ARTICLES

The Economic Efficiency of the Robust Rules of Modern Product Liability Law

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I. INTRODUCTION

The rules of liability assignment in product claims have changed significantly since the 1960s. Courts have embraced rules imposing "strict liability" on manufacturers while eschewing traditional negligence rules.⁴ Policy justifications for this shift have included risk

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spreading and deterrence\(^2\) as well as a "deep pockets" rationale.\(^3\)

This change has been costly to American industry which has faced significantly increased levels of litigation,\(^4\) liability for a broader


Other jurisdictions have enacted statutes adopting 402A. See, e.g., ARK. CODE. ANN. § 4-86-102 (Michie 1987); ME. REV. STAT. ANN. tit. 14, § 221 (West 1964).


2. See John W. Wade, On the Nature of Strict Tort Liability for Products, 44 Miss. L.J. 825 (1973). Professor Wade offers the following public policy reasons to support the adoption of strict liability: 1) the plaintiff was relieved of the difficulty of proving the manufacturer's negligence, 2) the cost of the injury was spread out over the consuming public instead of falling on one person, and 3) the potential imposition of strict liability would deter manufacturers from creating unsafe products. Id. at 826. Other commentators have criticized these reasons. See, e.g., David G. Owen, Rethinking the Policies of Strict Products Liability, 33 VAND. L. REV. 681, 703-714 (1980).

3. See Nancy DuBois Wright, Hoelter-Skelter: Product Defect and Plaintiff Negligence - A Connecticut Commentary on Confusion, 10 CONN. L. REV. 90, 117 (1977) (offering the view that businesses can estimate risks, plan for them and treat them as a business cost and are thus better able to absorb accident costs). But cf. Marcus L. Plant, Comparative Negligence and Strict Tort Liability, 40 LA. L. REV. 403, 416 (1980) (finding large but not small businesses able to sustain such costs).

4. An examination of suits filed in federal district courts reveals that the number of suits has increased by 758% from 1,579 to 13,554 during the period 1974-1985. See ALLIANCE OF AMERICAN INSURERS ET. AL., PROPERTY AND CASUALTY INSURANCE INDUSTRY DATA AND THE CASE FOR TORT REFORM: DOCUMENTING THE COST OF EXPANDING TORT LIABILITY DOCTRINES BEYOND TRADITIONAL COMMON LAW BOUNDARIES 35 (1986) [hereinafter AAI REFORM DATA]. But cf. UNITED STATES GENERAL ACCOUNTING OFFICE, GAO/HRD-88-36BR, PRODUCT LIABILITY: EXTENT OF
range of injuries and higher damage awards. In response, industry has pursued efforts at significant tort reform, counseling either a return to classical negligence rules or the adoption of a uniform federal products liability statute. More specifically, they argue that strict liability is both unjust and inefficient; that it has increased costs, stifled innovation and made it increasingly more difficult for American manufacturers to vie with foreign competitors. A fierce debate has ensued.

Legal scholars have joined the debate. Much of this scholarship

"Litigation Explosion" in Federal Courts Questioned (1988) (The GAO, while conceding that litigation of product claims has increased significantly, finds that the increase is deceptive because it is primarily a result of increased litigation of asbestos, Dalkon shield and bendictin cases.).

5. AAI Reform Data, supra note 4, at 6.
6. AAI Reform Data, supra note 4, at 38-39; see also James S. Kakalik & Nicholas M. Pace, Costs and Compensation Paid In Tort Litigation (1986).
14. Much of this scholarship has focused on the question of causation. This article does not directly address the issue of causation except insofar as discussions of economic efficiency are inherent to both. For a complete discussion of economic theory applied to the concept of proximate cause, see generally Mark F. Grady,
utilizes economic models to analyze legal rules. Legal rules assign liability for the costs of accidents to the accidents' parties and thus are assumed to provide incentives to those parties to take levels of precaution which affect the total social cost of the accidents. Some analysts conclude the tort system has abandoned efficient rules and has adopted inefficient ones. Other analysts conclude that the rules of tort law are efficient. Regardless of the conclusions reached, the conventional economic analysis is incomplete and has inadvertently misinformed the debate.

The general aim of this article is to show first that a set of efficient rules has been adopted by our tort system and second that the efficient rules adopted are not the rules which have been the

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16. Efficiency, when used in this context, means to "minimize the sum of accident costs and the costs of accident avoidance." See Guido Calabresi & John T. Hirshoff, Toward a Test for Strict Liability in Torts, 81 Yale L.J. 1055, 1057 (1972). Efficient rules provide incentives to the parties to take safety precautions that minimize the cost of accidents to society. Inefficient rules do not provide such incentives and social costs are not minimized. But cf. Richard A. Epstein, A Theory of Strict Liability: Toward a Reformulation of Tort Law 4 (1980) (Epstein "does not regard economic theory as the primary means to establish the rules of legal responsibility.").

17. See generally Steven Shavell, Strict Liability versus Negligence, 9 J. Legal Stud. 1 (1980). Shavell maintains that the conventional analysis, by inappropriately failing to consider levels of activity, incorrectly determines that a rule is efficient when in fact it is not. Cf. Cooter & Ulen, supra note 15, at 436. Cooter and Ulen generally conclude the rules themselves are efficient but are utilized inappropriately by the judiciary, leading to the failure of an otherwise efficient rule to provide the incentives necessary to achieve minimal accident costs.

subject of the debate. More specifically, legal scholars have erred in three ways. First, they have focused on an inappropriate and narrow set of "simple rules." In Part II, we will derive a mutually-exclusive and exhaustive set of simple rules by partitioning the "accident event space." We will determine the efficiency of each member of the set while eliminating the inefficient rules, arriving at a complete set of efficient simple rules. Second, scholars have assumed that simple rules deemed efficient within the parameters of their economic model will also be efficient in application. In Part III, we will explore this assumption and demonstrate it to be false. Third, scholars have incorrectly assumed that courts adopt simple rules and that courts' notion of strict liability is the same as the notion of strict liability adopted in the academic literature. In Part IV, we will provide an alternative set of "robust rules" which more accurately explain the courts' notion of strict liability and the seemingly capricious assignment of liability under modern negligence doctrine.

II. THE FORMAL DERIVATION OF A COMPLETE SET OF SIMPLE RULES OF LIABILITY ASSIGNMENT

Accidents are conceived of as involving "victims" and "injurers." The "socially-optimal level of precaution" exercisable by a potential
injurer is defined as $X^*$. 28 The socially-optimal level of precaution exercisable by a potential victim is defined as $Y^*$. 29 Accidents in which only the potential injurer can take precaution to reduce the probability of an injury’s occurrence or its severity are accidents under “conditions of injurer unilateral precaution.” 30 Accidents in which only the potential victim can take precaution to reduce the probability of an injury’s occurrence or its severity are accidents under “conditions of victim unilateral precaution.” 31 Accidents in which both the injurer and the victim can take precaution to reduce the probability of an injury’s occurrence or its severity are accidents under “conditions of bilateral precaution.” 32

The set of simple rules for assigning liability under the three sets of conditions are derived by partitioning the accident event space and engaging in a two step process.

liability should be automatically thrust upon manufacturers since they are defined as “injurers.” See, e.g., COOTER & ULEN, supra note 15; Brown, supra note 15. While we will continue the use of the literature’s terms, a more appropriate definition might employ the terms “user” and “manufacturer” since they bestow no a priori assignment of liability upon either actor. We do not consider assignment of liability to third parties such as Workman’s Compensation funds and persons who fail to initiate a rescue.

27. The socially-optimal level of precaution is the degree of precaution which minimizes the sum of accident and avoidance costs and thus the total social cost of accidents. For a complete discussion of economic efficiency related to social costs, see GUIDO CALABRESI, THE COSTS OF ACCIDENTS: A LEGAL AND ECONOMIC ANALYSIS (1970); Ronald N. McKean, Products Liability: Implications of some Changing Property Rights, 84 Q.J. ECON. 611 (1970); R.H. Coase, The Problem of Social Cost, 3 J.L. & ECON. 1 (1960).

28. $X^*$ is thus the level of precaution taken by an injurer which minimizes total social costs. Total social costs represent the sum of the costs of accidents and the costs of accident avoidance. We assume that courts are able to distinguish the socially-optimal level of precaution and incorporate it into the legal standard they adopt.

29. $Y^*$ is thus the level of precaution taken by a victim which minimizes total social costs. Total social costs represent the sum of the costs of accidents and the costs of accident avoidance.

30. An example would be a commercial airline accident. While the manufacturer and the airline (injurers) can take precaution, passengers (victims) can not. See infra notes 48, 75-79, 88, 91-92 and accompanying text (discussing injurer unilateral precaution conditions).

31. An example would be an accident occurring when cutting with a sharp knife. See Wade, supra note 2, at 844; infra notes 51, 80-87, 89-92 and accompanying text (discussing victim unilateral precaution conditions).

32. An example would be an automobile accident. The manufacturer may design a safe braking system and the victim may operate the vehicle safely.
First, by partitioning the event space, the legal standard or "test
criterion" of the rule is created. While the event space shown in
Figure 1 may be partitioned in a number of ways,\textsuperscript{33} in that \textbf{X} and
\textbf{Y} represent the levels of precaution resulting in the minimum total
social cost, the event space will, when partitioned, be partitioned at
\textbf{X} and/or \textbf{Y}.\textsuperscript{34} Second, once partitioned, rule derivation is completed
by assigning liability for the loss to one of the actors.\textsuperscript{35} For example,
in Figure 2, the event space has been partitioned only at \textbf{X} and the
right hand shaded section has been designated "the victim." The
statement of liability created is "the victim is liable for his own losses
if the injurer takes a level of precaution equal to or exceeding the
socially-optimal level of precaution required by the rule\textsuperscript{36} but the
injurer is liable otherwise." In symbolic notation this rule appears as
\textbf{VL if: }\textbf{X} \geq \textbf{X} \text{ OTHERWISE IL}.\textsuperscript{37} Table 1 shows all the possible
partitioning schemes and the simple rules derived.\textsuperscript{38}

\textsuperscript{33} For example, the event space may not be partitioned at all; it may be
partitioned only along the \textbf{X} axis, only along the \textbf{Y} axis or both.

\textsuperscript{34} See Figure 1. By partitioning at \textbf{X} and \textbf{Y} the legal standard conveyed by
the rule provides requirements for both injurers and victims to take their socially-
optimal level of precaution.

\textsuperscript{35} Traditionally, rules have been derived by assigning liability to only one of
the actors. See Brown, \textit{supra} note 15, at 328. See generally Calabrese & Hirshoff,
\textit{supra} note 16. This unilateral assignment of liability has resulted in an incomplete
set of simple rules. See generally \textit{infra} parts II, III. We will discuss the assignment
of liability to both actors and either actor. See generally \textit{infra} parts II, III, IV.

\textsuperscript{36} No precaution is required of the victim since no partition was made at \textbf{Y}.

\textsuperscript{37} Different analysts utilize various coding schemes to define the various rules
they analyze. See Brown, \textit{supra} note 15, at 328-31; Cooter \& Ulen, \textit{supra} note 15,
at 354-56. Our coding scheme is utilized for simplicity and defines the rule as follows:
\textbf{X} \geq \textbf{X} \text{ OTHERWISE IL} is the "legal standard" or test criterion section of the rule.
The test criterion defines the level of precaution required of an actor in order for
that actor to avoid liability. \textbf{VL if: } is the assignment of "residual liability." The
actor named as the bearer of residual liability bears that liability when the actor named in the test criterion section escapes liability by taking the level of precaution required by the test criterion. Thus, in the rule VL if: X ≥ X* OTHERWISE IL, if the injurer takes X ≥ X* precaution, the injurer escapes liability and the loss falls on the victim as the bearer of residual liability.

38. While 18 partition schemes exist, the literature, in general, has only given attention to (1), (2), (5), (10), (14) and (15). See Brown, supra note 15, at 328-31; Cooter & Ulen, supra note 15, at 354-71.
### Economic Efficiency

#### Table 1. Rules for Efficient Bilateral Precaution

<table>
<thead>
<tr>
<th>Rule</th>
<th>Condition 1</th>
<th>Condition 2</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>(11)</td>
<td>$X &lt; X^<em>$ and $Y &lt; Y^</em>$</td>
<td>Otherwise IL</td>
<td>VL if: $X &lt; X^<em>$ and $Y &lt; Y^</em>$</td>
</tr>
<tr>
<td>(12)</td>
<td>$X &lt; X^<em>$ and $Y &lt; Y^</em>$</td>
<td>Otherwise VL</td>
<td>IL if: $X &lt; X^<em>$ and $Y &lt; Y^</em>$</td>
</tr>
<tr>
<td>(13)</td>
<td>$X &lt; X^<em>$ and $Y \geq Y^</em>$</td>
<td>Otherwise IL</td>
<td>VL if: $X &lt; X^<em>$ and $Y \geq Y^</em>$</td>
</tr>
<tr>
<td>(14)</td>
<td>$X &lt; X^<em>$ and $Y \geq Y^</em>$</td>
<td>Otherwise VL</td>
<td>IL if: $X &lt; X^<em>$ and $Y \geq Y^</em>$</td>
</tr>
<tr>
<td>(15)</td>
<td>$X \geq X^<em>$ and $Y &lt; Y^</em>$</td>
<td>Otherwise IL</td>
<td>VL if: $X \geq X^<em>$ and $Y &lt; Y^</em>$</td>
</tr>
<tr>
<td>(16)</td>
<td>$X \geq X^<em>$ and $Y &lt; Y^</em>$</td>
<td>Otherwise VL</td>
<td>IL if: $X \geq X^<em>$ and $Y &lt; Y^</em>$</td>
</tr>
<tr>
<td>(17)</td>
<td>$X \geq X^<em>$ and $Y \geq Y^</em>$</td>
<td>Otherwise IL</td>
<td>VL if: $X \geq X^<em>$ and $Y \geq Y^</em>$</td>
</tr>
<tr>
<td>(18)</td>
<td>$X \geq X^<em>$ and $Y \geq Y^</em>$</td>
<td>Otherwise VL</td>
<td>IL if: $X \geq X^<em>$ and $Y \geq Y^</em>$</td>
</tr>
</tbody>
</table>

Any one of the eighteen rules would be adopted by a tort system. However, a tort system concerned with efficiency will only consider efficient rules; that is, those rules from among the eighteen that provide incentives to the appropriate actors to take their socially-optimal level of precaution so as to minimize total social costs. Therefore, our task is to determine which rules from Table 1 are efficient.

#### A. Efficient Rules Under Conditions of Bilateral Precaution

The incentive to take the socially-optimal level of precaution and the resulting attainment of the socially-optimal or minimum level of accident costs provided by any given rule depends on the particular situation to which it is applied.39 We will adopt Professors Cooter

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39. Rules may be economically efficient under conditions of bilateral precaution, they may be economically efficient only under conditions of unilateral precaution or they may not be economically efficient at all. Cooter and Ulen define an efficient rule as one that provides an incentive to the actors to exercise the socially-optimal level of care, thereby minimizing the total cost to society. See Cooter & Ulen, supra note 15, at 340-71 (discussing the determination of the efficiency of a simple rule).
and Ulens' test to judge the efficiency of a rule under conditions of bilateral precaution. They find that a rule that assigns one of the actors residual liability and requires, as a criterion of liability avoidance, that the other actor take the socially-optimal level of precaution will be economically efficient under conditions of bilateral precaution regardless of any other specification required by the criteria. The simple rules from Table 1 that meet this test and are efficient under bilateral precaution conditions are shown in Table 2.

### TABLE 2

**SIMPLE RULES EFFICIENT UNDER BILATERAL PRECAUTION CONDITIONS**

<table>
<thead>
<tr>
<th>RULE #</th>
<th>LIABILITY ASSIGNMENT STATEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>(5)</td>
<td>VL if: (X \hat{\times} X^*) OTHERWISE IL</td>
</tr>
<tr>
<td>(10)</td>
<td>IL if: (Y \hat{\times} Y^*) OTHERWISE VL</td>
</tr>
<tr>
<td>(14)</td>
<td>IL if: (X \hat{\times} X^<em>) and (Y \hat{\times} Y^</em>) OTHERWISE VL</td>
</tr>
<tr>
<td>(15)</td>
<td>VL if: (X \hat{\times} X^<em>) and (Y \hat{\times} Y^</em>) OTHERWISE IL</td>
</tr>
<tr>
<td>(17)</td>
<td>VL if: (X \hat{\times} X^<em>) and (Y \hat{\times} Y^</em>) OTHERWISE IL</td>
</tr>
<tr>
<td>(18)</td>
<td>IL if: (X \hat{\times} X^<em>) and (Y \hat{\times} Y^</em>) OTHERWISE VL</td>
</tr>
</tbody>
</table>

Two important observations emerge from an examination of the efficient simple rules shown in Table 2. First, simple rule 17 is efficient because it holds the victim residually liable if \(X \hat{\times} X^*\) and \(Y \hat{\times} Y^*\), but simple rule 18 is also efficient because it holds the injurer residually liable.

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40. Under the assumption that persons act rationally and seek to minimize private costs, a rule allowing one of the actors opportunity to escape liability by taking the socially-optimal level of precaution provides an incentive for that actor to do so. This leaves losses on the other actor as the bearer of residual liability. Therefore the bearer of residual liability, also a rational actor, will take the socially-optimal level of precaution so as to minimize expected private costs. Thus, the rule provides an incentive to both actors to take their socially-optimal levels of precaution and total social cost is minimized. For a complete discussion, see *id.* at 359-60.

41. See *id.* at 359-60 (While not explicitly stating this test, the test is implied by their discussion.). Some rules, for example rule 18 in Table 1, designate an actor as the bearer of residual liability but also require that actor to take the socially-optimal level of precaution as a condition of liability avoidance. Obviously, the requirement is redundant in terms of providing an incentive for that actor to take socially-optimal level of precaution, the actor cannot escape liability even if he takes it since he is the bearer of residual liability. Thus, the bearer of residual liability is provided an incentive to take the socially-optimal precaution whether or not he is also provided this incentive by the test criterion of the rule.
liable under the same test criteria. This anomaly can be remedied by combining these two rules. A new combined rule is formulated as:

**Either Liable if:** \( X \geq X^* \) and \( Y \geq Y^* \)

We will call this new assignment of liability "public interest liability," identify it as simple rule number 19 and, in Table 3, add it to the list of efficient simple rules.\(^{42}\)

Second, under conditions of bilateral precaution, no efficient simple rule remains in Table 2 for the test criteria \( X < X^* \) and \( Y < Y^* \) since both rules 11 and 12 were inefficient.\(^{44}\) We can remedy this second anomaly by holding both actors liable, perhaps on a proportional basis, when both could have, but neither did, take the socially-optimal level of precaution, thus creating an incentive for each of them to do so. This simple rule is formulated as:

**Both Liable if:** \( X < X^* \) and \( Y < Y^* \)

This assignment of liability has been called "comparative negligence,"\(^{45}\) we identify it as simple rule number 20 and, in Table 3, add it to the list of efficient simple rules under conditions of bilateral precaution. Table 3 thus represents a complete list of efficient simple rules under conditions of bilateral precaution.\(^{46}\)

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42. We refer to this liability assignment as public interest liability since the rule is efficient regardless of which actor is designated as the bearer of residual liability since both actors are provided, by the test criterion, an incentive to escape liability by taking socially-optimal precaution. The choice of which actor is residually liable is often the product of other criteria, such as broader issues of public policy and perceptions of the public interest. See infra notes 135-52 and accompanying text (discussing, in the context of robust rules, such other criteria).

43. See infra notes 135-52 (discussing this new rule).

44. Rule 11 is inefficient since the injurer is neither designated as the bearer of residual liability nor required by the test criterion to take a socially-optimal level of precaution. Therefore, the injurer is provided a positive incentive to take no precaution since that will minimize the injurer's expected private costs. Thus, only the victim is provided an incentive to take socially-optimal precaution under bilateral conditions. Rule 12 is similarly inefficient except that the roles of victim and injurer are reversed.

45. See Coover & Ulen, supra note 15, at 356-60; Daniel L. Rubinfeld, *The Efficiency of Comparative Negligence*, 6 J. LEGAL. STUD. 375 (1987). A tort system concerned with efficiency would be compelled to adopt such a rule when faced with situations in which both actors failed to take socially-optimal precaution. See infra notes 153-56 and accompanying text (discussing the adoption of comparative negligence).

46. These rules would be those considered by a tort system seeking economic efficiency under bilateral conditions.
TABLE 3

REvised SET OF ECONOMically EFFICIENT SIMPLE RULES UNDER BILATERAL CONDITIONS

<table>
<thead>
<tr>
<th>RULE #</th>
<th>LIABILITY ASSIGNMENT STATEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>(5)</td>
<td>VL if: X ≥ X* OTHERWISE IL</td>
</tr>
<tr>
<td>(10)</td>
<td>IL if: Y ≥ Y* OTHERWISE VL</td>
</tr>
<tr>
<td>(14)</td>
<td>IL if: X &lt; X* and Y ≥ Y* OTHERWISE VL</td>
</tr>
<tr>
<td>(15)</td>
<td>VL if: X ≥ X* and Y &lt; Y* OTHERWISE IL</td>
</tr>
<tr>
<td>(19)</td>
<td>Either Liable if: X ≥ X* and Y ≥ Y*</td>
</tr>
<tr>
<td>(20)</td>
<td>Both Liable if: X &lt; X* and Y &lt; Y*</td>
</tr>
</tbody>
</table>

B. Rules Efficient Only Under Conditions of Unilateral Precaution

While a simple rule may be inefficient under conditions of bilateral precaution, that same simple rule may be efficient when considered exclusively under conditions of unilateral precaution. For example, Rule 2 IL ALWAYS is inefficient under conditions of bilateral precaution. However, under unilateral conditions where only the injurer can take the socially-optimal level of precaution (i.e. X* > 0) and the victim cannot (i.e. Y* = 0), a rule that assigns the injurer residual liability will provide an incentive for the injurer to take such precaution to minimize expected private costs. In symbolic notation, such an efficient rule would appear as:

IL ALWAYS (when X* > 0 if: Y* = 0)

We will call this rule “special strict liability,” identify it as simple rule 21 and, in Table 4, add it to the efficient simple rules shown in Table 3.

Similarly, Rule 1, VL ALWAYS is inefficient under conditions of bilateral precaution. Nevertheless, under conditions where only
the victim can take the socially-optimal level of precaution (i.e. \( Y^* > 0 \)) and the injurer cannot (i.e. \( X^* = 0 \)), a rule which assigns the victim residual liability will provide an incentive for the victim to take such precaution. In symbolic notation, such an efficient rule would appear as:

\[
VL \text{ ALWAYS (when } X^* = 0 \text{ if: } Y^* > 0)\
\]

We will call this efficient rule "special first party liability," identify it as simple rule 22 and, in Table 4 add it to the efficient simple rules in Table 3.\(^{52}\)

The complete set of efficient simple rules, along with their academic identifications,\(^{53}\) is summarized in Table 4.\(^{54}\) All of these simple rules with the exception of rule 19 have been considered in the literature by analysts utilizing economic models.\(^{55}\)
TABLE 4
THE SET OF EFFICIENT SIMPLE RULES
UNDER ALL CONDITIONS

RULE # LIABILITY ASSIGNMENT STATEMENT

Under conditions of unilateral precaution

(21) IL ALWAYS (when X*>0 if: Y*=0)
(Special Strict Liability)

(22) VL ALWAYS (when X*=0 if: Y*>0)
(Special First Party or No Liability)

Under conditions of bilateral precaution

(5) VL if: X ≥ X* OTHERWISE IL
(Simple negligence)

(10) IL if: Y ≥ Y* OTHERWISE VL
(Strict Liability with A Defense of Contributory
Negligence)

(14) IL if: X < X* and Y ≥ Y* OTHERWISE VL
(Negligence with a Defense of Contributory Negligence)

(15) VL if: X ≥ X* and Y < Y* OTHERWISE IL
(Strict Liability with a Defense of Dual Contributory
Negligence)

(19) Either Liable if: X ≥ X* and Y ≥ Y*
(Public Interest Liability)

(20) Both Liable if: X < X* and Y < Y* (Comparative
Negligence)

III. THE INEfficIENCY OF SIMPLE RULES

The simple rules shown in Table 4 ostensibly represent "legal
rules" but, as legal rules, are incomplete. A complete, properly
formulated, legal rule is a statement constructed from at least two
simple rules. For example, the rule known as simple negligence, VL
if X ≥ X* OTHERWISE IL is a symbolic statement that holds the
victim liable if the injurer takes the socially-optimal level of precau-
tion. However, this simple rule is incomplete as a legal rule because
it has an implied alternative which holds the injurer liable if the
injurer takes less than his socially-optimal level of precaution. Thus,
the complete statement of the legal rule of simple negligence must be:

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independently by partitioning the accident space. This method leads to the discovery
of a new rule, "public interest liability" and an economic justification for the familiar
rule of comparative negligence.
While one may perceive the distinction between the simple rule

\[ VL \text{ if: } X \geq X^* \text{ OTHERWISE } IL \]

\[ \text{ALTERNATIVELY} \]

\[ IL \text{ if: } X < X^* \text{ OTHERWISE } VL \]

and the legal rule

\[ VL \text{ if: } X \geq X^* \text{ OTHERWISE } IL \]

\[ \text{ALTERNATIVELY} \]

\[ IL \text{ if: } X < X^* \text{ OTHERWISE } VL \]

as merely cosmetic, the difference between the two statements is significant. While the statement \( VL \text{ if: } X \geq X^* \text{ OTHERWISE } IL \) is efficient under bilateral precaution conditions using conventional economic analysis, the complete statement which includes the implied alternative, \( IL \text{ if: } X < X^* \text{ OTHERWISE } VL \), is not efficient because the implied alternative is inefficient.

The reason the simple rule of negligence, \( VL \text{ if: } X \geq X^* \text{ OTHERWISE } IL \), which holds victims liable if injurers take greater than or equal to their optimal level of precaution is efficient in analysis is because it provides an incentive for injurers to take socially-optimal precaution to minimize their expected private costs by avoiding liability.

Similarly, under the assumption that injurers have avoided liability by taking equal to or greater than their optimal level of precaution, the rule provides an incentive for victims, as bearers of residual liability, to take optimal precaution to minimize their total expected costs.

The simple rule's implied alternative, \( IL \text{ if: } X < X^* \text{ OTHERWISE } VL \), which holds injurers liable if they take less than socially-optimal precaution, is inefficient because it fails to subject the implied alternative assignment statement to analysis. His reason is that the injurer is, by definition, rational and will avoid liability by taking \( X \geq X^* \). Thus, the condition \( X < X^* \) is never encountered, resulting in Brown overlooking the inefficiency of the implied alternative. See id.

See Cooter & Ulen, supra note 15, at 359-60. If given the opportunity within the test criterion section (i.e. \( X \geq X^* \)) to avoid liability, under the assumption that we are all rational beings, we will take the socially-optimal level of precaution in order to do so.

See id. If you are the bearer of residual liability, (i.e. \( VL \text{ if: } \)) you will minimize your total cost by taking the socially-optimal level of precaution.

56. Brown also recognizes this. See Brown, supra note 15, at 328 (discussing "the negligence rule").

57. Compare Rule 5 in Table 1 with Rule 4 in Table 1. While Rule 5 is efficient, Rule 4 is not, yet they are the same rule. Brown, while recognizing that a complete rule consists of two simple statements, fails to subject the implied alternative assignment statement to analysis. His reason is that the injurer is, by definition, rational and will avoid liability by taking \( X \geq X^* \). Thus, the condition \( X < X^* \) is never encountered, resulting in Brown overlooking the inefficiency of the implied alternative. See id.

58. See Cooter & Ulen, supra note 15, at 359-60. If given the opportunity within the test criterion section (i.e. \( X \geq X^* \)) to avoid liability, under the assumption that we are all rational beings, we will take the socially-optimal level of precaution in order to do so.

59. See id. If you are the bearer of residual liability, (i.e. \( VL \text{ if: } \)) you will minimize your total cost by taking the socially-optimal level of precaution.
optimal level of precaution is inefficient in analysis because, while it provides an incentive for injurers, as bearers of residual liability, to take optimal precaution, it does not provide an incentive for victims since they are not required, as part of the test criterion, to do anything. Thus, the complete rule is inefficient in analysis because, while it provides an incentive for victims to take optimal precaution when injurers have taken equal to or greater than their optimal precaution, it provides victims an incentive to take no precaution, since no precaution minimizes their expected costs, when injurers have not or are perceived to have not taken optimal precaution.10

The complete rule then is inefficient in application under bilateral precaution conditions where injurers have not or are perceived by victims to have not taken optimal precaution, since no precaution minimizes victims' total costs when they do not expect to be held liable. Thus, the inefficiency of the complete rule in analysis mirrors the inefficiency of the complete rule in application. A complete legal rule must be efficient in application. In order to be efficient in application, it must be constructed from at least two simple rules that are efficient in analysis.

As a second example, the simple rule known as strict liability with a defense of dual contributory negligence:61 \( VL \) if: \( X \geq X^* \) and \( Y < Y^* \) OTHERWISE \( IL \) which holds victims liable if injurers take

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60. Actors take levels of precaution other than socially-optimal precaution because of "uncertainty." Cooter & Ulen identify "evidentiary uncertainty" which leads to too much precaution. See Cooter & Ulen, supra note 15, at 400-03. But see Marcel Kahan, Causation and Incentives to Take Care Under the Negligence Rule, 18 J. LEGAL. STUD. 427, 443 (1989) (demonstrating that "uncertainty always causes injurers to exercise less than optimal care."); Calabrese & Hirshoff, supra note 16, at 1058 (recognizing, within the context of the least cost avoider, "[t]hat there would be instances in which the victim who could avoid an accident more cheaply than could the injurer would fail to do so, because he would know that the injurer would nonetheless be held liable").

In order for victims to perceive injurers' failure to take optimal care, victims must know their injurers. Victims often do know their injurers. Product attributes are widely disseminated in lay literature such as Consumer Reports, advertising and public testing laboratories (e.g. Underwriters Laboratories), television and radio news programming (e.g. 60 Minutes) and comparison shopping. Two illustrative cases are that of three-wheel ATVs and the Suzuki Samurai. Much media coverage attention was devoted to these products' tendency to overturn.

61. "Strict liability with dual contributory negligence" is a term created by Brown. See Brown, supra note 15, at 329. A similar term is later adopted by Cooter & Ulen called "strict liability with a defense of dual contributory negligence." See Cooter & Ulen, supra note 15, at 367. We find this label confusing. See supra note 53 (discussing the origin of this confusion).
their socially-optimal level of precaution and victims do not is similarly incomplete. This rule’s implied alternatives hold injurers liable if both the injurer and the victim fail to take their socially-optimal level of precaution or both take their socially-optimal level of precaution or the injurer fails to take the socially-optimal level of precaution and the victim does. Thus, the complete rule of strict liability with a defense of dual contributory negligence is given by the statement:

\[
\begin{align*}
&\text{VL if: } X \geq X^* \text{ and } Y < Y^* \text{ OTHERWISE IL} \\
&\text{ALTERNATIVELY} \\
&\text{IL if: } X < X^* \text{ AND } Y < Y^* \\
&\text{OR} \\
&X \geq X^* \text{ AND } Y \geq Y^* \\
&\text{OR} \\
&X < X^* \text{ AND } Y \geq Y^* \text{ OTHERWISE VL}
\end{align*}
\]

While the simple rule is efficient under bilateral precaution conditions using conventional economic analysis, one of its implied alternatives, IL if: \(X < X^* \text{ AND } Y < Y^*\), is not.

The reason the simple rule of strict liability with a defense of dual contributory negligence in which victims are liable if injurers take greater than or equal to their socially-optimal precaution and victims do not is efficient in analysis is because it provides an incentive for injurers to take optimal precaution in order to avoid liability and similarly provides an incentive for victims, as bearers of residual liability, to take optimal precaution to minimize their total expected costs. However, its implied alternative, IL if: \(X < X^* \text{ AND } Y < Y^*\), which holds injurers liable if both the injurer and victim fail to take their socially-optimal precaution, is inefficient both in analysis and application because, while it provides an incentive for injurers as the bearers of residual liability to take optimal precaution in order to minimize their total expected costs, it provides a positive incentive for victims to take no precaution when injurers have not or are perceived to have not taken optimal precaution.\(^6^2\)

Analysts, concerning themselves only with the stated portion of simple rules, have incorrectly identified them as efficient because they have ignored consideration of their implied alternatives.\(^6^3\) Analysts

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\(^6^2\). This explains the rejection of a contributory negligence defense within the context of negligence actions. See infra notes 153-56 and accompanying text (discussing the shift from contributory negligence to comparative negligence).

\(^6^3\). See Brown, supra note 15; COOTER & ULEN, supra note 15. Analysts' failure to consider simple rules' implied alternatives may be one of the prime reasons why the debate in the literature has persisted. But see Shavell, supra note 17, at 22-23.
employing the standard economic model have erred by failing to recognize that when a simple rule is judged efficient, its implied alternative may not be efficient. They have also failed to recognize that an efficient simple rule whose implied alternative is inefficient in analysis will be inefficient in application. In general, all the efficient simple rules previously considered in the literature which are identified in Table 2, are inefficient in application when the their implied alternatives are considered. 64

IV. ROBUST RULES

A. THE DERIVATION OF ROBUST RULES

A tort system guided by principles of efficiency must adopt "robust rules." 65 Robust rules take the form "P ALTERNATIVELY Q." P is a simple rule and Q is its alternative. P and Q must both be efficient and Q must be the mirror-image of P. 66 Table 5 contains the efficient simple rules shown in Table 4 paired, when possible, with their efficient mirror-image simple rules. 67

His argument concerning the efficiency of simple negligence, while concerned primarily with the relationship between efficiency and levels of activity, implies a recognition that rules commonly thought efficient are not. But cf. generally Kahan, supra note 60, at 437-41 (noting the inefficiency of simple negligence rules under conditions of uncertainty); Calabrese & Hirshoff, supra note 16, at 1056-59 (providing a complete discussion and examples of the inefficiency in application of simple rules 5, 10, 14 and 15).

64. A tort system concerned with efficiency would thus reject these simple rules.

65. A "robust rule" is an explicit rule constructed from simple rules that are all efficient in analysis and will thus be efficient in application.

66. The test criterion of P must define the levels of precaution the actors named must take to escape liability. The alternative assignment of liability must be made only when the actors named "fail" to meet those requirements. Thus, the test criterion of the alternative assignment Q must be exactly the same as the initial assignment in P except that the operands must be reversed indicating a "failure" of the actors to take the level of precaution required of them. Simple rule Q then must be the efficient mirror-image of efficient simple rule P. When this is the case, the robust rule will be efficient in application and thus would be considered for adoption by a tort system concerned with efficiency in application.

67. We have dropped the OTHERWISE specification from each individual matched-pair of simple rules because it is redundant when two rules are viewed as a mirror-image pair forming one complete legal rule.
TABLE 5

EFFICIENT SIMPLE RULES PAIRED: WHERE POSSIBLE

Efficient mirror-image pairs under unilateral conditions:

(22) VL ALWAYS (when $X^* = 0$ if: $Y^* > 0$) and
(21) IL ALWAYS (when $X^* > 0$ if: $Y^* = 0$)

Efficient mirror-image pairs under bilateral conditions:

(15) VL if: $X \geq X^*$ and $Y < Y^*$ and
(14) IL if: $X < X^*$ and $Y \geq Y^*$
(19) Either Liable if: $X \geq X^*$ and $Y \geq Y^*$ and
(20) Both Liable if: $X < X^*$ and $Y < Y^*$

Efficient simple rules with no efficient mirror-image:

(5) VL if: $X > X^*$
(10) IL if: $Y \geq Y^*$

It is interesting to note that efficient simple rules 10, IL if: $Y \geq Y^*$ OTHERWISE VL, and 5, VL if: $X \geq X^*$ OTHERWISE IL are neither mirror-images of each other nor do they have efficient mirror-images. The mirror-image of rule 10 is rule 7, VL if: $Y < Y^*$ OTHERWISE IL. Rule 10 is efficient under conditions of bilateral precaution because it provides an incentive for victims to take their socially-optimal level of precaution in order to avoid liability and similarly provides an incentive for injurers, as bearers of residual liability, to take optimal precaution to minimize their total costs. Rule 7 however is inefficient under conditions of bilateral precaution because it provides no incentive for injurers to take their socially-optimal level of care when they perceive that victims will not or did not. In application, strict liability with the defense of contributory

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68. Brown has noted that the two rules have a symmetry in construction. See Brown, supra note 15, at 323, 328. They are, in fact, not symmetrical. The operands are the same but the test criteria are not. Note also that while he labels one rule a "negligence" rule and the other a "strict liability" rule they are, in fact, negligence rules because residual liability is assigned to an actor on the basis that the other actor has not been negligent (i.e. $X \geq X^*$ or $Y \geq Y^*$).

69. It may be argued that, in the case of a new product, manufacturers have no basis for the perception of what victims will or will not do with their product once it hits the market. In fact, manufacturers know their victims quite well. Market
negligence is inefficient when cast in the form \( P \text{ ALTERNATIVELY } Q \).

Similarly, the mirror-image of rule 5, \( VL \text{ if: } X \geq X^* \), is rule 4, \( IL \text{ if: } X < X^* \text{ OTHERWISE } VL \). Rule 5 was shown to be efficient under conditions of bilateral precaution.\(^{70}\) Rule 4, however, was eliminated as inefficient under conditions of bilateral precaution.\(^{71}\) In application, simple negligence (i.e. \( VL \text{ if: } X \geq X^* \)) is inefficient when cast in the form \( P \text{ ALTERNATIVELY } Q \), because its implied alternative (i.e. \( IL \text{ if: } X < X^* \)) fails to provide an incentive for victims to take their socially-optimal level of precaution when they perceive that injurers will not or did not.\(^{72}\)

The two simple rules of simple negligence and strict liability with a defense of contributory negligence are inefficient when viewed as rules in the form \( P \text{ ALTERNATIVELY } Q \). The two rules would thus be rejected by a tort system concerned with economic efficiency. The rules which are efficient in analysis when both assignments are considered and therefore efficient in application are the robust rules shown in Table 6. These robust rules, not simple rules, would be adopted by a tort system concerned with efficiency.

**TABLE 6**

**THE ROBUST RULES OF AN EFFICIENT TORT SYSTEM**

*Rule 1 - Used under unilateral precaution conditions:*

**STRICT LIABILITY IN TORT**

- \( IL \text{ ALWAYS (when } X^* > 0 \text{ if: } Y^* = 0) \)

- \( \text{ALTERNATIVELY} \)

- \( VL \text{ ALWAYS (when } X^* = 0 \text{ if: } Y^* > 0) \)

*Rule 2 - Used under bilateral precaution conditions when one actor fails to take socially-optimal precaution but the other actor does:*

**ORDINARY NEGLIGENCE**

- \( IL \text{ if: } X < X^* \text{ and } Y \geq Y^* \)

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70. See *supra* notes 56-60 and accompanying text.

71. Rule 4 provides no incentive to the victim to take socially-optimal precaution because the victim is neither the bearer of residual liability nor required by the test criterion to take such precaution.

72. See *supra* notes 56-60 and accompanying text (discussing the inefficiency of the rule of simple negligence).
Shavell, directly and simply isolates the problem with simple rules and indirectly identifies why robust rules are necessary to achieve efficiency. Although primarily concerned with levels of activity, he recognizes that the problem of simple rules is in essence:

that for injurers to be induced to choose the correct level of activity, they must bear all accident losses; and for victims to choose the correct level of their activity, they also must bear all accident losses. Yet it is in the nature of a liability rule that both conditions cannot hold simultaneously . . . .

Simply stated, Shavell points out that the minimizing of accident costs can only be achieved if both actors are each held liable for total costs. This is an impossibility with simple rules. Robust rules, however, provide incentives for both injurers and victims to minimize total cost because they offer the “threat” that both injurers and victims may bear all accident losses under each of the set of conditions. It is the threat that each will bear the total cost that, in the robust rules, provides the incentive not provided by the simple rules.

For example, an actor who fails to take socially-optimal precaution will be fully liable under unilateral conditions (e.g. Rule 1), fully liable under bilateral conditions if the other actor took socially-optimal precaution (e.g. Rule 2), or proportionately liable if the other actor also failed to take socially-optimal precaution (e.g. Rule 3). However, the other actor is similarly situated under the same conditions. Thus, under the set of three robust rules, both actors bear the threat of liability for total costs under all sets of conditions they may find themselves and are provided a positive incentive to take socially-optimal precaution under all conditions regardless of, or how they perceive, the other actor’s level of precaution. A tort system seeking efficiency must adopt robust rules.

73. Shavell, supra note 17, at 7.
B. THE USE OF ROBUST RULES

Product claims may be predicated on one of three legal theories: 1) negligence,\(^4\) 2) breach of warranty,\(^5\) or 3) strict liability.\(^6\) The primary difference between the three theories is that negligence focuses on the conduct of the actors, while warranty and strict liability focus on the characteristics or condition of the product. While a negligence claim requires the plaintiff to allege and prove some specific act of negligence, a strict liability claim contains no such requirement. Under a strict liability theory, it is necessary instead for the plaintiff to establish, prima facie, that the product was defective and that the product’s defect caused the injury which is the subject of the claim.\(^7\)

\(^4\) As part of its prima facie case, plaintiff's must prove that the defendant failed to exercise due care and that this negligent conduct was a cause-in-fact of the plaintiff's injury. The plaintiff is usually precluded from recovering from others in the distributive chain if only the manufacturer has been negligent.

\(^5\) Breach of warranty is technically a contract action. See U.C.C. §§ 2-313 to -316 (1987). Breach of warranty requires no showing of fault on the part of the defendant. There may exist a breach of express or implied warranty.

An express warranty arises when the seller makes an affirmation of fact or promise to the buyer which relates to the goods and becomes part of the basis of the bargain. Some express warranties involve affirmative assurances of safety. See Baxter v. Ford Motor Co., 12 P.2d 409 (Wash. 1932) (plaintiff injured by flying glass recovered because defendant, in promotional literature, created an express warranty of safety concerning the use of shatterproof glass), aff'd, 15 P.2d 1118 (Wash. 1932); Lane v. C.A. Swanson & Sons, 278 P.2d 723 (Cal. Dist. Ct. App. 1955) (plaintiff, severely injured when bone lodged in his throat, recovered because defendant used the term “Bonèd Chicken” on the label and, in advertising, used the words “no bones”). The tort analog to express warranty is codified in RESTATEMENT (SECOND) OF TORTS § 402B (1965).

Implied warranties arise by operation of law, irrespective of the seller's intention. Implied warranties include the warranties of merchantability and fitness for a particular purpose. The implied warranty of merchantability establishes that the product is warranted to be fit for its ordinary purpose, and in performing its ordinary purpose, the product should not injure you (e.g. lawnmower starts up and throws a blade, food poisons you, power drill electrocutes you). See generally William L. Prosser, The Implied Warranty of Merchantable Quality, 27 MINN. L. REV. 117 (1943). The implied warranty of fitness for a particular purpose provides that a product must be suitable for a particular purpose where the seller is aware of the purpose and the buyer relies on the seller's judgment. See generally Calvin W. Corman, Implied Sales Warranty of Fitness for a Particular Purpose, 1958 Wis. L. Rev. 219. See also supra note 1 (identifying those jurisdictions rejecting 402A and relying instead on breach of implied warranty).

\(^6\) Strict liability constitutes liability without requiring plaintiffs to prove fault on the part of the defendant. See supra notes 1-25 and accompanying text (discussing the shift from negligence to strict liability).

\(^7\) Although the methods by which the requirement is established differ, a
In strict liability, a specific act of negligence is imputed to the defendant without requiring the plaintiff, prima facie, to allege and prove it.78 A product may be defective in manufacture,79 in design,80 or in the sufficiency of warnings accompanying it.81

In order to demonstrate that our tort system has adopted efficient rules, it is necessary to demonstrate that it has adopted the set of robust rules shown in Table 6. Regardless of the theory pled, courts employ the robust rules. The primary difference between the utilization of robust rules in the three varying theories is the meaning given

defect is generally established by a showing that the product was unreasonably dangerous. See RESTATEMENT (SECOND) OF TORTS § 402A cmts. g, i (1965). See also supra notes 79-81, 107, 114 and accompanying text (discussing the varying methods of establishing that a product is unreasonably dangerous).

78. In this sense, strict liability bears a striking similarity to the doctrine of "res ipsa loquitur" in negligence claims. See infra notes 85, 86 and accompanying text (discussing the doctrine of res ipsa loquitur and the application of robust rules).

79. This refers to situations where the product is not in the condition the manufacturer intended at the time it left the manufacturer's control. Defectiveness is usually determined through a comparison of seller's design or specifications with that of the defective product and/or comparison with other units of the same product line. See Curtiss v. Young Men's Christian Ass'n, 511 P.2d 991 (Wash. 1973).

80. This refers to situations in which the product is in the condition intended by the manufacturer but was designed so as to create an inherent risk of harm when put to its ordinary or foreseeable use. See Cepeda v. Cumberland Eng'g Co., 386 A.2d 816 (N.J. 1978).

81. Whether a particular warning is adequate is an issue to be resolved by the fact finder, usually a jury. See MacDonald v. Ortho Pharmaceutical Corp., 475 N.E.2d 65, 71 (Mass. 1985). The factfinder may find a warning to be inadequate in its factual content. See id. In MacDonald, the court declared that adequate factual content must provide to consumers reasonable notice of the nature, gravity, and likelihood of known or knowable side effects and to consult a medical doctor before prolonged use. The product warned of blood clotting (a common cause of stroke) but not of stroke as such, and the plaintiff recovered when permanently disabled by a stroke. Id.; Billiar v. Minnesota Mining & Mfg. Co. 623 F.2d 240 (2nd Cir. 1980) (label warning of "toxic and caustic components" inadequate to warn user of severe facial burns). A warning may also be inadequate in its expression of the facts. See Campos v. Firestone Tire & Rubber Co., 485 A.2d. 305 (N.J. 1984). The court found that a conspicuous warning in English was inadequate in its expression of the facts because it was reasonably foreseeable that a large percentage of the unskilled and semi-skilled workforce (who work with tire rim machines) do not read English and that symbols should have been used. Id. A warning may also be inadequate in the method or form in which it is conveyed. See Torsiello v. Whitehall Labs., Div. of Home Products Corp, 398 A.2d. 132 (N.J. 1979). This court found that a manufacturer's warning to MDs of the danger of GI bleeding was inadequate in the method by which it was conveyed because the manufacturer had a duty to warn of all specific known risks in the package insert of over-the-counter drugs. A simple warning to consult your MD if use is longer than 10 days is not enough. Id.
to $X^*$. In negligence, $X^*$ is a standard of care ascribed to "the reasonable person," while under warranty and strict liability, $X^*$ is a non-defective product.

1. The Use of Rule 1

a. Manufacturing defects — Manufacturing defects always occur under conditions of injurer unilateral precaution. As such, courts always apply the upper portion of Robust Rule 1, (IL ALWAYS (when $X^* > 0$ if: $Y^* = 0$). Only injurers have the ability to monitor production and distribution (i.e. $X^* > 0$). Victims are without the means, prior to an injury occurring, to affect manufacturing and distribution processes, and there is no requirement that victims inspect the product prior to use to discover defects nor guard against the possibility that a defect may exist (i.e. $Y^* = 0$).

A common class of manufacturing defect cases involve exploding bottles. Under a negligence theory, courts invoke the doctrine of *res ipsa loquitur*. In strict liability and warranty claims, similar reasoning to that of *res ipsa loquitur* applies. Regardless of the theory used, courts, in manufacturing defect cases, employ the upper portion of Robust Rule 1, IL ALWAYS (when $X^* > 0$ if: $Y^* = 0$).


83. See RESTATEMENT (SECOND) OF TORTS § 402A cmt. n (1965) (rejecting the defense of contributory negligence consisting of "a failure to discover the defect in the product, or to guard against the possibility of its existence").


85. See RESTATEMENT (SECOND) OF TORTS § 328D (1965) (An inference of defendant's negligence arises when "(a) the event is of a kind which ordinarily does not occur in the absence of negligence; (b) other responsible causes, including the conduct of the plaintiff and third persons, are sufficiently eliminated by the evidence; and (c) the indicated negligence is within the scope of the defendant's duty to the plaintiff."). Res ipsa loquitur indulges an inference that the defendant was exclusively negligent and could have done more to prevent the accident (i.e. $X^* > 0$) while the victim could not (i.e. $Y^* = 0$).

86. In a strict liability claim, plaintiffs are excused from establishing a specific defect, particularly in cases where the product is destroyed by the defect, if circumstantial evidence creates a reasonable inference that it is more likely than not that the product was defective when it left the defendant's control.
b. Design Defects — Some design defect cases occur under unilateral precaution conditions. In such cases, Robust Rule 1 is used. If occurring under injurer unilateral precaution conditions, courts use the upper portion of Robust Rule 1. If occurring under victim unilateral precaution conditions, courts use the lower portion.

The first class of design defect cases occurring under injurer unilateral precaution conditions involve the "crashworthiness" doctrine. "Crashworthiness" is defined as "the protection that a passenger motor vehicle offers its passengers against personal injury or death as a result of a motor vehicle accident." Crashworthiness is concerned with a vehicle's ability to withstand the physical impact of a collision as well as its capacity to minimize the additional or "enhanced" injuries the passengers may sustain as the result of the "second collision" between the occupants and the interior of the vehicle. Under the crashworthiness doctrine, the initial accident need not have been caused by a defect in the car. Most courts considering the issue have held that the manufacturer has a duty to design a crashworthy vehicle. Crashworthiness principles have also been applied to airplanes, motorcycles and tractors.

In crashworthiness cases, the injurer is solely in control of the design features of the automobile which may mitigate or eliminate secondary collisions (i.e. \(X^* > 0\)). Victims are essentially powerless to affect the manufacturer's design choices or protect themselves from injury (i.e. \(Y^* = 0\)). Similarly, warnings are useless (i.e. \(Y^* = 0\)).


88. Crashworthiness was first recognized in Larsen v. General Motors Corp., 391 F.2d 495 (8th Cir. 1968). Since then, the majority of courts to consider the issue similarly have recognized the doctrine. See Hermann v. General Motors Corp., 720 F.2d 414 (5th Cir. 1983); Sours v. General Motors Corp., 717 F.2d 1511 (6th Cir. 1983); Hancock v. Paccar, Inc., 283 N.W.2d 25 (Neb. 1979); Roberts v. May, 583 P.2d 305 (Colo. Ct. App. 1978); Farmer v. International Harvester Co., 553 P.2d 1306 (Idaho 1976); Smith v. Ariens Co., 377 N.E.2d 954 (Mass. 1978); Huff v. White Motor Corp., 565 F.2d 104 (7th Cir. 1977); Horn v. General Motors Corp., 551 P.2d 398 (Calif. 1976); Ford Motor Co. v. Evancho, 327 So. 2d 201 (Fla. 1976); McMullen v. Volkswagen of America, 545 P.2d 117 (Or. 1976); Nanda v. Ford Motor Co., 509 F.2d 213 (7th Cir. 1974).


90. We exclude the rather indirect way consumer choice or preference of safer vehicles may affect a manufacturer's design decisions.

91. It is an inherent incident to normal use of motor vehicles that some will be involved in collisions and that some of these collisions will pose a serious risk to
A second class of cases alleging design defects under conditions of injurer unilateral precaution involve the use of state-of-the-art evidence as a defense. The Restatement appears to accept a state-of-the-art defense to product claims under strict liability. In Beshada v. Johns-Manville Products Corp., the New Jersey Supreme Court rejected the Restatement's view and held that manufacturers are always liable for the injuries caused by their product(s) under conditions of injurer unilateral precaution. The court concluded that imposing liability on manufacturers for a failure to warn was appropriate even in cases in which the manufacturer did not know of the dangers. The court advanced the rationale that an investment in person and property. See Larsen v. General Motors Corp., 391 F.2d 495, 501-02 (8th Cir. 1968). Warnings such as “do not crash” or “a crash may produce injuries including collisions with the interior of the vehicle” will be useless since the victim, even though heeding the warning, can do nothing in the midst of a collision to avoid the injury.

92. See Restatement (Second) of Torts § 402A cmt. j (1965) (denying strict liability where the danger was not something the manufacturer could have guarded against “by the application of reasonable developed human skill and foresight”).

93. 447 A.2d 539 (N.J. 1982). In Beshada, a manufacturer of asbestos was found liable for a failure to warn of the dangers of exposure to asbestos dust. Plaintiffs included exposed workers or their survivors who had contracted asbestosis, mesothelioma and other related illnesses. Id. at 542.

94. Specifically, the court found “that defendant’s products were not reasonably safe because they did not have a warning [without which] users of the product were unaware of its hazards and could not protect themselves from injury.” Id. at 549. The court’s justification was based on concepts of risk-spreading, accident avoidance and fairness. See id. at 547-49. See also Restatement (Second) of Torts § 402A cmt. c (1965) “[P]ublic policy demands that the burden of accidental injuries caused by products intended for consumption be placed upon those who market them, and be treated as a cost of production against which liability insurance can be obtained.” Id.

95. While liability was imposed on the manufacturer due to a failure to warn, claims that asbestos was defectively designed were also alleged. The resolution of the design defect case became unnecessary when the court assumed that the benefit of asbestos outweighed its risk but concluded that asbestos’ risk could have been reduced to a greater extent by an adequate warning which would not have impaired the product’s utility.

96. A central factual dispute concerned whether Johns-Manville knew, at the time of manufacture, the dangers of asbestos exposure. The resolution of this factual issue was not necessary, Judge Pashman assumed the defendants’ version of the facts finding that “culpability is irrelevant,” because “[s]trict liability focuses on the product, not the fault of the manufacturer.” Beshada, 447 A.2d at 546. The specific legal question was whether a “state of the art” defense was available in a strict liability product claim alleging a failure to warn. The court rejected this defense finding that the fact that a product is “unsafe because of the state of technology does not change the fact that [the product] was unsafe.” Id.
research could have and would have discovered the danger (i.e. $X^* > 0$) so that a warning could have been provided to innocent victims otherwise unable to protect themselves (i.e. $Y^* = 0$). The rule announced in *Beshada*, in symbolic notation, is: \( \text{IL ALWAYS (when: } X^* > 0 \text{ if: } Y^* = 0) \).

Some cases involving alleged design defects occur under conditions of victim unilateral precaution. These cases involve unavoidably unsafe products where the danger is inherent when the product is put to its ordinary use (e.g. sharp knives). On one hand, there is no way for the injurer to employ a safer design without completely destroying the product's ability to satisfy its ordinary purpose (i.e. $X^* = 0$). On the other hand, it is possible for the victim to guard against the possibility and/or severity of an accident by taking precaution when putting the product to its ordinary use (i.e. $Y^* > 0$). In such cases, courts utilize the lower portion of Robust Rule 1, \( \text{VL ALWAYS (when } X^* = 0 \text{ if: } Y^* > 0) \).

c. Failure to Warn — Another class of cases occurring under conditions of injurer unilateral precaution involve alleged failures to warn. In *Laaperi v. Sears, Roebuck and Co.*, the court affirmed the jury verdict against Sears under both negligence and implied warranty theories, holding that injurers' standard of reasonable care consists of warning of inherent non-obvious limitations of a product and/or non-obvious circumstances in which a product will not function. The court affirmed the jury's conclusion that the injurers had

97. The court found that "[B]y imposing on manufacturers the costs of failure to discover hazards, we create an incentive for them to invest more actively in safety research." *Id.* at 548.


99. While failures to warn are generally considered to be separate claims than those of design defects, for all practical purposes the determination of whether to include a warning and the determination of the extent and content of the included warning are design decisions. Many cases alleging a design defect also include claims of a failure to warn. In these cases, if it is determined that the product's design did not present an unreasonable danger to the eventual user, liability may still be imposed on the injurer because of the failure of the injurer to include an adequate warning to mitigate or eliminate inherent dangers in the product's use. See *Beshada v. Johns-Manville Prods. Corp.*, 447 A.2d 539 (N.J. 1982); *Borel v. Fibreboard Paper Prods. Corp.*, 493 F.2d 1076, 1088 (5th Cir. 1973).

100. 787 F.2d 726 (1st Cir. 1986). In *Laaperi*, plaintiffs brought suit against the seller and the manufacturer, based on an alleged negligent failure to warn that an AC-powered smoke detector might not operate in the event of an electrical fire caused by a short circuit.
failed to meet their standard of care when they could have and should
have warned that a short circuit which causes an electrical fire may
also render the smoke detector useless in the very situation in which
it is expected to provide protection (i.e. \( X^* > 0 \)).\(^{101}\) In this case, the
victims' had no standard of reasonable care as to the danger which
caused their injury in that the risk that “an electrical fire could
incapacitate an AC-powered smoke detector” is not obvious and thus
the victims could neither recognize nor take action to avoid the danger
(i.e. \( Y^* = 0 \)).\(^{102}\)

d. Conclusion — The rule of law utilized by the courts in cases
occurring under unilateral precaution conditions is not merely simple
rule 1 identifying the conditions under which injurers will be held
liable. Rather, it is a robust rule that holds injurers liable when only
they, and not victims, can take precaution (i.e. \( X^* > 0 \)) because of
victims' inability to recognize and guard against the danger (i.e.
\( Y^* = 0 \)) but, alternatively, holds victims liable if injurers could not
make an accident-proof product (i.e. \( X^* = 0 \)) if victims could have
avoided the accident by heeding an adequate warning and/or avoiding
a recognizable danger (i.e. \( Y^* > 0 \)). In symbolic notation, the court's
rule of law within the context of a product liability claim occurring
under unilateral precaution conditions is Robust Rule 1 from Table 6.

\[
\text{IL ALWAYS (when } X^* > 0 \text{ if: } Y^* = 0 \text{)}
\]

\[
\text{ALTERNATIVELY}
\]

\[
\text{VL ALWAYS (when } X^* = 0 \text{ if: } Y^* > 0 \text{)}
\]

Strict liability theory typically conceived of as IL ALWAYS is a
myth. In application, strict liability is a robust rule which: 1) can
impose residual liability on either injurers or victims, and 2) is applied
only under conditions of unilateral precaution.\(^{103}\)

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Specifically, the court found that whether the defendant was negligent in failing to
warn is a question of fact for the jury. \textit{Id.}

102. \textit{Id.} at 731. The court found that “[w]here the risks . . . are discernible . . .
the consumer is in just as good a position as the manufacturer to gauge the dangers . . . and nothing is gained by shifting to the manufacturer the duty to warn.” \textit{Id.} at
730-31. Specifically, the court found that an issue of fact for the jury consisted of
whether “the risk that an electrical fire could incapacitate an AC-powered smoke
detector is so obvious that the average consumer would not benefit from a warning.”
\textit{Id.} at 731. The jury found that such a risk was not obvious and the First Circuit
Court of Appeals affirmed the jury's conclusion. \textit{Id.} at 732-33.

103. Courts have traditionally applied a strict liability theory under conditions
of bilateral precaution. We find that this is a case of mixing apples (strict liability
2. The Use of Rule 2

a. Design Defects — Under conditions of bilateral precaution, some sort of negligence is required to impose liability. While courts have often applied the theory of strict liability in conditions of bilateral precaution, they have been forced to address negligence principles to do so. This mixing of strict liability theory with negligence principles occurs often in cases of alleged design defects.

104. Negligence, by definition, requires that an actor fails to meet a standard of precaution (i.e. \( X < X^* \) and/or \( Y < Y^* \)). A negligence rule is therefore any rule, logical (i.e. \( IL \text{ if: } Y \leq Y^* \)) or illogical (i.e. \( VL \text{ if: } Y \geq Y^* \)), requiring, in the test criterion, that an actor take an assigned level of precaution. See supra Table 1, part II (identifying all simple rules). See also supra Table 2, part II (identifying only the efficient simple rules).

105. Courts' failure to distinguish between conditions of unilateral and bilateral precaution has, in our view, been responsible for the difficulty in distinguishing negligence from strict liability. For example, under a unilateral precaution condition contributory or comparative negligence principles, by definition, cannot apply. See RESTATEMENT (SECOND) OF TORTS § 402A cmt. n (1965) (rejecting the defense of contributory negligence consisting of "a failure to discover the defect in the product, or to guard against the possibility of its existence" while adopting a defense of assumption of risk). If contributory or comparative principles apply, a bilateral precaution condition is presumed and strict liability cannot exist. Thus, when faced with conditions of bilateral precaution, while courts have spoken of strict liability with defenses of comparative negligence, those courts have actually been engaged in a pure negligence analysis.

106. See Camacho v. Honda Motor Co., 741 P.2d 1240 (Colo. 1987). This court notes that the use of consumer expectation test necessarily requires consideration of "'reasonable' or 'unreasonable' standards [introducing] certain negligence concepts into an area [strict liability] designed to be free from those concepts." Id. at 1245. See also infra notes 106, 107, 114 (discussing the consumer expectation test); Suter v. San Angelo Foundry & Mach. Co., 406 A.2d 140 (N.J. 1979) (court notes that risk/utility implicates the reasonableness of the manufacturer's conduct and thus interjects negligence principles into a strict liability context). See generally Sheila L.
Courts have endorsed two standards for determining whether a product is defective in design defect cases under a strict liability theory. The first standard is the consumer expectation test. In *Morrison v. Grand Forks Housing Authority*, one battery-powered smoke detector, manufactured by Honeywell Corporation, was installed in the apartment. The smoke detector failed to activate because Brenda Morrison had removed the battery. In *Morrison*, in addition to failure to warn claims, plaintiffs alleged that Honeywell committed a design defect by manufacturing a battery-operated smoke detector without an alternating current backup. The court found that “[t]he battery-powered smoke detector performed adequately and posed no unreasonable danger beyond the contemplation of the ordinary user, or that of Brenda. Under these circumstances, we conclude that reasonable persons could not find the detector to be defective.”

The Restatement’s consumer expectation test requires a judgment as to what constitutes the “ordinary consumer” possessing “ordinary

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107. See Restatement (Second) of Torts § 402A cmt. i (1965). Comment i states that in order for a product to be “unreasonably dangerous” and thus defective “[t]he article sold must be dangerous to an extent beyond that which would be contemplated by the ordinary consumer who purchases it, with the ordinary knowledge common to the community as to its characteristics.” *Id.* Other jurisdictions have adopted the same or similar definitions. See, e.g., Nichols v. Union Underwear Co., 602 S.W.2d 429, 432 (Ky. 1980) (“Some seventeen jurisdictions adhere to this rule, eighteen have repudiated it, and sixteen, including Kentucky, have not addressed the issue.”); Riordan v. International Armament Corp., 477 N.E.2d 1293, 1298 (Ill. App. Ct. 1985); Barnes v. Vega Indus., Inc., 676 P.2d 761, 763 (Kan. 1984) (trial court did not err in giving jury instruction consistent with the comment i consumer expectation test).

108. 436 N.W.2d 221 (N.D. 1989). In *Morrison*, plaintiffs were severely burned in a fire and brought suit against Honeywell, the manufacturer of the smoke detector installed in the apartment, under the theories of strict liability and negligence.

109. The fact that plaintiff removed the battery was uncontroverted, but there was disagreement over whether she removed the battery because the detector made chirping noises or to use in a small transistor radio. *Morrison* v. Grand Forks Housing Auth., 436 N.W.2d 221, 223 (N.D. 1989).

110. For a complete discussion of *Morrison*’s failure to warn claim, see infra notes 129-34 and accompanying text.

111. See *id.* at 223.

112. *Id.* at 224. The North Dakota Supreme Court endorses the definition provided by comment i § 402A of the Restatement (Second) of Torts. See supra note 107 (defining the consumer expectation test).
knowledge common to the community." In such cases, consumers’ expectations establish injurers’ standard of care (i.e. $X^*$) and injurers are liable if they design a product more dangerous than an ordinary consumer would expect it to be when put to its ordinary use, assuming victims do put the product to its ordinary use (i.e. $IL$ if: $X < X^*$ and $Y \geq Y^*$). Similarly, victims are held liable if injurers design a product no more dangerous than the hypothetical construct of the ordinary consumer would expect and victims misuse, abuse or otherwise use the product in an unforeseeable manner (i.e. $VL$ if: $X \geq X^*$ and $Y < Y^*$). Thus, in design defect cases employing the consumer expectation test, Robust Rule 2 is utilized.

An alternative standard also utilized in design defect cases under a strict liability theory requires a risk/utility analysis. A risk/utility analysis asks the factfinder to decide whether the product’s usefulness outweighs its risk. This alternative is particularly appro-

113. See supra note 107 (articulating the Restatement’s consumer expectation test).

114. It is important to recognize that “ordinary use” extends to foreseeable misuse, and injurers standard of care involves anticipating some misuse. See Findlay v. Copeland Lumber Co., 509 P.2d 28, 31 (Or. 1973) (defining misuse as “use or handling so unusual that the average consumer could not reasonably expect the product to be designed and manufactured to withstand it — a use which the seller, therefore, need not anticipate and provide for’’); Henkel v. R & S Bottling Co., 323 N.W.2d. 185, 191-92 (Ia. 1982) (The Iowa Supreme Court accepts the premise that the manufacturer is held to foresee a certain amount of misuse and must bear in mind the environment in which the product will be used in foreseeing such misuse.;) Venezia v. Miller Brewing Co., 626 F.2d 188 (1st Cir. 1980) (manufacturer need not consider the fact that children might throw bottles against telephone poles and be hurt if the bottles shatter). See also RESTATEMENT (SECOND) OF TORTS § 402A cmt. g (1965). For more on misuse, see generally Aaron D. Twerski, The Many Faces of Misuse: An Inquiry into the Emerging Doctrine of Comparative Causation, 29 MERCER L. REV. 403 (1978); Dix W. Noel, Defective Products: Abnormal Use, Contributory Negligence, and Assumption of Risk, 25 VAND. L. REV. 93 (1972).

115. Risk/utility analysis was introduced in Wade, supra note 2 at 837-38. Professor Wade identifies seven factors to be considered, including: 1) The usefulness and desirability of the product; 2) The safety aspects of the product; 3) The availability of a substitute product which would meet the same need and not be as unsafe; 4) The manufacturer’s ability to eliminate the unsafe character of the product without impairing its usefulness or making it too expensive to maintain its utility; 5) The user’s ability to avoid the danger by the exercise of care in the use of the product; 6) The user’s anticipated awareness of the dangers inherent in the product and their avoidability, because of general public knowledge of the obvious condition of the product, or of the existence of suitable warnings or instructions; and 7) The feasibility, on the part of the manufacturer, of spreading the loss by setting the price of the product or carrying liability insurance. Id.

116. While the specific factors considered differ from jurisdiction to jurisdiction,
priate in cases in which the “ordinary consumer” likely would not know what to expect.117 While a risk/utility analysis ostensibly focuses solely on the condition of the product, it necessarily implicates the reasonableness of the injurer’s conduct.118 As such, strict liability design defect cases employing a risk/utility analysis most often manifest the use of negligence principles and utilize Robust Rule 2.119

In risk/utility’s simplest manifestation, if risk outweighs utility, the product is unreasonably dangerous and liability is imposed on injurers. If, on the other hand, utility outweighs risk, the product is not unreasonably dangerous and liability is imposed on victims. This simple manifestation presupposes a unilateral precaution condition in which only injurers have a standard of due care to engage in a pre-manufacture and pre-marketing risk/utility evaluation. Unfortunately, the world of legal application is not so simple and, in practice, a number of bilateral case-law permutations exist in which risk/utility is employed. Fortunately, all these permutations utilize Robust Rule 2.

First, there are cases in which the risk of a product outweighs its utility (i.e. $X < X^*$), no warning can diminish the risk to an acceptable level and the product was put to its ordinary use (i.e. $Y \geq Y^*$).120 Such products are so dangerously defective that no alternative design nor
ECONOMIC EFFICIENCY

clear, conspicuous nor strongly-worded warning would justify the product’s marketing. In such cases, courts have utilized the upper portion of Robust Rule 2, \( \text{IL if: } X < X^* \text{ and } Y \geq Y^* \).

Second, there are cases in which utility outweighs risk, yet no particular warning as to the danger causing the injury was required because the danger was obvious and known to the victim. On the one hand, injurers have satisfied their socially-optimal level of precaution in marketing a product whose utility outweighs its risk (i.e. \( X \geq X^* \)). Victims, on the other hand, have been injured because they failed to satisfy their socially-optimal level of precaution when they chose to encounter an obvious, known risk (i.e. \( Y < Y^* \)). In such cases, courts have utilized the lower portion of Robust Rule 2, \( \text{VL if: } X > X^* \text{ and } Y < Y^* \).

Third, there are cases in which utility outweighs risk but only if risk is diminished to an acceptable level by an accompanying warning. Under this scenario, both injurers and victims have levels of socially-optimal precaution. Injurers must determine probable and possible side effects and provide adequate warnings as to both side effects and proper use (i.e. \( X \geq X^* \)). Victims must heed the warnings and put the product to its intended use (i.e. \( Y \geq Y^* \)).

b. Failure to Warn — The mixing of strict liability theory with negligence principles occurs as well in cases of alleged failures to

121. See Ruggeri v. Minnesota Mining & Mfg. Co., 380 N.E.2d 445 (Ill. App. Ct. 1978) (plaintiff died from burns when a highly flammable adhesive caught fire and court found that defendant’s duty was to manufacture products which are ‘reasonably safe’); Drayton v. Jiffee Chem. Corp., 395 F. Supp. 1081 (N.D. Ohio 1975) (liquid drain cleaner containing sodium hydroxide was so dangerous to human tissue that it should not have been marketed at all).

122. It is important to note these are not cases of unavoidably unsafe products, the danger of which is obvious and inherent in the product’s ordinary use (e.g. sharp knives). Such cases occur under unilateral precaution conditions and thus utilize Robust Rule 1. See supra note 98 (discussing unavoidably unsafe products with patent and known dangers utilizing Robust Rule 1).

123. See infra notes 129-34 and accompanying text (discussing Morrison and the encountering of a known or obvious danger).

124. See Borel v. Fibreboard Paper Prods. Corp., 493 F.2d 1076 (5th Cir. 1973) (Court found that even if asbestos is a product whose utility outweighed its risk, defendants possessed scientific knowledge of asbestos’ danger and were liable for failing to provide adequate warnings of the product’s danger); David v. Wyeth Labs., Inc., 399 F.2d 121 (9th Cir. 1968) (despite the fact that a polio vaccine’s utility outweighs its risk, defendant was held liable for failing to warn of the statistical risk that one person in a million would contract polio by taking the vaccine). For a complete discussion of cases involving alleged failures to warn, see infra notes 99-102, 129-34 and accompanying text.
warn. In the context of failure to warn claims, liability is imposed upon manufacturers when they fail to give warnings reasonably expected to be given under the circumstances. Manufacturers are not, however, obligated to warn of obvious dangers and "a seller is entitled to have his due warnings and instructions followed; and when they are [not], he is not liable.

In addition to alleging a design defect, in Morrison, plaintiffs' also unsuccessfully alleged, under negligence and strict liability, 129

125. See Torsiello v. Whitehall Labs., Div. of Home Prods. Corp., 398 A.2d 132, 137 n.2 (N.J. Super. Ct. App. Div. 1979) (The court noted: "We are satisfied that where the 'defect' of a product is in the failure of an appropriate accompanying warning as to use rather than in a design or manufacturing defect, the action is equally sustainable under § 388 of the Restatement, Torts 2d and under § 402A."). See, e.g., Sterling Drug, Inc. v. Yarrow, 408 F.2d 978, 992 (8th Cir. 1969) (prescription drug case, holding that the gist of the cause of action based on an inadequate warning is the same under both § 388 and § 402A).

126. In Seibel v. Symons Corp., 221 N.W.2d 50, 54-55 (N.D. 1974) the North Dakota Supreme Court found that "what is generally described as a duty to warn is actually two duties: one is to give adequate instructions for safe use, and the other is to give a warning as to dangers inherent in improper use." See RESTATEMENT (SECOND) OF TORTS § 388 (b) (1965) (A failure to warn amounts to negligence only where the supplier of the good known to be dangerous for its intended use "has no reason to believe that those for whose use the chattel is supplied will realize its dangerous condition."). See also id. § 388 cmt. k ("It is not necessary for the supplier to inform those for whose use the chattel is supplied of a condition which a mere casual looking over will disclose . . . ."); Plante v. Hobart Corp., 771 F.2d 617 (1st Cir. 1985). In finding unnecessary a warning that permitting a three-year-old child to ride on the running board of a tractor risks injury, the court found that if manufacturers were required to warn of every obvious danger inherent in a product's use, "[t]he list of obvious practices warned against would be so long, it would fill a volume." Id. at 620 (quoting Kerr v. Koemm, 557 F. Supp. 283, 288 n.2 (S.D.N.Y. 1983)). See also Sherk v. Daisy-Heddon, Div. of Victor Comptometer Corp., 450 A.2d 615 (Pa. 1982) (finding unnecessary a warning that firing a BB gun at another person at close range can injure or kill).

127. See id. § 388 cmt. k ("It is not necessary for the supplier to inform those for whose use the chattel is supplied of a condition which a mere casual looking over will disclose . . . ."); Plante v. Hobart Corp., 771 F.2d 617 (1st Cir. 1985). In finding unnecessary a warning that permitting a three-year-old child to ride on the running board of a tractor risks injury, the court found that if manufacturers were required to warn of every obvious danger inherent in a product's use, "[t]he list of obvious practices warned against would be so long, it would fill a volume." Id. at 620 (quoting Kerr v. Koemm, 557 F. Supp. 283, 288 n.2 (S.D.N.Y. 1983)). See also Sherk v. Daisy-Heddon, Div. of Victor Comptometer Corp., 450 A.2d 615 (Pa. 1982) (finding unnecessary a warning that firing a BB gun at another person at close range can injure or kill).

128. Morrison v. Grand Forks Housing Auth., 436 N.W.2d 221, 228 (N.D. 1989) (quoting Erickson v. Monarch Indus., 347 N.W.2d 99, 109 (Neb. 1984)). Cf. RESTATEMENT (SECOND) OF TORTS § 402A cmt. j (1965) ("Where warning is given, the seller may reasonably assume that it will be read and heeded; and a product bearing such a warning, which is safe for use if it is followed, is not in defective condition, nor is it unreasonably dangerous.").

129. The court found that "[u]nder a negligence theory, the question is whether or not the conduct of the manufacturer or seller in providing a certain warning with its product, or in providing no warning at all, falls above or below the standard of reasonable care." Id. at 224. In that the determination of the appropriate level of
that Honeywell failed to warn that a battery-powered smoke detector would not operate without a battery and also did not warn of the danger of removing the battery and leaving it out. In the context of Honeywell's alleged failure to warn under a negligence theory, the court utilized the lower portion of Robust Rule 2, VL if: \( X \geq X^* \) and \( Y < Y^* \). The court stated that "the duty to warn does not attach when the danger or potentiality of danger is obvious or is known to the injured person." Thus, in the context of obvious and/or known dangers, injurers have satisfied their standard of reasonable care by providing no warning (i.e. \( X \geq X^* \)), and victims have a standard of reasonable care to recognize and avoid the obvious danger, and when they fall short of this standard (i.e. \( Y < Y^* \)), they are liable.

reasonable care is central to the resolution of the legal issue, negligence actions utilize Robust Rule 2 which takes account of both the injurer's and victims' levels of care.

130. The court found that "under a strict liability theory, the question is whether or not the warnings, if any, which accompany a product are adequate to render the product not unreasonably dangerous to the ordinary user of it." 

131. Id. at 223. The court considered it "obviously dangerous for a consumer to rely on a battery-powered smoke detector to alert one to a fire when the consumer knows that the detector does not contain a battery." Id. at 226. The "obviousness" requirement endorsed by the North Dakota Supreme Court and adopted in comment n essentially adopts, in strict liability claims, the classic affirmative defense of assumption of risk available in negligence claims. Assumption of risk in strict liability requires a showing of more than contributory negligence in that the plaintiff must have voluntarily and unreasonably proceeded to encounter a known danger. Such knowledge must be actual subjective knowledge. Whether or not the plaintiff had such actual knowledge is a question of fact for the jury and is "not precluded by the conclusion that the danger should have been obvious." Camacho v. Honda Motor Co., 741 P.2d 1240, 1245 n.6. (Colo. 1987). See RESTATEMENT (SECOND) OF TORTS § 402A cmt. n ("If the user or consumer discovers the defect and is aware of the danger, and nevertheless proceeds unreasonably to make use of the product and is injured by it, he is barred from recovery."). See also RESTATEMENT (SECOND) OF TORTS § 496D cmt. c (endorsing, in negligence claims, a subjective standard for assumption of risk while distinguishing the objective standard applied to contributory negligence); Curtis v. General Motors Corp., 649 F.2d 808, 811 (10th Cir. 1981) (purchaser of automobile with fiberglass roof made a conscious choice to forego purchase of other automobile available with steel roof, the latter of which would have provided greater safety); Hunt v. Harley-Davidson Motor Co., 248 S.E.2d 15 (Ga. Ct. App. 1978) (plaintiff was denied recovery when injured because of motorcycle's lack of crash bars because he had extensive experience riding motorcycles both with and without crash bars, was aware of the purpose and the utility of crash bars, inquired as to their availability at point of sale, but failed to require their installation).

132. Morrison, 436 N.W.2d at 227.

133. Id. at 224.
In the context of Honeywell's alleged failure to warn under strict liability, the court again utilized Robust Rule 2. This rule finds injurers liable when they fail to provide a warning as to non-obvious dangers (i.e. \( X < X^* \)) and victims heed the warnings given and avoid obvious dangers (i.e. \( Y \geq Y^* \)). This rule alternatively holds victims liable when the product cannot possibly be made entirely safe for all consumption or use, but injurers adequately warn of non-obvious dangers (i.e. \( X \geq X^* \)), but nevertheless, the injury occurs because victims do not heed the adequate warnings or because the potential danger is obvious but victims fail to avoid it (i.e. \( Y < Y^* \)).

Therefore, under either a negligence or strict liability theory, the law imposes a duty of reasonable care upon manufacturers to provide adequate warnings and instructions (i.e. \( X > X^* \)) and a duty of reasonable care on consumers to follow the warnings and instructions given and to avoid accidents caused by obvious dangers (i.e. \( Y \geq Y^* \)). Thus, injurers are liable when they did not meet their standard of care to provide adequate warnings (i.e. \( X < X^* \)) and victims did meet their standard of care to follow adequate warnings and avoid obvious dangers (i.e. \( Y \geq Y^* \)). Conversely, victims are liable if injurers met their standard of care to provide adequate warnings (i.e. \( X \geq X^* \)) and victims did not meet their standard of care to follow adequate warnings and avoid obvious dangers (i.e. \( Y < Y^* \)). In symbolic notation, the rule used is Rule 2 of Table 6:

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134. The North Dakota Supreme Court agreed with the opinion of the trial court that "it was obvious and a matter of knowledge to Brenda that the battery powered smoke detector would not operate without a battery, and because Brenda Morrison had reason to know the detector was battery powered, the product was not unreasonably dangerous because no outright warning was not given to this effect." *Morrison*, 436 N.W.2d at 226-27. Under either negligence or strict liability theory, other courts have held that a duty to warn does not exist as to obvious dangers. See *Fanning v. LeMay*, 230 N.E.2d 182 (Ill. 1967); *Fisher v. Johnson Milk Co.*, 174 N.W.2d 752 (Mich. 1970); *Dempsey v. Virginia Dare Stores*, 186 S.W.2d 217 (Mo. Ct. App. 1945); *Berry v. Eckhardt Porsche Audi, Inc.*, 578 P.2d 1195 (Okla. 1978). *See also Restatement (Second) of Torts § 402A cmt. j (1965) ([A] seller is not required to warn with respect to products, . . . when the danger, or potentiality of danger, is generally known and recognized."). *But see Union Supply Co. v. Pust*, 583 P.2d 276, 283-84 (Colo. 1978) (court ruled that a duty to warn may exist even where the danger is patent if such a warning may reduce the risk of harm to the user). *See also Restatement (Second) of Torts § 402A cmt. i (1965) (discussing the unreasonably dangerous requirement in relation to otherwise safe products possessing an inherent risk of harm due to overuse or misuse); *Id.* § 402A cmt. k (discussing products which are unavoidably unsafe even if properly used).
3. The Use of Rule 3

Courts have adopted Robust Rule 3 in cases where, under conditions of bilateral precaution, both parties have satisfied their level of socially-optimal precaution or both parties have failed to satisfy their level of socially-optimal precaution. The upper portion of the rule, Either Liable if: \( X \geq X^* \text{ and } Y \geq Y^* \), has been adopted by courts in a number of contexts. In such cases, since liability can be imposed on either actor, the determination of which actor is liable is derived from considerations of which outcome best satisfies the public interest or is the best expression of public policy.

a. State-of-the-art — The first class of cases utilizing Robust Rule 3 involve state-of-the-art evidence as a defense in cases of unknowable dangers. In those jurisdictions permitting state-of-the-

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135. See Richard A. Epstein, A Theory of Strict Liability: Toward a Reformulation of Tort Law (1980). Epstein wrestles with the moral and economic problems which exist in circumstances when both actors satisfy their duty of due care concluding that the “decision that the conduct of both parties was ‘proper’ under the circumstances does not necessarily decide the legal case; there could well be other reasons why one party should be preferred to another.” Id. at 11. After discussing the famous case of Vincent v. Lake Erie Towing, he then continues concluding that when a victim is injured, the injurer should be held liable even though the injurer satisfied his duty of care. Id. at 14. Epstein thus endorses a rule purporting to be strict liability even though it is applied in the context of a negligence. Within our formulation, this is not a rule of strict liability but rather the rule IL if: \( X \geq X^* \text{ and } Y \geq Y^* \), a subset of the upper half of Robust Rule 3 in Table 6: Either Liable if: \( X \geq X^* \text{ and } Y \geq Y^* \).

136. See O’Brien v. Muskin Corp., 463 A.2d 298, 305 (N. J. 1983) (defining state-of-the-art as referring to “the existing level of technological expertise and scientific knowledge relevant to a particular industry at the time a product is designed”). It is important not to confuse state-of-the-art with state-of-the-art. See Chown v. USM Corp., 297 N.W.2d 218 (Ia. 1980) (Iowa Supreme Court distinguishes between “custom” and “state of the art”). “Custom” refers to what was being done in the industry, while “state of the art” refers to what feasibly could have been done. Id. at 221.

137. It is important to distinguish cases involving unknowable dangers from cases in which the dangers are known. These are not cases in which injurers improperly assessed the likelihood and seriousness of a danger known to be inherent in a chosen design nor are they cases in which victims do not properly recognize and avoid a
art evidence, the upper portion of Robust Rule 3 will be utilized. In cases of unknowable dangers, state-of-the-art evidence establishes that a risk was unknowable by the defendant at the time of manufacture and that the same risk was, by definition, unknowable to the plaintiff at the time of the injury.

In such cases, injurers and victims are similarly situated. Injurers have satisfied their socially-optimal level of precaution in foreseeing all the risks or dangers that technological expertise and scientific knowledge make possible for them to foresee (i.e. $X \geq X^*$), while victims have satisfied their socially-optimal level of precaution in recognizing and avoiding all the risks or dangers discoverable through the exercise of due care and the application of general knowledge (i.e. $Y \geq Y^*$). Nevertheless, an injury has resulted from the unknowable danger and a determination of which party will bear the costs of that injury must be made.

Risk/utility considerations provide a public policy basis for making this economic determination. On the one hand, courts have consistently denied victims recovery under strict liability when unexpected side effects are first caused by new drugs. On the other
hand, in cases other than drugs, courts have imposed liability on the party in the best position to spread the loss. A complete statement of the rule in this risk/utility context is thus: Either Liable if:

\[ X \geq X^* \text{ and } Y \geq Y^*. \]

b. Successor Liability — A second class of cases utilizing the upper portion of Robust Rule 3 involve a successor corporation’s liability for injuries caused by products manufactured by their predecessor corporation. In Ray v. Alad, the court, while conceding that under the typical rule there were no grounds to impose liability on the purchasing corporation, nevertheless expanded the typical rule creating a “product line” exception. Other courts have declined

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was blinded from arthritis treatment); Woodhill v. Parke-Davis & Co., 402 N.E.2d 194 (Ill. 1980). In such cases, utility outweighs risk and an adequate warning as to all knowable side effects has been given by the injurer (i.e. \( X \geq X^* \)) and the victim has heeded the warning while putting the product to its intended use (i.e. \( Y \geq Y^* \)). In this context, the rule utilized by the court was VL if: \( X \geq X^* \text{ and } Y \geq Y^* \), a subset of the upper half of Robust Rule 3 in Table 6: Either Liable if: \( X \geq X^* \text{ and } Y \geq Y^* \).

The application of risk/utility in this context has been adopted in comment k of § 402A of the Restatement. In those jurisdictions adopting § 402A, it has been noted that drugs, whether dangerous or not, “may be necessary to alleviate pain and suffering or to sustain life,” regardless of the unavoidable harm to some users. See Brown v. Superior Court, 751 P.2d 470, 478 (Cal. 1988). There was a finding for the defendants because the costs of injury to the consuming public are outweighed by the “broader public interest in the availability of drugs at an affordable price [and] public policy favors the development and marketing of beneficial new drugs, even though some risks . . . might accompany their introduction.” Id. at 478-79.

143. See Wade, supra note 2, at 838 (identifying the final factor in a risk/utility evaluation as the feasibility for the manufacturer of spreading the loss by price increase or liability insurance). In this context, the rule utilized will most often be IL if: \( X \geq X^* \text{ and } Y \geq Y^* \), a subset of the upper half of Robust Rule 3 in Table 6: Either Liable if: \( X \geq X^* \text{ and } Y \geq Y^* \) since victims are rarely in a position to spread the loss and injurers often are.

144. 560 P.2d 3 (Cal. 1977).

145. The typical formulation of the rule does not impose liability on a purchasing corporation for torts caused by the selling corporation’s products unless: 1) there is an express or implied agreement of assumption, 2) the transaction amounts to a consolidation or merger of the two corporations, 3) the purchasing corporation is a mere continuation of the seller, or 4) the transfer of assets to the purchaser is for the fraudulent purpose of escaping liability. See Ortiz v. South Bend Lathe, 120 Cal. Rptr. 556, 558 (Cal. Ct. App. 1975); Schwartz v. McGraw-Edison Co., 92 Cal Rptr. 776 (Cal. Ct. App. 1971).

146. Ray, 560 P.2d at 8-11. The justifications for adopting such a “product line” exception included: “(1) the virtual destruction of the plaintiff’s remedies against the original manufacturer caused by the successor’s acquisition of the business, (2) the successor’s ability to assume the original manufacturer’s risk-spreading rule,
to adopt such a rule comparing the effect such a rule will have on business transfers against the virtual destruction of the injured plaintiff's remedies against the original manufacturer. 147

c. Government Contractor Defense — A third class of cases utilizing the upper portion of Robust Rule 3 involve a defense for government contractors. In Boyle v. United Technologies Corp., 148 the Court held that companies making military equipment may be immune from suits in product liability "when (1) the United States approved reasonably precise specifications; (2) the equipment conformed to those specifications; and (3) the supplier warned the United States about the dangers in the use of the equipment that were known to the supplier but not to the United States." 149 The government contractors defense displaces state law if "a 'significant conflict' exists between an identifiable 'federal policy or interest and the operation and (3) the fairness of requiring the successor to assume a responsibility for defective products that was a burden necessarily attached to the original manufacturer's good will being enjoyed by the successor in the continued operation of the business." 149 Id. at 9.

147. In DeLapp v. Xtraman, Inc., 417 N.W.2d. 219 (Ia. 1987), the Iowa Supreme Court declined to follow Alad as to the "product line" exception noting that only three other jurisdictions have followed Alad's lead and that successor liability: 1) is inconsistent with elementary product liability principles and strict liability in particular because it imposes liability without a corresponding duty; 2) threatens small successor businesses with economic annihilation because of the difficulty in obtaining insurance for defects in a predecessor's products; and 3) is essentially a radical change in the principles of corporation law and, as such, should be left to legislative action. Id. at 221. See also Flaugler v. Cone Automatic Mach. Co., 507 N.E. 2d 331 (Ohio 1987).

of state law." In such cases, injurers have satisfied their level of socially-optimal precaution by conforming to government specifications and warning the government of known dangers (i.e. \(X \geq X^*\)) and victims similarly have satisfied their level of socially-optimal precaution by putting the product to its ordinary, intended use (i.e. \(Y \geq Y^*\)). Thus, a rule of \(VL\) if: \(X \geq X^*\) and \(Y \geq Y^*\) applies as to government ordered designs because it is considered in the best public interest to do so.

**d. Comparative Negligence** — Similarly, the lower portion of Robust Rule 3 in Table 6, **Both Liable if: \(X < X^*\) and \(Y < Y^*\)**, commonly known as "comparative negligence" is utilized in product claims under both a negligence theory and strict liability. Comparative negligence, where adopted, completely displaces the common-law defense of contributory negligence. In cases of comparative negligence, where adopted, completely displaces the common-law defense of contributory negligence. In cases of comparative negligence, where adopted, completely displaces the common-law defense of contributory negligence.

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150. *Boyle*, 487 U.S. at 507 (quoting *Wallis v. Pan American Petroleum Corp.*, 384 U.S. 63, 68 (1966)). In *McKay v. Rockwell International Corp.*, 704 F.2d 444 (9th Cir. 1983), the Court of Appeals identified the state law displaced as that derived from a state's application of 402A. *Id.* at 447. Thus, for the government and for government contractors, Robust Rule 1 does not apply and Robust Rule 3 does as a matter of sound public policy.

151. This rule is simply one form of Robust Rule 3; **Either Liable if: \(X \geq X^*\) and \(Y \geq Y^*\)**.

152. The Court, in *Boyle*, found that "[t]he imposition of liability on Government contractors will directly affect the terms of Government contracts: either the contractor will decline to manufacture the design specified by the Government, or it will raise its price. Either way, the interests of the United States will be directly affected." *Boyle*, 487 U.S. at 507.

153. In the United States, 40 states have utilized some form of comparative negligence. See Tracy M. Blake, Comment, *Comparative Negligence and Strict Products Liability: Where Do We Stand? Where Do We Go?*, 29 VILL. L. REV. 695, 698 (1983-84).

154. "At present, ... twenty-six states apply comparative principles to strict liability either through judicial decision or by statute, while only three states expressly refuse to make the application. In addition, eleven states apply comparative principles to warranty actions, while no state has explicitly refused such an application." *Id.* at 718-19 (citations omitted).

155. This displacement applies only in negligence claims. Contributory negligence constituted an all-or-nothing defense in which even the slightest negligence on the part of a plaintiff precluded that plaintiff's recovery. Comparative negligence is both a legislatively enacted and judicially adopted alternative to the common-law defense of contributory negligence. In claims under strict liability, a defense of contributory negligence consisting of a plaintiff's failure to discover a defect in the product or to guard against the possibility of a defect has never been permitted. See *Restatement (Second) of Torts* § 402A cmt. n. (1965). It is important to note that the displaced common-law defense of contributory negligence is in fact simple rule 11 from Table 1 **VL if: \(X < X^*\) and \(Y < Y^*\)** shown previously to be inefficient in both analysis and application. See *supra* note 44.
negligence, liability is apportioned on a percentage basis between victim and injurer in cases where both injurer and victim have failed to take the socially-optimal level of precaution.\footnote{156}

e. Conclusion — Thus, Robust Rule 3 in Table 6 is applied in product claims. In cases where both manufacturers and consumers fail to take the socially-optimal level of precaution, both are held liable on a percentage basis. In cases where both manufacturers and consumers succeed in taking their socially-optimal level of precaution, the rule applied is flexible so that either may be held liable based upon other criteria. These other criteria often reflect judgments of proper public policy and the public interest.\footnote{157}

V. Conclusion

The rules of law applied in products liability cases have changed significantly in the last thirty years. Many legal scholars have utilized economic models to evaluate sets of simple rules to explain these changes.\footnote{158} These scholars have, for the most part, derived and examined simple rules which this article has shown to be inefficient in application.\footnote{159}

This article has expanded the economic model, deriving a set of efficient robust rules.\footnote{160} Such robust rules take the form \textbf{P \textit{alternatively} Q}, where \textbf{P} and \textbf{Q} are mirror-images and both \textbf{P} and \textbf{Q} are efficient when each is put to the test of the model.\footnote{161} Further, through an examination of cases, we have demonstrated that courts have utilized the set of robust rules.\footnote{162} Recognition of the existence

\footnote{156. Numerous approaches to comparative negligence have been adopted including a pure form, a “less than” modified form, a “not greater than” modified form and others. \textit{See Blake, supra} note 153, at 699 (discussing the varying approaches). A number of cases have merged product misuse into comparative fault. \textit{See, e.g.}, General Motors Corp. \textit{v. Hopkins}, 548 S.W.2d 344 (Tex. 1977); Thibault \textit{v. Sears, Roebuck & Co.}, 395 A.2d 843 (N.H. 1978); Busch \textit{v. Busch Constr. Inc.}, 262 N.W.2d 377, 393-94 (Minn. 1977); Butand \textit{v. Suburban Marine & Sporting Goods, Inc.}, 555 P.2d 42 (Alaska 1976).}

\footnote{157. Courts have often justified their policy choices by appeals to fairness but, in so doing, they have, inadvertently, adopted rules which are economically efficient as well. This recognition leaves one to ponder the question of whether that which is fair is economically efficient or that which is economically efficient is fair.}

\footnote{158. \textit{See} notes 14-18 and accompanying text.}

\footnote{159. \textit{See generally supra} parts II, III.}

\footnote{160. \textit{See} Table 6, part IV(A). \textit{See also generally supra} notes 65-74 and accompanying text.}

\footnote{161. \textit{See generally supra} notes 65-72 and accompanying text.}

\footnote{162. \textit{See generally supra} notes 74-157 and accompanying text.}
and utilization of robust rules explains many anomalies heretofore unsatisfactorily explained. Indeed, the light cast by the recognition of robust rules, efficient in both analysis and application, more clearly illuminates the significant changes in products liability law since the 1960s.

First, the judicial utilization of the set of robust rules explains the abandonment of simple negligence in product claims under conditions of unilateral precaution. Further, utilizing robust rules explains, under conditions of unilateral precaution, the doctrine of “strict liability in tort.” This doctrine holds manufacturers liable when only they could have prevented the accident but did not, and holds victims liable when only they could have prevented the accident and did not. This further explains the refusal to adopt strict liability with a defense of contributory negligence. The adoption of robust rules thus effectively debunks the myth that the judiciary has adopted the academic notion of strict liability: IL ALWAYS.

Second, utilizing robust rules explains one of the great mysteries of modern product liability law; the sudden abandonment of the defense of contributory negligence in negligence suits and the adoption of a comparative negligence rule instead.

Lastly, the utilization of robust rules explains the seemingly inconsistent shifting of liability back and forth between injurers and victims in cases where both parties have satisfied their respective levels of socially-optimal precaution. This shifting has created the appearance of a “capricious” judicial policy towards liability assignment. We have demonstrated that it is not courts’ whim and caprice, but

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163. See generally supra note 1 and accompanying text.
164. See supra notes 47-55, 74-92 and accompanying text.
165. See RESTATEMENT (SECOND) OF TORTS §402A cmt. n (1965) (rejecting the defense of contributory negligence consisting of “a failure to discover the defect in the product, or to guard against the possibility of its existence” while adopting a defense of assumption of risk); see also supra notes 104, 114, 131, 153-156, 165 and accompanying text (discussing comparative negligence and the defense of assumption of risk).
167. See supra notes 153-56 and accompanying text (discussing the shift from contributory negligence to comparative negligence).
rather their adoption of Robust Rule 3 which accounts for this judicial shifting of liability.\textsuperscript{168} Robust Rule 3 explains the liability of successor corporations for tortious products manufactured by their predecessor,\textsuperscript{169} and the development of a government specification defense for contractors.\textsuperscript{170} Indeed, the light cast by the recognition of robust rules, efficient in both analysis and application, more clearly illuminates the significant change in products liability law since the 1960s.

\textsuperscript{168} The adoption of Robust Rule 3 requires courts to engage in overt and careful analyses and balancing of social and economic public policy.

\textsuperscript{169} See supra notes 144-47 and accompanying text.

\textsuperscript{170} See supra notes 148-52 and accompanying text.