Essays

Legal Entitlements as Auctions:

Property Rules, Liability Rules, and Beyond

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CONTENTS

This Essay concerns the different ways that policymakers can protect legal entitlements. The notion of a "legal entitlement" is an expansive one, encompassing such diverse rights as the right to bodily security, the right to a pollution-free atmosphere, the right to build a house that blocks another's view, or the right to damage another's reputation by false accusation.[1] Twenty-five years ago Guido Calabresi and Douglas Melamed distinguished between property rules and liability rules as techniques for protecting entitlements.[2] Property rules discouraged nonconsensual takings. Liability rules permitted nonconsensual takings in return for payment of damages.[3]

Recent articles have reconceptualized the distinction between property rules and liability rules in terms of options.[4] A liability rule gives at least one party an option to take an entitlement nonconsensually and pay the entitlement owner some exercise price. Thus, if the right against pollution is protected by a liability rule, a polluter may pollute if she is willing to pay damages.[5]

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1. The first two examples are interests in security (Hohfeldian rights proper); the second two are interests in liberty (Hohfeldian privileges). *See* Wesley N. Hohfeld, *Fundamental Legal Conceptions as Applied in Judicial Reasoning*, 26 YALE L.J. 710 (1917) [hereinafter Hohfeld, *Fundamental Legal Conceptions*]; Wesley N. Hohfeld, *Some Fundamental Legal Conceptions as Applied in Judicial Reasoning*, 23 YALE L.J. 16 (1913). The classification of the entitlement depends on who holds it. If the entitlement is placed in the hands of a polluter, it is a privilege to pollute; if the entitlement rests in the hands of the neighboring landowner, it is a right to be free from pollution.

2. *See* Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089 (1972).

3. *See id.* at 1092. These assumptions have recently come under critical scrutiny. *See* Ian Ayres & Eric Talley, *Solomonic Bargaining: Dividing a Legal Entitlement to Facilitate Coasean Trade*, 104 YALE L.J. 1027 (1995) [hereinafter Ayres & Talley, *Solomonic Bargaining*]; Ian Ayres & Eric Talley, *Distinguishing Between Consensual and Nonconsensual Advantages of Liability Rules*, 105 YALE L.J. 235 (1995) [hereinafter Ayres & Talley, *Distinguishing*].

Calabresi and Melamed also suggested another method of protecting entitlements, called "inalienability," which discouraged the parties from transferring the entitlement either consensually or nonconsensually. *See* Calabresi and Melamed, *supra* note 2, at 1092–93. The present Essay does not concern this form of entitlement protection.

4. *See, e.g.,* Ayres & Talley, *Solomonic Bargaining, supra* note 3; Ayres & Talley, *Distinguishing, supra* note 3; Louis Kaplow & Steven Shavell, *Property Rules Versus Liability Rules: An Economic Analysis*, 109 HARV. L. REV. 713 (1996) [hereinafter Kaplow & Shavell, *Economic Analysis*]; Louis Kaplow & Steven Shavell, *Do Liability Rules Facilitate Bargaining? A Reply to Ayres and Talley*, 105 YALE L.J. 221 (1995) [hereinafter Kaplow & Shavell, *Reply*]; James E. Krier & Stewart J. Schwab, *Property Rules and Liability Rules: The Cathedral in Another Light*, 70 N.Y.U. L. REV. 440 (1995); Madeline Morris, *The Structure of Entitlements*, 78 CORNELL L. REV. 822 (1993); *see also* Symposium, Property Rules, Liability Rules, and Inalienability: *A Twenty-Five Year Retrospective*, 106 YALE L.J. (forthcoming May 1997) (celebrating 25th anniversary of publication of Calabresi & Melamed, *supra* note 2); Jason Scott Johnston, *Bargaining Under Rules Versus Standards*, 11 J.L. ECON. & ORG. 256 (1995).

5. *See, e.g.,* Boomer v. Atlantic Cement Co., 257 N.E.2d 870 (N.Y. 1970) (requiring factory owners to pay permanent damages in compensation for right to pollute).

In many business situations, options are the result of a prior bargain, where the option to take at a given price is purchased for some premium. However, in the case of liability rules, the option is the result of preexisting legal rules; the law simply gives parties the right to take in exchange for damages.

Both the bargained-for option and the liability rule are examples of what Hohfeld termed a "liability." Hohfeld, *Fundamental Legal Conceptions, supra* note 1, at 727. A party has a Hohfeldian liability when another party has the right to alter the first party's rights unilaterally. *See id.* The second party has what Hohfeld called a "power." *See id.* The person who owns an option alters rights by exercising the option, creating a duty to pay the purchase price. The person who takes under a liability rule alters rights by interfering with the entitlement, creating a duty to pay damages.

From this perspective, the only difference between liability and property rules is the price of exercising the option—the damages to be paid for the nonconsensual taking.[6] Property rules set the exercise price so high that no one is likely to exercise the option to take nonconsensually, while the lower exercise prices of liability rules presuppose that some people will take nonconsensually.[7]

The option analysis deconstructs the original distinction between property rules and liability rules. Whereas Calabresi and Melamed assumed that property rules involved consensual agreements and liability rules involved nonconsensual takings, the options analysis shows that both property and liability rules involve options for nonconsensual taking. In other words, property rules are actually a special case of liability rules: Property rules are liability rules with an exercise price so high that the option is almost never taken.

In this Essay, we will argue that the analysis of property and liability rules in terms of options does not go far enough. Both property and liability rules are special cases of an even larger family of possible legal regimes: auctions. A deeper and more valuable way to think of legal entitlements is as species of auctions of differing lengths and with differing rules for the distribution of proceeds. From this perspective, both property rules and liability rules are *truncated auctions* of legal entitlements.

Why change our focus from property and liability rules to auctions? Calabresi and Melamed were not merely interested in offering a novel nomenclature, and neither are we. They argued that when transaction costs were high—because parties lacked information or bargaining was

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Hohfeld was careful to point out that having a liability to others (in his sense) is not always a bad thing; sometimes it is to our benefit that others can change our rights unilaterally. *See id.* at 742. For example, whenever a person makes an offer to us, she changes our bundle of rights, because we now have the right to accept the offer. And when a party destroys a chattel we do not value highly, we may benefit because we have the right to receive damages at the market price, which may be higher than our private valuation.

In a world with perfect information and costless bargaining, it is not advantageous to give others unilateral options to purchase, no matter how high the exercise price. It is more efficient to offer to sell the property to the highest bidder. That is one reason why parties normally demand premiums to grant options. But where transaction costs are high, an entitlement holder may prefer to grant options to potential buyers without receiving any premium in return. Such options help ensure that one can reap some profits from the exchange even when one may not be able to transfer consensually to a higher valuing buyer. The analogous insight is that where transaction costs are high, the law can increase efficiency by creating options in the form of liability rules.

6. *But see* Jules L. Coleman & Jody Kraus, *Rethinking the Theory of Legal Rights*, 95 YALE L.J. 1335 (1986) (arguing that change in degree of protection from nonconsensual taking changes content of entitlement).

7. The options framework seems particularly well-suited for some nuisance contexts where the taking party intentionally takes the right of another, and hence seems to be consciously choosing, say, to pollute or not pollute. By contrast, negligent tortfeasors do not intentionally take the interest of other parties, and might not seem to be affirmatively exercising an option. However, even a negligent tortfeasor chooses a level of care and thus can be said to choose intentionally a certain probability of taking that comports with the options framework.

impractical—liability rules in the form of damage awards were a more efficient way to protect entitlements.[8] Conversely, they concluded (incorrectly, as we shall argue) that property rules were a more efficient way to protect entitlements when transaction costs were low.[9] Thus, Calabresi and Melamed's distinction offered an important gloss on the Coasean point that imperfect information and other transaction costs might prevent the efficient allocation of resources.[10] Calabresi and Melamed showed that under these conditions not only the *ownership* but also the *form of protection* of the entitlement could affect allocational efficiency.

Although this basic insight remains correct, the actual arguments for the relative efficiency of property and liability rules now seem more problematic. It is by no means clear that property rules are always more efficient when bargaining is possible. The problem is that when parties have private information about their valuations of an entitlement, they face a classic case of asymmetric information. Ian Ayres and Eric Talley, as well as Louis Kaplow and Steven Shavell, have shown that where information is asymmetric, property rules do not necessarily produce the most efficient result, even when transaction costs are otherwise low.[11]

We shall show in this Essay that efficiency sometimes might be further enhanced by allowing additional rounds of "bidding"—that is, by allowing both sides successive options to take the entitlement back at successively higher prices. Just as ordinary liability rules sometimes dominate property rules, "higher-order" liability rules that feature successive and reciprocal options to take can sometimes dominate ordinary liability and property rules.

Our argument can be understood as an extension of a basic caveat to the Coase Theorem. Coase argued that regardless of the initial allocation of entitlements, efficient deals would be struck under ideal bargaining conditions, which include full information.[12] But many transactions in the real world occur under conditions of asymmetric information, where each party knows only her own private valuation of the bargained-for entitlement. Asymmetric

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8. *See* Calabresi & Melamed, *supra* note 2, at 1106–10.

9. *See id.* It might be more accurate to say that scores of legal scholars have interpreted Calabresi and Melamed to be saying that property rules are more efficient when transaction costs are low. *See, e.g.,* Robert P. Merges, *Of Property Rules, Coase, and Intellectual Property*, 94 COLUM. L. REV. 2655, 2655, 2664 (1994). Just as Coase never formally stated the Coase Theorem in Ronald N. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960), Calabresi and Melamed never succinctly stated what has been taken to be their primary normative conclusion.

10. *See* Coase, *supra* note 9, at 15.

11. Ayres and Talley argued that liability rules can force entitlement holders to reveal private information about how much they value their entitlements, and hence can facilitate trade. *See* Ayres & Talley, *Solomonic Bargaining, supra* note 3, at 1032–36. Conversely, Kaplow and Shavell have argued that liability rules may be more efficient even where transaction costs are low because the nonconsensual advantage of liability rules tends to persist when bargaining becomes possible. The extent of these different effects has spurred a lively debate. *See* Kaplow & Shavell, *Reply, supra* note 4; Ayres & Talley, *Distinguishing, supra* note 3; Kaplow & Shavell, *Economic Analysis, supra* note 4.

12. *See* Coase, *supra* note 9.

information will often prevent efficient negotiation—even when there are only two people bargaining. We have found that higher-order liability rules might be able to produce nonconsensual transfers that are more efficient than those produced by consensual trade under a property or a first-order liability rule.

In this sense, our result is also an extension of the basic insight of Calabresi and Melamed that the form of entitlement protection matters as well as its ownership. They saw that the choice between property rules and liability rules could make a difference where transaction costs were high. We shall now argue that one must sometimes go beyond property and liability rules to enhance efficiency, when bargaining in the shadow of these more traditional regimes fails to capture all the gains from trade.

Part I of this Essay explains how one can view liability rules with reciprocal taking options as forming a class of "internal" auctions—auctions where the proceeds are distributed among the bidders rather than to a third party. Ordinary or first-order liability rules feature only one round of possible takings; allowing successive and reciprocal taking options creates second- and higher-order liability rules. Part II discusses the relative efficiency of second- and higher-order liability rules under a relatively strict set of assumptions. Using a standard model featuring asymmetric information between two parties, we show that second- and higher-order liability rules are more efficient than first-order liability rules when the taking regime is costlessly administered, and when bargaining is not possible. Part III relaxes the first assumption by considering the relative efficiency of different rules when nonconsensual taking is not costless. Part IV relaxes the second assumption by considering how the possibility of bargaining affects the relative efficiency of different legal regimes. Part V applies the theory to some real world examples, with particular emphasis on contract negotiations.

I. ENTITLEMENTS AS INTERNAL AUCTIONS

Viewing entitlements as auctions implies that after one party exercises its option to take nonconsensually, the other has an option to "take back," and so on, for some number of rounds. However, almost all analyses of liability rules have implicitly assumed that the law deters the initial entitlement holder from taking back after an initial nonconsensual taking. For example, if a liability rule regime gives Calabresi an option to take some entitlement of Melamed for $100, most analysts assume that after this taking, Melamed (and others) would not have a viable option to take the entitlement back from Calabresi. In other words, most people have assumed that liability rules are protected by property rules.

Kaplow and Shavell are among the few scholars who have recognized and attempted to defend this assumption.[13] They offer two arguments against retaking entitlements—one of impossibility, the other of inefficiency. First, they point out that when an entitlement concerns a harmful externality like pollution, it is effectively impossible to retake the entitlement once it has been taken the first time. A polluted stream, for example, cannot easily be returned to its pristine state. Second, they argue that giving the original owner a take-back option might lead to an infinite sequence of takings and retakings if the exercise price for the take-back option (i.e., the damages assessed at each round) is set too low. If an object is worth at least $100 to both Calabresi and Melamed, but the price of taking and subsequently taking back is only $75, then giving take-back options could lead to an infinite number of takings: "Such *reciprocal takings* are problematic because they will lead inevitably to destructive contests to retain or to take control of things, and thus to the use of force."[14] Hence, "[t]he only apparent solution to the problem of reciprocal takings lies in a mixed system that would employ a liability rule for the initial taking combined with property rule protection of the taker's possessory right afterwards."[15]

As to the first objection, it is by no means clear that most retakings of legal entitlements are impossible. A chattel like the Maltese Falcon or a parcel of real estate like Blackacre could, in theory, be taken and retaken many times.[16] Kaplow and Shavell are correct that some takings, like the taking of an entitlement to a pollution-free river, are not easily undone after the fact.[17] But this objection only applies to harm that has already occurred, and not to additional harm that might happen in the future. In nuisance cases, for example, it is hardly unusual for courts to award damages for existing pollution combined with an injunction against future harm. As we shall see presently, there is no reason why a court could not offer to dissolve the injunction upon payment of an option price to the plaintiffs, followed by an offer to reinstate it upon payment of a still higher option price to the defendants. And if the court were willing to raise the option price at each level, the exercise might continue for several additional rounds, as long as the parties were willing to pay the damages (i.e., the exercise price) to each other at each round. Instead of a destructive flurry of takings, we would have a more

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13. *See* Kaplow & Shavell, *Economic Analysis, supra* note 4, at 767–68.

14. *Id.* at 767.

15. *Id.* at 767–68.

16. *See* THE MALTESE FALCON (Paramount Pictures 1941) (portraying valuable chattel encrusted with jewels taken and retaken many times with dramatic consequences).

17. Some types of pollution, however, may be more reversible than one might initially imagine. *See* William K. Stevens, *If It's East of the Mississippi, It's Blanketed in Pollution's Haze*, N.Y. TIMES, July 17, 1990, at C4 ("[I]f all human-made sources of air pollution were shut down, 'everything would clear out in three or four days and there would be, on the average, 90-mile visibility'" instead of the current pollution-induced 15-mile visibility) (quoting Dr. John Trijonis of the Santa Fe Research Corporation).

or less orderly indication of the parties' comparative valuations of the entitlement.

When the matter is phrased in this way, the situation begins to look like an auction with a predetermined set of bidding rounds and bid increments. And, of course, that is precisely our point. There is, at least in theory, no reason why such court-supervised auctions could not occur. In fact, as we describe below, they do occur in some areas of the law, and could easily be adapted to still others.[18]

Kaplow and Shavell's second objection is that a framework of reciprocal takings, even if possible, is surely inefficient. The burden of our Essay is to show that this is not so. Regimes that protect legal entitlements with a series of reciprocal taking options can sometimes be more efficient than either property or liability rules. That is because reciprocal takings regimes, like ordinary auctions, can increase efficiency by inducing participants to reveal information about how much they value an asset. This tends to place the asset in the hands of the person who is willing to pay the most for it. Although there are countervailing efficiency losses from a regime of reciprocal takings, these losses are sometimes outweighed by the corresponding gains. The balance of factors in each particular situation cannot be decided a priori. It must be empirically determined.

To establish this thesis, we will focus primarily on a stylized nuisance example with two contiguous property owners. We use this example for two reasons. First, the local impact of many nuisances allows us to analyze the strategic interaction of just *two* (physically contiguous) neighbors.[19] To be sure, multiple parties are often interested in taking a particular entitlement, and nuisances often affect multiple entitlement holders.[20] Nevertheless, we will

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18. *See infra* text accompanying notes 39–47; Part V. One could even imagine a regime in which the entire transaction took place ex ante. Suppose the law gave the polluter extremely strong incentives (for example, by a threat of imprisonment) to go into court to acquire legal permission before she began polluting. Under such a regime, the polluter would be required to obtain a permit establishing her right to pollute by paying what amounts to an exercise price for pollution. The court would then allow the pollutee to exercise its take-back option by offering to pay money to purchase an injunction.

Note that this regime contemplates the use of a property rule to steer the parties into an auction for the entitlement. This point can be generalized. Property rules of some form are inevitable in any system designed to protect legal entitlements. If they are not used to protect the entitlements directly, they will be used to induce parties to participate in the entitlement rules of the legal system.

19. For example, when early American mills flooded, they often only affected a single upstream landowner or at most a small set of landowners. *See infra* text accompanying notes 123–24 (discussing the New Hampshire Mill Act). The law might be able to avoid or ameliorate the multiple-takers problem in nuisance situations by granting retaking options only to one's upwind neighbor (or neighbors) This would create a "mixed" regime in a different sense than Kaplow and Shavell imagined The entitlement would be protected by a higher-order liability rule with respect to the upwind neighbor and by a property rule with respect to all others. Environmental factors—such as physical contiguity or the prevailing direction of wind or water—may also substantially limit the number of potential takers. *See* Richard L. Revesz, *Rehabilitating Interstate Competition: Rethinking the "Race-to-the-Bottom" Rationale for Federal Environmental Regulation*, 67 N.Y.U. L. REV. 1210, 1222–23 (1992).

20. Handling multiple parties who wish to exercise an option to take is a recurring and fundamental problem for allocating ordinary first-order liability rules, not just higher-order ones. *See, e.g.*, Ayres &

argue that there are important contexts where there is only one potential "taker" and one potential "takee."[21] For example, if Calabresi contracts to build a house for Melamed in six months, Melamed has an entitlement to Calabresi's performance. Calabresi, by breaching his promise, is the only person who can potentially take this entitlement. Thus, under executory contracts, promisors are often the only parties who can take promisees' contractual entitlements. The core of our analysis is limited to entitlement disputes between two parties. However, in the last Section (discussing regulatory choice of hazardous waste sites) we will relax this assumption and show how an internal auction could be structured to accommodate the problem of multiple takers.[22]

Second, we chose this nuisance situation because it has become the canonical example for discussing the relative efficiency of property and liability rules, and it helps contrast our conclusions with those of previous writers. To take only one example, Kaplow and Shavell recently argued that in nuisance cases "there is a prima facie case favoring liability rules over property rules."[23] They argued that properly structured liability rules can spur takings when, on average, the taker values the entitlement more than the original holder.[24] Hence, these liability rules more closely mimic the allocation that would result if efficient trade were possible.

We think their insight proves too much. They are right to see that liability rules harness the *taker's* private information. But traditional liability rules do nothing to harness the private information of the *takee*. Using the same model, we will show that giving the original entitlement holder a take-back option can result in second-order takings that produce even greater efficiency, because they economize on *both* parties' private information. Protecting a liability rule option with a liability rule can be more efficient than the traditional liability rule without such a take-back option.

As a matter of nomenclature, we will refer to the traditional liability rule of Calabresi and Melamed as a "first-order" rule because it contemplates at most one nonconsensual taking. And by analogy, we will call a regime where the entitlement holder has a take-back option a "second-order" liability rule, because this rule presumes the possibility of two nonconsensual takings.[25]

Talley, *Solomonic Bargaining, supra* note 3, at 1088–90; Kaplow & Shavell, *Economic Analysis, supra* note 4, at 732–37.

21. *See infra* Part V.

22. In contrast to the reciprocal takings problem involving only two parties, this "multiple takers" problem adds substantial complexity to administering a taking options regime. Such a regime would need to specify, among other things, the priority of option holders and whether the entitlement could be transferred nonconsensually by a series of different takers.

23. Kaplow & Shavell, *Economic Analysis, supra* note 4, at 721 (emphasis omitted).

24. *See id.* at 719–20.

25. Under this schema, a property rule might be referred to as a "zero-order" liability rule because it presumes that there will be no nonconsensual takings. We use the term "presume" advisedly. Just as it is theoretically possible to take nonconsensually under a property rule if one were willing to pay the exercise

Under a second-order liability regime, a potential polluter would have an option to pay the original entitlement owner a predetermined sum for the right to pollute. However, before pollution began, the original owner would then have the option to pay the polluter an even larger sum to maintain the status quo ante. In a second-order liability regime, once the original owner had exercised her take-back option, property rule protection would henceforth deter the polluter from polluting.

We need not stop there, of course. It is theoretically possible to consider third- or higher-order liability rules involving a longer series of reciprocal taking options.[26] Most of our analysis will focus on the relative efficiency of second-order liability rules, but we will also show that higher-order liability rules (with multiple taking options) can implement an efficient *auction*—where each taking represents a "bid" signaling a higher valuation.[27]

In its most general sense, an auction is a regime in which bids by competing players determine who will own an entitlement and how the "proceeds" of the auction will be allocated.[28] Auctions can be structured with a variety of rules,[29] but for our purposes it will be particularly useful to focus on two aspects of auction design: the size of the minimum (ascending) bid increments, and the rules for distribution of proceeds.[30]

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price, a person whose entitlement is protected by a first-order liability rule might, in theory, retake it, if she were willing to pay the exercise price (which might involve going to jail). Sometimes, as Kaplow and Shavell note, the retaking will simply be impossible. *See* Kaplow & Shavell, *Economic Analysis, supra* note 4, at 768 (discussing impossibility of reversing harmful externalities). But when it is not impossible, what makes the rule a first-order liability rule is the presumption that no rational person will retake at such a high price. Thus, just as property rules are liability rules in which no one is likely to take nonconsensually, a first-order liability rule can be thought of as a kind of second-order liability rule in which no one is going to exercise the take-back option. A similar point can be made about the relation of second-order liability rules to third-order rules, and so on.

26. For example, we will consider a third-order liability rule in which the factory could exercise the first-order option by paying $42; the laundry could then exercise the second-order option by paying $58; and the factory could then exercise the third-order option by paying $75. *See infra* Table 2. Subsequent takings would by definition be deterred by property protection—i.e., if the factory exercised the third-order option and took control of the entitlement, the laundry (and all others) would be deterred from further nonconsensual takings by arbitrarily high damages.

27. Our insight that legal rules can be used productively to harness parties' private information has its roots in a larger value-revelation literature. *See, e.g.,* T. Nicolaus Tideman & Gordon Tullock, *A New and Superior Process for Making Social Choices,* 84 J. POL. ECON. 1145, 1145–46 (1976) (proposing "demand-revealing" solution for problem of strategic maneuvering); *see also* Saul Levmore, *Self-Assessed Valuation Systems for Tort and Other Law,* 68 VA. L. REV. 771, 778–79 (suggesting self-assessment solution to problem of property tax collection).

28. *See generally* Robert Wilson, *Strategic Analysis of Auctions, in* 1 HANDBOOK OF GAME THEORY WITH ECONOMIC APPLICATIONS 227 (Robert J. Aumann & Sergiu Hart eds., 1992).

29. Auctions can be implemented with either sealed bidding or open-call bidding, and open-call bidding can be accomplished with either ascending bids (as in so-called "English" auctions) or with descending bids (as in so-called "Dutch" auctions). In "second-price auctions," winning bidders sometimes must only pay the second-highest bid, instead of what they bid themselves. *See id.* at 230 (describing auction variants).

30. One might think that another important consideration would be the number of possible rounds. In the examples we consider here, however, the parties' maximum valuation of the entitlement is already known. Hence, the number of possible rounds is largely dictated by the size of the bidding increments.

In the most familiar auction situation, winning bidders pay a third party (i.e., the seller), and not each other, but this is not a necessary rule for distributing the proceeds of an auction.[31] In fact, we will show that reciprocal taking option regimes, in which the winning "bidder" pays the losing "bidder," can produce the same allocational result as a traditional auction with minimum bid increments. Higher-order liability rules represent a kind of "internal" auction in which the auction proceeds are distributed internally among the auction bidders.[32] An arbitrarily larger number of reciprocal taking options will produce an internal auction with an arbitrarily small bid increment—which in the limiting case produces first-best efficiency.

This auction reinterpretation reveals that liability and property rules are also special cases of a larger family of truncated auctions. Traditional (first-order) liability rules are one-round auctions where we expect at most one bid. We can even think of property rules as zero-round auctions, because the law deliberately sets the initial exercise price above the highest valuation expected of all potential takers. A property rule is an auction in which the minimum initial bid is simply set too high.[33]

Efficiency-minded lawmakers will want to choose the auction structure (including the initial opening bid, the coarseness of subsequent bidding increments, and the rules for distribution of the proceeds) that minimizes a variety of competing inefficiencies. For example, despite the potential gains that flow from inducing the parties to reveal additional information, administrating a regime with second- or higher-order liability rules will not be costless. If the costs of taking are high, lower-order liability rules or even property rules may be more efficient. In contrast to Kaplow and Shavell, who argued that there is a prima facie case for first-order liability rules with regard to harmful externalities,[34] we will show that there is in fact no prima facie presumption. First-order liability rules are most efficient only for a rather narrow range of possible taking costs. When taking costs are greater than this

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31. For example, in a popular class exercise, a professor offers to auction a $10 bill to the highest bidder—with the important catch that both the first- and second-highest bidders are required to pay. Once the bidding hits $10, the second-highest bidder suddenly realizes that it is better to bid $11 to win the auction (and thereby lose $1) than to come in second and lose $9. For a real world example of this "war of attrition" auction, see Ian Ayres & Peter Cramton, *Pursuing Deficit Reduction Through Diversity: How Affirmative Action at the FCC Increased Auction Competition*, 48 STAN. L. REV. 761 (1996).

32. We distinguish this from the more familiar situation of an "external auction," where the parties bid for an entitlement owned by another and the winner pays the owner for it.

33. Or, to put it another way, a property rule is like an auction at Sotheby's where the owner really does not want to part with the painting, and thus requires an exceptionally high opening bid. In real life, the auction house will advise (or require) that the initial bid be set lower, because it wants to move merchandise and collect a percentage of the bid. But in this respect the legal system differs from the owner of an auction house; it may have good reasons to respect the desire of the owner not to surrender the chattel except consensually and at the owner's asking price. *See infra* text accompanying notes 36–38; Part VI.

34. *See* Kaplow & Shavell, *Economic Analysis, supra* note 4, at 721.

range, property rules are most efficient. When taking costs are less than this range, second- or higher-order liability rules are more efficient.

The more rounds we add to an internal auction, the more it appears to mimic bargaining between the participants. If we are correct that higher-order liability rules are sometimes more efficient than property rules or first-order liability rules, why could not the same efficiency be achieved by allowing direct bargaining under a property rule regime? Although the behavior of parties in an internal auction superficially resembles bargaining under property rules, the cases differ in two important ways.

First, internal auctions can be more efficient precisely because bargaining between individuals is not always practical. Lack of information and other transaction costs may prevent efficient bargains from being struck. The great advantage of auctions over unstructured bargaining lies in the way that they set clear choices and structure responses. In this fashion they compensate for the imperfections that block efficient negotiation.[35] As we shall show in greater detail, higher-order liability rules can force the parties to reveal information about their valuations and help produce results closer in efficiency to those that might have been achieved through bargaining with full information and under ideal conditions.

Second, bargaining between individuals in a property rule regime is consensual, but internal auctions are not. In face-to-face bargaining, the parties do not have to transfer their entitlements unless they agree to do so. However, under a higher-order liability regime, the entitlement holder might have her entitlement taken at any time without her consent. The taker, in turn, can have the entitlement retaken without her consent, and so on. In a truly consensual arrangement, parties can simply refuse to deal if they do not want to part with their existing entitlements. However, once an internal auction is set in motion by a party's nonconsensual taking, the takee may not be able to bargain her way out of the process. She may not be able to keep her entitlement unless she retakes.[36]

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35. The possibility of inefficient bargaining is dramatized by what economists call *bilateral monopoly*. Bilateral monopolies, which arise when two parties are locked into dealing with each other . . . can give rise to high negotiation costs that foreclose efficient transfers. Because there is no competitive pressure from outsiders, each party is likely to bargain "strategically"—asking much, offering little, bluffing, threatening to walk away from the deal—in an effort to get as much as possible. . . . "[B]ilateral monopoly is a social problem, because the transaction costs incurred by each party in an effort to engross as much of the profit of the transaction as possible are a social waste. They alter the relative wealth of the parties but do not increase the aggregate wealth of society. A major thrust of the common law . . . is to mitigate bilateral-monopoly problems."

JESSE DUKEMINIER & JAMES E. KRIER, PROPERTY 137 n.17 (3d ed. 1993) (quoting RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 62 (4th ed. 1992)). Higher-order liability rules may be able to mitigate bilateral monopoly problems in settings that otherwise seem to have low transaction costs.

36. In this respect, an internal auction differs from the familiar "highest bidder" auction that culminates in a consensual trade between the highest bidder and a third party. In these traditional auctions, participation is consensual in the sense that one does not have to bid; only those who participate and win pay proceeds to a third party, producing a result similar to a bargain freely entered into between them. But

Thus, higher-order liability rules can produce greater efficiency precisely in those cases where Coasean bargaining under ideal conditions is impractical. Nevertheless, higher-order liability rules are not necessarily more efficient. We argue that the choice among auction regimes is governed by a tradeoff between two important and competing considerations. Higher-order liability rules can increase efficiency by forcing more information from the parties. At the same time, they create problems of moral hazard: Parties who are unsure whether they will be able to keep an entitlement may be less likely to put the entitlement to socially beneficial uses. Thus, higher-order liability rules can counteract the effects of imperfect information, but they may lead to underinvestment. Conversely, property and other lower-order liability rules can better avoid the problem of underinvestment, but they may lead to inefficient results when there is asymmetric information between the parties.

Each situation presents a different mix of concerns, and we emphasize that there can be no a priori answer for all areas of the law. When asymmetric information is the most significant problem, reciprocal taking options with many rounds of bidding are more efficient. Conversely, the greater the dangers of moral hazard and underinvestment, the more likely the efficient solution will converge on the garden variety property rule.

Put another way, our thesis is that the best argument for property rules and lower-order liability rules is that they create the right incentives for investment. It is not, as many lawyer-economists have assumed, that they create incentives for more efficient bargains. There is no reason to think that property rules are generally preferable to liability rules in the latter respect.

We recognize that our conclusion is at odds with the received wisdom. For example, Judge Richard Posner has argued that where transaction costs are low (but not zero), property rules better encourage individuals to make efficiency-maximizing bargains.[37] But we think the received wisdom rests on a faulty inference from Calabresi and Melamed's original argument.

In the Coasean world of perfect information and no other transaction costs, it should make no difference for allocational efficiency who owns an entitlement initially or what form of protection it is accorded. In this imaginary world, property rules, traditional liability rules, and higher-order rules produce equally efficient results, and property rules have no advantage in producing efficient bargains. Calabresi and Melamed showed that in a world of high transaction costs, liability rules are superior to property rules in producing efficient bargains. We do not disagree with this insight. Indeed, we shall argue that in these cases higher-order liability rules can be even more efficient. But

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this case forms only a small class of possible auction regimes. For example, in third party auctions where the penultimate bidder must also pay, the parties may not be able to walk away so easily once the bidding starts. *See, e.g., supra* note 31 (discussing "war of attrition" auction).

37. *See* WILLIAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF TORT LAW 31, 36, 42–44 (1987); RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 70 (4th ed. 1992).

1996]

it does not follow from Calabresi and Melamed's argument that property rules produce more efficient bargains in the intermediate world in which information and transaction costs are low but not zero. In that world, property rules can be more efficient, but not necessarily because they induce better bargains.[38] It is most likely because they avoid moral hazard and underinvestment. In this intermediate world, where asymmetric information plays an important role, first- and higher-order liability rules can still be superior.

We suspect that notions of higher-order liability rules with reciprocal taking options will strike many readers as strange and unworldly. To give these abstract notions a slightly more human face (and especially before we proceed to introduce any mathematics), we pause briefly to provide two examples of second-order liability rules. The first is an existing common law rule, and the second is a proposal for a modification of a common law rule made several years back by our colleague, Robert Ellickson.

A good example of a second-order liability rule in the common law is the incomplete privilege of private necessity available in cases of intentional tort.[39] In the famous case of *Vincent v. Lake Erie Transportation Co.*,[40] the Minnesota Supreme Court used the doctrine of incomplete privilege to hold a shipowner liable when his ship damaged a dock while he attempted to moor the ship during a storm.[41] Yet the court simultaneously acknowledged that the dock owner would have had to pay damages to the defendant if the dock owner had subsequently unmoored the defendant's ship, causing it to be damaged.[42]

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38. It is certainly possible to construct examples in which property rules produce better bargaining But there are no a priori reasons to think that property rules facilitate trade when transaction costs are low

39. Under the privilege of necessity, a defendant is permitted to commit an intentional tort to another's rights in property or realty to protect a more valuable interest in property or an interest in bodily security or life. *See* RESTATEMENT (SECOND) OF TORTS §§ 262, 263 & cmt. d (1965). Where the more valuable interest belongs to a large number of persons, for example, where a city must be saved from a fire, the privilege is one of public necessity, and the defendant owes no compensation. *See id.* § 262 & cmt. d. However, where the more valuable interest belongs only to the defendant or a small number of persons, the privilege is classified as a case of private necessity, and the defendant must still compensate the plaintiff for the harm caused by the invasion. *See id.* § 263(2) & cmt. e. Because compensation is owed, the privilege is said to be incomplete. However, because the defendant has a privilege, the plaintiff must pay for the damages caused by any self-help she undertakes to avoid the taking. *See id.* § 263 cmt. b, *see also* Ploof v. Putnam, 71 A. 188 (Vt. 1908).

40. 124 N.W. 221 (Minn. 1910).

41. *See id.* at 222.

42. *Vincent's* discussion of *Ploof v. Putnam* makes clear that the shipowner's option to take can itself be retaken if damages are paid:

> In Ploof v. Putnam . . . the Supreme Court of Vermont held that where, under stress of weather, a vessel was without permission moored to a private dock at an island in Lake Champlain owned by the defendant, the plaintiff was not guilty of trespass, and that the defendant was responsible in damages because his representative upon the island unmoored the vessel, permitting it to drift upon the shore, with resultant injuries to it. If, in that case, the vessel had been permitted to remain, and the dock had suffered an injury, we believe the shipowner would have been held liable for the injury done.

Vincent, 124 N.W. at 222. The shipowner's option—a liability rule—is itself protected by a liability rule.

Jon Hanson and Matt Stowe have identified *Vincent* as a vivid example of how the common law protects an option to take an entitlement (a liability rule) with another liability rule.[43] The dock owner holds the initial entitlement to the physical security of the dock. The shipowner (because of the exigencies of the storm) has a first-stage option to "take" the dock by mooring the ship to it and by paying damages for any injury that results. The dock owner has a second-stage option to unmoor the ship, but at a cost: The dock owner gives up a cause of action against the shipowner for damages and exposes himself to tort liability for any resulting damages to the ship and its crew. Exercising this second-stage option imposes on the dock owner a direct cost (potential tort liability) and an opportunity cost (potential tort damages).[44]

Our second example comes from Robert Ellickson. In the early 1970s, Ellickson proposed a modification of nuisance rules that would amount to a second-order liability rule, and our Essay has in large part been inspired by his analysis.[45] Ellickson argued that when a landowner committed an intentional nuisance or other unneighborly activities, the landowner would be liable for damages, but that other parties could enjoin continuation of the activity if they were willing to compensate the landowner for any losses he suffered from that injunction.[46] Under Ellickson's proposed regime, the defendant (polluter) decides whether to purchase the right to pollute, and the plaintiff (pollutee) then decides whether to purchase an injunction to stop the pollution.[47]

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43. Hanson and Stowe refer to the *Vincent* standard as a "two-sided" liability rule. Jon Hanson & Matt Stowe, Lecture Notes, Torts, Harvard Law School (Fall 1996) (on file with the *Yale Law Journal*).

44. We emphasize this dual cost because readers are likely to imagine that the total cost of the dock owner's action is the payment of damages. It is important to account for these opportunity costs—foregoing damages created by the other party's previous taking—if we wish to understand how much exercising an option really costs an actor.

45. *See* Robert C. Ellickson, *Alternatives to Zoning: Covenants, Nuisance Rules, and Fines as Land Use Controls*, 40 U. CHI. L. REV. 681 (1973). In fact, Ellickson, Hanson, and Stowe, to our knowledge, are the only people who have seriously analyzed the potential utility of higher-order liability rules. In 1980, Mitch Polinsky saw that the law could give both polluters and pollutees a liability option to change the initial amount of legally permissible pollution. *See* A. Mitchell Polinsky, *Resolving Nuisance Disputes: The Simple Economics of Injunctive and Damage Remedies*, 32 STAN. L. REV. 1075, 1086–88 (1980). Polinsky opined that this type of regime "has not to my knowledge been considered by legal commentators or the courts. Since this remedy turns out to be unhelpful in most of the situations examined in this article, I will hereafter ignore it." *Id.* While Polinsky's article included a pathbreaking analysis of first-order liability rules, he never addressed the sequence in which second-order taking options might be exercised. *See also* Morris, *supra* note 4, at 822, 891–93 (recognizing possible usefulness of second-order liability rules, but not pursuing question of when these rules might be efficient).

46. *See* Ellickson, *supra* note 45, at 748. Ellickson described this proposal as a combination of two different types of entitlement regimes originally offered by Calabresi and Melamed. *See id.* at 738. Calabresi and Melamed's "Rule 2" gives the polluter an option to pollute and pay damages, while their "Rule 4" gives the pollutee an option to enjoin pollution by paying damages to the polluter. *See* Calabresi & Melamed, *supra* note 2, at 1115–24.

47. In contrast, the "purchased injunction" featured in the famous case of *Spur Industries v. Del E. Webb Development Co.*, 494 P.2d 700 (Ariz. 1972), represents a first-order liability rule. The polluter, in this case the owner of a feed lot, has the original entitlement to pollute. However, this entitlement is only protected by a liability rule. The neighbors have the option to stop pollution by paying damages and purchasing an injunction. Their taking is then protected by a property rule in the form of that injunction. *See id.* at 705–08.

In the end, we will argue that reciprocal taking options are most likely to be efficient only where: (1) there are two (or a small number of) potential entitlement owners; (2) property rules (because of strategic bargaining) fail to induce efficient trade; (3) the process of takings itself does not destroy value; and (4) the prospect of takings does not undermine people's incentives to create and develop property. Many readers will no doubt object that the first two conditions are almost never met, because two parties will normally be able to capture the potential gains from trade. Yet the theory of bilateral monopoly[48] argues that substantial inefficiency can persist even when there are only two bargainers and the only transaction cost is incomplete information. For example, the case of contract renegotiation (described *infra* Part V) is a classic case where such bilateral monopoly problems routinely occur.

Even when these conditions are not met, our reinterpretation of property and liability rules as part of a greater class of truncated auctions can help policymakers recognize the value of auction mechanisms in allocating entitlements. In particular, we shall show the advantages of "internal" auctions where winning bidders pay losing bidders. One might think that subjecting entitlements to auctions would create uncertainty and thereby undermine investment incentives, especially for risk-averse parties. Yet the reverse is true. We will show that internal actions do not undermine (ex ante) incentives to invest, and may even promote them. Moreover, internal auctions actually help promote efficiency when parties are risk averse.[49]

II. THE NONCONSENSUAL ADVANTAGE OF SECOND-ORDER LIABILITY RULES

Consider a stylized example involving two competing land uses: a factory and an adjacent laundry.[50] The factory must pollute to operate, but the laundry cannot operate if the factory pollutes. The pollution has no other

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A mortgagor's right of redemption provides yet another example of a second-order rule. Statutes in roughly half of the states give a mortgagor the option to buy back property *after* a foreclosure sale, by paying the foreclosure sale purchaser the foreclosure sale price. *See* Michael H. Schill, *An Economic Analysis of Mortgagor Protection Laws*, 77 VA. L. REV. 489, 495 (1991). The foreclosure sale is often an explicit auction—harnessing the private information of third parties—which allows a nonconsensual taking of the property from the mortgagor. *See id.* at 493. The statutory right of redemption, however, gives the mortgagor a take-back option, which allows the mortgagor to signal a higher (or equivalent) valuation of the property. The right of redemption might be viewed as a way to harness public and private information about the property's value, especially if temporary illiquidity prevents a mortgagor from signalling a high valuation at the time of the foreclosure sale.

48. *See supra* note 35.

49. *See infra* Section II.D.

50. The assumption that only two parties are affected obviates the multiple takers problem. *See supra* text accompanying note 16. If it is common knowledge that no one else in society cares about whether the factory pollutes, then the law might limit the reciprocal taking options to the interested parties. *See* Ayres & Talley, *Solomonic Bargaining, supra* note 3, at 1084.

public or private effects.[51] The factory and laundry each knows what its own
profit from operating would be, but each firm knows only the probability
distribution of the other firm's profits. The latter assumption creates a classic
asymmetric information structure, in which each player knows more about its
own valuation for the entitlement than it knows about the other player's
valuation.[52] Following convention,[53] we will focus on the canonical case in
which each firm only knows that the other firm's operating profit is uniformly
distributed between $0 and $100.[54] Thus, from each firm's perspective, the

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51. This hypothetical is not as unrealistic as it might appear. It is strikingly similar to the facts of
Copart Industries v. Consolidated Edison Co., 362 N.E.2d 968 (N.Y. 1977):

> [On a portion of the former Brooklyn Navy Yard, the plaintiff, Copart] conducted a storage and
> new car preparation business . . . catering to automobile dealers in the metropolitan area of New
> York City. Adjacent to the navy yard was [defendant Con Edison's] Hudson Avenue plant,
> engaged in the production of steam and electricity since about 1926. . . .
>   Based on allegations that noxious emissions from defendant's nearby [smoke]stacks caused
> damage to the exterior of autos stored for its customers such as to require many to be repainted,
> that reports were received in early 1971 from patrons of paint discoloration and pitting, and that
> dealers served by plaintiff terminated their business by early May, plaintiff contends that
> because of said emissions it was caused to cease doing business on May 28, 1971.

Id. at 969–70. *Copart* nicely illustrates the example of a nuisance that primarily affects only one other
company; moreover, it is also a case where the legal decision largely determines whether the car
preparation business or the power plant continues to operate.

52. In our model, each firm's "valuation" of the entitlement is the lost profits at stake if it cannot
operate because it fails to control the decision regarding whether there will be pollution. Thus, a firm's
"value" is its willingness to pay for an entitlement it does not currently possess. There may be a difference
between this "offering price" and a firm's "asking price"—the price it would accept to surrender an
entitlement it owns—because of endowment and wealth effects. Endowment effects are produced by the
psychological tendency to value an entitlement more when we already possess it. *See* Mark Kelman,
Consumption Theory, Production Theory, and Ideology in the Coase Theorem, 52 S. CAL. L. REV. 669,
673 (1979). Wealth effects are produced by budget constraints on our ability to pay: We may ask more to
surrender an entitlement we own than we could offer to purchase it. *See* Duncan Kennedy, *Cost-Benefit
Analysis of Entitlement Problems: A Critique*, 33 STAN. L. REV. 387, 401 (1981).

      In auction settings, however, only offering prices count, because each party bids for an entitlement
whose ultimate ownership is in doubt. And because first- and higher-order liability rules are similar to
auctions, only willingness to pay will determine whether a firm takes nonconsensually: At each round the
parties decide whether or not to take based on their willingness to pay the extra damages. (A symmetrical
effect occurs with descending auctions using put options as discussed *infra* text accompanying notes 90–91;
these auctions compare the parties' willingness to accept money in return for surrendering the entitlement
(i.e., their asking prices).)

      First- and higher-order liability rules might tend to mitigate endowment effects, because initial
possession does not confer security from nonconsensual taking—initial entitlements are held subject to
another person's option. *See* Ayres & Talley, *Solomonic Bargaining, supra* note 3, at 1101–02. In any
event, we assume for purposes of our discussion that offering and asking prices do not differ significantly.

53. *See, e.g.*, Ayres & Talley, *Solomonic Bargaining, supra* note 3, at 1048; Jennifer Gerarda Brown
& Ian Ayres, *Economic Rationales for Mediation*, 80 VA. L. REV. 323, 336 (1994); Kalyan Chatterjee &
William Samuelson, *Bargaining Under Incomplete Information*, 31 OPERATIONS RES. 835, 837–38 (1983);
Peter C. Cramton, *Strategic Delay in Bargaining with Two-Sided Uncertainty*, 59 REV. ECON. STUD. 205,
208 (1992); Kaplow & Shavell, *Economic Analysis, supra* note 4; Kaplow & Shavell, *Reply, supra* note
4, at 227; Roger B. Myerson, *Analysis of Two Bargaining Problems with Incomplete Information, in*
GAME-THEORETIC MODELS OF BARGAINING 115, 116–30 (Alvin E. Roth ed., 1985) [hereinafter GAME-
THEORETIC MODELS]; Roger B. Myerson & Mark A. Satterthwaite, *Efficient Mechanisms for Bilateral
Trading*, 29 J. ECON. THEORY 265, 267 (1983).

54. Our core results do not depend, however, on the uniform distribution assumption. If the firms'
profits were normally distributed (with a Gaussian distribution), second- and higher-order liability rules
would still produce more efficient equilibria. However, the ensuing auction would not have uniform
minimum bidding increments.

other firm's operating profits are equally likely to be any number within this range.

We further assume that the government only knows the probability distribution of profits and that even after the fact the government cannot precisely determine who values more the entitlement to control pollution.[55] The damages for nonconsensual taking (i.e., the exercise prices) that the government sets are therefore a function only of the probability distribution and not of the firms' actual valuations.[56]

To begin with, we also assume that trade between the factory and laundry is impossible but that nonconsensual transfer is costless. Neither of these assumptions is realistic: Parties often can bargain with each other over whether harmful externalities will occur, and the costs of determining liability rule damages and securing payment are far from trivial. But starting with these unworldly assumptions illuminates the nonconsensual advantage of higher-order liability rules. We consider the complications of adding trade and taking costs in later sections.[57]

Using these assumptions, it is possible to evaluate the relative efficiency of property and (first- and higher-order) liability rules. Kaplow and Shavell, for instance, have rigorously shown that the optimal first-order liability rule (where the exercise price is set equal to the takee's expected profit) is more efficient than any property rule. Suppose, for example, that the laundry has the initial entitlement to enjoin the factory's pollution.[58] Giving the factory an

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55. If the government could determine the relative value of pollution, it might simply allocate the entitlement to the business with the higher valuation.

56. Even if damages are determined ex post, the parties might be able to predict the exercise prices ex ante by applying the applicable damage formula. *See* Ellickson, *supra* note 45, at 744 ("If the collective rules were comprehensible, the parties could calculate the damages the plaintiff would collect in litigation from the defendant and the price the plaintiff would have to pay for an injunction.")

Even if the government could determine the firms' precise valuations after the fact, it might not want to "tailor" damages based on this more precise information. Where information is asymmetric, tailoring damages to predictions of the firms' actual valuations can encourage inefficient strategic behavior by the parties. Because more now turns on the firms' private information, they may engage in tactics to disguise their real valuations. *See* Ayres & Talley, *Solomonic Bargaining, supra* note 3, at 1065. Johnston, *supra* note 4; Kathryn E. Spier, *Settlement Bargaining and the Design of Damage Awards*, 10 J. ECON. & ORG. 84 (1994).

57. Similar assumptions are often used in the literature. Consider the following example from William Samuelson:

> [S]uppose that an upstream paper mill is negotiating a pollution agreement with a downstream fishery that has the right to clean water. The mill seeks to obtain the right to discharge moderate amounts of pollution and is willing to pay the fishery for the privilege. Denote the mill's value for this right by v_m (embodying the clean-up cost it avoids) and the fishery's pollution cost by v_f. Then if $v_f < v_m$, both sides can profit from a pollution agreement whereby the mill obtains the right to pollute and makes a payment P to the fishery . . . . The difficulty is that each value is known only to the player himself.

William Samuelson, *A Comment on the Coase Theorem, in* GAME-THEORETIC MODELS, *supra* note 53, at 321, 326.

58. Because in this example the factory and laundry have the same expected value, the identity of the initial entitlement holder does not affect efficiency.

option to pollute if it pays the laundry's expected loss of $50 is more efficient than protecting the laundry's entitlement with a property rule.

Under a property rule regime, nonconsensual takings never occur (the factory never pollutes) and the laundry on average has a $50 profit. The expected profit of the two firms' activities taken together is thus $50. However, under a liability rule (with $50 damages), the expected profit of the two firms together is $62.50. The factory will pollute (operate and pay the laundry $50 in damages) when its expected profits are between $50 and $100—an average value of $75. It will refrain from operating when its expected profits are between $0 and $50, but the laundry will operate at an expected profit of $50. Since both events are equally likely, the expected profit of the two firms together is .5 x $75 + .5 x $50, or $62.50.[59]

As Kaplow and Shavell pithily observe: "[T]he virtue of the liability rule is that it allows the state to harness the information that the injurer naturally possesses."[60] By setting the damage rule properly, the factory will take when (and only when) it knows that its activities create profits higher than the laundry's expected profits. This simple example shows how a liability rule can induce nonconsensual takings when the taker expects the transfer to be efficient.

The only problem with a first-order rule is that it does not go far enough in "harnessing" the private parties' information. A first-order rule makes use of some of the taker's private information, but it does not make use of the takee's private information. Even after a factory expresses its willingness to pay $50 for the right to pollute, the laundry may still have good reason to think that it has a higher valuation for the entitlement. Suppose that the laundry knows that it will lose $95 in profits if it does not operate. Even if the factory takes, the average value of its profits is only $75. The laundry knows that keeping the entitlement is more likely to be efficient, but a first-order liability rule does not take advantage of this information.

A. *Naive Second-Order Liability Rules*

Second-order liability rules, however, can harness the private information of both sides. The sum of the firms' expected profits can be increased by giving the laundry a "take-back" option:[61] Once the factory exercises its first-order option to pollute by paying the laundry $50, the laundry would have an

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59. Although $50 of the factory's $75 profits go to the laundry as damages, the firms' *joint* profit is not affected by this transfer between them.

60. Kaplow & Shavell, *Economic Analysis, supra* note 4, at 725 (emphasis omitted).

61. Referring to this as a "take-back" option is a little misleading, because readers may mistakenly infer that the factory immediately begins to pollute before the laundry can exercise its right to "take back." But as discussed *supra* note 18, the factory would not actually begin to pollute until after the laundry had been given a chance to pay to maintain the pollution injunction.

option to reinstate the pollution injunction by paying the factory some dollar amount.[62]

The first-order liability rule enhanced efficiency by giving the factory an incentive to take when its value was higher than the laundry's expected value ($50). Hence, one might try to set the second-order exercise price at an amount that would induce the laundry to take back when its value was higher than the expected value of taking factories (in this case, $75). Although the laundry (and the government) initially expect the factory's valuation to be $50, the factory's payment of $50 *reveals new information* about its value. Because the factory is willing to pay $50 in damages, we may infer as an initial matter that the factory's valuation must be above $50 (and by assumption below $100). Thus, on average we should expect that factories exercising their option have a $75 valuation. If so, setting the second-order exercise price at $75 might induce the laundry to take back when its private valuation is higher than its updated expectation of the factory's valuation.

As a starting point, then, let us consider a second-order liability rule that first gives the factory an option to pay $50 for the right to pollute, but (before pollution begins) gives the laundry an option to pay the factory $75 to maintain the prohibition on pollution.[63] In this second-order regime, the factory's first-order taking option (a liability rule) is itself protected only by a liability rule—because the laundry might choose to take back nonconsensually.[64]

This "naive"[65] second-order rule increases efficiency by harnessing the

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62. As an accounting matter, it is important to decide whether the factory will exercise its option by actually paying the $50 or merely offering to pay if and when the laundry decides not to take back. Throughout this Essay, we will assume that the factory actually pays the first-order exercise price and that the laundry then has the option to retain the entitlement by giving back the $50 plus some additional amount. Whether the factory actually pays or merely makes a firm offer does not affect the model, but making this choice and sticking to it will avoid later confusion.

Consider a second-order regime in which the factory has a first-stage option to actually pay $50, followed by the laundry's option to pay $75 to prevent pollution. This is mathematically identical to a second-order regime in which the factory makes a firm offer to pay $50 followed by the laundry's option to *refuse this offer* and pay $25 to prevent pollution. In the first case, the laundry gets $50 and exercises its option by paying out $75. In the second case, the laundry exercises its option by forgoing the $50 it could have pocketed if it had not exercised the option and paying an additional $25 out-of-pocket. The practical result is the same in each case.

In many contexts—such as the situation in *Vincent v. Lake Erie*—the initial taker will not actually pay at the time of taking, but will expose itself to damages by taking. We adopt the alternative "pay as you take" assumption to highlight the increasing auction bids and the implicit opportunity costs of each taking However, for interested readers, we will occasionally mention in the footnotes how an alternative *Vincent*-like auction might be implemented.

63. As discussed *supra* note 62, this "pay as you take" regime is equivalent to one in which the factory merely *offered to pay* $50 and the laundry would have to reject the offer and pay $25 to maintain the pollution injunction.

64. The laundry's second-order taking option, however, is protected by a property rule: We assume that the consequences of the factory trying to pollute after the laundry takes back are so dire (i.e., greater than $100) that no factory would trespass on this right.

65. We call this second-order rule "naive" because it does not take into account all of the possible strategic considerations of the parties. *See infra* Section II.B. When we consider the various ways that the

laundry's private information. The laundry takes back when its private valuation is greater than the factory's expected valuation.[66] Table 1 shows us that the optimal first-order rule generates expected joint profits of $62.50, while the naive second-order rule produces expected joint profits of $64.58. In fact, giving the laundry a $75 take-back option increases the expected payoff of *both* firms: The laundry's expected payoff increases from $50 to $51.82 and the factory's expected payoff increases from $12.50 to $12.76.[67]

TABLE 1. THE RELATIVE EFFICIENCY OF A "NAIVE" SECOND-ORDER LIABILITY RULE

REGIME	EXERCISE PRICES, D_i (DAMAGES)	EQUILIBRIUM TAKING STRATEGIES	EXPECTED PAYOFFS, π_i
Property Rule	$D_1 = 100$	1st Stage: take if $v_F \geq 100$	$\pi_L = 50$ $\pi_F = 0$ $\pi_{Joint} = 50$
First-Order Liability Rule	$D_1 = 50$	1st Stage: take if $v_F \geq 50$	$\pi_L = 50$ $\pi_F = 12.50$ $\pi_{Joint} = 62.50$
Naive Second-Order Liability Rule	$D_1 = 50$ $D_2 = 75$	1st Stage: take if $v_F \geq 41.67$ 2nd Stage: take if $v_L \geq 75$	$\pi_L = 51.82$ $\pi_F = 12.76$ $\pi_{Joint} = 64.58$

Notice that allowing second-order takings does not inevitably lead to an infinite series of reciprocal takings. Because the laundry's take-back option is protected by a property rule, the factory never persists in taking after the laundry "purchases its injunction" in the second stage.[68] Indeed, because the exercise price of the laundry's take-back option is relatively high ($75), the

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parties can act strategically, the efficiency of the regime is improved and we arrive at the "optimal" second-order rule.

66. As we emphasize below, however, *see infra* text accompanying note 77, there is an even more efficient way to structure a second-order rule.

67. The factory's expected payoff can be calculated by multiplying the payoff for a particular outcome by the probability that the outcome occurs. If the factory does not take, its payoff is zero. However, 58.33% of the time the factory will take (because, as we shall see shortly, it makes sense for strategic reasons for all factories with valuations greater than $41.67 to take). The most that any factory values the entitlement is $100, so the average valuation of those factories that take is $(100 + 41.67) ÷ 2 or approximately $70.84.

If the factory takes, there is a 25% chance that the laundry will take back. The expected payoff to the factory if the laundry fails to take back (which occurs 75% of the time) is $20.84: This number is the expected valuation of those factories that take ($70.84) minus the $50 cost of taking. The expected payoff to a factory if the laundry takes back is the $25 it receives from the laundry. Combining these numbers yields the expression for a factory's expected payoff: .5833 x [(.75) x $20.84 + (.25) x $25] = $12.76. The laundry's expected payoff and the expected joint payoff can be derived analogously.

68. Ellickson developed the idea of purchased injunctions. *See* Ellickson, *supra* note 45, at 738–48.

laundry exercises this second-order option just under 15% of the time.[69] Previous analysts who have worried about infinite series of takings have only considered reciprocal taking regimes in which the exercise prices remain constant.[70] Yet, as argued above,[71] the government, in setting the exercise price, should naturally consider the prior takings as evidence of the parties' higher valuation. This fact by itself should counsel in favor of successively higher exercise prices.

B. *Optimal Second-Order Liability Rules*

However, we can do still better. Our "naive" second-order liability rule suffers from two weaknesses. First, its exercise prices overlook the fact that the laundry's take-back option induces factories to exercise their first-order option strategically. Some factories with valuations less than $50 might still take in the hope of making $75 if the laundry chooses to take back. For example, a factory with a $42 valuation might still exercise its $50 option to pollute—because it realizes that 25% of the time the laundry will take back and reward it with a $75 payment. It thus gains $25 if its gamble is successful. A 75% chance of losing $8 is more than offset by a 25% chance of making $25—hence it makes sense to exercise the option strategically. Table 1 shows that this strategic incentive is sufficient to induce factories with valuations as little as $41.67 to exercise the first-order option to pay $50.[72]

Second, the naively chosen exercise prices imperfectly harness the parties' private information. While it makes superficial sense to induce takings when the taker thinks her value is greater than the expected value of the takee, this approach ignores the fact that many takings are not dispositive. Some of the takees will have values higher than the expected value of the taker, and they will protect their interests by taking back. Inducing takings from these high-value takees does not improve total efficiency because it does not put the asset in the hands of one who values it more, and in any case, these takees will simply take back. An optimal regime should focus on takings that will be final, or dispositive. Hence:

> Optimal exercise prices should induce a firm to take whenever the taker's private valuation is greater than the expected valuation of

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69. As shown in Table 1, the naive rule induces the factory to take 58.33% of the time (i.e., when its valuation is greater than $41.67) and 25% of the laundries then take back (i.e., when their valuation is greater than $75). Accordingly, the probability of two takings is 14.6% (.5833 x .75).

70. *See, e.g.*, Kaplow & Shavell, *Reply, supra* note 4, at 222–24 (considering bargaining difficulty but not changing exercise prices). Incidentally, this is the problem in the movie THE MALTESE FALCON, *supra* note 16, and it leads to predictably destructive results.

71. *See supra* text accompanying notes 62–64.

72. A factory with a $41.67 valuation is indifferent between taking and not taking. Not taking produces a certain payoff of $0, which equals its expected payoff from taking (.75) x ($41.67 - $50) + (.25) x ($25).

takees *who will not take back.*[73]

We call this the "dispositive takings principle," because it implies that dispositive takings, on average, will increase welfare.

At first glance, it looks as if the "naive" exercise price causes too many factories to take at the first stage. For the strategic reasons outlined above, factories with valuations as low as $41.67 will take from laundries with an average value of $50. But this concern is illusory. A factory's first-order taking only ends the game if the laundry's valuation is below $75. Only laundries with valuations between $0 and $75 will not take back, and their average valuation is $37.50—which is less than $41.67. Under the "naive" regime, the factories' first-stage decisions are inefficient not because factories take too often, but because they take too infrequently. A more efficient first-order rule would induce factories to take whenever their valuation was greater than $37.50 (the expected valuation of laundries who will not take back).

There is an analogous problem in setting the price for the take-back option. Under the "naive" regime, a laundry will take back when its valuation is greater than $75. In reality, however, it is taking from factories that have an average valuation of only $70.84.[74] A more efficient regime would lower the exercise price to take this effect into account. Laundries should be induced to take back whenever their valuation is larger than the expected value of the class of factories from which they actually take.[75]

To calculate the optimal second-order liability rule, we need to satisfy the dispositive takings principle simultaneously for both taking stages.[76]

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73. Algebraically, an optimal Nth-order liability rule regime should induce firms to exercise when the following set of conditions hold jointly:

$$\forall\ i=1, N: \quad S_i^a = \int_{S_{i-1}^b}^{S_{i+1}^b} v^b f(v^b) d(v^b),$$

where S_i^a is that cutoff taking strategy for firm "a" in taking stage "i"; $S_0 = 0$; and $S_{N+1} = 100$. The equation suggests that this cutoff (or pivot) value for each taking decision will be equal to the expected value of the takees who will not take back. The limits of integration produce the average value of takees who have been willing to take up to this particular stage ($v^b > S_{i-1}^b$), but who will not be willing to take back in the subsequent stage ($v^b < S_{i+1}^b$).

74. That is because factories with valuations as low as $41.67 and as high as $100 will take. The expected valuation of this group of factories is $70.84.

75. Note that in this case we face no problem of including in our expected value the valuations of factories who will take back after the laundry takes. By assumption, in a second-order regime all second-order takings are dispositive. Because a second-order liability rule is protected by a property rule, factories will not have a (practical) third-order option to retake.

76. The text has attempted to describe the intuitions behind optimally structured liability rules. Although the competing considerations seem complicated, it is actually relatively straightforward to express the joint payoffs mathematically in terms of the first- and second-order exercise prices. One finds the optimum in the usual way, by setting the first-order conditions equal to zero and solving for the unknown exercise price. We verified our calculations with Mathematica.

TABLE 2. COMPARING THE RELATIVE EFFICIENCY OF OPTIMAL HIGHER-ORDER LIABILITY
RULES

REGIME	EXERCISE PRICES, D_i (DAMAGES)	EQUILIBRIUM TAKING STRATEGIES	EXPECTED PAYOFFS, π_i
Property Rule	$D_1 = 100$	1st Stage: take if $v_F \geq 100$	$\pi_L = 50$ $\pi_F = 0$ $\pi_{Joint} = 50$
Optimal First-Order Liability Rule	$D_1 = 50$	1st Stage: take if $v_F \geq 50$	$\pi_L = 50$ $\pi_F = 12.50$ $\pi_{Joint} = 62.50$
Optimal Second-Order Liability Rule	$D_1 = 44.44$ $D_2 = 66.67$	1st Stage: take if $v_F \geq$ 33.33 2nd Stage: take if $v_L \geq$ 66.66	$\pi_L = 50$ $\pi_F = 14.82$ $\pi_{Joint} = 64.82$
Optimal Third-Order Liability Rule	$D_1 = 41.67$ $D_2 = 58.33$ $D_3 = 75.00$	1st Stage: take if $v_F \geq$ 25.00 2nd Stage: take if $v_L \geq$ 50.00 3rd Stage: take if $v_F \geq$ 75.00	$\pi_L = 50$ $\pi_F = 15.63$ $\pi_{Joint} = 65.63$
Optimal Fourth-Order Liability Rule	$D_1 = 40.00$ $D_2 = 53.33$ $D_3 = 66.67$ $D_4 = 80.00$	1st Stage: take if $v_F \geq$ 20.00 2nd Stage: take if $v_L \geq$ 40.00 3rd Stage: take if $v_F \geq$ 60.00 4th Stage: take if $v_L \geq$ 80.00	$\pi_L = 50$ $\pi_F = 16.00$ $\pi_{Joint} = 66.00$
Optimal Nth-Order Liability Rule	for $i = 1, N$: $D_i = \dfrac{100(N+2i)}{3(N+1)}$	for Stage $i = 1, N$: take if $value(v_F, v_L) \geq \dfrac{100i}{N+1}$	$\pi_L = 50$ $\pi_F = \dfrac{50N(N+2)}{3(N+1)^2}$ $\pi_{Joint} = \dfrac{50(4N^2+8N+3)}{3(1+N)^2}$

Table 2 shows that the optimum second-order liability rule (for the assumed probability distributions) allows the factory to pay $44.44 for the right to pollute, but then allows the laundry to pay $66.67 to maintain the pollution prohibition. Taking into account the strategic influence of the take-back option, these exercise prices induce factories to take if their valuation is above $33.33 and induce laundries to take back if their valuation is above $66.66.[77]

Notice how this equilibrium satisfies our dispositive takings principle. Laundries take back only when their valuation is above $66.66. Hence factories' dispositive takings come from those laundries that value the entitlement between $0 and $66.66, because these are laundries that will not take back. It follows that the optimal second-order regime should induce factories to exercise their first-order option to pollute only when they have valuations greater than $33.33.

Similarly, factories will take initially only when their valuation is between $33.33 and $100. The average value of factories that take is thus $66.67. Laundries take back only when their valuation is higher than this expected value. In this way all of the dispositive transfers—whether at the first stage or the second—increase the expected value of the entitlement.

Not surprisingly, the optimal second-order liability rule produces higher joint payoffs than the naive rule ($64.82 vs. $64.58), as depicted in Figure 1.[78] Nevertheless, this optimal second-order rule still creates three symmetric types of inefficiency:

1. Factories with valuations between $0 and $33.33 may fail to take—even from laundries with lower valuations. In these cases the entitlement is inefficiently controlled by a laundry that values it less.
2. Laundries with valuations between $33.33 and $66.66 may fail to take back—even when they have a higher valuation than the factories. In these cases, the entitlement is inefficiently controlled by a factory that values it less.
3. Factories with valuations between $66.66 and $100 may fail to retake—even though their valuation is higher than laundries that

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77. Once again, we could structure the rule so that factories did not have to pay $44.44 in damages initially but merely had to make a firm offer to pay if the laundry declined to take back and pay damages. In such a "take now and pay later" regime, the laundry's second-stage damages would be $22.22. Only laundries with valuations greater than $66.66 would take back, because they would be foregoing the factories' promised payment of $44.44 and committing themselves to pay $22.22.

78. However, the expected payoff to the laundry actually decreases when we move from the naive to the optimal second-order regime, from $51.82 to $50.

Both the naive and optimal second-order rules are Pareto superior to the optimal first-order rule. We call the second-order rule "optimal" because it maximizes the parties' joint payoffs and hence is Kaldor-Hicks superior to the naive second-order rule. However, neither is Pareto superior to the other.

The Pareto superiority of the optimal second-order rule over the optimal first-order rule can be generalized: Higher-order optimal rules are Pareto superior to all lower-order optimal rules.

have exercised their take-back option. Hence, the entitlement is inefficiently controlled by a laundry that values it less.

Figure 1 Three Sources of Inefficiency Associated with the Optimal Second-Order Rule

It is important to recognize that any second-order rule would produce similar kinds of inefficiency: At any point in the sequence of potential takings, the higher-valuing firm may fail to take because the exercise price is too high. Nevertheless, by equalizing these three different kinds of inefficiencies, the optimal second-order rule minimizes their joint losses. It thus induces a group of dispositive takings that, on average, increases the expected joint payoffs by the greatest amount.
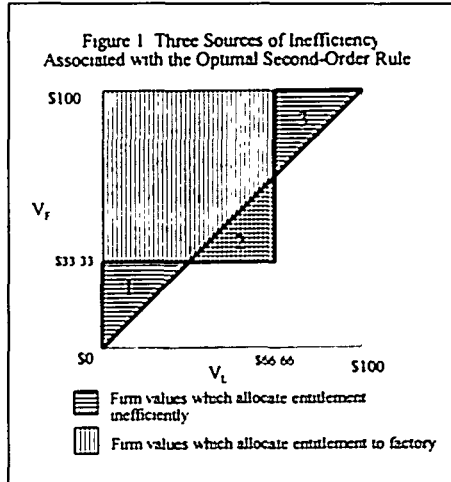
C. *Higher-Order Liability Rules as Auction Surrogates*

Table 2 shows, however, that higher-order liability rules can induce even more efficient allocations. The "equilibrium taking strategies" column in Table 2 reveals that higher-order rules evenly divide the range of possible valuations into successively finer bidding increments. This allows the parties to identify their valuations more precisely. Under the optimal third-order rule, the pivotal taking strategies come in $25 increments ($25, $50, and $75); and under the optimal fourth-order rule, they come in $20 increments ($20, $40, $60, and $80).[79]

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79. Table 2 expresses the exercise prices (damages) that would be paid in full after each taking Table 3 offers prices for a "take-now-and-pay-later" system. It lists the exercise prices (or net damages) that the last taker would pay after the last taking. It produces equilibria that are equivalent to those in Table 2.

TABLE 3. EQUIVALENT EXERCISE PRICES (TO TABLE 2) UNDER A "TAKE-NOW-PAY-LATER" SYSTEM·
DAMAGES PAID ONLY IF NO FURTHER TAKING

REGIME	EXERCISE PRICES, ND_i (NET DAMAGES)
Property Rule	$ND_1 = 100$
Optimal First-Order Liability Rule	$ND_1 = 50$
Optimal Second-Order Liability Rule	$ND_1 = 44.44$; $ND_2 = 22.22$
Optimal Third-Order Liability Rule	$ND_1 = 41.67$; $ND_2 = 16.67$; $ND_3 = 58\ 33$
Optimal Fourth-Order Liability Rule	$ND_1 = 40.00$; $ND_2 = 13.33$; $ND_3 = 53.33$; $ND_4 = 26\ 67$

Indeed, a striking pattern emerges: Optimal liability rules induce the same behavior as auctions structured with ascending bids and minimum bid increments.[80] For example, the optimal third-order rule produces the same entitlement allocation as an alternating offer auction with $25 bid increments where the factory must place the first bid.[81] By paying the exercise price (of $41.67), the factory signals a valuation greater than $25. By paying the price of retaking the entitlement ($58.33) the laundry signals a value greater than $50. Finally, by retaking (and paying damages of $75) the factory signals a value greater than $75.

As the number of reciprocal taking options increases, the size of the bid increments decreases. For an Nth-order liability rule, the bid increment is simply $100/(N+1)$. This means that a ninety-ninth-order liability rule (i.e., a regime with ninety-nine reciprocal take-back options) would produce the same allocation as an alternating bid auction with a $1 bid increment. Under such a regime, the factory would initially take if its valuation is greater than $1, the laundry would take back if its valuation were greater than $2, and so on. Maintaining the (increasingly far-fetched) assumption that there are no taking costs, the only inefficiency from this regime would stem from the rather negligible chance that a firm's value is less than $1 greater than the other firm's value—so that a higher-valuing firm might not be willing to pay the next bid increment.[82]

Optimal Nth-Order Liability Rule	for i = 1, N:
	$$ND_{fi} = 100[\frac{1}{3} + \frac{i}{3(N+1)}], \quad \forall \ odd \ i$$ $$ND_{li} = 100[\frac{i}{3(N+1)}], \quad \forall \ even \ i$$

80. The uniformity of the bid increments is an artifact of our uniform distribution assumption. Other distributions of private valuations would produce ascending auctions as well, but the minimum bid increments would not be constant.

81. Formally, one might argue that the laundry has to choose whether to make an initial bid of $0. But because all laundries would exercise this $0 exercise-price option, the nontrivial conception of the auction begins with the factory's $25 signal.

$$D_i = \frac{N}{3(N+1)} + \frac{2}{3}S_i$$

82. Interestingly, Table 2 also reveals that the optimal exercise price for the first taking in any regime will never fall below $33. For example, in a regime with a 99th-order liability rule, the factory's initial option is to pay $33.67. This signals that the factory values the entitlement at least at $1. Strategic considerations explain this result: Because the factory knows that many of the laundries will value the entitlement more highly than the exercise price and take it back, factories with valuations as little as $1 can expect a profit on average by gambling and taking.

Exercise prices vary between $33.33 and $100, but the lowest or cutoff price at which strategic taking becomes rational varies between $0 and $100. Hence it is easy to see that the exercise prices (D_i) increase at two-thirds the rate of the lowest valuation that makes strategic taking rational (S_i). Thus, for the optimal second-order rule, the difference between D_1 and D_2 ($22.22) is two-thirds the difference between the first and second stage cutoff prices ($33.33).

This similarity between reciprocal takings and auctions helps explain why—as shown in Table 2—increasing the number of reciprocal takings options (in an optimally structured liability regime) monotonically increases the firms' expected joint payoffs.[83] Just as an alternating-bid auction approaches first-best efficiency in the limit as the bidding increment approaches zero, increasing the number of reciprocal taking options makes the expected joint payoffs move asymptotically toward first-best efficiency of $66.66.[84] Just as auctions can induce bidders to reveal their private information, multiple-order liability rules can complete the process begun by first-order rules by harnessing private information to allocate entitlements efficiently.

D. *The Benefits of Internal Auctions: Risk Aversion, Equity, and Ex Ante Investment*

Our central finding is that higher-order liability rules can increase the parties' expected joint payoffs. Yet, the argument tells us nothing about the risk associated with particular payoffs, and it also tells us nothing about how the joint payoffs are allocated. If firms are risk averse, focusing on *expected* payoffs is inappropriate. If the distributions are inequitable, or undermine the firms' ex ante incentives to increase productive capacity, then focusing on *joint* payoffs is also inappropriate.

However, our studies have led us to two surprising results: First, the possibility that one or more of the parties may be risk averse actually militates *in favor* of higher-order liability rules. Second, higher-order liability rules are extremely flexible and adaptable to distributional concerns. Policymakers can choose among many possible distributions of expected joint gains and still retain the efficiency-enhancing properties of our initial model. Higher-order liability rules let us have equity without sacrificing efficiency.[85]

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83. Notice, however, that the laundry's expected profit remains constant at $50—so that all of the expected efficiency enhancement accrues to the factory. Higher-order liability rules still Pareto dominate lower-order regimes, but only in the weak sense. In the limit, the type-specific expected payoffs for the laundry and the factory are, respectively,

$$\pi_L = \frac{100}{3} + \frac{v_L^2}{200}$$

$$\pi_F = \frac{v_F^2}{200}$$

84. Using L'Hôpital's rule, it is straightforward to show that the limit as $N \to \infty$ of the closed form expression for expected joint payoffs in Table 1 is $66.66.

85. These two results are based on *ex ante* analysis of the players' expected payoffs—assessed before the laundry and the factory acquire their private information. From an *interim* perspective—i.e., once the firms have learned their valuations but before they consensually or nonconsensually transfer the entitlement—moving from a lower- to a higher-order liability rule may increase the risk or reduce the expected payoffs for players with particular valuations. The differences between ex ante and interim

At first blush a regime with successive reciprocal taking options seems to introduce considerable uncertainty. But uncertainty about which firm will end up controlling the entitlement is different from uncertainty about the firms' expected payoffs. In fact, the variance of the laundry's expected payoffs declines as the number of potential takings (N) increases.[86] This can most easily be seen in comparing property and first-order liability rules. Under a property rule regime, the laundry expects that it is equally likely that its profits will be anywhere between $0 and $100. Yet, under a first-order liability regime, the laundry is guaranteed to make $50 fully half of the time; it is only exposed to the $0 to $100 risk when the factory does not take.[87] The desire by others for its valuable asset creates a sort of insurance policy for the laundry's profits: The very fact that others would willingly take the entitlement and pay damages reduces the laundry's downside risk.

Ex ante, then, risk-averse laundries should actually prefer higher-order liability rules: Multiple rounds of potential takings keep the laundry's expected payoff constant (at $50) and systematically reduce risk. Even risk-averse factories might prefer higher-order liability rules. Although increasing the number of potential takings (N) increases the variance, and thus the riskiness of their investment,[88] higher-order liability rules also increase the factory's expected payoffs.[89] On balance then, the possibility of risk aversion hardly weakens the case for higher-order liability rules, and probably strengthens it.

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analysis are discussed more fully in Ayres & Talley, *Solomonic Bargaining, supra* note 3, and in Brown & Ayres, *supra* note 53.

86. Table 4 summarizes the variance of the laundry's and factory's expected payoffs for various entitlement regimes:

TABLE 4. VARIANCE OF FIRMS' EXPECTED PAYOFFS UNDER ALTERNATIVE RULES

ENTITLEMENT REGIME	VARIANCE
Property Rule	$Var(\pi_L) = \$833.33$; $Var(\pi_F) = \$0$
Optimal First-Order Liability Rule	$Var(\pi_L) = \$416.67$; $Var(\pi_F) = \$260.42$
Optimal Second-Order Liability Rule	$Var(\pi_L) = \$339.51$; $Var(\pi_F) = \$274.35$
Optimal Third-Order Liability Rule	$Var(\pi_L) = \$312.50$; $Var(\pi_F) = \$276.23$
In the limit as N approaches infinity	$Var(\pi_L) = \$277.78$; $Var(\pi_F) = \$277.78$

As shown in Table 4, the variance of the laundry's expected payoff decreases monotonically in N, moving asymptotically to $277.78, and the variance of the factory's expected payoff increases monotonically in N, moving asymptotically as well to $277.78.

87. The variance of the laundry's expected payoff under a property rule is $833.33, but only $416.67 under a first-order liability rule. Note that a descending auction compares the parties' willingness to accept payment in return for surrender of the entitlement, whereas the more familiar ascending auction compares their willingness to pay for the entitlement. *See supra* note 52.

88. *See supra* Table 4.

89. For example, a property rule eliminates the factory's risk completely, but only by eliminating the chance of any positive payoff.

Moreover, the internal auction scheme implicit in higher-order liability rules gives policymakers surprising flexibility to create ex ante investment incentives or to respond to equitable concerns. Table 2 offers an example of one distributional choice: Higher-order liability rules maintain the laundry's expected payoff (of $50) while allocating all gains from the possibility of nonconsensual taking to the factory.

But other distributions are equally possible. Using different auction rules can produce widely divergent distributions without any sacrifice in efficiency. To make this point more dramatically, we offer an example with a very different distributional result: a downward spiraling auction that employs "puts" rather than "calls."

Puts and calls are symmetrical options: A put is an option to sell, while a call is an option to buy. The reciprocal taking options we have considered up to this point have been call options; they give a potential taker the option to buy nonconsensually the entitlement. It is also possible to create an entitlement regime that consists of a sequence of put options that give potential takees the option to force takers to buy the entitlement. Thus, while the call options we have been considering permit takings without the sellers' consent, a system of put options permits takings without the buyers' consent.

For example, a first-order put liability rule might initially give the laundry both the original entitlement and an option to force a sale to the factory for $50.[90] Under this regime, the laundry would exercise its option when its valuation was less than $50. The parties' expected joint payoffs in this regime would be $62.50—identical to the expected joint payoffs for the first-order call liability rule that we analyzed earlier in Table 1. But there is a crucial difference.

Using the put option reallocates all of the expected payoffs to the laundry. Fifty percent of the time, the laundry will exercise its put option and force the factory to pay $50 for the right to pollute; the other fifty percent of the time, the laundry retains its initial right to enjoin pollution and realizes a $75 profit on average. This gives the laundry a total expected payoff of $62.50. The factory, on the other hand, expects a $0 payoff: Half the time it does not operate at all, and half the time it must pay $50 for an entitlement that on average it values at $50.

As before, there is no reason why one could not implement higher-order put liability regimes. In an optimally structured second-order regime of put options, the laundry would begin with the entitlement and have an option to force a sale for $55.56, but the factory would then have a "put back" option: It would have the option to force the laundry to buy the entitlement back for $33.33. Once again, the possibility of a subsequent taking induces strategic

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90. Madeline Morris was the first to point out the possibility of such first-order put liability rules *See* Morris, *supra* note 4, at 851–56.

behavior at the earlier stage. Thus, even some laundries with valuations greater than $55.56 would be willing to sell their entitlement for $55.56 because of the substantial chance that the factory would allow them (or, more correctly, force them) to buy back the entitlement for the lower price of $33.33.

Optimal put liability rules produce a *descending* auction analogous to the *ascending* auction created by call liability rules. In a second-order regime, the laundry would exercise its put option whenever its valuation is less than $66.66, and the factory would "put back" whenever its valuation is less than $33.33. Again, the expected joint profits from this optimal second-order regime are $64.82. However, like the first-order put regime, using put options distributes all of these expected gains to the laundry.[91]

This example vividly illustrates how policymakers can manipulate the expected distribution of expected payoffs while still maintaining the size of the overall pie. Krier and Schwab have powerfully argued that first-order put options can be useful when we know which party can make the best decisions about efficient use of resources but it is inequitable to force them to pay for the entitlement.[92] Instead, we can give this more deserving party the entitlement plus a put option, so that it can force sales to others when it is not the most efficient user. This helps ensure that the option holder will capture the lion's share of joint expected payoffs.

As we noted earlier, an important concern with reciprocal taking options is the fear that parties will underinvest in productive capacity. Thus, one might worry that making the laundry's initial entitlement subject to a series of reciprocal auctions would undermine the laundry's incentive to acquire new property and improve existing property.[93] Table 2, however, shows that optimally structured call liability rules can maintain the laundry's expected payoff under a property rule in ways that can mitigate the standard underinvestment problem. For example, consider a firm that is deciding whether to build a laundry. Assume that this firm does not know what its actual profit will be until after the laundry is built. Under a property rule regime, the laundry will invest if its expected costs are less than $50 (the expected profits). But a risk-neutral laundry would make the same investments under a first- or higher-order liability regime, for Table 2 shows that these regimes yield precisely the same expected profits. Moreover, as argued above,

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91. The variance of expected payoffs for the laundry and factory are reversed from the variances reported in Table 4.

92. *See* Krier & Schwab, *supra* note 4, at 471.

93. Kaplow and Shavell note that, as Samuelson acknowledges, auctions where the winning bidder pays the losing bidder

> are often not useful because they would require the initial holder of an entitlement to share too much of the auction proceeds with others. Holders of entitlements might therefore not agree to participate in the auctions (and, if the law required participation, incentives to acquire and improve property would be adversely affected).

Kaplow & Shavell, *Economic Analysis, supra* note 4, at 734 n.66 (citing Samuelson, *supra* note 57, at 336–37).

a risk-averse laundry would be even more likely to invest under higher-order regimes because reciprocal taking options reduce the risk of unexpectedly low or high payoffs.

If we use put options, we can give laundries even stronger ex ante incentives to invest. Of course, there is a tradeoff between how much of an investment incentive is given to the laundry and how much is given to the factory.[94] However, our point is that giving the factory a partial claim to the laundry's entitlement can enhance efficiency without undermining the laundry's initial investment decision.[95] Dividing the claims to an entitlement between two firms can reduce the firms' individual incentives to create or develop the entitlement in question. Yet higher-order liability rules need not exacerbate this underinvestment problem because they preserve—or in the case of put options, increase—the original entitlement owner's expected profits.[96] These results demonstrate an especially attractive feature of "internal" auctions, where winning bidders compensate losing bidders instead of external third parties: Wanting to distribute the lion's share of the expected profits to one firm does not prevent policymakers from harnessing all of the other firm's private information.[97]

III. THE RELATIVE EFFICIENCY OF SECOND-ORDER RULES WHEN TAKING IS NOT COSTLESS

Although in theory reciprocal takings options can produce many of the efficiencies of auctions, in practice the costs of implementing these regimes may not be worth the candle. An arbitrarily large number of taking stages can come arbitrarily close to first-best efficiency, but such a regime also produces an arbitrarily large number of takings. If each nonconsensual taking consumes substantial resources, then the most efficient rule is likely to look very different from an "optimal" Nth-order liability rule. This Part investigates how

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94. If the investments are sequential, we might want to give the first investor the entitlement subject to the second investor's call option so that each firm captures the marginal benefit of its investment.

95. Samuelson, for example, suggests that preassigning an entitlement to a particular bidder can impede efficient allocation. *See* Samuelson, *supra* note 57, at 325. In contrast, he describes his "rights bidding" mechanism as making the bidders "joint owners of the right" with the opportunity to "share equally" in its value. *Id.* at 331.

96. This result contrasts with other attempts to improve efficiency by dividing an entitlement among bidders: "Attempts to remedy adverse selection often exacerbate moral hazard. . . . Solomonic entitlements may give bargainers suboptimal prebargaining incentives to make value-enhancing investments." Ayres & Talley, *Solomonic Bargaining, supra* note 3, at 1085 (citation omitted).

97. Samuelson has proposed a bidding mechanism to allocate entitlements that also has "no seller to collect the proceeds; instead, the proceeds are returned to the parties themselves." Samuelson, *supra* note 57, at 331. Under what he terms "split-the-difference bidding," the firms would submit sealed bids and the high bidder would receive the entitlement and pay the low bidder one-half the average bid. Samuelson shows that this mechanism can produce efficient allocations, *see id.* at 331-35, just as we find an Nth-order liability rule would. The potential efficiency of "internal" auctions—where the proceeds of the auctions are shared internally among the bidders—is formalized in the seminal article by Peter Cramton et al., *Dissolving a Partnership Efficiently,* 55 ECONOMETRICA 615 (1987).

introducing a fixed cost per taking, paid by the taking firm, affects the relative efficiency of different regimes. Although we analyze a situation with fixed costs per taking here, we note that there are many other ways of modeling the taking costs created by liability regimes.[98] Nevertheless, the two main results of this Part apply equally to models with many different alternative taking-cost assumptions:

1. Optimal exercise prices will be an increasing function of taking costs;
2. When taking costs rise sufficiently, lower-order liability rules become Pareto superior to higher-order liability rules.[99]

For both of these reasons, the optimal liability regime will produce fewer expected takings as takings become more costly.

Table 5 shows how equilibrium taking strategies in an optimally structured second-order regime are sensitive to taking costs. The first- and second-stage taking strategies for the optimal rule without taking costs were $33.33 and $66.67, respectively. Introducing taking costs increases both the optimal exercise prices[100] and the cut-off taking strategies. As shown in Table 5, when costs per taking are $10, the optimal second-order rule will induce a laundry to take back only if its valuation is above $88.41. If the taking costs

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98. Takings costs might be: (i) fixed or variable; and (ii) initially borne by the taking firm, the non-taking firm, or by the general public. The prospect of takings might also induce a variety of ancillary inefficiencies—such as underinvestment in creating or developing the original entitlement—which might be deemed as a fixed cost of a liability regime. See Ayres & Talley, Solomonic Bargaining, supra note 3, at 1083–84 (discussing three costs of divided entitlement regimes).

99. If the taking costs of administering a liability rule regime are fixed, then the exercise prices may not be a smoothly increasing function of these costs, but the second result will still hold: Lower order liability rules and/or property rules will become more efficient as these costs become sufficiently high.

100. The optimal exercise prices (not depicted in Table 5) are:

TABLE 6. EXERCISE PRICES FOR OPTIMAL SECOND-ORDER LIABILITY RULE AS A FUNCTION OF TAKINGS COSTS (IN $)

COST PER TAKING	OPTIMAL FIRST-STAGE EXERCISE PRICE	OPTIMAL SECOND-STAGE EXERCISE PRICE
0	44.44	66.67
8	48.82	76.61
10	49.33	78.41
12	49.77	80.03
14	49.95	81.54
16	49.99	82.99

Note that the second-order exercise prices plus the takings cost equal the second-order cutoff strategies.

are $16, the laundry will only take back in the rare instance that its valuation is above $98.99.

TABLE 5. EXAMPLE OF HOW HIGHER TAKINGS COST DECREASES TAKINGS IN SECOND-ORDER
LIABILITY RULE REGIME (IN $)

COST PER TAKING	OPTIMAL FIRST-ORDER TAKINGS STRATEGY (FACTORY TAKES IF ITS VALUE EXCEEDS)	OPTIMAL SECOND-ORDER TAKINGS STRATEGY (LAUNDRY TAKES BACK IF ITS VALUE EXCEEDS)
0	33.33	66.67
8	53.25	84.61
10	56.83	88.41
12	60.16	92.03
14	63.19	95.54
16	65.81	98.99

If taking costs exceed $16.67, the optimal second-order rule establishes a second-stage exercise price of $100 (or more) that completely deters laundries from taking back. At this point, the optimal second-order rule becomes equivalent to a first-order liability rule (protected by a property rule). Put another way, the first-order liability rule is the efficient solution because the social benefits from harnessing the private information of the laundry are swamped by the costs of retaking.

This example shows that as taking costs increase, the increase in optimal exercise prices will eventually create lower-order liability rules. The crucial efficiency crossover points are depicted in Table 7. When the taking costs are between $7.14 and $16.67,[101] an optimally structured second-order liability rule is more efficient than any higher- or lower-order liability rule. If taking costs are below $7.14, higher-order rules become efficient, and if taking costs are greater than $16.67, first-order liability or property rules become efficient. Optimally structured first-order liability rules are efficient for taking costs between $16.67 and $50, and property rules are efficient for taking costs above $50.[102]

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101. The lower-bound estimate of $7.14 is a numeric estimate, because we were not able to calculate a closed-form expression for this third-order cutoff.

102. The intuition is straightforward for why property rules are efficient when taking costs are greater than $50. Under a first-order rule, factories internalize all of the taking costs and the optimal exercise price remains $50—so factories internalizing the cost of taking will only take when their value is greater than the taking cost plus the exercise price of $50. When the taking cost is less than $50, some range of

TABLE 7. RELATIVE EFFICIENCY OF DIFFERENT PROTECTION REGIMES AS COST PER TAKING
VARIES (IN $)

REGIME	RANGE OF TAKING COSTS WHERE REGIME IS EFFICIENT
Property Rule	t > 50.00
First-Order Liability Rule	50.00 > t > 16.67
Second-Order Liability Rule	16.67 > t > 7.14

In light of Table 7, we can now see why Kaplow and Shavell's prima facie case for first-order liability rules needs to be qualified. First-order liability rules are dominant for only a discrete range of taking costs. Even if these authors are right that taking costs are low enough to establish presumptively that first-order liability rules are more efficient than property rules, there is no a priori reason to exclude second- and higher-order rules from consideration.

IV. THE RELATIVE EFFICIENCY OF SECOND-ORDER RULES WHEN BARGAINING IS POSSIBLE

Parts II and III showed that higher-order liability rules enhance the nonconsensual advantage of first-order rules by harnessing more of the firms' private information. This nonconsensual advantage persists even when bargaining is allowed. However, when bargaining is possible, first-order liability rules may have a "consensual" advantage over higher-order liability rules. First-order rules force the parties *when bargaining* to reveal more information about their valuations than higher-order rules, and the higher-order the rule, the smaller this "information-forcing" effect. Hence higher-order regimes are less likely to facilitate efficient trades. Indeed, at some point the sequence of nonconsensual takings effectuated by higher-order liability rules becomes a substitute for the consensual advantage of lower-order (property and first-order liability) rules. Thus, higher-order liability rules are most likely to be efficient when consensual trade is unlikely—for example, because of the temporal exigencies in a case like *Vincent v. Lake Erie.*

In *Solomonic Bargaining*, Ayres and Talley showed that first-order liability rules have an "information-forcing" effect that can produce more bargaining

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factories with high valuations will still find it valuable to take and will increase the expected joint payoffs. The choice of optimal exercise prices under a higher-order regime, however, is more complicated. The factory, in making its first taking decision, does not internalize all the costs of its decision, because it might provoke a laundry to take back and consume more resources. Optimally chosen exercise prices try to dampen the firms' incentives to take excessively.

and greater efficiency than property rules.[103] The information-forcing effect stems from the fact that the entitlement holder can make two different types of bargains: She can either bribe the potential taker not to take (i.e., not to pollute), or she can offer to sell the entitlement outright. In these pre-taking negotiations, the entitlement holder (the laundry) has a robust incentive to signal whether she values the entitlement at more or less than the exercise price (the potential damage award). Only laundries that place a high value on the entitlement would ever offer to bribe the factory not to pollute; conversely, only laundries with comparatively low valuations would offer to sell the entitlement outright.[104] The possibility of making these two kinds of bargains credibly partitions the class of entitlement holders according to their relative valuations. As Ayres and Talley show, this self-partitioning reduces the firms' asymmetric information and thus may facilitate consensual trade.[105]

Reciprocal taking options, however, do not produce as strong an information-forcing effect and thus are not as prone to facilitate trade. *Solomonic Bargaining* emphasized that the existence of two types of trade—bribing the taker or selling the entitlement—signaled the entitlement holder's private valuation.[106] Higher-order liability rules, however, increase the number of possible kinds of trade, confusing the issue. For example, under a second-order liability rule, there are three possible trades that could correct the three types of inefficiencies depicted above in Figure 1:

(i)   When the factory values the entitlement more than the laundry, but both value it less than $33.33, the factory will inefficiently fail to take. Nevertheless, the laundry might sell its entitlement and its take-back option for some price less than $44.44.[107]

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103. *See* Ayres & Talley, *Solomonic Bargaining, supra* note 3. *But see* Kaplow & Shavell, *Reply, supra* note 4 (conceding that Ayres & Talley provide example with low transaction costs where first-order liability rule is more efficient than property rule, but arguing that liability rule's greater efficiency stems from nonconsensual headstart which persists when bargaining is allowed and not because liability rule "facilitate[s] bargaining"); Ayres & Talley, *Distinguishing, supra* note 3 (conceding that their initial example does not adequately distinguish between consensual and nonconsensual advantages of liability rules, but providing example where first-order liability rule has no nonconsensual headstart, but becomes more efficient than property rule when bargaining is allowed).

104. Ayres and Talley show, however, that there might be a class of laundries with intermediate values who would not make serious offers to enter into either type of trade. *See* Ayres & Talley, *Solomonic Bargaining, supra* note 3, at 1053–58.

105. While first-order liability rules induce different types of laundries to "separate"—i.e., to play different strategies that reveal their valuation—they often induce factories to "pool"—i.e., to play the same strategies that conceal their relative valuation. Ayres and Talley suggested that the self-partitioning effect was only likely to facilitate trade when the laundries' private information was the most significant constraint. *See id.* at 1059–60 ("By effectively forcing the [parties] to reveal information about their valuations, liability rules mitigate the inefficiencies of bargaining under private information.") The trade-facilitating effect is only a possibility. *See* Ayres & Talley, *Distinguishing, supra* note 3, at 240.

106. *See* Ayres & Talley, *Solomonic Bargaining, supra* note 3, at 1038.

107. *See* Triangle 1 in Figure 1. The laundry's selling both its entitlement and its take-back option for a price less than $44.44 might dominate the laundry's selling just its entitlement—because it discourages high-value laundries from strategically offering to sell in order to decrease the likelihood of a factory's

(ii)   When the laundry values the entitlement more than the factory, but both value it between $33.33 and $66.66, the laundry will inefficiently fail to take back after the factory takes. Nevertheless, the laundry could buy the factory's taking option so as to preserve its entitlement.[108]

(iii)   When the factory values the entitlement more than the laundry, but both value it more than $66.66 and less than $100, the factory will inefficiently fail to retake the entitlement from the laundry after the laundry takes it back. Nevertheless, the laundry could sell its entitlement and its take-back option for a price greater than $44.44.[109]

Does the possibility of these three kinds of bargains have the same information-forcing effect as we witness in the case of first-order liability rules? Does one or the other class of firms credibly partition itself according to its private valuation of the entitlement? The answer to both questions is a qualified yes: Second-order liability rules also produce an information-forcing effect, but the self-partitioning effect is somewhat muted.

Under a first-order liability rule, the party who does not hold the option (the laundry, in our example) credibly signals its valuation whenever it makes a serious offer to buy the option or to sell its own entitlement. Under a second-order regime, this signal is no longer fully reliable. A laundry may have an incentive to send false signals about its value in order to affect the factory's decision whether to take.[110] Thus, under a second-order regime, laundries no longer have strong incentives to speak credibly about their valuations because

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taking. Specifically, laundries with valuations above $66.66 might offer to sell their entitlement for a low price—hoping that their offer will be rejected and that the factory (thinking that the laundry has a low value) will be less likely to take. Selling its take-back option makes it more expensive to engage in this behavior, because the high-value laundry cannot take back.

108. *See* Triangle 2 in Figure 1.

109. *See* Triangle 3 in Figure 1. The laundry's selling both the entitlement and the take-back option for a price greater than $44.44 is equivalent to the laundry's selling just its take-back option. If the laundry only sells its take-back option, its payoff will be $44.44 from the factory's nonconsensual taking plus whatever it earns from selling its take-back option (say $x). This transaction is equivalent to selling the entitlement and take-back option immediately for $44.44 + $x. The factory would like to stop low-value laundries from pooling with high-value laundries in accepting these offers, but the same incentives to pool occur in either case.

110. As discussed above, factories may strategically choose to take even when their valuation is below the first-order exercise price because they hope to profit if the laundry takes back. The factory's decision to act strategically turns crucially on its belief about the laundry's likelihood of taking back. If the factory is certain that the laundry's valuation is above $66.66, then all factories will take. If the factory is certain that the laundry's valuation is below $66.66, then only factories with valuations above $44.44 will take. Knowing this, laundries may choose to send false signals about their valuation. For example, a laundry with a low valuation might signal a high valuation by making an offer to buy the factory's option. This would increase the chance that the factory will take. The laundry hopes that the factory will reject the offer and take nonconsensually because it will then pay the laundry in damages more than the laundry valued the entitlement. Analogously, laundries that valued the entitlement greatly might be willing to make offers to sell their entitlement for less than $44.44. This would signal a low value and consequently reduce the chance that factories would take nonconsensually.

the factories' beliefs about the laundries' valuations shape the factories' decision to take. Instead, second-order regimes produce an information-forcing effect for *factories*.

In a second-order regime, the factory can sell its original option to take or bribe the laundry not to retake after it takes. A factory making either type of offer credibly signals whether its valuation is above or below the second-stage exercise price ($66.66 in the optimal second-order regime). Factories with a higher value would never offer to sell their option to take; factories with a lower value would never offer the laundry a bribe not to retake.[111] Strategic concerns do not enter here because the laundry's strategy of taking whenever its valuation is above $66.66 is independent of its beliefs about the factory's valuation. Hence factories do not have a strategic incentive to distort the laundries' beliefs.[112] Any offer from a factory to buy a laundry's take-back option credibly signals that the factory's valuation is greater than $66.66, and any offer to sell its taking option signals that the factory's valuation is less than $66.66.[113]

The factories' self-partitioning might facilitate trade. However, second-order regimes also induce a proliferation of inefficient *pooling* strategies. Firms conceal their different valuations by mimicking each other's behavior. This undermines the firms' ability to bargain. Pooling (or mimicking) behavior takes two different forms. Sometimes firms will mimic legitimate offers hoping that their offers will be rejected, but that they will thereby affect the other side's decision whether to take nonconsensually.[114] Sometimes firms will mimic legitimate offers hoping that their offers will be accepted—in this way a firm might try to buy the other side's entitlement on the cheap or sell an option that it would never exercise.[115] In either case, because mimicking firms pursue trades that they know cannot enhance the parties' joint payoffs, they make value-enhancing trade less likely.[116] Indeed, we conjecture that increasing the

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111. To put it another way, any offer from a factory to buy a laundry's take-back option credibly signals that the factory's valuation is greater than $66.66, while any offer to sell its taking option signals that the factory's valuation is less than $66.66.

The factory has a third type of bargain available to it: It can offer to buy the laundry's entitlement and take-back option for less than $44.44. This offer does not, however, signal the factory's value. High-value factories might well try to pool with low-value factories to buy the laundry's entitlements on the cheap.

112. We can generalize this point: In any Nth-order liability rule, the party with the last or Nth option will be able to act strategically with respect to the exercise of this option. The party with the next to the last ((N-1)th) option will not, because the Nth taking is protected by a property rule. This removes the practical option to retake.

113. Serious offers to enter into the third type of trade (namely, to buy the laundry's entitlement and take-back option for less than $44.44) do not, however, signal the factory's value. High-value factories might well try to pool with low-value factories to buy laundries' entitlements on the cheap.

114. *See, e.g., supra* note 110 and accompanying text.

115. For example, a factory with a high valuation might offer to buy a laundry's entitlement for less than $44.44. This type of trade could only be socially beneficial if a factory had a valuation below $33.33. Nevertheless, a factory with a high valuation would pursue it not to create value but to transfer value.

116. The generic offering incentives of the firms either to separate (self-partition), to mimic behavior hoping for acceptance, or to mimic behavior hoping for rejection amount to the following for the three

number of reciprocal taking options will gradually eliminate the opportunities for trade.

Even in the absence of trade, higher-order liability rules increase asymptotically toward first-best efficiency, so there are fewer inefficiencies for trade to correct. And higher-order regimes make it much more difficult for bona fide bargainers to avoid the pernicious effects of pooling. For example, in a ninety-ninth-order liability rule regime (which emulates an ascending auction with $1 bid increments), there would be 100 inefficiency triangles, potentially correctable by 100 different types of trade. But the probability of mimicking offers is so much larger than the probability of bona fide offers that in all likelihood value-enhancing trade will be foreclosed. In sum, we suspect that the nonconsensual advantages of higher-order liability rules would persist once bargaining is allowed,[117] but that higher-order liability rules are unlikely to produce much additional efficiency from consensual bargains.

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types of trade:
    (i) The laundry might sell its entitlement (and its take-back option) for a price less than $44.44.

Factories:	Factories with high and intermediate valuations (greater than $33.33) might mimic factories with low valuations (less than $33.33) by offering to buy the laundry's entitlement; these factories hope for acceptance.
Laundries:	Laundries with high and intermediate valuations (greater than $33.33) would never accept an offer to sell for less than $44.44, but might mimic offers made by laundries with low valuations (less than $33.33) to reduce the chance that the factory will take; these laundries hope for rejection.

    (ii) The laundry could buy the factory's taking option.

Factories:	Factories with low valuations (less than $33.33) might mimic factories with intermediate valuations (between $33.33 and $66.66) by offering or accepting offers to sell their take-back option; these factories hope for acceptance. Factories with high valuations (greater than $66.66) will self-partition by refusing to offer (or accept an offer) to sell their take-back option.
Laundries:	Laundries with high valuations (greater than $66.66) might mimic the behavior of laundries with intermediate valuations (between $33.33 and $66.66) by trying to buy factories' taking options; these laundries hope for acceptance. Laundries with low valuations (less than $33.33) might mimic laundries with intermediate valuations (between $33.33 and $66.66) by offering to purchase the take-back option to increase the chance that factories will take; these laundries hope for rejection.

    (iii) The laundry could sell its entitlement and its take-back option for a price greater than $44.44.

Factories:	Only factories with high valuations (greater than $66.66) would self-partition by offering (or accepting an offer) to buy their take-back option.
Laundries:	Laundries with low and intermediate valuations (less than $66.66) would mimic the behavior of laundries with high valuations (greater than $66.66) by offering to sell their take-back option; these laundries hope for acceptance.

117. In game-theoretic terms, the participation constraints on any bargaining equilibrium ensure that the payoffs from trade will never be less than the payoffs when trade is not allowed.

Note, however, that our conclusions are merely conjectural, because explicitly solving a robust model of how people will bargain in the shadow of second-order liability rules has proven to be exceptionally difficult. In addition, our conjectures must be qualified because we have only considered bargaining in a world where takings are costless.[118] If nonconsensual takings consume sufficient resources, higher-order liability rules again might have the potential to facilitate trade; people would bargain in part to avoid the high cost of nonconsensual takings.[119]

V. APPLYING THE THEORY

In this Part we look briefly at some practical applications of our theory. We begin with some caveats about how lawmakers should set exercise prices. Second, we tackle the problem of accommodating three or more bidders. The solution we propose—a "sealed bid" auction—shows once again the deep connections between entitlement regimes and more familiar kinds of auctions. Finally, we consider how our theory might be applied to a recurring problem in contract law: the parties' attempted modification of an ongoing contractual relationship after one of them breaches.

A. *Setting the Exercise Prices*

Setting the damages for each successive potential taking to induce a truncated auction is a formidable task. Here we try to explain why it is so daunting, and to give some hint of what aspects would be particularly hard for a government (with very limited information) to accomplish.

Fortunately, the option exercise prices do not need to be established in advance. As long as the law establishes the *principles* by which damages will be determined ex post (say, at trial), potential takers can form estimates of their potential exposure, and the government can create the incentives required for our model.[120] But if the state determines damages ex post, then the parties will not pay damages after each round of taking. Only the final taker will pay the net damages. The government must recognize that each second- and higher-stage taking entails an opportunity cost (in foregone potential damages) as well as a direct cost (in exposure to a tort suit).

Sometimes the "opportunity cost" is relatively easy to calculate. If we want the dock owner in a *Vincent v. Lake Erie* context to unmoor a boat only if his

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118. After relaxing our initial assumption that takings are costless in Part II, we would have preferred to analyze bargaining in the shadow of costly nonconsensual takings. Unfortunately, solving such a model has proven so far to be beyond our analytic grasp.

119. A similar result has been shown for first-order liability rules. *See* Ayres & Talley, *Distinguishing, supra* note 3, at 242–51.

120. *See supra* text accompanying note 56.

private valuation is above $50,000, then the damages for unmooring the boat should be $50,000 minus what he would have expected to receive if he had left the boat in place. This latter amount is, to be sure, speculative, but asking a jury to determine it does not seem significantly more onerous than the valuation questions that are regularly put to juries.[121]

Establishing the option price in a first-order regime seems feasible because the government only needs to assess the average damages.[122] For example, the nineteenth-century New Hampshire Mill Act[123] established statutory damages for the owners of upstream land if the installation of a mill caused flooding. The statute mandated that compensation would be fifty percent above the market value of the land. We believe this damage measure is consistent with Kaplow and Shavell's insight that liability rules can create incentives for efficient nonconsensual takings as well as for efficient bargains. The fact that upstream landowners have not chosen to sell their land at current market prices is evidence that they value the land more than the current market price. The legislature might have believed that the average upstream landowner (who has not sold her house) has an average value which is fifty percent above the market price.[124]

Unfortunately, the legislature's ex ante or the court's ex post task becomes much harder in establishing appropriate damages for a second-order liability rule regime. To begin with, second-stage damages must be set under the assumption that a first-stage taking has occurred. Thus, in our laundry and factory example, lawmakers should consider that factories willing to take in the first stage have signaled that they have higher than average valuations. Conditioning damages on the first-stage taking will inevitably mean that the second-stage damages (including the opportunity cost) will be larger than the first-stage damages.

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121. On the other hand, it may be easier for juries to assess damages for events that have already occurred than to assess damages for events that did not actually occur.

Moreover, while praising the general structure of *Vincent* as an example of a second-order liability rule, we are concerned that the measure of second-order damages will not account for the dock owner's opportunity cost, i.e., the damages the dock owner could have collected if it had not unmoored the ship. Failing to deduct first-order damages (the damage to the dock if the ship is moored) could artificially inflate the cost of retaking, thus turning the current *Vincent* rule into a first-order liability rule. If total second-order damages are too great, they may deter dock owners from exercising their second-order takings option (that is, unmooring the boat). For another context in which courts have failed to account properly for opportunity costs, see Ian Ayres, *Analyzing Stock Lock-ups: Do Target Treasury Sales Foreclose or Facilitate Takeover Auctions?*, 90 COLUM. L. REV. 682 (1990).

122. Ayres and Talley (and others) have shown that tailored damages can actually increase the obstacles for Coasean trade because more turns on the parties' private information about what the tailored damages will be. *See supra* note 56.

123. 1868 N.H. Laws, ch. 20, § 3 (set out in Head v. Amoskeag Mfg. Co., 113 U.S. 9, 10–11 (1885)); *see also Head*, 113 U.S. at 20 (relating history of statute).

124. Richard Epstein interpreted these statutory damages as ensuring a division of the surplus brought about by the forced exchange. *See* RICHARD A. EPSTEIN, TAKINGS: PRIVATE PROPERTY AND THE POWER OF EMINENT DOMAIN 174 (1985). We think that they are more consistent with Kaplow and Shavell's theory, described in the text.

But in setting second-stage damages, the wise lawmaker must also take into account the possibility that the existence of second-stage takings may give rise to strategic first-stage takings. In our original discussion of "naive" second-order rules, factories were willing to pay more for the right to pollute than it was worth, because they hoped that laundries would pay them even more money in exercising their second-stage options. In *Vincent*, this might mean that shipowners with low valuations would tie up to a dock hoping that they might subsequently be cast off. To the extent that such machinations might arise, policymakers would have to set damages to induce the right amount of taking. While we have shown that this is possible in a pristine mathematical model, we are much less sanguine about the capacity of courts or other lawmakers to make such corrections.

Finally, lawmakers would need to implement our "dispositive takings principle": Prices should be set with only dispositive takings in mind because only dispositive takings should increase expected joint payoffs. Under a second-order regime, this means that the first taking should occur when the taker's value is greater than the average valuation of those takees who will not take back. Again, while these calculations can be made in principle, they present serious problems in practice.

We emphasize these myriad difficulties to underscore the gap between our stylized model and realistic implementation. However, the possibility of workable second-order regimes in contexts such as *Vincent* gives us some reason to think that second-order rules can be useful. Moreover, as discussed in the next Section, viewing entitlement regimes as auctions may lead lawmakers to consider more explicit auction structures with more discernable exercise prices and taking strategies.

B. *Accommodating Multiple Bidders*

Although the two-person situations we have been considering up to now are not inconceivable, they are admittedly infrequent. We would be disappointed if our insights into reciprocal taking auctions lost all relevance when there are multiple parties. Nevertheless, when multiple takers are involved, the law faces several interdependent questions: First, in what sequence should takings occur; second, how should damages for takings be calculated; and third, how should damages be distributed among the "losers," i.e., those participants who do not receive the entitlement?

We can try to avoid these perplexing issues by using alternative auction mechanisms. For example, we have compared liability rules to ascending auctions. But in many auctions bidders submit a single sealed bid. Thus, instead of arranging for reciprocal takings, lawmakers might consider sealed bids to accommodate the possibility of multiple bidders. Sealed bidding is especially useful in implementing an internal auction of multiple bidders. It

solves many thorny administrative issues.[125] Moreover, in ascending auctions the losers may act strategically to increase their share of the pie in ways foreclosed by a single sealed bid.

To see the advantages of a sealed bid entitlement auction with multiple bidders, consider the classic NIMBY[126] problem in which each of three cities vies to avoid the placement of a hazardous waste facility in its own "backyard."[127] A sealed bid entitlement auction might have each city submit a dollar figure indicating how much it would be willing to pay to avoid having the facility located in its boundaries. The facility would be located in the city that submitted the lowest bid. Note that in this regime the auction "proceeds" are distributed internally; the winning bidders (the cities placing the two highest bids) make pro rata contributions equalling the loser's bid.[128] In the language of liability rules, each of the winners "takes" the loser's right to avoid having the waste site and pays "damages" for the privilege.

As emphasized above, policymakers have wide latitude in deciding how to distribute the expected gains between the winners and the loser, while still maximizing ex post efficiency by locating the facility in the city with the lowest valuation of costs. The law could divide the surplus to promote equity, to create more incentives for efficient ex ante investment, or to account for some combination of both.[129]

Implementing such a bidding system in the real world may be more difficult than this simple example suggests. For example, a particular site can produce a variety of externalities.[130] Nevertheless, we hope that we have shown that thinking of entitlements regimes in terms of auctions can still be valuable even when multiple potential takers are on the horizon.

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125. To understand just a few of the complexities, imagine a multibidder ascending auction analogous to the optimal fourth-order liability rule described in Table 2. If one of the bidders takes at the third stage, whom would she pay?

126. "NIMBY" situations are collective action problems in which no party wants to absorb costs that would benefit all of the others, but each would like someone else to absorb these costs. The initials stand for "Not In My Back Yard."

127. *See generally* Michael O'Hare, *"Not on My Block You Don't": Facility Siting and the Strategic Importance of Compensation*, 25 PUB. POL'Y 407 (1977); Gerald R. Faulhaber & Daniel E. Ingberman, Markets vs. Governments: The Political Economy of NIMBY (1996) (unpublished manuscript, on file with authors).

128. *See* Samuelson, *supra* note 57, at 337.

129. For example, at one extreme, the law might force the winning bidders to pay their nominal bids to the losing bidder; at another extreme, the winning bidders would only need to contribute pro rata to paying the losing bidder's bid.

130. *See* MICHAEL O'HARE ET AL., FACILITY SITING AND PUBLIC OPPOSITION (1983); Lawrence S. Bacow & James R. Milkey, *Overcoming Local Opposition to Hazardous Waste Facilities: The Massachusetts Approach*, 6 HARV. ENVTL. L. REV. 265 (1982); Robert Cameron Mitchell & Richard T. Carson, *Property Rights, Protest, and the Siting of Hazardous Waste Facilities*, 76 AM. ECON. REV. 285 (1986).

C. *Facilitating Contract Renegotiations*

We close with a very familiar problem in contract law: The promisor has failed to deliver on an executory contract, but the promisee still wants performance. Under what conditions should the court enforce the parties' modification to ensure performance, and under what conditions should it view the attempted modification as void for failure of consideration? Our solution to this perennial problem sidesteps the problem of consideration through the creation of a truncated auction.

As we noted earlier, the performance of executory contracts presents an important context in which an entitlement can have only one potential taker. Where a promisee is entitled to a promisor's performance, the promisor is usually the only person who has an opportunity to take the entitlement by breaching.

Expectation damages give promisees liability rule protection for their contractual entitlement.[131] The promisor can "take" by breaching the contract, but only if he or she pays damages. Like other liability rules, expectation damages may beneficially harness the promisor's private information about whether performance is efficient. Promisors will not breach unless they value the entitlement more than the expected valuation of the promisee. However, our analysis suggests that simple expectation damages may not go far enough in achieving efficiency. That is because they fail to harness the *promisee's* private information.

Because of changed circumstances, a promisor may reasonably believe that her costs of performance are greater than the promisee's value, and, via the mechanism of anticipatory repudiation, signal her intention to breach her contractual obligation to perform. But at this point, contractual damages do not give the promisee a mechanism to signal that (notwithstanding the promisor's higher costs of performance) the performance is still efficient.

The most direct way to implement our model would be to give the promisee an additional option for responding to a promisor's anticipatory repudiation.[132] After a promisor signaled her intention to breach, the promisee might be given the option to purchase "specific performance" by paying an amount above and beyond the initial contract price. This proposal would be analogous to Ellickson's proposal that the victims of nuisance should be given a second-stage option to purchase an injunction against pollution.[133]

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131. This point has been recognized repeatedly in the literature. *See, e.g.,* Anthony T. Kronman, *Specific Performance,* 45 U. CHI. L. REV. 351, 352 (1978); Thomas S. Ulen, *The Efficiency of Specific Performance: Toward a Unified Theory of Contract Remedies,* 83 MICH. L. REV. 341, 375–76 (1984).

132. Currently, the promisee has the option to "await performance" for a "commercially reasonable time." U.C.C. § 2-610 (1990).

133. *See* Ellickson, *supra* note 45, at 738–48.

The option to purchase specific performance creates what is in effect a truncated auction over the terms of contract renegotiation.

We could produce such an auction in another way, by giving the promisee the option of increasing the damages she would receive for the promisor's breach by making a firm offer to pay more for performance. Thus, after a seller anticipatorily repudiated a contract, we would give the buyer the option of offering the seller an additional amount to perform. The seller could either accept this amount and perform, or breach the contract and pay ordinary damages *plus the additional amount that the buyer offered to pay.* For example, suppose the buyer offered to pay $50,000 more for a seller's performance. If the seller refused this offer, she would have to pay ordinary expectation damages plus $50,000.[134]

The latter rule has several advantages over the current doctrine, which requires judges to determine whether contract modifications are in good faith or simply seek performance of a preexisting duty. Our proposal represents a smaller departure from the preexisting duty rule than the current U.C.C. good faith approach, because buyers receive additional consideration in exchange for offering more money—the possibility of higher damages if their offer is rejected.

Our proposal is also consistent with the goal of tailoring expectation damages to make the promisee (or buyer) truly as well off as if the contract had been performed. Our model suggests that rational courts should use evidence of a party's willingness to pay to update their estimates of the party's valuation. Currently, courts do not allow evidence of how much promisees were willing to pay to secure performance to increase their estimates of how much those promisees really have to lose from a breach.

Law and economics scholars have long recognized that promisors would not have any bargaining power to extract additional payments from promisees if the damages for breach of contract truly implemented expectation damages. If damages made the promisee as well off as performance, promisees would be indifferent as to whether promisors breached, and therefore would not be willing to pay more money to assure performance.[135] Our proposal allows promisees to push contract damages toward fuller expectation awards by credibly signaling when they believe that court-awarded damages are insufficient.

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134. Judges could implement this scheme by instructing a jury to determine ordinary expectation damages (without knowledge of the attempted modification), and then simply adding the enhancement to the jury's award.

135. *See, e.g.,* Oliver Hart & John Moore, *Incomplete Contracts and Renegotiation,* 56 ECONOMETRICA 755 (1988); Thomas J. Miceli, *Contract Modification When Litigating for Damages Is Costly,* 15 INT'L REV. L. & ECON. 87 (1995); William P. Rogerson, *Efficient Reliance and Damage Measures for Breach of Contract,* 15 RAND J. ECON. 39 (1984); Steven Shavell, *The Design of Contracts and Remedies for Breach,* 99 Q.J. ECON. 121 (1984).

The buyer's (i.e., promisee's) representations are credible if at the time buyers make their offer, they are uncertain whether they will have to pay the additional amount (which would occur if the seller accepts the offer) or whether they will receive the additional amount (which would occur if the seller rejects the offer and breaches).[136] Buyers may want performance, but they do not want it at any cost. Thus, buyers deciding how much to offer to induce performance will have a powerful incentive not to offer too much. If the offer is too generous, the seller will simply accept it and perform. Offering to pay a million dollars extra in the hope of receiving it in damages presents a risky strategy, because the seller might agree to perform for this amount.[137]

Of course, if second-order liability regimes clearly represented better ways to structure contract renegotiations, why do we not see parties contracting for these mechanisms in their initial contracts? The history of the development of commercial arrangements demonstrates that not every efficient arrangement has always existed. Some require initial ingenuity as well as legislative or common law clarification that such renegotiation mechanisms would be legally enforceable.[138] Even afterwards, their rough edges must be worked out in practice. Nevertheless, the absence of such mechanisms in current commercial contexts may suggest one of two possibilities. First, the problems with strategic take-backs might be more serious than we have imagined. Second, the opportunities for consensual renegotiation, whether subsequently enforceable by the courts or not, may do most of the work that contracting parties need. This flexibility would obviate the need for creating an elaborate nonconsensual takings structure.

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136. Uncertainty about whether one will be able to pay or receive a reported price can induce people to speak more honestly. *See* Ayres & Talley, *Solomonic Bargaining, supra* note 3, at 1030

137. We must offer an important caveat to this analysis. Buyers might make an inflated offer (i e , an offer that exceeds their private values for performance) if they know that changed circumstances have rendered the seller's performance impossible. If a buyer is confident that her firm offer will be rejected, this scheme will fail to harness the buyer's information. Consequently, courts or legislatures might have to impose some good faith or reasonableness requirement on the buyer's offer to insure that the offer is reasonably related to the buyer's actual valuation. This good faith review would not be necessary when the seller's performance was possible—particularly if the goods exist, and it is merely a question of to whom the seller is going to sell.

138. Original contract provisions that give promisees a limited right to inflate damages might not be enforceable if courts characterized the enhanced damages as penalties, *see* Eric L. Talley, Note, *Contract Renegotiation, Mechanism Design, and the Liquidated Damages Rule,* 46 STAN. L. REV 1195, 1196 (1994). or if courts characterized the provisions as violating the prohibition against introducing evidence of settlement negotiations, *see* FED. R. EVID. 408.

At a minimum, we are proposing that there should be no immutable rule against such a renegotiation mechanism. It is a more difficult question, however, to determine whether the default rule governing contract renegotiation should be our proposal as opposed to, for example, the U.C.C 's good faith standard or the common law's preexisting duty rule. The text implicitly treats our proposal as the governing default. but for now we are agnostic about whether it might make more sense for parties to have to "opt in" affirmatively to our renegotiation scheme rather than forcing them to "opt out." For a fuller discussion of appropriate default choice, see Ian Ayres & Robert Gertner, *Filling Gaps in Incomplete Contracts An Economic Theory of Default Rules,* 99 YALE L.J. 87 (1989). and Ian Ayres & Robert Gertner, *Strategic Contractual Inefficiency and the Optimal Choice of Legal Rules,* 101 YALE L.J. 729 (1992).

VI. CONCLUSION

This Essay has attempted to show three things. First, property rules and liability rules are only special cases of a more general class of rules for protecting entitlements that feature reciprocal taking options. Second, optimally structured reciprocal taking options can be Pareto superior to either traditional liability or property rules. Third, the reason why optimally structured reciprocal taking options possess this superior efficiency is that they have an auction-like structure. This auction-like structure has been difficult to appreciate because previous scholars have considered only liability rules, or what we have called first-order regimes. Yet if we analyze first-order liability rules as a subset of a broader class of reciprocal taking options, we discover that liability rules harness private information because they produce truncated auctions: In other words, nonconsensual takings can credibly signal value in the same way that auction bids can allocate an entitlement to the highest valuer.

This Essay is certainly not a proposal for ninety-ninth-order liability rules—or even for across the board use of second-order liability rules. We have already noted some of the practical difficulties in implementing such regimes. However, if policymakers appreciate that property and liability rules are part of a larger family of auction mechanisms, they might turn to more traditional auctions (with more transparent bidding strategies) that will often be less costly to administer. Our hazardous waste example offers only one situation in which auctions might fruitfully be employed.

Nevertheless, higher-order liability regimes may have two advantages over more traditional auctions. First, although traditional external auctions may consume smaller administrative costs, they often produce a larger inefficiency through underinvestment because the proceeds of the auction escheat to the government (or some other third party) instead of to the initial investor. In contrast, optimally structured liability rules are *internal* auctions. They produce allocations equivalent to those found in more familiar external auctions without transferring the auction proceeds to a third party. Indeed, we have shown that, when designed properly, higher-order liability rules can replicate or even enhance the payoff that the original entitlement holder would expect under a property regime. Consequently, these higher-order liability rules need not reduce the entitlement holder's incentive to create or develop the entitlement in the first place.

Second, multiple-order liability rules create auctions without auctioneers. When temporal or structural exigencies preclude more traditional auction methods, multiple-order liability rules can reproduce some of their allocational benefits. The doctrine of necessity announced in the famous case of *Vincent v. Lake Erie* provides a powerful example where we believe that something

like the common law's second-order liability rule is sound.[139] During the storm, neither the dock owner nor the shipowner had much opportunity to bargain over the entitlement to moor the ship, much less to hold an auction. Under these conditions, a second-order liability rule has enormous advantages: It implements what amounts to a truncated auction, one that uses each party's private information to arrive at a more allocationally efficient solution.

Although our models have employed highly reductive assumptions, they illuminate the underlying advantages of reciprocal taking options that persist to some degree even in more realistic situations: the harnessing of private information, and the replication of auction-like efficiencies.

We do not doubt that at first glance, multiple-order liability rules will strike many commentators as unstable and inefficient. But our analysis suggests that these higher-order regimes should have two natural sets of advocates. On the one hand, people who are attracted to traditional, first-order liability rules because they harness private information[140] should be attracted to the way that higher-order regimes can harness this information even more efficiently. On the other hand, scholars who recognize that auctions are presumptively efficient should be attracted by the ways that higher-order regimes can implement truncated auctions.

The idea that property entitlements are varieties of auctions is inevitable, given the underlying premises of the economic approach to law. From an economic perspective, property entitlements are not natural rights of individuals, but rather state assignments of power that have different efficiency consequences depending on the assignment. If one of the state's normative goals is efficiency, it will want to structure legal entitlements so that they will eventually end up in the hands of people who value them most. The auction is, of course, a familiar and standard way of ensuring that a valuable asset is put in the hands of the person who values it most. Once this connection is grasped, it seems natural to think of all legal entitlements as variations on different forms of auctions.

The analysis presented here flips a common understanding about property entitlements. Our ordinary intuition is that private property should remain in the hands of its existing holder unless there are good reasons for the state to shift it to another person. Yet because auctions tend to place valuable property in the hands of persons who value it most, one might think that the presumption should be precisely the reverse: All property entitlements should be subjected to some form of auction mechanism unless there are good reasons to do otherwise.

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139. We qualify our endorsement of *Vincent* because it is not clear that common law courts are striving to set first- or second-order damages in accordance with our dispositive takings principle. *See supra* text accompanying notes 73–75 (discussing dispositive takings principle).

140. *See, e.g.,* Kaplow & Shavell, *Economic Analysis, supra* note 4.

There are, of course, many good reasons for truncating auctions: moral hazard, underinvestment, the costs of administering the auction, and the costs of making bids. It is surely not our intention to suggest that everyone's private property should routinely be auctioned off to the highest bidder. Our point is rather a simple one: To the extent that the goal of private property is to promote a societal interest in efficiency, the idea that private property might be subject to some form of auction structure should not be ruled out on a priori grounds.

This flip in perspective is important because it reveals more clearly that the law not only can but does choose from among the different families of possible auction schemes to promote efficiency. In making this choice, it must balance the competing concerns of moral hazard and underinvestment on the one hand, and asymmetric information on the other. There is no perfect way to do this in most cases because considerations of moral hazard and asymmetric information usually pull in opposite directions. In fact, we can think of different entitlement rules as striking different balances between these competing considerations. Where moral hazard and underinvestment are of the greatest concern, the law should tilt toward more truncated auctions. However, where asymmetric information is the greater problem, there is a justification for designing a scheme with more potential rounds of bidding.

Finally, this flip in perspective is useful because, as our analysis shows, no particular form of property entitlement, whether a full-scale auction or a zero-round property rule, is a priori efficient in all cases. The wise legislator must carefully study and choose among a host of varying designs adapted to differing situations. There is no single regime of "private property" that constitutes an efficient institution. Rather, one must choose among different combinations of regimes of private property, some of which are more efficient than others in different situations. The defense of a private property regime on grounds of efficiency is not the defense of a set of fee simple estates; it is really the defense of an intricate and variegated scheme of truncated auction rules created and implemented by the state.
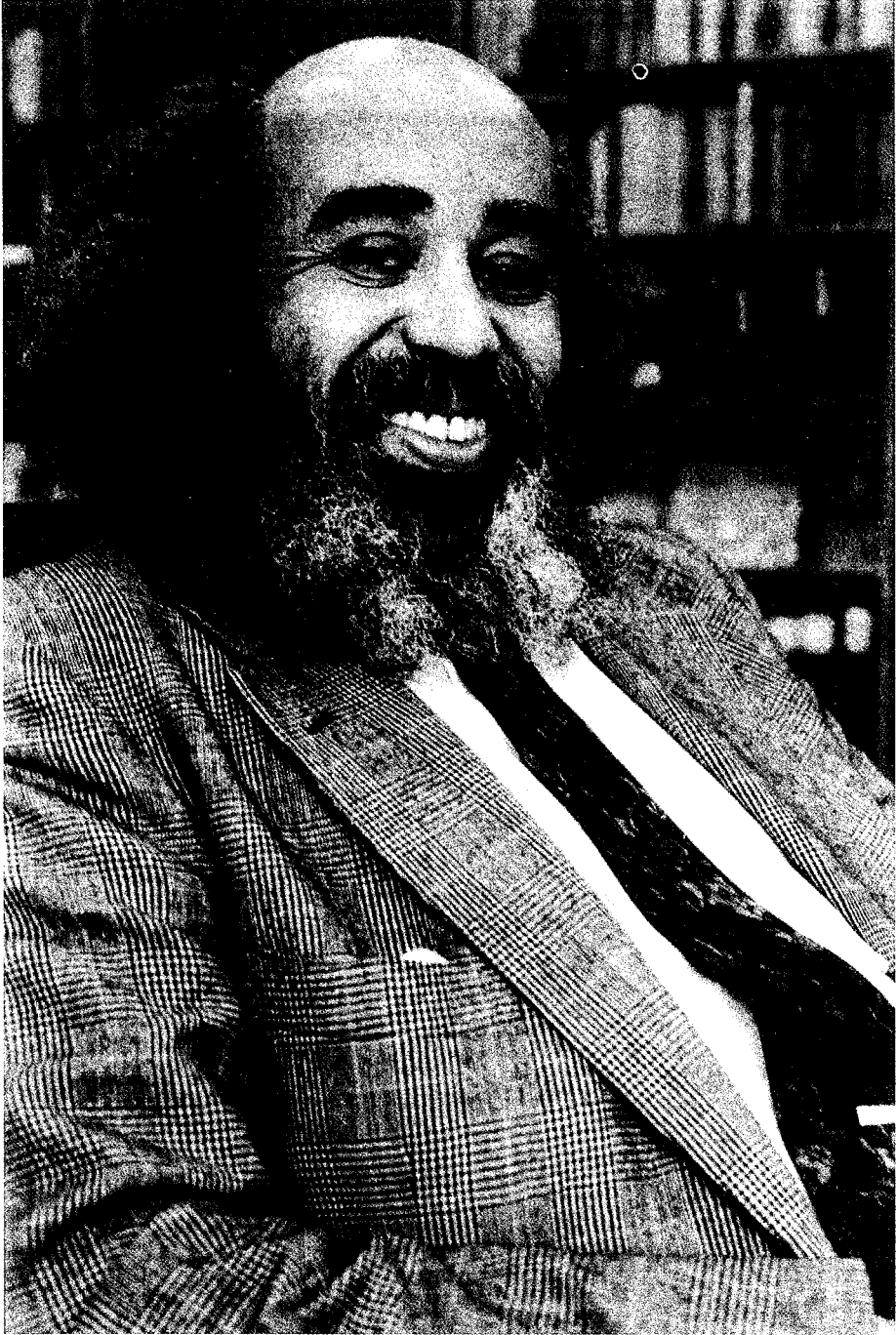
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Photo by Seth Burns.