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THE POSITIVE ECONOMIC THEORY OF TORT LAW

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Academic literature on tort law consists largely of (1) lawyers' analysis of doctrine and (2) normative analysis, by lawyers and others, of such issues as no-fault compensation for victims of automobile accidents. Only a small proportion of the literature attempts a scientific study of the tort system, comparable to the study of organic systems by biologists or of the price system by economists. Lately, however, interest in the scientific study of the legal system has been stimulated by the "law and economics" movement, some members of which have advanced the following hypothesis: the common law is best explained as if the judges who created the law through decisions operating as precedents in subsequent cases were trying to promote efficient resource allocation. We call this hypothesis, as applied to tort law, "the" positive economic theory of tort law because no rival positive economic theory of tort law has yet appeared.

This article is designed as an introduction to the positive economic theory. Part I of the article traces the emergence of the theory from earlier scientific studies of tort law and discusses recurrent criticisms of it. Part II describes the economic model
underlying the theory and shows how it can be used to decide whether negligence or strict liability is the more efficient liability standard in particular circumstances. Part III evaluates the success of the model in explaining (1) the negligence standard itself, (2) the cases applying the standard, and (3) the areas of strict liability in tort law. Part IV discusses recent developments in tort law that may have altered its efficient character.

This article does not purport to prove the positive economic theory of tort law. Our aim is more modest: to show that the theory is sufficiently promising to warrant efforts by legal and economic scholars to test the theory empirically on larger bodies of data than we have thus far used.

I. BACKGROUND AND CRITICISMS OF THE THEORY

The scholarly tradition from which the positive economic theory of tort law comes could be said to have begun with Jeremy Bentham, who first applied economics to laws regulating nonmarket behavior, or even with Adam Smith. However, we have chosen, somewhat arbitrarily to be sure, a more recent event from which to date the tradition — the publication of Holmes's The Common Law in 1881. With the benefit of hindsight, it is possible to find in Holmes's chapters on trespass and negligence, and in slightly later articles on tort law by Ames and Terry, prefigurings of the economic approach. Holmes suggested that the only difference between negligence and strict liability as tort standards was that the latter provided a form of accident insurance. This is not the whole of the difference from an economic standpoint, but it is an important part of it. Ames wrote that the law was "utilitarian," although he did not explain what he meant by the term. Terry described the negligence standard in terms of a balance of utilities. The early writings do not state explicitly, however, that the tort law contains standards of conduct that promote efficient resource allocation. The writers recognized the deterrent effect of tort law,

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1 O.W. HOLMES, THE COMMON LAW (1881).
2 See id. at 94-96.
4 See Terry, Negligence, 29 HARV. L. REV. 40 (1915).
6 In an action for negligence it is of no consequence to the law whether the particular
but they did not connect the idea that tort principles are based on utilitarian values with the idea that liability deters harmful conduct that is not justifiable on utilitarian grounds.

The next burst of scientific tort scholarship came in the heyday of legal realism, the 1920's and 1930's. The legal realists believed that it was naive to talk of "fault" in connection with accidents or to think that the law could have much effect on the accident level; legal doctrine, they believed, had little effect on how cases were actually decided (this was their "realism"). They saw the only realistically attainable function of tort law to be the provision of insurance. On this basis they recommended the assignment of liability regardless of fault to injurers having "deep pockets" and the abolition of defenses such as contributory negligence and assumption of risk that reduced the scope of liability. Among the descendants of the legal realists can be found both the advocates of "no fault" compensation (in effect, compulsory accident insurance coupled with abolition or curtailment of tort liability) and many advocates of strict liability. The latter turn Holmes on his head. Holmes opposed strict liability on the ground that the state had no business providing insurance. The legal realists urge strict liability (or compulsory accident insurance) on the ground that the only proper function of tort law is to provide insurance to those who fail to insure themselves against being injured in an accident. Our present interest, however, is not in the normative analysis of the legal realists but in their scientific premise that the legal system in operation diverges fundamentally from its formal functioning in accordance with legal doctrine.

The third wave of tort scholarship began in 1961 with the publi-

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Id. at 269.

4 The writing in this genre is voluminous, and no useful purpose would be served by extensive citation. For a single good example, see Douglas, *Vicarious Liability and the Administration of Risk* I, 38 *Yale L.J.* 584 (1929).

7 The most prominent advocate of the position that all accidents should be governed by either strict liability or no fault (i.e. no liability) is Jeffrey O'Connell. See, e.g., *J. O'CONNELL, ENDING INSULT TO INJURY* (1975). See also *R. KEETON & J. O'CONNELL, BASIC PROTECTION FOR THE TRAFFIC VICTIM: A BLUEPRINT FOR REFORMING AUTOMOBILE INSURANCE* (1965).
This wave is the economic analysis of torts. The germ of the analysis is Jeremy Bentham's proposition that people maximize utility in all areas of life. This implies that liability rules can be used to affect the level of accidents, although Bentham himself never drew this implication. A more direct antecedent of the economic approach to torts is the concept of social cost, or external cost, notably as articulated by Pigou. Using, among other examples, that of the locomotive that emits sparks which damage the crops of farmers located along the railroad right-of-way, Pigou noted the potential divergence of social from private cost. The crop damage, he argued, was not a private cost to the railroad, and only private costs determine behavior. It was a social cost, however, because the farmer is a member of society as is the railroad. Therefore, unless some means were found to force the railroad to internalize the cost, there would be too much, or too careless, railroading.

Perhaps because Pigou himself thought that the proper way to force the cost to be internalized was through a tax, and thus he did not discuss liability rules, Pigou's analysis of social cost was not applied to tort law until the Coase and Calabresi articles. Coase's article is best known for its criticism of Pigou's position. Coase showed that if transaction costs were zero, the parties (railroad and farmer) would bargain to an efficient allocation of resources regardless of whether the railroad was liable (or taxed) for the crop damage. This important theoretical insight later became known as the "Coase theorem." An initially neglected aspect of Coase's article was his examination of actual English nuisance cases and his suggestion that the English courts had displayed a better (intuitive) grasp of the economics of the problem than had economists in the Pigovian tradition.

Calabresi was not primarily interested in how or whether the

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8 Coase, The Problem of Social Cost, 3 J.L. & Econ. 1 (1960); Calabresi, Some Thoughts on Risk Distribution and the Law of Torts, 70 Yale L.J. 499 (1961). Although it bears a date of 1960, Coase's article was actually published in 1961, and Calabresi's paper was independent of Coase's.
11 See Coase, supra note 8, at 27-28, 38.
courts tried to use tort principles for cost internalization. Like Bentham in this respect, Calabresi was interested in constructing an efficient system of accident law from first principles rather than in appraising the operations of the existing system of accident law, the tort system — although in later work he has criticized the tort system as failing to conform to the requirements of economic efficiency.¹²

After a ten-year hiatus following the publication of the Coase and Calabresi articles, economic scholarship on torts erupted in a sustained flow that continues to this day along two paths which can, in a rough way, be traced back to the Coase and Calabresi articles respectively. Calabresi sketched a model of efficient accident law that Peter Diamond and other theoretical economists proceeded to formalize.¹³ Coase had suggested that the common law was a mechanism of social-cost internalization, and Demsetz, sketchily,¹⁴ and Posner, more comprehensively, proceeded to develop this insight. Posner's 1972 article on negligence discussed the negligence standard itself and a number of related doctrines (contributory negligence, last clear chance, assumption of risk, and others) as methods of bringing about an efficient allocation of resources to safety and care.¹⁵ An article published the next year, as well as the first edition of Economic Analysis of Law, published in 1973, extended the analysis to strict liability.¹⁶ John Brown pro-

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¹⁴ See Demsetz, Issues in Automobile Accidents and Reparations from the Viewpoint of Economics, in C. GREGORY & H. KALVEN, JR., CASES AND MATERIALS ON TORTS 870 (2d ed. 1969). This is the earliest paper we know of, apart from Coase's article, in which it was suggested that the common law of torts might serve to promote economic efficiency. However, Demsetz devotes only two pages to this question. See id. at 873-74. Most economists in this period seem to have agreed with Calabresi that the tort system, especially in accident cases, was an inefficient system of accident regulation. See Vickrey, Automobile Accidents, Tort Law, Externalities, and Insurance: An Economist's Critique, 33 LAW & CONTEMP. PROB. 464 (1968).


¹⁶ See R. POSNER, ECONOMIC ANALYSIS OF LAW 92-95 (1973); Posner, Strict Liability: A
duced his formal analysis of liability rules the same year. Since then, Posner, Landes, Shavell, and other economic analysts of law have examined various areas of tort law with a view to evaluating their efficiency.

Among the recent areas studied are intentional torts, the common-law rules relating to joint and multiple tortfeasors, the privacy and defamation torts, nuisance, negligent misrepresentation, the "good Samaritan" question, and false advertising. At the same time, the theory has been criticized on various grounds. Many of the criticisms of the economic analysis of law are not, however, criticisms of the positive theory. For example, critics like Epstein and Dworkin have argued that a system of law designed simply to make society wealthier is immoral. How-


17 See Brown, Toward An Economic Theory of Liability, 2 J. Legal Stud. 323 (1973). Brown's work is perhaps better classified with Diamond and the other formalizers of ideal, as distinct from actual, liability rules. While Brown models concepts of negligence, contributory negligence, comparative negligence, and strict liability, he does not attempt to give these terms their legal meaning.

18 See R. Posner, Economic Analysis of Law 119-61 (2d ed. 1977), and references cited therein for the state of the literature as of 1977. We admit to a certain unease in trying to divide economic analysts of torts neatly into two camps — formalists doing normative analysis and "informalists" doing positive analysis. For example, Steven Shavell, whose work on the economics of tort law we refer to frequently in this article, is a formal theorist; and our own economic model, expounded in part II, is formal though it is simpler than the models of those whom we have classified as formalists. As we shall explain, there is a positive correlation between formal simplicity and positive analysis but the correlation is not 100 percent.


24 See Bishop, Negligent Misrepresentation through Economists' Eyes, 96 Law Q. Rev. 360 (1980).


As will become clear when we explain our formal model in part II, we call a policy change
ever forceful a criticism this might be of a normative economic theory of tort law, it is misplaced when directed at the positive theory. We are interested in explaining rather than defending the common law of torts. Its moral inadequacy, if it is morally inadequate, is relevant only insofar as this might cast doubt on the plausibility of attributing such an approach to the judges who fashioned the common law of torts.

There are three recurrent objections to the positive economic theory of tort law that we think merit consideration here. The first, echoing the realist critique of formal law, is that the positive theory rests on unrealistic behavioral assumptions; that tort doctrines, however abstractly calculated to promote efficient resource allocation, do not actually affect human behavior. Most people, it is argued, do not even know the doctrines of tort law; behavior in the face of danger is dominated by concern with personal safety rather than with the financial consequences of behavior, especially for people who carry liability insurance; and people lack sufficient information about the probability of an accident to make rational judgments concerning accident avoidance. These points, which impy that tort law probably is not an effective method of deterring inefficient behavior, draw support from a deep vein of skepticism concerning the deterrent effect of law generally.

The same points (with the exception of liability insurance) could be and have been made to show that the criminal law does not deter violent crime, yet there is now a large body of statistical evidence demonstrating that both the severity and certainty of criminal punishment have a substantial deterrent effect on such crime. Moreover, although there has been little systematic study of the

“efficient” if the joint income or wealth of the people affected by the change is greater after the change than before. Thus, we abstract from distributive considerations. Our concept of efficiency, although it is one commonly used in economics, is ethically controversial. For a discussion of the ethical issues, see the Hofstra Law Review’s recent Symposium on Efficiency as a Legal Concern, 8 Hofstra L. Rev. 485-771, 811-973 (1980).


deterrent effect of tort law, empirical evidence tends to support the proposition that tort law deters too — even in the area of automobile accidents, where liability insurance is widespread and concerns with personal safety might be thought to dominate any concern with the financial consequences of an accident.\(^3\)

Even if it were shown that tort law does not have a significant effect on behavior, this showing would not falsify the theory that we are expounding in this article. Ours is a theory of the rules of tort law rather than of the consequences of those rules for behavior. Assume with Aristotle that the real purpose and only proper effect of tort law are to do "corrective justice," that is, to restore to a person what has been wrongfully taken from him, rather than to improve the allocation of resources.\(^3\) It would still be necessary to inquire into the source of those norms on the basis of which conduct was judged wrongful. The source might well be economic. Efforts have been made to explain ethical concepts, including the sense of being wronged, in economic (or closely related biological) terms.\(^3\) It would be consistent with these efforts to find that the tort concept of fault has an economic meaning also.

A second criticism of the positive economic theory of tort law is that its proponents have not explained the mechanism by which efficient tort rules might emerge in a common-law system. Twenty years ago this omission would not have seemed troublesome. In that period, one of general optimism concerning governmental intervention in the economic system, the dominant positive theory of the state was that the state supplied public goods.\(^3\) For obvious


\(^3\) See ARISTOTLE, THE NICHOMACHEAN ETHICS 114-17 (David Ross trans., rev. ed. 1980). Of course, these need not be inconsistent objectives.


\(^3\) See, e.g., W. BAUMOL, WELFARE ECONOMICS AND THE THEORY OF THE STATE (1952). Public goods are goods that can be consumed without paying for them. An example is national
reasons, the provision of public goods by a free market is a prob-
lem, and it was thought until recently that the actual, as well as
the ideal, function of the state was to provide such goods and
thereby rectify a failure of the private market. In our positive eco-
nomic theory, tort law is a public good and its provision by the
state would not have seemed problematic in the period when the
state was assumed to be in the business of providing public goods.

Today, however, the dominant theory of the state is redistribu-
tive. Interest groups struggle for a place at the public trough, and
government intervenes in the economy to redistribute wealth from
politically less powerful to politically more powerful groups rather
than to provide public goods. But this view seems overstated. We
have armed forces, police, courts, and other (relatively) uncon-
troversial public goods provided by government, and it is hardly
credible that these goods are produced simply as the accidental by-
product of redistributive policies. Tort law may be one of those
goods.

This is all the more plausible because tort law deals with activi-
ties (mainly accidents) that do not lend themselves well to redistri-
bution in favor of politically influential interest groups. The
probability of being involved in an accident, either as victim or as
injurer, does not vary in a regular or consistent fashion across the
compact and readily identifiable interest groups that bulk so large
as recipients of government largess in the redistributive theories of
government. Consequently, it does not seem plausible to suppose
either that an interest group would organize to seek redistribution
through the accident-law system (a group consisting of the “acci-
dent prone” or of drunken drivers, for example) or that some ex-
isting group — the poor, blacks, retail druggists — would place
accident law high on the agenda for legislative action. We do not
wish to overstate our point. The nuclear industry obtained a limi-
tation on liability from Congress; well-organized groups of the per-
sonal-injury bar lobby vigorously against no-fault automobile com-
pensation plans; the railroad workers’ unions fight modifications of
defense. An individual who did not contribute to the cost of national defense would none-
thless enjoy whatever deterrent or other benefits it created.

44 See, e.g., Peltzman, The Growth of Government, 23 J.L. & Econ. 209 (1980); Stigler,
The Theory of Economic Regulation, 2 Bell J. Econ. & Mgmt. Sci. 3 (1971).
45 See Posner, The Ethical and Political Basis of the Efficiency Norm in Common Law
Adjudication, 8 Hofstra L. Rev. 487, 502-06 (1980).
the Federal Employers' Liability Act. However, the scope of systematic wealth redistribution in regard to accidents (and, even more clearly, in regard to intentional injuries such as assault and battery) does seem more limited than in regard to tariffs, price regulation, taxation, wages, the development of public lands, and other familiar areas of special-interest legislation. Where systematic redistribution is difficult to achieve, an interest group's best strategy may be to support policies that will increase the wealth of the society as a whole, because the members of the group can be expected to share in that increase. Hence it is consistent that the AFL-CIO should support both the minimum wage and a strong national defense. The former is a redistributive policy that benefits its members directly, the latter an efficient policy that also benefits its members, though in common with all other members of the society. We think that tort law is the latter kind of policy.

The third criticism of the positive economic theory of tort law that we shall discuss here is that the evidence used to support (or refute) the theory is spongy, meager, and equivocal, and the theory itself poorly defined. Because it is a theory about rules, the principal evidence for and against it consists of interpretations of rules. There are several problems with this mode of empirical verification. First, rules are hard to quantify for purposes of sampling and hypothesis testing. What would it mean to say, for example, that eighty-two percent of the rules of tort law were efficient? Would it mean eighty-two percent of someone's catalogue of the rules of tort law? Whose catalogue? Prosser's? The American Law Institute's? Our own? Moreover, rules differ vastly in their importance. The "rule" that each dog is entitled to one bite (actually, as we shall see in part III, an oversimplified version of the principle that liability for damage inflicted by domestic animals requires knowledge or reason to know that the animal is dangerous) is not on the same level with the rule that employers are liable for the torts of their employees committed in furtherance of the employer's business (respondeat superior). No recognized method exists for weighting

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860  GEORGIA LAW REVIEW  [Vol. 15:851

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8 Our colleague George Stigler is a forceful exponent of this point of view, which he has stated in conversations with us and in an unpublished paper, G. Stigler, Is the Common Law Efficient? (Jan. 16, 1980). A number of specific criticisms of the evidentiary basis of the positive theory are made in the Hofstra symposium referred to in note 27 supra and replied to in Posner, A Reply to Some Recent Criticisms of the Efficiency Theory of the Common Law, 9 Hofstra L. Rev. 775, 780-85 (1981). We do not discuss them here.
different rules of law by their importance.

There are ways around the problems, however. First, appellate decisions can be sampled randomly.\(^7\) (A problem, however, is that rules of no liability tend, for obvious reasons, to be underrepresented in such a sampling procedure.) Second, leading cases can be identified by the number of citations to them.\(^8\) Third, casebooks, treatises, and the *Restatement of Torts* can be used as a source of authoritative cases and doctrines. Given these methods, we do not consider fundamental the sample-bias objection to our methodology for testing the positive theory.

Even if the sampling problem is overcome, there is still the problem of evaluating the outcome of each case in the sample. Rarely will there be sufficient information about the costs and benefits of alternative safety measures to enable a confident judgment that the court's outcome is the efficient one. This problem leads to another: our methodology may not enable us to distinguish between a tort system that is efficient in some meaningful sense and a system that simply is not indifferent to efficiency. We rarely will be able to say of a decision more than that it indicates a sensitivity to the economics of the situation before the court. Yet one would not want to describe the system of resource allocation in the Soviet Union as efficient merely because it allows people to marry whom they choose and pays workers on a piece-rate system. Merely because the tort law makes some crude economic distinctions, it does not follow that it is an efficient system — that efficiency is its lifeblood.

We have two answers to this criticism. First, economic analysis has identified subtle as well as gross economic distinctions that tort law makes.\(^9\) Second, one is unpersuaded that the Soviet Union allocates resources efficiently by isolated evidence of sensitivity to economic considerations because one knows that other principles besides efficiency guide resource allocation in the Soviet system, but there is no well-developed theory of what motivates or explains tort law besides efficiency.\(^40\) To be sure, if asked what tort


\(^{39}\) Such as the activity-care and joint-alternative care distinctions discussed in parts II and III of this article.

\(^{40}\) However, there are hints of a positive theory in the work of Epstein, Fletcher, and
law is based upon, most tort lawyers would answer that it is based upon notions of justice, equity, fairness, or morality — not efficiency. But all of these terms may be, in the tort setting, synonyms. It is not as if efficiency considerations entered as constraints (as apparently they do in the Soviet system) on allocative choices made on different grounds; so far as torts scholars have been able to discover, the only force operating in a systematic fashion to shape tort law is a concern with efficiency.

Another objection to our empirical procedure is that it consists of rationalization rather than prediction. We know the rules of tort law, it is argued, and knowing them we always can come up with a plausible rationalization based on economic theory. If a rule seems allocatively inefficient, considerations of administrative cost are available to save the theory from a contradiction. Or, if allocative and administrative costs appear to dictate a different rule from the actual rule, we may be able to appeal to risk aversion to bail us out. This procedure is quite different, it is said, from formulating a theory and then testing it on unknown bodies of data.

The difference, however, is more theoretical than practical. Much of economic theory is directed toward explaining known data, and this article is an example of applying a theory originally developed and tested on one body of data to a different body. The danger to which the criticism points, however, is a real one. One can complicate a theory to the point where any empirical observation is consistent with it. When that point is reached, the theory cannot be refuted, and a theory that cannot be refuted cannot be confirmed either. Concern with this problem has led us to propose an extremely simple economic model of tort law — a model in which, for example, risk aversion plays no role. In explaining this model in part II of this article, we shall comment further on the importance of a simple model to a theory designed to guide empirical research.

Another objection to our empirical procedure, this one more likely to be made by lawyers than economists, is that we use as
evidence only some features of the appellate opinions in tort cases — the outcome of the case and the rule that can be extracted from the opinion — and ignore the language, concepts, and reasoning in the opinion. Thus, it is argued, in explaining judicial opinions in economic terms we ignore the terms in which the authors themselves thought and wrote. A partial reply is that none of the actors whose behavior the economist seeks to explain uses an explicit economic vocabulary to describe his actions: not the consumer, not the worker, not the criminal, not even the businessman. The rejoinder is that the consumer, worker, criminal, and businessman are not engaged in a self-conscious, expressive activity comparable to drafting a judicial opinion. They are not required by their occupation to articulate reasons for their actions, but the judge is. The judge’s reasoning ought to be considered by the theorist and not brushed aside as an irrelevance.

We agree that judicial reasoning is relevant to the economic analysis of law. It is always material and sometimes essential to determining the scope and meaning of the rule that can be extracted from the judicial opinion. Our quarrel is with the narrower proposition that the refusal of judges to speak in the language of economics shows that the rules they formulate are not based on efficiency. People can apply the principles of economics intuitively — and thus “do” economics without knowing they are doing it. Indeed, economic principles may be encoded in the ethical vocabulary that is a staple of judicial language. The language of justice and equity that dominates judicial opinions could represent simply the translation of economic principles into ethical language.

Another methodological criticism is that by drawing precedents indiscriminately from the fourteenth through twentieth centuries, we conceal significant trends in the common law — including a recent and pronounced trend away from efficiency. Far from denying that the common law has changed over the years, however, we regard changes in the law as important tests of the positive economic theory. If a relevant social circumstance (such as the relative costs of buyer and seller in determining whether a product is defective) changes, we predict that the law will change. But perhaps recent changes in products liability law, medical malpractice, and other areas of tort law are not justified by any changes in the relative costs of safety; this is a serious and important argument which we examine in part IV of this article.
A related criticism is that the efficiency theory of tort law is poorly defined. Does the theory hold that all tort rules and outcomes are efficient? If not, how can it be refuted? Or, is the theory temporally limited, perhaps to exclude the last twenty years? Is it a theory equally applicable to all common-law jurisdictions or does it exclude, for example, California, which has led the recent movement away from efficiency as a ruling principle of tort law? These are legitimate questions. Our tentative answer is that, throughout the history of the common law, efficiency has been the dominant value embodied in tort law but not the only value. The distributive and other nonefficiency concerns that have shaped legislative interventions in safety questions from workmen's compensation through no-fault automobile accident compensation have indeed influenced the courts, especially in recent years.

If our theory is that efficiency has been the dominant rather than the only value served by tort law, the question arises how it can be refuted. To repeat an earlier point, a positive theory that cannot be refuted even in principle cannot be confirmed either. Under the formulation offered here, if a rule of tort law cannot be explained on efficiency grounds, this is not a contradiction of the theory or even a puzzle; it is consistent with the proposition that most rather than all tort doctrines are efficient. However, this point does not show that our theory cannot be refuted. A theory that most rules are efficient is refuted by evidence that most are inefficient, or that a nonefficiency theory explains more tort rules than an efficiency theory.

We could discuss the criticisms of the positive economic theory of tort law at greater length, but the discussion would be inconclusive — most debates over methodology are. The reader who is unconvinced by our rebuttals should suspend judgment at least until the end of the article (or, if he is very patient, until he has read the book upon which it is based). The reader will be better able then to judge what we consider the most troubling criticism of our approach: the difficulty of forming confident judgments about the efficiency of specific case outcomes without knowing more than the opinions reveal about the facts.

II. THE MODEL OF EFFICIENT TORT LAW

This part of this article presents the formal model that underlies the positive economic theory of tort law. There is nothing new
If there is any novelty in this part of the article, it is in our effort to exposit the model in a way that will enable lawyers with little or no mathematical or economic background to understand it.

A. A Model of Accidents

1. Choice under Uncertainty. There is a problem in attaching values to, and hence choosing among, uncertain prospects. How is one to value the prospect of a 10% chance of $20 and a 90% chance of $1 compared to a certain income of $2? Or a 10% chance of suffering a $10 injury compared to a 1% chance of a $100 injury? Fortunately, there is a well-developed model of choice under uncertainty. The basic assumption of the model is that an individual ranks uncertain prospects by their expected utility and chooses that prospect with the highest expected utility.

In presenting the expected-utility model, it is convenient to assume that the individual's utility depends upon a single composite good called "income" (or "wealth"), as in

\[ U = U(I), \]

where \( I \) is income. Thus, for example, if a person is injured in an accident, his injury can be expressed in terms of a loss in units of the composite good, \( I \). We assume that the individual prefers more to less income or, in other words, that the marginal utility of income is positive — i.e., the increment in utility from a $1 increase in income is positive. Hence, \( U($1000) > U($500) > U($499) \), and given the choice among these incomes, $1000 would be chosen. We can extend the analysis to uncertainty by defining the expected utility of a prospect as

\[ U = \sum_{i=1}^{n} p_i U(I_i) \]

where there are \( n \) mutually exclusive states of the world or outcomes, \( U(I_i) \) is the utility associated with the income in state \( i \) \((i=1, \ldots, n)\), \( p_i \) is the subjective probability of each state \( i \), \( 0 \leq p_i \leq 1 \), and \( \sum p_i = 1 \). (Notice that if \( p_i = 1 \), we are back at

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41 It is essentially the same model introduced in Brown, supra note 17. We have used the model in our previous work. See Landes & Posner, supra note 20; W. Landes & R. Posner, supra note 19.
an analysis of choice under certainty.) The assumption of expected utility maximization implies that the individual will select that prospect with the greatest expected utility.\(^4\)

There are three important classes of utility functions in the expected-utility model: risk-averse, risk-neutral, and risk-prefering.\(^4\) These are shown in Figure 1. Although marginal utility of income is positive for all three functions, it is diminishing for the risk-averse function, constant for the risk-neutral function, and increasing for the risk-prefering function (i.e., \(U' > 0\) for all three functions but \(U'' > 0\) depending on whether the individual is risk-prefering, risk-neutral, or risk-averse).\(^4\)

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\(^4\) One can obtain a more intuitive understanding of expected utility analysis by assuming that there are only two possible states of the world, for example, an accident and no-accident state where

\[ p = \text{probability of an accident} \]
\[ (1 - p) = \text{probability of no accident} \]

Expected utility equals

\[
\bar{U} = pU(P^0) + (1 - p)U(P^1)
\]

where \(P^0\) and \(P^1\) are the incomes in the accident and no-accident states respectively, and \(P^0 < P^1\). We can compare the expected utility from this prospect with that of other prospects involving different income levels or accident probabilities, or to the prospect of receiving a certain income between \(P^0\) and \(P^1\). The expected-utility model enables us, for example, to determine how much an individual would pay, if anything, for insurance against the accident, or the level of care that maximizes expected utility, assuming \(p\) depends upon care.

\(^4\) A single utility function also could have segments that are risk-averse, risk-neutral, and risk-prefering. To simplify, we assume the utility function exhibits only one of these characteristics.

\(^4\) \(U'\) denotes marginal utility of income (the derivative of utility with respect to income) and \(U''\) denotes the rate of change of \(U'\) (the second derivative of utility with respect to income). A derivative is simply a rate of change. Where, as with the risk-averse function, the function is increasing but at a decreasing rate, the first derivative is positive but the second negative.
Generally, people are assumed to be risk-averse. It seems intuitive that the marginal utility of money income does diminish eventually, so that a person will not gamble his entire net worth for a fifty percent chance of doubling it, particularly if losing it means starvation. There is a good deal of evidence for the prevalence of risk aversion in the behavior of securities investors, in the purchase of insurance, and in other areas. Nevertheless, our analysis of the economics of tort law assumes that the utility functions of both injurers and victims are risk-neutral rather than risk-averse.

Our principal reason for adopting so seemingly unrealistic an assumption is that a risk-neutral model of liability rules yields more definite predictions than a model that assumes risk aversion. To assume risk aversion would give us too many degrees of freedom in explaining common-law rules and would make the efficiency theory of those rules difficult to refute (and hence to confirm). This would be an inadequate reason for assuming risk neutrality if we were analyzing an institution patently designed to reduce risk, such as insurance. But there is no compelling reason to assume that common-law judges in formulating efficient rules of accident control would think it important to try to reduce risk as well as accident and accident-avoidance costs. Both accident and liability insurance have long been available to prospective victims of accidents and prospective injurers alike, and before there was market insurance there was informal insurance provided through the family. If people who want insurance and are willing to pay for it can obtain insurance in the insurance market or in some informal substitute for it, there is no reason to use the tort system to provide insur-

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46 The purchase of insurance is intelligible only on the assumption of risk aversion: because of administrative costs, the insurance premium is always greater than the expected value of the insurance.

47 See, e.g., O.W. Holmes, supra note 1, at 961 ("Universal insurance, if desired, can be better and more cheaply accomplished by private enterprise.").

48 The role of the family as an insurance mechanism is emphasized in Posner, A Theory of Primitive Society, with Special Reference to Law, 23 J.L. & Econ. 1, 10-18 (1980).

Contract law, in contrast to tort law, has been analyzed in several studies that assume risk aversion. See, e.g., S. Cheung, The Theory of Share Tenancy (1969); Posner & Rosenfield, Impossibility and Related Doctrines in Contract Law: An Economic Analysis, 6 J. LEGAL STUD. 83 (1977). The difference between tort and contract law in this respect is that moral-hazard problems greatly complicate the provision of market insurance for breach of contract and for injury caused by such breach. For example, it is difficult to purchase market insurance against a rise in the price of an essential input. Thus, risk-shifting may be an important function of contracts and contract law but not of tort law.
The tort system then can treat injurers and victims as if they were risk-neutral. The adequacy of insurance outside the tort system is, to be sure, a matter of fair debate, and we lack enough data to form a judgment on the costs of insurance through tort liability relative to those of market insurance or insurance through the family (and lately through the state). However, given the availability of insurance to people involved in accidents, whether as injurers or as victims, it is not grossly unrealistic to posit risk-neutral utility functions for purposes of the positive economic analysis of tort law.

2. Optimal or Due Care. What actions should prospective parties to an accident take to minimize the social costs of accidents? Each party is assumed to be risk-neutral and therefore to have a utility function that in terms of Figure 1 is linear. That is, \( U = a + bI \) where \( a > 0 \) and \( b > 0 \). Observe that \( U \) is positive for all levels of income and increases at a constant rate equal to \( b \), the marginal utility of income, as income increases. Because a person's expenditure on care or insurance will be the same for all values of \( a \) and \( b \), provided \( b > 0 \), it is convenient to assume that \( a = 0 \) and \( b = 1 \), and therefore that \( U = I \). If, in addition, we let social welfare equal the sum of all utilities, then assuming \( U = I \) has the computational advantage of allowing us to measure social welfare as the sum of all incomes, thus equating efficiency with income or wealth maximization. This does not mean that social welfare actually is, or should be, simply the sum of all incomes, or even that there is such a thing as a social welfare function. The purpose of assuming a particular social welfare function is to enable us to define the term "social costs of accidents" and then to test the hypothesis that the rules governing tort liability are best explained as efforts to minimize these costs.

Assume that an accident, if it occurs, involves two people, \( A \) and \( B \), where \( A \) is the victim (plaintiff) and \( B \) the injurer (defendant). Defining \( x \) as \( A \)'s inputs of care and \( y \) as \( B \)'s inputs of care, we can

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48 It can be shown that if insurance is actuarially fair, a risk-averse person will (1) insure until his income is equalized in all states of the world, and (2) act as if he is risk-neutral with respect to expenditures on care. See Ehrlich & Becker, Market Insurance, Self-Insurance, and Self-Protection, 80 J. Pol. Econ. 623 (1972).
express \( p \), the probability of accident between \( A \) and \( B \), as a function of \( x \) and \( y \); that is
\[
p = p(x, y). \tag{4}
\]
We assume that \( p_x \) and \( p_y \), the marginal products of care, are both negative and diminishing, meaning that a small increase in \( A \)'s or \( B \)'s inputs of care, \( x \) and \( y \), will reduce \( p \) but at a decreasing rate. (Diminishing marginal product is denoted by \( p_{xx} > 0 \) and \( p_{yy} > 0 \).)\(^5\) Let \( D \) denote the dollar equivalent of the injury to \( A \) if the accident occurs, and \( A(x) \) and \( B(y) \) the costs of care to \( A \) and \( B \) respectively. We then can write the expected utilities (equal to expected incomes under the assumption of risk neutrality) of \( A \) and \( B \) respectively as
\[
U_a = p(I_a - D - A(x)) + (1 - p)(I_a - A(x)) \tag{4a}
= I_a - pD - A(x)
\]
\[
U_b = p(I_b - B(y)) + (1 - p)(I_b - B(y)) \tag{4b}
= I_b - B(y)
\]
and the sum of their expected utilities (or expected income) as
\[
U_a + U_b = I_a + I_b - pD - A(x) - B(y). \tag{4c}
\]
If it is assumed that everyone else's utility is independent of \( A \)'s and \( B \)'s utility, social welfare is maximized when \( U_a + U_b \) is maximized. Because \( I_a \) and \( I_b \) are fixed, this is equivalent to minimizing the social costs of accidents defined as the sum of the expected accident losses and the costs of care (or avoidance). That is, we want to pick the levels of \( x \) and \( y \) that minimize
\[
L(x,y) = p(x, y)D + A(x) + B(y) \tag{5}
\]
where \( L(x,y) \) is the social cost of accidents. Let \( x^* \) and \( y^* \) be the values that minimize \( L(x,y) \), i.e., the "due care" levels, and assume the marginal costs of care, \( A_x \) and \( B_y \), are positive and nondecreasing. Then \( x^* \) and \( y^* \) can be found by taking the first partial derivatives of \( L \) with respect to \( x \) and \( y \) and setting the resulting expression equal to zero.\(^6\) This requires that \( x^* \) and \( y^* \)

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\(^5\) \( p_x \) and \( p_y \) are the first partial derivatives of \( p \) with respect to \( x \) and \( y \), and \( p_{xx} \) and \( p_{yy} \) are the second partial derivatives. Throughout the article we denote derivatives by subscripts unless indicated otherwise.

\(^6\) Our assumptions of diminishing marginal products (\( p_{xx} > 0 \) and \( p_{yy} > 0 \)) and increasing or constant marginal costs of care (\( A_{xx} \geq 0 \) and \( B_{yy} \geq 0 \)) assure that \( x^* \) and \( y^* \) yield the
satisfy the following conditions:

\[ A_x = -p_x D \]  
\[ B_y = -p_y D. \]  

(6a)  
(6b)

The results are intuitive. A should keep adding inputs of care until the reduction in expected damages \((-p_x D)\) is equal to the marginal costs of the last unit of care. Before that point is reached, an additional input of care would confer a greater social benefit in reducing A’s expected damages than it would cost in additional expenditures on care; beyond that point an additional input of care would cost more than it was worth in accident prevention. The analysis of B’s optimal care is parallel.

The optimal or due care levels are shown graphically in Figures 2 and 3. In both diagrams, the demand curves show the expected reduction in the victim’s damages from additional units of care and the supply curves show the marginal costs of taking care. Demand curves are shown downward sloping, indicating decreasing marginal products of care, and supply curves are shown upward sloping, indicating increasing marginal costs of care. The due care levels, \(x^*\) and \(y^*\), occur at the intersections of the demand and supply curves.\(^6\)

\[ \text{Figure 2} \]
\[ \text{Figure 3} \]

When both \(x^*\) and \(y^*\) are positive, meaning that it is optimal for minimum and not the maximum value of \(L\).

\(^6\) Generally, the marginal product of A’s care also will depend on the level of \(y\), and the marginal product of B’s care on the level of \(x\) (i.e., \(p_{xy} \neq 0\)). In terms of Figure 2, therefore, a different demand curve exists for each level of \(y\) and in Figure 3 a different demand curve for each level of \(x\). To simplify the diagrams, the demand curve in Figure 2 is drawn assuming \(y = y^*\) and in Figure 3 assuming \(x = x^*\).
both A and B to take some care, we speak of the situation as one of "joint care." Where it is optimal for either A or B to take care, and for the other party not to take care, we refer to the situation as one of "alternative care." The distinction will become clear in due course. A further point to bear in mind is that inputs of care, x and y, can take two forms. One is doing an activity more carefully; the other is doing less of the activity. For example, while one way of reducing crop damage from locomotive sparks is to reduce the level of the activity, either railroading or farming, another is to conduct the activity more carefully. For example, the railroad could run the same number of trains but install spark-arresting equipment on each locomotive, or the farmer could plant the same amount of crops and as close to the railroad tracks as before but spray them with some fire-retardant chemical. Though unimportant in our formal analysis, the distinction between carefulness and activity will become important when we compare the legal standards of negligence and strict liability as methods of creating incentives for accident avoidance. These standards have different effects on the incentive to avoid an accident by reducing the level of one's activity as distinct from conducting the activity more carefully.

Some other assumptions of our formal analysis should be noted briefly. We assume that the parties' inputs of care affect only the probability of an accident and not the cost of the accident (D) if it occurs. The model could easily, indeed trivially, be expanded to allow x and y to affect D as well as p — to deal, for example, with the case where wearing seatbelts will reduce the cost of an accident if it occurs while not affecting the probability it will occur. We also assume that people can be sorted into potential injurers and potential victims, rather than that they are symmetrical. Other economic analysts of accidents, notably Peter Diamond, have assumed that injurers and victims are drawn from an identical pool, and that when they encounter each other in an accident it is a matter of pure chance who is victim and who is injurer. Our model is

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52 This distinction was introduced into the literature in Landes & Posner, supra note 20. Alternative care, for example where \( x^* = 0 \), would be depicted in Figure 2 by a demand curve that was everywhere below the supply curve.

53 The distinction between care and activity as methods of accident avoidance is discussed in Posner, supra note 16, at 208-09, and formalized and elaborated upon in Shavell, Strict Liability versus Negligence, 9 J. LEGAL STUD. 1 (1980).

54 See Diamond, supra note 13; Diamond, Accident Law and Resource Allocation, 5 BELL
simpler than Diamond's and there appear to be no important differences in substantive implications.\(^5\)

Finally, we assume that \(A\) and \(B\) are complete strangers and that the costs of a voluntary negotiation between them are prohibitive. Without this assumption liability rules would not affect the level of care; the Coase theorem implies that the parties would agree to use \(x^*\) and \(y^*\) inputs of care, because these are the levels of care that maximize their joint incomes.\(^6\) With the assumption that a transaction is infeasible, we confront, as noted in part I, a serious externality problem. Why should \(B\) expend any resources on care when the benefits of that expenditure will inure to \(A\)? And if \(B\) takes no care, will not \(A\) be led to take excessive care from an overall social standpoint? The question to which we turn next is how liability rules can internalize the cost of accidents and thereby induce \(A\) and \(B\) to buy \(x^*\) and \(y^*\) inputs of care, respectively.

### B. A Model of Liability Rules

1. **No-Liability.** A no-liability rule is a genuine liability rule because it affects the incentives of the parties. It is sometimes the optimal rule. Although \(B\) has no incentive to take care because he is not liable for \(A\)'s accident costs, \(A\) has an incentive to invest in care up to the point where \(A_x = -p_x D\) given \(y = 0\). This point will be optimal if \(y^* = 0\), i.e., in the alternative-care case where \(A\), the potential victim, is the more efficient accident avoider. If the case is one of joint care, so that \(x^*\) and \(y^*\) both are positive, a no-liability rule is inefficient. Moreover, if the care inputs of injurers and victims are partly substitutable, the victim's care level under a rule of no-liability will be greater than \(x^*\).\(^7\) For example, if some

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\(^5\) See Appendix to this article, where we extend our model to the symmetrical case.

\(^6\) Although our formal analysis focuses on accidents between complete strangers (in the sense that transaction costs are prohibitive), it easily can be extended to torts that arise out of a contractual setting (e.g., where \(A\) buys a product or service from \(B\)). Assuming risk neutrality, the parties to a contract would maximize its joint value by agreeing to use \(x^*\) and \(y^*\) inputs of care. Thus, in an accident between parties to a contract, one would define negligence and contributory negligence in the same way as one defines it in an accident between strangers — i.e., as a level of care less than due care.

\(^7\) By "substitutable" we mean that a reduction in \(y\) raises the marginal product (\(p_{xy}\)) of \(x\) — i.e., \(p_{xy} > 0\). Since \(p_x\) is negative, a higher marginal product as \(y\) declines means a larger negative number (e.g., \(-6\) instead of \(-4\)) for \(p_x\) and therefore a positive value for \(p_{xy}\).
care by drivers is optimal, a pedestrian probably will take more care than \( x^* \) if drivers are not liable for running down pedestrians, but he might take less. Measures of victim accident avoidance that were feasible when drivers took some care against pedestrian accidents might become infeasible (unproductive) when drivers took no care against such accidents, and no other pedestrian-care measures might be feasible either.

2. **Strict Liability.** Strict liability is symmetrical to no liability. Under strict liability (with no defense of contributory negligence), the victim, \( A \), has no incentive to take care, because he is fully compensated for his injury, \( D \). But \( B \) has an incentive to invest in care up to the point where \( B_y = -p_yD \) given \( x = 0 \), because under strict liability \( D \) is a cost to \( B \) if an accident occurs. Just as no liability is efficient where the case is one of alternative care and \( y^* = 0 \), so strict liability is efficient where the case is one of alternative care and \( x^* = 0 \), i.e., where there is no reasonable (cost-justified) measure that the victim can take to avert the accident or reduce the probability that it will occur. There is, however, an important asymmetry between no liability and strict liability that appears once we relax the implicit assumption that there are no costs of operating the legal system: no liability is cheaper to administer. Strict liability is costly to administer because (ignoring possible defenses to strict liability) every accident that occurs gives rise to a legal claim for compensation and thus a possible lawsuit. No liability is administratively costless. Administrative costs are discussed in more detail later.

3. **Negligence.** Under a negligence rule (and ignoring for the moment contributory negligence), an injurer is liable for his victim’s damages if and only if the accident resulted from the injurer’s failure to take due care, which for now we will assume (an assumption to be relaxed later) means a failure to use \( y^* \) inputs of care (i.e., \( y < y^* \)). So defined, a negligence rule gives \( B \) an incentive to use the optimal amount of care, \( y^* \).

If we put to one side the problem of contributory negligence by assuming that \( x^* = 0 \), \( L \) is minimized when

\[
L(0,y^*) = p(0,y^*) + B(y^*). \tag{7}
\]

We then can state the negligence rule as follows: if an accident occurs, \( B \) must pay \( A \)’s damages \( (D) \) if \( B \)’s actual inputs of care are lower than \( y^* \), the due care level; conversely, \( B \) is not liable if \( y \geq \)
Let $y_0$ be any level of $y$ (including 0) less than $y^*$. $B$ will choose to be negligent or nonnegligent depending upon whether

$$p(0,y_0)D + B(y_0) \leq B(y^*).$$

We know, however, that

$$L(0,y_0) = p(0,y_0)D + B(y) > L(0,y^*)$$

because, by definition, $y^*$ minimizes $L(0,y)$. Because $B(y^*) < L(0,y^*)$, it is also less than $L(0,y_0)$; hence a negligence rule creates an incentive for a potential injurer to use due care.

4. Strict Liability and Negligence Compared. Conventional legal scholars long have assumed that strict liability would induce potential injurers to be more careful than they would be under a negligence standard; economic analysis suggests that their analysis is superficial. Assuming that $x^* = 0$, $B$ will choose $y^*$, the due care level, whether he is strictly liable or liable only if negligent. The intuitive explanation is straightforward. Even if strictly liable, meaning that he must pay $D$ whether he was at the due care level or not, $B$ will not exceed that level. By definition, at any level of care greater than $y^*$, the cost of the marginal unit of care to $B$ is greater than the expected reduction in his liability for $A$'s damages. Therefore, $B$'s expected net income $(I - pD - B(y))$ is greater at $y^*$ than $y > y^*$, and he will never use care greater than $y^*$. But neither will he under a negligence rule ever use care greater than $y^*$, because he will not be liable for any accident that occurs when he is at the due care level, $y^*$. Notice also that the victim's care level will be zero under both strict liability and negligence (assuming a case of alternative care where $x^* = 0$). Under strict liability, $A$ has no incentive to take care because he is compensated for his injury should an accident occur. Under negligence, $A$ does not expect to be compensated for his injury but he still has no incentive to take care, because the costs of care are greater than the resulting reduction in expected damages.

Strict liability and negligence are not, however, economically identical standards. They differ in two major respects. The first involves the costs of administering the liability rule. These costs are of two types, which we shall call with some looseness “information costs” and “claim costs.” The former we define as the costs of ascertaining whether $B$'s actual level of care, $y$, was equal to $y^*$. These costs are zero under strict liability because due care is not
an issue in a case decided under a strict liability standard, but they may be substantial in a negligence case. The second kind of cost, claim costs, comprises the costs (other than information costs as defined above) of processing and collecting a legal claim; that is, of determining damage, causation, and other issues not involving the level of care of the defendant, and of transferring money from injurer to victim if the injurer is held liable. These costs are higher under strict liability than under negligence because the number of claims is larger. Under strict liability, a claim arises every time there is an accident caused by someone worth suing; under negligence, there is a claim only if the victim thinks he can show that the defendant failed to use due care. Defenses to liability may reduce the scope of liability under both negligence and strict liability, but presumably not more so under the latter; thus the relative administrative costs are unaffected.

Because information costs are higher under a negligence rule and claim costs higher under strict liability, we would expect that, other things unchanged, a fall in information costs would result in a shift away from strict liability and toward negligence. Looking broadly at the history of liability rules and at the differences between liability rules in primitive and modern societies, we find that the secular decline in the costs of information associated with growing literacy and knowledge of how the physical world operates has been accompanied by a movement away from strict liability and toward negligence as the dominant rule of liability. The evidence for these trends, presented elsewhere, supports our theory that tort law has been shaped by economic considerations.

The other major respect in which negligence and strict liability differ economically is in incentives to avoid accidents by reducing the level of activity rather than by increasing the care with which the activity is conducted. We mentioned earlier that $y^*$ might involve running fewer trains as well as installing spark-arresting equipment on each locomotive. Under strict liability, a potential injurer will interpret $y^*$ broadly. He is interested in any measure that would reduce his expected liability by more than the cost of the measure; it is a matter of indifference to him whether the cost results from having to purchase some safety input or from foregoing the profits from a higher level of productive activity. However,

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**See Posner, supra note 49, at 42-52; Posner, supra note 32, at 90-91.**
when a court determines $y^*$, as it must when the rule is negligence rather than strict liability, it may take a narrower view of the potential injurer's options. The court will consider how the defendant might conduct his activity more carefully but it may not consider the benefits and costs of the defendant's avoiding accidents by reducing his activity. For example, a court in an automobile-accident case would consider whether the defendant had driven carefully when the accident occurred but it would not consider whether the trip was really necessary in the sense that the benefits of the trip exceeded all of its costs including expected accident costs.

This is essentially a point about information costs. One way of economizing on the costs of determining $y^*$ is for the court to look at only a subset of care inputs — those that relate to the safety with which the activity is carried out, as distinct from the amount of the activity. If courts in negligence suits constrict their vision in this way, strict liability may result in fewer accidents than negligence — not by inducing the defendant to be more careful but by inducing him in some cases to reduce the level of his activity and with it the expected number of accidents.

Before concluding that strict liability is allocatively more efficient than negligence, however, we must consider a heretofore neglected factor, the victim's activity level. Put aside any issue of the victim's being careless in a negligence sense by assuming that there is a defense of contributory negligence under both a strict liability and a negligence standard. Assume also that contributory negligence resembles negligence in that the activity of the victim is not considered in determining whether he used due care. On these assumptions, strict liability and negligence have opposite, and potentially offsetting, effects on injurer and victim activity. Under strict liability, the injurer has an incentive to change or reduce his activity where such an adjustment is an optimal method of accident avoidance, because he bears the costs of any accident that could be avoided by such an adjustment; but the victim has no incentive to adjust his activity because he is compensated for any injury not resulting from his own failure to be careful. Under negligence, the injurer has no incentive to adjust his activity level but the victim does, because he is not compensated for any injury that occurs un-
less it could have been avoided by the injurer's being more careful rather than by the injurer's reducing his activity level. Hence the different effects of strict liability and negligence on activity do not provide an economic reason for preferring strict liability to negligence, unless an adjustment in the defendant's activity, but not in the plaintiff's, would be an efficient method of accident avoidance. Strict liability may not result in fewer accidents than negligence; it will reduce the defendant's activity level but it will increase the plaintiff's, and the number of accidents may be greater, fewer, or the same as under a negligence standard.

This analysis yields predictions concerning the pattern of strict liability and negligence that one will observe in the law if the positive economic theory of tort law is correct. If a change in the plaintiff's activity is unlikely to be an efficient method of accident avoidance, but a change in the defendant's activity is likely to be an efficient method, strict liability is an attractive rule. It will deter many accidents, and what we have called the claim cost of strict liability will be reduced. However, where greater care rather than less activity is the optimal method of accident avoidance by potential injurers, the case for negligence is strengthened, for now the claim costs of strict liability are likely to be high relative to its allocative effect, compared to negligence. Whether the pattern of strict liability and negligence follows the predictions of our analysis is considered in part III.

The activity point is not relevant only to the choice between strict liability and negligence. In the Restatement's formulation of the nuisance standard, the utility of both the plaintiff's and the defendant's activities must be considered and compared in deciding whether there is an actionable nuisance. Often a change in activity levels is a feasible means of avoiding damage in a nuisance case where greater care in the activity would not be. The reduction in property values caused by a funeral parlor cannot be eliminated by conducting funerals more discreetly or carefully, but it can be eliminated by relocating the funeral parlor — a change in activity rather than care. The nuisance standard illustrates the common

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60 See Restatement (Second) of Torts § 826 (1977), and comments thereto.
61 W. Prosser, Handbook of the Law of Torts 599-601 (4th ed. 1971), stresses the importance of relocating either defendant's or plaintiff's operations as a mode of avoiding damage in nuisance cases.
law's recognition that when the place, kind, or amount of activity is an important factor in bringing about an optimal level of damage, it should be part of the legal standard.

Activity occasionally is considered in negligence cases as well. The utility of the plaintiff's activity was one of the factors singled out by Henry Terry in his formulation of the negligence standard, a formulation that foreshadows the Hand formula discussed in part III. Terry was discussing rescue cases, one of the principal areas where the activity point is considered under the negligence standard. Suppose that A rushes into a burning building to save his hat. His behavior would be deemed negligent even if he did everything possible to minimize the hazard to himself—short of not entering the building in the first place. Because the cost of curtailing the activity is less than the expected accident cost, his behavior is, as we shall see, held to be negligent. The costs to the factfinder of determining the optimal activity level are low in this case, so the concept of due care is enlarged to include the level of the activity as well as the care with which it is undertaken. Where it is difficult to ascertain the optimal activity level, however, the courts applying a negligence standard generally do not attempt to do so. They do not consider, for example, whether the best way to avoid certain accidents at railroad crossings is for railroads to run fewer trains, or for travelers using the crossing to travel less. The determination of the opportunity costs of a lower activity level would in this case be very difficult. In the rescue case it is simple.

There is thus a trade-off between the information costs of considering the injurer's activity level as an aspect of due care and the allocative costs of ignoring the activity level. If the common law has made this trade-off correctly, there is no merit to the argument that the movement from strict liability to negligence in nineteenth-century tort law amounted to a covert subsidizing of productive but dangerous activities. To be sure, strict liability increases the private costs of injurers compared to negligence liability, but if the imposition of those costs on them is not the best method of acci-

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* See Terry, supra note 4.
dent control, the removal of those costs cannot be regarded as a subsidy. The repeal of an unjustified tax is not a subsidy to the former taxpayer.

One question remains to be considered in our comparison of strict liability and negligence: why are there any negligence cases? It is easy to see why there will be some cases under a rule of strict liability even if all potential injurers take due care ($y^*$). Although the probability of an accident will be lower than if injurers took less care (assuming that the plaintiff's optimal care level is zero or negligible), the number of accidents will still be positive and injurers will be liable for the damages resulting from them, so claims will be generated. Under negligence, however, it would seem that the number of cases should be zero. If the injurer maintains a care level of $y^*$, he is not liable for any accidents that occur; and he will not set a lower level of care because, as we showed earlier, he minimizes his private costs by adhering to that level.

There are several reasons for observing a positive number of negligence cases even if the courts set a care level of $y^*$ for nonnegligent behavior and injurers are all rational economic maximizers:

(1) Either the court or the injurer may make a mistake in applying the standard to the facts. (Victims may make the same mistake, but their mistakes would result in cases in which negligence was alleged rather than in cases where it was found.) Mistakes give rise to the possibility that the parties will have divergent expectations of the likely outcome of litigation and divergent expectations can lead to litigation.64

(2) As emphasized by Peter Diamond, care has a stochastic (random) element.65 For example, suppose that a potential injurer tries to achieve a level of care $y^*$, but his realized care is $y = y^* + e$, where $e$ is a random error term with a mean of zero. Although $E(y)$, the injurer's expected care, is $y^*$, there will be instances when $e$ will be negative and $y$ will fall below $y^*$. If an injury occurs when $y < y^*$, a court that ignored the stochastic element of care would deem the injurer negligent. Because an omniscient court would take account of the stochastic character of care and decline to find negligence whenever $E(y) = y^*$ even though the realized level of care was below $y^*$, Diamond's is really a point about the

64 See, e.g., Landes, An Economic Analysis of the Courts, 14 J.L. & Econ. 61 (1971).
65 See note 13 supra.
information costs of determining negligence in difficult cases.

(3) A related reason for expecting there to be some negligence cases, also introduced into the economic literature by Diamond, is the "average man" or "reasonable man" concept of negligence law. Due care is judged by the capabilities of the average individual rather than by those of the particular defendant (again, presumably because of information costs). If the defendant's capabilities are below average, the costs of his taking care will be above average and he may choose a care level below the average \( y^* \). If an accident occurs, he will be held liable.\(^6\) (Stated differently, reasons (2) and (3) both imply a strict liability element in negligence.)

(4) If judicial factfinding and law-applying were so accurate that nobody behaved negligently, was accused of negligence, or was adjudged negligent, there would be for a time no cases, supposing reasons (2) and (3) above were not operative either. But this happy situation could not last. As time passed, the precedents defining the standard of care would become stale, the difficulty of predicting the outcome of negligence cases (if they should arise) would therefore grow, and people would begin to behave negligently or be sued for negligence because of misapprehension of what the legal standard was or how it would be applied to them.\(^7\) Presumably, then, the common-law equilibrium is one where there are some negligence cases in the courts at all times.

5. Negligence Plus Contributory Negligence. Our analysis of strict liability and negligence was simplified by assuming that \( x^* = 0 \), i.e., that optimal avoidance requires no inputs of care by the potential accident victim. If we assume instead that the social costs of accidents, \( L(x,y) \), are minimized only when both \( x^* \) and \( y^* \) are positive, we have an important reason why the legal system would favor negligence with a defense of contributory negligence over strict liability with no such defense.

Assume that contributory negligence, defined as \( x \) less than \( x^* \) (just as negligence was \( y < y^* \)), is a complete bar to the victim's recovering damages from the injurer. Under a standard of negligence plus contributory negligence so defined, and denoting by \( s^a \)

\(^6\) Although his optimal care level is less than \( y^* \), a below-average person (provided he is not too far below average) may bring his care level up to \( y^* \) under a negligence rule to avoid liability if an accident occurs.

\(^7\) See Landes & Posner, supra note 38, at 271-72.
the share of damages \((D)\) that falls on the victim \(A\) and by \(s^b\) the share of damages that is shifted by the liability system to the injurer \(B\), we have the following relationship between care and liability:

<table>
<thead>
<tr>
<th>Care</th>
<th>Liability</th>
</tr>
</thead>
<tbody>
<tr>
<td>(x^<em>, y^</em>)</td>
<td>(s^a = 1; s^b = 0)</td>
</tr>
<tr>
<td>(x &lt; x^<em>), (y^</em>)</td>
<td>(s^a = 1; s^b = 0)</td>
</tr>
<tr>
<td>(x &lt; x^<em>, y &lt; y^</em>)</td>
<td>(s^a = 1; s^b = 0)</td>
</tr>
<tr>
<td>(x^<em>, y &lt; y^</em>)</td>
<td>(s^a = 0; s^b = 1)</td>
</tr>
</tbody>
</table>

For example, when both parties take due care \((x^*, y^*)\) or both take less than due care \((x < x^*, y < y^*)\), none of \(A\)'s damages are shifted to \(B\) (i.e., \(s^a = 1\) and \(s^b = 0\)). If only the injurer is negligent, \(A\)'s full damages are shifted to \(B\) (i.e., \(s^a = 0\), \(s^b = 1\)).

Assume that each party acts to minimize his expected loss (or equivalently to maximize his expected income), taking account of the particular liability rule and the likely behavior of the other party. First consider the potential victim's behavior. Table 1 shows the victim's expected loss for different levels of his and the injurer's care. If \(A\) expects \(B\) to be negligent and use \(y_o\) inputs of care, \(A\) will minimize his expected loss by choosing \(x^*\).

**Table 1**

<table>
<thead>
<tr>
<th>(B)'s care</th>
<th>(A)'s Expected Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(x_o &lt; x^*)</td>
</tr>
<tr>
<td>(y_o &lt; y^*)</td>
<td>(p(x_o,y_o)D + A(x_o))</td>
</tr>
<tr>
<td>(y^*)</td>
<td>(p(x_o,y^*)D + A(x_o))</td>
</tr>
</tbody>
</table>

Because \(p(x_o,y_o)D + A(x_o)\) in Table 1 may be written as \(L(x_o,y_o) - B(y_o)\), and \(L(x^*,y^*)\) is by definition the minimum expected social cost of an accident, the best choice for \(A\) given \(y = y_o\) is \(x^*\) because \(L(x_o,y_o) - B(y_o) > L(x^*,y^*) - B(y_o) > A(x^*)\). Alternatively, if \(A\) expects \(B\) to choose the due care level \(y^*\), \(A\) will also choose \(x^*\) because by definition \(L(x^*,y^*) - B(y^*) < L(x_o,y^*) - B(y_o)\)

\(^{**}\text{\(Y_o \text{ inputs may be zero or any amount less than } y^\). Similarly, \(x_o \text{ may be zero or any amount less than } x^*.}\)
Now consider B's behavior. Table 2 gives B's expected loss for different assumed values of A's and B's care.

Table 2

<table>
<thead>
<tr>
<th>A's care</th>
<th>y_0 &lt; y*</th>
<th>y*</th>
</tr>
</thead>
<tbody>
<tr>
<td>x_0 &lt; x*</td>
<td>B(y_0)</td>
<td>B(y*)</td>
</tr>
<tr>
<td>x*</td>
<td>p(x*,y_0)D + B(y_0)</td>
<td>B(y*)</td>
</tr>
</tbody>
</table>

Obviously, the best possible outcome for B is (x_0,y_0) because he can use zero care and still not be liable for A's injury should it occur. We have shown, however, that A has an incentive always to use x*. Thus, B will expect that potential victims are using due care. Hence B's choice is limited to the second row of Table 2. From the definition of due care we know that B(y*) < L(x*,y*)D - A(x*) < L(x*,y_0) - A(x*) = p(x*,y_0)D + B(y_0); therefore B will choose y*.

The intuition behind this result is straightforward. Each party knows that if he is careless, the other party will have an incentive to be careful as a way of throwing the entire liability onto him; knowing this, each has an incentive to be careful. Thus, suppose a $100 injury to B can be averted if A spends $50 and B $40, and each will be deemed negligent (in A's case, contributorily negligent) for failing to make that expenditure. B knows that if he fails to spend $40, A will spend $50, for by doing so A shifts a $100 loss to B at a cost of only $50; knowing this, B will invest his $40 so as to avert a loss of $100 (resulting in a net gain of $60). Conversely, A knows that if he fails to spend $50, he will be barred from recovering damages from a negligent B by the doctrine of contributory negligence. Moreover, even if A expects B to be nonnegligent, A can avoid a $100 loss by spending $50 on care. Knowing this, A will spend $50.

The rule of contributory negligence is only one possible allocation of loss between injurer and victim. Other allocations — as under a strict liability rule with a defense of contributory negligence (where s^a = 0 and s^b = 1 when x = x* and y = y*) or a
comparative negligence rule (where the parties divide the losses if an accident occurs and both have used less than due care) — would have the same effect on the parties' levels of care. No proof of this proposition will be presented here,* but an arithmetical example for comparative negligence will indicate the underlying intuition. Suppose the rule were that the negligent victim could collect 90 percent of his damages from a negligent injurer — i.e., when \( x < x^* \) and \( y < y^* \), \( s^a = .10 \) and \( s^b = .90 \). Then, in the above example, \( A \) might appear to have no incentive to take care because 10 percent of \$100\ is less than \$50. \( B \) would have an incentive to take care, however, because by doing so he could avoid an expected liability of \$90\ at a cost of only \$40. Therefore, \( A \) will expect \( B \) to spend \$40 on care. \( A \) knows that he thus will incur the full \$100\ loss unless he spends \$50, so he will do so. Although comparative negligence has the same allocative effect as contributory negligence, at least in a joint-care case, it is more costly to administer, and hence less efficient in terms of our analysis. Its traditional rejection by common-law courts is thus consistent with the positive theory.

III. THE MODEL APPLIED: NEGLIGENCE AND THE CHOICE BETWEEN NEGLIGENCE AND STRICT LIABILITY

Having presented a formal model of the basic principles of tort liability in accident cases, we turn now to a comparison of that model with the actual doctrines of tort law. The liability rules modeled in part II were economic concepts of liability; it remains to inquire whether the actual rules of tort liability correspond to the predictions of the economic model. The scope of such an empirical inquiry is as broad as tort law itself, and no effort to explore the full range of tort principles will be made in this article. We shall merely begin the empirical inquiry by examining (1) the basic negligence standard, encapsulated in the Hand formula; (2) contributory negligence, and some defenses thereto; (3) the application of the negligence standard in representative cases; and (4) the common law's choice between strict liability and negligence as the liability standard in particular classes of case.

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* For a proof, see Landes & Posner, supra note 20, at 539 n.51.
A. The Hand Formula

In *United States v. Carroll Towing Co.*\(^{70}\) the question was whether the owner of a barge owed a duty to keep an attendant on board while the barge was moored in the harbor, because on occasion unattended barges would break loose from their moorings and cause damage to other ships. Judge Learned Hand defined the owner’s duty as a function of three variables:

\[
P = \text{probability that the barge will break away;}
L = \text{gravity of resulting injury, if it does break away;}
B = \text{burden of precaution adequate to prevent it from breaking away.}
\]

According to Hand, the owner would be negligent if the burden of precautions \(B\) was less than the probability times the gravity \((PL)\); i.e., if \(B < PL\). This is the “Hand formula” of negligence.

Because *Carroll Towing* is a recent decision by common-law standards and because few if any other decisions have used this or any other algebraic formulation, it has been questioned whether the Hand formula states the legal meaning of negligence accurately. Since Hand was purporting only to make explicit what had long been the implicit meaning of negligence, however, the comparative recency of the case does not establish the novelty of the definition. Something like the Hand formula has long been used to decide negligence cases. For example, in a case decided in 1864, the court stated that

in all cases the amount of care which a prudent man will take must vary infinitely according to circumstances. No prudent man in carrying a lighted candle through a powder magazine would fail to take more care than if he was going through a damp cellar. The amount of care will be proportionate to the degree of risk run and to the magnitude of the mischief that may be occasioned.\(^{71}\)

The Hand formula obviously resembles the economic model of due care (see equations (6a) and (6b) in part II), but how close is the resemblance? The Hand formula makes no reference to care by

\(^{70}\) 159 F.2d 169 (2d Cir. 1947).

the accident victim; we take up this problem in the next section. In addition, the formula is inexplicit on whether accident costs and benefits are to be considered in the correct marginal, rather than total, terms. If for \( B \), the burden or cost of precautions, we substitute \( B_y \), the marginal cost of care, and for \( PL \), the expected damage from the accident, we substitute \(-p_y D\), the marginal reduction in accident damage, the Hand formula for negligence can be written as \( B_y < -p_y D \). This means that it is negligent to use a level of care at which the marginal cost of accident avoidance is less than the marginal benefit from avoidance; that is, to use a care level less than \( y^* \).

This is the correct economic standard of negligence, but have we altered the meaning of the Hand formula by expressing it thus in marginal terms? To answer this question requires a consideration of actual cases, which we provide below. To anticipate, we find that the courts do consider marginal rather than total values in applying the standard. This is an unexpected benefit of the constricted focus which critics of the fault system consider a weakness of case-by-case determination of fault issues. The court asks, “What additional care inputs should the defendant have used to avoid this accident, given his existing level of care?” The focus on the particular accident and the particular inputs that could have prevented it invites a marginal analysis.

B. Contributory Negligence and Some Defenses Thereto

The common law used the doctrine of contributory negligence to evaluate the victim’s care. Because the legal standards of negligence and contributory negligence are the same, we can infer that Judge Hand would have applied his formula to victims as well as injurers in any case where contributory negligence was alleged. Thus, if \( A_x \) is less than \(-p_x D\), the victim is barred from recovering damages.

The negligence-contributory negligence approach, defined in marginal Hand formula terms, yields optimal results in cases of joint care (i.e., cases where \( x^* \) and \( y^* \) are both positive), provided that the law applies the Hand formula to each party on the assumption that the other party is exercising due care.\(^7\) Here our

\(^7\) Recall from part II that if \( x \) and \( y \), the inputs of care, are complementary or substitutable, the marginal products of one will depend upon the other; hence, \( x^* \) can be determined
interest is in the application of this principle to the victim. Suppose that if a railroad makes no effort to limit the emission of sparks from its locomotives, the expected damage to the farmer's crops will be $150, but this damage can be averted by the farmer's not planting crops near the tracks, at a cost to the farmer of $100. The damage also will be averted if the railroad spends $50 on a spark arrester and the farmer $5 on keeping a small space between his crops and the tracks. Obviously, the second method of avoidance, involving joint care by the railroad and the farmer, is more efficient, but if the Hand formula is applied to the farmer without the qualification suggested above, because $100 is less than $150 the farmer will be deemed contributorily negligent and will be led to relocate his crops. The accident will be averted, but at a cost that is $45 higher than necessary. If, instead, the farmer is required to protect himself only against accidents that will not be averted by due care on the part of the railroad, then he will maintain only the small space between crops and tracks, at a cost of $5.

Under this interpretation of contributory negligence, the defense comes into play only where neither party exercises due care, defined as the care that is optimal if the other party to the interaction is using optimal care.

This analysis explains the remark in Justice Holmes's concurring opinion in LeRoy Fibre (the most famous American railroad spark case) that "as a general proposition people are entitled to assume that their neighbors will conform to the law . . . and therefore will not be negligent." In that case the railroad's locomotive, as a result of negligent operation by the railroad's employees, spewed large quantities of sparks and live cinders which ignited a pile of flax stacked eighty-five feet from the tracks. The accident no doubt could have been prevented by removing the flax to a greater distance from the track, but if this fact in itself were deemed to make the owner of the flax contributorily negligent, the railroad would have had an incentive to spew sparks and cinders with total abandon, in order to induce the owner of the flax to remove it to as great a distance as possible, thus minimizing the railroad's own damage-prevention costs. The real question in the case was

by assuming \( y = y^* \), and \( y^* \) by assuming \( x = x^* \). If \( x \) and \( y \) are independent \( (\rho_{xy} = 0) \), then due care for one party can be determined without reference to the other party's care.

whether the flax should have been more than eighty-five feet from the tracks to prevent damage from a nonnegligently operated train — in which event plaintiff should not have been allowed to recover. 74

Although the legal position on contributory negligence yields correct results in the joint-care case, it may yield incorrect results in the particular alternative-care case where \( x^* \) is zero given \( y^* \) but positive given \( y = 0 \). Suppose that an expected accident cost of $100 can be avoided by an expenditure of either $20 by A (the victim) or $10 by B (the injurer), and that the best avoidance strategy from a social standpoint is for B to spend $10 on care and A nothing; that is, \( x^* = 0 \) given \( y^* \). If B spends nothing on care and an accident occurs, A will be deemed contributorily negligent for having failed to take care (because $20 < $100). A therefore will take care and the accident will be avoided, but at a higher social cost than necessary ($20 instead of $10). The problem does not arise when the victim is the cheaper accident-cost avoider. In that situation, the rule of contributory negligence brings about the correct allocation of resources even in the alternative-care case. But where the case is one of alternative care and the injurer is a cheaper accident-cost avoider than is the victim, comparing each party’s costs of care with expected reductions in accident cost brings about a misallocation of resources.

This misallocation would be avoided if, instead of examining negligence and contributory negligence separately, the courts explicitly compared the parties’ costs of avoidance. However, to do so in every case — obviously at some price in higher costs of information — would be a dubious strategy, because the comparison would, as we have seen, yield an allocative improvement in only a subset of cases. It would yield no gain in any joint-care case, in any alternative-care case where the victim was the cheaper cost avoider, or in any alternative-care case where the costs of accident avoidance were the same to victim and injurer. In the limited group of alternative-care cases where a comparison of the victim’s and injurer’s avoidance costs would yield an improvement, there is an alternative to case-by-case comparison: creating defenses to

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74 Justice Holmes thought this question should have been left to the jury; the majority disagreed, perhaps because of the way in which the certified questions that the Court had been asked to answer were phrased.
contributory negligence that deal on a category rather than an individual-case basis with the recurring cases where the costs of accident avoidance are lower to injurer than to victim.

In nineteenth-century tort cases there is considerable talk of the “degrees” of negligence — slight, ordinary, and gross. These were (and to some extent still are) used in other tort contexts, but for now our interest is in their use in comparing plaintiff’s and defendant’s negligence. Several state courts held during this period that contributory negligence was a bar to plaintiff’s recovering only if the plaintiff’s negligence was of the same or a higher degree than the defendant’s. Thus, if defendant was grossly negligent and plaintiff only slightly or ordinarily negligent, plaintiff could still recover damages. This approach, however, yields no allocative improvement in joint-care cases. Consider a case where the expected accident cost is $150, optimal care requires that the potential injurer spend $5 and the potential victim $50, neither party takes care, and an accident occurs. One way to think of the degrees of negligence is in terms of the ratio of the costs of care to the expected reduction in accident damages: the lower the ratio, the greater the negligence. In the case just put, the ratio is 1/30 for the injurer and 1/3 for the victim. A fair translation of these ratios into words would be that the injurer was grossly negligent and the victim ordinarily negligent. But if, on this ground, the victim is awarded damages, there is no allocative benefit. In future cases, the potential injurer will spend $50 on care, and knowing this the victim will have an incentive to spend $5 to avoid an accident for which he would not be compensated because the injurer would not be deemed negligent. As we saw earlier in discussing LeRoy Fibre, the same result is reached under a simple negligence standard. The degrees of negligence add nothing in a joint-care case — except administrative costs when deterrence fails and a court must decide liability.

The degrees-of-negligence approach to the problem of different victim and injurer costs of avoiding accidents soon fell into disfavor, but other defenses to contributory negligence proved more durable and seem more sensible because they are not applicable in joint-care cases, where, as we have seen, they are not needed. We shall discuss briefly two of these defenses, beginning with the doc-

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76 See W. Prosser, supra note 61, at 434.
trine of "last clear chance" as illustrated by *Kumkumian v. City of New York*. Kumkumian jumped or fell onto a subway track in front of an approaching train. The train struck him — without fault on the part of the defendant or its employees — and immediately stopped. Kumkumian's body had triggered an automatic mechanism that halted the train whenever it hit an object on the tracks. The subway motorman reset the mechanism without bothering to see what was on the track. The train started up, struck Kumkumian again, and again stopped. Once again the motorman reset the automatic tripping mechanism without looking to see what was on the track. Kumkumian's fatal injuries, it seems, occurred not when he was first struck by the train but when he was struck the second and third times, after the motorman restarted the train. The court assumed that Kumkumian had no business on the track, that he was a trespasser who could have avoided the accident simply by not trespassing. Because the motorman had the "last clear chance" to avoid the accident, however, Kumkumian's status as a trespasser (contributorily negligent) did not bar the suit. The cost to the motorman of seeing what it was that was tripping the automatic mechanism was lower than the cost to Kumkumian, once he already had been struck by the train, of avoiding a further injury.

Whether *Kumkumian* and the last clear chance doctrine in general really is explainable on economic grounds is more problematic than just suggested. The correct perspective for judging the efficiency of a legal rule is an *ex ante* — *i.e.*, does the rule create incentives for parties to behave efficiently in the future? Suppose, for example, that Kumkumian could have avoided trespassing (and hence any injury) at a cost of $1, but once he had trespassed the cost rose to $1 million. Suppose further that the subway could have avoided injuring Kumkumian at a cost of $5. Because the cost of accident avoidance is either $1, $5, or $1 million, this would be an example of alternative care where the injurer's optimal care level was zero. A rule of no liability therefore would seem to be efficient. Applying the last clear chance doctrine in these circumstances would be inefficient because the victim, knowing the in-

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*76 305 N.Y. 167, 111 N.E.2d 865 (1953).*

juror would be liable if an accident occurred unless the injurer had spent $5, would not take care. Knowing this, the injurer would have an incentive to spend $5 to avoid liability. The accident would be prevented but at a social cost $4 greater than it would have been if the victim had used due care.

On closer analysis, however, two reasons appear why the last clear chance doctrine may create incentives for efficient behavior. One is that even from an ex ante perspective, the cost to the injurer may be lower than the cost to the victim of not trespassing. In the typical last clear chance case, the injurer’s costs are indeed negligible — the cost of blowing a whistle or slamming on the brakes. In Kumkumian we do not know what the victim’s cost would have been, because we do not know why he was on the track. However, the statement of facts in the court’s opinion suggests he may very well have been mentally ill, in which event his cost of accident avoidance may have been high. The subway’s costs appear to have been trivial. The subway train was equipped with a tripping mechanism for the safety of its passengers and crew and the cost of the mechanism would have been no lower had Kumkumian never trespassed. Given the mechanism, it was virtually costless for the motorman to look under the track to see why the train had stopped. Indeed, he probably should have done so for the safety of himself and his passengers, in which case the cost was negative.

The other economic reason behind the last clear chance doctrine is related to our earlier point that care has a probabilistic rather than a certain effect on safety. Suppose that if Kumkumian spends $1 on care (including avoiding trespasses) there will still be a .01 probability that he will trespass on the subway tracks and receive an injury (assuming that the subway takes no care) of $1000. Suppose that the subway could spend $5 on care to reduce the probability of injuring Kumkumian, if he trespasses, from 1.078 to .5 and that if it fails to do so and an accident occurs it will be liable for Kumkumian’s injury under the last clear chance doctrine. The subway will, of course, spend $5 to avoid a certain liability of $1000 if it observes a trespasser on its tracks, and this is efficient given that the victim is already on the tracks. The critical question

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78 This is the conditional probability of hitting Kumkumian given that he trespasses; the probability that he will trespass, we said, was only .01.
is whether Kumkumian will still spend $1 on care (as we want him to do), knowing that, if he trespasses, the threat of liability under the last clear chance doctrine will induce the subway to take care.

To answer this question, we must consider Kumkumian’s options. If he spends $1 on care, the sum of his expected injury costs and costs of care will be $6 (=(.01)(.5) $1000 + $1) compared to $500 (=(.5) $1000) if he doesn’t take care. Thus, he will take care. The last clear chance doctrine will give him an incentive not to take care only when the subway’s taking care will reduce the probability of an injury to near zero. (In the nonprobabilistic case discussed earlier, it was assumed that the subway’s expenditure of $5 did in fact reduce this probability to zero.) For example, if the subway’s $5 expenditure would reduce the probability of injury to less than .001 (instead of to .5), Kumkumian will not take care. Surprisingly, this is the efficient outcome. Because the subway’s $5 expenditure will reduce Kumkumian’s expected damages to $1, it would be inefficient for him to spend $1 to reduce his expected damages from trespassing by 99 cents, i.e., from $1 to (.01)(.001) ($1000) = $0.01. While counter-examples could be constructed where the last clear chance doctrine would yield inefficient results (too much care by the subway and not enough by Kumkumian), our analysis suggests that in a broad range of plausible cases the doctrine yields efficient results.

Another interesting defense to contributory negligence is the “attractive nuisance” doctrine. Children are attracted to various dangerous conditions on land, including railroad turntables and swimming pools or holes. As trespassers, they ordinarily would be barred from recovering damages if injured by one of these conditions even if the cost of fencing to the landowner was also less than the expected accident cost, so that the landowner was negligent. The economic explanation is that the cost of not trespassing is usually negligible relative to the landowner's cost of fencing. Under the attractive nuisance doctrine, however, the landowner's negligence is not excused by the child's status as a trespasser. The economic basis of this result is that the costs to the children —

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7 If Kumkumian takes care, the sum of his expected injury costs and his cost of care is $1.01 (=(.01)(.001) ($1,000) + $1), compared to $1.00 (=(.001) ($1000)) if he does not take care.

80 See W. PROSSER, supra note 61, at 364-76.
more realistically, to their parents — of avoiding the lure of the attractive nuisance probably are greater than the costs to the landowner of fencing out the children. It is an alternative-care setting because either fencing in or fencing out will avoid the accident; doing both would be redundant. We shall discuss later an interesting analogy to the attractive nuisance doctrine in the law relating to damages caused by straying cattle.

The notorious Britt case, long regarded as an illustration of Justice Holmes's hard side, further illustrates the economic logic of the attractive nuisance doctrine. Two children were killed when they dove into a pool that they thought contained just water but that actually contained sulphuric acid as well. The Supreme Court held that the attractive nuisance doctrine was inapplicable because the pool was not visible from the public highway from which the boys had entered the defendant's land. This fact made the pool less dangerous to children, because the only children who would be attracted by it would be those who already had entered defendant's land despite the absence of any visible attraction. Hence the cost-justified level of defendant care was less than in the usual attractive nuisance case. It may not have paid to fence the pool given the low probability that any children would be attracted to it. Furthermore, the costs of accident avoidance by the victims and their parents were lower because they did not have to fight the lure to trespass created by the sight of an apparent swimming hole.

C. Judicial Applications of the Hand Formula (Economic) Approach

We could give other examples of defenses to contributory negligence, but rather than do that we will examine further how the courts apply the fundamental negligence doctrine, encapsulated in the Hand formula, to both injurer and victim negligence.

Hendricks v. Peabody Coal Co. illustrates how courts approach the question of determining $B_y$, the effect on the injurer's cost of care of adding another input of care. Plaintiff, a youth of sixteen, was seriously injured while swimming in defendant's abandoned strip mine which had become filled with spring water. Defendant

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82 Or, if visible, was not shown to have been the lure that drew the boys to the site.
knew that the water hole was used frequently for swimming, knew also of the hazard (a concealed shelf beneath the water's surface at the point where plaintiff dived) that caused plaintiff's injury, and "undertook to police the area but did not do so effectively." Considering measures that the defendant might have taken to avert the accident, the court noted: "The entire body of water could have been closed off with a steel fence for between $12,000 and $14,000. The cost was slight compared to the risk to the children involved . . . ." Alternatively, the defendant could have barricaded the road to the site to prevent entry, or at the very least could have posted warning signs. Because the plaintiff's damages had been assessed at $200,000 and the swimming hole was heavily used, a fact which suggests that accidents of comparable severity were likely to happen in the future, the court seems to have been on safe ground in concluding that the defendant had failed to use due care.

An older case, *Adams v. Bullock*, illustrates the situation where the cost of care is disproportionate to the expected accident cost, and where accordingly the failure to take care is not negligent. Plaintiff, a twelve-year-old, while crossing a bridge under which defendant's trolley line ran, swung a wire eight feet long over the side of the bridge. The wire touched the defendant's trolley wire, which ran underneath the bridge. The trolley wire was not insulated and when plaintiff's wire touched it there was a shock which burned him. Because "[t]he trolley wire was so placed that no one standing on the bridge or even bending over the parapet could reach it," the court regarded the accident as an extraordinary casualty, not fairly within the area of ordinary prevision. . . . No special danger at this bridge warned the defendant that there was need of special measures of precaution. No like accident had occurred before. No custom had been disregarded. We think that ordinary caution did not involve forethought of this extraordinary peril.

Although the court spoke in terms of foreseeability, it seems to

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84 Id. at 46, 253 N.E.2d at 61.
85 Id. at 45, 253 N.E.2d at 61.
86 227 N.Y. 208, 125 N.E. 93 (1919).
87 Id. at 210, 125 N.E. at 93.
have meant simply that there was only a slight probability that the trolley wire beneath the bridge would injure anyone.

Regarding the burden of precautions, the court stated:

There is, we may add, a distinction not to be ignored between electric light and trolley wires. The distinction is that the former may be insulated. Chance of harm, though remote, may betoken negligence, if needless. Facility of protection may impose a duty to protect. With trolley wires, the case is different. Insulation is impossible. Guards here and there are of little value. To avert the possibility of this accident and others like it at one point or another on the route, the defendant must have abandoned the overhead system, and put the wires underground.88

This is as clear a statement as one might ask of the proposition that the optimal level of care is a function of its cost, other things being equal. On the one hand, even if the probability of harm were slight, if the cost of avoiding the harm were also slight, failure to avoid it might be negligence. On the other hand, even if the probability and magnitude of harm were the same for trolley and electric wires, electric companies might be liable and trolley companies not, simply because the cost of care was lower for the electric companies.

Just as the optimal level of care varies with the cost of care \( (B_y) \), so it varies with the probability of an accident. In Nussbaum v. Lacopo,89 plaintiff was struck by a golf ball which the defendant had hit out of the golf course. The court alluded to the cost of care by noting that "even the best professional golfers cannot avoid an occasional 'hook' or 'slice,'"90 but its emphasis was on the low probability of this particular accident. Not only was plaintiff's property situated at a substantial angle to the direction in which the ball was shot, but the ball had to traverse a rough area twenty to thirty feet wide between the golf course and plaintiff's property, and the rough area contained trees forty-five to sixty feet in height, with their full summer foliage. The court stated: "The mere fact that a person may have been careless in the performance of an

88 Id. at 211, 125 N.E. at 94.
90 Id. at 319, 265 N.E.2d at 767.
act does not necessarily result in actionable negligence. It is only required that the care be commensurate with the risk and danger.”

Maybe defendant could have hit the ball more carefully, but the cost of care would have been disproportionate to the cost of the accident discounted by the extremely low probability that a careless shot would injure plaintiff or anyone else. And as the court pointed out, it is not easy, even for an experienced golfer, to avoid an occasional hook or slice shot that might carry out of the course.

*Nussbaum* resembles the famous English negligence case of *Bolton v. Stone*, where a cricket ball hit with unusual force by a member of a cricket team playing in defendant’s cricket grounds carried out of the grounds and hit a pedestrian in the street near her home. Defendant was held not liable. The probability that a cricket ball would carry outside the cricket grounds and injure a pedestrian was remote. Moreover, the cost of avoiding the accident would have been substantial. The cricket grounds would have had to be enlarged, or an extremely high fence erected, or the players instructed to hit the ball less hard — an instruction that would reduce the satisfactions of the game to both participants and spectators.

Another well-known English case where defendant was held not to be negligent because of the low probability of harm is *Blyth v. Birmingham Waterworks Co.* Plaintiff suffered water damage when the defendant’s water main opposite his house burst because of an extraordinary frost. As one judge explained:

> A reasonable man would act with reference to the average circumstances of the temperature in ordinary years. The defendants had provided against such frosts as experience would have led men, acting prudently, to provide against; and they are not guilty of negligence, because their precautions proved insufficient against the effects of the extreme severity of the frost of 1855, which penetrated to a greater depth than any

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81 *Id.*

82 [1951] A.C. 850 (H.L.)

83 The ball that hit the plaintiff had carried over the 12-foot fence surrounding the cricket ground, and because of a rise in the ground the fence started from a point 17 feet above the road on which the plaintiff was walking when she was struck. Thus, the fence was, in effect, 29 feet high.

which ordinarily occurs south of the polar regions. Such a state of circumstances constitutes a contingency against which no reasonable man can provide. The result was an accident, for which the defendants cannot be held liable.\textsuperscript{85}

This passage indicates an implicit concern with marginal or incremental, rather than total, costs of care. The court was not interested in whether the total costs of burying the main to a depth at which it would not have burst even in the unusually severe frost of 1855 were less than the expected accident costs. It was interested in whether, given that the mains had been buried to a depth that would prevent their freezing in any ordinary frost, the incremental expense of protecting against an unusually severe frost would have been justified by the incremental reduction in accident costs brought about by such an expense.

A case that illustrates judicial awareness of the importance of the magnitude of the loss if an accident occurs ($D$ in our notation), as well as of the probability of the accident and the cost of care, is \textit{Paris v. Stepney Borough Council}.\textsuperscript{86} Plaintiff was a workman who had only one good eye. While working as a garage man for the defendant, he struck a bolt with a hammer, and a chip flew off and injured him seriously in his good eye. He claimed that defendant's failure to supply him with goggles was negligent. The parties agreed that, given the unlikelihood of such an accident in this line of work, it would not have been negligent to fail to supply goggles to an employee who had two good eyes. The court nevertheless held that failure to supply this employee with goggles was negligence because of the greater harm that would accrue to him if an accident occurred. As one judge stated, "the more serious the damage which will happen if an accident occurs, the more thorough are the precautions which an employer must take."\textsuperscript{87}

All of the elements of the Hand formula come together, in the context of contributory negligence, in \textit{Eckert v. Long Island Railroad}.\textsuperscript{88} Defendant was running its train at excessive speed and without adequate signals in a densely populated area. Eckert saw a small child sitting in the track in front of the advancing train. He

\textsuperscript{85} \textit{Id.} at 784-85, 156 Eng. Rep. at 1049.

\textsuperscript{86} \textit{Id.}

\textsuperscript{87} \textit{Id.} at 385.

\textsuperscript{88} 43 N.Y. 502 (1870).
ran to rescue the child and managed to throw it clear but was himself killed. The court held that he had not been negligent. Had Eckert

for his own purposes attempted to cross the track, or with a view to save property placed himself voluntarily in a position where he might have received an injury from a collision with the train, his conduct would have been grossly negligent, and no recovery could have been had for such injury.\footnote{Id. at 505.}

However, “it was not wrongful in him to make every effort in his power to rescue the child, compatible with a reasonable regard for his own safety. It was his duty to exercise his judgment as to whether he could probably save the child without serious injury to himself.”\footnote{Id.}

Let us translate the court’s discussion into economic terms. Assume hypothetically that the railroad could negotiate costlessly with Eckert to rescue the child. Because the railroad was negligent, it would be liable for the injury to the child who, we assume — plausibly enough on the facts — was certain to be killed if not rescued by Eckert. In deciding whether to “buy” Eckert’s services, the railroad would compare the reduction in the probability of killing the child (equivalent to the reduction in the probability of the railroad’s liability), multiplied by the value of the child’s life, with the costs of Eckert’s services, in this case an uncertain cost equal to the probability of Eckert’s being killed times the value of his life. In terms of our notation, $-\rho_x D$ is the benefit of Eckert’s rescue services and $A_x$ is the cost of his services. So long as $-\rho_x D$ was not less than $A_x$, the railroad and Eckert would have contracted to have Eckert rescue the child. Although the transaction costs between the railroad and Eckert were in fact prohibitive, we still can use the zero-transaction-cost model to infer that Eckert was not negligent if $-\rho_x D \geq A_x$, because the railroad would have “bought” Eckert’s services had a transaction been possible.\footnote{An alternative but equivalent way to model Eckert’s behavior is to define the expected cost of the rescue to Eckert, $A_x$, as the injury to him discounted by the probability that he would be hit by the train. To determine the benefits of care, $-\rho_x D$, we must ask what care Eckert would have had to give up if he had forgone the rescue and thereby averted the expected accident cost to himself. The answer is the value of the child’s life discounted by}
life and Eckert's are assumed to have roughly the same value, the question whether Eckert was negligent is reduced to whether the probability of his rescuing the child was less than the probability of being killed himself. If it was less, then \(-p_xD\) (the probability of rescuing the child times the value of the child's life) would be greater than \(A_x\) (the probability of losing his own life times the value of that life). In asking whether Eckert "could probably save the child without serious injury to himself," the court was comparing these probabilities, for if Eckert probably could have saved the child without serious injury to himself, this implies that the probability of a successful rescue was greater than the probability of his being hit by the train himself.

If the object of the rescue had not been a child but instead property of slight value, \(-p_xD\) would have been lower because one of its components, the value of the object rescued, would have been smaller. This much the court made clear, but presumably it did not mean to imply that it is never prudent to risk life for property. In a subsequent case, Liming v. Illinois Central Railroad,\(^{102}\) plaintiff, in an effort to rescue some horses, ran into a building that was on fire because of the defendant's negligence and was burned. The court stated that

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\text{a person would not be justified in exposing himself to as great danger in saving property as he would in saving human life, and whether the person injured acted with reasonable prudence would, in most cases, be a question of fact depending upon the circumstances under which the act was done.}\tag{103}\]

The court refused to hold plaintiff contributorily negligent per se.

This discussion of cases has been designed to establish several points. First, the Hand formula is an accurate formulation of the negligence standard (including contributory negligence) in diverse periods and jurisdictions. Second, it is applied in marginal rather than total terms, and thus coincides with the economic model of negligence. This is clearest in Blyth, but in the other cases also the courts seem to have been evaluating the costs and benefits of safety measures at the margin. Third, in none of the cases is it

\[^{102}\text{81 Iowa 246, 47 N.W. 66 (1890).}\]
\[^{103}\text{Id. at 254, 47 N.W. at 68.}\]
likely that optimal accident avoidance required a change in the level of activity of either plaintiff or defendant.\textsuperscript{104} For example, in Adams \textit{v.} Bullock, eliminating trolley lines would not have been an efficient way of preventing the accident. This suggests that cases where activity is an important factor in achieving an efficient level of accidents are not decided under the negligence standard; further evidence of this point is presented later. Finally, in none of the cases was the sequential application of the Hand formula (\textit{i.e.}, first to negligence and then to contributory negligence) a source of problems. In Hendricks, an alternative-care case where the defendant probably was the cheaper accident-cost avoider, the defense of contributory negligence was precluded by the attractive nuisance doctrine. In Eckert, another alternative-care case, it seems plain that the cost of accident avoidance was lower to the railroad than to the victim, who was allowed to recover damages.

To all this it may be replied that we have discussed only a tiny, and perhaps deliberately selected, sample of cases applying the negligence standard. However, one of us once examined a random sample of 1,500 tort cases decided between 1875 and 1905 and found considerable congruence between the economic model and the legal practice.\textsuperscript{108} The cases discussed here should be regarded as an addition to that large sample. Furthermore, most of the cases we have discussed in this section are leading cases on negligence. Certainly Eckert, Blyth, Stepney, Bolton, and Carroll Towing are in this category. These are not legal "sports" that happen to coincide with economic analysis.

However, in an effort to construct a sample that is immune to a charge of bias, we also have examined all the cases reprinted in the current edition of Kalven, Gregory, and Epstein's torts casebook that deal with the meaning of negligence.\textsuperscript{108} Those authors cannot be accused of undue partiality to the economic theory of tort law. Professor Kalven once wrote that the concern of tort law is with

\textsuperscript{104} Except possibly Lacopo, where the golfer-defendant was a trespasser on the golf course. However, his trespass was probably not a cause of the accident when "cause" is interpreted in legal terms; but we defer explanation of this point to the causation chapter of our forthcoming book.

\textsuperscript{108} See Posner, \textit{supra} note 15.

\textsuperscript{108} See C. Gregory, H. Kalven, & R. Epstein, \textit{Cases and Materials on Torts} 102-30 (3d ed. 1977). This section is entitled "Calculus of Risk" and is described as an exploration of "the judicial efforts to fashion and apply a standard of reasonable care." \textit{Id.} at 102.
equity rather than efficiency, and Professor Epstein is, of course, a pertinacious critic of both the positive and normative economic theories of tort law. Nevertheless, every one of the cases included by those authors to illustrate the legal meaning of negligence appears to be consistent with the Hand formula interpreted in economic terms.

Three of the cases reprinted in the relevant section of the casebook have been discussed already: Blyth, Eckert, and Carroll Towing. We did not, however, analyze the facts in Carroll Towing. Defendant’s bargee had left his barge for twenty-one hours, and during this period the barge broke away from its mooring and caused damage. No good reason for the bargee’s protracted absence was offered. The harbor was a busy one (it was the height of World War II), the days short, and the danger of collision manifest. Hence $-pD$ was substantial, while the lack of a satisfactory explanation for the bargee’s absence implied that $B_y$ was very low. The court properly found negligence.

The casebook reprints the portion of the opinion in Osborne v. Montgomery that discusses the negligence standard. The discussion is consistent with the economic approach. For example, the court states:

Circumstances may require the driver of a fire truck to take his truck through a thickly populated district at a high rate of speed, but if he exercises that degree of care which such drivers ordinarily exercise under the same or similar circumstances, society, weighing the benefits against the probabilities of damage, in spite of the fact that as a reasonably prudent and intelligent man he should foresee that harm may result, justifies the risk and holds him not liable.

In Cooley v. Public Service Co., another case reprinted in the casebook to illustrate the meaning of negligence, a power line owned by the defendant electric company broke during a storm and hit a telephone cable which was strung below it, causing a loud

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108 203 Wis. 223, 234 N.W. 372 (1931).
109 Id. at 232-33, 234 N.W. at 376. The court did not discuss the application of the standard to the actual facts of the case.
110 90 N.H. 460, 10 A.2d 673 (1940).
noise on the telephone line that plaintiff was using. She fainted. The evidence showed that the only devices that the power company might have used to prevent the accident would have increased the risk of electrocution to people on the street below from the power line. Balancing the risk of electrocution (which is part of the cost of taking care) against the expected reduction in the injury from noise, the court held that the power company had not been negligent in failing to adopt either device suggested by plaintiff. By was much higher than \(-p,D\).

*Union Oil Co. v. Oppen*111 upheld the right of commercial fishermen whose livelihood had been impaired by an oil spill in the Santa Barbara Channel to recover damages from the oil companies that had caused the spill. The defendants’ negligence was stipulated, which makes the inclusion of the case in this part of the casebook somewhat puzzling, and the only issue was whether the plaintiffs could recover for a purely “economic” loss (the fish that were destroyed were not their property). The court held that they could. The opinion contains a confused discussion of the economic approach to tort questions,112 but the outcome seems correct. Giving the plaintiffs a tort right was a method of internalizing some of the external costs of the oil spill.113

Next in the casebook come a pair of railroad accident cases, *Hauser v. Chicago, R.I. & P. Railway*114 and *McDowall v. Great Western Railway*.115 In *Hauser*, the plaintiff, a passenger on defendant’s railroad, fainted in the toilet compartment and was burned severely when her face came into contact with a hot steam pipe that ran along the wall of the compartment beneath the sink. The court held that the railroad had not been negligent in the design or construction of the toilet compartment. The court thought the probability that a passenger would fall and wedge his face or other exposed part of the body against the hot steam pipe too remote to require the railroad to have relocated or shielded the pipe, assum-

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111 501 F.2d 558 (9th Cir. 1974).
114 205 Iowa 940, 219 N.W. 60 (1928).
115 [1903] 2 K.B. 331 (C.A.), rev’d [1902] 1 K.B. 618. Both the lower-court and the court of appeal decisions are reprinted in the casebook; because the court of appeal is more authoritative, we discuss its opinion.
ing that this would have been practicable. In economic terms \(-p_y D\) was lower than \(B_y\), and it was not negligent not to have taken greater care. In *McDowall*, some boys broke into a railroad car parked on an incline and decoupled and unbraked it. The car rolled down the incline and caused damage. Plaintiff argued that the railroad should have placed the car on the other side of a "catch-point" which would have prevented it from rolling down. In rejecting this argument and exonerating the railroad from the charge of negligence, the court of appeal made two points. First, although the boys previously had broken into railroad cars to steal apples and the like, they never before had tried to decouple and unbrake a car and the probability that they could do so was slight. Second, opening the catch-point would have been a simpler operation for the boys than decoupling and unbraking the car, so presumably it would not have been a significant obstacle to their plan. Thus, \(-p_y D\) was low and (from the second point) probably negative, suggesting that it would have been inefficient to make even a negligible expenditure to move the car.

The last two cases reprinted in the relevant section of the casebook, *Quintal v. Laurel Grove Hospital*\(^{116}\) and *Lucy Webb Hayes National Training School v. Perotti*,\(^ {117}\) are medical malpractice cases. In *Quintal*, the plaintiff, while being operated on by an ophthalmologist for an eye condition, suffered cardiac arrest which resulted in permanent brain damage. One negligence issue was whether the ophthalmologist should have known how to perform a thoracotomy (open heart massage) and, if not, whether a surgeon competent to perform such an operation should have been present. There was evidence that the standard of care prevailing in the locality where the operation was performed required that a surgeon capable of performing an open heart massage be present at every operation involving general anesthesia. Cardiac arrest is a risk in every such operation and can have terrible consequences — death or severe brain damage — if not terminated within three minutes, which is too short a time in which to procure a surgeon from another part of the hospital. Another negligence issue was whether the ophthalmologist and the anesthesiologist may have been negligent in failing to heed certain warning signs (fever and

\(^{117}\) 419 F.2d 704 (D.C. Cir. 1969).
(apprehensions) in the plaintiff which increased the risk of cardiac arrest. A judgment for the defendants was reversed.

In Perotti, plaintiff's decedent, who was confined in defendant’s hospital because of mental illness (including suicidal tendencies), slipped out of his closed ward and while being escorted back to it broke away from his escort and plunged to his death through a closed window. There were two negligence issues: whether the window should have been either barred or made of a stronger kind of glass, and whether the decedent should have been allowed to escape from the closed ward. The court held for the hospital on the first issue and for the plaintiff on the second. The negative effects of barred windows on the therapeutic activities of the hospital provided a strong reason against barred windows and there was no expert evidence that thicker glass than that used by the hospital — bulletproof glass, for example — would have been feasible. The hospital, however, had established a standard requiring confinement of mental patients such as the plaintiff's decedent and had violated its own standard without justification.

This was not a case where a determined patient managed to commit suicide in a mysterious or unexpected fashion. Nor is this a case where a calculated risk was taken for therapeutic reasons with a patient of known suicidal tendencies, nor where a hospital had concluded after examination that a patient was not suicidal and hence did not require precautions.\footnote{Id. at 710.}

In other words, $-p_yD$ was high relative to $B_y$ given that the hospital had established a closed ward for such patients and had only to secure it against a patient not shown to be “determined . . . to commit suicide in a mysterious or unexpected fashion.”

In both cases, the court's resolution of the negligence issues seems consistent with the economics of the situations presented. The reference to and deference accorded customary standards of care in both cases are also appropriate from an economic standpoint. The existence of a preexisting voluntary relationship between doctors and patients suggests that transaction costs are not prohibitive and hence, via the Coase theorem, that customary standards are efficient.
D. The Areas of Strict Liability in Accident Law

We now consider whether the choice that the common law has made between strict liability and negligence to govern particular kinds of accidents is consistent with the predictions of the economic model. We said that strict liability is more likely to be the superior regulatory device in cases where optimal accident avoidance requires altering the defendant's activity rather than his care or the plaintiff's activity or care. Is this the pattern of the law?

We begin with rules relating to damage caused by animals. The common law distinguished between domestic animals, such as dogs, pigs, and sheep, and wild animals, such as bears and tigers. The owner's liability for damage caused by wild animals was absolute. If B's pet lion clawed A, B was liable for A's damages even if he had used all reasonable care to prevent the lion from attacking people. With regard to domestic animals, the owner's liability again was strict — provided that he had notice of the animal's vicious disposition. This principle is the origin of the famous "one bite" rule for dogs. Before a dog has bitten anyone, its owner usually will have no reason to think it vicious; once it has bitten someone, however, he is on notice of its vicious disposition. The common law was not in fact so mechanical:

A single incident does not necessarily place the owner on notice the animal is dangerous or vicious. The test is whether the incident was of such a nature as to lead a reasonable person to believe the dog was sufficiently dangerous as to be likely to cause injury to a person at a later date.\(^1\)

Within the class of domestic animals, there was an important exception: owners of trespassing cattle or other livestock were strictly liable for property damage (though not for personal injury) caused by their animals.\(^2\)

We have put our statement of the common law relating to liability for damage caused by animals in the past tense because of important developments that have led to changes in the traditional common law. First, with the growth of zoos and animal parks, there has been a tendency to relax the rule of strict liability for

\(^2\) On the common-law principles governing liability for damage caused by animals, see W. PROSSER, supra note 61, at 496-503; G. WILLIAMS, LIABILITY FOR ANIMALS (1939).
wild animals when they are kept for purposes of exhibition as in a zoo.\textsuperscript{121} Second, many of the western American states rejected the English common-law rule of strict liability for property damage caused by wandering livestock.\textsuperscript{122}

This pattern is consistent with what economic analysis of the choice between strict liability and negligence liability predicts. In the case of a dog not known to be dangerous, the expected accident cost is too small to warrant the dog's owner either in expending substantial resources to restrain the dog from biting people or in substituting another domestic animal. Moreover, many bites by gentle dogs are due to provocation by the victim rather than to carelessness by the owner. However, once a dog is known to be dangerous, the probability of its biting people, and hence the expected accident costs associated with the dog, rise sharply. Yet as any dog owner knows, it is difficult to restrain a dog at all times. Because care alone may not be sufficient to avoid an accident, we want the owner of the animal to consider whether the animal is worth keeping — an activity-level point. Were vicious dogs so valuable that the prospect of having to pay repeated damages to dog-bite victims would never deter an individual from keeping such a dog, no allocative purpose would be served by imposing liability for a bite that could not have been averted by greater care. But because a gentle dog is ordinarily a good substitute for a vicious one, imposing strict liability on the owner of a dangerous dog, and thereby forcing him to consider whether the extra benefits of having such a dog exceed the social costs, may have allocative benefits.

The argument for making the owner of a wild animal strictly liable for damage caused by the animal is even stronger. On the one hand, care undertaken by owners and potential victims may not be effective in preventing the animal from endangering people. On the other, keeping such an animal is not so valuable an activity that the threat of substantial tort liability will have no effect in inducing people to substitute toward a less dangerous animal — again an activity-level point. The situation is different when the wild animal is kept not as a pet, curiosity, or watch animal, but in a zoo.

\textsuperscript{122} See, e.g., Belhorm v. Griswold, 27 Mont. 79, 69 P. 557 (1902); Delaney v. Errickson, 10 Neb. 492, 6 N.W. 600 (1880); 3 T. Shearman & A. Redfield, A Treatise on the Law of Negligence 1719-22 (6th ed. 1913); 1 E. Thomas, Negligence 998-1002 (2d ed. 1904).
or animal park. In a carefully operated zoo, the probability of an animal's harming people is very low, and activity changes are unlikely to be optimal (what would a zoo be without dangerous animals?). These considerations may explain the trend away from strict liability for such harm.

The special rule applicable to straying farm animals, and the rejection of the rule in the western states, is a good illustration of the economic rationale of strict liability. It is difficult through fencing to prevent cattle, sheep, and other domestic farm animals from straying. It is impractical to keep fences always in good repair, and cattle and sheep are forever finding ways through and around fences. These straying animals do considerable damage, particularly in areas of dense cultivation. The alternative of fencing them out is also costly in such areas because of the amount of cultivated land that would have to be fenced. Abandoning cultivation would not be a feasible means of reducing this damage either. These circumstances make a rule of strict liability economically attractive, because the rule forces the rancher to consider either a reduction in his herds or flocks or a relocation of his activity to a less densely cultivated area. But the western United States was not densely cultivated, and livestock raising was not a marginal activity. Fencing out may well have been a more feasible method of controlling damage to crops from cattle and sheep than fencing in because the area under cultivation was smaller than the area being used for ranching. The analogy to the attractive nuisance doctrine, where fencing out is chosen in preference to fencing in because the area to be fenced out is so much smaller than the area that would have to be fenced in, should be evident. If limiting herd size or substituting other land use for ranching was not a feasible means of limiting crop damage in the western states, strict liability for such damage would not be the optimal approach — and that approach was not followed.

The greater density of population and cultivation in England than in the United States also may explain the stricter liability for fire damage under English, as compared to American, common law. For example, in England, in the absence of statutory privi-

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123 This issue was debated extensively at the time. See W. Webb, The Great Plains 282-83 (1931).
124 See W. Prosser, supra note 61, at 503-05; Note, 16 Va. L. Rev. 174 (1929).
lege, a railroad that caused spark damage to crops along the right-of-way was strictly liable for the damage caused even if its locomotives were equipped with the latest and best spark-arresting equipment. In the United States, the railroad was liable only if negligent, negligence being defined for these purposes as not having the state-of-the-art spark-arresting equipment. Not only were locomotive sparks a greater hazard in England because of the greater density of population and cultivation, but railroads were probably a more valuable activity in the United States because of the greater distances. On both of these counts, limiting the number of trains was less likely to be a feasible method of damage control here than in England, so strict liability was less likely to be adopted as the liability rule here.

Many of the areas of strict liability in the common law are grouped under the rubric of ultrahazardous or abnormally hazardous activities. The keeping of wild animals, and in England the setting of fires, are examples of such activities. The roots of this principle in the economics of optimal accident avoidance are suggested by the Restatement's list of the factors to be considered in determining whether an activity is abnormally dangerous:

(a) existence of a high degree of risk of some harm to the person, land or chattels of others;
(b) likelihood that the harm that results from it will be great;
(c) inability to eliminate the risk by the exercise of reasonable care;
(d) extent to which the activity is not a matter of common usage;
(e) inappropriateness of the activity to the place where it is carried on; and
(f) extent to which its value to the community is outweighed by its dangerous attributes.

The elements in this definition are, first, a high expected accident cost (factors (a) and (b)); second, the impracticability of avoiding accidents through exercising greater care (factor (c)); and third,
the feasibility of reducing accidents by curtailing (factors (d) or (f)) or relocating (factor (e)) the activity. The first element shows that there are substantial social benefits from reducing the accident rate, the second that this cannot be done economically simply by conducting the activity with greater care, and the third that maybe it can be done economically by curtailing or relocating the activity, because the activity, either in general or in the particular place where it is being conducted, is marginal and can be changed or eliminated without great social loss. The Restatement’s definition of ultrahazardous activities thus coincides with the economic principles that make strict liability the preferred liability rule for some activities.

The leading case in England on strict liability, *Rylands v. Fletcher,* from which the modern concept of ultrahazardous activities is descended, held that a landowner was strictly liable for any “nonnatural” use of his land, in that case the storage of water in a reservoir. The general principle of *Rylands,* that of strict liability for nonnatural land uses, was absorbed into the American law as an element in the definition of an ultrahazardous activity — the “not a matter of common usage” provision of the Restatement. But the application of that principle in *Rylands* to the storage of water in a reservoir was generally rejected, especially in the western states. Because water is abundant in England, the construction of a reservoir was, at least when the case was decided, an unnatural land use. The western United States, however, is dry and the building of reservoirs was not “unnatural” in the sense of a marginal use of the land which might be abandoned if the landowner bore the costs of accidents caused by his use. The more valuable

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128 L.R. 3 H.L. 330 (1868).

129 As stated in Turner v. Big Lake Oil Co., 128 Tex. 155, 96 S.W.2d 221 (1936):

In Texas we have conditions very different from those which obtain in England. A large portion of Texas is an arid or semi-arid region. The country is almost without streams; and without the storage of water from rainfall in basins constructed for the purpose, or to hold waters pumped from the earth, the great livestock industry of West Texas must perish.

Again, in England there are no oil wells, no necessity for using surface storage facilities for impounding and evaporating salt waters therefrom. In Texas the situation is different. Producing oil is one of our major industries. One of the by-products of oil production is salt water, which must be disposed of without injury to property or the pollution of streams. The construction of basins or ponds to hold this salt water is a necessary part of the oil business.

*Id.* at 165-66, 96 S.W.2d at 226.
a land use relative to its alternatives, the less likely it is to be altered by the imposition of liability for accidents that can be avoided only by altering the activity and not by using greater care, and the weaker therefore is the case for strict liability.

Judging by the number of cases, the most common example of an ultrahazardous activity is blasting with explosives. This is, of course, a dangerous activity and considerable danger remains even after all reasonable care has been used to confine the effects of the blast. Moreover, people who are injured or suffer property damage as a result of debris or vibrations from blasting can do little either by taking greater care or by altering their activity to avoid or reduce damage. In addition, because blasting usually is done in connection with construction, which is ubiquitous, potential victims cannot, by relocating their activities, feasibly avoid blasting damage. Finally, there are substitutes for blasting, so that strict liability may very well alter the level of the activity. Strict liability makes economic sense here.

Another traditional, but now waning, example of ultrahazardous activity is flying. Airplane owners traditionally were held strictly liable for damage caused to people or property on the ground, although collisions between airplanes, and injury to passengers and crew, were governed by the negligence standard. An old case, Guille v. Swan, illustrates the economic basis of strict liability for ground damage. A balloonist descended into plaintiff’s garden, damaging plaintiff’s vegetables, and additional damage was caused when a crowd of onlookers broke into the garden to help the balloonist land safely. The balloonist was held strictly liable for all the damage. As the court noted, the balloonist had no control over the balloon’s horizontal motion and hence little ability to control its descent. Thus it was not a case where the accident could have been avoided by the exercise of due care, and there was no suggestion that the balloonist was careless. But the accident could have been prevented by his not ascending in the balloon in the first place. The reason for the balloon ride is not disclosed in the opinion but the court seems to have regarded balloon riding, at least over New York City, as a rather frivolous activity. If the activity was not a valuable one, abandoning it may well have been the optimal method of accident avoidance, in which event strict liability

\[^{130}\text{19 Johns. (N.Y.) 381 (1822).}\]
would have induced abandonment. Plainly, it would not have been more efficient for plaintiff to have switched from gardening to some land use less sensitive to damage from balloons and crowds of onlookers; thus, a no-liability rule was not an attractive alternative to strict liability.

The situation in the early days of the airplane was much the same as in the balloon case. Flying was a marginal activity, avoidance of damage to the subjacent property could not be assured simply by taking care, and the subjacent property owners could not protect themselves by altering their activity. As flying became both an established and a relatively safe activity, the likelihood that strict liability for ground damage would reduce the amount of flying, and with it the amount of ground damage, fell. Hence the economic analyst is not surprised that strict liability for ground damage is giving way to negligence.\(^{181}\)

The situation with regard to airplane collisions has always been different. The parties to a collision are in a symmetrical position insofar as reducing accidents through reducing activity is concerned; moreover, virtually all collisions result from failure to exercise due care. In these circumstances, the economic argument for strict liability is weak. Moreover, because each party is both an injurer and a victim, there is no obvious way to apply a strict liability standard. Our analysis in the appendix shows how a negligence standard in these circumstances leads both parties to take due care.

The situation of passengers and crew is also different from that of people on the ground who suffer damage from an airplane crash. The passengers and crew have a contractual relationship with the airline. In such a relationship, the Coase theorem implies, there are powerful incentives to attain the optimal safety level regardless of the rule of liability. Here strict liability is unlikely to produce a lower accident rate than negligence liability.

The above analysis suggests a more general hypothesis. During the early stages of development of a new product or activity, we lack sufficient experience to determine whether the benefits of the product exceed its full costs including costs to third parties (e.g., property owners who suffer ground damage from airplane crashes).

One way to gather such information is to hold the producer or user strictly liable for accidents to third parties resulting from the activity. Strict liability forces the innovator to internalize all the costs of his activity. If the activity still flourishes in spite of a strict liability standard, we can be confident that its benefits exceed its full costs or, equivalently, that eliminating or greatly reducing the new activity would not be optimal. At this point the argument in favor of strict liability weakens. Experience already has demonstrated that the activity’s benefits exceed its full costs, and society is now being burdened with the greater administrative costs associated with an increasing number of claims brought about by the growth of the activity. We would predict, therefore, a shift toward negligence and away from strict liability as a new industry or activity matures. Notice that this hypothesis is the reverse of the “infant industry” or “subsidy” arguments sometimes made for the use of the negligence standard in the nineteenth century.

There are, however, two factors that may work against the hypothesis. First, strict liability may not provide information on the full costs of a new activity because an accident may result in a large number of small claims, each of insufficient amount to provide an incentive to bring a suit. If there is no feasible means of aggregating small claims, we are in effect in a world of no liability and can offer no hypothesis on the relative advantages of different liability rules. The other factor is that strict liability, even at the early stages of a new activity, reduces the incentives for the potential victim to take care or alter his activity level to minimize risk. These disadvantages of strict liability will tend to be minor, however, when the activity begins on a small scale, when the probability of being a victim is small, and when the victim would have to take care or change his activity level to avoid the accident before he had knowledge of whether he was likely to be a victim. If the victim’s care is an important component of due care in the early stages of an activity, as it was for airplane collisions and injuries to pedestrians from automobiles (because the cost of pedestrian care is often trivial), strict liability would be inefficient even initially and we would predict that it would not be adopted.

A number of activities have been classified as ultrahazardous, and hence subjected to strict liability, on an ad hoc basis. The considerations used by the courts seem to be those listed by the Restatement in its definition of ultrahazardous activities, a definition
that, as we have seen, tracks closely the economic model. In *Cities Service Co. v. State,*\textsuperscript{132} for example, defendant, in connection with its phosphate rock mining, impounded billions of gallons of phosphatic slimes behind an earthen dam. The dam broke, causing substantial damage to the surrounding area. The court held defendant strictly liable for the damage. Potential victims were apparently helpless to avoid or reduce the damage, while defendant, although not careless, might have been induced by strict liability to reconsider its decisions to build an earthen dam.

Another recent case, *Siegler v. Kulhman,*\textsuperscript{133} illustrates a different element of the economic model of the choice between negligence and strict liability: information costs. Defendant's trailer tank broke free and spilled thousands of gallons of gasoline. The gasoline exploded, destroying the car driven by plaintiff's decedent and killing decedent. In holding that this was an appropriate case for strict liability, the court pointed out that when large quantities of gasoline transported by truck explode, the explosion is likely to destroy the evidence necessary to establish whether the accident was caused by negligence. The information costs of applying the negligence test prevented use of that test in *Siegler.* Therefore, as between strict liability and no liability, the former was the preferable standard because it was more likely that defendant could have prevented such an accident at reasonable cost than that plaintiff's decedent could have done so.

One result the courts have reached may seem puzzling in light of the blasting cases. We refer to cases holding that the storage of gunpowder is not an ultrahazardous activity that subjects the owner of the storage facility to strict liability for damage caused by an explosion. If blasting subjects the blaster to strict liability, why should not storage of the material used for blasting also give rise to strict liability?

*Tuckashinsky v. Lehigh & Co.*\textsuperscript{134} illustrates the economic distinction between these cases. The defendant was engaged in coal mining and kept several kegs of black powder near the mine shaft for use in blasting. A bolt of lightning hit the powder and the concussion from the explosion injured the plaintiff, who was standing

\textsuperscript{132} 312 So. 2d 799 (Fla. Dist. Ct. App. 1975).
\textsuperscript{133} 81 Wash. 2d 448, 502 P.2d 1181 (1972).
\textsuperscript{134} 199 Pa. 515, 49 A. 308 (1901).
in the doorway of her father's house nearby. The court stated:

The evidence in this case shows that the powder magazine had been in use by the defendant company for more than 30 years, and that plaintiff has resided within about 700 feet of it for some 16 years. Yet there is no testimony to show that any apprehension of danger, or any fear of explosion, was felt or expressed by any one during that time. No objection to the location or maintenance of the magazine has been shown. The explosives were stored in small quantities to meet current needs. Such materials are always dangerous, but, as their use is essential to the work of mining, it is impossible to protect, absolutely, persons or property in the immediate vicinity. The risk is similar to that arising from the operation of steam boilers and other machinery and apparatus necessary to the prosperity of great communities.135

The difference between Tuckashinsky and the blasting cases is that in Tuckashinsky plaintiff's optimal activity level was an important choice variable. People cannot relocate to avoid the danger from blasting because blasting may accompany any new construction and new construction is ubiquitous, but they do not have to live 700 feet from a mine or, as in the Kleebauer case, near a plant that manufactures high explosives.136 Tuckashinsky was really a nuisance case rather than an accident case. The issue was the optimal pattern of land development, and there was no presumption that defendant's use of his land to store gunpowder was less appropriate than use by plaintiff's father of his land for a residence.

An interesting feature of the strict liability standard is that contributory negligence, as such, is not a defense. In a wild-animal case, for example, plaintiff is barred from recovery only by (in the language of the Restatement) "knowingly and unreasonably subjecting himself to the risk that a wild animal . . . will do harm to his person . . . ."137 Under this rule, one who enters a lion's cage and is mauled by the lion is barred from recovering damages, but the question whether the cost of accident avoidance to the victim

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135 Id. at 518, 49 A. at 309.
136 See Kleebauer v. Western Fuse & Explosives Co., 138 Cal. 497, 71 P. 617 (1903).
was less than the expected accident cost is not examined beyond this; the Hand formula is not applied. At first glance, this result seems inconsistent with the economic model in part II, but the inconsistency is superficial. Recall the possible consequences of applying the Hand formula sequentially to injurer and victim conduct in an alternative-care case where the victim's cost of accident avoidance, while lower than the expected accident cost, is higher than the injurer's avoidance cost. Ultrahazardous activities are by definition activities in which the expected accident cost is high. Often it will be higher than the cost of care to the victim. If your neighbor keeps a pet lion in his backyard, the expected accident cost may justify extraordinary measures of self-protection. The cost of these measures probably will be greater than the cost to the lion's owner of avoiding an accident simply by substituting a less dangerous watch animal. The optimal solution is obtained by not applying the Hand formula to the victim's care, and this is what is done. Where, however, the cost of care to the victim is low (and possibly negative) relative to the cost of curtailing the activity, as where the victim enters the lion's cage, the defense of "knowingly and unreasonably subjecting himself to the risk" brings about the efficient solution.

Probably the most important principle of strict liability in tort law (other than in the products liability area, which is not discussed in this section), at least as measured by the number of cases in which it is applied, is that of respondeat superior: an employer is strictly liable for the torts of his employees committed in furtherance of the employment. This principle has been thought to be an example of the law's sympathy for accident victims. Employees often lack sufficient assets to pay a tort judgment, and respondeat superior allows the victim to reach into the employer's "deep pocket." This is an unsatisfactory explanation. The principle of respondeat superior is not recent but dates back to a period in which the common law was not otherwise noted for sympathy for accident victims. Moreover, the employer is strictly liable only for damages resulting from the negligence of his employees. A victim injured by an employee who is exercising due care has no claim against the employer.

The economic explanation of respondeat superior focuses on the fact that employees often are unable to pay a tort judgment against them, and therefore lack adequate incentive to take due
The employer could use the threat of termination or refusal to promote as a substitute inducement to careful conduct, but he will do so only if the employee's carelessness is a cost to him. There are also activity-level measures that employers might take to reduce the number of accidents caused by negligent employees, such as making greater use of independent contractors or giving their employees simpler tasks requiring less care.

In view of these arguments for employer liability for the torts of employees, is there any justification for the common law's refusal to hold parents liable for the torts of their children? One difference is that it is unlikely that imposing liability on parents would significantly affect people's choice of whom to marry or how many children to have; in other words, activity-level adjustments do not seem a promising method of reducing torts by children.

Second, children are generally less dangerous than employees; this is, of course, just another reason for not expecting that liability would call forth many activity changes. The principal exception to parental nonliability is consistent with these distinctions: the "family car" rule that many common-law jurisdictions have adopted. Under this rule, the owner of a car is liable for the torts of family members committed while they are driving it. Not only does the car make even (or perhaps especially) a child dangerous, but there is a simple activity change to reduce expected accident costs — preventing the child from driving the car.

A notable exception to respondeat superior is the "fellow servant" rule, which existed in the days when accidents to workers were subject to tort rather than workmen's compensation law. Under this rule, the employer was not liable for the tortious injury to one of his workers by another unless the employer had reason to know that the tortfeasor was careless. The rule encouraged workers to monitor each other's level of care and report careless workers to the employer. Because workers have better information in this respect than the employer himself, this rule should produce a lower accident rate than if each worker is insured by his employer.

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138 The arguments are developed more fully in Landes & Posner, supra note 20, at 526-28, 534.

139 Of course, parents who are negligent in supervising their children are liable for such negligence and principles of vicarious liability do not come into play.

140 See W. Prosser, supra note 61, at 483-86.
against the carelessness of his co-workers.

Even if the reader is convinced by our discussion that the areas of strict liability in tort law make economic sense, he still may object that we have not shown that the areas of tort law governed by negligence rather than strict liability are not equally or more appropriate for treatment under strict liability. We shall not attempt such a showing here beyond noting that the principal areas of tort law not governed by strict liability involve collisions and professional (chiefly medical) malpractice. Neither is an area suitable for strict liability. In collision cases, due care typically requires both parties to exercise care, and there is no presumption that altering the injurer's activity level is a more efficient method of accident avoidance than altering the victim's activity level. Hence there is no allocative advantage to strict liability. (Whether there is a savings in administrative costs depends upon whether the higher information costs of the negligence standard exceed the higher claims costs of the strict liability standard; as a first approximation, it seems best to treat these costs as offsetting.) As for medical malpractice, to treat every case in which medical treatment injures the patient as one of strict liability would entail much loss-shifting for small allocative gains. Most medical procedures involve a risk of injuring the patient. Under a standard of strict liability, every one of these procedures, however carefully administered, would give rise to a claim for damages if injury occurred.\footnote{It also may be more difficult, and therefore more costly, to determine in a medical malpractice suit, as compared to an ordinary accident case, whether the victim's injury was caused by the injurer's behavior. This would make the claims cost of a medical malpractice suit greater than the cost of an ordinary accident case. Although causation would be a requirement under both strict liability and negligence (and there are important economic reasons why this is so), the fact that the claims cost of a medical malpractice case is great would tend to make the savings in administrative cost an important factor in preferring negligence to strict liability.}

IV. IS TORT LAW GROWING LESS EFFICIENT?

Part III of this article revealed considerable congruence between the legal doctrines of negligence, contributory negligence, and strict liability and the economic model of efficient tort law explicated in part II. But while giving some examples of how the law had changed to adapt to changing economic circumstances, we did not ask whether the law as a whole was becoming less responsive to
efficiency. That question now must be faced in light of frequent assertions that whatever the situation may once have been, tort law as interpreted and applied in recent years, especially since 1970, is not efficient.\textsuperscript{142}

The best way to evaluate this contention would be to draw a random sample of recently decided tort cases and compare them with the cases and doctrines discussed in part III of this article. To do so, however, would extend the article to an unmanageable length. Instead, we shall offer some summary impressions of recent trends in tort law, leaving to another day the more rigorous inquiry that the question deserves.

(1) The formulation of the negligence standard has not changed in recent years; it is still the Hand formula, or some verbal counterpart to it. What does seem to have changed is the amount of control that judges exercise over juries. Judges in the nineteenth century were quick to withdraw cases from juries where they disagreed with the jury’s assessment of the defendant’s negligence. Judges today are more deferential to juries. This trend apparently has coincided with a decline in the quality of juries. The rising value of time has made productive people increasingly reluctant to serve on juries. If, as is likely, juries bias the application of the Hand formula in favor of the accident victim, then the two trends we have mentioned are increasing both random and biased error in applying the formula.

(2) The demarcation between negligence and strict liability has not changed, at least in the areas discussed in this article, except as dictated by changes in the economic environment (e.g., the growing safety of flight and the establishment of zoos). If anything, the scope of strict liability has been contracting, because some activities have been reclassified from ultrahazardous to normally hazardous, as discussed in part II. This trend rebuts any simple claim of a uniform expansion in tort liability.

(3) Not every expansion in liability is inefficient. For example, the trend in recent years toward broader recovery for negligently inflicted emotional distress\textsuperscript{143} probably is making tort law more,

\textsuperscript{142} See, e.g., Epstein, The Static Conception of the Common Law, 9 J. LEGAL STUD. 253 (1980).

\textsuperscript{143} See, e.g., Barnhill v. Davis, 300 N.W.2d 104 (Iowa 1981); Sinn v. Burd, 486 Pa. 146, 404 A.2d 672 (1979).
rather than less, efficient. Such distress — the horror, for example, that the mother feels when seeing her child run over by a car — is a real social cost. Courts formerly were inhibited about granting recovery in such cases by the difficulty of determining accurately the causal relationship between a physical accident to one person and emotional distress to another and of quantifying those damages. The growth of our knowledge of emotional illness, slow as that growth has been, has, by lowering the costs of establishing these facts, increased the net social benefit of allowing damages to be awarded in such cases.

(4) Economics is beginning to be used explicitly in the trial and decision of tort cases, especially with reference to damages. Sophisticated treatments of such questions as the value of a child to his parents and the proper treatment of inflation in calculating lost earnings now may be found in the cases.

(5) The recent and dramatic expansion in products liability may seem to undermine our claim that the boundaries between negligence and strict liability have been shifting only in response to changes in the economic environment. However, the real problem with modern products liability is not the encroachment of the strict liability principle on the negligence principle. That encroachment has been only modest, because the requirement of proving a defect preserves a strong foothold of the negligence concept in strict liability products cases. The real problem with modern products liability law is, rather, the growing reluctance of courts (1) to allow the market to set the standard of safety even where the market can be expected to work with reasonable efficiency, and (2) to allow the plaintiff's contributory fault to bar him from recovering damages. The first of these trends is illustrated by design-defect cases, where courts inappropriately use the Hand formula to decide whether a product should have been designed more safely. Because transaction costs between manufacturer and user are low, the market can be expected to generate the product design that minimizes all costs, including expected accident costs. There is no

144 See, e.g., D'Ambra v. United States, 481 F.2d 14 (1st Cir. 1973); Wycko v. Gnodtke, 361 Mich. 331, 105 N.W.2d 118 (1960).
145 See, e.g., Doca v. Marina Mercante Nicaraguense, S.A., 634 F.2d 30 (2d Cir. 1980).
146 These trends are documented in R. Epstein, Modern Products Liability Law (1980).
147 See, e.g., Dawson v. Chrysler Corp., 630 F.2d 950 (3d Cir. 1980).
occasion for the court to substitute its own conception of what an optimal design would be. A parallel trend in the area of medical malpractice has led some courts to disregard the customary standard of care and to substitute their own conception of due care.¹⁴⁸

The second trend in the products liability area, the withering away of defenses based on plaintiff's status or conduct, deserves attention because it appears to be a general characteristic of tort law in recent years. Some of the developments in this area, to be sure, may be consistent with, or even required by, efficiency. For example, more and more courts are abandoning the traditional principle that the status of being a trespasser or licensee bars one from recovering damages for an accident caused by the landowner's (or occupier's) negligence.¹⁴⁹ The victim's status vis-à-vis the landowner is relevant to the negligence calculus because the cost of avoiding trespassing may be lower than the cost to the landowner of avoiding harm to the trespasser. It is not always lower, however, as the common law recognized in such defenses to the no-duty-to-trespassers principle as last clear chance and attractive nuisance, discussed in part III. To eliminate the common law categories and substitute a standard whereby the plaintiff's status is relevant to, but not determinative of, his right to recover damages — the course taken by the California court in Rowland v. Christian and followed by many other courts — may actually be superior to the common-law approach. It does, however, interact disturbingly with another trend we have noted — the expanding discretion of the jury. The common-law categories kept from the jury certain cases where plaintiff's cost of accident avoidance was low; the approach of Rowland v. Christian makes the plaintiff's cost of accident avoidance just another issue for the jury to weigh, with minimal judicial control.

Other tendencies relating to plaintiff status or conduct as a bar to recovery of damages are less easy to reconcile with efficiency. These include the substitution of comparative for contributory negligence in thirty-seven states,¹⁵⁰ the widespread abolition of

¹⁵⁰ See Alvis v. Ribar, 85 Ill. 2d 1, 421 N.E.2d 886, 891-92 (1981). A cognate trend that we cannot explain on efficiency grounds is that toward substituting contribution among joint tortfeasors for the common-law rule of no contribution. See Landes & Posner, supra note
assumption of risk as a defense,\textsuperscript{181} and the increasing reluctance of
courts to enforce clauses limiting liability for negligence.\textsuperscript{182}

Have such trends reached the point of changing the basic char-
acter of the common law? It is difficult to say. The common law
remains an area of incremental rather than radical change; not all
the changes in recent years have been opposed to efficiency; and
the pattern of change has been uneven across jurisdictions —
much more rapid in California than elsewhere. We think it would
be an exaggeration to say that recent tort decisions have changed
the character of the common law fundamentally; but if the adverse
trends traced above continue, the day is not far distant when that
character will be profoundly different from that described in this
article.

Will these trends continue? The expansion of tort liability that
is the dominant trend of the recent period seems related to the
general expansion of social-insurance principles during that period.
At this writing, the legislative expansion has stopped; indeed, con-
traction may be beginning. Perhaps the judicial expansion of tort
liability will be reversed also.

V. CONCLUSION

In this article we have attempted to introduce to a nonspecialist
audience the positive economic theory of tort law — the theory
that the common law of torts is best explained on the “as if”
assumption that the judges are trying to maximize efficiency. The
purpose of the article has been introductory, not definitive. We
have described the history, and replied to the recurrent criticisms,
of the theory; explicated the economic model that underlies it; dis-
cussed the congruence between the model and some basic tort doc-
trines relating to negligence, contributory negligence, and strict
liability; and, very briefly, reflected on recent trends in the law
that threaten, but have not yet fundamentally changed, the effi-
cient character of tort law. We have not proved that the theory is

\textsuperscript{20.}

\textsuperscript{181} The leading case here is Meistrich v. Casino Arena Attractions, Inc., 31 N.J. 44, 155

\textsuperscript{182} See, e.g., Tunkl v. Regents of Univ. of Cal., 60 Cal. 2d 92, 383 P.2d 441, 32 Cal. Rptr.
correct. We hope that this article will stimulate the additional em-
pirical research that is necessary to confirm or refute it.
APPENDIX: THE MODEL EXTENDED TO THE SYMMETRICAL CASE

In part II, we assumed, to simplify the exposition, that parties to an accident could be divided into injurers and victims — i.e., that only one party to the accident was injured. The assumption is unrealistic for many accident cases, especially those involving a collision between vehicles. Here we extend the model to the symmetrical case (i.e., where both parties are simultaneously potential victims), and show that the implications of the model are not substantively affected by the modification.

One possibility in a collision is to let the damages lie where they fall. A and B would select care levels to minimize respectively

\[ \lambda^a p(x,y)D + A(x) \]  
\[ \lambda^b p(x,y)D + B(y) \]

where \( \lambda^a \) is the fraction of the total damages \( D \) incurred by A and \( \lambda^b \) is the fraction incurred by B (before in our analysis \( \lambda^a = 1 \) and \( \lambda^b = 0 \)). Each party will take the other’s care as given and some pair \((x,y)\) would be selected. How does that pair compare with the due care level \((x^*,y^*)\)? It will tend to be lower, because each party is in equilibrium when his share of expected reduction in damages is equal to the cost of an additional unit of care. For example, suppose that \( \lambda^a = .5 \), \(-p_xD = \$2\), and \( A_x = \$1 \) at 5 units of \( x \). A would be in equilibrium because \(- \lambda^a p_x D = A_x\). From society’s viewpoint, however, an additional \$1 in care reduces expected damages by \$2. Therefore, it would be optimal for A to go beyond 5x. The problem with a rule that lets losses lie where they fall is that neither party has an incentive to take account of the benefits to the other party.

A possible alternative would be to make one of the parties, say B, liable for the entire damages caused by the accident. This would be tantamount to a rule of strict liability with no contributory negligence, and would yield inefficient results (assuming \( x^* \) is positive) because A would have no incentive to take care. Now consider negligence. Here losses lie where they fall only if both parties are negligent or both use due care. The distribution of losses for both A and B are illustrated in Table 4.
First, consider A’s behavior. If B selects due care, A will compare $p(x_0, y^*) D + A(x_0)$ with $k^a p(x^*, y^*) D + A(x^*)$. We know from the definition of due care that $L(x_0, y^*) - B(y^*) > L(x^*, y^*) - B(y^*) = p(x^*, y^*) D + A(x^*) > k^a pD(x^*, y^*) D + A(x^*)$. Therefore, A will select $x^*$ if B chooses $y^*$. Similarly, B will select $y^*$ if A chooses $x^*$. Suppose, however, that B chooses $y_0$. What will A do? A will choose $x_0$ or $x^*$ depending upon whether

$$\kappa pD(x_0, y_0) D + A(x_0) \leq A(x^*). \quad (12)$$

It seems possible that if $\kappa$ is relatively small and $A(x^*) - A(x_0)$ is relatively large, A will prefer to be negligent. A similar argument holds for B. That is, B will choose $y_0$ or $y^*$ (if A chooses $x_0$) depending upon whether

$$k^b pD(x_0, y_0) + B(y_0) \leq B(y^*). \quad (13)$$

It would appear, therefore, that we do not have a unique solution:

1. If one party chooses due care, the other will also choose due care; or
2. If one party chooses less than due care, the other may also behave negligently.

Although it seems that either $(x_0, y_0)$ or $(x^*, y^*)$ are possible equilibrium solutions, this is not so. For both A and B to behave negligently would require that

$$\kappa pD(x_0, y_0) D + A(x_0) < A(x^*) \quad (14)$$

$$k^b pD(x_0, y_0) + B(y_0) < B(y^*) \quad (15)$$

which implies (by the addition of (14) and (15)) that

$$p(x_0, y_0) D + A(x_0) + B(y_0) < A(x^*) + B(y^*) \quad (16)$$
which contradicts the definition of \((x^*, y^*)\) as care levels that minimize \(L(x, y)\). Hence only \((x^*, y^*)\) is an equilibrium.

The intuitive explanation for this result is similar to that in the parallel case of negligence-contributory negligence. If \(A\) does not use due care, \(B\) certainly will have an incentive to do so, because he thereby can throw the full costs of the accident onto \(A\); knowing this, \(A\) will exercise due care also. An identical argument can be made for \(B\). To illustrate, suppose that the total damages from the accident are \(\$100\), they fall equally on both parties \((\lambda^a = \lambda^b = .5)\), and \(x^* = \$25\) and \(y^* = \$25\). If \(A\) fails to use due care, \(B\) will see an opportunity to avert damages of \(\$50\) by using due care at a cost of only \(\$25\). Knowing this, \(A\) will use due care also to avert having to pay both his damages and \(B\)'s. The particular numbers are immaterial so long as the costs of \(x^* + y^*\) are less than \(\$100\) (if their sum exceeded \(\$100\), it would not be efficient to avoid the accident). For example, suppose that the injury to \(A\) if the accident occurs will be only \(\$10\), but the injury to \(B\) will be \(\$90\). Initially, it may seem that \(A\) would have no incentive to invest \(\$25\) in care to avoid an accident that would cost him only \(\$10\). However, \(B\) will have an incentive to avert a \(\$90\) injury by expending \(\$25\) on due care; once \(B\) does so, \(A\) will face expected accident costs of \(\$100\) (\(\$10\) in injury costs to \(A\) that he cannot recover from \(B\), and \(\$90\) in injury costs to \(B\) that \(B\) can recover from \(A\)), which he can avert by expending \(\$25\) on care.