Savage Tables and Tort Law: An Alternative to the Precaution Model

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INTRODUCTION

The model of precaution has become a central tool of law and economics, beginning with Judge Learned Hand's brilliant opinion in United States v Carroll Towing Co.[3] In it he argues that a defendant should be found liable for harm if and only if the expected cost of additional care is less than the expected benefit.[4]

The model of precaution relies upon the economics of incentives, a subfield of game theory – the study of how individuals choose actions when these actions affect others.[5] The landmark books of Professors William Landes and Richard Posner and Professor Steven Shavell illustrate how the precaution model illuminates a wide variety of legal rules.[6] Professors Guido Calabresi and A. Douglas Malamed show how it can be used to integrate tort and property.[7] Professor Robert Cooter uses the model to provide a unified analysis of tort and contract.[8]

A central result of the model is that the standard for negligence provides incentives for individuals to take socially optimal actions.[9] This perspective is controversial. Professor Richard Epstein argues that the model of precaution cannot explain observed law, and does not provide an adequate model of causation as used in court.[10] He suggests that the socially efficient rule should be one of strict liability.[11] Posner responded providing a number of examples where Epstein's approach would lead to undesirable results.[12] He describes Epstein's model as being based upon moral rather than economic

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[3] 159 F2d 169 (2d Cir 1947).

[4] Id at 173.

5 For an early game theoretic analysis of tort law, see J.P. Brown, Toward and Economic Theory of Liability, 2 J Legal Stud 323 (1973). For an explicit game theoretic analysis of the Hand Rule, see Feldman and Kim, The Hand Rule and United States v Carroll Towing Co. Reconsidered, 7 Am L & Econ Rev 523 (2005).

[6] See William A. Landes and Richard A. Posner, The Economic Structure of Tort Law (Harvard 1987); Steven Shavell, Economic Analysis of Accident Law (Harvard 1987)

[7] Guido Calabresi and A. Douglas Melamed, Property Rules, Liability Rules, and Inalienability: One View of the Cathedral, 85 Harv L Rev 1089, 1089–93 (1972).

[8] Robert Cooter, Unity in Tort, Contract, and Property: A Model of Precaution, 73 Cal L Rev 1, 43–45 (1985).

[9] Richard A. Posner, A Theory of Negligence, 1 J Legal Stud 29, 40–41 (1972).

[10] Richard A. Epstein, A Theory of Strict Liability, 2 J Legal Stud 151, 154–60, 164–65 (1973).

[11] Id at 203.

[12] Richard A. Posner, Strict Liability: A Comment, 2 J Legal Stud 205, 205–12 (1973).

considerations.[13]

In this paper we show that the model of precaution is a special case of a more general economic model. We develop a simple technique for discussing this more general model that we dub a "Savage Table,"[14] following Professor Leonard Savage .[15] Our more general model based on general equilibrium theory and decision theory encompasses the views of both Posner and Epstein and sheds light on Epstein's observation that the Hand rule is not consistently used to determine liability.[16] We show that rational choice does not imply the Hand rule unless one imposes additional restrictions that are not often satisfied in practice.

We show that strict liability can be viewed as a special case of the negligence standard. In addition, the notion of a causal effect can be easily and naturally defined in our framework. The benefit of a clear definition is that it highlights the key evidentiary requirements to determine causation. Recent work in statistics has greatly clarified our understanding of causal inference.[17] There is no way to prove the existence of a causal relationship. The best we can do is to use a credible model of the world, and make causal statements within the context of the model.[18]

Once we look at economic phenomena from our more general perspective we are led to the following legal impossibility theorem: For every legal rule that is potentially efficient there exists an environment with rational decision makers for which the rule is not efficient. A rational decision maker must make choices conditional upon the information she has. Given incomplete information, there is no guarantee that a rule that encourages good decision-making in one context will work in another.

Posner observed that the best way to deal with this problem is to rely upon empirical evidence.[19] Models are still useful. In fact Professor Paul Holland shows that model building is essential to the measurement of causal effects.[20] Theory and evidence must work together to identify those worldviews that are more successful than the alternatives.

The plan for the rest of the paper is as follows. The next Part provides a very brief discussion of the background theory we use. This is followed by a simplified presentation of the main ideas of the economic theory of exchange and rational choice, in particular the key notions of a "commodity," an "act" and a "Savage Table" which provides a convenient way to illustrate these concepts. We show that this model leads naturally to a well defined notion of causality and relate it to the work of Holland.[21] We then illustrate how these ideas can be applied to tort law, and discuss some of the empirical work in the area, with particular reference to our own empirical research on tort law.

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13 Id at 220. For a discussion of recent developments regarding the debate between Epstein and Posner, see Richard A. Epstein, (2010), Toward a General Theory of Tort Law: Strict Liability in Context', 3 J Tort L 1 (2010).

14 See Table 1

15 Leonard J. Savage, The Foundations of Statistics (Dover 1972).

16 Epstein, 2 J Legal Stud at 164–65 (cited in note 11).

17 See Paul W. Holland, Statistics and Causal Inference, 81 J Am Stat Assn 945 (1986).

18 Id at 959.

19 Posner, 2 J Legal Stud at 221 (cited in note 13).

20 Holland, 81 J Am Stat Assn at 959 (cited in note 18).

21 Id at 959.

I. BACKGROUND

The purpose of this paper is to briefly outline an alternative to the standard model of precaution. This alternative relies upon ideas developed in the 1950s by Professors Herbert Simon, Leonard Savage, Kenneth Arrow and Gerard Debreu.[22] Savage's ideas were integrated into modern game theory by Professors David Kreps and Robert Wilson,[24] and later applied to the law by Professors Douglas Baird, Robert Gertner, and Randal Picker.[25] Nabil Al-Najjar shows that many of these ideas can be reformulated in a Bayesian framework and applied to important issues in regulation, such as climate change.[26]

Debreu was awarded the 1983 Nobel prize in economics for his lucid development of the two welfare theorems of general equilibrium theory. The first welfare theorem states that when markets are "complete" then competitive equilibria are efficient. The second welfare theorem is that efficient allocations can be realized as the outcome of a competitive equilibrium. These very technical results were later popularized by Professor Milton Friedman, who argued that a free market is the best way to allocate resources.[27] Yet, strictly speaking, the welfare theorems cannot be applied to observed economies because markets in practice are always incomplete. Friedman recognized this problem, but he reasoned that in an economy with free markets, markets would become more complete, and therefore more efficient, over time.[28]

Professor Oliver Hart showed that adding more markets could however lead to less efficient outcomes.[29] Thus, as long as markets remain incomplete, there may be a role for legal institutions to make markets work more efficiently. Hart applied insights from Arrow and Debreu's general equilibrium theory to the understanding of property law as it applies to the theory of the firm.[30]

This paper considers the application of ideas from Arrow and Debreu to a second aspect of civil law, tort law. The standard model of precaution supposes that individuals respond in a predictable fashion to the incentives provided by the tort system. Yet, as we will see, the empirical evidence suggests that the extent to which the tort system reduces the costs of injuries is sensitive to the context. We use

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[22] See Gerard Debreu, Theory of Value (Yale 1959); Kenneth Arrow and Gerard Debreu, Existence of an Equilibrium for a Competitive Economy, 22 Econometrica 265 (1954); Savage, The Foundations of Statistics (cited in note 16). These authors are now taught to all first year economics students. See Andreu Mas-Collell, Michael D. Whinston, and Jerry R. Green, Microeconomic Theory (Oxford 1995). For a well ahead of the times application of these ideas to the problem of standard form contracts, see Lewis A. Kornhauser 'Unconscionability in Standard Forms', 64 Cal L Rev 1151, 1167–68 (1976).

[24] See David M. Kreps and Robert B. Wilson, Sequential Equilibria, 50 Econometrica 863 (1982).

[25] See Douglas B. Baird, Robert H. Gertner, and Randal C. Picker, Game Theory and the Law (Harvard 1994).

[26] Nabil I. Al-Najjar, A Bayesian Framework of PrePrecaution Policies (Presented at Conference on Developing Regulatory Policy, University of Chicago Law School, May 2013).

[27] See Milton Friedman, Capitalism and Freedom (University of Chicago 1962).

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[29] Oliver Hart, On the Optimality of Equilibrium When the Market Structure is Incomplete, 11 J Econ Theory 418, 442 (1975).

[30] Oliver Hart, Firms, Contracts and Financial Structure at 71 (Oxford 1995).

"Savage Tables," developed using Debreu's notion of a commodity[31] combined with the seminal ideas of Savage to explain this sensitivity to context.[32] A richer theory of tort suggests a more nuanced role for the courts than simply setting rules for potential tortfeasors such that the benefits of taking precaution are weighed against the costs of causing harm.

II. THE NOTION OF A COMMODITY

Debreu's classic, Theory of Value provides a model of a world with scarce resources and individuals who care about how these resources are allocated.[33] The model provides a very general way to think about the world: Inefficient outcomes stem from failures of the environment to satisfy the axioms of general equilibrium theory. Hence, the theory provides a benchmark for evaluating any allocation of resources.[34]

Debreu introduces the idea of a "commodity" that generalizes our concept of a good or service.[35] First of all, a commodity must be something that exists and enters our utility function, that is, something that we do or do not want. The ideas of "wheat" or "wages," are not well defined commodities because a good becomes a commodity only when its characteristics are precisely specified (for example the quality of the wheat), as well as the date and location at which the good is traded. Similarly, labor services become a commodity when the characteristics of the service (was the waiter friendly?) are specified, as well as the time and the delivery location of the service.[36]

The next step in general equilibrium theory is to suppose that markets are "complete," that is one can trade any desired commodity. The first welfare theorem states that at a competitive equilibrium – each person chooses the bundle of goods they prefer and supply equals demand – the allocation is Pareto efficient. Any change to the competitive equilibrium will make some party strictly worse off.[37]

In the context of the model of precaution the assumption that markets are complete implies that every action chosen is a different good with a different price. As Professor Gary Becker [1976] observes, the

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[31] See Part II.
[32] See Part III.
33 Debreu, Theory of Value at (cited in note 23).
[34] Id at 74–90.
35 Id at 35. Debreu cites Professor John R. Hicks, Value and Capital (Clarendon 1939) and Professor Erik Lindahl, The Place of Capital in the Theory of Price, in Studies in the Theory of Money and Capital 269 (Rinehart 1939) as pointing out that time and space are important. Yet the press release for Debreu's Nobel prize states: "The concept of 'goods' for instance, is defined so broadly that the theory may be used in pure static equilibrium analysis, the analysis of the spatial distribution of production and consumption activities, intertemporal analysis and the analysis of uncertainty. Thus, within the same model, Debreu's general equilibrium theory integrates the theory of location, the theory of capital, and the theory of economic behavior under uncertainty." The Prize in Economics 1983 – Presentation Speech, Nobelprize.org (Nobel Media AB 2013), online at http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/1983/press.html (visited Aug 28, 2013)
[36] Debreu, Theory of Value at 35–36 (cited in note 23).
[37] Id at 74–90.

notion of price used here is not the same as the notion of price in law.[38] In the second welfare theorem price measures the opportunity cost of the good – technically it is the Lagrange multiplier associated with the aggregate resource constraint. Economists talk of the price of the good even when it is not traded. They mean the marginal value of the resource constraint, a concept that is very useful when evaluating the efficiency property of an allocation, but may not correspond to an observed price.

Price in law defines the terms of trade for a good exchanged between two parties – the amount that the seller agrees to pay the buyer for a good, rather than the shadow value of a good. If the good delivered is not satisfactory or the buyer does not pay then there is breach of contract. In that case Judge Oliver Wendell Holmes [1897], page 462 observes:

"The duty to keep a contract at common law means a prediction that you must pay damages if you do not keep it,—and nothing else."[39]In other words, if the seller chooses a quantity or quality different from the agreement, then the amount she receives will be reduced, normally using the rule of expectation damages.

In order to distinguish the two concepts of price without adding too much jargon, we call the former shadow value an "economic price" and the later transacted value a "contract price." We can see the difference with a simple example. Suppose that the seller chooses to deliver or not, and agrees to pay damages for non-delivery. In this case there are two economic prices corresponding to each of the two commodities – the price that is paid when delivery occurs and the price that is paid when delivery does not occur.

The law in this case is quite a bit more subtle than the economic analysis. In particular, the law distinguishes between several contract forms. One is a two part tariff in which the seller can choose to deliver or not, and then is paid the corresponding price (say penalty k when there is no delivery). The second is a specific liquidation damage clause requiring k be paid in the event of non-delivery.

In the first case non-delivery is not breach of contract – only non-payment is a breach. In contrast, in the second case non-delivery is a breach of contract. In the former case, as long as the seller pays the penalty, there is no breach of contract and the buyer has no right to bring an action against the seller. In the second case, the buyer has the right to bring the seller to court. Even if the seller voluntarily pays the stipulated damages, the buyer has the right to have a court review the dispute, a right that is denied in the first case. In a world where going to court is costly, these contracts are not the same.

Finally, there is the "fixed price" contract in which the parties agree to a price and quantity/quality of the good to be traded, with no other terms. In this case non-delivery is a breach of contract, which gives the buyer the right to a court hearing to determine damages.

Scholars often claim that fixed price contracts are the norm for many sales contracts, and that this is a puzzle for economics because the theory predicts different prices in different states of the world. However, since breach leads to a different allocation from non-breach, the *contract price* may be fixed, but the *economic price* is not.[40]

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[38] Gary S. Becker, The Economic Approach to Human Behavior at 6 (University of Chicago 1976).
[39] Oliver Wendell Holmes, The Path of the Law, 10 Harv L Rev 457, 462 (1897).
40 See, for example, E. Posner 112 Yale L J at 859, stating in his discussion of the economic theory of contract: "The

The development of norms for the production and exchange of cotton provides an example of the creation of new commodities. Professor Lisa Bernstein describes the historical evolution of the private law regarding cotton.[41] One can view the development of "bright line rules" as the creation of well-defined quality standards for cotton.[42] Once quality standards were specified, cotton could be traded upon an open market with different quality goods fetching different prices.

Chapter 7 of Debreu addresses uncertainty in the context of the commodity model.[43] The model begins with the hypothesis that one can in principle describe all possible world histories (called states), including all possible future events. In this model learning can be viewed like the fog lifting. As time moves on some histories (states of the world) do not occur, and fewer and fewer possibilities are left, until time fully unfolds and all that remains is a single state representing all that can be known. An event in this model is a set of possible states. For example the event that it rains today means that all states in which it did not rain have not occurred.

Uncertainty can be accommodated by allowing a commodity to be state/event contingent. Consider home insurance. It is a commodity that pays the buyer an amount L if and only if the house burns down. There are many possible contracts – L could be fixed, L could be a function L(s), which pays the full loss when a fire of severity s occurs. Such contracts can be bought and sold in a market.

There are two points worth highlighting. First, bargaining parties often think in terms of moving the burden of a loss in a state to one party or the other. Calabresi's seminal article Some Thoughts on Risk Distribution and the Law of Torts explicitly addresses this issue and discusses the various meanings that have been attached to risk sharing.[44] The notion of a commodity illustrates that risk is like any other characteristic of a good. The allocation of risk across states is an issue of personal preference and individuals will differ in their valuation of different allocations of risk.

The second, subtler point is that the definition of uncertainty does not require a theory of probability! Once payoffs are defined for each state, parties can trade and agree to state contingent prices without reference to probability! Probability is central to the theory of precaution beginning with the Hand rule for negligence. But in order to bring probability into the discussion, we need to turn to ideas outlined by Savage.[45]

III. SAVAGE AND THE THEORY OF DECISION

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contracts that the models predict do not exist in the world. Instead, we see simple fixed price contracts or contracts that are conditional on a relatively small number of real world contingencies. Intuitively, the problem with the predicted contracts is that they are too complex for parties to design."

[41] Lisa Bernstein, Private Commercial Law in the Cotton Industry: Creating Cooperation Through Rules, Norms, and Institutions, 99 Mich L Rev 1724 (2001).

42 Id at 1731. .

43 Debreu, Theory of Value at 98–102 (cited in note 23).

[44] Guido Calabresi, Some Thoughts on Risk Distribution and the Law of Torts, 70 Yale L J 499 (1961).

45 Savage, The Foundations of Statistics (cited in note 16).

In this Part we briefly outline the Savage model of decision making, or choice.[46] Savage's work clearly illustrates why the model of precaution, while useful, does not accurately capture how individuals think about decisions, nor how a particular legal rule may affect actual choice.

A. The Savage Algorithm and Savage Tables

The Savage algorithm for rational choice follows several steps. First, a decision maker builds a "small world model." This is a simplification of the real world since it is impossible for anyone to contemplate all possible states of the world. He states "This [i.e. the idea that people consider all possible alternatives and then choose the best] is utterly ridiculous … because the task implied in making such a decision is not remotely resembled by human possibility."[47]

Model building requires the decision-maker to identify those possible states of the world that are relevant to the decision at hand. A state is a complete description of those possible futures that are relevant for determining the consequence of a decision. These might include the possibility of rain, harm to others and so on. The focus is on only those states that the decision maker believes are relevant.

Model building is expensive and time consuming. An immediate implication is that even when the decision maker is sophisticated, models will necessarily be incomplete and contain errors. In contrast, in law and economics scholars often assume that sophisticated parties do not make errors. However, the Savage model suggests that rational parties will sometimes err and that they may do so because they fail to consider events that should have been relevant to their decision.

Savage calls each choice an "act." By this he is explicitly recognizing that choices have uncertain consequences. A number of outcomes may stem from the decision to bring an umbrella to work – the umbrella may be lost or the decision-maker may use it when it rains. Conversely, the "act" of not bringing an umbrella to work ensures that it is safe at home, but the person may get wet when it rains.

In the famous case of United States v Carroll Towing a barge broke loose from its moorings and caused an accident. The decision or "act" in question was how the bargee adjusted the mooring lines and whether a crew member was left on board at night, with the relevant events being whether the barge broke loose and the consequences of it breaking loose.[48]

We can formalize the problem as follows. We begin by modeling the possible states of the world and the consequences that occur in each state. In the context of Carroll Towing suppose there are three states, h, m, and l. State h is the high or good state corresponding to good weather. The middle state, m, corresponds to say strong winds. The low state, l, corresponds to a hurricane.

For simplicity, suppose that in the event that the barge breaks loose, there is a fixed harm of $H>0$. If the weather is good then the barge never leaves its moorings. If the event is l, then the barge always breaks loose, and hence a harm of H is always suffered.

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46 See Yoram Halevy and Vincent Feltkemp, A Bayesian Approach to Uncertainty Aversion, 72 R of Econ Stud 449, 449–451 (2005), (showing how one can integrate behavioral economics into the Savage model).

47 Savage, The Foundations of Statistics at 16 (cited in note 16).

48 Carroll, 159 F2d at 170–72.

The interesting case is state m. If care is taken, no harm is suffered, but if the agent is not careful, the barge leaves its moorings and causes harm H. We can identify high and low care with two distinct state contingent commodities, where the three values inside the brackets show the harm in each state of the world under either high effort or low effort on the part of the bargee:

- High effort: {0, 0, -H}
- Low effort: {0, -H, -H}

Notice that this is effectively a complete description of the consequence of different effort levels in different states of the world.

The next step is to discuss the bargee's choice of effort. We can suppose that there is no cost to low effort, but high effort costs c. A "act" for the bargee would be a mapping between effort and the payoff consequences for each choice. If there is no liability then the payoffs will be:

- High effort: {– c, – c , – c}
- Low effort: {0, 0, 0}

This information can be summarized in what we dub a "Savage Table." Each box provides the payoff to the potential tortfeasors and victim respectively of each possible act in each possible state:

Action	State		
	h	m	l
a_L	(0,0)	(0, – *H*)	(0, – *H*)
a_H	(– c, 0)	(– c, 0)	(– c, – *H*)

Table 1. Payoffs with No Liability in United States v Caroll Towing

These acts provide all the information necessary to make a decision – for each state of the world the decision maker understands the consequence of each action. A rational decision maker ranks the acts and chooses the one she prefers. In this example she chooses one action or the other. Decision theory only requires that the bargee make a choice. In this example, she is better off choosing a_L since she gets zero in this case, and would pay -c if she choose a_H. Notice that probabilities are not needed when making this choice.

Deciding what to do under a negligence regime that has her pay H when she causes the accident is a more difficult decision. In this case the Savage Table is:

Action	State

	h	m	l
a_L	(0,0)	$(0, -H)$	$(0, -H)$
a_H	$(-c, 0)$	$(-c, 0)$	$(-c, -H)$

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Table 2. Payoffs under the negligence rule

Now she has to compare paying c in every state with paying H in state m. Rational choice theory only requires that she make a choice, and that her choices are transitive (that is, that she can consistently rank her decisions) and complete (that she makes a decision). There is no need to formally introduce probability, though beliefs about probabilities may well be helpful to making a decision.

What Savage shows is that in situations like this, individuals choose as if they have assigned probabilities to the states h, m, and l.[49] (the exact conditions are found on the inside of the cover of the Dover edition of the book). If we let these probabilities be given by:

$p = \{p_1, p_2, p_3\}$

then the bargee chooses high effort if and only if:

$-c - p_3 \times H > -(p_2 + p_3) \times H$

These probabilities are values derived from the preferences and beliefs of the bargee. There is no reason for the judge and the bargee to have the same assessment of the likelihood of a particular state – especially for states that are infrequent. This argument does not preclude the use of the Hand formula by judges: It may be a useful way to determine a legal rule. However, there is no logical reason to assume that the probabilities used by judges will affect the decisions of potential tortfeasors in a consistent or even in a predictable fashion. What this simple model illustrates is how the actions of the bargee are causally related to outcomes. A different causal question is how the choice of tort regime, such as the choice of strict liability versus a negligence standard, affects the choices of individuals in practice. This is the question that we address next.

B. Potential Outcomes and the Fundamental Problem of Causal Inference

The idea of a causal relationship has a long history.[50] Savage treats causal relationships as an integral element of what it means to act. In particular, the barge example makes clear that whether or not a decision has a causal effect depends upon the state of nature.

If state l or h occurs, then the choice of action has no effect upon the level of harm. In the low state there is no harm regardless of the action of the bargee. This fact does not mean that there should be no consequence. For example, drunk drivers may be fined even when they do not cause an accident.

49 Savage, The Foundations of Statistics at 27–55 (cited in note 16).

50 See, for examplethe entry in the Stanford Encyclopedia of Philosophy where there is an extensive bibliography. See Jonathan Schaffer, The Metaphysics of Causation, The Stanford Encyclopedia of Philosophy (Fall 2008 ed), online at http://plato.stanford.edu/entries/causation-metaphysics/ (visited Aug 28, 2013).

Professors Jennifer Arlen and Bentley MacLeod point out that with judgment proof tortfeasors, it is efficient to penalize them whenever they are careless regardless of whether there is harm.[51] They show that the law of vicarious liability can achieve this effect by making organizations liable for the torts of their agents.[52]

In practice the issue is complicated when the state is imprecise, unobserved or unknowable. Hence, while in theory the definition is clear, in practice whether an act causes an outcome is often controversial. In economics, the most widely used approach to this problem is the potential outcomes approach.

We introduce this idea and illustrate how to use Savage Tables from the perspective of the courts, rather than the tortfeasor. Suppose that there is a state n, which is a nasty storm similar to l, but which would not result in the barge breaking loose if the bargee chooses a_H. Suppose the courts are unable to distinguish between states n and l, but they can distinguish between states h, m and the combination of {n,l}. In this case the Savage Table for the bargee in the absence of any tort liability is given by:

Action	State			
	h	m	n	l
a_L	(0,0)	$(0, -H)$	$(0, -H)$	$(0, -H)$
a_H	$(-c, 0)$	$(-c, 0)$	$(-c, 0)$	$(-c, -H)$

Table 3. Acts with States h,m,n,l

Here states m and n are identical from the perspective of the bargee. Harm is avoided in both states by taking the precaution. Hence in both states m and n we can say that the bargee could causally avoid the harm through her actions.

Let us now consider the court's perspective and use the Savage Table to describe different legal rules – here each rule can be view as an "act" because it associates an outcome with a state. Suppose that the acts in the court's choice set are strict liability (denoted SL) in which the tortfeasor pays H whenever there is an accident, and the Epstein Rule (denoted ER) in which the tortfeasor pays H whenever she causes an accident. Epstein recommended that this rule be used rather than the Hand rule.[53]

Table 4 shows how we can use a Savage table to analyze decision-making under each rule:

[51] Jennifer Arlen and Bentley MacLeod, Torts, expertise, and authority: liability of physicians and managed care organizations, 36 Rand J of Econ 494, 497 (2005).
[52] Id at 516.
[53] Epstein, 2 J Legal Stud at 203 (cited in note 11).

Acts by Courts	Events							
	No Harm				Harm in Moderate Storm	Harm in Severe Storm		
	States - (act, weather) combinations							
	(a_L, h)	(a_H, h)	(a_H, m)	(a_H, n)	(a_L, m)	(a_L, n)	(a_L, l)	(a_H, l)
Strict Liability	0	0	0	0	H	H	H	H
Epstein Rule	0	0	0	0	H	?	?	?

Table 4. Potential Outcomes

In this simple example, the potential outcomes are "no harm" or "harm." The court observes the event associated with the harm. Technically an "event" is a set of states. The term is used in probability theory to refer to the information known at the time a decision is taken. In this example, the court only observes one of the potential outcomes, and the severity of the storm - h, m or {n or l}.

In this example it is assumed that the courts cannot observe the action of the bargee. It is worth highlighting that acts in the past become part of the description of the state in the future. That is, the act of the bargee affects the states facing the court. Thus this model can be adopted to deal with strategic situations, such as the case of contributory negligence where the harmed party can also make decisions that affect the outcome. However, it is beyond the current article to explain how this works.[54] - see Kreps and Wilson [1982] for details.

With the information available the courts can determine causality in the state "Harm with Moderate Storm." In that situation harm occurs if and only if the bargee is not careful—in other words the courts can both infer the action of the bargee and note that there is causation. Hence, Epstein's Rule can be applied and liability assigned to the bargee.

In the event "Harm with Severe Storm" the exact severity of the storm is unknown, and we cannot tell if harm could have been avoided. Technically causation is well defined - that is the agent caused the harm if and only if she choose a_L and the state of the weather was n. If instead the state was l then nothing the bargee could have done would have stopped the harm. If state n were not possible, then we would be back to the original situation in which nothing the bargee can do that would avoid harm in the event of a storm, and under both the Hand rule and the Epstein Rule there would be no liability.

In practice, it is not possible to directly observe all the primitive states in a decision problem. Is there a way, at least conceptually, to measure the causal effect? Holland provides an elegant synthesis of the potential outcome approach that provides a solution and has become very influential in economics.[55]

[54] For details, see Kreps and Wilson, 50 Econometrica at 863 (cited in note 25).

55Holland, 81 J Am Stat Assn at 959 (cited in note 18).For a modern treatment, see Guido W. Imbens and Donald B. Rubin, Causal Inference in Statistics and Social Sciences (Oxford 2011); Jonah B. Gelbach, Locking the Doors to Discovery? Assessing the Effects of Twombly and Iqbal on Access to Discovery, 121 Yale L J 2270, 2295 (2012). (illustrating the application of the potential outcomes framework to the question of how Supreme Court decision affects the

Rather than attempt to build a complex state space model, the potential outcomes approach is very pragmatic and is based upon relationships between observed variables.

In this example, the potential outcomes are No Harm and Harm. Let Y(a) be the outcome if action a is chosen, where Y = 1 if harm occurs and Y=0 if not. The counter factual question is what would happen if the bargee chose high effort instead of low effort? The causal effect of high effort is then defined by:

(2) $CE = Y(a_H) - Y(a_L)$.

The point here is that this effect is measured after the state of nature has been revealed. Holland observes that there is only one sure way that we could measure (2).[56] It would require having the bargee choose low effort and observing the result. We would then have to go back in time to the exact same situation, choose high effort, and observe the result. Going back in time would ensure that the same state occurred again, and we would then be able to see the counter factual effect of changing effort. If we had a time machine then, like the hapless hero in the movie Groundhog Day, we could experiment with different life experiences until we made the best choices.[57] This is clearly impossible, an observation that Holland calls the "*fundamental problem of causal inference"*

Holland's contribution is to illustrate a way of thinking about and measuring causality without directly observing the deep structure of the environment (whether the state is n or l in our example). Suppose for example, we want to know the causal effect of penicillin. What is often done is to take a group of sick patients and treat some with penicillin and some with a placebo. Under the assumption that the sick patients are all similar, then we will be able to deduce the action of the drug by comparing the two groups. Note that conducting this type of trial does not require knowledge of the exact mechanism through which the drug works. It does require a strong assumption about the similarity of the patients. We now know, for example, that penicillin is not equally effective against all infections, so if the patients had different types of infection, or if some of them were allergic to penicillin, then this would affect the results of the trial.

What we learn from Savage's model is that the problem of determining causality is one of information and not philosophy. The fact that we cannot observe the deep structure of every case before the courts implies that there are situations where causality is indeterminate. No amount of philosophizing can substitute for this lack of information. In the next Part we discuss how the Savage model can used to discuss tort doctrine. The model teaches us there cannot be an optimal rule that applies to every situation.

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outcomes in related cases).

56 See Holland, 81 J Am Stat Assn at 959 (cited in note 18).

57 Groundhog Day (Columbia Pictures 1993), in the film Bill Murray plays Phil Conners, an arrogant TV weatherman who is in a time loop repeating the day over and over until he finally learns to become a good person. Like Holland's article, critical appreciation of the movie has increased over time and it was listed in the United States Film Registry in 2006. See National Film Registry, National Film Preservation Board (Library of Congress Dec 13, 2011), online at http://www.loc.gov/film/registry_titles.php (visited Aug 8, 2013).

IV. Tort Law

Tort law allows individuals freedom of action, but assigns liability in states of the world that cause harm to others. Let us return to the Savage Table used to represent the Hand model of precaution. The most general tort rule in this case can be written as:

Action	State		
	h	m	l
a_L	(0,0)	$(-L_m, L_m - H)$	$(-L_l, L_l - H)$
a_H	$(-c, 0)$	$(-c, 0)$	$(-L_l - c, L_l - H)$

Table 5. General Tort Rule

If courts can observe the state, the issue is how to set L_m and L_l. A necessary condition for liability under the negligence rule is that the action of the agent must cause the injury. That cannot occur in state l and thus $L_l = 0$ under the negligence regime. Under the Learned Hand rule the tortfeasor is liable in state m if and only if the expected harm is greater than cost: $p_m H > c$. The relevant probability is not necessarily an objective quantity, but a *value* established by the court (though of course objective evidence may be used to determine the probability).

Consider now the famous case of Helling v Carey,[58] a malpractice action against ophthalmologists in which a patient claimed that she suffered permanent visual damage due to glaucoma as a result of defendants' failure to diagnose and treat the condition. Ophthalmologists rarely performed glaucoma tests on young patients, and the court found for the defendants at trial. However, upon appeal, the appellate court used the Learned Hand rule to argue that since the cost of the test was very low, it should be administered as a matter of practice. The decision was reversed and returned to the trial court to assess damages.[59]

In the context of our model of actions and states of the world, we can represent the court's view of the ophthalmologists' problem this way:

Action	State		
	A	B	C
a_L	(0,0)	$(-H, 0)$	$(0, -H)$
a_H	$(-c, 0)$	$(-c, 0)$	$(-c, -H)$

Table 6. Negligence Rule

[58] 519 P2d 981 (Wash 1974), disapproved of by Barton v Owen, 71 Cal App 3d 484 (Ct App 1977).
[59] Carey, 519 P2d at 983.

Where in state A the patient does not have glaucoma, in state B the patient has glaucoma, and in state C the patient has some other serious eye disease.

The key point is that the rule followed by the court and illustrated in Table 6 is not necessarily the rule followed by most ophthalmologists when they decide how to treat their patients. Arguably, ophthalmologists are concerned with providing appropriate care. If the court determines that it is negligent to omit a glaucoma test, then medical practice is likely to change in the direction of always doing the glaucoma test.

Note that it is not even clear that the Learned Hand rule was applied correctly in this case. The total cost of testing millions of people without the disease could be greater than the benefit of detecting one case of the disease unless the cost of blindness is infinite. But in terms of influencing ophthalmologists' behavior, the true costs and benefits are irrelevant once the court has spoken. Similar issues come up in the case of screening for prostate cancer, or doing mammograms on women under fifty. Even though experts now agree that the costs of such screening may exceed the benefits, the screenings remain embedded in medical practice.

The fact that the court uses the Hand rule does not require individual decision makers to use the same rule. The standard law and economics approach evaluates different tort rules as if the potential tortfeasors make decisions using the Learned Hand rule. The example of the ophthalmologists suggests that this is an error! Individuals do modify their behaviour in response to incentives, but there is little evidence that courts are good at predicting their responses.

Individuals often respond to incentives in unexpected ways. For example, Professor Steven Kerr provides many examples from successful firms of incentive systems with unintended consequences.[60] One firm wired a secretary's typewriter to measure key strokes and tied her compensation to the number of strokes. The secretary responded by spending her lunch breaks hitting a single key on her typewriter![61]

Legal doctrines, such as the defence of contributory negligence, evolve in response to cases that document the behaviour of individuals in specific situations. The building of a model or world view focused on a small number of actions and states may ignore some important possibilities.

A. Strict Liability vs. the Negligence Rule

The framework we have developed is helpful for illustrating the difference between strict liability (in which the tortfeasor is liable whenever there is harm) and the negligence rule (in which the tortfeasor is

[60] See Steven Kerr, On the Folly of Rewarding A, While Hoping for B, 18 Acad Mgmt J 769, 769–79 (1975).

liable only if he is negligent). We will illustrate the difference in behaviour under these two rules using the model with actions and states applied to the case of the Good Samaritan doctor.

The potential Good Samaritan can exert high effort, low effort, or he can take evasive actions to avoid liability completely. For example a physician who happens on a traffic accident can leave the scene unobserved, failing to disclose that he is a physician. As in the case United States v Carroll Towing, let us suppose that the courts cannot perfectly establish causation. Under strict liability we have:

Action	States			
	h	m	n	l
	Events			
	Light Injury	Moderate Injury	Severe Injury	
a_L	(0, 0)	(–H, 0)	(–H, 0)	(–H, 0)
a_H	(–c, 0)	(–c, 0)	(–c, 0)	(– (H+c), 0)
a_0	(–u, –H)	(–u, –H)	(–u, –H)	(–u, –H)

Table 7. Strictly Liability with Evasion

Here the first term in each bracket is the payoff to the doctor while the second is the payoff to the patient. Assume that all the court can observe is whether the injury is light, moderate, or severe. In the case of severe injury, the court cannot tell whether the physician could have ameliorated the injury or not. We also assume that the court cannot observe evasive actions and if a_0 is chosen there is never any liability. We further assume that the potential Good Samaritan must choose an action without knowing the full extent of the victim's injuries. The payoff -u is the disutility or guilt felt by the Good Samaritan if he does not treat.

Causation here is necessarily probabilistic. Epstein argues that one should use the rule of strict liability whenever there is causation.[62] But in the case of "Severe Injury" it is not possible for the courts to establish causality. They are forced to assign probabilities to states. Moreover, the physician can always completely avoid liability by choosing a_0. Epstein argues that physicians should be held liable in these cases while Posner disagrees pointing out that the Good Samaritan can always find a way to avoid the situation.[63]

More importantly, if the potential Good Samaritan faces strict liability, then he has a positive incentive to avoid becoming involved. Instead, one would like to provide positive incentives to act when it will

[62] Epstein, 2 J Legal Stud at 203 (cited in note 11).
[63] See Id at 199; Posner, 2 J Legal Stud at 219–20 (cited in note 13).

be helpful. If we interpret the negligence rule as imposing liability only if there has been harm in state m then if u > c the Good Samaritan would always act. Hence, the negligence rule could improve outcomes relative to strict liability by improving the incentives faced by the Good Samaritan.

Notice that in the case of Helling v Carey the requirement to do a glaucoma test is easy to implement and if the test is viewed as a standard part of an eye exam, then the ophthalmologist will include the cost in the standard bill.[64] In other words, compliance with the tort system is much easier when individuals know that liability is triggered by well-defined events.

Consider next the case of product liability, where the rule of strict liability is normally used. In that case the default action is the non-production of the good. Consider the use of sports equipment such as skis or skateboards where the nature of an injury depends upon the intensity of the use. The courts can observe the intensity, but in the case of intensive use, the court may have difficulty determining whether an injury is the result of product failure, or an unavoidable result of the activity itself. The payoff matrix from the perspective of the seller can be written as:

Action	States			
	h	m	n	l
	Events			
	Light Activity	Moderate Activity	Extreme Activity	
a_L	(P, u)	$(P, u - H)$	$(P, u - H)$	$(P, u - H)$
a_H	$(P - c, u)$	$(P - c, u)$	$(P - c, u - H)$	$(P - c, u - H)$
a_0	(0, 0)	(0, 0)	(0, 0)	(0, 0)

Table 8. Strict Liability

In this case the seller pays the harm H regardless of whether or not he takes appropriate precaution. What differentiates this case from the medical liability case is that evasive action prevents the good from being produced, and hence prevents harm.

In a world with perfect information the cost of harm can always be offset via the price. The difficulty is that in general there is asymmetric information – individuals cannot observe a_L or a_H and hence they are not in a position to evaluate the good. Moreover, the seller may have a better idea than the buyer about the range of ways the product will be used. Under strict liability sellers internalize harms from the use of the product, even when the product failure might not be caused by their actions. Strict liability provides a positive incentive for the manufacturer to learn about the potential harm before production begins. Once production has started, the manufacturer has a positive incentive to avoid

[64] Carey, 519 P2d at 983.

learning about state l after the fact. In contrast to the medical liability case where harm occurs if the physician does not act, here harm occurs only if the manufacturer acts.

The use of Savage Tables highlights both the considerations that are included in the analysis, as well as those that are excluded. There will always be both states of the world and acts that are not considered ex ante by either the courts or individuals. We do not exclude the use of probabilities, but highlight the fact that probabilities are values that are determined after one has built a model of the world which defines the relevant states.

B. Informed Consent

Medical services are generally covered by the negligence rule which not only reduces the incentive for physicians to withhold services, but allows the standard of care to vary over time. From the perspective of the Savage model medical services are acts that represent complex commodities that include the possibility that there is harm to the patient. Tort law can be viewed as enforcing a contract defined in terms of the performance of the physician, rather than in terms of the goods supplied (which may include harm).

Savage tables highlight the fact that services are necessarily state contingent. When a physician provides services there no guarantee that the patient will be cured, only that the physician will do her best to provide appropriate care. Whenever surgery is performed there is a chance of misadventure. Doctors can miss symptoms and fail to diagnose conditions that with hindsight they should have seen. The product they are selling is not a good outcome, but the promise to do a good job.

The requirement that the standard of care meets community standards is nothing more than an obligation to provide a service with certain characteristics. The negligence rule as modelled using the model of precaution requires that the care supplied meets community standards. Yet, community standards are a moving target. For example, Scott v Bradford,[65] established that providing information about available alternatives and obtaining informed consent "is as essential as the physician's care and skill."[66] The services provided by physicians are complex commodities in the sense of Debreu, and their nature varies over time.

It is likely that our concept of the commodity represented by medical care will continue to evolve. In our most recent work,[67] we distinguish between the diagnostic skill and surgical skill of obstetricians. In the context of the current discussion, we can think of the commodity the physician supplies as a complex good consisting of both aspects of skill. We show that while higher surgical skill is beneficial

[65] 606 P2d 554, 556–57 (Okla 1980).
[66] See Parris v Limes, 277 P3d 1259, 1263 (Okla 2012).
[67] Janet M. Currie and W. Bentley MacLeod, Diagnosis and Unnecessary Procedure Use: Evidence from C-Section (18977), (Technical report, NBER, Cambridge, MA 2013), online at http://www.nber.org/papers/w18977 (visited Aug 29, 2013).

to high-risk women, better diagnostic skill benefits both high and low risk women, since both groups benefit from better matching of medical procedures to their needs.[68]

Savage reminds us that the act of building a model is an explicit tool used in the process of making a thoughtful decision. Given that perfect models are not possible, it also highlights the dangers of relying solely upon a theoretical model when evaluating the quality of a legal rule. In the next Part we discuss empirical evaluations of tort law.

V. The Causal Impact of Legal Rules upon Behavior

Using Savage Tables we have presented a number of examples of how tort law affects individual decisions. To recap, the first step in the rational choice model is thinking in terms of potential outcomes, states and acts. In some situations, the model allows us to evaluate rules without reference to probabilities. Even if a potential tortfeasor is fully rational, her model of the world does not have to correspond to a court's.

We have also shown that strict liability and negligence can create different incentives to build a detailed model of the world. Under strict liability a manufacturer has an incentive to consider possible states in which the consumer might be harmed by their product. If we rely instead upon market pricing, then the cost of investigating these events would be moved to the consumer, who would typically have considerably fewer resources and less experience to carry out such an exercise.

Conversely, the negligence standard allows individuals to act and supply services free of liability as long as they meet community standards of behavior. This rule creates an incentive to take precaution while reducing the incentive to withhold services in situations where there is a chance of harm, as in the case of the Good Samaritan physician.

Given that individuals are likely to build different models of the world when making choices, there is no a priori way of determining the impact of a legal rule in practice.[69] Here we briefly discuss a few contributions that directly address this issue and which show that in fact tort law does lead to deterrence.

As we discussed in the causality Part above, estimating the causal impact of the law upon behavior is very difficult. Many factors are changing at the same time, and hence it is difficult to know if observed changes are due to a rule or due to some unobserved factor. In keeping with the discussion above, theoretical models of tort tend to emphasize particular types of incentives to the exclusion of others, with the result that they will not always make the best empirical predictions. Hence, it is necessary to turn to the data. One of the best ways to measure the effect of the law is to view the United States as a laboratory in which each state sets its own rules.

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[68] Id at 26–33.
[69] See generally Posner, 2 J Legal Stud 220–21 (cited in note 13).

Even though the United States has a common culture, one cannot use cross-state variation in rules to look at the effect of the law. Each state has a unique history, meaning that observed rules and outcomes have multiple sources. Rather, the standard approach is to use variations over time to explore the causal effect of a rule. The idea is that we can compare relevant outcomes in the year before and after a rule change to see if there is an effect upon behaviour. In this approach, the state before the rule change is used as the best approximation to what the state would have been like had the rule change not taken place. Even this approach has drawbacks, as discussed by Professor Marianne Bertrand et al.,[70] but for the moment it is the source of the best evidence of the effect of legal rules.

Professors Alma Cohen and Rajeev Dehejia have a nice study looking at the effect of the introduction of no-fault automobile insurance upon traffic fatalities.[71] They use variations in state laws regarding no-fault insurance over the 1970 to 1998 period and find that a move from a regime with fault to no fault causes a 6 percent increase in traffic fatalities. What one cannot exclude is the possibility that changes in the law are associated with changes in the population that are themselves correlated with accident rates and the passage of the law.[72]

This issue is more easily addressed in the context of medical care. Professors Daniel Kessler and Mark McClellan explore the impact that changes in state law have on the outcomes of elderly heart attack patients on Medicare.[73] Heart attack patients are a good group to study because they generally go to the nearest hospital, and don't cross state lines to get into a better hospital. They find that a reduction in tort liability has a small, close to insignificant effect upon patient outcomes, but a large negative effect upon costs.[74]

Kessler and McClellan use rather broad tort categories. For example, they treat reform to the collateral source rule and the rule of joint and several liability as a single rule change.[75] Currie and MacLeod update the law data and use finer granularity regarding the law. We explore the effect of tort reform upon both the incidence of C-sections and outcomes of the mother and child.[76]

We find that a decrease in liability (either reducing the cap on damages or disallowing harm due to pain and suffering) leads to an increase in C-section rates.[77] Many find this result counter-intuitive because

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[70] Marianne Bertrand, Esther Duflo, and Sendhil Mullainathan, How much should we trust differences-in-differences estimates?, 119 Q J Econ 249, 272–74 (2004).
[71] Alma Cohen and Rajeev Dehejia, The effect of automobile insurance and accident liability laws on traffic fatalities, 47 J L & Econ 356 (2004).
[72] Id at 371–89.
[73] Daniel Kessler and Mark McClellan, Do Doctors Practice Defensive Medicine?, 111 Q J Econ 353, 363 (1996).
[74] Id at 372–88.
[75] Id at 371–72.
[76] Janet Currie and W. Bentley MacLeod, First do no harm? Tort reform and birth outcomes, 123 Q J Econ 795, 796–98 (2008).
[77] Id at 819–25.

there has been so much discussion of the idea that C-sections are a form of "defensive medicine." In a world in which doctors were starting from the optimal C-section rate and were always acting in the best interests of their patients, then fear of lawsuits might push them to do more C-sections. This is the type of thinking that is based upon the model of precaution – tort liability leading doctors to be more careful to avoid bad outcomes and hence to higher C-section rates.[78] However, the real world C-section rate is thought to be much higher than necessary, suggesting that the marginal C-section is an unnecessary surgery that is not in the best interests of the patient. That is, there are other forces leading doctors to perform unnecessary surgeries, and this tendency is restrained by the tort system. Therefore, when liability is reduced, C-sections rise.[79] This counter-intuitive result provides a concrete demonstration of the dangers of relying on an overly simplistic model of precaution without adequate empirical evidence.

The study's second lesson concerns the importance of dealing with heterogeneous treatment effects. Most of the variation in C-section rates occurs for women whose medical condition is in a grey area – that is, there is some indication that a C-section may be appropriate, but it is a question of judgment. For these marginal cases, the gain from a C-section is close to the cost. However, C-sections are surgeries and there are a number of tort cases involving botched C-sections. A rise in C-section rates as a consequence of reduced liability is consistent with poor surgeons increasing their C-section rates because they know they are less likely to be sued. We also find that the law has no effect upon high risk patients, where a C-section is more likely and the quality of the physician is likely to be higher.[80]

Another surprising result comes from our work on the reform of the doctrine of joint and several liability ("JSL"). When there are multiple tortfeasors in a regime of JSL a plaintiff can recover all of her losses from a single defendant. However, this does not mean that the other defendants escape liability. Landes and Posner explore the contribution movement in the United States – contribution is a rule change that allowed the defendant who is found liable to recover losses from the other tortfeasors.[81]

There has been a move to modify JSL to a regime in which each tortfeasor is responsible only for the harm they have caused. One of the motivations comes from the area of medical malpractice. When there is a bad medical outcome it is common to list hospital nurses as co-defendants. Under the respondent superior doctrine, and with JSL, the hospital could end up liable for the full amount of damages because nurses are employees of the hospital.

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[78] Id at 795–97.
[79] Id at 819–26.
[80] Currie and MacLeod, 123 Q J Econ at 819–25.
[81] Landes and Posner, The Economic Structure of Tort Law at (cited in note 7).

Several observers have pointed out that the new rule does not in fact change overall liability because, for example, the hospital could sue doctors for contribution. Hence, one might expect the rule change to have no impact on behaviour. However, Carvell, Currie and MacLeod point out that in the real world, other defendants are often judgment proof. Under JSL it may not be worthwhile for the "deep-pocketed" defendant to sue the others for contribution, especially if they are judgment proof. With reform, even if another tortfeasor is judgment proof, the "deep pocketed" defendant may have an incentive to join them to the case in order to reduce his own liability. We show that this is not only a theoretical possibility, but that there is evidence that JSL reform has reduced the rate of accidental death in the United States.[82]

VI. DISCUSSION

The model of precaution is an excellent first order way to think about how individuals respond to incentives. It is nevertheless a relatively crude tool that necessarily relies upon value judgments – the subjective evaluation of how alternative choices by the tortfeasor might lead to different consequences. In this paper we have discussed how combining the model of commodities introduced in general equilibrium theory with the standard economic model of rational choice developed by Savage allows us to look at decision making with the help of a Savage Table - a table that makes explicit the fact that a decision or act is a state-contingent commodity.[83]

Savage emphasized that careful consideration of the future states that might occur is the first step in making a rational choice. Understanding that a commodity is a good with specific characteristics including time and location is essential to creating these models. Savage solved a fundamental problem in rational choice theory by freeing the decision maker from the need to have a correct model of the world that considers every possible contingency and from the need to know the true probabilities associated with all states of the world. Clearly, such a model would be impossibly complex, and true probabilities are unknowable. Rather, Savage argued that actual decision making involves a simplified model of the world that focuses on likely events and that once a decision-maker has built her worldview, then the probability of an event is constructed from her preferences and subjective beliefs. In other words, it is necessary to first decide the set of possibly relevant outcomes before one can think about assigning probability weights to them.

This perspective focuses attention on the different events that are likely to lead to harm. These events, and the liability associated with them can be discussed without necessarily appealing to underlying probabilities. This is a useful innovation because evidence presented in court can be viewed as carefully specifying the events leading up to a particular outcome. In some cases decisions can be reached

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Carvell, Currie, and MacLeod, Accidental Death and the Rule of Joint and Several Liability at 16, 23–24 (cited in note x)

[83] See generally Savage, The Foundations of Statistics (cited in note 16).

without appealing to probabilities, as in cases where the rule of strict liability is involved, or when a previous case has already established liability for the case at hand.

Within the context of the Savage model causality is always clear and unambiguous. However, the model is also able to capture the fact that decision makers may be unable to determine causal relationships from the evidence at hand. We briefly discussed the fundamental problem of causal inference that states that in general determining a causal effect is impossible. Rather, the inference of causality is a function of how we believe the world operates, and in that sense requires a model of the world.

Even if the courts have a good model of the world, and are able to correctly apply the Learned Hand rule, there is no reason to expect individuals to have the same model of the world or to behave in a way consistent with the Hand rule. If everyone's decision making is governed by their own model of the world and their own subjective probabilities, then it should not be surprising that people faced with what appear to be similar situations will make different decisions.

The Savage approach assigns consequences to events. This is a more concrete activity than attempting to assess the probability of all possible events. Hence, whether or not the courts use the Hand rule for the determination of negligence, it is more useful to a decision maker if they can reliably assign legal liability to a specific event via a bright line rule. Doing so removes an element of uncertainty in the law by reducing reliance upon necessarily subjective and most likely incorrect assessments of probabilities.

Like Posner, we conclude that the only real way to know how a law affects people's behaviour is to conduct empirical studies.[84] We have discussed some empirical studies that address the effects of changes in tort law. Possibly one of the most challenging questions going forward is to better understand the causal impact of legal rules on individual behaviour, as well as how to use this information to improve legal rule making.

[84] Posner, 2 J Legal Stud at 220–21 (cited in note 13).