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Broken Elevators in the Cathedral: The Burden of Determining Property Rules & Liability Rules

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Abstract

Scholars have long argued for and against property rules and liability rules based on justice or efficiency. Recent arguments have focused on judges' ability to assess the information needed to administer these rules. Some observers argue that courts should find imposing property rules informationally less burdensome than liability rules because property rules require only a relative comparison of valuations, whereas liability rules compel a specific estimate of a party's valuation. Other commentators argue that liability rules demand less information because only one value must be estimated, while property rules require two. In this Article, Professor Brooks reconciles these opposing views, uncovering implicit assumptions about the court's ability to manage uncertainty under the two remedial regimes. Using a heuristic model, he highlights the salient factors that lead judges to be in a better position to determine one class of remedies or the other. The theory is then applied to numerous cases taken from contract, property, and tort law. Through this application Professor Brooks explains existing remedial regularities and suggests some new considerations.

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I Introduction

Judges routinely grapple with weighty tasks. Perhaps no task is more important than choosing how to protect the rights and legal entitlements of the parties who appear before them. One view of how judges discharge this task was offered three decades ago by Guido Calabresi and Douglas Melamed, using their now well-known taxonomy of property rules and liability rules.¹ Property rules protect entitlements using the court’s police powers to *prohibit* would-be interference; liability rules merely *discourage* interference through court-determined monetary compensation. Following Calabresi and Melamed, legal scholars developed and agreed upon various criteria for evaluating the relative advantages of these rules—criteria grounded in some form of justice or efficiency. Recently scholars have focused their attention on the court’s ability to assess the requisite information to implement these rules. Here, however, a consensus has yet to be reached. Indeed, the discussion among commentators is characterized by diametrically opposing views. Some commentators maintain that judges find property rules informationally less burdensome than liability rules. In order to reach an optimal² decision under a property rule, the court need only determine whether one party values the entitlement more than the other party. According to Richard Posner, this is easier than determining either party’s value (which is required for a liability rule); “just as it is easier to determine whether one person is taller or heavier than another than it is to determine how tall or heavy either per-

¹Guido Calabresi & Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089 (1972). Calabresi and Melamed neither limited their remedial options to just property rules and liability rules nor attempted to exhaust all the remedial choices available to courts. See Saul Levmore, *Unifying Remedies: Property Rules, Liability Rules, and Startling Rules*, 106 YALE L.J. 2149, 2150-2151 (1998) (noting that “Calabresi and Melamed were plainly not seeking to specify all remedial choices available to courts[,]” since they did not consider remedies relating to criminal law, contract law, constitutional law, or international law). See also Madeline Morris, *The Structure of Entitlements*, CORNELL L. REV. 822, 844 (1993) (observing property rules and liability rules are merely defining elements of the structure of entitlement forms, of which there are many possibilities).

²Optimality is defined in terms of maximizing the total value of entitlements, which roughly implies that the court allocates the entitlement to the party who values it more. This implication is not exact, because investment and other considerations that affect the total value of entitlements are not captured by this definition. Thus, the optimality criterion used here is *ex post* allocative efficiency.

son is.”³ Let’s refer to this claim as the “eyeballing-differences” argument. Other commentators, such as Louis Kaplow and Steve Shavell, argue that the “guesswork” involved in administering property rules “is necessarily greater than under liability rules[,]” since property rules require both an estimate and a comparison of two values, whereas optimal liability rules require only sufficiently accurate estimates of one value.⁴ This claim implies that the information needed to apply liability rules is a subset of that which is needed for property rules—the so-called “information-subset” argument.⁵

While both the information-subset and the eyeballing-differences arguments appear plausible, their oppositional relationship suggests that both cannot be correct. Nor, in any case, is it necessary that either argument is accurate. In this Article I demonstrate that both arguments fail to provide a satisfactory answer to the fundamental question: how does one evaluate the relative difficulty of determining property rules and liability rules given the varying and limiting information structures faced by judges? That is, with various possible types of imperfect information, what may we say about judges’ ability to optimally render decisions under a property rules regime or a liability rules regime? I proceed by developing and then applying a heuristic model that highlights the salient issues at the heart of this specific question. My aim is not to present a general theory on the choice between property rules and liability rules. The elusiveness of a comprehensive theory is evidenced by the long and distinguished list of often conflicting contributions to this discussion. Rather, my aim is to analyze the specific debate concerning the evidentiary burden on the court in choosing between property rules and liability rules.⁶ The implications from this analysis are intuitive yet revealing. Consider the hypothetical below, which offers a descriptive account of the principal claims and insights from the Article.

³RICHARD A. POSNER, *ECONOMIC ANALYSIS OF LAW* 77-78 (5th ed., 1998).

⁴Louis Kaplow & Steven Shavell, *Property Rules Versus Liability Rules: An Economic Analysis* 109 HARV. L. REV. 715, 730 (1996).

⁵This implication follows from a set of assumptions that are spelled out in greater detail in the text. See *infra* Part II.A.1.

⁶The choice between property rules and liability rules may be made according to many criteria, including justice, distributional and efficiency concerns. Even within the context of efficiency alone, one may focus on allocative efficiency, optimal investment or efficient bargaining (see e.g., *infra* notes 16 through 29). These considerations are not directly addressed here. The single concern of this analysis is the relative burden (or costs, or difficulty) faced by judges when attempting to determine property rules and liability rule.

The Broken Elevator Imagine that Judge Posner stands before an elevator bank charged with the following task: when the doors of the next elevator open (at which time he will observe Professors Louis Kaplow and Steve Shavell standing side by side) he must make one of two determinations. He must either determine Kaplow's height with sufficient accuracy (say, within 2 inches) or he may elect to determine whether Kaplow is taller than Shavell. Feeling confident that he can assess any person's height within 2 inches, Posner elects to determine Kaplow's height. However, he is reminded that he does not have to make his selection until after the elevator doors open. So he waits. Finally when the doors open he is surprised! It seems that the elevator is not functioning properly. With the doors opened, Posner sees that the elevator has not landed flushly with the floor. In fact, the elevator is half-way between floors, leaving the lower halves of Kaplow's and Shavell's bodies not visible. At this point, Posner may abandon his initial inclination to determine Kaplow's height and elect instead to determine whether Kaplow is taller than Shavell. The decision to abandon the determination of Kaplow's height is quite reasonable given the likelihood of error due to constrained perspective rendered by the broken elevator. Yet, while the broken elevator makes an individual assessment of Kaplow's height more demanding and error-prone, a comparison of Kaplow's height to Shavell's height is less affected because Posner's errors are likely to be common (i.e., positively correlated) to both parties.

This need not be the case, of course. For example, what if the elevator opens half-way between floors, as described above, but not flatly? Imagine that one of two cords attached to the top of the elevator snaps, causing the elevator to tilt. Now, as Posner looks at Kaplow and Shavell in the tilted elevator between floors, Kaplow appears relatively taller than he actually is and Shavell appears shorter. When assessing Kaplow's and Shavell's heights, the tilt of the elevator will cause Posner to make errors that tend to go opposite directions (i.e., negatively correlated errors). As such, a comparison of heights is now more difficult, though it may remain easier or more reliable than a determination of Kaplow's height alone. Recall that the elevator is still between floors blocking some of both Kaplow's and Shavell's lower halves. The visible height of each party is truncated, but now by different amounts. If the likely errors resulting from this truncation are more salient than the likely errors due to the tilt, then a relative comparison of heights may be preferred.

One can also imagine a situation where the errors in assessing the heights of Kaplow and Shavell due to elevator malfunctions have no obvious relationship to each other (i.e., uncorrelated or independent errors). For example, as Posner stands before the elevator bank, assume that Kaplow and Shavell are now in separate elevators⁷ that open simultaneously. Can anything be said about which determination Posner would elect when the doors open? What if one or both of the elevators' doors do not open: which will he choose? The choice may depend on many factors, such as his proximity to each elevator, his prior experiences and beliefs. Despite the independence of elevator malfunction-related errors, the costs or efforts required to determine one person's height might not be the same as those of the other person. This asymmetry could favor use of the single determination or the comparative determination. Furthermore, what if Shavell intentionally slouches or Kaplow stands on his tip-toes? When parties have vested interests in the transaction, as is usually the case, we must be sensitive to the impact of strategic behavior on the judge's decision-making abilities and likely errors.

The point of the hypothetical is to focus attention on the key factor driving the relative determination question (i.e., the question of whether property rules or liability rules are more easily determined.) That factor is the nature of judicial errors. When judges are able to effortlessly and perfectly estimate the values that parties place on entitlements, both property rules and liability rules are easily determined. It is because judges err when estimating values that the relative determination question arises. To answer this question, one needs to consider the errors that judges are prone to make and to examine how these errors are related to each other. For example, when judicial errors are significant and common to both parties, property rules become relatively easier for the judge to accurately determine. This case was illustrated by the initial description of the hypothetical, where the malfunctioning elevator blocks from view half (say three feet) of both Professors Kaplow's and Shavell's bodies. The broken elevator creates significant observational "noise" that is common to both parties, making the property-rule-like comparison of heights relatively easier. When the observational noise is varied across parties (i.e., negatively correlated or uncorrelated), then the liability-

⁷That is, assume that these elevators are in no manner connected. For example, they both run on separate emergency back-up power so that even a power failure would not cause the same affect in both, and so forth.

rule-like task of determining a single height is easier.⁸ For instance, perhaps Judge Posner tends to underestimate the height of people standing more to his right than his left, or tends to overestimate the valuation of tort victims relative to tortfeasors. All of this suggests that an analysis of the relative difficulty of determining property rules and liability rules requires a framework for discussing judicial errors.

This Article develops such a framework and applies it to various areas of law. First, however, the next Part of the paper places the current debate in context by reviewing the literature leading up to this point of contention. The discussion introduces and illustrates the contours of the murky debate over the relative ease, or difficulty, of determining property rules and liability rules.⁹ Part III presents a heuristic analysis that operationalizes the notion

⁸There are other important considerations beyond the relationship of likely errors in estimates of values. For example, the likely values themselves play a key role in understanding the relative difficulty of making property rule and liability rule determinations. The theoretical framework in Part III, *infra*, provides an expanded discussion of this point.

⁹A brief note on the evaluative criteria of optimality is warranted. The discussion thus far has focused on the fairly obvious claim that when judges are uncertain about parties' valuations they are not always able to determine whether a property rule or a liability rule should be ordered. But why are inaccurately determined property rules and liability problematic? These inaccuracies are problematic from an allocative efficiency perspective, *inter alia*. Consider, for example, a plaintiff who brings a clearly valid legal claim before the court, leaving the judge with the single task of determining a remedy. Though other criteria may and should be relevant (*see e.g., infra* notes 16 through 29), let's assume for the moment that the court will select the remedy based solely on *ex post* allocative efficiency. The Coase Theorem informs us that allocative efficiency is always achieved when transaction costs are sufficiently small irrespective of the judge's remedial choice. Therefore, assume that transaction costs are non-trivial, implying that the parties to the suit cannot easily bargain around the judge's determination. So there are meaningful allocative implications for inaccurately determined rules. To illustrate this well-known point, take a case involving a breach of contract between the buyer and seller of a good. First consider the property rule remedy of specific performance. If the plaintiff's value of the contract (v) is less than the defendant's cost of completing it (c), then a court order of specific performance will lead to inefficient performance. (Unless, of course, the parties reach an optimal post-judgment agreement.) However, if the plaintiff's value is greater than the defendant's cost (i.e., $v > c$), then not awarding specific performance may lead to inefficient breach. Similarly, the liability rule remedy of money damages can lead to inefficient performance or inefficient breach: if the court awards a money damage remedy that is predictably overcompensatory then performance may occur where efficiency demands that it does not; on the other hand, undercompensatory awards will create incentives for too much breach. Thus, efficiency requires the court to accurately

of judicial guesswork in order to shed light on the relative burden of determining liability rules and property rules. Part IV discusses applications of the theoretical framework in contract, tort, property law. Part V provides concluding remarks and suggestions for future avenues of research.

II Background and Contours of the Debate

The debate over the relative superiority of property rules and liability rules originates with Calabresi and Melamed's analysis of how legal entitlements are, or ought be, *assigned* and *protected*.¹⁰ In a dispute between party *A* and party *B*, the judge may assign the entitlement to either *A* or *B*. The judge's choice of assignment, which has been the subject of many articles, may be based on efficiency, fairness, or some form of justice.¹¹ The choice of assignment is represented by the rows in the table below. The columns of the

		Form of Entitlement Protection	
		Property Rule	Liability Rule
Entitlement Assigned to	<i>A</i>	<i>Rule 1</i>	<i>Rule 2</i>
	<i>B</i>	<i>Rule 3</i>	<i>Rule 4</i>

table represent the court's choice of how to protect the entitlement. The two

determine whether the plaintiff's value is greater than the defendant's (when using a property rule) or alternatively to determine the plaintiff's value with sufficient accuracy (when using a liability rule). This trade-off between incorrect property rule assignments and inaccurate liability rule awards underlies the current scholarly debate concerning the court's remedial skills.

¹⁰Calabresi & Melamed, *supra* note 1.

¹¹See James E. Krier & Stewart Schwab, *Property Rules and Liability Rules: The Cathedral in Another Light*, 70 N.Y.U. L. REV. 440, 447-449 (1995) (discussing theory and literature on assignment).

available choices available are, as Calabresi and Melamed described, property rules and liability rules.¹² Property rules protect entitlements by using the state’s police powers to *disallow* non-consensual appropriations, whereas liability rules use court-determined monetary compensation to *discourage* non-consensual appropriations. The matrix of entitlement assignment and protection reveals four general rules that are available to judges for resolving disputes. These four rules are easily illustrated using the standard example of a pollution nuisance.¹³ Assume that party *B* generates air pollution that necessarily and negatively impacts party *A*. The court may assign the entitlement of unpolluted air to *A*, and guarantee this entitlement with its police powers (Rule 1) or by ordering *B* to pay damages to *A* whenever *B* pollutes (Rule 2). Alternatively, the court may assign the entitlement to *B*, allowing *B* to pollute, and protect *B*’s right to do so with its police powers (Rule 3) or by ordering *A* to pay monetary compensation to *B* if *A* appropriates *B*’s entitlement to pollute (Rule 4).¹⁴

The choice of entitlement protection through property rules and liability rules (even more so than the issue of entitlement assignment) has been the focus of numerous commentaries. Commentators have based arguments for

¹²As the title of their article suggests, there is a third choice in the Calabresi & Melamed taxonomy: inalienability. Inalienability refers to entitlements that may not be appropriated by others, with or without the entitlement holder’s consent. Inalienability is not part of the current debates and therefore it is not included in the analysis of this Article.

¹³The usefulness of the ubiquitous pollution example for motivating the liability rules property rules dichotomy has been questioned. See Carol M. Rose, *The Shadow of The Cathedral*, 106 YALE L.J. 2175 (1998) (arguing that, while nuisance is frequently offered as the motivating example in discussing the four rules, the true motivation often lies in other areas of the law, such as contracts and law of accidents. Rose argues that the cost of these shadow examples has been an unfortunate blurring of legal principles).

¹⁴By treating liability rules as options, recent scholarship has added two “new” rules. See e.g., Morris, *supra* note 1; Ian Ayres & Paul M. Goldbart, *Optimal Delegation and Decoupling in the Design of Liability Rules*, Working Paper # 249, Program for Studies in Law, Economics, and Public Policy, Yale Law School (2001) [hereinafter Ayres & Goldbart, *Optimal Delegation*]; and Ronen Avraham, *Modular Liability Rules*, Working Paper (Apr. 2001). Rules 2 and 4 are modeled as call options and the new Rules 5 and 6 are put options. Thus under Rule 2, the polluter (party *B*) may be viewed as having a call option to buy the other party’s (party *A*’s) entitlement to unpolluted air; whereas, if the polluter could choose whether to make the other party pay her to stop the pollution then the polluter would have put option (Rule 5). Rules 4 and 6 may be similarly defined with respect to the other party. See *infra* Part III.A.3 for a discussion of the court’s ability to optimally choose among this fuller set of liability rules.

and against property rules and liability rules on efficient allocation,¹⁵ investment,¹⁶ bargaining,¹⁷ transaction costs,¹⁸ revealing information,¹⁹ concealing information,²⁰ victim behavior,²¹ injurer behavior,²² undercompensation,²³

¹⁵Departing from Ronald Coase, *The Problem of Social Costs*, 3 J.L. & ECON. 1 (1960), scholars have suggested that liability rules are superior when transaction costs are high because inefficient property rules allocations cannot easily be corrected. This argument is discussed below in some detail.

¹⁶See Lucian Ayre Bebchuk, *Property Rights and Liability Rules: The Ex Ante View of the Cathedral*, Draft (April, 2001) (arguing that the choice of rules affects the *ex post* division of value and therefore the *ex ante* incentive to invest).

¹⁷See Ian Ayres & Eric Talley, *Solomonic Bargaining: Dividing a Legal Entitlement To Facilitate Coasean Trade*, 104 YALE L.J. 1027 (1995) (arguing that the “divided ownership” feature that liability rules generate allow for more efficient bargaining by abating the the parties’ incentive to strategically misrepresent their privately known valuations). See also Louis Kaplow & Steven Shavell, *Do Liability Rules Facilitate Bargaining? A Reply to Ayres and Talley*, 105 YALE L.J. 221 (1995); Ian Ayres & Eric Talley, *Distinguishing Between Consensual and Nonconsensual Advantages of Liability Rules*, 105 YALE L.J. 235 (1995).

¹⁸See Kaplow & Shavell, *supra* note 4, at 764-765 (recounting—and then dismissing as misleading—the widely held view that property rules forces parties to bargain when transaction costs are not prohibitive). See also Krier & Schwab, *supra* note 11, at 452-453 (tracing the early representation and popularization of this argument to Richard Posner’s 1972 text on the economic analysis of law).

¹⁹See Kaplow & Shavell *supra* note 4, at 725 (arguing that liability rules possess an information harnessing affect that makes them preferable to property rules in asymmetric information settings).

²⁰Omri Ben-Shahar & Lisa Bernstein, *The Secrecy Interest in Contract Law*, 109 YALE L.J. 1885 (2000) (arguing that the court might find the information needed to determine liability rules more burdensome to acquire than that needed to determine property rules when parties have incentive to keep their exact valuation private).

²¹See Kaplow & Shavell, *supra* note 4, at 738-739 (discussing the indeterminacy of victim behavior considerations with respect to the preferred rule).

²²See Steven Shavell, *The Judgment Proof Problem*, 6 INT’L REV. L. & ECON. 45 (1986) and Kaplow & Shavell, *supra* note 4, at 739-741 (arguing that if judgment-proof defendants cannot pay the liability award, then they may exercise insufficient levels of precaution. In these cases a property rule may be preferred).

²³See Jeffrey Standen, *The Fallacy of Full Compensation*, 73 WASH. U. L.Q. 145 (1995) (discussing the incompleteness and undercompensatory nature of liability rules as they are currently administered).

overcompensation,²⁴ risk aversion,²⁵ loss aversion,²⁶ endowment effects,²⁷ holdouts,²⁸ and unconscionability²⁹ among other considerations, discussion of which is prohibited by the scope and space of this Article.

A Arguments and Assumptions About the Relative Costs of Determining Rules

Arguments specifically focused on the administrative costs of property rules and liability rules have traced two principal paths: the costs of repeated litigation and the cost of court supervision. Under property rules, parties

²⁴See Robert Cooter & Melvin Eisenberg, *Damages for Breach of Contract* 73 CAL. L. REV. 1434 (1985) (arguing that the liability rules, as often administered, may be overcompensatory by allowing plaintiffs to recover losses that may have been preventable or mitigatable).

²⁵See Lewis A. Kornhauser, *An Introduction to the Economic Analysis of Contract Remedies*, 57 U. COLO. L. REV. 683, 706 (1986) (noting that with regards to risk-preferences, “it may not be possible to construct a rule that gives [parties] appropriate incentives”). See also Kaplow & Shavell, *supra* note 4, at 743-744 (arguing that there is no a priori reason to prefer either rule with respect to risk-aversion, with or without the possibility of insurance).

²⁶See Cass R. Sunstein, *Behavioral Analysis of Law*, 64 U. CHI. L. REV. 1175, 1181 (1997) (observing, “[l]oss aversion also has large implications for the choice between...rules. Property Rules allow a taking based on ... ‘willingness to accept’; liability rules frame the question in terms of ‘willingness to pay’. ... [T]he resulting valuations may be dramatically different.”)

²⁷See Jeffrey J. Rachlinski & Forest Jourden, *Remedies and the Psychology of Ownership*, 51 VAND. L. REV. 1541, 1575 (1998) (observing “[p]roperty rules create an endowment effect which impedes transactions, but liability rules do not”). See also Ward Farnsworth, *Do Parties to Nuisance Cases Bargain After Judgment? A Glimpse Inside the Cathedral*, 66 U. CHI. L. REV. 373, 384 (1999) (providing non-experimental empirical support for the endowment effects argument).

²⁸See Richard A. Epstein, *A Clear View of the Cathedral: The Dominance of Property Rules*, 106 YALE L.J. 2091, 2092-94 (1998) (arguing that property rules create risks of holdouts that the legal system must balance against the risks of undercompensation generated by liability rules).

²⁹See Richard Craswell, *Property Rules and Liability Rules in Unconscionability and Related Doctrines*, 60 U. CHI. L. REV. 1, 64 (1993) (concluding that the choice between property rule protection and liability rule protection for plaintiffs who enter into contracts without proper consent—due to unconscionability or other contractual defects—should be based on the underlying costs to obtaining proper consent in the first place).

are not required to litigate over subsequent harm emanating from the initial controversy due to the once-and-for-all character of injunctions, specific performance, and other similar rules.³⁰ However, because the court may be called to oversee injunctions, performance of a contracts, and such, the supervision costs of property rules put them at a disadvantage to liability rules.³¹

Less attention has been devoted to the specific issue of whether property rules or liability rules should be favored with respect to court determination costs (also referred to as valuation costs). These costs may be thought of as direct court costs (or judicial time spent or court opportunity costs) in making one type of calculation as compared to another. While this issue has been present in the literature for decades, it has existed only in implied form, hidden in unstated background assumptions and derived from conclusory propositions. Consider, for example, the often-stated proposition that when transaction costs are low, property rules are better; and otherwise liability rules are preferred.³² Implicit in this conventional proposition is a strong unarticulated assumption about the relative difficulties faced by judges when determining property rules and liability rules. Namely, that judges face lower

³⁰See ROBERT COOTER & THOMAS ULEN, LAW AND ECONOMICS 176-177 (1988) (observing that remedies that address past harm, while not incorporating future harm, are less desirable than more permanent remedies, such as injunctions. Cooter & Ulen do note that permanent damages may be reached, but acknowledge the difficulty of such an exercise). See also Ayres & Goldbart, *Optimal Delegation*, *supra* note 14, at 82 (observing that “when bargaining is not possible, the costs of administering liability rules militate toward the use of property rules.”); Ian Ayres & J.M. Balkin, *Legal Entitlements as Auctions: Property Rules, Liability Rules and Beyond*, 106 YALE L.J. 703, 717 (1997) (noting that the multiple damage calculations required for higher-order liability rules put them at a relative disadvantage in terms of administrative costs); Alan Schwartz, *The Case for Specific Performance*, 89 YALE L.J. 277 (1979).

³¹See, e.g., CHARLES L. KNAPP AND NATHAN M. CRYSTAL, PROBLEMS IN CONTRACT LAW, 1087-88 (3d ed. 1993) (noting that specific enforcement of contracts may be unavailable when it involves difficult or prolonged supervision by the court).

³²See sources cited *supra*, note 18. Scholars have not focused on the relative determination issue in the context of low or zero private bargaining costs. The reason for this omission (presumably) is that judicial errors are costlessly correctable when there are no private bargaining costs. While it is certainly true that zero bargaining costs implies that any chosen rule of the court will lead to allocative efficiency (a restatement of the Coase Theorem), the relative determination issue does not go away simply because private parties can correct suboptimal judicial rulings. The issue, however, is admittedly less salient when errors are costless.

determination costs for liability rules.

Krier and Schwab confront this convention and, in doing so, bring the implicit assumption concerning determination costs squarely to the front of the debate.³³ They refute the conventional view that liability rules are superior to property rules when transaction costs make private bargaining prohibitive. They depict this refutation in the table below, wherein the columns represent assumptions about the court's costs of determining the liability rule (what Krier and Schwab refer to as the costs of assessing damages or "information costs"). The rows represent assumptions about the transaction costs of private bargaining ("transaction costs").³⁴ If transaction costs are low (i.e., the bottom row) then both rules work well, regardless of the court costs of assessing the liability rule.³⁵ If transaction costs are high and information costs are low (the upper right cell), then liability rules are preferred;³⁶ and if information costs are high (the upper left cell), then neither liability rules nor property rules work well. In their own words, "when (a) [information] costs promote inaccurate damage awards by the judge, and (b) bargaining between the parties is at the same time impeded by transaction costs, there is no a priori basis for favoring liability rules over property rules."³⁷ That is, the assumption that judges can better determine liability rules when transaction costs are high is unsupported. By explicitly incorporating the costs of

³³Krier and Schwab credit Mitch Polinsky with first advancing the counter claim that there is no reason to have a presumption in favor of liability rules if transaction costs prohibit private bargaining. Krier & Schwab, *supra* note 11, at 441 n.5 (citing A. Mitchell Polinsky, *Resolving Nuisance Disputes: The Simple Economics of Injunctive and Damage Remedies*, 32 STAN. L. REV. 1075 (1980)). The court may find it equally difficult (or possibly even more difficult) to reach a correct liability rule determination when private bargaining is not possible because of high transaction costs.

³⁴See Krier & Schwab, *supra* note 11, at 454 tbl.2.

³⁵If information costs are low and transaction costs are low (the lower right cell), then both property rule and liability rules work well: the courts can easily assess the proper damages and impose the liability rule or the parties can easily bargain around an incorrectly assigned property rule by the court. Similarly, if information costs are high and transaction costs are low (the lower left cell), both rules will again work well, because the parties can easily bargain around an incorrectly assigned property or liability rule. Thus the Krier & Schwab analysis makes no claims about relative determination costs when private bargaining costs are low.

³⁶Liability rules work well because the courts can assess the proper damages at low cost and the parties cannot easily bargain around incorrectly determined property rules.

³⁷Krier & Schwab, *supra* note 11, at 455.

Costs of Assessing Damages

		High	Low
Transaction Costs of Private Bargaining	High	Neither Rule Works Well	Liability Rule Favored
	Low	Both Rules Work Well	Both Rules Work Well

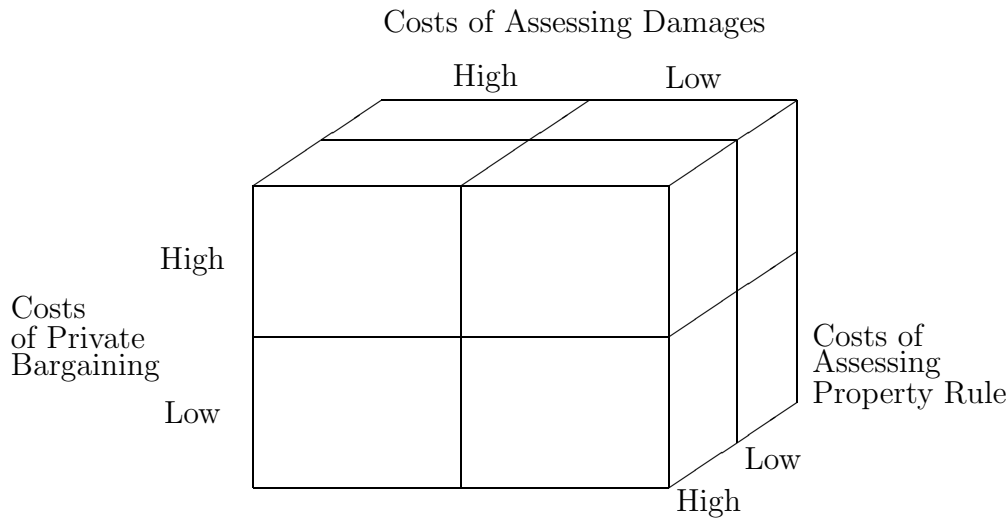
assessing liability rules, Krier and Schwab significantly advance the debate concerning relative efficacy of courts in determining property rules and liability rules. But, unfortunately, they do not go far enough.³⁸ Missing from their analysis is any mention of information assessment costs relating to property rules. They either ignore these costs or treat them as zero—as though to suggest that judges simply pick, without effort, the party who should get the property rule protection.³⁹ One could just as easily assume that judges simply pick a damage award (say \$10) with no thought to the real figure, but such an assumption would hardly be compelling. Indeed, Krier and Schwab label this assumption “strange,” while not seeming to appreciate the implication of that label for their own assumption trivializing the court costs of determining appropriate property rules.⁴⁰ As the table below demonstrates,

³⁸In all fairness to Krier and Schwab, it must be noted that did not intended to contribute to this particular debate, but rather their aim was to clarify another point of confusion in the literature. With regards to that aim, even a cursory reading of their insightful article would reveal their success.

³⁹This position is revealed, somewhat, in the following: “Presumably property rules should still be preferred in the low-transaction-cost cases on the ground that the damage calculation necessary to a liability rule entails more judicial time and effort than does a simple order of injunctive relief (or a denial of all relief).” Krier & Schwab, *supra* note 11, at 455 n.49. The Coase Theorem tells us that in the low-transaction-cost cases any damage award (just as any property rule) will achieve the efficient allocative result, and therefore the damage calculation does not require any more judicial effort or time than a simple order of injunctive relief.

⁴⁰“In these terms, liability rules would be as good as property rules only if judges were to just go ahead and order any old damage award, making no effort whatsoever to calculate

the assessment costs of property rules adds a new dimension to the Krier and Schwab framework.⁴¹ In the rear upper left box the costs of assessing the property rule is low and the costs for liability rule is high. In that case, rather than neither rule working well, the property rule would be preferred to the liability rule.⁴²



This previously unexplored dimension is at the heart of the current debate mentioned in the introduction. No longer lurking within unarticulated assumptions, the line of arguments concerning the difficulty of determining property rules and liability rules have now been clearly drawn. These are the arguments. Posner maintains that property rules are easier because judges need only compare which one of two valuations is greater, as opposed to the more difficult task of determining either valuation. This argument is commonly supported with the familiar analogy of the relative ease comparing two “heights” as opposed determining a single height. Kaplow and Shavell note, however, that “comparing the height [sic] of two adjacent trees” is an entirely different endeavor from comparing the valuations from two compet-

an appropriate measure. Strange as that proposition might seem, something much like it is defended [by Ian Ayers and Eric Talley].” Krier & Schwab, *supra* note 11, at 455 n.49.

⁴¹While Krier and Schwab consider, at least trivially, the trade-off between “the damage calculation necessary to a liability rule” and “a simple order of injunctive relief” necessary to a property rules in the low-transaction-cost cases, no mention is made of this trade off in the high-transaction-costs cases.

⁴²In the front upper left box, the costs of assessing both the property rule and the the liability rule are high, implying that neither rule works well in this regard.

ing uses.⁴³ They contend that valuations do not stand next to each other, as do trees or persons, and therefore valuations can only be compared by first deriving individual measures of each; and in taking this first step of deriving individual measurements, the work of determining the liability rule is done. While ostensibly plausible, these arguments ultimately prove insufficient for the task of explaining the relative information burden faced by courts. I demonstrate this using a simple heuristic model below. The model offers an alternative and useful approach, but a model is not required to show the trouble with these competing arguments. As the analogy aptly suggests, the problem with these arguments is that they focus on the trees at the expense of missing the forest. Their claims rely on restrictive assumptions about the court's information structure. Under one set of assumptions, Posner is correct; under another set Kaplow and Shavell are correct. Without restrictive assumptions, both arguments are wrong.

1 Information-Subset Argument Reconsidered: Nonequivalence Critique

Kaplow and Shavell claim that the estimation of a single variable under liability rules involves less guesswork for judges than property rules, which require that judges estimate and then compare two variables. One might be tempted to challenge this claim by observing that the counting of variables to be estimated does not dictate the rank order of the costs involved in estimating those variables. That is, it may be easier for judges to determine two values than one. But Kaplow and Shavell's claim withstands this challenge, as it is premised on a subtle (but powerful) assertion: judges *may* in principle use the same estimate of the entitlement-holder's valuation under both property rules and liability rules regimes.⁴⁴ If judges do use the *same*

⁴³"In some contexts ([e.g.] comparing the height [sic] of two adjacent trees), it is possible to determine which of the two things is larger without having to quantify either separately. But the harm caused by externalities ... and the costs of reducing it ... are not immediately comparable, so it is necessary to quantify each." Kaplow & Shavell, *supra* note 4, at 729 n.49. In the same footnote they go on to state that, "[i]t also would not be necessary to quantify harm and prevention costs separately if the two were directly correlated." The analysis in the sections to follow will show, however, that even when there is no direct correlation, it may still be easier for judges to determine the property rule.

⁴⁴Kaplow & Shavell, *supra* note 4, at 742.

estimate under these regimes, then the number of estimates will dictate the relative costs of estimation. Yes, perhaps judges could use the same estimate for the entitlement holder's valuation (regardless of whether property rules or liability rules are used), but under what circumstances would they optimally choose to do so?

To answer this question, Kaplow and Shavell's argument must be worked out a bit more fully. First, they do not claim that the court's estimate of a party's valuation under the liability rule *must* equal the court's estimate under the property rule. Rather, they claim merely that "courts could set damages [for the liability rule] using the same crude estimate of harm that they would have employed in assigning the entitlement under a property rule."⁴⁵ Indeed, in many cases, a single (even grossly imperfect) estimate of value (or harm) will produce efficient outcomes under both property rules and liability rules. However, in many other cases, a single estimate will lead to an efficient outcome under a property rule, but not under a liability rule.⁴⁶ In any specific instance, the information needed to optimally resolve a

⁴⁵Kaplow & Shavell, *supra* note 4, at 731-732.

⁴⁶To see this, let's focus on the information a judge needs to optimally impose a property rule or a liability rule in a specific instance. Consider a breached contract between a buyer, who values a good at v , and a seller who values it at c . (The seller's value is the greater of the opportunity costs, or production/procurement costs, of the good.) Assume that the judge's exclusive concern is allocative efficiency (i.e., the judge wants the good to end up with the party who values it most). Under property rules, let the information the judge requires to correctly (i.e., in terms of allocative efficiency) resolve the dispute be $\{v_P, c_P\}$, such that for any v_P and any c_P , we have $v_P \geq c_P$ if and only if $v \geq c$ (the subscript P references property rules). That is, if the buyer's valuation (v) is weakly greater than the seller's (c), then any set of estimates reached by the court (i.e., $\{v_P, c_P\}$) that preserves this order is sufficient. The required information under liability rules may similarly be defined as $\{v_L\}$, such that for any v_L , $v_L \geq c$ if and only if $v \geq c$. In other words, if the buyer's valuation (v) is greater than or equal to the seller's (c), then any estimate of the buyer's valuation reached by the court (i.e., $\{v_L\}$) that is weakly greater than the seller's true valuation (c) is sufficient. It is easy to show that v_P and v_L are need not be the same. For example, let the buyer's true value be $v = 110$ and the seller's true value be $c = 100$. Efficiency requires that the buyer gets the good, since $v > c$. Assume that the only reason why the buyer values the good more than the seller is because she undertook some unique and verifiable reliance investment costing \$5. Let's further assume that the court can easily verify that the cost of producing the good is \$50, and the price paid by the buyer is \$55. (While it may have cost the seller \$50 to produce the good, the opportunity cost of relinquishing the good to the buyer may be greater. Imagine, for instance, that a third party has offered the seller \$100 for the good, which is the full value that this

controversy may differ significantly under the two rules. Kaplow and Shavell abstract away from this issue by leveraging two extreme assumptions. On the one hand, they assume that judges cannot observe valuations in any specific cases.⁴⁷ And on the other hand, they assume that if judges could determine valuations on a case-specific basis, judges would do so perfectly.⁴⁸ Between these two extremes, of course, lie almost all cases, where judges have some knowledge of the specific parties' valuations, but that knowledge is imperfect. Under this most common setting, the information-subset argument does not logically follow.

To appreciate the restrictiveness of the information-subset argument, recall the broken elevator hypothetical. The assumption of no case-specific knowledge is tantamount to assuming that the elevator doors never open. In that case, Judge Posner must make his selection without actually looking at the persons in the elevator. Given this significant constraint, he may be best off using the average height of an American male of Kaplow's age to determine Kaplow's height. To determine whether Kaplow is taller than Shavell, he could then use the average height of an American male of Shavell's age and then compare this figure with his previously determined estimate of Kaplow height. This latter task thus incorporates the information from the former determination, making the property rule more burdensome than the liability rule: the information-subset argument. However, because elevator doors typically open, which is to say that judges generally have case-specific (albeit

third party places on the good.) Assume that the court cannot observe (or chooses not to consider) other non-verifiable (or speculative) aspects of the good for both the buyer and the seller. Using verifiable information alone (i.e., $v_P = \$60$ and $c_P = \$50$) the court may reach an efficiency-inducing property rule. However, a liability damage award of \$60, would not lead to an efficient result. (The seller would transfer the good to the third party who values it less than the buyer.) The verifiable information concerning the buyer's value is not sufficient for the an appropriate (i.e., efficiency inducing) liability rule. In this case, using the estimated value from the property rules regime (i.e., $v_P = 60$) for the liability rule award would lead to a suboptimal result. The set of optimal valuations under the two rules are not the same. Of course, this example is quite contrived, but it is sufficient for its purpose of demonstrating the non-equivalence of v_P and v_L .

⁴⁷“The reader should bear in mind that we are assuming that the court cannot observe the actual harm in particular cases, so it must use *a single, fixed number* as the measure of damages.” Kaplow & Shavell, *supra* note 4, at 728 n.46 (emphasis added).

⁴⁸“When courts can ascertain harm on a case-specific basis ..., the liability rule will automatically result in damages equal to harm and in behavior superior to that under a property rule.” *Id.* at 729 n.48.

imperfect) information about parties' valuations, there is no clear justification for the assumption of no case-specific knowledge.⁴⁹ Nonetheless, the information subset argument, as a theoretical proposition, is not wrong, so much as it is restrictive.

For example, anticipating the "specific instances" criticism, Kaplow and Shavell observe that judges need not focus on specific cases, since "the liability rule, with damages equal to average harm, is superior on average to property rules."⁵⁰ This observation reveals an important insight from their work,⁵¹ yet its validity is conditioned on the assumption that judges make unbiased estimates. They concede that if estimates are systematically biased then their argument "might" not hold. This concession is significant given the widely shared view that judges systematically underestimate harm by limiting recovery to market-based considerations and excluding emotional, idiosyncratic, speculative, and non-verifiable components.⁵² This obviously presents a problem for the information-subset argument; to which Kaplow and Shavell respond: "[i]n principal, ... the problem could be solved, but per-

⁴⁹If a judge has some insight about the valuations in specific cases and if that insight varies under the two remedial regimes, then it is not clearly optimal for the judge to constrain herself by using a single measure of valuation. Yet, I do not wish to overstate this point. There may be practical advantages that are realized when judges limit themselves to a single value regardless of the remedial regime. One can certainly imagine a situations where it would be optimal for a judge to credibly commit to a single value in order to limit strategic behavior, promote efficient bargaining, encourage optimal investment, minimize administrative costs or achieve some other objective. See Ayres & Talley, *supra* note 17, at 1065-1072 (discussing some disadvantages of liability rules that are tailored to specific parties). However, there situations that demand more flexibility and the use of tailored liability rules by judges. Ultimately, there is no *a priori* reason to believe that the former set of situations is more likely than the latter. For a discussion of the ways in which various rules encourage particular types of strategic misrepresentations and useful court responses see Richard R.W. Brooks, *Simple Rules for Simple Courts: Specific Performance, Expectation Damages and Hybrid Mechanisms* (Working Paper, Nov. 2001).

⁵⁰Kaplow & Shavell, *supra* note 4, at 727.

⁵¹Kaplow and Shavell show that by setting the award equal to average damages, a liability rule allows potential infringers (who know whether their own valuations exceed the average) to make the allocation choice from their more informed perspective vis-a-vis the courts. Thus, liability rules are able to harness the private information held by potential infringers, which make these rules superior to property rules (in this respect) on average. *Id.* at 725.

⁵²See Standen, *supra* note 23 (arguing that fully compensatory damages falls far short of its ideal in practice).

haps only if the process by which damages are calculated is altered.”⁵³ Still, even if it were feasible to overhaul the court’s damage calculation methodology to eliminate this type of systematic underestimation, the problem of bias would not disappear. The fact is, bias and other difficulties with determining property rules and liability rules result from a variety of constraints.

Various behavioral and institutional constraints present a significant challenge for the information-subset argument. Consider, for example, the thesis of contractual secrecy interest offered by Omri Ben-Shahar and Lisa Bernstein.⁵⁴ Ben-Shahar and Bernstein argue that when a party in a breach of contract case reveals her true valuation to the court for the expectation remedy, she does so at the cost of limiting her future bargaining power.⁵⁵ Given this cost, she may be reluctant to provide evidence in support of expectation damages. The implication of this reluctance is that the court might find the information needed to determine the expectation damages liability rule more burdensome to acquire (because of her secrecy interest) than the information needed to determine the property rule of specific performance.⁵⁶ Thus the entitlement *holder* may differentially affect the court’s efforts to determine her valuation under property rules and liability rules regimes. The entitlement *infringer* may also affect the court’s relative costs of assessing valuations under the two regimes. Take, for instance, a polluting firm infringing on party’s entitlement to unpolluted air. Henry Smith has argued that in the environmental pollution context, third party (e.g., courts) measurement costs may

⁵³*Id.* at 731.

⁵⁴See also Omri Ben-Shahar & Lisa Bernstein, *The Secrecy Interest in Contract Law*, 109 YALE L.J. 1885 (2000).

⁵⁵The strategic motivation for concealing private valuation has been much discussed in the law and economics literature. Benjamin E. Hermalin & Michael L. Katz, *Judicial Modification of Contracts Between Sophisticated Parties: A More Complete View of Incomplete Contracts and Their Breach*, 9 J.L. ECON. & ORG. 230, 233 (1993) (observing “[f]or example, a railroad’s customer might be reluctant to announce the great importance that he places on the delivery of a shipment for fear that the railroad would then charge a much higher rate”). See also Philippe Aghion and Benjamin E. Hermalin, *Legal Restrictions on Private Contracts Can Enhance Efficiency*, 6 J.L. ECON. & ORG. 381 (1990); Jason Johnston, *Strategic Bargaining and the Economic Theory of Contract Default Rules*, 100 YALE L.J. 615 (1990).

⁵⁶This claim follows if plaintiffs are more willing to demonstrate that they value performance more than the defendant values nonperformance but still unwilling to reveal their precise valuation.

differ in response to alternative technological choices of the polluter.⁵⁷ The polluting firm may choose one technology under a property rule regime and another technology under a liability rule regime.⁵⁸ The result is that courts typically incur different assessment costs under property rules and liability rules.

These endogenous effects were hinted at in the broken elevator hypothetical, where Judge Posner stands before an elevator trying to size up Professors Kaplow and Shavell. Disputing parties (Kaplow and Shavell in the hypothetical) generally have strong vested interests, interests that often engender efforts to alter the judge's ability to make the relevant assessments. In the hypothetical, these efforts were described as Shavell intentionally slouching or Kaplow standing on his tip-toes. In the real world, the court costs of acquiring the requisite information about the entitlement holder's valuation may differ to the strategic incentives of the entitlement holder (as in the case of Ben-Shahar and Bernstein's secrecy interest model) or the entitlement infringer (as in Smith's model). It is also possible that the source of difference is due to factors beyond the strategic behavior of the parties.⁵⁹ The source of the difference is unimportant for this argument. The point here is that judges do not face the same costs in determining a party's valuation under the two regimes.⁶⁰

Facing different determination costs under the two regimes, a judge, if required to use a single fixed number as the measure of damages, would apply property rules and liability rules with different degrees of certainty. The difference in certainty may lead to a judicial preference for liability rules in some cases and property rules in others. Consider, for example, the biblical account of King Solomon's clever resolution of a custody dispute.⁶¹ The dispute involved two women, each claiming to be the mother of a baby. When King

⁵⁷Henry E. Smith, *Ambiguous Quality Changes from Taxes and Legal Rules*, 67 U. CHI. L. REV. 647, 679-696 (2000). Smith presents a strong challenge to the implicit static assumption that is required to generate the information-subset argument.

⁵⁸Technology is used here to refer to not just machinery, but also process. Quality changes are considered technological changes as well.

⁵⁹For instance, a judge's education, experience and background could lead to different information acquisition costs under property rules and liability rules.

⁶⁰I make no claims about the relative magnitude of costs under the two regimes. I merely observe that these costs need not be the same.

⁶¹1 *Kings* 3:16-28.

Solomon threatens to cut the child in half the “true” mother immediately relinquishes her claims to the child. The act of relinquishing her custody claims convinces King Solomon that this woman values the life of the child more than the other woman. He, in turn, grants her custody (a property rule). Ignoring issues concerning the accuracy of King Solomon’s conclusion,⁶² one may say that because he held strong beliefs about who valued the child more he was able to confidently determine the optimal property rule. How confident could he have been about an optimal liability rule? That is, what if instead of granting custody to the “true” mother King Solomon ordered the other women to pay some amount, how certain could he have been about the appropriate amount? The overwhelming practical and moral difficulties of placing a dollar value on a mother’s valuation of her child notwithstanding, it is hard to imagine that King Solomon could have been particularly confident about an appropriate liability rule. Any estimate of the “true” mother’s value that was less than the value held by the other woman would have led to an inappropriate outcome.⁶³ In this case the property rule was easier to determine than the liability rule. In other cases, liability rules may be more easily reached for practical and normative reasons. Such institutional realities seriously undercut the salience and general applicability of the information-subset argument.

⁶²The real mother (under stress of the abduction and the trial) may have preferred any outcome to her child ending up in the hands of its kidnaper. Several scholars have issued interesting and thoughtful critiques of King Solomon’s wisdom in this case. See, e.g., Saul Levmore, *Rethinking Group Responsibility and Strategic Threats in Biblical Texts and Modern Law*, 71 CHI.-KENT L. REV. 85, 91-94 (1995); Ann Althouse, *Beyond King Solomon’s Harlots: Women in Evidence*, 65 S. CAL. L. REV. 1265, 1272 (1992); STEVEN J. BRAMS, BIBLICAL GAMES: A STRATEGIC ANALYSIS OF STORIES IN THE OLD TESTAMENT 118-123 (1980). On the other hand, Martha Minow has argued that truth-revelation was not the purpose of King Solomon’s decision: he was simply trying to identify the better mother for the child. Martha L. Minow, *The Judgment of Solomon and the Experience of Justice*, in THE STRUCTURE OF PROCEDURE 447, 447-450 (Robert M. Cover & Owen M. Fiss, eds. 1979)

⁶³By inappropriate I mean a ruling that would result in the child being separated from the “true” mother. If we take for granted that mothers value their children more than anyone else, then we may substitute “inefficient” for “inappropriate” in the language above. There are, however, obvious reasons to use restraint in making these types of linguistic substitutions. Separately, it should be noted that the inappropriate (inefficient) result ignores liquidity constraints. That is, it is assumed that parties can pay up to their valuation.

2 Eyeballing-Differences Argument Reconsidered: Sufficiency Critique

In arguing that property rules are more easily determined than liability rules, Judge Posner claims that it is easier to determine which one of two parties places greater value on an entitlement, than it is to determine how much either party values it.⁶⁴ The significance of the claim lies in the motivation for the determinations, which in this context is allocational efficiency. Recall that allocationally efficient rules direct entitlements to the parties who value them most. Thus, in order to reach an allocationally efficient liability rule, a judge must determine, with sufficient accuracy, the value that a plaintiff places on the entitlement: if the judge underestimates this value by too much, then the entitlement may go to a defendant who values it less than the plaintiff; if the judge's estimate of the plaintiff's value is too excessive, then a higher-valuing defendant may be deprived of the entitlement. In order to avoid these inefficient outcomes, a judge must select optimal liability rules from a broad continuum of possibilities with some care. However, there is no continuum from which to choose optimal property rules. Property rules, as Judge Posner observes, possess a discrete quality. One litigant either values the entitlement more than the other litigant or not. No additional information is required to reach allocationally efficient property rules. There is no need to estimate how much either litigant values the entitlement. Property rules rely on a simple dichotomous choice, a discrete choice. This discrete choice intuition underlies the eyeballing differences argument favoring property rules.

Surprisingly, perhaps, optimal liability rules also have a discrete quality to them. Any liability rule estimate that the judge reaches for one litigant will be optimal so long as that estimate does not upset the true rank order of values among the parties: if the plaintiff values the entitlement more than the defendant, then any estimate of the plaintiff's value that is more than the defendant's will lead to an efficient result; if the defendant values the entitlement more, then any estimate of the plaintiff's value that is less than the defendant's value will be efficiency inducing. So long as the liability awards respect the threshold that preserves the rank order of values, then there are no constraints on the accuracy of the determination.⁶⁵

⁶⁴Posner, *supra* note 3, at 77-78.

⁶⁵See *supra* note 46 for a slightly more formal treatment of this intuition.

In fact, liability rules can be significantly and arbitrarily inaccurate and still lead to allocatively efficient outcomes. The degree of acceptable inaccuracy with liability rules is determined by the potential inefficiencies resulting from incorrectly chosen property rules.⁶⁶ This claim can be sketched out using a simple numeric example.⁶⁷ Consider a breach of contract case involving the buyer and seller of a good. Assume that the buyer values performance at $v = 100$ and seller has two possible costs, high costs ($c_H = 110$) or low costs ($c_L = 80$). The allocatively efficient result is predicated on the buyer getting performance if and only if the seller has low costs. If the court orders specific performance when costs are high, or denies specific performance when costs are low, then inefficiency will result.⁶⁸ Such inappropriate grants or denials of the property rule creates some expected inefficiencies. These inefficiencies imply that perfectly estimated liability rules are more efficient than property rules. Furthermore, even imperfectly estimated liability rules may be superior.⁶⁹ To see this, assume that the seller's true cost is 80. So long as the court does not underestimate the buyer's value by more than 20, the efficient result should obtain (whereas, an order denying specific performance will lead to an inefficient result).⁷⁰ On the other hand, if the seller's true cost is 110, then efficiency will result so long as the court does not over-

⁶⁶The phrase "incorrectly chosen property rules," is meant in the narrow *ex post* allocative efficiency sense: where property rule protection is granted to the lower-valuing party. Of course, beyond *ex post* allocative efficiency, there are many good and correct reasons to grant property rule protection to a lower-valuing party.

⁶⁷A more formal demonstration of this claim may be found in Richard R.W. Brooks, *Sufficiently Accurate Damages* (Working Paper, Nov. 2001).

⁶⁸Assume, without loss of generality, that the court's order is final, or that transaction costs prohibit post-court order renegotiation. Alternatively, one may simply state that inefficiency will occur with strictly positive probability.

⁶⁹Assume that the court spends the same fix amount of resources to determine valuations under property rules and liability rules. Therefore, slightly imperfect liability awards that require significant courtroom expenditures are not being compared to low cost property rule assessments, and vice versa. As the discussion in *supra* Part II.A.1 suggests, however, there are a variety of institutional and strategic reasons why one class of rules may be determined at lower costs than the other. Nonetheless, the assumption is made for comparative theoretical reasons.

⁷⁰If the seller's cost was high (i.e., 110), then the court has unlimited freedom to underestimate costs without resulting inefficiency. However, given that the seller's cost is 80, underestimating the buyer's value of performance by 25 (i.e., ordering money damages of 75) will lead to inefficiency; but underestimating the buyer's value of performance by 15 (i.e., ordering money damages of 85) will not. The cutoff between those underestimated damages that lead to efficiency and those that do not is 20.

estimate the buyer's value by 10 or more (while an order granting specific performance will lead to an inefficient result). As the example demonstrates, it is the difference between actual costs and value that defines how accurate the court's estimate of the liability rule must be for efficiency purposes. The key question is whether judges find it easier to determine if one litigant values the entitlement more than the other (i.e., the property rule criterion) or whether they find it easier to determine the *approximate* value of the litigant being granted the liability rule protection. Borrowing Judge Posner's analogy, it is a choice between determining whether one person is taller than another versus determining one person's height *roughly*. Exactly how rough can be demonstrated formally, but that demonstration would lead this work significantly off its path.⁷¹

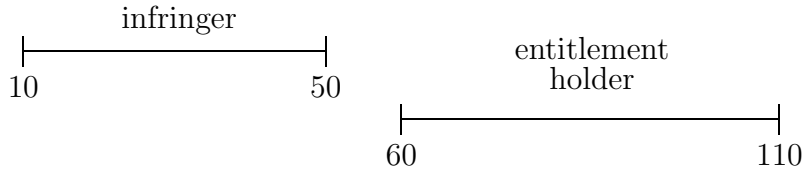
III Theoretical Framework

When seeking to protect an entitlement with property rules or liability rules, judges face an obvious problem: They do not know the values that parties place on the entitlement, which is not to suggest that judges are entirely uninformed. Judges often know, or have a sense of, the possible values held by the parties and which of those values are more likely than others. This knowledge may be conveniently reflected through probability distributions. Probability distributions, or simply distributions, represent possible outcomes (i.e., possible values) with a description of the likelihood of each outcome occurring—that is, an assignment of probabilities to possible outcomes.⁷² Though often lacking the knowledge to directly compare the parties' values, judges can (and often do) compare the distributions of these values or at least some aspects of the distributions. For example, a judge can simply compare the ranges of the distributions. The figure below shows an infringer's possible values ranging from 10 to 50 and the entitlement holder's possible values going from 60 to 110.⁷³

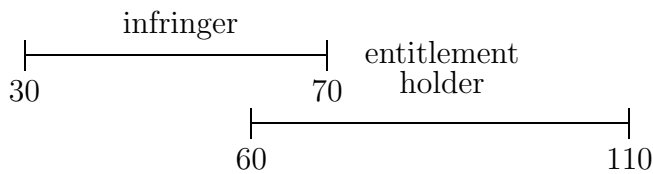
⁷¹See Brooks, *supra* note 67, for an extensive treatment.

⁷²More formally, probability distributions are assignments of probabilities to subsets (known as events) of the set of possible outcomes.

⁷³The possibilities are based on the judge's subjective beliefs.



In this case, all of the infringer's possible values are less than every possible value of the entitlement holder. A judge knowing these ranges can confidently order an optimal property rule or liability rule.⁷⁴ Unfortunately, knowledge of the ranges of the parties' possible values is often not sufficient. Frequently, the ranges overlap, as shown below where the infringer's possible values now range from 30 to 70.



How confident can a judge be when imposing a property rule or a liability rule in this case? The answer to this question turns on the degree to which the judge believes that the values will fall in the overlapping region, between

⁷⁴ "Believing" and "knowing" are treated as equivalents in this setting.

60 and 70. If the judge believes that infringers with values greater than 60 are quite unlikely, then she may be almost as confident as she was in the non-overlapping ranges case. On the other hand, if the judge thinks infringers are very likely to have values greater than 60, she ought to be substantially less confident.⁷⁵ Under such circumstances, the judge may turn to her knowledge of the most common values for infringer, an aspect of the distribution known as the mode. The mode is one measure of central tendency (i.e., an “average-like” characterization) of the distribution, the arithmetic mean is another.⁷⁶ The mean is the sum of the possible values divided by the number of possible values. A mean that is within or close to the overlapping region may indicate that many other values are in the overlapping region. But, while knowing the proximity of the mean to the overlapping values may be useful, it may also be deceptive. The mean could be largely determined by extreme values that are unlikely to occur (sometimes referred to as outliers). So in addition to her beliefs concerning the central tendency of the distribution (as expressed by the mean), the judge may also rely on her beliefs concerning how spread out the values are around the mean. When the values are closely spread around the mean then she may be more confident in those cases than when the values are spread widely around the mean. The aspect of the distribution that captures the spread of the values around the mean is known as the variance.⁷⁷ Higher variances denote values that are more spread out or random (in some sense). Lower variances indicate that the possible values are less spread out, suggesting that the judge may be more confident in her estimates of the parties’ values. As such, the mean, the variance and other measures of distributions reveal information about the uncertainty faced by judges attempting to assess parties’ valuations. These measures can thus be employed to characterize the extent of guesswork involved in determining remedial rules. The next subpart of the Article presents a highly stylized model

⁷⁵Similarly, if the judge believes that the entitlement holder’s value is not likely to fall in the overlapping region then she may be almost as confident as in the non-overlapping ranges case.

⁷⁶Other measures of centrality include the the midrange and the median. The midrange is the sum of the smallest possible value and the largest possible value divided by two. The median is found by taking the middle value when all the possible values are placed in rank-order.

⁷⁷Given some random variable x , the variance of x (denoted $Var(x)$) is represented as $Var(x) = E[(x - \bar{x})^2]$, where E is the expectation operator and \bar{x} is the mean of x . It should be noted that the variance is just one of countless measures of randomness that may be usefully employed in this setting.

in order to specifically demonstrate how these measure may be employed in the current debate over property rules and liability rules.

A Judicial Guesswork in Determining Property Rules and Liability Rules

Consider a judge who is deciding between determining whether one party values a parcel of land more than another party, and estimating the value that the first party places on the land. Further imagine that there are precious minerals or oil under the land, about which both litigating parties are fully knowledgeable. The judge may or may not be aware of the important subterranean aspects of the land. Let's say that she is. She knows that there is oil under the land, but her knowledge of its value is significantly less precise than the knowledge of the litigants, who are submitting conflicting reports to her.⁷⁸ In this case, if the judge is likely to make a large error in estimating the value of the oil to the parties (which is highly correlated) then determining one party's value (i.e., the liability rule determination) becomes relatively more difficult and less reliable than a comparison of the parties' values (i.e., the property rule determination). However, if the judge's likely error in estimating the value of the oil is small, then the opposite may be true. The intuition behind these claims, the same as that derived from the broken elevator hypothetical, is characterized more explicitly through the analysis below. The analysis begins with a very basic structure (model), for ease of explication, and then engages in successive levels of refinement.

1 The Basic Model

Take two parties, A and B , who are litigating over an entitlement, e . The judge's measure of the value that A places on the entitlement (v_A) may be written as $v_A = u_A(e) + x$, where $u_A(e)$ is the dollar measure of utility that A derives from the entitlement, and x is a random error-component of the

⁷⁸For example, one can imagine that the deed-holder of the land may likely inflate the value and the would-be infringer might understate the value.

judge's estimation of A 's utility in terms of dollars. To further characterize the judge's error (x), assume that $x = x_A + x_C$, where x_A represents random errors that affect only A 's valuation and x_C are common random errors affecting the valuations of both A and B .⁷⁹ The court's estimate of B 's valuation (v_B) may likewise be written as $v_B = u_B(e) + x_B + x_C$. The random error components are partitioned such that x_A , x_B and x_C are all independent.⁸⁰

The court's relative ability to determine property rules and liability rules may initially be assessed through a comparison of variance under the two rules. Thus in evaluating whether the court is better able issue a liability rule (through determination of A 's valuation, v_A) or a property rule (by a comparison of the relative valuations of A and B , i.e., $v_A \geq v_B$ or $v_A \leq v_B$) we can compare the randomness involved in issuing each rule by considering the "variance(s)" in the court's determination. The guesswork or variance ($Var(v_A)$) involved in determining A 's valuation (i.e., the liability rule in this model) is equal to the sum of the variance of A 's idiosyncratic error component and the variance of the common error component:⁸¹

⁷⁹This structure of the court's errors—that is, decomposable correlated random errors—is restrictive, but expositionally quite useful. There are situations wherein correlated errors are decomposable. Take, for example, a dispute over the sale of a piano, where cash or diamonds are found hidden inside the piano after the sales contract is signed but before it is completed. The court may seek to impose a property rule (specific performance or excused performance due to mistake) or a liability rule. In terms of judicial errors, it is likely that errors about the value of the diamonds will be common to the buyer's and the seller's estimated valuation. See *Cesarini v. United States*, 296 F. Supp. 3 (1969) (\$4,500 found in used piano purchased for \$15). Similar issues arise in stock valuations. Investors assessing the value of stocks, may likely make errors based on the riskiness of the investments due to general conditions of the market (known as systemic risks) and errors related to the specific risks of certain stocks (i.e., idiosyncratic risks). Though situations involving decomposable correlated errors occur, a more general formulation—reflecting errors that may or may not be correlated and that are not clearly decomposable—would be more realistic. Nonetheless, this generalization would significantly complicate the model without adding to the intuition of the broken elevator hypothetical.

⁸⁰Assume that $E(x_A) = E(x_C) = E(x_A) * E(x_C) = 0$, that is X_A and X_C are independent with expected values equal to zero (and similarly for X_B and X_C). See Paul Milgrom and John Roberts, *ECONOMICS, ORGANIZATION & MANAGEMENT* (1992) for a similar treatment in the context of comparative performance evaluation for executive compensation.

⁸¹The variance is determined as follows: $Var(v_A) = E[(v_A - E(v_A))^2] = E[(v_A - u_A(e))^2]$, which can be rewritten as $E[(u_A(e) + x_A + x_C - u_A(e))^2] = E[x_A^2] + E[x_C^2] +$

$$\text{Var}(v_A) = \text{Var}(x_A) + \text{Var}(x_C). \quad (1)$$

The variance involved in determining B 's valuation is

$$\text{Var}(v_B) = \text{Var}(x_B) + \text{Var}(x_C). \quad (2)$$

Using equations 1 and 2, the guesswork involved in the determining the property rule (i.e., the relative valuations) may be characterized as

$$\text{Var}(x_A) + \text{Var}(x_B). \quad (3)$$

Note that the court's common error component may be ignored in this case since it impacts both parties identically and therefore does not alter the relative magnitudes of the estimated valuations. Now the relative ease or difficulty of determining liability rules and the property rules may be gauged by comparing terms 1 and 3—that is, by comparing the total variance in the liability rule determination and the property rule determination:

$$\overbrace{\text{Var}(x_A) + \text{Var}(x_C)}^{\text{liability rule guesswork}} \underset{\text{property rule guesswork}}{\gtrless} \overbrace{\text{Var}(x_A) + \text{Var}(x_B)} \quad (4)$$

$E[2x_Ax_C] = \text{Var}(x_A) + \text{Var}(x_C) + 2\text{Cov}(x_Ax_C)$. Finally, since $\text{Cov}(x_Ax_C) = 0$ we have $\text{Var}(x_A) + \text{Var}(x_C)$. Similarly, $\text{Var}(v_B) = \text{Var}(x_B) + \text{Var}(x_C)$.

When the right-hand side of equation 4 is less than the left-hand side, the property rule is “easier” for the court in terms of total variance. Furthermore, since $Var(x_A)$ appears on both sides of the equation, we may simply say that property rules involve less guesswork when $Var(x_C) \geq Var(x_B)$. Intuitively, when common errors (x_c) are responsible for a significant portion of the variance involved in A ’s value, then property rules gain some relative advantage.⁸² Recall the broken elevator that created an obstructed the view of Professors Kaplow and Shavell’s lower halves. Consider the case where the elevator landed flatly between floors. From Judge Posner’s perspective the variance due to the elevator is common to both professors. Now imagine an extreme situation where only the heads and shoulders of Kaplow and Shavell are visible. In this situation, the randomness involved in determining their heights is so significant and common to both parties that Judge Posner may find it rather easier to guess who is taller as opposed to the approximate height of Professor Kaplow. In exactly this manner, when judicial errors are likely to be significant and common to both parties (i.e., positively correlated) then comparing magnitudes—the kind of exercise required for property rules—becomes relatively easier in relation to determining the value of a single party, the exercise required for liability rules. Alternatively, when the right-hand side of equation 4 is greater than the left-hand side (or simply when $Var(x_C) \leq Var(x_B)$), then the liability rule becomes relatively “easier.” Liability rules involve relatively less guesswork on the part of the court when the randomness in its determination of values is generally not common to both A and B .

2 Adding the First Moment to the Basic Model

The model thus far provides some insight for evaluating the relative judicial efforts required for property rules and liability rules. Yet, one might be concerned that the analysis’ exclusive focus on variance is too limiting. To illustrate this concern, let’s go back to the elevators. Assume that Judge Posner now stands before *two* elevators with the following instructions: When the doors of the elevators open (at which time he will observe one person in

⁸²In other words, if much of the randomness involved in determining the value for A is common to both A ’s and B ’s estimated values then property rules become relatively easier.

each elevator) he must make one of two determinations. He must either determine the height of the person in the left elevator, or he may elect to determine whether the person in the left elevator is taller or shorter than the person in the right elevator. Let's assume further that Judge Posner knows that the person in the left elevator is a center who was chosen randomly from the National Basketball Association (NBA), while the person on the right is a student from a local junior high school. In this case, the variance of height among centers in the NBA may be quite similar to the variance of height in the local junior high school and the correlation may be small. If he were to rely solely on a comparison of variances, Judge Posner would not take advantage of the information available to him. That is, since he knows (or believes, if you prefer) that the average height (i.e., the expected value of height) of a NBA center is significantly greater than that of most junior high school students, Judge Posner would be much better off making the relative comparison determination rather than a determination of a single height. Thus one may plausibly claim that property rules are relatively easier when there are significant differences in the expected values of the litigating parties.⁸³ To incorporate this consideration into the model, let δ represent the absolute difference in the means (or expected values) of the distributions of A 's value and B 's value,⁸⁴ i.e., $\delta = |u_A(e) - u_B(e)|$.⁸⁵ The equation for determining the relative difficulty of determining the liability rule and the property rule can then be adjusted to reflect consideration of expected values. For example, equation 4 may be rewritten as follows,

$$\underbrace{\text{Var}(x_A) + \text{Var}(x_C)}_{\text{liability rule guesswork}} \underset{<}{\overset{\geq}{>}} \frac{\underbrace{\text{Var}(x_A) + \text{Var}(x_B)}_{\text{property rule guesswork}}}{f(\delta)}, \quad (5)$$

⁸³Kaplow and Shavell alluded to this point when they observed that "property rules can be cheaper than the liability rule. For instance, suppose that the state can easily assign property rights to injurers because *prevention costs are usually very high relative to harm.*" Kaplow & Shavell, *supra* note 4, at 743 (emphasis added).

⁸⁴The expected value ($E[v_A] = E[u_A(e) + x_A + x_C]$) is equal to $u_A(e)$ since $E[x_A] = E[x_C] = 0$.

⁸⁵The difference in means is determined as follows: $\delta = |E[v_A] - E[v_B]| = |u_A(e) - u_B(e)|$.

where $f(\delta)$ is some appropriate function of δ that the judge chooses to reflect the importance he or she places on expected values.

The analysis thus suggests that judges may, and I would propose *do*, employ the means and variances of the relevant distributions when determining whether property rules are “easier” than liability rules. It must be emphasized, however, that the mean and the variance represent the simplest and most commonly derived measures characterizing distributions of random variables.⁸⁶ These measures belong to a class of measures known as the *moments* of a distribution,⁸⁷ where the mean is the first moment and the variance is the second.⁸⁸ Certainly “higher” moments may be, and perhaps ought be, utilized in this framework.⁸⁹ However, computations and interpretations of these measures are beyond the scope of this present analysis.

3 Accounting for More Rules

The analysis thus far has formulated the problem as whether the court is better able issue a liability rule (through determination of A 's valuation, v_A) or a property rule (by a comparison of the relative valuations of A and B , i.e., $v_A \geq v_B$ or $v_A \leq v_B$). This formulation implicitly restricts the court's choice of remedies to Rule 1, Rule 2 and Rule 3.⁹⁰ Calabresi and Melamed

⁸⁶It is also important to emphasize this this Article seeks only to offer a heuristic model, not a fully formal one. As discussed earlier, a dichotomous measure of covariance (i.e., decomposable common variance) limits the power of the model. Furthermore, focusing on variance of a point estimates does not reflect the leeway available to judges when determining liability rules. That is, judges need only determine valuation with sufficient accuracy to reach the correct liability rule. *See supra* Part II.A.1. Nonetheless, the model does capture the essence of the argument presented here.

⁸⁷More precisely, the class is referred to as moments about the mean of a distribution.

⁸⁸The mean tells us something about the typical or average value in the distribution and the variance tells us how spread out the values are in the distribution.

⁸⁹Such as the third moment, a measures skewness, which may clearly be useful to the court; just a measure of the “peakedness” or flatness of distributions might be called into use. Peakedness is captured by what is known as the coefficient of kurtosis, the fourth moment.

⁹⁰This or similar formulations are often reached by separating the issues of entitlement assignment and entitlement protection. Analyses often proceed sequentially, first determining to whom the entitlement will be assigned and then focusing on the form of

first addressed the nature of this restriction by introducing Rule 4, a liability rule (through determination of B 's valuation, v_B).⁹¹ To consider all four rules, equation 4 may be modified as follows:

$$\overbrace{\text{Min}\{Var(x_A), Var(x_B)\} + Var(x_C)}^{\text{liability rule guesswork}} \underset{\leq}{\overset{\geq}} \frac{\overbrace{Var(x_A) + Var(x_B)}^{\text{property rule guesswork}}}{f(\delta)},$$

where $\text{Min}\{Var(x_A), Var(x_B)\}$ under the liability rule guesswork bracket implies that the liability rule with lower variance (Rule 2 or Rule 4) is the relevant rule for comparison against the property rule guesswork. To illustrate the significance of this modification, consider a dispute between a buyer and a seller of a commodity. As courts often have difficulty assessing buyers' valuations (especially when buyers are known to impute nonmarket considerations into their values), the buyer's expectation damages (i.e., Rule 2) calculation may involve a significant amount of variance. On the other hand, the calculation required for specific performance (i.e., the property rule in favor of the buyer, Rule 1) or an excuse (i.e., the property rule in favor of the seller, Rule 3) may be easily assessable. In this case, property rules involve less guesswork than the Rule 2 liability rule. However, since the opportunity costs of performance (i.e., the seller's value) is often readily verifiable, a liability rule in favor of the seller (Rule 4) may require the lowest determination efforts. That is, Rule 4 may involve less guesswork than the property rules determinations, while Rule 2 involves more.⁹² To account for this case, the

entitlement protection: "Once the judge in [a case] has determined the initial allocation of the entitlement to the resource in question, there remains the matter of entitlement protection." Krier & Schwab, *supra* note 11, at 450. This sequential separation of assignment and protection, however, is sometimes inappropriate—not matching actual behavior—and often unnecessary.

⁹¹Calabresi & Melamed, *supra* note 1.

⁹²Generally, the total variance (or costs) involved in determining one party's valuation need not be (and generally is not) the same as the variance related to the other party's valuation. See *infra* Part III.D, which discusses asymmetric assessment costs in more detail.

equation above takes the liability rule with the lower variance and compares that to the property rules.⁹³

Having included Rule 4 in the analysis, a reasonable next step might be to add the “new” Rule 5 and Rule 6 (liability rules). These new rules are revealed by treating liability rules as options.⁹⁴ The options treatment of liability rules can be illustrated using the familiar example of a dispute between a polluter and a resident who is affected by the pollution. Under Rule 2, the polluter has a call option to buy the resident’s entitlement to unpolluted air (i.e., the polluter has the option to pollute as long as she is willing to pay the resident damages). Under Rule 4, the resident has a call option to buy the polluter’s right to pollute (i.e., the resident can have unpolluted air as long as she is willing to pay the polluter damages). Introducing put options, as opposed to call options, Rule 5 and Rule 6 materialize. If the polluter can choose whether to pollute or force the resident to pay her damages to stop her from polluting, then the polluter has a put option (Rule 5). On the other hand, if the resident can choose whether to have unpolluted air (i.e., enjoin the polluter) or make the polluter to pay her damages in return for polluting, then it is the resident who has the put option (Rule 6).

Form of Entitlement Protection

		Property Rule	Liability Call	Liability Put
Entitlement Assigned to	A	<i>Rule 1</i>	<i>Rule 2</i>	<i>Rule 6</i>
	B	<i>Rule 3</i>	<i>Rule 4</i>	<i>Rule 5</i>

How is the analysis of this Article affected by inclusion of these two new lia-

⁹³Yet ultimately, the court may not be able to freely choose among the four rules. There may be precedent, justice considerations or some other constraints, whereby the judge is limited in her choice among the entitlement assignment. The applications discussion of the Article addresses touches on some of these considerations.

⁹⁴See Avraham, *supra* note 14; Ayres & Balkin, *supra* note 30; Ayres & Goldbart, *Optimal Delegation*, *supra* note 14; Ayres & Talley, *supra* note 17; Krier & Schwab, *supra* note 11; Levmore, *supra* note 1; Morris, *supra* note 1; Rose, *supra* note 13.

bility rules? Let's begin to answer this question by first focusing on the two old liability rules: Rule 2 and Rule 4. Observe that under Rule 2, the court must determine the resident's valuation, and under Rule 4, the court must determine the polluter's valuation. These are the same valuations that the court must determine under the new rules.⁹⁵ That is, under Rule 5 the court determines the polluter's valuation (as it must under Rule 4) and under Rule 6 the court determines the resident's valuation (as it must under Rule 2). The addition of Rule 5 and Rule 6 does not introduce new variables for the court to determine—which is not to suggest that the costs of determining the resident's valuation are the same under Rule 2 and Rule 6.⁹⁶ Importantly, the resident's value may differ under these two rules. Under Rule 6, the resident has an unqualified right to prohibit pollution, which she may or may not exercise. Under Rule 2, the resident's right to unpolluted air may be appropriated by any polluter willing to pay the court determined damages.⁹⁷ Thus, the resident's valuation may be augmented by an endowment effect under Rule 6, but not under Rule 2.⁹⁸ This augmentation may add variance to the Rule 6 damage calculation, possibly making Rule 2 more easily determinable. A similar argument can be advanced about Rule 4 and Rule 5—that is, the put option (Rule 5) has more variance than the call option (Rule 4) due to endowment effects. If Rule 5 and Rule 6 necessarily have more variance, then it is not necessary to modify the theoretical framework since it already relies on the lower variance liability rules (Rule 2 and Rule 4). If, however, the endowment effect is not determinative of the relative variance between Rule 2 and Rule 6 (and Rule 4 and Rule 5 respectively), then equation 4 may be easily modified to consider all six rules. The modification would simply expand the $\text{Min}\{\cdot\}$ operator to include the variances of A 's and B 's valuations in the context of the put options formulation of

⁹⁵Regardless of the rule, damages are always set equal to the court's best estimate of the non-option holder's valuation. See Ayres & Goldbart, *Optimal Delegation*, *supra* note 14, at 8 (referencing Kaplow & Shavell, *supra* note 4).

⁹⁶Nor, for that matter, are the costs of determining the polluter's valuation the same under Rule 4 and Rule 5.

⁹⁷In this sense, Rule 2 offers a somewhat weaker form of entitlement protection. This point has been made Madeline Morris, who questions whether liability rules, which allow "a non-entitled party to force a transfer of an entitlement—even a compensated transfer—without the consent of the entitlement holder can be said fully to 'protect' that entitlement." Morris, *supra* note 1, at 842.

⁹⁸See Sunstein, *supra* note 26; Rachlinski & Jourden, *supra* note 27.

liability rules.⁹⁹

B Correlated Errors and Correlated Values

The key to understanding the relative ease of judicial determination with regard to these rules turns on the judge's likely measurement error. A comparative assessment of two values becomes increasingly reliable relative to the estimate of a single value when the magnitude of the court's errors is sufficient and common to both values. In other words, property rules become relatively easier for judges to determine when errors are strongly and positively correlated. Thus the first important implication of this analysis is that correlated errors can be determinative of whether property rules or liability rules are easier.

Previous Correlated Values Claims This Article is not the first to discuss issues of correlation related to property rules and liability rules. Both Krier and Schwab, and Kaplow and Shavell develop claims using notions of correlation to assess the relative superiority of property rules and liability rules. However, their treatments are distinct from each other's, as well as from mine. First, Krier and Schwab focus on correlation between the judge having high costs of determining an efficient liability rule and the parties having high costs of private bargaining. They suggest that those cases where it is difficult for a judge to calculate liability rules are also likely to be in-

⁹⁹There are other classes of liability rules beyond those mentioned above, wherein either the plaintiff or the defendant chooses to exercise a call or a put option (the so-called single chooser rules). For example, both parties may be given options that could be exercised sequentially (i.e., dual chooser rules) or the right to the right to veto an exercised option (joint veto rules). The court's optimal selection of who chooses in the single chooser rules (or the order of choice in the dual chooser rules) is driven, in large part, by its knowledge of the parties' valuations. See Avraham, *supra* note 14 and Ayres & Goldbart, *Optimal Delegation*, *supra* note 14 (presenting thoughtful analyses utilizing value correlation and means to compare these rules). Further, it may be that the informational burden on the court of, say, a dual chooser rule is lower than the informational burden of property rules. This might be the case, for instance, when the court's information about which party is the better chooser is vastly superior to its information about the parties' valuations.

stances with high private bargaining costs.¹⁰⁰ Krier and Schwab conclude that this correlation favors neither property rules nor liability rules.¹⁰¹

Kaplow and Shavell make a different correlation argument, which has elsewhere been referred to as the “tangibility argument.”¹⁰² In developing the tangibility argument, Kaplow and Shavell begin by decomposing the value that a party places on an entitlement into two components: first, a common value component, which is the same for all parties; and second, an idiosyncratic component that is unique to a specific party.¹⁰³ Next, observing the distinction between “nuisance entitlements” and “chattel entitlements,” or what Kaplow and Shavell refer to as “the causing of harm” and “the taking of things,” they apply their correlated values argument.¹⁰⁴ When it comes to disputes involving chattels or things (as opposed to, for example, nuisances¹⁰⁵), parties on both sides of a dispute largely experience shared valuations;¹⁰⁶ and in cases where valuations are shared (or positively corre-

¹⁰⁰For example, when parties fail to reach a privately negotiated solution in the presence of asymmetric information and strategic behavior, this same information asymmetry and behavior will often frustrate the judge’s efforts too.

¹⁰¹When “the very circumstances that make for high or low transaction costs also make for high or low assessment costs” with respect to the liability rule then “a principled choice between property rules and liability rules appears, once again, to be pretty hopeless as well.” Krier & Schwab, *supra* note 11, at 459.

¹⁰²See Ian Ayres & Paul Goldbart, *A Critique of “Tangibility” as the Basis of Probability Rules*, Working Paper # 251, PROGRAM FOR STUDIES IN LAW, ECONOMICS, AND PUBLIC POLICY, YALE LAW SCHOOL at 7 (2001) [hereinafter Ayres & Goldbart, *Critique of Tangibility*]; Ayres & Goldbart, *Optimal Delegation*, *supra* note 14, at 94-97.

¹⁰³See Kaplow & Shavell, *supra* note 4, at 759-760. It is important to note that the common versus idiosyncratic distinction drawn by Kaplow and Shavell is different from that which was presented in the formal model above. See Part III.A.1. The analysis in this Article focuses on common and idiosyncratic errors made by judges rather than common and idiosyncratic valuations belonging to parties. The implications of the different approaches are significant, as will be shown below.

¹⁰⁴See Ayres & Goldbart, *Critique of Tangibility*, *supra* note 102, at 9 (offering the useful labels of nuisance and chattel entitlements).

¹⁰⁵In cases of nuisance there is often no meaningful relationship between the harm that party suffers and the cost to a second party of abstaining from causing that harm. “[W]e suppose that the distribution of harm is statistically independent of the distribution of prevention costs. This assumption seems natural to make because, for example, one would not expect a firm’s cost of controlling emissions per unit to be correlated with a victim’s susceptibility to disease.” Kaplow & Shavell, *supra* note 4, at 727 n.43.

¹⁰⁶See Ayres & Goldbart, *Critique of Tangibility*, *supra* note 102, at 10 (noting that the

lated), liability rules, with damages set to average valuation, are less efficient than property rules.¹⁰⁷ Liability rules are relatively inefficient in this context because infringers with higher-than-average valuations will regularly usurp entitlements and pay only average damages to the entitlement holders. Overall, the entitlement holders will be undercompensated because they also place higher-than-average valuations on the entitlement (a fact derivable from the strong correlation between valuations). The basis of this argument is the relative efficiency of property rules and liability rules, which is not the same as the relative efficacy of judicial determination of property rules and liability rules.

The heuristic model presented here does not address the relative efficiency of the rules *per se*; rather, the model focuses on the relative valuation costs of the rules. The analysis indicates that as the court's likely common errors in assessing the valuations become larger, then property rules become relatively easier to determine. That is, at any given level of effort or costs, the relative accuracy of property rules increases with the common error component of the judge's estimates (though it may still be the case that liability rules are more easily determined and superior to property rules along other lines).

Additionally, unlike Kaplow and Shavell's tangibility argument, the important correlation here is not between the *true* valuations that parties place on entitlements, but rather between the valuations judges perceive and the nature of the errors they are likely to make. In terms of the elevator hypothetical, when the malfunctioning elevator blocks exactly the same amount of the parties' lower halves, Judge Posner may misperceive the information before him in a highly correlated manner. This implies that determining who is taller (the property-rule-like calculation) may be easier for the judge, regardless of any correlation between the actual heights of the parties. Of course, when actual values are correlated, then the likelihood of correlated errors increases. Thus, there is a meaningful connection between correlated values and correlated errors, but not a necessary one. Consider the following.

potential exchange value of things is a major source of correlated valuation).

¹⁰⁷Ayres and Goldbart, however, demonstrate that the relative superiority of property rules and liability rules is invariant to the magnitude of correlation between the parties' valuations. "Put simply, if a liability rule dominates in the absence of any common value variation, it will continue to dominate even if the common value variation becomes arbitrarily large." *Id.* at 30.

When there is no correlation between actual values, as is often the case with pollution externalities, Kaplow & Shavell suggest that comparing the harm caused by such externalities and the costs of reducing this harm is like comparing apples and oranges. The values of these entities are not likely to be correlated and therefore “are not immediately comparable, so it is necessary to quantify each” to determine a property rule.¹⁰⁸ Yet, in quantifying each, there may be correlated errors in the judge’s estimates.¹⁰⁹ This implies that optimal property rules may be relatively easier to determine even when there is no correlation between underlying values.

Furthermore, even when there is significant correlation between underlying values, it is possible to have uncorrelated errors. This occurrence is not only possible but, as Ayres and Goldbart argue, it may be more common than a superficial analysis would suggest.¹¹⁰ A superficial analysis might suggest that since parties tend to have correlated or shared values for “things” (in the sense used by Kaplow and Shavell), it is reasonable to assume that judicial errors in estimating the values of things will also be highly correlated. However, Ayres and Goldbart point out that judges may not safely rely on this assumption. They observe that the shared values for things tend to be reflected in market prices or other markers that are observable to judges. But it is precisely the idiosyncratic aspects of an entitlement’s valuation that are generally unobservable to judges. Since judges often cannot observe these idiosyncratic privately known aspects of the parties’ valuation, errors involving property rules are likely to result even in the context of significant common values.¹¹¹

¹⁰⁸Kaplow & Shavell, *supra* note 4, at 729 n.49.

¹⁰⁹It is *this* correlation between errors—rather than between actual values—that drives the theoretical analysis of this Article.

¹¹⁰Ayres & Goldbart, *Critique of Tangibility*, *supra* note 102, at 10.

¹¹¹“This is not to say that there cannot be correlated values that are privately known, only that the strength of the tendency may not be as great as Kaplow and Shavell suggest...”
Id.

C Valuation Costs and Error Costs

The discussion thus far has focused almost exclusively on the costs of estimating relative and absolute valuations (i.e., valuation costs¹¹²). There are, however, other costs related to selecting and implementing property rules and liability rules.¹¹³ Among the most frequently addressed are error costs—the costs of making an inefficient property rule choice or reaching a damage estimate that leads to inefficient results.¹¹⁴ Krier and Schwab, among others, have addressed the relative merits of property rules and liability rules based on error costs and valuation costs. The problem can be reduced to the following question: “Which kind of rule, property or liability, promises to minimize the sum of valuation and error costs?”¹¹⁵ Of course, one might also add relative monitoring costs to this sum, as well as the costs of subsequent litigation and further valuation costs related to that litigation and so forth. As Krier and Schwab suggest, reaching an answer to this question can become a hopeless enterprise.¹¹⁶

Fortunately, the analysis presented here need not embark on that enterprise to address the debate that motivates this Article. The debate is not about minimizing the costs of judicial implementation of rules; rather, it is about the relative difficulty of estimating property rules or liability rules. Once valuation is assessed, then implementation may lead to relatively more or less costs—error costs among others—under a property rule regime or a liability rule regime. These costs are separate and distinct from the relative costs of determining the rules. As a conceptual tool, imagine that post-judgment transaction costs are zero, meaning that the optimal allocation will costlessly be reached by the parties following the judge’s determination.¹¹⁷ In this case

¹¹²Krier & Schwab, *supra* note 11, at 459. These costs are sometimes referred to as process costs (see Schwartz, Encyclopedia of L&E).

¹¹³There are monitoring costs, for instance, which tend to be greater for property rules, but not necessarily so. Monitoring costs (and error costs) are not explicitly included in the analysis for reasons discussed below.

¹¹⁴Even if these inefficiencies are reversible through private bargaining, the costs of corrective private bargaining efforts are also properly considered as error costs.

¹¹⁵Krier & Schwab, *supra* note 11, at 459.

¹¹⁶Krier & Schwab focus more on the problems related to incomensurability of valuation costs and error costs, problems which they argue become essentially intractable in the context of correlation between these costs. *Id.*

¹¹⁷Implicit in this is the assumption that pre-judgment transaction costs are not zero,

the error costs go away, but the valuation costs of assessing property rules and liability rules remain.¹¹⁸ The zero transaction costs assumption highlights the fact that valuation costs may be considered in isolation of error costs. The analysis presented here does not require error costs to answer its motivating question: whether judges are more easily able to determine property rules or liability rules. There may be consequences that follow such determinations, but these are subsequent (albeit important) issues that follow the relative determination question.¹¹⁹

D Asymmetric Valuation Costs

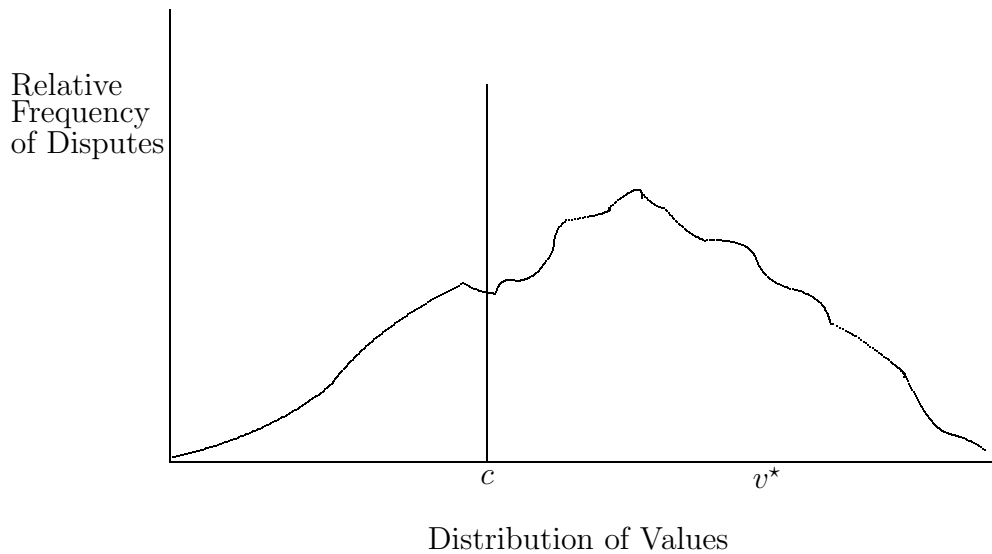
In the debate over the informational burden of determining property rules and liability rules, one common assumption is that the court has equal difficulty in assessing each party's valuation. Clearly, this need not be, and often is not, the case. One valuation is frequently known or knowable with sufficient specificity at a reasonable cost. Therefore, the relevant comparison made by the court is not necessarily between two unknown valuations with equal variance. Instead, the court often attempts to assess an unknown value in comparison to a known value. If the plaintiff's value is known (or know-

which is required for that matter to reach the judge.

¹¹⁸One might observe that these valuation costs bear little consequence, since the *ex post* bargaining between the parties will set matters correct. The judge may simply pick a property rule at the flip of a coin or she may randomly pick a dollar figure under a liability rule. In either case, both the costs of flipping a coin and the costs of some other simple random selection mechanism are low, and cannot be distinguished on principled grounds. Thus, the judge may select either property rules or liability rules without any costs or efforts because it simply does not matter (in terms of *ex post* allocational efficiency). However, if the judge is not completely confident of the *ex post* bargaining solution or if she is otherwise motivated to make the allocationally efficient decision, then the valuation costs may have meaningful consequences.

¹¹⁹One might usefully speculate about the relationship between error cost and valuation costs. For example, when it comes to property rules, error costs may be inversely related to valuation costs. That is, if the parties' valuations for an entitlement are very close, then it may become difficult to tell who values it more. In this case the efficient property rule might be hard to determine, but the cost of an incorrect rule should presumably be low given the nature of the parties' relative valuations. In terms of the model, as $f(\delta)$ increases, it was shown that the property rule becomes increasingly relatively easier, yet the costs of an incorrect property rule also increases.

able at low cost), then the liability rule is easier to determine.¹²⁰ This point is illustrated in the figure below, which depicts the distributions of possible values for a buyer and a seller in a dispute involving a breach of contract.

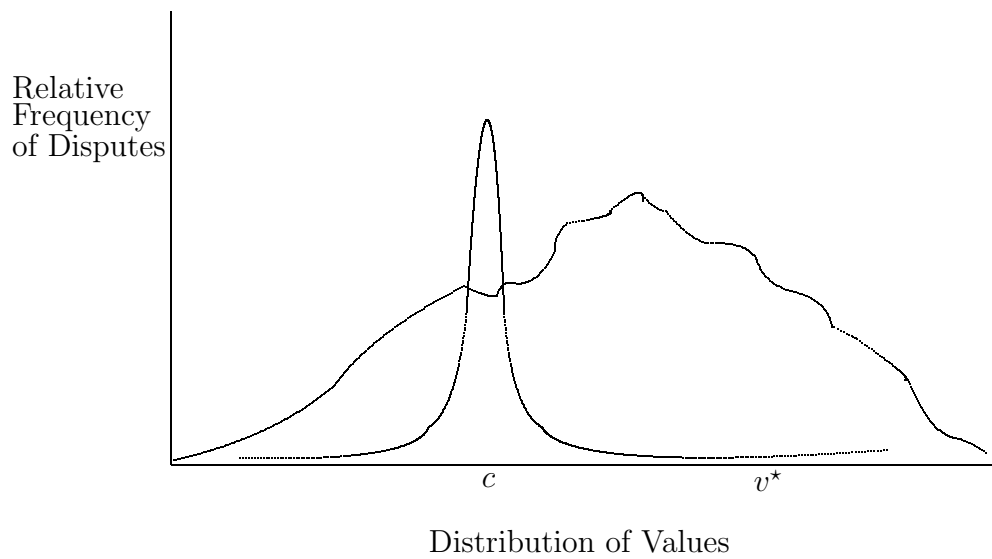


Assume that the seller's breach has been clearly established and the court is seeking to remedy the breach with a property rule (specific performance) or a liability rule (money damages). Assume further that the seller's costs of performance (*ex post*) are known and represented by c in the figure. Now the court's task of determining whether the buyer's valuation (v^*) is greater or less than the seller's cost may be easier than determining the buyer's valuation with sufficient certainty. In terms of the discussion of variance above, when costs are known, then $Var(x_B) = 0$, which implies that the property rule is relatively easier since $Var(x_A) \geq Var(x_B)$.¹²¹ Even when the seller's value is not known with certainty, but its variance is falling, i.e.,

¹²⁰If the defendant's value is known, then the property rule may be easier to determine, assuming that the defendant will not receive liability rule protection.

¹²¹The liability rule in favor of the seller (Rule 4) is the easiest to calculate here since the seller's valuation is known. However, that rule is generally not available for reasons discussed at length in the next Part of the Article.

$Var(x_B) \rightarrow 0$, then the court's ability to determine the appropriate property rule rises relative to its ability to determine the correct monetary award. The figure shows a diagram where the seller's costs are not perfectly observable to the courts, but the variance is fairly small. Under these circumstances it may remain optimal to use a property rule.



IV Applications

In this Part I apply some of the insights from the model to further our understanding of the choice between property rules and liability rules. As previously stated, no catch-all theory that can fully explain how judges make, or should make, this choice. There are many reasons why property rules are chosen in some settings and liability rules in others. The discussion in this Part of the Article will not belie this reality by claiming more of the model than it is able to offer. The aim here is to use the model to assist in explaining some remedial regularities in various areas of law, including contract, tort and property.

A Contracts

As noted above, Calabresi and Melamed do not discuss contract remedies,¹²² nor do Kaplow and Shavell. Ayres and Goldbart suggest a likely reason for this omission is that neither Calabresi and Melamed's nor Kaplow and Shavell's models explain why liability rules are the default in contractual disputes. "Calabresi and Melamed's [theory] held that property rules should dominate when transaction costs were low—but with ... contractual entitlements where parties have already demonstrated an ability to [transact], the law protects entitlements with the liability rule of expectation damages."¹²³ Ayres and Goldbart also observe that "Kaplow and Shavell's correlated-value claim leads us to expect that contractual entitlements would be protected by property rules, when they are not."¹²⁴ This Part uses the theoretical framework presented earlier to provide some support for existing patterns of remedial defaults in contractual disputes.

Liability rules are overwhelmingly used by courts as the remedial default in breach-of-contract cases. The model suggests that such a preference for liability rules may develop where judges are less likely to make significant errors that are common to both parties when estimating values. To clarify,

¹²² See *supra* note 1.

¹²³ Ayres & Goldbart, *Critique of Tangibility*, *supra* note 102, at 9.

¹²⁴ *Id.*

let's momentarily jump ahead. The next section, focusing on tort law applications, argues that nuisances may be usefully thought of as a single activity producing two distinct products: a base product that the person creating the nuisance enjoys, and a by-product that the person complaining of the nuisance endures. Since these disputes involve distinct products, with probable distinct values, judicial errors are less likely to be correlated or common to both parties. The model thus predicts that liability rules have a relative advantage over property rules in such nuisance cases.¹²⁵ Leaving nuisances for the moment, one might observe that contracts cannot be usefully conceived as involving distinct products. Contracts are quintessentially characterized by a shared recognition of what is being traded, that is, "consensus ad idem" (agreement on the same thing). Absent this shared understanding, courts will often say there is no contract at all.¹²⁶ Thus a perception of distinct products may imply lack of mutual assent or mistake, triggering judicial recourse falling under formation or excuse doctrines, rather than the breach remedies of specific performance (property rule) or money damages (liability rules).¹²⁷ The distinct products argument cannot provide a useful framework for the judicial preference for liability rules in breach-of-contract cases. Still, the model may usefully be employed. First, however, we must partition breach of contract cases into those involving service contracts and commodity contracts.

1 Service Contracts

For contracts that involve one party performing a service, as opposed to delivering a commodity, the typical remedy for breach is a liability rule. Liability rules are preferred in this context for several well-known reasons.¹²⁸

¹²⁵Of course, property rules are the default in nuisance cases, contradicting the suggestion of the model. See *infra* Part IV.B, which offers a lengthy discussion reconciling this seeming contradiction.

¹²⁶The classic case demonstrating this principle is *Raffles v. Wichelhaus*, Court of Exchequer, 1864, 159 Eng.Rep. 375, where a contract for delivery of cotton of a ship named Peerless was not formed because the parties each had a different "Peerless" in mind.

¹²⁷Formation or excuse doctrines may themselves be thought of as property rules.

¹²⁸Common law-based breach of service or labor contracts will not, as a default, be afforded specific performance, see e.g., *Barndt v. County of Los Angeles*, 259 Cal. Rptr. 371 (Ct. App. 1989). However, specific performance is often granted under statutory-based

The three most common reasons are (1) court resistance to “involuntary servitude,”¹²⁹ (2) prohibitive court monitoring costs,¹³⁰ and relatedly (3) the problem of moral hazard on the part of the service performer.¹³¹ This analysis provides another justification for the liability default in service contracts. One ought not necessarily expect a strong positive correlation between the cost of providing a service and the value another party gets from this service, especially in cases where a breach has occurred.¹³² Therefore the judge’s errors are less likely to be correlated or common to both parties, implying that liability rules are relatively easier to determine in this context.¹³³

claims, such as breach of employment contract based on gender or racial discrimination, *see e.g.*, *Williams v. City of Montgomery*, 550 F.Supp. 662 (M.D. Ala, 1982).

¹²⁹Courts have held it against public interest to impose what may be viewed as forced labor. Courts, however, are more willing to impose negative injunctions that prohibit a breacher from performing the service elsewhere for a limited time, *see e.g.*, *Lumley v. Wagner*, 42 Eng. Rep. 687 (Ch. 1852) (prohibiting an opera singer, who breach her performance contract, from performing for another party during specified time); *Shubert Theatrical Co. v. Rath*, 271 F. 827 (2d Cir. 1921) (enjoining acrobats from elsewhere performance); and *American Broadcasting Co. v. Wolf*, 52 N.Y.2d 394, 420 N.E.2d 363 (restricting a sportscaster from working for another network for a limited time).

¹³⁰Courts are typically unwilling to specifically enforce labor agreements that require continued and careful supervision (such as construction contracts) because of the specialized skills and knowledge that are required for such projects. However, where there is a substantial public interest at concern, courts have been willing to undertake extensive supervisory roles, *see e.g.*, *Laclede Gas Co. v. Amoco Oil Co.*, 522 F.2d 33 (8th Cir. 1975).

¹³¹ “[E]ven absent an adequate remedy at law, equity will not specifically enforce contract for personal service ... because ‘the mischief likely to result from the enforced continuance of the relationship ... is so great that the best interests of society require that the remedy be refused.’ ” E. Allen Farnsworth, *CONTRACTS*, P.781 (3d. 1999) (quoting from *Fitzpatrick v. Michael*, 9 A.2d 639 (Md. 1939)).

¹³² *Cf.* Ayres & Goldbart, *A Critique of “Tangibility”*, at 10-11 (observing, “[v]aluations of contractual entitlements to services will tend to be correlated (even though the cost of performance and the benefits of use may be independent) because the exchange value is likely to be correlated.”) This point is well taken, though breach often implies a disruption to prior correlation.

¹³³ When the party who is scheduled to receive the service (i.e., the buyer of the service) breaches then the default may be thought of as specific performance or money damages, implying that property rules and liability rules are equally difficult in this context.

2 Commodity Contracts

Liability rules are often, though not always, the default for contracts that involve the exchange of a commodity. To justify the defaults here, let's again partition the class of cases into two sets. In the first set, place those cases where there exist well-established relatively efficient markets for the commodity in the contract. The second set consists of cases where there are no such markets. When there is a well-established market for the stipulated commodity, the default is a liability rule.¹³⁴ Liability awards are easy to calculate based on prices in the market. Even where prices do not fully reflect the buyer's valuation,¹³⁵ the existence of a market means that the buyer may go elsewhere to acquire the commodity at the market price, making constructive performance a viable option.¹³⁶

Further, existing correlations between the costs of providing a commodity on the seller's part and the valuation that the buyer places on it are often disrupted when breach occurs. Why? Breach is generally due to an unexpected increase in the seller's costs.¹³⁷ When the increase in costs is unique to a particular seller, any close prior relationship between that seller's costs and the buyer's valuation may be substantially weakened. With a weakened correlation, common judicial errors become less salient, leaving liability rules in a relatively advantaged position in terms of determination efforts. Of course, given the existence of an efficient market, the high-cost seller can presumably secure the commodity through a transaction with a lower-cost seller. Yet, this transaction may be prohibited by the conditions in the market or strate-

¹³⁴This liability rule may be restitutional damages, reliance damages or most commonly expectation damages.

¹³⁵Market prices reflect the lowest value that a buyer in the market places on the good, so it is almost by definition less than the value of a typical buyer. This difference between the buyer's valuation and market price is commonly called as consumer surplus.

¹³⁶The transaction costs related to making the purchase elsewhere can easily be, and generally is, reflected in the damage award. *See* Uniform Commercial Code (UCC) Article 2, §§2-710 and 2-715 (discussing seller's and buyer's incidental damages).

¹³⁷The discussion in the text proceeds using the seller as the breaching party. When it is the buyer who has breached, the property rule and the liability rule often converge to be the agreed upon contract price. If the buyer has promised something other than (or in addition to) a payment of money, then the analysis is similar to that of the seller's breach. Namely, question whether it is a service or commodity that was promised, and if it is a commodity look for the existence of a well-function market to be determinative.

gic behavior among sellers. On the other hand, when an unexpected increase in costs affects all sellers then prior correlations between buyers' and sellers' valuations are more likely to be preserved. The commodity that the buyer contracted for increases in value when the costs of providing it increases generally. In this case, property rules are relatively advantaged because judicial errors relating to the seller's increased costs will similarly impact the court's estimate of the buyer's heightened valuation. Interestingly, these are exactly the cases where courts have shown willingness to deviate from the liability rule default and issue specific performance. That is, when the seller breaches and the buyer argues that getting the good elsewhere (i.e., covering) is prohibitively costly. The the buyer's inability to cover counts strongly in favor of awarding specific performance,¹³⁸ though covering itself may be thought of as a property rule.

Now let's consider the second set of commodity contract cases—those cases where markets do not exist for the commodity in the contract. These are essentially breach cases involving unique goods, and the default rule is a property rule. Breach of contracts to deliver hard to find or replace items (such as works of art, heirlooms and land) typically trigger specific performance. As noted above, inability to cover (i.e., to purchase elsewhere) weighs in favor of specific performance. Liability awards are more difficult to calculate without a market to form a basis of the buyer's valuation and to provide an alternative source for the commodity's acquisition. Thus property rules are common in cases where the commodity is not homogeneous, which is a form of market failure. That is, a failure relative to competitive market results that are produced by the interaction of many buyers and many sellers trading a homogeneous (non-unique) commodity with limited transaction costs. Even when there is an established price, such as with real estate, the uniqueness of the commodity implies that using that price to determine the liability rules may be inadequate, without the backup of a market where the buyer may pursue constructive performance. The analysis in this work further suggests that since the transaction involves a commodity (or what Kaplow and Shavell would call a "thing"), we might expect some correlation in the judge's errors the of buyer's and the seller's valuations.¹³⁹ Therefore

¹³⁸ See *e.g.*, UCC Article 2 §2-713, comment 3.

¹³⁹ This claim is made notwithstanding the previous discussion about the disruption of correlation especially in the case of beached contracts.

given the increased difficulty of calculating the buyer's valuation and the likelihood of positively correlated or common judicial errors, the property rule determination becomes relatively easier when a market for the commodity does not exist.

B Torts

This Part applies the analysis to tort cases involving nuisances and accidents. The discussion of nuisances focuses on common nuisances and industrial pollution. Other forms of intentional harm to persons (such as, assault, battery and infliction of emotional distress) are not considered below, though trespass and other infringements of land, chattels and intellectual property will follow in the section on property law.

1 Nuisances

Judges choose between property rules and liability rules for a wide variety of reasons.¹⁴⁰ Many of these reasons are situationally more compelling than the relative ease or difficulty of a determining the appropriate rule. For instance, the bases behind the default remedy for breach of a service contracts (as discussed previously) rest more significantly on issues relating to prohibitions against forced labor and moral hazard problems rather than on the relative judicial assessment costs of property rules and liability rules.¹⁴¹ Nuisance provides another example where factors other than the relative costs of rule determination is predictive of the default rule. However, the relative determination model does provide a useful lens for observing the court's willingness to deviate from its default. To demonstrate this, the discussion below begins with some preliminaries about the default and then applies the model to "common nuisances" and "industrial pollution."

¹⁴⁰ See *supra* notes 16 to 29 for a illustrative though incomplete list of possible bases for selecting one rule or the other.

¹⁴¹ Still, relative assessment costs may provide a partial explanation. See discussion of service contracts *infra* §1.

Preliminaries Economists refer to a single input or activity that generates multiple outputs as joint production. Traditional economic examples of a joint production include cows producing both beef and leather, and sheep producing mutton and wool. There are many non-pastoral cases of joint production as well.¹⁴² Some economists have gone so far as to suggest that most production efforts may be characterized as joint production.¹⁴³ One might even characterize nuisances, such as industrial pollution, as a joint production activity. The firm's activity produces a valuable output, which it sells to consumers in the marketplace, in addition to a second output, which is consumed by the party complaining of the nuisance. It is unimportant for this analogy that the complainant derives disutility from consuming the second output (or by-product). The key feature is that the two outputs are different and in all likelihood they would have a different value even when consumed by the same party. Since valuations are distinct and often unrelated, judges are unlikely to make significant common errors. Therefore, a presumption in favor of liability rules in nuisance cases may be advanced. This presumption is only limitedly reflected in practice, where property rules are the standard default.

Common Nuisances Examples of common nuisances include loud late-night parties, roaming pets, and foul odors. A common thread of these nuisances is that they usually involve neighbors. Neighbors are bound to each other, which is to say that one neighbor cannot pick up and leave without incurring substantial transaction costs. Thus simple damages are unlikely to cure nuisances of this kind—nuisances that are often repetitive and long-term in nature. The long-term relational character of neighborly interaction requires a fairly absolute and permanent solution (such as property rules)

¹⁴²Another example may be found in the blood industry, where whole blood is used to produce both plasma and red blood cells. There are separate markets for plasma and for red blood cells, just as there are separate markets for leather and beef. Many other processes may be characterized as joint-production industries, such as natural gas (producing gas and coke) and crude oil (producing gasoline and several other independent products).

¹⁴³See *e.g.*, F.W. Taussig, *The Tariff Act of 1913*, 8 QUARTERLY JOURNAL OF ECONOMICS (1913) (describing any situation where a plant or equipment is used to produce multiple items as involving joint production.); *Cf.* A.C. Pigou, *Railway Rates and Joint Costs*, QUARTERLY JOURNAL OF ECONOMICS (1913) (introducing the notion of “shared costs” to distinguish Taussig’s expansive notion of joint production).

to prevent repeated conflict with the ever present threat of escalation over time. Commentators have also noted that there are often low transaction costs involved in getting two neighbors to bargain around an inefficient property rule.¹⁴⁴ However, neighbors can also bargain around inefficient liability rules, and permanent damage awards offer the same absolute quality as property rules. Why then are liability rules not used more frequently in common nuisances? The answer is straight-forward. First, forecasting and quantifying the harm for permanent damages represents a tremendous evidentiary burden.¹⁴⁵ Second, and relatedly, once the damages are paid, the defendant faces a significant moral hazard problem which could lead to increased nuisance activity beyond the forecasted level. Certainly, the plaintiff may then pursue additional actions for damages, but these additional legal actions undercut the motivation for permanent damages in the first place. For the reasons above, common nuisances are typically resolved with property rules.

Industrial Pollution Property rules are less uniformly issued in nuisance cases involving industrial pollution.¹⁴⁶ To determine the optimal property rule in these cases, the court must weigh the plaintiff's costs of consuming pollution (hereinafter pollution costs) against the firm's prevention costs. Prevention costs are the costs of limiting the plaintiff's consumption of the pollution, which is the lesser of the firm's shutdown costs and pollution abatement costs.¹⁴⁷ When the firm's shutdown costs are higher, the court compares

¹⁴⁴See Calabresi & Melamed, *supra* note 1. Additionally, the administrative costs of the liability rule may be higher: "if property rule assignments of entitlements tend to resemble optimal assignments, then property rules involve low administrative costs. Under liability rules, however, administrative costs will be borne whenever harm optimally occurs, because damages will be paid." Kaplow & Shavell, *supra* note 4, at 755.

¹⁴⁵See Cooter & Ulen *supra* note 30, at 176-77 (discussing the difficulty of estimating permanent damages).

¹⁴⁶*Cf.* Kaplow & Shavell, *supra* note 4, at 748 n.111 (arguing that industrial pollution is significantly controlled through state regulation, which may be thought of as a property rule, where the state (rather than private parties) seek enforcement of the entitlement protection).

¹⁴⁷There are a variety of ways that a firm might limit the plaintiff's consumption of the pollution. First, it could stop, reduce or relocate its production activities. The costs associated with these actions—roughly, the opportunity costs of production—are, for convenience, summarily referred to as "shutdown costs." Second, the firm could limit consumption of the pollution at the site of production by installing scrubbers or other pollution abatement equipment. Third, it could limit pollution at the site of consump-

abatement costs with the plaintiff's pollution costs. Since pollution costs tend to be positively correlated with abatement costs,¹⁴⁸ it may be easier for the court to determine the property rule (i.e., whether pollution costs are greater than prevention costs) than the liability rule (i.e., determining pollution costs with sufficient accuracy). Thus, when pollution and prevention costs are highly correlated, the choice of the property rule default is supported by the relative costs of remedy determination.¹⁴⁹ However, pollution costs and prevention costs are frequently not correlated at all.¹⁵⁰ For example, when the least-cost option for the firm is simply to move the plaintiff, there is little reason to assume that this cost is correlated with the plaintiff's pollution costs.¹⁵¹ Therefore, liability rules may be relatively easier to determine in this context. Indeed, in this context, courts appear willing to shift from the property rules default to liability rules. The courts' willingness to

tion by, for example, installing filters in the home of the plaintiff. Fourth, the firm could stop the plaintiff's consumption by moving the plaintiff to another residence. Using this option, the firm may avoid future action from third parties by purchasing and holding the plaintiff's original residence. The Article shall refer to the second, third and fourth alternatives as the costs of abatement. Combinations of all of the above alternatives as well as other options may also be employed. The key point is that the real cost to the firm is the least costly method of limiting consumption of the offending output.

¹⁴⁸ “[A] firm’s *total* prevention [i.e., abatement] costs and a victim’s *total* harm [i.e., pollution costs] will be correlated because both will rise with the quantity of the firm’s emissions.” Kaplow & Shavell, *supra* note 4, at 727 n.43. For example, if the firm abates by installing and maintaining scrubbers or filters, then installation and maintenance costs should plausibly increase as production does. Since, increases in production also generally imply more pollution and consequently higher costs of consuming pollution, total pollution consumption costs and total abatement costs will often rise and fall together. However, focusing on marginal costs rather than total costs, Kaplow and Shavell, persuasively argue that at the margin, these costs are not correlated: “[O]ne would not expect a firm’s cost of controlling emissions per unit to be correlated with a victim’s susceptibility to disease.” *Id.* Less persuasively, they conclude that their analysis can disregard the correlation at the aggregate level since courts can observe the total quantity of a firm’s emissions, and adjust damages accordingly. Commentators and scientists, however, have long expressed the difficulty of measuring actual levels of pollution emissions from firms. *See, e.g.*, Smith, *supra* note 57, at 687.

¹⁴⁹ This conclusion presumes that the court has decided to assign the entitlement to the plaintiff. If the

¹⁵⁰ Furthermore, the court’s *errors* in estimating costs need not be correlated even when the underlying costs are. *See* discussion of correlated errors and correlated values, *supra* Part III.A.3.

¹⁵¹ Similarly, one would expect little to no correlation between the costs of shutting down (or relocating) the firm and the plaintiff’s pollution costs.

shift, however, has less to do with correlated errors than with other aspects of the model *inter alia*.

Understanding Shifts from Property Rule Default Why are liability rules are sometimes used in industrial pollution cases? To answer this, consider the case where the firm’s least-cost method of limiting its pollution is to scale back operations possibly to the point of shutting down. In this case, the court’s task is to compare the plaintiff’s pollution costs with the firm’s costs of shutting down or scaling back its operations, which translates into lost profits.¹⁵² It is unlikely that judicial errors relating to the calculation of lost profits will be correlated with judicial errors related to the plaintiff’s pollution costs. Just as a rancher’s expected sales of beef has little correlation with a neighboring homeowner’s cost of smelling cow manure on her front porch.¹⁵³ The court may thus shift from its property rule default to a liability rule because the covariance between court errors of the parties’ values ($Var(x_C)$) is small. That is, the common errors made by the court are likely to be trivial—which, according to the model, implies that liability rules are relatively advantaged.

Furthermore, the model suggests another, more compelling, argument for why and when courts are willing to shift from the property rule default. The essence of this argument has been previously observed by Richard Epstein: “The art of wisdom in these cases is to ask what disparity in value is sufficient to shift the presumption away from the conditional injunction to the dam-

¹⁵²In some cases the firm’s costs of shutting down will be distinct from and easier to determine than lost profits *per se*. For example, if the firm’s operation may be feasibly relocated then the costs to the firm is simply the relocation costs. When relocation costs are easy to determine in many cases, though they are sometimes difficult to establish. For instance when the firm faces, in addition to moving costs, unpredictable start-up costs in the new location and hard to quantify lost goodwill in the old location.

¹⁵³The activity level of the rancher’s operations may be an underlying source for correlation between expected beef sales and the homeowner’s disutility of smelling cow manure. That is, the rancher’s expected lost sales and the homeowner’s disutility may be correlated because the both tend to increase with the number of cows on the ranch. So, if the court significantly underestimate the number of cows on the ranch, then it simultaneously underestimate the rancher’s expected lost sales and the homeowner’s disutility. The question then becomes, how significant is this common error.

age award.”¹⁵⁴ Disparities in values will sometimes encourage courts to use liability rules. Why? In terms of the model, when the absolute difference in expected values increases (i.e., a very big $f(\delta)$ in the equations), it becomes relatively easy to determine whether a property rule is efficient. When courts can clearly and confidently determine that a property rule is not efficient then liability rules are often sensibly chosen. This argument may be best illustrated by reviewing some instances where courts have issued liability rules for nuisances.

The classic instance of a liability rule in a nuisance case is *Boomer v. Atlantic Cement Co.*,¹⁵⁵ wherein a cement plant generated pollution affecting local residents. The New York Court of Appeals issued an order for permanent damages rather than granting injunctive relief to the plaintiffs. In reaching this decision the court relied on figures suggesting that the cement company valued the entitlement at nearly 250 times that of the residents.¹⁵⁶ In this case the difference in the expected values played a significant role. It was easier for the court to determine that the cement company had a higher value for the entitlement than it was to determine the value of the entitlement to the residents. That is, the court could easily determine the efficient property rule, which demanded that the entitlement go to the cement company and not the residents.¹⁵⁷ Yet, offering the residents no protection worked against the court’s justice concerns. In cases where “efficiency and justice concerns point in the same direction [then the matter] is relatively simple.”¹⁵⁸ However, when they point in opposite directions, as they did in *Boomer*, then the matter is more complicated. In *Boomer*, justice required that the court protect the neighbors’ entitlement, while efficiency required that the form of protection *not* be a property rule. The court was left with only one option

¹⁵⁴Richard A. Epstein, TORTS 371 (1999).

¹⁵⁵257 N.E.2d 870 (N.Y. 1970).

¹⁵⁶The permanent damages for the residents was estimated at \$185,000, while the operational value of the cement plant was estimated to be \$45 million.

¹⁵⁷Protecting the resident’s entitlement with an injunction would lead to a significant reduction in economic welfare since they valued the entitlement much less than the firm. In many cases, post judgment bargaining will prevent the welfare loss from occurring because a high valuing firm would be willing to buy the entitlement from the residents for an amount much greater than their costs of enduring the pollution. However, in this case, the number of residents imply high transaction costs, with a strong possibility of holdouts. It is likely that post-judgment bargaining would not occur.

¹⁵⁸Krier & Schwab, *supra* note 11, at 447.

that was consistent with both its efficiency and justice concerns.¹⁵⁹

*Spur Industries Inc. v. Del E. Webb Dev. Co.*¹⁶⁰ is another classic example of a liability rule in a nuisance case. In this case, Del Webb's residential development (Sun City) expanded to abut a preexisting cattle feed lot belonging to Spur Industries. The court viewed the value of the housing development as clearly greater than the feed lot, so the efficient property rule was easily determinable. The efficient property rule would give the entitlement to Del Webb. However, as Del Webb "came to the nuisance," justice favored Spur Industries. As with *Boomer*, efficiency pointed one way and justice another. The court in *Spur Industries* found it relatively easy to determine that Del Webb and the Sun City residents had a higher value for the entitlement than feed lot owner. Yet, despite the relative ease of determining the optimal property rule, the court opted to use a liability rule, ordering Del Webb to compensate Spur Industries for its forced relocation.¹⁶¹ When justice calls

¹⁵⁹*Cf. Whalen v. Union Bag & Paper Co.*, 101 N.E. 805 (N.Y. 1913), where the New York Court of Appeals ordered a presumably inefficient property rule by granting a plaintiff with harm assessed at \$100 annually an injunction against a paper mill worth over \$1,000,000. Faced with a conflict of efficiency and justice, the court here picked justice, choosing not to compromise with a liability rule: "Although the damage to the plaintiff may be slight as compared with the defendant's expense of abating the condition, that is not good reason for refusing an injunction. Neither courts of equity nor law can be guided by such a rule, for if followed to its logical conclusion it would deprive the poor litigant of his little property by giving it to those already rich." *Whalen* at 806. The court's justice concern for the *poor litigant* and *his little property* clearly dominate any efficiency considerations.

¹⁶⁰494 P.2d 700 (Ariz. 1972)

¹⁶¹It is a popular interpretation of this case that the court used Rule 4 (liability rule) when it leveraged its equitable powers to force the developer to indemnify Spur Industries for its relocation costs. However, one might argue that the court in fact used Rule 3, assigning the entitlement to the residents of Sun City and protecting that assignment with the property rule of a permanent injunction. The mandatory indemnification (compensation) by Del Webb was simply an *ex post* equitable ruling intended to affect the court's distributional and justice concerns. So the property rule was chosen and Spur Industries lost its entitlement. However, justice demanded compensation from Del Webb. This is a far less strained interpretation of the opinion than treating it as a Rule 4 case. As Krier and Schwab note, "Rule four implies a choice by Del Webb to pay up or shut up." Krier & Schwab, *supra* note 11, at 445 n.23. In the opinion, however, Justice Cameron compels Spur Industries move and requires Del Webb to pay. The opinion does not say that Del Webb may take Spur Industries' entitlement without its consent so long as court determined compensation is paid (which would be the proper form of Rule 4 in this context). In fact, Justice Cameron explicitly states that he would not have removed Spur Industries' entitlement to engage in its lawful feed lot activity but for the innocent residents of

for one property rule and efficiency calls for an other, liability rules serve as useful compromises.

2 Accidents

The circumstances attending most accidents prohibit meaningful application of property rules. Accidents first occur, then remedies are sought, at which time only damages—liability rules—are available. There are two conceivable situations where a property rule could be available in the case of an accident. First, a property rule might be feasible if an accident occurs over a long protracted period and at least one of the involved parties can halt the accident (call this cessation of harmful activity). Second, if the accident is sufficiently foreseeable, then the likely victim or victims may seek an injunction against the prospective injurer (call this probabilistically significant infringement). Automobile accidents do not fall under either of these situations. Accident victims do not have time to seek a court order in the midst of a car crash; nor are accidents with particular drivers sufficiently foreseeable to justify preliminary property-rule relief. Yet, automobile accidents have been discussed in the literature concerning the choice between property rules and liability rules. Kaplow and Shavell note that because drivers cannot bargain with their victims *ex ante* “liability rules should, according to [their] analysis, be superior to property rules.”¹⁶² However, liability rules are chosen not because of a failure of bargaining, but rather because the choice of property rules does not exist for practical purposes. Even if drivers and their potential victims could reach *ex ante* agreements, how could a court enforce such agreements using property rules? Through torts, there is simply no practical property

Sun City: “Were Webb the only party injured, we would feel justified in holding that the doctrine of “coming to the nuisance” would have been a bar to the relief asked by Webb.” The comparison of values in this case was between Spur Industries and the Sun City residents, not Del Webb. Krier and Schwab have also noted the point that “the residents of Sun City [] were the people whom the court regarded as the real parties in interest.” Krier & Schwab, *supra* note 11, at 469-70. In effect a property rule was granted in favor of those residents, not Del Webb. The only matter remaining involved the court ordering Del Webb to pay Spur Industries’ relocation costs for creating the mess in the first place.

¹⁶²Kaplow & Shavell, *supra* note 4, at 752.

rule protection against harm resulting from automobile accidents.¹⁶³

Moving away from automobile accidents, consider accidents that are either reasonably foreseeable or are otherwise preventable by court order. Imagine, for example, a freight train that carelessly transports dangerous chemicals through a populated suburban or inner-city neighborhood. Let's say that the neighbors seek a property rule remedy for an infringement of their entitlement.¹⁶⁴ In this case, the court's first task is to determine the nature of the entitlement in question. Namely, is the neighbors' entitlement a right to be free from fear of such accidents or is the claim based on a right to be free from the imposition of increased risks of such accidents?¹⁶⁵ In *Nicholson v. Connecticut Half-Way House*,¹⁶⁶ the residents of a middle class suburban neighborhood sought an injunction to prohibit the operation of a halfway house in their community.¹⁶⁷ In rejecting the plaintiffs' plea for injunctive relief, the court noted that fear or apprehension could not serve as a basis for property rule protection.¹⁶⁸ The second argument, based on the neighbors' right to be free from the imposition of increased risks,¹⁶⁹ may be placed un-

¹⁶³Criminal law, on the other hand, affords some property-rule-like protection. Drivers may be pulled off the road, have their licenses revoked, or even locked up. However, the offenses that trigger these property rules are not based infringement of the potential victims' entitlements, at least not strictly speaking. The infringement is a violation of the state's rights, though individuals may possibly enforce such rights through citizen suits. Citizen suit provisions, such as those found in Clean Air Act Amendments and the Clean Water Act, may be broadly thought of as property rule protection against the imposition of some risk.

¹⁶⁴Liability rule protection may be granted to the neighbors using a strict liability or a negligence rule to hold the train operator liable for any resultant harm. The negligence rule offers limited protection to the neighbors, giving the train operator a property-rule-like entitlement: once the safety standard is reached, the train operator "acquires a property rule entitlement to cause harm." Kaplow & Shavell, *supra* note 4, at 753.

¹⁶⁵The neighbors' entitlement may also be more quantifiable, such as a reduction in the neighbors property value due to the high-risk operation of the train.

¹⁶⁶218 A.2d 383 (Conn. 1966)

¹⁶⁷The residents' case was based on two claims. First, the plaintiffs expressed fear that the prospective residents of the half-way house would commit criminal acts. Second, the plaintiffs argued that the half-way house would cause a depreciation in their property values.

¹⁶⁸The court found the claim based on depreciation of property value too subjective and speculative.

¹⁶⁹Liability for increase risk of harm was recognized in *Schwegel v. Goldberg*, 209 Pa.Super. 208, 228 A.2d 405 (1967). The defendant's automobile hit a four-year-old,

der the legal doctrine of anticipatory nuisance. The availability of property rule protection for anticipatory nuisances rests, in part, on the permissibility or reasonableness of the challenged conduct. In *Nicholson*, the court denied preliminary injunctive relief because, among other considerations, the defendant's half-way house was a permitted and reasonable use and the plaintiff's future harm was highly speculative.¹⁷⁰ In granting or denying preliminary injunctions, judges use a balancing test. For a preliminary injunction to be granted, plaintiffs must demonstrate that the harm is sufficiently probable and would be relatively significant: "At the preliminary relief stage, the risk of injury must be sufficiently great and sufficiently irreparable to *override the risk of error*."¹⁷¹ The concern for erroneous orders diminishes when the expected value of the plaintiffs clearly outweighs the defendants'.¹⁷² This is exactly what the model predicts: as the difference in expected values increase (i.e., very big $f(\delta)$) judges can more confidently identify efficient property rules.¹⁷³

fracturing the child's skull and causing a brain contusion. A neurosurgeon testified that the child had a 5% chance of developing seizures within twenty years. The court held that evidence of increased harm was proper and could support a remedy.

¹⁷⁰Of course, the reasonableness of the defendants conduct is informed by the likelihood of harm to the plaintiff. For example, see *Brainard v. Town of West Hartford*, 103 A.2d 135 (Conn. 1954). Also, see *Lakeshore Hills v. Adcox* 413 N.E.2d 548 (Ill. App. 1980), where the plaintiffs sought an injunction to compel a neighbor to remove a 575-pound Canadian black bear from his property. Though the claim was based on a breach of an ambiguous clause in a residential covenant, the court acknowledged the threat of harm and the plaintiff's unreasonable use: "it is contrary to the nature of people to live with or in the immediate vicinity of bears." The interaction between reasonable behavior and possible harm to the plaintiff is clearly important, but not determinative. Even impermissible or otherwise unreasonable defendant uses will not be prohibited by preliminary injunctions when the attributes of the plaintiff's anticipated harm can be adequately determined.

¹⁷¹Douglas Laycock MODERN AMERICAN REMEDIES 420 (2d. 1994) (emphasis added). To get the anticipatory property rule protection plaintiffs must show that their valuations are significant. When the plaintiffs' valuations are significant and sufficiently larger than the defendants', then the balance of harms test favors the plaintiffs, making the injunction more probable.

¹⁷²Plaintiffs with extremely high valuations relative to defendants are more likely to receive the property rule. However, if the parties' valuations are in close parity, then an order of this property rule becomes less certain. In terms of the model, when the expected values are close, then the property rule becomes harder for the judge to reach. Additionally, there is no *a priori* reason to believe that valuations are correlated in this setting, implying that judicial errors are also unlikely to be correlated. Under these conditions the use of property rules (preliminary injunctions) become less likely.

¹⁷³Identification of efficient property rules does not mean that they will be so ordered.

C Property

The discussion of property begins with physical property and then moves to intellectual property. With regards to physical property, the analysis focuses on trespass and encroachment. Property rules are the default in almost all cases involving property. There are, however, occasional deviations from the default. And as the discussion below highlights, these deviations are highly consistent with the predictions of the model.

1 Physical Property

Trespass & Encroachment As a general policy courts will not permit invasion of property without prior consent. There are exceptions to this policy, typically falling under the necessity doctrine. When a trespass dispute arises in the context of necessity, liability rules are often chosen as the remedial default. How might the theoretical framework of this Article be employed to aid in understanding these defaults? First, let's partition the world of trespass into two categories: one where the trespasser uses the entitlement in the same exact manner as the entitlement holder and a second category where the trespasser uses the entitlement in a different way. Under the first category there is a single commodity being used in exactly the same manner. In this situation one would image a high degree of correlation between the trespasser's and the entitlement holder's valuations. This implies likely correlation in judicial errors of the parties' valuations, which tends to favor property rules with respect to determination costs. When the trespasser's use is distinct from the entitlement holder's, then there are two further categories to consider: permissible and impermissible uses. For impermissible uses, the court forces the trespasser's valuation to be zero. That is the court will not recognize any value that the trespasser derives from the impermissible activity. At the same time, the entitlement holder's valuation, while unknown to the court, is almost certainly presumed to be greater than zero. When the court knows that all possible valuations of the entitlement holder are greater than the valuation of the trespasser, then the property rule is

As discussed *supra* Part III.B.1, judges do not remedy legal conflicts based on efficiency alone.

relatively easier to determine.

Now let's consider why we observe shifts away from the property rule default for the entitlement holder. When the trespasser's use is distinct and permissible, the correlation of values is not likely to be significant. Since the trespasser and the entitlement holder use the property in very different ways, judicial errors about valuation are unlikely to be correlated. Thus liability rules become relatively easier to determine in these cases. Furthermore, permissible uses are often characterized by extremely high trespasser valuations. So protecting the entitlement holder with a property rule (which prohibits the nonconsensual use by high-valuing would-be trespassers) would often lead to inefficient results.

The case of *Ploof v. Putnam* offers a good illustration of high trespasser values leading to an abandonment of property rules protection for property owners.¹⁷⁴ In *Ploof*, the plaintiff, caught in a storm, secured his boat without permission to a private dock owned by the defendant. The defendant then unmoored the boat from the dock, setting it adrift. The court held that the defendant (dock owner) had to compensate the plaintiff (boat owner) for damages suffered as a result of the unmooring of the boat.¹⁷⁵ Consider how the nature of the entitlement assignment and protection changed throughout the sequence of events described above. The entitlement was initially assigned to the defendant and that assignment was protected with a property rule (Rule 1). Then came the storm, giving the plaintiff a necessity-based right to the entitlement.¹⁷⁶ It is a limited right, however, for if harm results

¹⁷⁴81 Vt. 471, 71 A. 188 (Supreme Court of Vermont, 1908). See also, *Vincent v. Lake Erie Transportation Co.* 124 N.W. 221 (Minn. 1910).

¹⁷⁵The specific remedial mechanism in this case operated through the necessity doctrine. Necessity claims may take the form of a private necessity (discussed below) or a public necessity, when a third party or a natural force necessitates the destruction of property to save lives or other property. For example leveling someone's house to forestall a fire. Other examples of necessity include a ship's captain jettisoning someone's cargo to save vessel and life—so-called general average contribution—or trespassing into a burning building to rescue one's property. See Epstein, *supra* note 154, at 65-68.

¹⁷⁶In *Smith v. Stone*, (King's Bench 1648, Style, 65) a defendant who was carried "by force and violence of others" on to the plaintiff's property was deemed to not have violated the property right. (Cf., *Gilbert v. Stone*, Kings Bench, 1648 Style, 72, holding that a defendant *who entered* the plaintiff's house to evade twelve armed men trespassed. (emphasis added).)

from the boat owner's use of the dock, then a liability rule protects the dock owner's entitlement (Rule 3).¹⁷⁷ Furthermore, the temporally bound assignment of the entitlement to the boat owner is itself protected by a liability rule (Rule 4).¹⁷⁸ Thus the dock owner had to pay compensation for infringing on the boat owner's privilege to the entitlement. But "why the privilege of necessity in the first place? The best explanation stems from the relative value that [the parties] attach to the dock."¹⁷⁹ In necessity cases, the party in need presumably places a significantly higher value on the entitlement than does the entitlement holder.¹⁸⁰ This leads to a very high absolute difference in expected values, making the efficient property rule easy to determine.¹⁸¹

Even beyond necessity, courts will deny injunctions against trespass when large differences in expected values suggest that property rule protection is inefficient. For example, the majority in *Crescent Mining Co. v. Silver King Mining Co.* would not grant property rule protection to a landowner who sought to prohibit the defendant from digging a trench, and laying and maintaining a pipe across the plaintiff's land.¹⁸² While the opinion was clearly motivated by public policy concerns,¹⁸³ the court emphasized that a liabil-

¹⁷⁷See *Vincent* (referring to *Ploof*: if "the dock had suffered an injury, we believe the ship owner would have been held liable for the injury done.")

¹⁷⁸One might also say that the necessity doctrine simply flips the entitlement assignment while keeping the form of protection a property rule. That is, under necessity, the infringer now has the property-rule-protected right to the dock. The court in *Ploof* makes it clear that the dock owner lost his right to self help (a property rule) in instances of necessity, though boat owner may have been able to use self-help to re-secure the boat after the dock owner unmoored it (Rule 2).

¹⁷⁹Epstein, *supra* note 154, at 61.

¹⁸⁰The court clearly recognized that providing the dock owner with an absolute right to exclude entry through self-help (or some other form of property rule protection) would lead to an inefficiency and socially undesirable outcome since the dock owner's value was significantly less than the boat owner's and transactions costs prohibited bargaining around this inefficiency.

¹⁸¹As suggested in *supra* note 178, it may be argued that *Ploof* represents a property rule for the boat owner (Rule 2) rather than a liability rule (Rule 4). In either event, there was a deviation from the default of property rule protection for the property owner (Rule 1), which can be rationalized through the model.

¹⁸²17 Utah 444, 54 P. 244 (Supreme Court of Utah, 1898).

¹⁸³"Without the water, one of the largest mining industries in the state [i.e., the defendant], employing hundreds of laborers, and producing hundreds of thousands of dollars worth of minerals annually, must be closed down and cease operation." Cf. *Whalen*, *supra* note ??, where the Court of Appeals of New York, disregarded the fact that the defendant

ity rule could sufficiently protect the plaintiff's entitlement to the "strip of barren, rocky, worthless, uncultivated, unused land, on a barren hillside." The court's rhetoric reveals its view that the land was not being put to a purposeful use by the plaintiff, especially as compared to the socially beneficial use employed by the defendant. The different uses of the entitlement between the plaintiff and the defendant was clearly salient to the court, and implies that the errors by the court were likely to be uncorrelated. So the covariance indicator points to use of a liability rule. Furthermore, because the large difference in the expected values implies the efficient property rule is not the "just" one, the court issued a liability rule.¹⁸⁴

Crescent Mining reflects a more permanent form of invasion than most people equate with trespass. Courts often classify permanent or "continual trespasses" as encroachments; and for encroachments, property rules are asserted to be the strong default rule. As with temporary trespass, the availability of the property rule remedy for encroachments turns, in part, on the intentionality of the act.¹⁸⁵ If the encroacher did not intentionally invade the entitlement, which is to say that he neither intended nor recklessly encroached on the other party's property, then property rule protection will be denied "where the encroachment is slight and the cost of removing it is great."¹⁸⁶ In other words, when the expected values of the parties are far apart (i.e., large $f(\delta)$ in the model), the court can and will make the correct property rule

"invested a large sum of money, and employs great numbers" in ruling that minimal harm to the plaintiff compare to significant costs to the defendant and society "is not a good reason for refusing an injunction." The difference between these opinions may be attributed to differences in the demand for water and water rights between the East and the West during this time.

¹⁸⁴The court felt that the cost to the infringer was much greater than the cost to the initial entitlement holder. Thus the efficient property rule would protect the infringer's right to use the entitlement. But to order the efficient property rule would mean that court offers no protection to the original entitlement holder. Thus the court deviates from the traditional default of property rule protection for the initial entitlement holder (which it well knows would lead to an inefficient outcome) and orders a liability rule that is less than the value that the infringer places on the entitlement.

¹⁸⁵Recall that the difference in the results of the trespass cases of *Smith v. Stone* and *Gilbert v. Stone* (see *supra* note 176) was due to the perception of choice and intention on the part of defendants.

¹⁸⁶*Ariola v. Nigro*, 156 N.E.2d 536 (Ill. 1959). See *Nitterauer v. Pulley* 82 N.E.2d 643 (Ill. 1948) for discussion equating recklessness or inadequate precaution with intent in this context.

determination. However, when there is intentionality or recklessness in the mind or behavior of the defendant, then he encroaches at his own peril:¹⁸⁷ “if the encroachment is intentional, neither the expense involved, nor the absence of damage to the land encroached upon will defeat the right to an injunction.”¹⁸⁸ That is, the default of property rule protection for trespass, temporary or continual, holds when the trespasser has a meaningful option to not infringe on the entitlement and yet intentionally or recklessly infringes nonetheless.¹⁸⁹ There are clear policy reasons for this rule that have nothing to do with the relative costs of reaching the proper liability rule or property rule.¹⁹⁰ However, when intentionality is dominated by necessity or replaced by reasonable ignorance, then the courts will consider the relative costs of reaching the correct rule.

2 Intellectual Property

Property rules are the strong default for the protection of intellectual property. Copyright laws, for instance, generally prohibit infringement without the consent of the entitlement holder. However, a privilege to appropriate the copyright holder’s entitlement may be granted through copyright’s fair use doctrine or compulsory licensing.¹⁹¹ The fair use privilege gives a property-rule-protected entitlement to the would-be infringer.¹⁹² In making

¹⁸⁷See *Tyler v. Haverhill*, 172 N.E. 343 (Mass. 1930).

¹⁸⁸*Ariola v. Nigro*.

¹⁸⁹The necessity cases reflect the court’s view that there does not exist meaningful alternative options other than infringement.

¹⁹⁰For example, such a policy provide greater incentives for parties to make proper investigations and it promotes optimal *ex ante* investment decisions.

¹⁹¹See the Copyright Act, 17 U.S.C. §107.

¹⁹²In those cases the infringer does not have to compensate the copyright holder for the nonconsensual use. The Copyright Act provides factors to be used to determine when application of the fair use defense is merited. The factors largely turn on the competing values of the parties. Why doesn’t the court force the infringer to compensate the other party for use of the entitlement? Some scholars have suggested that the answer to this question involves a reluctance to commodify the entitlement or practical difficulties in assigning a price to the use. Maureen A. O’Rourke, *Toward a Doctrine of Fair Use in Patent Law* 100 COLUM. L. REV. 1177, 1190-91 (2000). Furthermore, if the court is principally concerned with maximizing the social value of the entitlement (a frequently cited motivation for the development of American intellectual property law) then compensation

the determination whether to grant this privilege, the court weighs the copyright holder's value of continued exclusive use against the value created by the infringer's use.¹⁹³ Courts tend to be "more receptive to a fair use defense where the infringer has added substantial value to the original work."¹⁹⁴ This tendency lines up well with the implications of the model—which is to say, the court should be more confident determining the efficient property rule in cases where the expected value to one party largely outweighs the other party's expected value. Thus the requirement of substantial value-added by the infringer compared to minimal reduction in the value of exclusive use to the copyright holder, may be viewed as a means to provide the court with some assurance that the property-rule protected entitlement is going to the highest value user: When the infringer's value is low compared to the other party, the fair use defense will be rejected, conferring property rule protection to the copyright holder; When the infringer has high value then the courts will grant the infringer a privilege protected by a property rule.

Unlike copyright, patent law does not offer a general fair use defense, though various doctrines may be pieced together used to achieve a limited fair use patchwork.¹⁹⁵ A similar thread running through these doctrinal defenses to patent infringement is the presumption of high value that infringers place on entitlements relative to the costs of infringement to patent holders.¹⁹⁶ As in the copyright setting, highly divergent expected values tend to support deviation from the traditional property rules protection for patent holders. Yet, while the limited patchwork defense for patent infringement does provide some relief for high valuing would-be infringers, academics and practitioners have called for a broader fair use policy in patents.¹⁹⁷ Many of the suggested mechanisms for implementing a broad policy are well aligned with the model. For example, in advocating expanded research-based infringements of patents, Rebecca Eisenberg, has made a case for selecting the remedy based

is not required.

¹⁹³This concern is reflected in many of factors described in the Copyright Act, but most clearly in the fourth: "the effect of the use upon the potential market for or value of the copyrighted work." 17 U.S.C. §107.

¹⁹⁴O'Rourke, *supra* note 192, at 1192.

¹⁹⁵*Id.*, at 1192-1196.

¹⁹⁶Examples include an infringement for non-commercial experimental use and infringement that creating a radical improvement.

¹⁹⁷See O'Rourke, *supra* note 192.

on the outcome (or final product) of that infringement.¹⁹⁸ If the final product reflects only a slight improvement on an existing patented product, then (Eisenberg argues) the infringer should be required to obtain a license to market the slightly improved product (i.e., a property rule for patent holders in the case of mere improvements). This argument is consistent with the analysis presented here. First, note the values that the parties place on the slightly improved final product and the existing patented product are likely to be highly correlated. The model predicts that court errors are, in this case, also likely to be correlated, making property rules relatively easier to determine. On the other hand, according to Eisenberg's scheme, if the research results in a non-infringing (basically distinct) final product, then monetary compensation for the research infringement should be imposed (i.e., a liability rule). Here again, the argument is consistent with the model's predictions. The values that parties place on the basically distinct product and the existing patented product are less likely to be highly correlated, along with court errors, making property rules relatively harder to determine.

Beyond the academic discourse, officials in developing countries have also sought broader implementation of fair use or compulsory licensing for patented products. Brazil, for instance, threatened to produce generic forms of AIDS medication patented by Merck & Co. and Roche Holding Ltd.¹⁹⁹ Brazil based the credibility of its threat on its national emergency legislation, though Brazilian officials also pointed to the TRIPS Agreement,²⁰⁰ which allows members states limited rights to infringe on patents when doing so would protect public health or promote vital public interests. Developed countries have also cited protecting public health and national interests as bases for patent infringements. For example, during the recent bioterrorism scare, the Bush Administration proposed seeking congressional approval to infringe on

¹⁹⁸Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017 (1989); Rebecca S. Eisenberg *Propriety Rights and the Norms of Science in Biotechnology Research*, 97 YALE L.J. 220 (1988).

¹⁹⁹See Miriam Jordan, *Brazil to Break Roche Patent on AIDS Drug*, WALL ST. J., Aug. 23, 2001, at A3; Jennifer L. Rich, *Roche Reaches Accord on Drug With Brazil*, N.Y. TIMES, Sept. 1, 2001, at C1, C14; Miriam Jordan, *Brazil Makes a Name for Itself Pumping Out AIDS Drugs*, Wall Street Journal, Apr. 27, 2001 at A17; Miriam Jordan, *Brazil May Flout Trade Laws to Keep AIDS Drugs Free for Patients*, WALL ST. J., Feb. 12, 2001, at B1,

²⁰⁰See, the Trade-Related Aspects of the Intellectual Property Rights of the General Agreement on Tariffs and Trade (GATT), articles 8 and 30 of the TRIPS Agreement.

Bayer's patented anthrax drug Cipro.²⁰¹ These threatened infringements are based on claims analogous to the necessity defense discussed earlier. The disproportionate infringer value (in terms of lives saved and suffering avoided) is advanced as a motivation to provide a privilege.²⁰² In these cases where infringers possess sufficiently high values, the court can easily determine that property rules protection for patent holders is inefficient.²⁰³

V Conclusion

Legal scholars have long argued for and against property rules and liability rules based on efficient breach, bargaining, transaction costs, and fairness. Recently, however, scholars have expanded and intensified the debate by considering the court's ability to acquire and then assess the information needed for an efficient resolution. Some observers have argued that courts should find imposing property rules informationally less burdensome than imposing liability rules. To reach an optimal decision under a property rule, the court need only determine which party places greater value on the entitlement. Other commentators have argued that the "guesswork" involved in administering property rules is more burdensome because property rules require estimates and a comparison of two values, whereas liability rules require only an estimate of one value. This Article reconciles these opposing arguments

²⁰¹Edmund L. Andrews, *Bayer Is a Bit Taken Aback By the Frenzy to Get Its Drug*, N.Y. TIMES, Oct. 25, 2001, at B8. Shortly the Bush Administration's threat, Bayer offered to sell Cipro to the U.S. government at approximately half the established price. Keith Bradsher, *Bayer Halves Price for Cipro, but Rivals Offer Drugs Free*, N.Y. TIMES, Oct. 25, 2001, at A1. (See 28 U.S.C. §1498(a) for code on unauthorized use of patented invention by the U.S. government). Bayer also challenged Canada's infringement of its Cipro patent, following a decision by Canada's Health Minister to purchase unauthorized generic versions of Cipro. Heather Scoffield, *Rock Rapped for Bungling Cipro Deal*, GLOBE & MAIL, Feb. 21, 2002, at A7.

²⁰²The pharmaceutical patent holders counterclaim that they too have high value that goes beyond the profits from any particular drug at issue. They assert that this type of infringement will dissipate the incentive to develop new drugs, costing more lives and suffering in the future.

²⁰³A liability rule or the inefficient property rule (in terms of a specific case from an *ex post* perspective) may, nonetheless be chosen in order to preserve the correct incentives for pharmaceutical innovation by drug companies.

by uncovering implicit assumptions concerning the court's decision-making abilities in the face of uncertainty. The analysis then points to indicators that tend to make the comparative assessment of property rules more or less difficult than the single determination of efficient liability rules. For instance, a comparative assessment of values is more easily determined when the court's likely errors are sufficiently large and common to both parties, or when the expected values of competing parties are disparate. Using a heuristic model, the analysis more generally suggests that courts consider expected values, variances and other aspects of their beliefs about the distribution of the parties who appear before them. Based on these beliefs, property rules or liability rules may be more easily determined in any given class of cases or any specific case. The analysis applies the model to contract, property, and tort cases to demonstrate the significance of this approach both as a practical matter and in the continuing academic discussion of property rules and liability rules.