or to

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[8] Approximately two-thirds of the states, which have allegedly adopted comparative fault, have actually rejected the pure comparative negligence rule, and opted for various forms of "modified" comparative negligence. In many of these jurisdictions the plaintiff is totally bared from recovery if found more than 50% at fault (for example, Michigan has enacted such a 50% rule in 1996 – Mich. Comp. Laws Ann. § 600.2959) – *See* Schwartz, *supra* note 1, Woods & Deere, *supra* note 1, and the Restatement (Third) of Torts: Products Liability, § 17, comments a and b.

[9] For the justice-based arguments – see, e.g., Robert E. Keeton, VENTURING TO DO JUSTICE, 49-53 (1969); John G. Fleming, *Foreword: Comparative Negligence at Last – By Judicial Choice*, 64 Calif. L. Rev. 239 (1976); William Prosser, *Comparative Negligence*, 51 Mich. L. Rev. 465, 469-470 (1953); Gary T. Schwartz, *Contributory and Comparative Negligence: A Reappraisal*, 87 Yale L. J. 697 (1978). For efficiency-based arguments – see David Haddock & Christopher Curran, *An Economic Theory of Comparative Negligence*, 14 J. Legal Stud. 49 (1985); Robert C. Cooter & Thomas S. Ulen, *An Economic Case for Comparative Negligence*, 61 N.Y.U. L. Rev. 1067 (1986); Samuel A. Rea, *The Economics of Comparative Negligence*, 7 Int'l Rev. L. & Econ. 147 (1987); Daniel L. Rubinfeld, *The Efficiency of Comparative Negligence*, 16 J. Legal Stud. 375 (1987); and Omri Ben-Shahar, *supra* note 3.

the negligence rule with a defense of contributory negligence – vanish.[11] However, the real world, in which liability rules operate, is rarely (not to say never) free from uncertainty, and it has been argued that under conditions of uncertainty – where findings of negligence occur at equilibrium - comparative negligence emerges as the most efficient rule. This paper reexamines these pro-comparative negligence arguments.

Several studies have incorporated various forms of uncertainty into the traditional economic model of tort law.[12] In particular, uncertainty is generated, when liability rules are implemented by imperfectly informed courts.[13] Two main types of judicial error have been identified. The first is evidentiary uncertainty, namely court errors in assessing a party's true level of care. In this assessment process, the court may hear testimony and admit evidence presented by the opposing parties. The inaccuracy of such a process is evident. The second type of judicial error concerns the determination of the levels of due care as part of the implementation of negligence-based liability rules. A legal rule based on judicial setting of optimal due care standards imposes a harsh informational burden on the courts.[14] In reality courts rarely possess the necessary information.

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[10] *See*, for example, Steven Shavell, ECONOMIC ANALYSIS OF ACCIDENT LAW (1987), ch. 2.
[11] *See* Shavell, *id*, pp. 15-16.
[12] *See*, for example, Haddock & Curran, *supra* note 9, Cooter & Ulen, *supra* note 9, Rea, *supra* note 9, Rubinfeld, *supra* note 9, Shavell, *id*, Aaron S. Edlin, *Efficient Standards of Due Care: Should Courts Find More Parties Negligent under Comparative Negligence?* 14 Int'l Rev. L. & Econ. 21 (1994) and Ben-Shahar, *supra* note 3. Actually, Rea, *id*, Rubinfeld, *id*, and Ben-Shahar, *id*, focus on asymmetric information and not on uncertainty *per se*.
[13] This important category of uncertainties has drawn considerable attention in the literature. See, in particular, Haddock & Curran, *id*, Cooter & Ulen, *id*, Shavell, *id*, and Edlin, *id*.
[14] In order to derive the optimal due care standards the court must know the magnitude of the expected harm, the precaution opportunities of the parties (specifically how these precautions affect the probability and magnitude of the potential harm) and the costs of these precaution opportunities.

It has been shown that these distinct types of judicial error are analytically equivalent.[15] Hence, for clarity of exposition I shall generally focus on evidentiary uncertainty.

In light of the obvious importance of this form of uncertainty in tort adjudication, an argument that comparative negligence is the most efficient rule given evidentiary uncertainty would naturally provide powerful support for the pro–comparative fault campaign. Such an argument in favor of comparative negligence was put forward by professors Cooter and Ulen.[16] I shall demonstrate that this argument does not generally hold. Judicial error does not establish a case for comparative negligence.[17, 18]

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[15] See John Calfee & Richard Craswell, *Deterrence and Uncertain Legal Standards*, 2 J. L. Econ. & Org. 279 (1986) and Shavell, *supra* note 10. A third, non-judicial, type of uncertainty is also analytically equivalent to the two types of judicial error described in the text. This distinct category of uncertainty concerns the incomplete control by the injurer and the victim over their momentary levels of care (see Shavell, *id*, pp. 81-82 for a discussion of this third type of uncertainty).

[16] See Cooter & Ulen, *supra* note 9. Haddock & Curran, *supra* note 9, also argue that uncertainty "tilt[s] the scale toward comparative negligence" (at p. 66, see also pp. 63-64). The conclusion reached by professors Cooter and Ulen was that "… comparative negligence minimizes the total amount of excessive precaution when the parties are "symmetrically situated" – i.e., when efficiency requires both parties to take similar amounts of precaution. Therefore, comparative negligence is the preferable rule in such situations." - Cooter & Ulen, *id*, at p. 1092. Although apparently restricted to situations where the parties are "symmetrically situated", the argument is of general importance as a basis for tort policy. The importance of the symmetric case is not limited to scenarios in which a positive claim of symmetry can be made for each injurer-victim pair. Policy may be based on the analysis of the symmetric case also when neither injurer nor victim is systematically better situated than the other party to reduce the expected loss. Professors Cooter and Ulen provide alternative policy prescriptions for scenarios, in which systematic asymmetry exists. These policy prescriptions are reexamined in Oren Bar-Gill, *Does Uncertainty Call for Comparative Negligence? The Relative Efficiency of Liability Rules when Courts are Imperfectly Informed*, mimeo, Harvard Law School (2001).

[17] It should be noted that the pro-comparative negligence view expressed by professors Cooter and Ulen and by professors Haddock and Curran, *see id*, is not the only view within the law and economics literature. Notably, professor Shavell argued that **"**[t]he precise nature of the comparison of behavior and of social welfare under the different rules appears subtle**"**. The present study can be read as an exploration of this subtle comparison.

The paper begins with an analytical examination of the efficiency argument for comparative negligence. It then proceeds to verify the analytical results using computer simulations. When uncertainty is incorporated into the economic model of tort law, the complexity of the enriched model renders it virtually impossible to derive a general analytical solution. Drawing from methods developed in other disciplines to cope with complexity problems, the uncertainty extension of the tort law model is solved numerically *via* computer simulations.[19] Given the possibility of judicial error, a computer algorithm calculates the equilibrium care levels and the corresponding social costs induced by different liability rules. It is shown that the comparative negligence rule does not generally produce the lowest social cost.

The remainder of the paper is organized as follows. Section II presents the efficiency argument for comparative negligence. This argument is shown to rely on three building blocks: (1) a specific ordering of the care levels induced by different liability rules (henceforth – "the ordering result"); (2) a claim that given the ordering result comparative negligence induces the most symmetric deviations from optimal care; and (3) an argument that symmetric incentives are efficient. Section III discusses the ordering result, and questions its robustness. Section IV proves that symmetric deviations from the optimum are efficient only under certain assumptions. Section V shows that even if symmetric deviations are efficient, the comparative negligence rule does not generally induce the most

[18] The comparative negligence rule may also be inferior to other liability rules in terms of administrative costs. The present study shows that even when administrative costs are insignificant comparative negligence is not generally the most efficient rule.

symmetric deviations, even when the ordering result holds. Section VI utilizes computer simulations to provide further support for the conclusion that comparative negligence is not the superior rule. Section VII concludes, sketching the implications of the analysis for current debates over the optimal reach of the comparative fault principle.

II. The Efficiency Argument for Comparative Negligence

The argument supporting the efficiency of the comparative negligence rule begins with the undisputed fact that evidentiary uncertainty causes deviations from optimal care. Let x^* and y^* denote the socially optimal levels of care for the injurer and the victim, respectively. Also, focusing on the simple negligence (SN) rule, the negligence rule with the defense of comparative negligence (or simply the comparative negligence – CmN – rule)[20] and the negligence rule with the defense of contributory negligence (or simply the contributory negligence – CnN rule), denote the care levels induced by these rules as follows. Let x^{SN}, x^{CmN} and x^{CnN} represent the levels of care chosen by the injurer under the simple negligence rule, the comparative negligence rule and the contributory negligence rule, respectively. Similarly, let y^{SN}, y^{CmN} and y^{CnN} represent the levels of care chosen by the victim under the simple negligence

[19] Currently, the law and economics literature has made little use of computer simulations. A notable exception is Randal C. Picker, *Simple Games in a Complex World: A Generative Approach to the Adoption of Norms*, 64 U. Chi. L. Rev. 1225 (1997).

[20] Several different versions of the comparative negligence rule have been adopted in the United States. *See supra* note 8. The analysis in Sections II-V does not distinguish between the different versions of comparative negligence. The numeric analysis presented in Section VI assumes pure comparative negligence.

rule, the comparative negligence rule and the contributory negligence rule, respectively.[21] When judicial error is accounted for none of the values x^{SN}, x^{CmN} or x^{CnN} will generally equal x^*, and none of the values y^{SN}, y^{CmN} and y^{CnN} will generally equal y^*.[22]

While it is not disputed that the first best outcome cannot be achieved given evidentiary uncertainty, it has been argued that the comparative negligence rule induces the second best outcome. The argument can be shown to rely on three building blocks. The first building block stipulates a specific ordering of the care levels under the different liability rules. Specifically, the claim is that $x^{CnN} < x^{CmN} < x^{SN}$ and $y^{SN} < y^{CmN} < y^{CnN}$, namely that relative to other liability rules the comparative negligence rule induces intermediate care levels by both the injurer and the victim.[23] The second building block asserts that given the ordering of care levels from the first building block comparative negligence induces symmetric intermediate deviations from optimal care by both the injurer and the victim. These symmetric deviations are then contrasted with the alleged asymmetric deviations induced by the simple negligence rule and by the contributory negligence rule, i.e. these rules are said to induce a large

[21] The argument for comparative negligence implicitly assumes that *ex ante*, when the level of care is chosen, the parties know their "role" as potential injurers or potential victims. The distinction between the injurer's care level, *x*, and the victim's care level, *y*, relies on this assumption. If, on the other hand, *ex ante* each party is both a potential injurer and a potential victim (e.g. traffic accidents between two automobiles), then the distinction between the injurer's care level and the victim's care level disappears (of course, *ex post*, for each particular accident, one could still distinguish between the injurer's care level and the victim's care level).

[22] See Shavell, *supra* note 10, p. 85.

[23] *See* Cooter & Ulen, *supra* note 9, pp. 1091-1092.

deviation by the injurer and a small deviation by the victim, or vice versa.[24] The final building block of the argument proceeds to claim that symmetric deviations from optimal care are more efficient than asymmetric deviations, thus reaching the conclusion that the comparative negligence rule is the most efficient rule.[25]

I shall question each one of the three building blocks, from which the argument in favor of comparative negligence is constructed. The ordering of care levels claimed by the first building block will be shown to rely on several unrecognized assumptions. Moving on to the second building block, it will be shown that even if the ordering of care levels from the first building block is valid, still the comparative negligence rule does not generally induce the most symmetric deviations from optimal care. In fact, it will be argued that the contributory negligence rule, and not the comparative negligence rule, will generally induce the most symmetric deviations. Finally, regarding the third building block of the argument, I shall demonstrate that symmetric deviations are more efficient than asymmetric deviations only under certain assumptions, which are not generally satisfied. Thus, even if comparative negligence induced the most symmetric deviations from optimal care, this symmetry result would be insufficient to support a claim in favor of the comparative negligence rule. In short, uncertainty does not establish a case for comparative negligence.

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[24] Professors Cooter and Ulen do not distinguish, in their argument, between the first and second building blocks. *See* Cooter & Ulen, *id*. This may be explained by their assumption that deviations from optimal care will always be towards excessive care. *See* Section IV, *infra*.

[25] *See* Cooter & Ulen, *id*, p. 1092. Recall that professors Cooter and Ulen limit their argument for the efficiency of symmetric deviations to scenarios where the injurer and the victim are "symmetrically situated" *See* note 16, *supra*.

III. The Ordering Result

Evidentiary uncertainty and the possible finding of negligence, which accompanies it, lead to biases in the parties' incentives to exercise precaution, relative to the socially optimal incentives.[26] It has been shown that the magnitudes of these incentives vary from one rule to the other. Moreover, it has been argued that the inefficient incentives induced by the three rules – the simple negligence rule, the comparative negligence rule and the contributory negligence rule - follow a specific ordering. As stated by professors Cooter and Ulen, "the injurer's precaution will be greatest under the [simple] negligence rule, intermediate under the rule of comparative negligence, and least under the rule of negligence with a defense of contributory negligence."[27] And conversely "the victim's precaution will be greatest under the rule of negligence with a defense of contributory negligence, intermediate under the rule of comparative negligence, and least under the rule of negligence [= the simple negligence rule]."[28] As stated in the previous section, the ordering result implies $x^{CnN} < x^{CmN} < x^{SN}$ and $y^{SN} < y^{CmN} < y^{CnN}$.

The intuition for the ordering result was described by professors Cooter and Ulen as follows: When both the injurer and the victim are negligent "[u]nder the rule of negligence with a defense of contributory negligence [the injurer] will not be liable even though he was at fault. Thus, his liability will be discounted by one hundred percent. By contrast, under comparative negligence, the [injurer's]

[26] See Shavell, *supra* note 10, pp. 83-85.
[27] Cooter & Ulen, *supra* note 9, p. 1108-1109. See also Shavell, *id*, p. 85.

liability will be discounted by the victim's relative fault.... Finally, under the rule of simple negligence, a victim's conduct will not be considered at all; the court will discount [the injurer's] liability by zero percent. ... [The injurer's] incentives for taking precaution are inversely related to the discount.... Turning to the victim, his incentive to take precaution is strongest when the injurer's incentive to take precaution is smallest, because the victim bears the residual cost of any uncompensated harm. Conversely, the victim's incentive is weakest where the [injurer's] incentive is greatest. Therefore, his incentive ranking is the mirror image of the injurer's."[29]

I am aware of one attempt, by professors Cooter and Ulen, to formally prove the ordering result.[30] However, it seems that the proof offered by professors Cooter and Ulen inconsistently separates and later combines the two parts of the ordering result. Professors Cooter and Ulen prove the ordering of the injurer's incentives assuming "that the victim's precaution is constant"[31], and similarly prove the ordering of the victim's incentives assuming that the injurer's precaution is constant. But, if the victim's care levels under the three rules follow the stipulated ordering, then how can the ordering of the injurer's care levels be proved assuming "that the victim's precaution is constant"? And, if the injurer's care levels under the three rules follow the stipulated ordering, then how can the

[28] Cooter & Ulen, *id*, p. 1109. See also Shavell, *id*, p. 85.
[29] Cooter & Ulen, *id*, pp. 1091-1092.
[30] Cooter & Ulen, *id*, pp. 1108-1110.
[31] Cooter & Ulen, *id*, p. 1109 (note 151).

ordering of the victim's care levels be proved assuming that the injurer's precaution is constant?[32]

Nevertheless, I do not wish to base my criticism of the efficiency argument for comparative negligence on the questions raised above regarding the robustness of the ordering result. In fact, I do believe that the ordering result often holds - a belief, which is also supported by the numeric analysis section of the present study.[33] Therefore, I proceed to show that even when the ordering result is valid evidentiary uncertainty does not establish a case for comparative negligence.

IV. Are Symmetric Biases Really Efficient?

Even assuming that the ordering result is valid, the efficiency argument for comparative negligence still relies on two additional building blocks – that symmetric biases in the parties' care levels are efficient, and that comparative negligence induces the most symmetric biases. Section IV demonstrates that symmetric biases are not generally efficient.[34] I derive the sufficient conditions for the efficiency of symmetric biases, and show that often these conditions are not

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[32] Moreover, regarding the comparative negligence rule, professors Cooter and Ulen do not account for the effect of the parties' precautions on the division of liability between the two parties, when both parties are deemed negligent. This effect further qualifies the ordering result.

[33] The precise conditions, under which the ordering result holds, are derived in Bar-Gill, *supra* note 16.

[34] The analysis below assumes that the injurer and the victim are "symmetrically situated" to exercise care, or that neither party is systematically better situated to exercise care. *See* note 16, *supra*. Clearly, when one party is systematically better situated to exercise care, symmetric biases are not generally efficient. For a more complete analysis of scenarios, where the parties are not "symmetrically situated" – *see* Bar-Gill, *supra* note 16.

satisfied. The question whether comparative negligence induces the most symmetric biases is addressed in Section V.

Before examining whether, or when, symmetric biases are efficient, it must first be made clear what symmetric biases are. As explained above, a liability rule induces deviations from optimal care, or biases, with respect to both the injurer's care level and the victim's care level. When theses two biases are of equal magnitude, the liability rule is said to induce symmetric biases.[35] More generally, the smaller the difference between the two biases, the more symmetric they are considered to be. Formally, if x^A and x^B represent the levels of care chosen by the injurer under rules A and B, respectively, and y^A and y^B represent the levels of care chosen by the victim under rules A and B, respectively, then rule A is said to induce more symmetric biases than rule B *if and only if*

$$\left|\left(x^A - x^*\right) - \left(y^A - y^*\right)\right| < \left|\left(x^B - x^*\right) - \left(y^B - y^*\right)\right|.$$

The left hand side of the condition measures the difference between the injurer's bias, $x^A - x^*$, and the victim's bias, $y^A - y^*$, under rule A. Similarly, the right hand side of the condition measures the difference between the injurer's bias, $x^B - x^*$, and the victim's bias, $y^B - y^*$, under rule B.

The prototypical case in favor of symmetric biases is illustrated by the following example.

Example 1: The optimal care levels for the injurer and the victim are: $x^* = y^* = 10$. The injurer's care levels under the three rules are:

$x^{CnN} = 15, x^{CmN} = 20, x^{SN} = 25$, and the victim's care levels under the three rules are: $y^{SN} = 15, y^{CmN} = 20\ y^{CnN} = 25$.

In example 1, the symmetric biases induced by the comparative negligence rule are indeed more efficient than the asymmetric biases induced by the other two rules, as long as precaution expenditures suffer from decreasing marginal productivity.[36] However, the efficiency of symmetric biases in example 1 crucially depends on two implicit assumptions.

The first implicit assumption is what I shall refer to as the "constant sum hypothesis". Note, that in example 1 –

$$\left|x^{SN} - x^*\right| + \left|y^{SN} - y^*\right| = \left|x^{CmN} - x^*\right| + \left|y^{CmN} - y^*\right| = \left|x^{CnN} - x^*\right| + \left|y^{CnN} - y^*\right|,$$

where each one of the three parts in this three-way equality measures the sum of the biases – in the injurer's care level and the victim's care level – under one of the three liability rules. The left hand side of the equality represents the sum of the injurer's bias, $\left|x^{SN} - x^*\right|$, and the victim's bias, $\left|y^{SN} - y^*\right|$, under the simple negligence rule. The middle term represents the sum of the injurer's bias, $\left|x^{CmN} - x^*\right|$, and the victim's bias, $\left|y^{CmN} - y^*\right|$, under the comparative negligence rule. Finally, the right hand side of the equality represents the sum of the injurer's bias, $\left|x^{CnN} - x^*\right|$, and the victim's bias, $\left|y^{CnN} - y^*\right|$, under the contributory

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[35] In addition, symmetry implies that the two biases are in the same direction. Namely, either both biases are towards excessive care or both biases are towards inadequate care.

[36] The important role of the assumption that precaution expenditures suffer from decreasing marginal productivity was first identified in Ben-Shahar, *supra* note 3. However, contrary to the assumptions, which are identified and analyzed in the text that follows this note, the assumption of decreasing marginal productivity is standard and seemingly less problematic in the present context.

negligence rule. In short, the constant sum hypothesis asserts that the sum of the biases – in the injurer's care level and the victim's care level – is constant across the three liability rules.

Proponents of the comparative negligence rule have not attempted to defend the constant sum hypothesis, which actually seems quite unrealistic.[37] The central role of the constant sum hypothesis is illustrated by the following example:

Example 2: The optimal care levels remain as in example 1: $x^* = y^* = 10$. The injurer's care levels under the three rules are: $x^{CnN} = 11, x^{CmN} = 20, x^{SN} = 25$, and the victim's care levels under the three rules are: $y^{SN} = 15, y^{CmN} = 20\ y^{CnN} = 21$.

In example 2, comparative negligence continues to induce the most symmetric biases. Nevertheless, it seems quite clear that the contributory negligence rule, and not the comparative negligence rule, is superior in this example.

The second implicit assumption, which is required for the efficiency of symmetric biases, and which was followed in both example 1 and example 2, is that both the injurer and the victim exercise **excessive** care under all three rules.[38] This assumption is unrealistic, at least with respect to the victim's choice of care.

[37] If the magnitude of the loss, which the liability rules divide between the parties, was unaffected by the pertaining rule, then the constant sum assumption may have been easier to defend. But the magnitude of the loss is clearly influenced by the liability rule.

[38] This assumption is common in the literature. For example, Cooter & Ulen, *supra* note 9, argue that "[e]videntiary uncertainty … prompts rational decision makers to exceed the legal standard of care."

For example, under the simple negligence rule the victim will always choose inadequate care. To see this note that under the simple negligence rule, if the injurer is never found negligent, then the victim will bear any potential loss, and will thus exercise optimal care. But, given the possibility of judicial error, the injurer will be found negligent with a positive probability, and thus the victim no longer enjoys the full loss-reducing effect of his precaution investment. This dilutes the victim's incentives, and leads him to exercise less than optimal care.[39] Moreover, it has been shown that for high levels of uncertainty, both the injurer and the victim may choose inadequate care at equilibrium, under all three liability rules.[40]

The problematic excessive care assumption is crucial for the efficiency of symmetric biases. The following example is illustrative:

Example 3: The optimal care levels remain as in example 1: $x^* = y^* = 10$. The injurer's care levels under the three rules are: $x^{CnN} = 7, x^{CmN} = 8, x^{SN} = 11$, and the victim's care levels under the three rules are: $y^{SN} = 7, y^{CmN} = 8, y^{CnN} = 9$.

In example 3, comparative negligence continues to induce the most symmetric biases, and even the constant sum hypothesis is satisfied. Nevertheless, the optimality of the comparative negligence rule is far from being

[39] The result that the victim will always exercise inadequate care under the simple negligence rule, and may exercise inadequate care under the other two rules as well, is formally stated and proved in Bar-Gill, *supra* note 16.

[40] This result was proved by Calfee & Craswell, *supra* note 15, in a unilateral care model (where only the injurer can exercise care) under the simple negligence rule, and was extended by Bar-Gill, *supra* note 16, to a bilateral care model, where both the injurer and

clear. For instance, if deviations towards inadequate care are more detrimental, in terms of the overall social cost, compared to deviations towards excessive care, the simple negligence rule may well be the superior rule in example 3. Since the overall social cost function is generally asymmetric with respect to "positive" versus "negative" deviations from optimal care, symmetric biases are not necessarily efficient.

Both the constant sum hypothesis and the assumption that all deviations from the optimum are towards excessive care are crucial for the efficiency of symmetric biases.[41] I have also argued that these two assumptions are not generally satisfied. In the following section, I shall prove that even under these two strong assumptions, judicial error does not establish a case for comparative negligence.

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the victim were shown to exercise inadequate care at equilibrium under all three liability rules.

[41] In fact, it can be shown that under fairly weak conditions these two assumptions are sufficient for the efficiency of symmetric biases. – See Bar-Gill, *supra* note 16.

V. Does Comparative Negligence Induce the Most Symmetric Biases?

If all deviations are toward excessive care (i.e. the biases are all positive) and the constant sum hypothesis is valid, then the rule, which induces the most symmetric biases, is indeed the superior rule.[42] However, even if we accept the validity of these assumptions, and believe that symmetric biases are indeed optimal, there is still one more obstacle that we must pass before the comparative negligence rule can be declared the most efficient rule. We must show that comparative negligence indeed induces the most symmetric biases. And as it turns out the comparative negligence rule does not necessarily induce the most symmetric biases.

Traditional analysis implicitly assumes that the average deviation from optimal care on the injurer's side is equal to the average deviation on the victim's side. Under this assumption, comparative negligence indeed induces the most symmetric biases. Naturally, no argument was put forward in support of this implicit assumption, and there is no reason to believe that it is generally satisfied.[43] In fact, it can be argued that the average deviation on the injurer's side is systematically larger than the average deviation on the victim's side. All three negligence rules share an inherent asymmetry regarding the division of burden between the injurer and the victim. The injurer bears no liability under all three rules, unless she is found negligent. The victim, on the other hand, may bear the

[42] *See* note 41, *id.*

[43] When this assumption of equal average deviations is relaxed, neither comparative negligence nor any one of the two other rules generally induces the most symmetric biases. Bar-Gill, *supra* note 16, derives the conditions, under which each one of the three rules induces the most symmetric incentives.

harm even if he is not found negligent. This common asymmetry generates stronger incentives for the injurer to exercise excessive care under all three rules. The three rules diverge only in the event that the injurer is found negligent, and only contingent on such a finding of negligence is the comparative negligence rule more symmetric. But, considering the common asymmetry pushing towards more excessive care by the injurer, the contributory negligence rule, which supplies the weakest incentives for the injurer to exercise excessive care conditional on a finding of negligence, may be the most symmetric rule overall. The following example is illustrative.

Example 4: The optimal care levels remain as in example 1: $x^* = y^* = 10$. The injurer's care levels under the three rules are: $x^{CnN} = 22, x^{CmN} = 27, x^{SN} = 32$, and the victim's care levels under the three rules are: $y^{SN} = 15, y^{CmN} = 20\ y^{CnN} = 25$.

In example 4, the contributory negligence rule, and not the comparative negligence rule, induces the most symmetric incentives.

Symmetric incentives are not generally efficient. But, even when they are efficient, the comparative negligence rule does not generally induce the most symmetric incentives.

VI. Testing the Efficiency of Comparative Negligence *via* Computer Simulations

The above analysis has demonstrated that the comparative negligence rule is not generally superior to the other liability rules. Section VI utilizes computer simulations to illustrate this result.[44] The numeric analysis specifies the functional dependence of the expected loss, *l*, on the levels of care exercised by the injurer and the victim, *x* and *y*:

$$l(x,y) = h \cdot \left(\frac{1}{1+\lambda \cdot x} + \frac{1}{1+\lambda \cdot y} \right),$$

where the parameter *h* can be interpreted as representing the magnitude of the potential harm, and the parameter λ may represent the effectiveness of the parties' precautions in reducing the probability that harm will occur. The chosen family of expected loss functions follows the assumption of decreasing marginal productivity of precaution expenditures for both parties.[45]

Given this specification, the optimal levels of care are functions of the parameters *h* and λ, i.e. $x^* = y^* = O(h,\lambda)$. Assuming that the court's errors are proportional to the level of care, let ω represent the level of uncertainty, where the standard deviation of the error term is $\sigma = \omega \cdot O(h,\lambda)$.

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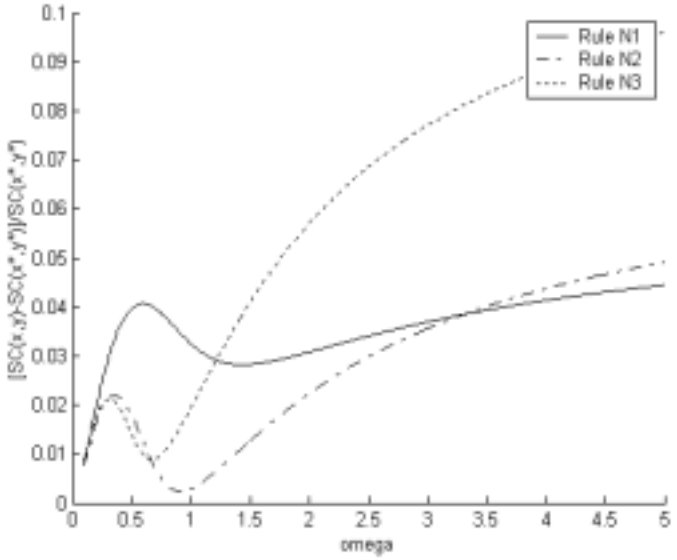
[44] The computer simulations were implemented in the MATLAB 6.0 environment. The algorithm used in the simulations, as well as the source code itself, can be found in Bar-Gill, *id.*

[45] The chosen loss functions alleviate one complexity. Due to the separable structure of the expected loss functions, the effectiveness of care exercised by one party is independent of the level of care exercised by the other party. Hence, the optimal level of care for one party is independent of the level of care exercised by the other party. Also, following Cooter & Ulen, *supra* note 9, the chosen loss function represents scenarios, in which the injurer and the victim are symmetrically situated to exercise care. The analysis can be easily extended to allow for scenarios, in which the injurer and the victim are not symmetrically situated, by assigning an independent λ-parameter for each party.

Starting with $h = 10000$ and $\lambda = 1$, and assuming that court errors follow a Normal distribution[46] with no systematic bias (i.e. the mean of the error distribution is zero), I derive the relative social cost under the three liability rules, for different values of ω. Figure 1 presents the results of the numeric analysis.

(a)



(b)

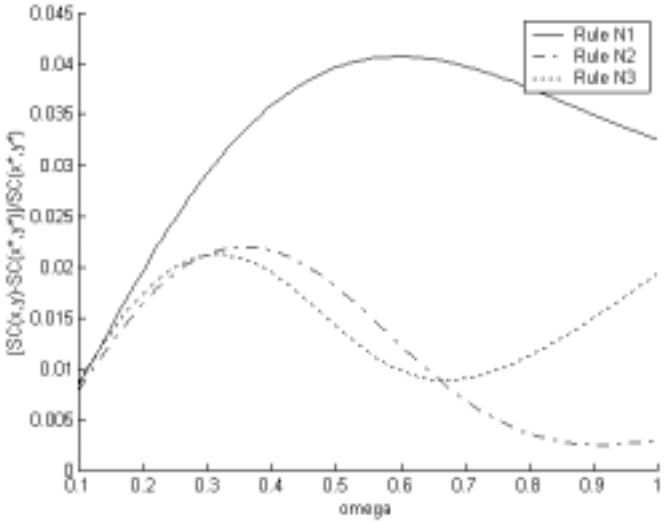


Fig. 1: Relative social cost as a function of ω -
(a) broader range of ω; (b) focus on low levels of uncertainty

[46] Qualitatively similar results obtain for a Uniform error distribution.

As illustrated in figure 1, the comparative negligence rule is optimal for low levels of uncertainty.[47] However, as the standard deviation of the court's error exceeds 30% of the optimal care level, the contributory negligence rule becomes optimal. Comparative negligence becomes optimal again when the standard deviation of the court's error exceeds 65% of the optimal care level. Finally, the simple negligence rule is optimal for very high levels of uncertainty (in the present setting, whenever the standard deviation of the error exceeds 350% of the optimal care level).

These results are qualitatively robust to extreme variations in the levels of the parameters *h* and λ, subject to minor adjustments in the threshold levels of ω at which the efficiency ranking of the three rules changes. However, these threshold levels of ω are extremely sensitive to the functional form of *l(x,y)*. For example, if $l(x,y) = h \cdot \left(e^{-\lambda \cdot x} + e^{-\lambda \cdot y}\right)$, simple negligence replaces comparative negligence as the superior rule, already when the standard deviation of the court's error exceeds 60% of the optimal care level.

The numeric analysis supports the previous conclusion that uncertainty does not establish a case for comparative negligence. All three rules may turn out to be optimal depending on the degree of uncertainty and on the functional form of the expected loss function.

[47] When the standard deviation of the court's error falls below 10% of the optimal care level, the three rules generate very similar efficiency results, which are very close to the socially optimal level of care. For numeric reasons, it is difficult to calculate the precise equilibrium care levels for this range.

VII. Conclusion

Comparative negligence, and more broadly comparative fault, is spreading through tort law, and beyond. The rise of the comparative negligence rule has been supported by economic analysis, claiming that when courts are imperfectly informed this rule induces the most efficient outcome. The present study proves that this economic argument for comparative negligence does not generally hold. In fact, the traditional contributory negligence doctrine may well provide for lower overall costs when evidentiary uncertainty is accounted for. While theoretical support for comparative negligence may come from other directions, uncertainty does not establish an economic case for comparative negligence.

While the analysis in this study has focused on the pure comparative negligence rule, as compared to the simple negligence rule and the contributory negligence rule, its implications are broader. First, with respect to the divide among the states over the optimal form of comparative negligence, the present analysis suggests that pure comparative negligence may not be the optimal rule. In fact, various modified forms of comparative negligence, and in particular the rule with a (contributory negligence type) total bar to recovery for a plaintiff, who is more negligent than the defendant,[48] may prove to be the more efficient rules. Second, the present analysis urges careful consideration by courts and legislatures, before allowing the comparative fault principle to trump down remaining doctrines, which still provide for a complete bar to liability. Finally,

[48] *See supra* note 8.

the skepticism concerning the efficiency of comparative negligence, suggests caution in expanding the principle of comparative fault to the areas of products liability, apportionment of liability among multiple tortfeasors and contract law.