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Solomonic Bargaining: Dividing a Legal Entitlement to Facilitate Coasean Trade

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Articles

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I. INTRODUCTION

It is a common argument in law and economics that divided ownership can create or exacerbate strategic behavior. For instance, when several persons own the land designated for a proposed stadium, individual sellers may "hold out" for a disproportionate share of the gains from trade.[1] Alternatively, when building a public library would benefit multiple residents, individual buyers may "free ride" on the willingness of others to pay for its construction.[2] Such transaction costs of collective action fall under a variety of analytic rubrics, including the "tragedy of the commons" and the theory of "public goods."[3] Nonetheless, each example of market failure shares a common attribute: The division of a single legal entitlement, or of rivalrous entitlements,[4] among joint sellers or joint buyers may prevent socially efficient transactions, particularly when the parties possess private information about their preferences.[5]

This Article explores a different way of dividing an entitlement. Rather than analyzing divisions among buyers or among sellers, we consider the effects of splitting an entitlement *between* the two groups. Our core insight is Solomonic in character: Dividing a legal entitlement between rivalrous users can facilitate efficient trade.[6] More specifically, we show that when two

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1. *See, e.g.*, ROBERT COOTER & THOMAS ULEN, LAW AND ECONOMICS 192–93 (1988); RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 48–49, 55 (3d ed. 1986); George J. Mailath & Andrew Postlewaite, *Asymmetric Information Bargaining Problems with Many Agents*, 57 REV. ECON. STUD. 351 (1990).

2. *See* COOTER & ULEN, *supra* note 1, at 109; POSNER, *supra* note 1, at 55.

3. The contributions to this literature are far too dense and numerous to be mentioned here. For general overviews, however, see WILLIAM J. BAUMOL & ALAN S. BLINDER, ECONOMICS: PRINCIPLES AND POLICY 309–33 (6th ed. 1994); COOTER & ULEN, *supra* note 1, at 88–122; POSNER, *supra* note 1, at 29–77.

4. While it is arbitrary to characterize a particular set of claims either as the division of an individual entitlement or of rivalrous entitlements, we seek to explore rivalries that either party can end by successfully purchasing the other party's claim. For example, an easement and a fee simple subject to an easement might be thought of as separate entitlements or as a division of a single entitlement. *See* Robert C. Ellickson, *Property in Land*, 102 YALE L.J. 1315 (1993). But regardless of their characterization, these claims might be rivalrous if an individual could develop the land more profitably by acquiring ownership of both claims.

5. In his seminal article, Ronald Coase argued that, in the absence of transaction costs, private bargaining will lead to efficient outcomes. *See* Ronald H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960).

6. The title of this Article is, of course, an allusion to the much-repeated biblical account of King Solomon deciding which of two women claiming parentage of a child was the actual mother. Unable to deduce the truth from claims that the two women made, Solomon requested a sword so that he might slice the baby into two equal pieces, giving half to each party. When only one of the women offered to drop her claim for custody if Solomon spared the child's life, Solomon immediately awarded her custody. *See* 1 *Kings* 3:16–28. This biblical account is suggestive of our results, especially in that Solomon's threat to split the baby induced the revelation of private information, leading ultimately to complete custody by the true mother. Nonetheless, the success of his decision rule is inconsistent with the assumption that both parties know the rules of the legal game (an assumption that we make in this Article). If both women had known what Solomon would do, then it would have been a dominant strategy for each woman to offer to surrender her claim.

Jon Elster has used the Solomonic analogy to argue that divided (probabilistic) entitlements can produce more effective child custody decisions in situations where negotiated settlement is unlikely. JON ELSTER, SOLOMONIC JUDGMENTS: STUDIES IN THE LIMITATIONS OF RATIONALITY 123–74 (1989). For a discussion of the differences between Elster's probabilistic model and ours, see *infra* note 141.

parties have private information about how much they value an entitlement, endowing each party with a partial claim to the entitlement can reduce the incentive to behave strategically during bargaining, thereby enhancing economic efficiency.

Private information is a particularly pernicious form of transaction cost, especially in legal contexts where, for procedural or other reasons, parties must negotiate within "thin" markets.[7] In such contexts, self-interested bargainers have a strong incentive to misrepresent their private valuations so as to capture a larger share of the bargaining "pie." These incentives often lead to predictable opportunistic strategies: Sellers tend to overstate the value they place on the bargained-for item, while buyers tend to understate their desire to purchase it. As a result of such strategic behavior, the parties may fail to detect and exploit a mutually beneficial trade, and even when they can it is usually after considerable and costly delay.

In this Article, we argue that divided entitlements can facilitate trade by inducing claim holders to reveal more information than they would under an undivided entitlement regime. Owners of divided, or "Solomonic," entitlements must bargain more forthrightly than owners of undivided entitlements, because the entitlement division obscures the titular boundary between "buyer" and "seller." More precisely, endowing each bargainer with a share of the underlying entitlement creates the possibility of two different types of Coasean trade: A bargainer might buy the other party's claim, or, alternatively, she might sell her own. During negotiation, each party is likely to be uncertain about whether she will ultimately emerge as a seller or a buyer. This strategic "identity crisis" can strongly mitigate each party's incentive to misrepresent her respective valuation; each party must balance countervailing interests in shading up her valuation, as one would *qua* seller, and shading down her valuation, as one would *qua* buyer. This form of rational ambivalence, we argue, can lead the bargainers to represent their valuations more truthfully.[8]

To illustrate this identity crisis with a traditional type of property division, consider a negotiation between Smith and Jones about who should develop Blackacre as a mall. Assume it is commonly known that Blackacre's most valuable use is as a mall, and that either Smith or Jones is the most efficient developer. But assume also that the parties' private valuations make it unclear who is the more efficient developer. Blackacre is divided so that Smith owns Blackacre in fee simple, subject to an executory interest in Jones that becomes

7. *See, e.g.*, ERIC RASMUSEN, GAMES AND INFORMATION: AN INTRODUCTION TO GAME THEORY 227 (1989) (noting that in such thin markets, usual assumptions of efficient competitive markets break down).

8. Within principal-agent literature, this form of rational ambivalence is more often known as "countervailing incentives." The notion of countervailing incentives was first examined in Tracy R. Lewis & David E.M. Sappington, *Countervailing Incentives in Agency Problems*, 49 J. ECON. THEORY 294 (1989); *see also* William Samuelson, *A Comment on the Coase Theorem*, *in* GAME THEORETIC MODELS OF BARGAINING 321, 324–31 (Alvin Roth ed., 1985) (discussing problems of bargaining inefficiency resulting from parties' self-interest and asymmetric information).

possessory if Blackacre is ever used for any purpose other than a horse buggy factory. Because of the low demand for horse buggies, Blackacre's value as a buggy factory is negligible. Under these circumstances, the mall might only be built if one of the parties agrees to sell her estate in the land to the other.[9] Imagine what would go through Smith's mind in considering how much to offer to purchase Jones' interest. Smith, as a buyer, would want to offer a low price, but the possibility that Smith could become a seller complicates Smith's decision. If Smith offers too low a price, Jones is liable to turn the tables by suggesting that Smith should sell her own claim. In essence, Jones would be saying: "Where did you get that price? If that's all you think Blackacre is worth, I'll buy your claim." Thus, when ownership is so divided, a party's explicit or implicit representation about the entitlement's value might be used by the other side to propose the other type of transaction.[10]

This example illustrates how a particular type of division can facilitate efficient trade. Throughout this Article, we compare bargaining in the shadow of an absolute, undivided entitlement to bargaining in the shadow of a number of such Solomonic divisions.[11] Our analysis, however, revolves around two broad axes of division. The first axis represents the *degree of protection* accorded a given entitlement, and the second axis represents the explicit *ownership structure* of the entitlement.

With respect to the first axis of division, the law may effect a Solomonic division through the degree to which it protects one's ownership interest in the underlying entitlement. Our discussion of this axis centers predominantly on the distinction—first analyzed by Calabresi and Melamed[12]—between "liability rules" (i.e., remedies at law) and "property rules" (i.e., equitable relief). Protecting an "owner" of an entitlement with a liability rule is a type of Solomonic division, because a liability rule endows "nonowners" with an option to take the entitlement nonconsensually and pay the damage amount.[13]

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9. Even though the value of Blackacre as a buggy factory is negligible, Smith will refuse to fulfill the condition that triggers the executory interest so she can bargain for compensation from Jones.

10. This countervailing effect, however, is not present when one party to the negotiation has an undivided interest in the entitlement: For example, if Jones owns Blackacre in fee simple, then Smith (as buyer) need not worry that Jones will use her low offer as the basis for a counteroffer to purchase Smith's claims, for the simple reason that Smith has nothing to sell.

11. Robert Ellickson has recently characterized absolute entitlements as the "Blackstonian bundle." Ellickson, *supra* note 4, at 1362–63 (citing 2 WILLIAM BLACKSTONE, COMMENTARIES *18–19), *see also* 2 WILLIAM BLACKSTONE, COMMENTARIES *2 (describing right of property as "sole and despotic dominion which one man claims and exercises over the external things of the world, in total exclusion of the right of any other individual in the universe"). Ellickson defines the Blackstonian bundle as ownership by a single individual in perpetuity with absolute rights to exclude would-be entrants, with absolute privileges to use and abuse the land, and with absolute powers to transfer the whole (or any part carved out by use, space, or time). Ellickson, *supra* note 4, at 1362–63. While the fee simple estate is often referred to as if it were such an absolute right, Ellickson stresses that fee simple is "far more nuanced than the pure Blackstonian package." *Id.* at 1363.

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

13. For example, if a farmer's ownership of spark-free land is protected by a "weak" liability rule, then an adjoining railroad would have the option to emit sparks (nonconsensually) onto the land and pay

Property protection, on the other hand, does not represent a division, since the nonowner lacks power to appropriate the underlying entitlement nonconsensually.

We show that liability rules possess an "information-forcing" quality that property rules do not.[14] Under a liability rule regime, a nominal entitlement owner has an incentive to reveal truthfully whether her valuation is above or below the damage amount. We demonstrate that the entitlement owner's choice between two different kinds of Coasean transactions acts as a credible signal whether she has a relatively high or relatively low valuation. This credible signal of valuation decreases the aggregate amount of private information by "partitioning" the entitlement holders into two discrete sets, thereby facilitating more efficient trade. In contrast, property rule protections render such credible signaling impossible.[15]

Our argument that liability rules can catalyze consensual trade challenges various common wisdoms in law and economics. Many scholars have argued that clear property rights are appropriate when transaction costs are low, because property rights encourage people to bargain. For example, Judge Posner has captured the common wisdom by asserting that in "low-transaction-cost settings . . . the law should require the parties to transact in the market; it can do this by making the present owner's property right absolute (or nearly so), so that anyone who thinks the property is worth more *has to negotiate with the owner.*"[16] These scholars often assert that property rules are "market-encouraging,"[17] while liability rules are "market-mimicking."[18] Although a

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damages. The farmer's claims to the land would be partial or incomplete, because her ownership would be subject to the railroad's option to take and pay damages.

A liability rule is usually defined to allow a "nonowner" to take an entitlement nonconsensually from an owner and pay damages that are tailored to "approximat[e] . . . the value of the object to the original owner." *Id.* at 1125. Our analysis, however, focuses on *untailored* liability rules, which require the nonowner to pay a fixed amount of damages upon a taking, regardless of the owner's showing of actual loss. For a definition and discussion of tailoring, see Ian Ayres, *Preliminary Thoughts on Optimal Tailoring of Contractual Rules*, 3 S. CAL. INTERDISCIPLINARY L.J. 1 (1993).

14. While this Article argues that liability rules have information-forcing qualities that can increase efficiency, it does not argue that a randomly chosen liability rule will outperform the optimal property-like assignment. In fact, others have shown that this assertion is demonstrably false. *See* Steven Shavell, Property Rights and the Rule of Liability in a Simple Bargaining Model (1988) (unpublished manuscript, on file with authors). We do assert, however, that it is possible to find a liability rule that will outperform any type of property rule. *See* Eric L. Talley, Property Rights, Liability Rules and Coasean Bargaining Under Incomplete Information (John M. Olin Program in Law and Economics, Working Paper No. 114) (Stanford Law School, Aug. 1994) (formally demonstrating this assertion in mechanism design framework).

15. Even though the property rule itself does not give the parties a method of signaling valuation, other aspects of the law, or prior agreements of the parties themselves, may allow the parties to mitigate the allocational inefficiencies associated with private information. *See generally* Jennifer G. Brown & Ian Ayres, *Economic Rationales for Mediation*, 80 VA. L. REV. 323 (1994) (discussing possibility that various mandatory and voluntary mediation techniques might mitigate adverse selection and moral hazard).

16. POSNER, *supra* note 1, at 49 (emphasis added); *see also* COOTER & ULEN, *supra* note 1, at 100 ("One well-confirmed result in the literature on bargaining is that bargainers are more likely to cooperate when their rights are clear, and less likely to agree when their rights are ambiguous.").

17. Richard Craswell, *Property Rules and Liability Rules in Unconscionability and Related Doctrines*, 60 U. CHI. L. REV. 1, 15 n.28 (1993); Saul Levmore, *Explaining Restitution*, 71 VA. L. REV. 65, 79–81 (1985).

few strands of the law-and-economics literature—particularly the literature on efficient breach of contract—have allowed for parties to bargain in the shadow of liability rules as well as in the shadow of property rules,[19] we are the first to show that liability rules may induce both *more contracting* and *more efficient contracting* than property rules.

Viewing liability rules as market catalysts, rather than substitutes, can also lead to other contradictions of the accepted wisdom in law and economics. For instance, the common assertion that liability rules are market-mimicking has led numerous scholars to conclude that the best liability rules are the ones that carefully "tailor" the damage amount to the plaintiff's valuation.[20] Only in this way, many argue, can a court replicate the terms for which parties would have bargained had they been able to negotiate.[21] Because Calabresi and Melamed were so successful in showing that *tailored* liability rules are appropriate when parties do not have an opportunity to contract, subsequent scholars have overlooked the possibility that *untailored* rules—which fix damages at one size to fit all plaintiffs regardless of plaintiffs' actual valuation—may promote trade when contracting is possible. And, in fact, we find that when parties have the opportunity to contract, untailored liability rules can be more effective in channeling bargainers toward consensual trade, where the parties tailor the terms of trade themselves. Indeed, tailoring legal rules to give parties private information about the consequences of nonconsensual taking can severely undermine the incentives to trade consensually.[22] When dividing entitlements to facilitate trade, courts should therefore avoid tailoring that creates *additional* informational asymmetries that amplify strategic behavior. Untailored liability rules represent a largely missing category of entitlement protection that may facilitate trade without the judicial costs of tailoring.[23]

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18. David D. Haddock et al., *An Ordinary Economic Rationale for Extraordinary Legal Sanctions*, 78 CAL. L. REV. 1, 21 (1990) ("[I]mitating a market is appropriate only when circumstances make it unreasonable or unnecessary for the parties to rely on a market. In a property violation case, efficient law would not help mimic a missing exchange, but instead would encourage the principals facing other potential exchanges to bargain.").

19. *See* Anthony T. Kronman, *Specific Performance*, 45 U. CHI. L. REV. 351, 353 n.12 (1978); A. Mitchell Polinsky, *On the Choice Between Property Rules and Liability Rules*, 18 ECON. INQUIRY 233 (1980).

20. *E.g.*, COOTER & ULEN, *supra* note 1, at 318; A. MITCHELL POLINSKY, AN INTRODUCTION TO LAW AND ECONOMICS 20 (2d ed. 1989); *cf.* POSNER, *supra* note 1, at 62 n.5 (discussing difficulty of tailoring when damages cannot be ascertained with reasonable accuracy).

21. *See* Haddock et al., *supra* note 18, at 13–17; Kronman, *supra* note 19, at 360–61.

22. This result does not mean, however, that certain (non-probabilistic) rules need to be superior to uncertain rules in promoting Coasean trade. An uncertain ("muddy") rule can promote information revelation, and therefore trade, if the legal consequences of nonconsensual taking are equally uncertain to all bargainers. Indeed, our model of fractional property entitlements shows that legal uncertainty can be more efficient than a certain property rule if the uncertainty is commonly known, as in a coin flip. *See infra* notes 140–42 and accompanying text.

23. *See, e.g.*, Kronman, *supra* note 19, at 360 (suggesting that "it would be very difficult and expensive for a court to acquire the information necessary" to tailor damages). In Section B of Part II, we discuss several contexts in which the consequences of nonconsensual taking come closer to approximating untailored rules that might, according to our thesis, facilitate trade.

The second axis of division we analyze is the actual ownership structure of an entitlement, focusing explicitly on the benefits of ownership that is "fractional" in nature. Following Professor Ellickson's analysis of land divisions, we show that the identity crisis can facilitate trade whenever an entitlement is divided in any of the traditional ways—"by use, space or time."[24] As in the earlier Blackacre example, each of these species of division can facilitate consensual trade by endowing the respective parties with a partial claim to the underlying entitlement. Scholars have previously recognized that blurring the consequences of decision making can mitigate strategic inefficiencies when partners invoke a buy-sell agreement or when children decide how to cut a cake.[25] But we show that a similar countervailing incentive can exist *whenever* parties bargain in the shadow of such fractional ownership structures and hence are uncertain whether they might ultimately buy or sell a Solomonic claim.[26]

In addition to the traditional forms of divided ownership structure, we examine one nontraditional division with similar benefits. Legal uncertainty or ambiguity about who owns property can constitute a probabilistic division in that more than one person has a contingent claim to the enjoyment of the underlying right or privilege. Returning to our Blackacre example, if there is a 50% chance that the court will award Blackacre in fee simple to Jones or Smith, then each party has a probabilistic claim. Bargaining in the shadow of this uncertainty might result again in two different types of transactions: buying the other side's claim or selling one's own claim. Once again, the Solomonic division can make it more difficult for either side to offer a price that diverges from her private valuation: One can easily imagine a conversation in which Smith offers to sell her probabilistic share (relinquish all rights to Blackacre) for an inflated price, and Jones responds, "If you think a 50% chance at Blackacre is worth that much, I'll relinquish my rights to you for that price." Foreseeing the possibility of this response, Smith would inflate her selling price by a lesser amount than if she had unambiguous ownership. Accordingly, we predict that parties with private information may be able to bargain more efficiently when property rights are uncertain. This finding

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24. Ellickson, *supra* note 4, at 1363. For example, we show that the identity crisis can produce more efficient trade when:

(1) one party has a part of the acreage and the other party owns the remainder (spacial division);
(2) one party has a life estate and the other party has the remainder (temporal division); or
(3) one party has a right to pollute up to a certain level and the other party has a right to enjoin pollution beyond that level (activity-level or use division).

Each of these examples produces a bargaining identity crisis because the entitlement division gives rise to different types of Coasean transactions. *See infra* part III.B–C.

25. For a discussion of these examples, see *infra* note 133 and accompanying text.

26. Our result is reminiscent of Saul Levmore's idea that a property owner will speak more honestly about her value if she is uncertain whether the valuation will be used as an offer to sell. Saul Levmore, *Self-Assessed Valuation Systems for Tort and Other Law*, 68 VA. L. REV. 771 (1982) (discussing strengths and weaknesses of relying on self-assessment to promote accuracy in property tax assessment, tort damage determination, and corporate stock valuation).

contradicts the accepted wisdom that unambiguous property rules encourage contracting.[27] Thus, while Robert Cooter and Tom Ulen merely restate the consensus view in opining that "bargainers are more likely to cooperate when their rights are clear, and less likely to agree when their rights are ambiguous,"[28] we extend the seminal insights of Jason Scott Johnston to show in a rigorous model how ambiguity can induce bargainers to act more cooperatively.[29]

This Article focuses on a specific type of transaction cost: private information. When private information is the predominant form of market failure that impairs the operation of the Coase theorem,[30] Solomonic divisions are likely to facilitate efficient allocations through trade.[31] Consequently,

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27. *See, e.g.*, Clifford G. Holderness, *A Legal Foundation for Exchange*, 14 J. LEGAL STUD. 321, 344 (1985) (arguing that "a unique definition and assignment [of property rights] is essential to a well-ordered system [of social interactions]"); Thomas W. Merrill, *Trespass, Nuisance, and the Costs of Determining Property Rights*, 14 J. LEGAL STUD. 13, 14 (1985) ("[W]hen the costs of transacting are low, the legal system will gravitate toward rules that determine entitlements at a low cost—such as the strict liability rule of trespass."); Carol M. Rose, *Crystals and Mud in Property Law*, 40 STAN. L. REV. 577, 590 (1988) (discussing several articles claiming that "precise entitlements facilitate the efficient allocation of goods, they allow us to identify right-holders and to organize trades with them until all goods arrive in the hands of those who value them most"); *see also* Craswell, *supra* note 17, at 15; Levmore, *supra* note 17, at 79–81 (explaining how denial of restitution to intervening providers encourages complex market of many active buyers and sellers).

28. COOTER & ULEN, *supra* note 1, at 100. Cooter and Ulen cite to Elizabeth Hoffman & Matthew L. Spitzer, *The Coase Theorem: Some Experimental Tests*, 25 J.L. & ECON. 73 (1982), and Elizabeth Hoffman & Matthew L. Spitzer, *Experimental Tests of the Coase Theorem with Large Bargaining Groups*, 15 J. LEGAL STUD. 149 (1986). While these articles by Hoffman and Spitzer explore the effects of bargaining *after* an entitlement is allocated (so that there is no legal ambiguity at the time of bargaining), we explore the effects of bargaining *before* legal uncertainty is resolved.

29. Johnston was the first to see how uncertain ownership of an entitlement could improve bargaining efficiency. *See* Jason Scott Johnston, Bargaining Under Rules Versus Standards (June 28, 1994) (unpublished manuscript, on file with authors). Our analysis in Part III shows more directly how the parties' uncertainty about who will be the buyer and who will be the seller causes this increased efficiency. We also show how the same type of identity crisis might improve negotiations over a number of other types of divided entitlement allocations. *See infra* part III.

Our conclusion that legal uncertainty can promote more efficient negotiation also qualifies the traditional view that adjudicators should strive for accuracy (as long as accurate decision making is not too costly). *See* Louis Kaplow, *The Value of Accuracy in Adjudication: An Economic Analysis*, 23 J. LEGAL STUD. 307 (1994). We find that decision makers might eschew accuracy even if making accurate court decisions were costless.

30. Private information is a major source of negotiation inefficiency. Buyers and sellers frequently attempt to capitalize on private knowledge by misrepresenting their respective valuations or by shading their contractual offers.

31. The law does not ordinarily penalize strategic misrepresentations of valuation. Although the law of fraud traditionally regulates misrepresentations of fact, courts almost never rescind contracts because representations of the parties' own valuation were proven to be false. Courts often cannot verify private knowledge of how one values a particular entitlement. Some jurisdictions have treated such representations as being beyond the purview of fraud law by finding as a matter of law that these facts are not "material." *See* Ian Ayres & F. Clayton Miller, *"I'll Sell It to You at Cost": Legal Methods To Promote Retail Markup Disclosure*, 84 NW. U. L. REV. 1047, 1049–51 (1990) (stating various ways in which courts have declined to penalize sellers for misrepresenting their costs); *see also* MODEL RULES OF PROFESSIONAL CONDUCT Rule 4.1 cmt. 2 (1983) ("Under generally accepted conventions in negotiation, certain types of statements ordinarily are not taken as statements of material fact. Estimates of price or value placed on the subject of a transaction and a party's intentions as to an acceptable settlement of a claim are in this category.") When sellers inflate their asking price or when buyers understate what they are willing to pay, the entitlement may not end up with the highest-valuing owner.

Solomonic entitlements may not always facilitate trade if other transaction costs are primarily responsible for Coasean inefficiency.[32] In such cases, Solomonic divisions may even exacerbate such inefficiencies by impeding competition, exacerbating hold-up problems, or weakening investment incentives.[33] These contraindications make clear why undivided property rules are still efficient in many settings. And, in fact, an overarching "Coasean" theme of our analysis is that the type of transaction cost matters: It is inadequate to think of "transaction costs" as some sort of composite good whose components imply similar policies. Nevertheless, this Article shows that claims about the efficiency of property rules cannot be justified by the common, unqualified assertion that property rules encourage trade.

The Article is divided into three parts. Part II describes the information-forcing effect of liability rules and shows how conditioning either liability or damages on private information can exacerbate the inefficiencies of bargaining under asymmetric information. Part III explores the identity crisis that can be created by other types of entitlement divisions, including probabilistic, physical, temporal, and activity-level divisions. Part IV discusses some limiting principles and examines the legal implications of our analysis.

II. THE INFORMATION-FORCING EFFECT OF UNTAILORED LIABILITY RULES

More than twenty years ago, Guido Calabresi and Douglas Melamed saw that, as a descriptive matter, the legal system protects entitlements in two qualitatively distinct manners.[34] In some contexts, the law attempts to impose sanctions that are severe enough to deter all nonconsensual takings.[35] The protection of entitlements with such severe sanctions is what Calabresi and Melamed called "property" rules. In other contexts, the law requires nonconsensual takers to pay an amount of damages that is set not to deter all

32. For example, if there is a fixed cost of writing a contract (representing the only impediment to transferring entitlements to their highest valuer), then Solomonic entitlements will not induce more efficient contracting. *See also* COOTER & ULEN, *supra* note 1, at 101 (providing useful typology of transaction costs).

33. *See infra* part IV.A.

34. Calabresi & Melamed, *supra* note 12, at 1092.

35. Calabresi and Melamed did not focus on the mechanism of deterrence: "An entitlement is protected by a property rule to the extent that someone who wishes to remove the entitlement from its holder must buy it from him in a voluntary transaction in which the value of the entitlement is agreed upon by the seller." *Id.* While they did not dwell on what aspect of a legal rule would force the would-be taker to the bargaining table, it is axiomatic that rational takers will be deterred from nonconsensual taking if the sanction is greater than any possible benefit. Still, the authors did emphasize that nonlegal sanctions may play an important part in deterring nonconsensual taking. *Id.* at 1093; *see also* ROBERT C. ELLICKSON, ORDER WITHOUT LAW (1991). Subsequent authors, however, have explicitly seen that legal, and possibly nonlegal, reactions to nonconsensual takings create a property rule. *See* Haddock et al., *supra* note 18, at 13 (defining property rule damages as amount that "would reduce to zero the expected gain available to the defendant from the injurious activity, leaving no incentive for him to attempt the activity in the first place").

takings but rather to compensate the entitlement holder for the loss of the entitlement.[36] The protection of entitlements with these less severe sanctions is what Calabresi and Melamed called "liability" rules.[37] Restraining orders, specific performance clauses, and certain types of punitive sanctions represent "property" protections, while expectation damages, the Takings Clause of the Fifth Amendment, and compulsory licenses are examples of "liability" protections.[38]

This descriptive distinction between property rules and liability rules has led some scholars to suggest that the normative choice of the appropriate form of protection is really between contracting costs and litigation costs. The "folklore" among law-and-economics academics is that property rules induce negotiation and contracting, while liability rules induce nonconsensual taking, subsequent litigation, and judicially determined prices.[39] The folklore instructs efficiency-minded lawmakers to choose the form of protection that minimizes these costs.

While this dichotomy between contracting costs and litigation costs has considerable power,[40] it ignores the fact that liability rules can themselves

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36. A liability rule obtains "[w]henever someone may destroy the initial entitlement if he is willing to pay an objectively determined value for it." Calabresi & Melamed, *supra* note 12, at 1092, *see also id* at 1125 ("Liability rules represent only an approximation of the value of the object to its original owner . . . .").

37. *Id.* at 1105–06. Calabresi and Melamed also analyzed "inalienability" rules *Id* at 1111–15 The precise definition of an "inalienable" right is somewhat murky, but common definitions focus on non-salability, non-transferability, non-relinquishability, or non-losability. *See* Margaret J Radin, *Market-Inalienability*, 100 HARV. L. REV. 1849, 1849–50 (1987); Susan Rose-Ackerman, *Inalienability and the Theory of Property Rights*, 85 COLUM. L. REV. 931 (1985). In this Article, we confine our attention to legal rights that are readily "commodifiable" in that they are salable under legally valid contracts This is by no means a complete description of legal rights; rather, it catalogues only the set of legal rights that can be readily subjected to economic analysis. For many other legal entitlements, there are frequently philosophical problems with commensurability between individuals' rights. *See generally* Cass R Sunstein, *Incommensurability and Valuation in Law*, 92 MICH. L. REV. 779, 780 (1994) (noting that "efforts to insist on a single kind of valuation and to make goods commensurable, while designed to aid in human reasoning, actually make such reasoning inferior to what it is when it is working well").

38. For a discussion of the distinction between property and liability rules in contract remedies, see, e.g., Kronman, *supra* note 19, at 352.

39. *See, e.g.*, COOTER & ULEN, *supra* note 1, at 107 (explaining that injunctive relief is optimal when "bargaining is likely to be successful"); POLINSKY, *supra* note 20, at 19 (noting that under "intermediate" levels of entitlement, in which entitlement holders are protected by liability amount, there is no negotiation); POSNER, *supra* note 1, at 55–56 (arguing that when bilateral monopoly problems exist, liability rules are efficient because they prescribe terms of exchange); Calabresi & Melamed, *supra* note 12, at 1125 (noting that because liability rules force transactions at "approximate" prices, it is "obvious" that property rules are often more desirable than liability rules); Craswell, *supra* note 17, at 8–9 (noting that property rules are more efficient when courts wish to "induce the parties to negotiate," because liability rules tend to "select[] a price on behalf of the parties"); Haddock et al., *supra* note 18, at 16 (arguing that liability rules allow potential defendants simply to take from potential plaintiffs and pay liability amount rather than negotiate with plaintiffs as they would do under property rules); Robert Merges, Intellectual Property Rights and Bargaining Breakdown: The Case of Improvement Inventions and Blocking Patents 30–31 (1994) (unpublished manuscript, on file with authors) (arguing against compulsory licenses in "new use" patents—a type of liability rule—because such rules "allow[] *courts*, not the parties themselves, to set the terms of exchange").

40. It is true, for example, that there should be no litigation for nonconsensual taking when entitlements are protected by property rules, assuming rational decision making and no mistaken or

induce a great deal of contracting.[41] The vast majority of potential "disputes" settle even before one of the parties files suit. Moreover, of those suits filed, the lion's share settle before trial, even when the damages in tort or contract serve a compensatory, rather than deterrent, purpose.[42] Even when liability rule damages are not sufficient to deter nonconsensual takings, the Coase theorem predicts that the parties may still have incentives to engage in consensual transactions.[43]

This Part moves beyond the traditional argument that liability rules are market-mimicking substitutes for consensual trade, arguing that liability rules may actually *facilitate* trade by reducing the effective amount of private information. Indeed, when an entitlement is protected by a liability rule, the entitlement holder may wish to engage in two very different types of consensual transactions: The entitlement holder may wish to (1) "bribe" a potential taker not to take the entitlement; or (2) "sell" her entitlement at a price less than the liability rule damage amount.[44] The fundamental insight of this Part is that under a liability regime, only those entitlement holders who value the entitlement more than the liability award will be interested in entering the first type of bargain, and only those entitlement holders who value the entitlement less than the liability award will be interested in the second type of transaction.

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accidental takings. The goal of minimizing the costs of protection would need to account for how the form of protection affected incentives to create or develop the entitlement. Systematic undercompensation for entitlement holders under a liability rule regime would undermine the entitlement holders' incentive to create or develop the entitlement. We discuss these important forms of inefficiency *infra* part IV.A.1.

41. Oliver Williamson's monumental work on transaction cost economics underscores the notion that it is insufficient simply to examine the initial allocation of entitlements to infer their ultimate allocation. Consequently, he argues that the appropriate approach is to assume that bargaining is always possible, or even likely, after allocation of initial property rights:

> Transaction cost economics maintains that it is impossible to concentrate all of the relevant bargaining action at the *ex ante* contracting stage. Instead, *bargaining is pervasive*—on which account the institutions of private ordering and the study of contracting in its entirety take on critical economic significance. The behavioral attributes of human agents, whereby conditions of bounded rationality and opportunism are joined, and the complex attributes of transactions . . . are responsible for that condition.

OLIVER E. WILLIAMSON, THE ECONOMIC INSTITUTIONS OF CAPITALISM 29 (1985). The law-and-economics literature has addressed this issue only sporadically, predominantly in the literature on "efficient breach." *See* COOTER & ULEN, *supra* note 1, at 290; *see also infra* note 208 and accompanying text.

42. Among federal cases filed, less than five percent go to trial. *See, e.g.*, H. LAURENCE ROSS, SETTLED OUT OF COURT: THE SOCIAL PROCESS OF INSURANCE CLAIMS ADJUSTMENTS 217 (1970). Many of these pretrial negotiations, however, occur after a taking, as in the run-of-the-mill tort case. But many contractual entitlements to performance that are protected merely by a liability rule are renegotiated prior to the promisor's taking of the entitlement through breach.

43. ROBERT E. SCOTT & DOUGLAS L. LESLIE, CONTRACT LAW AND THEORY 98–103 (1988); *see also* Johnston, *supra* note 29, at 6 (noting this phenomenon); Eric L. Talley, Note, *Contract Renegotiation, Mechanism Design, and the Liquidated Damages Rule*, 46 STAN. L. REV. 1195, 1218–42 (1994) (noting phenomenon within "mechanism design" framework, but without using explicit bargaining procedure); Zvika Neeman, Property Rights and Efficiency in Public-Good Mechanisms Under Asymmetric Information (1993) (unpublished manuscript, on file with authors).

44. Contrary to intuition, the owner may be willing to sell her entitlement for less than the liability amount, especially if the liability amount is sufficiently high so that the nominal owner believes that in the absence of such a sale, the potential defendant will not be willing to take and pay the liability amount.

Thus, despite the fact that strategic misrepresentations are normally endemic to bargaining, the entitlement holder bargaining under a liability rule does not act strategically when signaling her preferred *type* of transaction. We show that:

> *Under a liability rule, the type of offer that an entitlement holder makes credibly signals whether her valuation is above or below the liability amount.*

An offer to bribe signals that the entitlement holder's valuation is greater than the damage amount, while an offer to sell signals that her valuation is less than the damage amount. By simply listening to the type of offer, the potential taker can infer the entitlement holder's relative valuation.

Ordinarily, bargainers can put little faith in the other side's representation concerning valuation. The adage "talk is cheap" (meaning unreliable) seems to apply. Here, however, liability rules induce entitlement holders to engage in a credible form of "cheap talk" to communicate whether their valuations are above or below the liability amount.[45] Property rules, in contrast, allow for only one type of Coasean bargain, and thus do not induce this type of information revelation.

Using an instructive example in Section A and then an explicit game-theoretic model in Section B, we begin by analyzing "untailored" liability rules, which require payment of a fixed damage amount whenever an entitlement is taken nonconsensually. Section C then explores how "tailoring" the liability rule affects bargaining. We examine two particular types of judicial tailoring: tailoring the amount of *damages* (usually to the plaintiff's valuation) and tailoring the assessment of *liability* (usually to the defendant's valuation). Somewhat surprisingly, we find that certain tailored liability rules can significantly *reduce* parties' respective incentives to bargain truthfully.

A. *Information Revelation in the Shadow of Liability and Property Rules*

This Section examines how property and liability rules differentially affect the parties' incentives to reveal information. To motivate the analysis, consider the potential trade of an entitlement between two people: a potential "plaintiff," who ostensibly owns the original entitlement, and a potential "defendant," who

45. This argument is related to other results in the "cheap talk" bargaining literature, which note that although bargaining parties formally "compete" with one another in capturing gains from trade, they often have mutual incentives to signal to one another whether conditions are "good" or "bad" for trade to occur. *See, e.g.*, Joseph Farrell & Robert Gibbons, *Cheap Talk Can Matter in Bargaining*, 48 J. ECON. THEORY 221 (1989) (discussing possible gains created by allowing bargaining parties to signal whether they are "keen" or "not keen" on reaching bargaining agreement); Jason Scott Johnston, Cheap Talk, Sunk Costs, and Contractual Liability in Preliminary Negotiation (Apr. 1994) (unpublished manuscript, on file with authors) (modeling role that "cheap talk" can play in facilitating negotiations).

threatens to take the entitlement nonconsensually.[46] Suppose that the plaintiff and the defendant each know their own private valuations of the entitlement but not that of the other party. For concreteness, we assume that each party's valuation can take on any value between $0 and $100. These assumptions produce a canonical example of negotiation under asymmetric information.[47] The parties' private information makes it unclear whether there are gains to trade and if so, what would be a mutually agreeable price.

We begin by analyzing bargaining in the shadow of untailored rules, which force a defendant who takes nonconsensually to pay a fixed, or untailored, damage amount. Although courts often attempt to tailor damages to equal the plaintiff's lost value (which we have assumed to vary between $0 and $100), there are several contexts in which the damages are sufficiently untailored—i.e., they sufficiently diverge from the plaintiff's actual valuation—to give plaintiffs an incentive to signal whether their valuation is above or below the expected court award.[48]

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46. It is important to note here that the nominal identities of the parties are only of empirical, and not theoretical, significance. In the paradigmatic civil suit, the plaintiff typically accuses the defendant of appropriating her entitlement, and therefore seeks compensatory or injunctive relief. A popular example of such an action pits plaintiff residents against a defendant smoke-billowing factory, as in Boomer v. Atlantic Cement Co., 257 N.E.2d 870 (N.Y. 1970) (awarding plaintiffs property-like injunctive relief against defendant cement company).

Nevertheless, there have been a number of cases in which the identities of the parties were reversed. For instance, the equally popular case of Spur Industries, Inc. v. Del E. Webb Development Co., 494 P.2d 700 (Ariz. 1972), established the right of a residential development to enjoin the operation of a stinky cattle feedlot, but only if the development compensated the feedlot for lost profits. The holding in this case arguably gives a plaintiff (e.g., the development) the option of appropriating a defendant's entitlement in exchange for compensating the defendant (e.g., the feedlot) for reasonable damages pursuant to the taking. This option is essentially a liability right. Similarly, in patent law, the paradigmatic case pits a patentee plaintiff against an infringing (i.e., "taking") defendant. *See infra* part IV.C.1. It is just as frequent for a potentially infringing user to bring suit under the Declaratory Judgment Act, 28 U.S.C. § 2201 (1988), to litigate the question of infringement; in these suits, the identities of the plaintiff and the defendant are the opposite of those in the paradigmatic case.

47. The assumption of uniformly distributed valuations is consistent with a myriad of other analyses that study bargaining under private information. *See, e.g.*, Kalyan Chatterjee & William Samuelson, *Bargaining Under Incomplete Information*, 31 OPERATIONS RES. 835 (1983); John Kennan & Robert Wilson, *Bargaining with Private Information*, 31 J. ECON. LITERATURE 45 (1993).

48. Such contexts include:

(1) Liquidated damages. The assumption of constant damages is reasonable if we want to assess negotiation to modify a contract when there is a fixed liquidated damages amount. In this context, the promisee would be the entitlement holder who would have an incentive to say whether she valued performance more or less than the liquidated damages amount.

(2) Unverifiable damages. If the plaintiff will not be able to prove to a court the exact amount of harm (the damages are not *ex post* observable), the court will only be able to set damages on the basis of verifiable evidence. The untailored assumption also captures a class of cases that are observationally equivalent to the judge: where both sides know that a certain amount of damages is provable, but both sides also know that plaintiff's valuation may be more or less than this amount. For example, if damages for breach of a promise to perform are limited to diminution of market value, it is possible that the plaintiff has a subjective valuation that is greater or lower than the likely judicial award. *See, e.g.*, Jacob & Youngs v. Kent, 129 N.E. 889 (N.Y. 1921) (holding that damages for using incorrect brand of pipe in building were equal to difference in market value).

The magnitude of the untailored damages determines whether the plaintiff's entitlement receives property or liability protection. Specifically, if the damages are greater than $100 (the highest valuation of any potential defendant), then the plaintiff's entitlement is "property-like" in nature: With such relatively high damages, potential takers would be deterred from nonconsensual takings, and the entitlement would be transferred only by consensual agreement. Damages less than $100 would not, however, deter all defendants from taking and would provide only a weaker form of liability protection. Protecting the plaintiff's entitlement by a liability rule is an example of dividing the possible claims to the entitlement between the parties.

Under a property rule, the plaintiff owns an undivided entitlement because she has the only legally cognizable claims. In contrast, under a liability rule, the defendant in effect has a "call option"—i.e., an option to buy the entitlement for the damage amount.[49] Under such a regime, the plaintiff owns the entitlement subject to the defendant's decision whether to exercise this liability call option.

Here, we explore the parties' incentives to disclose information when negotiating under either a property rule of $100 damages or a liability rule of $50 damages.[50] It is well known that bargainers have an incentive to

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This list is not exhaustive. Several other legal rules produce a similar effect. For example, the doctrine of "conditional privilege" (or "incomplete privilege") creates an untailored liability rule. The privilege allows a shipowner, during a storm, to use someone else's dock nonconsensually and pay compensation equal to the rental value of the dock, plus damages for any loss inflicted during the storm. *See* RICHARD A. EPSTEIN, BARGAINING WITH THE STATE 54–58 (1993) (discussing "conditional privilege" doctrine).

The copyright statute provides for compulsory licenses at specified royalties for musical recordings, songs played on jukeboxes, certain cable television transmissions, and certain uses of copyrighted works by public television. Robert P. Merges, Contracting into Liability Rules: Institutions Supporting Transactions in Intellectual Property Rights 24–25 (1994) (unpublished manuscript, on file with authors). These compulsory licenses also represent classic untailored liability rules. Although it is safe to say that most liability rules are at least partially tailored, one purpose of this Article is to suggest that lawmakers and academics have not paid sufficient attention to untailored liability rules as a policy alternative. *But cf.* AMERICAN LAW INST., ENTERPRISE RESPONSIBILITY FOR PERSONAL INJURY 223 (1991) (suggesting use of relatively untailored schedule of damages in awards for pain and suffering).

49. In finance, a "call option" is a right to purchase a financial instrument (such as a stock) at a prespecified price (called the "strike price" or "exercise price") at some future date. In this context, the plaintiff holds a "long" position with regard to the entitlement, but a "short" position with regard to this call option. *See* RICHARD A. BREALEY & STEWART C. MYERS, PRINCIPLES OF CORPORATE FINANCE 485 (4th ed. 1991).

50. Setting the liability amount at $50 corresponds not only to the mean valuation of all plaintiffs, but also to the mean valuation of plaintiffs who go to trial in equilibrium. *See infra* text accompanying notes 137–53. We confine our attention to these two damage amounts for expositional purposes only. The Appendix shows the effect of other damage amounts on bargaining. *See infra* app. at pp. 1104–13. Our analysis supports Coleman and Kraus' claim that the type of protection determines the content (and value) of each party's entitlement. Jules L. Coleman & Jody Kraus, *Rethinking the Theory of Legal Rights*, 95 YALE L.J. 1335 (1986).

We also assume that after a taking, or after contractual allocation of the entitlement, the ownership is protected by a property rule. So, for example, if the defendant takes nonconsensually and pays the plaintiff $50, we assume that the plaintiff does not have an option to retake the entitlement—or, more precisely, that the legal consequences of such a retaking are so dire that plaintiffs would never retake. This assumption that the defendant's call option is protected by a property rule is not foreordained. Ellickson has suggested that in nuisance actions, defendants have an option to pollute and pay damages, but that this option itself should be protected merely by a liability rule—the plaintiff should have an option to take back

misrepresent their valuations: Sellers tend to overstate their true valuation, and buyers tend to understate their true valuation. When the plaintiff's entitlement is protected by a property rule, the parties know that the plaintiff owns an undivided claim and therefore *must* bargain as a seller, while the defendant owns nothing and therefore *must* bargain as a buyer. Plaintiffs accordingly will offer to sell the entitlement for some amount more than their valuation, and defendants will offer to buy the entitlement for some amount less than their valuation. The strategic inefficiency created by the parties' private information is an example of what economists call "adverse selection."[51]

When the plaintiff's entitlement is protected by a liability rule, however, the parties can enter into two different types of Coasean trade:

COASEAN BARGAIN #1	The *plaintiff bribes the defendant* not to take the entitlement.
COASEAN BARGAIN #2	The *defendant buys the plaintiff's* entitlement.

TABLE 1. *Liability Rules Create Two Types of Coasean Transactions*

Under the first Coasean bargain, *the plaintiff buys the defendant's call option.* For example, as shown in Figure 1, a plaintiff (with a $90 valuation) might pay a defendant (with a $60 valuation) $15 not to exercise his call option and take nonconsensually. In the absence of the bargain, the defendant would take; after a taking and payment of the $50 damages, the plaintiff and defendant would end up with $50 and $10, respectively.[52] But the $15 Coasean bribe not to take is Pareto-superior—increasing the plaintiff's and defendant's payoffs to $75 and $15, respectively.[53]

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the right to stop pollution nonconsensually by paying some prescribed amount. Robert C. Ellickson, *Alternatives to Zoning: Covenants, Nuisance Rules, and Fines as Land Use Controls*, 40 U. CHI. L. REV. 681, 738–48 (1973).

51. *See* Brown & Ayres, *supra* note 15, at 331–35; *see also infra* part IV.A.1 (discussing how attempts to remedy adverse selection caused by private information may exacerbate problems of underinvestment).

52. The defendant would have a net payoff of $10, because she would own an undivided claim to the entitlement, worth $60, but would have paid the damage amount of $50. Even though the plaintiff would value an undivided claim to the entitlement at $90, she only owns a divided or partial claim, because her ownership is subject to the defendant's call option.

53. The plaintiff gains an undivided interest in the entitlement, worth $90, but needs to pay $15. The defendant gains the $15 bribe. The explicit numbers given in the text are only illustrative. The driving force behind this example is that the parties' valuations are privately held. If the parties' information were part of the public domain, then it would be common knowledge who should receive the entitlement, and the only real decision for the parties would be how to divide the gains from trade. Assuming they can "coordinate" on a division, the Coase theorem would hold. It is in this frictionless context that the system of legal entitlement becomes "irrelevant" under the "perfect information" version of the Coase theorem. *See* COOTER & ULEN, *supra* note 1, at 101 n.11.

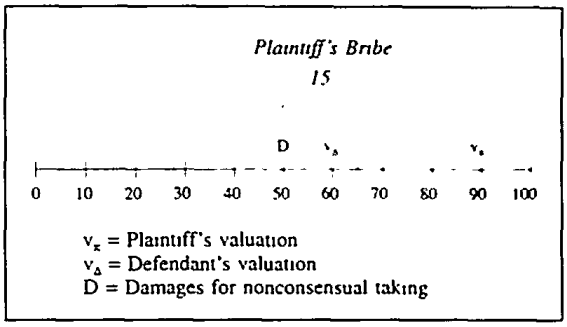

FIGURE 1. *Example of Plaintiff's Incentive To Bribe Defendant Not To Take*

Under the second Coasean bargain, *the defendant buys the plaintiff's entitlement.* As shown in Figure 2, a defendant (with a $30 valuation) might pay a plaintiff (with a $10 valuation) $25 for the entitlement. In the absence of the bargain, the defendant would not take the entitlement, even though it was the higher valuer, and the plaintiff's and the defendant's payoffs would be $10 and $0, respectively. In response, the plaintiff might agree to "renegotiate" the liability term downward, so as to induce the defendant to take. In this case, a $25 Coasean agreement is again Pareto-superior to autarky, raising both the plaintiff's and the defendant's payoffs to $25 and $5, respectively.

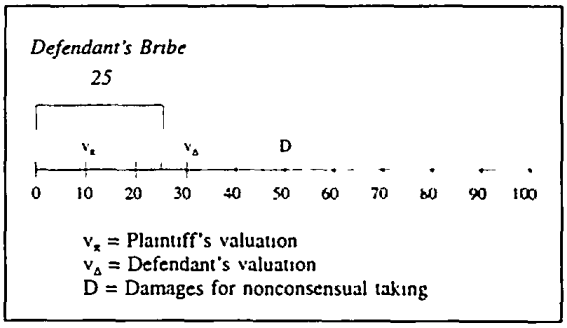

FIGURE 2. *Example of Defendant's Incentive To Buy Plaintiff's Entitlement*

This second Coasean bargain is analogous to the sale of an entitlement protected by a property rule. Under a liability rule regime, however, the contract price will never be more than the damage amount: Even if the plaintiff knows that the defendant has a $90 valuation for the entitlement, the plaintiff will never be able to extract a price higher than $50, because defendants will never consent to pay more than $50 for what they can take nonconsensually for $50.

It is important to note that the possibility of entering into two different types of Coasean bargains generally does not mitigate the *defendant's* incentives to misrepresent his valuation. High-valuing defendants, who will

exercise their call option in the absence of bargaining, might feign a low valuation in order to purchase the entitlement from plaintiffs for even less than the $50 exercise price. Low-valuing defendants, on the other hand, who have no intention of exercising the call option, might feign a high valuation so that plaintiffs would bribe them not to exercise their option.

The possibility of entering into two different types of Coasean bargains, however, *does* dramatically affect the *plaintiff's* incentives to reveal information. Under liability rule protection, only plaintiffs who value the entitlement more than the damage amount would have an incentive to express interest in purchasing the defendant's call option (Coasean bargain #1). A low-valuing plaintiff (with, say, a $40 valuation) would have no reason to pay a defendant not to take the entitlement. Indeed, absent bargaining, the low-valuing plaintiff stands to make a windfall should the defendant take nonconsensually and pay the $50 damage.

An analogous argument illustrates that only plaintiffs who value the entitlement less than the damage amount would have an incentive to express interest in selling their entitlement (Coasean bargain #2). A high-valuing plaintiff (with, say, a $65 valuation) would never agree to sell the entitlement for less than $50 and would never be able to sell it for more than $50. Put simply, a plaintiff's type of offer credibly signals whether her valuation is above or below the liability amount: High-valuing plaintiffs will never offer to sell their entitlement for less than $50, while low-valuing plaintiffs will never offer to bribe the defendant not to take.

As a result of this incentive structure under a liability rule, high-valuing and low-valuing plaintiffs willingly "partition" themselves into two sets. As shown in Figure 2, only plaintiffs to the left of the damage amount would be interested in selling their entitlement, and only plaintiffs to the right of the damage amount would be interested in buying the defendant's call option.

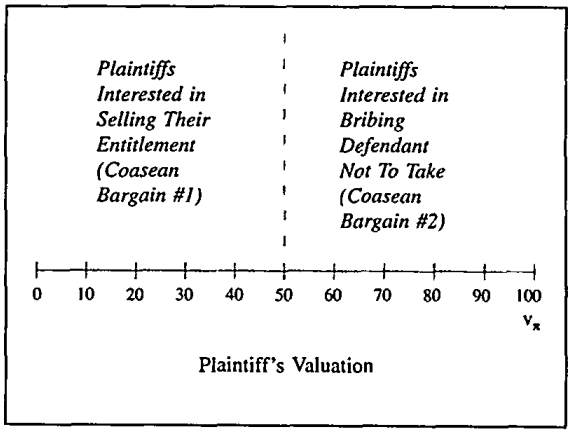

FIGURE 3. *The Damage Amount Partitions Plaintiffs into Two Groups*

This partitioning is an example of self-selection, because the plaintiffs have individual, private incentives to separate themselves into two groups. A defendant can infer whether the plaintiff's valuation is greater or less than the liability amount simply by inquiring which type of transaction the party prefers.[54]

Liability rules have an "information-forcing" characteristic not shared by property rules.[55] With "property-like" damages (i.e., $100 or more), plaintiffs are still willing to signal whether their private valuations are greater than or less than the damage amount; however, because the damage amount is so high, the plaintiffs cannot partition themselves into two groups.[56]

The willingness of plaintiffs to self-select in this fashion is consistent with the normal strategic incentives of sellers to overstate and buyers to understate their respective valuations. Thus, the plaintiff at times will have a seller's incentive to overstate her valuation and at other times will have a buyer's incentive to understate her valuation. The plaintiff's normal incentive to overstate as a seller or to understate as a buyer, however, is severely constrained by the defendant's ownership of the liability rule call option, because under a liability regime the plaintiff must choose between buying or selling one of the divided entitlements.

As a potential seller of the entitlement, a plaintiff wishes to overstate her private valuation. But a low-valuing plaintiff gains nothing from misrepresenting her valuation as larger than the damage amount, because a defendant would never buy for $60 what she could take nonconsensually for $50. The defendant's ownership of the liability rule call option thus acts as an upper bound on the ability of a low-valuing plaintiff to overstate her valuation: Low-valuing plaintiffs will still attempt to overstate their valuations, but since they have less "room to lie," their misrepresentations will never exceed the damage amount.[57]

Similarly, as a potential buyer of the defendant's call option, the high-valuing plaintiff wishes to understate her valuation, so as to reduce the size of the bribe necessary to stop the defendant from taking nonconsensually. Nonetheless, there is a natural limit to how much the plaintiff can understate her valuation: A plaintiff offering to buy the defendant's option—that is, offering to bribe the defendant not to take—cannot credibly claim that her valuation is less than the damage amount, because defendants know that

54. Such a simple device is in fact what we use to model the bargaining game. *See infra* text accompanying notes 78–83.

55. Default rules can also be chosen to induce parties to reveal information to each other or to the courts by penalizing silent parties with unwanted terms. *See* Ian Ayres & Robert Gertner, *Filling Gaps in Incomplete Contracts: An Economic Theory of Default Rules*, 99 YALE L.J. 87, 97–100 (1989).

56. Because plaintiffs' valuation never exceeds $100, no plaintiff would want to bribe the defendant not to take.

57. The plaintiff would love to be able to extract some of the valuation from a high-valuing defendant, but the defendant's call option eliminates the plaintiff's ability to bargain for a higher selling price.

plaintiffs with such low valuations would have no reason to pay to stop a nonconsensual taking. The defendant's ownership of the liability call option, therefore, places a lower bound on the amount by which a high-valuing plaintiff can understate her valuation.

The damage amount under a liability rule thus serves as both a *ceiling* to overstatements and a *floor* to understatements by the plaintiff choosing whether to make offers to buy the defendant's call option or to sell her own entitlement.[58] Property rule regimes cannot produce this type of partitioning, because the plaintiff would only be interested in *selling* her entitlement, and the high damage amount does not constrain the incentive of the plaintiff (*qua* seller) to overstate her valuation.

The willingness of entitlement holders to engage in credible signaling during Coasean bargaining is not a fragile result of a specific game-theoretic model. It does not depend on particular bargaining rules. It does not depend on particular assumptions about how the parties' valuations are distributed; indeed, the plaintiff need not know the defendant's distribution of valuations. And, most important, it generally does not depend on the plaintiff's beliefs about the defendant's behavior: Regardless of the defendant's strategy,[59] a high-valuing plaintiff will not offer to sell the entitlement for less than the damage amount, and a low-valuing plaintiff will not offer to buy the defendant's call option. Self-selection of plaintiffs is an "iterated" dominant strategy.[60]

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58. The defendant does not face the same upper and lower bounds on her misrepresentation. As a potential seller of her call option, the defendant has an incentive to overstate her valuation (of the option), and thus even low-valuing sellers might claim high valuations. As a potential buyer of the entitlement, the defendant has an incentive to understate her valuation (of the entitlement), so that even high-valuing defendants will have an incentive to claim low valuation.

59. One requirement that we do place on the defendant, however, is that he be somewhat rational and avoid behaving in a way that is clearly not in his interests relative to his payoffs absent bargaining. For instance, it cannot be the case that the defendant will offer the plaintiff $1 million for the entitlement when the most the defendant could lose by taking nonconsensually is $50.

60. *See* DREW FUDENBERG & JEAN TIROLE, GAME THEORY 45–57 (1991) (defining iterated dominance).

The only assumptions that are crucial to this "no misrepresentation" result are that (1) the damage amount must be common knowledge, and (2) the defendant's own valuation of the entitlement must not depend on his beliefs about the plaintiff's valuation. If either of these assumptions fails, a plaintiff may affirmatively misrepresent whether her valuation is greater or less than the damage amount to manipulate the defendant's choice about whether to take the entitlement nonconsensually. For example, in many litigation contexts, both parties are trying to value an entitlement where the parties' valuations are both uncertain and correlated. In this setting, a liability rule might not reveal information, because a high-valuing plaintiff may not want to increase the chance that the defendant will want to take, and a low-valuing plaintiff may not want to decrease the chance of a taking. *See infra* part IV.A.3.

In the precise parlance of game theory, partitioning is a rationalizable strategy. Essentially, rationalizability builds on the assumption that it is common knowledge that no player will behave in a way that is clearly against her interests. Such an assumption allows one to narrow down the number of transactions that rational parties would make in an iterative way. Thus, as applied to our model, it is common knowledge that no plaintiff would accept a settlement offer from a defendant that was lower than what the plaintiff could expect through litigation. In turn, a defendant can deduce the types of offers that the plaintiff might accept. Among these "acceptable" offers, we can be sure that no rational defendant would make an acceptable offer that would, if accepted, make the defendant worse off. Finally, knowing

Although our conclusion is robust that plaintiffs' type of offer credibly signals whether their valuations are higher or lower than the damage amount, several factors can mitigate the practical importance of this conclusion. First, liability rules do not produce an incentive to produce precise information; plaintiffs separate themselves into only two groups. Second, liability rules can exacerbate defendants' incentive to misrepresent valuation,[61] so that liability rules are most likely to mitigate informational inefficiencies when the plaintiff's private information is the primary impediment to efficient trade.[62] Third, various costs of contracting can deter entitlement holders from making *any* Coasean offer. While those plaintiffs who do make serious Coasean offers signal whether they are high-valuing or low-valuing, some subset of plaintiffs may remain silent. Finally, although this partitioning result clearly holds for all types of damages awards, it may fail to have efficiency-enhancing qualities when the legal rules become more tailored.[63]

B. *A Formal Model of Untailored Liability and Property Rules*

To illustrate the implications of the intuition presented above, we now show in an explicit model how the information-forcing effect of liability rules can produce more efficient Coasean trade than a property rule regime. The structure of the Coasean bargaining game is the following. There are two players, a potential plaintiff (denoted "π") and a potential defendant (denoted "Δ"). Each of these parties places a privately known value on the right to conduct her activities free from interference by the other's activities. For instance, recall the example from the Introduction in which Smith and Jones are bargaining over land development: Each party privately knows how much she values developing the land, but only one of them can do it. While there are numerous such hypothetical examples,[64] assume for now that the competing

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what types of serious offers she can expect, a plaintiff will have no incentive to lie about whether her valuation is above or below the liability amount. Rationalizability is the Bayesian cousin of iterated dominance. In fact, for strategic situations with two players, the notions of rationalizability and iterated dominance coincide. *See* FUDENBERG & TIROLE, *supra*, at 48–53 (explaining concept and noting that rationalizability is "weak" restriction on behavior).

61. For example, under a property rule, a $20 defendant might represent that he only has a $10 valuation in an attempt to purchase the plaintiff's entitlement cheaply. Under a liability rule, however, the same defendant might falsely claim to have a $70 entitlement in an attempt to sell his worthless call option at an inflated price.

62. For example, if the plaintiff has a contractual entitlement as a buyer to the seller's manufacture of a certain machine, it may be that the seller's valuation is more readily observable than the plaintiff's valuation, for the simple reason that the seller's cost or resale option may be more accessible. If the defendant's private valuation is the more important cause of informational inefficiency, then a reverse liability rule may be appropriate. *See infra* part II.B.4.

63. In a later section, we will show how various forms of tailoring can undermine the information-forcing quality of liability rules. *See infra* part II.C.

64. To take a quintessential Coasean example, the potential plaintiff may represent a farmer who wishes to grow corn free from the potential hazards of sparks from a passing train, and the potential defendant may represent a railroad company that wishes to run its train across tracks that run alongside the farmer's land. Alternatively, in a contracts setting, the potential plaintiff may represent a promisee who is

uses are completely incompatible—if one party enjoys the entitlement, the other cannot.[65]

1. *Defining the Game*

As before, to capture the essence of bargaining under incomplete information, suppose that each party knows the value *she* places on the legal entitlement, but is unsure of the other party's valuation. Explicitly, assume that the plaintiff's privately known valuation, v_π, takes on a realization between \$0 and \$100 with equal probability—the so-called "uniform distribution."[66] The defendant's private valuation, v_Δ, on the other hand, takes on only two equally probable values, \$40 and \$60. Our assumption that plaintiffs have a wider range of valuations than defendants makes the plaintiff's private information an important cause of Coasean inefficiency and allows us to focus on the potential benefits of inducing the plaintiff to reveal information.[67]

Absent agreement, the defendant may "take" from the plaintiff,[68] but in return he must pay the plaintiff a fixed damage amount of \$D.[69] As argued above, the size of the damage amount determines whether the plaintiff's entitlement is protected by a liability rule or a property rule.[70] Damages of \$100 represent a property rule, because this damage amount would deter both types of defendant from nonconsensual taking;[71] damages of \$50 represent a liability rule—which, absent bargaining, allows nonconsensual takings.[72]

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awaiting performance from the potential defendant, who in turn values breaching his duties under contract.

65. In Part III, we analyze the case in which an entitlement is divisible into activity levels, thus allowing both parties to utilize the resource in part. To focus on the role of liability rules, however, this Section assumes that the outcome is binary—only one party can receive the entitlement.

66. More explicitly, v_π is a continuous random variable with probability *density* of 1/100 for each value of v_π. The term "probability" is used in the text only for stylistic reasons, since for a continuous random variable the probability that it takes on an exact value is zero.

67. The plaintiff's revelation is more important because the variance of the defendant's valuation is less than the variance of the plaintiff's valuation, so that the pooling of defendants is less significant than the pooling of plaintiffs. As discussed *infra* part II.B.4, if the defendant's private information is the major cause of inefficiency, then reverse liability rules may enhance allocational efficiency relative to a property rule.

68. Assume for simplicity that there are only two possible activity levels: Either the defendant "takes" (e.g., the rail company runs its train by the farmer's land), or the defendant does not take (e.g., the train does not run, and the farmer conducts her activities unimpeded). For a discussion of settings where the level of taking is a continuous variable, see *infra* part III.B.

69. We begin by assuming that plaintiffs are "observationally equivalent" to both the defendant and the court, and the damage amount thus is not "tailored" to vary with a plaintiff's actual damages. Later in this Section, we analyze the effects of awarding to the plaintiff a more "tailored" liability amount that equals her actual damages v_π, *see infra* part II.C.1, and awarding damages to the plaintiff only if the court determines that $v_\Delta < X$, where X is the negligence standard, *see infra* part II.C.2.

70. *See supra* notes 35–36 and accompanying text.

71. For this particular specification, any damage amount greater than \$60 would represent a property rule, which would deter nonconsensual takings. *See infra* app. at pp. 1106–09.

72. Table 2 below describes the "noncooperative" expected payoffs for the defendant and the plaintiff (i.e., the payoffs that the parties could expect absent bargaining) when damages equal \$50 or \$100. As shown in the table, under the liability rule when D equals \$50, only the high-valuing defendant takes absent bargaining. In this situation, the plaintiff's expected payoff is the average of her private valuation v_π (which

As discussed above, liability rules can give rise to two types of bargains. When D = $50, a defendant whose valuation is $40 may be interested in "buying" the right to take from a low-valuing plaintiff at a price less than the judicially determined $50 exercise price. Conversely, a $60 defendant might attempt to sell his option to take for $50.

To illustrate explicit bargaining under liability rules and property rules, we adopt the following stylized bargaining procedure.[73] In the first stage of the game, the plaintiff tells the defendant whether she is interested in buying the defendant's call option or in selling her entitlement. Thus, the plaintiff must solicit one of two different types of offers from the defendant: She can say "I would like to bribe you not to take my entitlement" (i.e., Coasean bargain #1), or she can say "I would like to sell my entitlement" (i.e., Coasean bargain #2). In the second stage of the game—after this proclamation by the plaintiff—the defendant makes a single all-or-nothing offer: The defendant can either offer to sell his call option (i.e., agree not to take nonconsensually) for some price, or the defendant can offer to buy the plaintiff's entitlement.[74] Thus, the

she would earn if the defendant were a low valuer) and the $50 damages (which she would get if the defendant were a high valuer).

DAMAGE AMOUNT	D = $50	D = $100
TYPE OF ENTITLEMENT PROTECTION	Liability Rule	Property Rule
DEFENDANT'S BEHAVIOR	Only high-valuing defendants take	Defendants never take
PLAINTIFF'S EXPECTED NONCOOPERATIVE PAYOFF	$(50 + v_x)/2$	v_x
DEFENDANT'S EXPECTED NONCOOPERATIVE PAYOFF	0 if $v_\Delta = 40$; 10 if $v_\Delta = 60$	0

TABLE 2. *Expected Noncooperative Payoffs Under Liability and Property Rules*

In the Appendix, we more generally analyze liability-like rules based on damage amounts ranging between $40 and $60. *See infra* app. at pp. 1110–13. The Appendix also shows that damage amounts less than $40 effectively allocate the entitlement to the defendant, because all defendants will take absent bargaining, though such amounts will mandate a small compensatory payment. *See infra* app. at p. 1109.

73. This model assumes that the parties use a single bargaining procedure to govern their Coasean negotiations, regardless of the legal environment that they face. Assuming a consistent bargaining procedure allows us to extract conclusions that must be due to the change in legal environment rather than a change in bargaining procedures. On the other hand, by clinging to a single bargaining game, we do not address the prospect that the parties' procedure might be environment-dependent, and that as the legal rule changes, so will the bargaining "game." Coauthor Talley has addressed this prospect in another paper and has found that our results recur even when the parties choose bargaining procedures that are socially "optimal" for every legal environment. *See* Talley, *supra* note 14, at 35–39.

74. Giving the defendant the power to make an all-or-nothing offer allocates a great amount of market power to the defendant. *See* Ian Ayres & Robert Gertner, *Strategic Contractual Inefficiency and the Optimal Choice of Legal Rules*, 101 YALE L.J. 729, 735–46 (1992) (exploring inefficiencies that arise from strategic bargaining when one party to contract has private information and other side has some market power). For example, if the defendant knew the plaintiff's type, the defendant could capture all the gains from trade by simply demanding a price that was just lower than the plaintiff's valuation. Giving the

defendant's offer, must specify what is being traded—the plaintiff's entitlement or the defendant's option—and the price. In the third stage of the game, the plaintiff, upon hearing the defendant's offer, accepts or rejects this offer, and the trade occurs if the offer is accepted.[75] Because the defendant's offer, however, is "take-it-or-leave-it," a rejection by the plaintiff ends the bargaining, and in the final possible stage of the game,[76] the defendant chooses whether to take the entitlement nonconsensually and pay the damage amount,[77] or to abstain from taking and leave the entitlement with the plaintiff.

2. *Deriving the Equilibrium*

The equilibrium bargaining strategies and outcomes of the above bargaining game depend on the type of entitlement protection. Thus, we analyze property rule damages (of D = $100) and liability rule damages (of D = $50) separately.[78] Before proceeding, however, it is useful to derive as benchmarks the expected payoffs both (1) when Coasean bargaining is perfectly efficient, and (2) when bargaining is not allowed—a situation that we shall call "legally mandated autarky."[79] Under the first scenario, in which Coasean negotiations succeeded in costlessly allocating the entitlement to the highest valuer, the parties would have an expected surplus of $63 to divide.[80] Under the second benchmark of legally mandated autarky, the expected joint

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defendant this all-or-nothing offer also reduces the relative importance of the defendant's private information, thereby allowing the model to focus on the strategic inefficiency of the buyer's information. Because liability rules can exacerbate misrepresentations by defendants, this type of divided entitlement is likely to facilitate trade only when the plaintiff's private valuation is the impediment to efficient negotiations.

75. Thus, if the plaintiff agrees to sell her entitlement, she transfers the entitlement to the defendant in exchange for the agreed purchase price; if the plaintiff agrees to buy the defendant's option, the plaintiff retains the entitlement, but pays the defendant the agreed bribe.

76. Of course, players only reach this stage of the game if the plaintiff rejects the defendant's offer. The explicit game tree is depicted in the Appendix. *See infra* text accompanying notes 246–47.

77. We assume that the plaintiff can costlessly sue and collect damages. Including litigation costs in the model can result in even higher rates of Coasean trade, because the parties have a joint incentive to avoid the costs of litigation. This incentive only holds true for liability rules, under which the parties still have credible threats to take and/or sue. *See* Talley, *supra* note 14, at 32–35.

78. Thus, we examine only two "snapshots" of the value of the damage amount (D), which more generally could take on any positive value.

79. The notion of "legally mandated autarky" is closely related to what Calabresi and Melamed called "inalienability" rules. *See* Calabresi & Melamed, *supra* note 12, at 1106. If one defines "autarky" as the absence of trade, then legally mandated autarky is analogous to what Radin has called a rule of "nonsalability." Radin, *supra* note 37, at 1854; *see also* Rose-Ackerman, *supra* note 37, at 933–37 (noting that non-salability is but one manifestation of inalienability rules).

80. Even though the average valuation of each plaintiff and each defendant is $50, the average *highest* valuation of a plaintiff *and* a defendant is $63, because, intuitively, there are two chances to draw a party with a valuation greater than $50. In statistics terminology, the expected $63 is an "ordered statistic." *See, e.g.*, SHELDON ROSS, A FIRST COURSE IN PROBABILITY 224–25 (3d ed. 1984). For an explanation of the calculation of the $63, see *infra* app. at p. 1104.

welfare in a property regime is \$50,[81] while the expected joint welfare in a liability regime is \$55.[82] The ability of liability rules to increase the expected social welfare when bargaining is impossible resonates with the insights of Calabresi and Melamed: When transaction costs are prohibitively high, liability rules can enhance allocational efficiency by allowing high-valuing defendants to take and pay damages. It is a different question, however, whether this result holds when Coasean bargains are made in the presence of asymmetric information, which adds some (though not prohibitive) friction to bilateral bargaining.[83]

a. *Bargaining Under an Undivided Property Rule*

Under an undivided property rule, the defendant would never want to exercise his option to take and pay \$100. Because the defendant has no credible threat of taking, he has nothing to "sell" to the plaintiff. The plaintiff, therefore, would never offer to bribe the defendant not to take the entitlement. Accordingly, in the first stage of the game under a property rule, the plaintiff signals only an interest in selling her entitlement to the defendant (i.e., Coasean bargain #2).

The defendant will make a take-it-or-leave-it offer to purchase the plaintiff's entitlement for a price that maximizes the defendant's expected profits, given his uncertainty about the plaintiff's valuation. As usual, the defendant as a buyer has an incentive to offer less than his valuation. A lower offer benefits the defendant if the plaintiff accepts, but reduces the chance of acceptance. In the Appendix, we show that the defendant whose valuation is \$40 will bid \$20 and the defendant whose valuation is \$60 will bid \$30 to buy the entitlement.[84] Plaintiffs with valuations below the contract offers will accept and those with valuations above the contract offers will reject.

This bargaining equilibrium is depicted in Figure 4.

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81. Under this type of property regime, both consensual and nonconsensual takings by defendants would be deterred, so the entitlement would simply remain with the plaintiff, who would have an expected valuation of \$50.

82. If contracting were prohibited but the defendant had an option to take the entitlement nonconsensually for \$50, only defendants with \$60 valuations would take, so that 50% of the time a \$60 valuer would own the entitlement and 50% of the time the entitlement would remain with a random plaintiff who would have an expected valuation of \$50. The expected value is thus (5)\$60 + (5)\$50 = \$55.

83. As noted above, the folk wisdom on this point is that the existence of "some" transaction costs will likely mean that property rules are more efficient, since such rules give parties the incentive to set their own price for a taking; liability rules, on the other hand, usually are unable to overcome small transaction costs, so the parties must use the court-determined price for exchange. *See supra* notes 16–18 and accompanying text.

84. *See infra* app. at p. 1108.

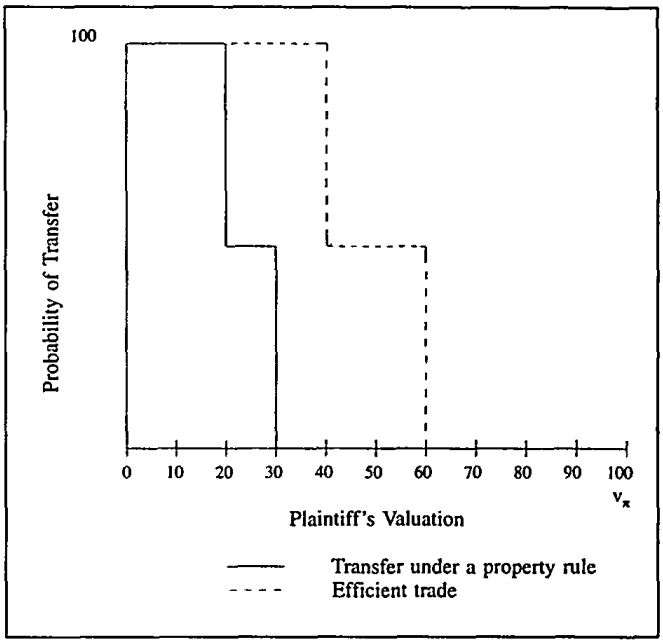

FIGURE 4. *Probability that Entitlement Will Be Transferred from Different Plaintiff Types Under a Property Rule*

The horizontal axis depicts the various plaintiff valuations and the vertical axis depicts the probability that the entitlement will be transferred (by sale or taking) to the defendant. As shown in Figure 4, 100% of plaintiffs with valuations less than $20 will sell their entitlement, because these plaintiffs will accept both the $20 and $30 offers from both types of defendants; there is a 50% chance that plaintiffs with valuations between $20 and $30 will sell their entitlement, because these plaintiffs will reject the $20 offers (from $40 defendants) and accept the $30 offers (from $60 defendants). Plaintiffs with valuations above $30 will never sell because they value the entitlement more than either type of the defendants' take-it-or-leave-it offer. The figure also illustrates the inefficiency of this equilibrium outcome by showing (with dotted lines) the efficient level of trade. For example, 100% of plaintiffs with valuations less than $40 should sell their entitlement to higher-valuing defendants, yet in the figure only 50% of plaintiffs with valuations between $20 and $30 sell and no plaintiffs with valuations between $30 and $40 are willing to sell.[85]

85. Efficient trade would also induce 50% of plaintiffs with valuations between $40 and $60 to sell to those defendants with $60 valuations. Under a property rule, however, none of these transactions takes place; the plaintiff's private information is a but-for cause of this inefficiency. If the seller knew the plaintiff's valuation, the higher-valuing seller would offer to buy the entitlement at a price just below the plaintiff's valuation, thereby inducing allocational efficiency.

Under a property rule, the parties' strategic interactions produce an expected surplus of approximately $59.75.[86] Thus, Coasean bargaining with imperfect information does not guarantee efficiency under a property rule; the parties' expected payoffs are some $3.25 less than the "first-best" level of $63.[87] There are, however, significant gains from Coasean trade: As discussed above, the parties' expected payoffs under a liability rule *without* Coasean trade were only $55—so (as is well understood[88]) protecting an entitlement with a property rule and allowing the parties to bargain can enhance allocational efficiency. If one were to assume that bargaining is infeasible under a liability rule, the property protection would, after bargaining, produce an expected surplus that is $4.75 higher than "autarky" under a liability rule. The traditional analysis of liability and property rules is flawed, however, in that (at least implicitly) it only compares the expected gains from a liability rule *without* trade to the gains from a property rule *with* trade. In contrast to this rather popular comparison, we show below that protecting an entitlement with a liability rule—because of the information-forcing effect—can enhance Coasean bargaining even more.

b. *Bargaining Under a Liability Rule*

When the damage amount D is equal to $50, in the absence of agreement the $60 defendant will take, and the $40 defendant will abstain from taking. Under a liability rule, then, the defendant's threat to take is credible *if and only if* the defendant's private valuation is $60. At first blush, one might intuit that the intermediate level of damages merely adds another dimension of private information to bargaining—for only the defendant knows whether his ostensible threat to take is credible—so that the bargaining outcome would be more inefficient than bargaining under a property rule. It turns out, however, that the information-forcing character of liability rules has a much stronger efficiency-enhancing effect that can facilitate Coasean exchanges.

When the damage amount is $50, the bargaining game delineated above has a number of potential equilibria. All of these equilibria, however, exhibit the information-forcing characteristic that plaintiffs never have an incentive to misrepresent their valuations.[89] Moreover, the most "plausible" of these

86. As one would suspect, plaintiffs endowed with an (undivided) entitlement protected by a property rule garner the bulk of this expected value. As shown below in Table 5, the plaintiffs on average garner $53.25, and the defendant earns $6.50. *See infra* part II.B.3. The $40 defendant's expected payoff is $4, and the $60 defendant's is $9. The plaintiff's expected payoff will be v_p if her valuation exceeds $30, ($v_p/2$ + $30) if her valuation is between $20 and $30; and $25 if her valuation is less than $20

87. *See supra* note 80 and accompanying text.

88. *See supra* notes 27–28 and accompanying text.

89. A number of plaintiffs with intermediate valuations, however, will be indifferent between expressing interest in the two types of Coasean trade, because these plaintiffs know that in equilibrium they will not be able to reach agreement with defendants exploiting their take-it-or-leave-it market power The valuation of these plaintiffs is not sufficiently different from the damage amount to make trade worthwhile

equilibria produce expected payoffs that exceed the expected $59.75 surplus produced by bargaining under a property rule. Table 3 reports the representative strategies of just such an equilibrium:[90]

STAGES OF THE GAME	EQUILIBRIUM STRATEGY
PLAINTIFF'S REPORT OF INTEREST:	• If a plaintiff's valuation v_π is less than $50, she reports interest in selling her entitlement. • If a plaintiff's valuation v_π exceeds $50, she reports interest in buying defendant's option to take.
DEFENDANT'S OFFER:	• If plaintiff reported interest in selling her entitlement, *both* types of defendant offer to buy the entitlement for $32.50. • If plaintiff reported interest in buying defendant's option to take, *both* types of defendant offer to sell their option to take for $17.50.
PLAINTIFF'S ACCEPTANCE DECISION:	• A plaintiff, who has reported interest in selling her entitlement, will accept the defendant's $32.50 bid if and only if her valuation is less than $15. • A plaintiff, who has reported interest in buying defendant's option to take, will accept the defendant's $17.50 demand if and only if her valuation is greater than $85.
DEFENDANT'S TAKING DECISION:	• After a rejected offer, the defendant will take the entitlement (and pay plaintiff $50) if and only if v_Δ = $60.

TABLE 3. *Representative Strategy Profiles in Equilibrium*

In this equilibrium,[91] the plaintiff's willingness to reveal some informa-

These intermediate-valuing plaintiffs will drop out of any bargaining game if communication costs increase even an infinitesimal amount. Thus, in many real-world settings, we would expect plaintiffs to partition themselves into three groups: High valuers would seek to bribe defendants, low valuers would seek to be bribed, and intermediate valuers would remain silent.

90. The Appendix contains a derivation of this equilibrium for liability rule values of D between $40 and $60. *See infra* app. at pp. 1110–13.

91. Unlike the D = $100 game, the D = $50 does not have a unique Bayesian perfect equilibrium. There are a number of equilibrium "refinements," however, that allow one to dismiss certain equilibria as "implausible" because they require threats of deviation by players who are unlikely to want to deviate. Using one such refinement known as "divinity," we can narrow the plausible equilibrium outcomes of this game precisely to those described in the text. For more on the notion of equilibrium refinements, see Jeffrey S. Banks & Joel Sobel, *Equilibrium Selection in Signaling Games*, 55 ECONOMETRICA 647 (1987)

tion about her valuation (by expressing an interest in purchasing the defendant's option or selling her own entitlement) can facilitate Coasean trade: Only plaintiffs with valuations greater than $50 will say, "I am interested in bribing you not to take my entitlement," and only plaintiffs with valuations less than $50 will say, "I am interested in selling you my entitlement." This self-selection, or partitioning phenomenon, can increase the likelihood of an efficient transaction, because it effectively gives the parties less "room" to misrepresent their private valuations in bargaining.[92]

As discussed above, however, liability rules can amplify defendants' incentives to misrepresent their valuations: Even though liability rules induce plaintiffs to act less strategically, they may induce defendants to act more strategically. In particular, as shown in Table 3, the liability rule induces the different types of defendants to formulate identical offers. In game-theoretic terms, the liability rules cause the defendants to "pool."[93] No matter whether the plaintiff expresses interest in buying (the defendant's call option) or in selling (her own entitlement), one "type" of defendant will always find it optimal to *mimic* the behavior of the other type of defendant so as not to reveal his true intention about taking.[94]

Because of the defendant's mimicking behavior, the plaintiff will be unsure whether a bid/offer has issued from a "contender" or a "pretender." For

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(discussing divinity as such); In-Koo Cho & David M. Kreps, *Signaling Games and Stable Equilibria*, 102 Q.J. ECON. 179 (1987) (discussing less restrictive refinements)

92. The existence of the "cheap talk" signaling phase in our model is, as one might expect, crucial to our results. When we take away the ability of the plaintiff to signal, bargaining under liability rules no longer leads to more efficient outcomes than under property rules. Indeed, while liability rules create the possibility for two types of bargaining, the signaling phase of the game is what allows the parties to coordinate the type of transaction. Removing signaling lowers the probability of consensual trade to zero. Thus, a $50 liability rule without signaling by the plaintiff results in the equivalent of autarky, which produces an expected social welfare of $55. Conversely, a property rule does not suffer from such a coordination failure, and it thereby produces consensual trade, resulting in an expected social surplus of $59.75.

93. Recall that under the property rule, the different types of defendants did not pool because they offered to buy at different prices.

94. While the precise derivations of defendants' equilibrium bids are in the Appendix, we can sketch some of the intuitions here. Consider the case where a plaintiff values her entitlement less than the $50 and has so signaled to the defendant. The only possible transaction of interest to the plaintiff involves selling her entitlement to a $40 defendant who otherwise would not take. But the plaintiff will only be able to make such a transaction at a price less than $40, because low-valuing defendants will not offer to purchase an entitlement for a price greater than $40.

At the same time, this brand of transaction is extremely attractive to high-valuing defendants. Even though these defendants would take in the absence of successful bargaining, by taking they would have to pay $50. If, however, the high-valuing defendant could convincingly "mask" herself as a low-valuing defendant, she might be able to buy the entitlement at an even lower price than the $50 damage amount. As such, the high-valuing defendant will find it profitable to feign a low valuation so as to "fool" the plaintiff into reducing the price of taking. Such a defendant, then, must mimic the bid of a low-valuing defendant, for if she reveals herself to be a high-valuing defendant, the plaintiff will surely reject any bid, knowing that a $50 damages payment is forthcoming. This is why both types of defendants "pool" to bid $32.50 for the plaintiff's entitlement in Table 3.

A similar type of strategic mimicking occurs in the other situation, when a plaintiff has signaled a preference for the "bribe" transaction. Here, conversely, the low-valuing defendants mimic the behavior of the high-valuing defendants.

example, when a low-valuing plaintiff hears a defendant's $32.50 offer to buy the entitlement, the plaintiff will know there is a 50% chance that the defendant has a $60 valuation (and intends to take the entitlement for $50 should the plaintiff reject the offer). Accordingly, a low-valuing plaintiff will be reluctant to sell her entitlement *unless* the sales price sufficiently exceeds her valuation to compensate her for the (50%) possibility that she is facing a $60 defendant who will pay $50 if she rejects the offer. Thus, even though the low-valuing plaintiffs receive all-or-nothing offers to buy for $32.50, only plaintiffs who value the entitlement at less than $15 choose to sell. A plaintiff whose valuation is $15 is indifferent between accepting and rejecting the defendant's $32.50 offer to sell because rejecting yields a 50% chance of $50 and a 50% chance of $15, which equals an expected value of $32.50.

The willingness of plaintiffs to accept only contractual offers that are higher than their valuations can help discipline the $40 defendant to make a more competitive offer. In choosing an offering price to purchase the plaintiff's entitlement, the low-valuing ($40) defendant knows that the high-valuing ($60) defendant will mimic his bid. The $40 defendant recognizes that because of this mimicking, the plaintiff will be less willing to accept that bid *ceteris paribus*. This heightened scrutiny can help to discipline the $40 defendant to raise his bid closer to his actual valuation. The $32.50 offer to purchase thus represents the price that maximizes the $40 defendant's expected payoff (given the $60 defendant's mimicking and the plaintiff's reluctance that the mimicking engenders). A similar analysis explains the defendants' $17.50 offers not to take.[95]

The plaintiffs' reluctance to trade with pooling defendants reduces the information-forcing effect of liability rules. Plaintiffs with intermediate valuations (between $15 and $85) know that they will not accept any pooled-defendant offers and thus have a weaker incentive to signal their relative valuations. Indeed, if reporting an interest in a particular type of Coasean trade costs an arbitrarily small amount, then plaintiffs with these intermediate valuations would remain silent and only the 30% of plaintiffs with relatively extreme valuations (i.e., with valuations greater than $85 or less than $15) would signal their types. Defendant pooling might therefore easily induce silence among plaintiffs with intermediate valuations, but it does not give plaintiffs with intermediate valuations an affirmative incentive to misrepresent

95. In both cases, the plaintiff demands a payoff that is at least $17.50 greater than the worst-case outcome. A plaintiff with a valuation of $15 is worried that the defendant will not take in the absence of bargaining, but still demands a payoff of $32.50 ($17.50 higher) to sell her entitlement. A plaintiff with a valuation of $85 is worried that the defendant will take in the absence of bargaining (which would give the plaintiff only $50), but this plaintiff still demands a net payoff of $67.50 (which again is $17.50 higher) and accordingly is unwilling to pay a bribe of more than $17.50 (because $85 minus the $17.50 bribe not to take produces the required net payoff of $67.50). The willingness of $40 defendants to mimic the $60 defendants' $17.50 offers not to take thus causes high-valuing plaintiffs to bribe only when their private valuations are sufficiently high (greater than $85).

that their valuation is above or below the damage amount. Moreover, this example shows that liability rules induce affirmative disclosure among those plaintiffs for whom Coasean trade has the highest return.

This equilibrium for bargaining under a $50 liability rule is depicted in Figure 5. As in Figure 4, the horizontal axis depicts the various plaintiff valuations, and the vertical axis depicts the probability that the entitlement will ultimately be enjoyed by the defendant, through either a purchase or nonconsensual taking.

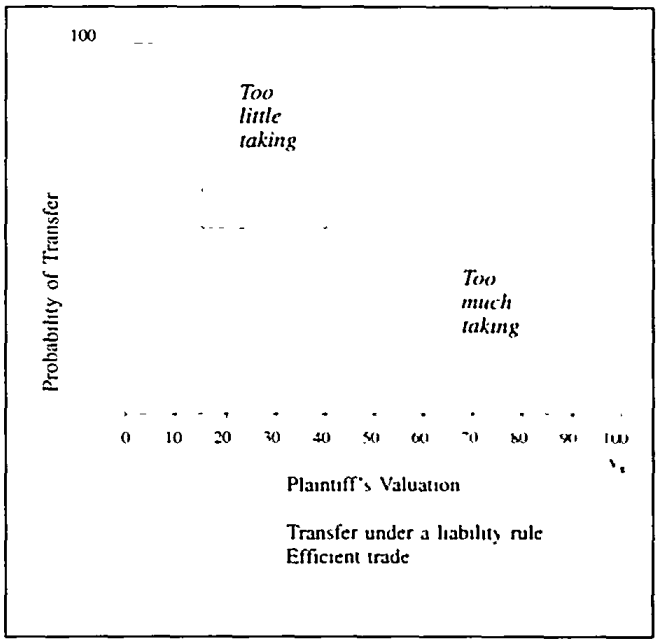

FIGURE 5. *Probability that Entitlement Will Be Transferred from Different Plaintiff Types Under a Liability Rule*

Under the $50 liability rule, there is a 100% chance that plaintiffs with valuations of less than $15 will sell their entitlements because these plaintiffs will accept the $32.50 offer that both types of defendants will make to buy the entitlement. There is a 50% chance that plaintiffs with valuations between $15 and $85 will have their entitlements taken nonconsensually (by $60 defendants). Plaintiffs with valuations between $15 and $50 will reject defendants' offers to buy for $32.50, and plaintiffs with valuations between $50 and $85 will reject defendants' offers to sell their options to take for $17.50. Finally, plaintiffs with valuations above $85 will acquire an undivided ownership in the entitlement.

As before, Figure 5 shows why bargaining under a liability rule does not eliminate strategic inefficiency. By comparing these equilibrium probabilities of transfer under a liability rule to the efficient level of trade (indicated with dotted lines), we can identify two areas of inefficiency: (1) plaintiffs with

valuations between $15 and $40 should always sell their rights to higher-valuing buyers, but these plaintiffs refuse to accept any pooled offers to buy their entitlements—so that only 50% of the entitlements are taken nonconsensually by defendants (with $60 valuations); and (2) plaintiffs with valuations between $60 and $85 should always retain the entitlement, but these plaintiffs refuse to accept the pooled offers to sell the liability call option—so that 50% of the entitlements are taken nonconsensually by lower-valuing, $60 defendants.

3. *Liability Rules Can Facilitate Coasean Trade*

As is obvious from the above example, bargaining under a liability rule does not necessarily result in a "first-best" outcome. Nevertheless, bargaining under a liability rule may be more efficient than bargaining under a property rule. Table 4 shows for both property and liability rules the equilibrium proportion of defendants who will:

- enter into one of the two types of Coasean agreements;
- take nonconsensually; and
- refrain from contracting or taking.

	Property Rules			Liability Rules		
	%	Expected Joint Payoffs	Contribution to Total Inefficiency	%	Expected Joint Payoffs	Contribution to Total Inefficiency
Coasean Trade	25%	$52.00	$0.00	30%	$71.25	$0.00
Nonconsensual Taking	0%	$0.00	$0.00	35%	$60.00	$1.56
Neither Trade Nor Taking	75%	$62.33	$3.25	35%	$50.00	$1.56
Expected Total	100%	$59.75	$3.25	100%	$59.88	$3.12

TABLE 4. *Equilibrium Trade and Taking Under Property and Liability Rules*

Table 4 shows how liability rules facilitate Coasean trade. Under a property rule only 25% of the bargainers reach Coasean agreement, but under a liability rule this figure rises to 30%.[96] The table also shows that expected payoffs for

96. As shown in Figure 4, under a property rule 25% of bargainers reach agreement, because all plaintiffs with valuations under $20 trade (20% of all bargains) and half of plaintiffs with valuations

those reaching a Coasean agreement are significantly higher under a liability rule ($71.25) than under a property rule ($52.00).[97] Even though liability rules induce excessive nonconsensual takings by some defendants (giving rise to an inefficiency of $1.56),[98] bargaining under the liability rule is more efficient because it raises the probability of Coasean trade (where the entitlement always ends up in the hands of the highest valuer) and dramatically reduces the failure of goods to pass to higher-valuing defendants due to the defendants' failure to contract or take. Under a property rule, 75% of plaintiffs fail to contract and no taking occurs; under a liability rule this figure is reduced to 35%. The liability rule equilibrium reduces the inefficiency from this autarkic category by more than half (from $3.25 to $1.56).

The net impact of these effects is that under a liability rule, the expected joint payoffs ($59.88)[99] are higher than those produced by bargaining under a property rule ($59.75).[100] Liability rules are more efficient because they induce more trade.[101] By effectively forcing the plaintiffs to reveal

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between $20 and $30 trade (5% of all bargainers). As shown in Figure 5, under a liability rule 30% of bargainers reach agreement because all plaintiffs with valuations less than $15 trade (15% of all bargainers) and all plaintiffs with valuations more than $85 trade (15% of all bargainers).

97. Under a liability rule, half of the trades will allow plaintiffs with an average value of $92.50 (between $85 and $100) to retain the entitlement, and half of the trades allow defendants with an average value of $50 ($40 or $60) to acquire the entitlement—so the expected payoff will be (.5)$92.50 + (.5)$50 = $71.25. Under a property rule, 40% of trades allow a $40 defendant to acquire the entitlement and 60% of the trades allow a $60 defendant to acquire the entitlement—so the expected payoffs will be (.4)$40 + (.6)$60 = $52.

98. In the liability rule equilibrium, this excessive taking was caused by $60 dollar defendants who would inefficiently take from plaintiffs with valuations ranging from $60 to $85.

99. For the exact calculations, see *infra* app. at p. 1113.

100. Although in this example the liability rule only increases the expected surplus from the property rule by $0.12, alternative assumptions about the distribution of plaintiff and defendant types could easily produce a greater differential. For example, if the defendant's two valuation types were $20 and $80, then an intermediate liability rule could produce an expected surplus $3.00 higher than what a property rule would produce. In this case, the liability rule would mitigate 75% of the inefficiency that would otherwise exist under a property rule.

The amount of improvement is of course capped by the size of the surplus available under first-best trade, which in Table 5 equals $63, but the improvement is not limited to an amount less than "transaction costs." First, in this model, transaction costs are not easily monetized because of the amount of private information that induces the inefficiency. Second, even when the dollar costs of contracting inhibit Coasean bargaining, the amount of inefficiency may be greater than the contracting costs. *See* Ayres & Gertner, *supra* note 74.

101. In the absence of bargaining (a situation that we have labeled "autarky"), a $50 liability rule dominates a property rule in terms of expected joint payoff. Kaplow and Shavell have persuasively shown that liability rules already have a "head start" on property rules under autarky because nonconsensual takings will tend to transfer the entitlement to a higher-valuing owner, and that it is not surprising that this liability rule advantage *persists* in circumstances when bargaining is possible. Louis Kaplow & Steven Shavell, *Property Rules Versus Liability Rules* (1994) (unpublished manuscript, on file with authors). While Kaplow and Shavell are clearly correct about the autarkic headstart of liability rules, the information-forcing property of liability rules may provide an independent reason that liability rules can dominate property rules when bargaining is possible. Two phenomena support this belief. First, as the next Section makes clear, an attempt by the court to "tailor" its damages to the plaintiff's private valuation can actually decrease joint welfare. *See infra* part II.C.1. If the persistence of the autarky advantage were the sole cause of the liability rule advantage with bargaining, one would expect that bargaining under a tailored liability rule could do no worse than bargaining under the untailored rule studied here (the opposite is in fact the case). Second, coauthor Talley has found that introducing litigation costs into the model can induce "first best" bargaining

information about their valuations, liability rules mitigate the inefficiencies of bargaining under private information.[102]

This efficiency-enhancing quality of liability rules stands at odds with the law-and-economics "folk wisdom" on how to induce bargaining. Most scholars have assumed that the law can best ensure efficient Coasean bargaining by maximizing the size of the potential "bargaining pie"—i.e., the range of

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under a liability rule (again because the parties bargain more forthrightly). *See* Talley, *supra* note 14, at 29–33. Property rules, on the other hand, are unable to induce first best bargaining, with or without litigation costs. Once again, if the predominant value of liability rules were their ability to facilitate nonconsensual transfer to higher-valuing owners, then we would expect that increasing the cost of nonconsensual transfer (via litigation costs) would decrease (rather than increase) the expected payoffs. Clearly, the benefit must be substantially driven by bargaining.

102. The distributional consequences of the various rules are also somewhat interesting. Table 5 compares the relative efficiency and distributional consequences of four different entitlement regimes.

LEGAL BARGAINING REGIME	EXPECTED JOINT PAYOFF	EXPECTED PLAINTIFF PAYOFF	EXPECTED DEFENDANT PAYOFF
"FIRST-BEST" ALLOCATION	*$63.00*		
BARGAINING UNDER LIABILITY RULE	$59.875	$51.125	$8.75
BARGAINING UNDER PROPERTY RULE	$59.75	$53.25	$6.50
AUTARKY UNDER LIABILITY RULE	$55.00	$50.00	$5.00
AUTARKY UNDER PROPERTY RULE	$50.00	$50.00	$0.00

TABLE 5. *Expected Payoffs Under Four Legal Regimes*

The above table confirms that plaintiffs, *on average*, favor a property rule, while defendants, *on average*, favor a liability rule. This result is consistent with the intuition about the distributional consequences of these rules. Once both parties learn their respective valuations, however, neither plaintiffs nor defendants are unanimous in their preference. Even though a property rule would seem to disfavor defendants in general, low-valuing defendants actually prefer a property rule. Since a property rule does not induce defendant "pooling" or "mimicking," plaintiffs do not scrutinize the bids they receive from low-valuing defendants as closely. Indeed, low-valuing defendants receive a larger payoff from the property rule ($4.00) than they do under the liability rule ($3.75), while high-valuing defendants do better under liability rules ($13.75) than under property rules ($9.00). Conversely, all plaintiffs whose private valuations are less than $50 favor liability rules over property rules.

Because of this heterogeneous ordering of preferences both among and between litigants, it is unlikely that the parties would be able to agree on one rule over another. If, however, the parties were able to bargain about which rule to implement *before they became aware of their private valuations*, and if side payments were allowed, then it is a straightforward Coasean proposition that the parties would settle on a divided entitlement rather than a property rule. This Coasean conclusion is valid in such a situation because the parties do not have any private information when they bargain over the legal rule. This possibility may explain why contracting parties often wish to liquidate damages in a contractual term before they learn their private information, for a liquidated damages term is nothing more than a simple liability call option as modeled here. It might also explain why courts often invalidate stipulated terms that appear penalty-like in nature. For a more extensive analysis of this point, see generally Talley, *supra* note 43.

potential prices that might be agreed upon by the parties.[103] In contrast, our model finds that liability rules can increase social welfare by forcing people to bargain over smaller, discrete bargaining ranges. A $50 liability rule actually bifurcates one large bargaining range (under a property rule between $0 and $100) into two smaller bargaining ranges,[104] yet *increases* expected social welfare. This quality of liability rules exposes the fundamental flaw in the "maximize the pie" recipe for characterizing efficient legal rules. Such a recipe mistakenly assumes that the amount of strategic behavior *remains constant* regardless of the size of the underlying bargaining pie. To the contrary, the above model illustrates that even though liability rules force parties to agree to a price within a narrower bargaining range, these rules can have an *even greater* effect of stemming the amount of strategic behavior by inducing entitlement holders to reveal some of their information.[105]

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103. *See, e.g.*, Merges, *supra* note 39, at 22–28.

104. Under a property rule, the possible prices from a Coasean transaction can range from $0 to $100. Under a liability rule, however, regardless of which Coasean transaction the entitlement holder signals, the potential prices range only between $0 and $50.

105. As noted earlier, our results are robust amid variations in our assumptions about the structure of information and the bargaining rules. *See supra* notes 57–60. For instance, the defendant's valuation need not take on symmetric values around $50, nor need it have symmetric 1/2 probabilities. Moreover, our results are robust even in environments where the parties vary their bargaining procedure when the legal environment changes. *See supra* note 73.

In their text on game theory and the law, Baird, Gertner, and Picker explore a bargaining environment similar to ours in analyzing the potential effects of a specific performance remedy in the classic case of Peevyhouse v. Garland Coal & Mining Co., 382 P.2d 109 (Okla. 1963) (holding that when cost of specific performance of contract calling for land restoration would substantially outweigh enhanced value of land after reclamation, plaintiff is not entitled to specific performance). Their analysis underscores the importance of "exit options" in determining the outcome of bilateral bargaining. *See* DOUGLAS BAIRD ET AL., GAME THEORY AND THE LAW 224–32 (1991). In their example, a taking of sorts—breach of contract—has already occurred. Garland has refused to perform its promise to restore the Peevyhouses' land after strip mining. The Peevyhouses, as the aggrieved party, are conjectured to have a right to specific performance should bargaining fail, and thus they may "exit" from negotiations and force Garland to restore the land at any time during negotiations. The authors examine a situation where there are two "types" of plaintiffs: a high-valuing type who places a subjective value of $800,000 on land restoration, and a low-valuing type who values such reclamation at only $200,000. The cost of restoration is commonly known in their model to be $1,000,000. *Id.* at 224–26.

The authors find that the existence of this specific performance option can lead to inefficient outcomes if the Peevyhouses have private information. High-valuing Peevyhouses will choose to exit the negotiations since their offers (not to seek specific performance in exchange for compensation) are indistinguishable from mimicking "bluffs" issued by low-valuing Peevyhouses. If the probability of a low-valuing Peevyhouse is sufficiently high, Garland will likely reject any bids by the Peevyhouses of $800,000 or more, thinking that the bid is more likely than not a bluff. As such, Garland is willing to let the high-valuing Peevyhouses exit even though their exiting and exercising the specific performance remedy results in inefficiency. *Id.* at 229–31.

Their results are consistent with our finding that an absolute property right vested in one party can often lead to allocational inefficiencies. Indeed, the specific performance entitlement is a type of property rule: The Peevyhouses have the ability to "take" from Garland for zero compensation. Our discussion in the Appendix of the case where D = $0 conducts just such an analysis. *See infra* app. at p. 1109. Both our model and theirs find that property rules can create inefficient failures to transfer the property right through negotiations.

While Baird, Gertner, and Picker do not formally analyze bargaining with incomplete information under a "liability rule," our model could easily incorporate such a rule. Consider, for instance, a rule that allows the Peevyhouses to force restoration of their land, but only for an exercise price of $500,000. In such a case, just as in our model, the low-valuing Peevyhouses would not exercise such an option, while

4. *Reverse Liability Rules and Compensated Injunctions*

Throughout the above analysis, we have assumed that the defining characteristic of a liability rule is that it gives the defendant a call option to take. There are, however, other types of liability regimes that can be given alternative option interpretations. Indeed, it is plausible to think of situations in which the option on whether a taking occurs lies with the "aggrieved" party. A reverse liability rule is just such a situation. This rule would give the *plaintiff* the right to force a taking at the prescribed liability amount. Effectively, then, while a "run-of-the-mill" liability rule places a *call option* in the hands of the defendant, the reverse liability rule places a *put option* in the hands of the plaintiff.[106]

As it turns out, reversing the option right produces a truth-telling result similar to what an ordinary liability rule produces, but it affects the opposite party. Consider, for example, a reverse liability rule that endows the plaintiff with the right to force a sale to the defendant at a price of $50. Analogous to the previous case, there are two types of Coasean bargains. In the first type,

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the high-valuing Peevyhouses would.

To "map" our model onto theirs completely, however, we would need to relax the assumption that "no restoration" is the efficient decision. Indeed, the assumption that the cost of restoration ($1,000,000) exceeds any realistic valuation of the Peevyhouses ($200,000 or $800,000) ensures that the first-best allocational decision is common knowledge in their model. Therefore, Garland always prefers the type of Coasean bargain in which it bribes Peevyhouse not to take. Selling its liability entitlement for an amount less than $500,000 is never attractive to such a high-valuing Garland, as this would only increase the probability of a taking *and* increase Garland's net loss in the event of such a taking. The analogue of our model, in contrast, allows for Peevyhouse's privately known valuation to vary between $0 and $1,000,000. When Garland's valuation varies in this manner, it creates an incentive for the high- and low-valuing Garlands to separate themselves through credible signaling, thus giving our "partitioning" result. This example illustrates the notion that liability rules can increase efficiency when there is private information on the non-optionholder's side (i.e., Garland).

106. The difference between a liability rule and a reverse liability rule can be illustrated by the facts of Boomer v. Atlantic Cement Co., 257 N.E.2d 870 (N.Y. 1970), which involved a cement plant's polluting of neighboring homes. The court's decision implemented a traditional liability rule: The neighbors had a right not to be exposed to pollution, but this right was subject to the cement plant's option to pollute and pay court-determined damages. One could imagine a court, possibly on alternative facts, finding that it would be so difficult to determine whether the cement plant was polluting that the court would give the neighbors not only the right not to be exposed to pollution, but also the option to sell this right to the cement plant for the same court-determined damage amount. This remedy would protect the neighbors from surreptitious pollution that could not be legally proven to violate the neighbors' original entitlement. Giving the neighbors the pollution entitlement plus this put option constitutes a reverse liability rule. Under *Boomer*'s liability holding, the cement plant has the right to decide whether to pay court-determined damages for the right to pollute. Under a reverse liability rule, the neighbors have the right to decide whether they will be paid court-determined damages to give the cement plant the right to pollute.

Madeline Morris was the first to use this put-call analogy to examine ordinary and reverse liability rules. *E.g.*, Madeline Morris, *The Structure of Entitlements*, 78 CORNELL L. REV. 822, 851–56 (1993). While reverse liability rules are much less common than ordinary rules, there are instances within American law in which the plaintiff likely has a limited put option. A possible example of this notion is the so-called "forced sale" doctrine in contract law. Under U.C.C. § 2-709, a seller aggrieved by a buyer's material breach may have the option of forcing the buyer to purchase contracted goods at the specified price. Note, however, that this remedy is limited to the case of unique or damaged goods—i.e., goods that cannot easily be resold. *See* U.C.C. § 2-709 (1993). Examples of legally imposed liability rules include "[g]un buy-out offers by police departments and soft-drink container deposit redemption laws." *See* Morris, *supra*, at 855.

a low-valuing defendant might bribe the plaintiff not to exercise her option.[107] In the second type, a high-valuing defendant might purchase the plaintiff's entitlement.[108]

Under a reverse liability rule, the possibility of these two transactions now eliminates the *defendant's* incentive to misrepresent whether his valuation is above or below the damage amount. While plaintiffs might have some incentive to lie,[109] a defendant's type of offer credibly signals his valuation: Low-valuing defendants would never offer to purchase the entitlement for more than $50, and high-valuing defendants would never want to bribe the plaintiff to abstain from exercising the put option.[110]

Defendants can also be induced to partition themselves if they are given the entitlement and plaintiffs are given the call option to take nonconsensually and pay damages. This allocation corresponds to the famous "category 4" of Calabresi and Melamed—which would permit the plaintiff to enjoin the defendant's conduct, but only if she compensated the defendant for the defendant's losses caused by the injunction.[111] Lawmakers and jurists largely overlooked this form of "compensated injunction" until the Arizona Supreme Court in *Spur Industries v. Del E. Webb Development Co.* required, as a condition for granting a nuisance injunction against a preexisting feedlot, that

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107. For example, suppose the plaintiff's valuation is $30 and the defendant's valuation is $10. Absent bargaining, the plaintiff will exercise the put option and will receive a payoff of $50, leaving the defendant with a payoff of minus $40. This result is clearly inefficient, since the aggregate social surplus ($10) is lower than what would emerge if the plaintiff abstained from exercising her option ($30). One can imagine a Coasean bargain in which the defendant pays (bribes) the plaintiff $25 to abstain from taking (i.e., the defendant purchases the plaintiff's put option). Such a bribe would reduce the defendant's loss from $40 to $25, and it would increase the plaintiff's payoff to $55.

108. This transaction might occur if the high-valuing defendant did not expect the plaintiff to force a sale. For instance, going back to the situation where the exercise price on the plaintiff's option is $50, suppose that the plaintiff valued the entitlement at $60 and the defendant valued it at $80. Absent bargaining, the plaintiff clearly would not choose to exercise her option. This inaction would result in an aggregate surplus of $60—again inefficient. If, however, the defendant offered to purchase the plaintiff's entitlement for, say, $65, the plaintiff, after accepting, would be better off (as would the defendant), and aggregate welfare would increase to $80.

It is interesting to note here that, contrary to our example of regular liability rules, the two transactions both entail the defendant's purchasing something from (i.e., bribing) the plaintiff. The bribes, however, are for two distinct actions that the plaintiff might take (exercising or not exercising). This observation suggests that what is important under a liability rule is *not* the possibility that the parties might be on either *side* of a transaction, but rather the possibility that a liability rule would create two qualitatively distinct *types* of transactions that the parties might pursue.

109. Indeed, low-valuing plaintiffs would sometimes offer to sell for more than $50, and high-valuing plaintiffs would sometimes propose a bribe not to exercise the put option.

110. As a worst-case scenario, the low-valuing defendant would be forced to purchase the entitlement for $50, should the plaintiff exercise the put. Since this forced transaction would give the defendant a negative payoff to begin with, it makes little sense for the low-valuing defendant to pay *even more* to receive the entitlement. Since the low-valuing defendant would therefore never enter into such a transaction, such a defendant is always willing to signal credibly that his valuation is less than $50.

A high-valuing defendant, on the other hand, will receive a windfall if the plaintiff exercises the put option and therefore has no incentive to purchase the put option from the plaintiff. Hence, the only transaction that appeals to the high-valuing defendant involves purchasing the entitlement from the plaintiff.

111. Calabresi & Melamed, *supra* note 12, at 1115–23.

the plaintiff pay for the feedlot's costs "of moving or shutting down."[112] Our earlier argument suggests that if the costs of the injunction are untailored—so that the defendant feedlot's costs might be higher or lower than the court-ordered compensation—then the defendant feedlot could credibly signal whether its damages were higher or lower than the court award by offering either to bribe the plaintiff not to seek an injunction or to agree to stop polluting for a price less than the court award. Compensated injunctions induce defendant partitioning by merely switching the roles of plaintiff and defendant. The defendant is given the entitlement, but its ownership is subject to the plaintiff's option to take the entitlement and pay compensating damages.

This analysis suggests that there are two liability rule methods of inducing defendants to partition themselves: reverse liability rules and compensated injunction rules. A fundamental equation from finance theory, called the "put-call parity formula," shows the precise relationship between these two types of liability rules: The put-call parity formula establishes the relative value of put and call options written with identical exercise prices on the same underlying entitlement as follows:

Value of entitlement + Value of put = Value of call + Value of exercise price.[113]

This put-call parity formula can easily be restated in terms of the reverse liability and compensated injunction rules. Under a reverse liability rule, the plaintiff owns both the entitlement and a put option to sell the entitlement at fixed exercise price—so that the value of the plaintiff's claims under a reverse liability rule should equal the left-hand sum of the put-call parity formula. Under a compensated injunction rule, the plaintiff owns only a call option to take the entitlement and pay the fixed exercise price. Accordingly, it is possible to rewrite the parity formula as follows:

Value of reverse liability rule = Value of compensated injunction rule + Value of exercise price.

Restated in this manner, it is easy to see that the plaintiff's payoffs under a reverse liability rule will exceed her payoffs under a compensated injunction by exactly the amount of the untailored damages. As a first approximation, the only difference between the two types of liability rules is that a reverse liability rule transfers the value of the exercise price from the defendant to the plaintiff.[114]

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112. 494 P.2d 700, 708 (Ariz. 1972). Ellickson originally coined the term "compensated injunction." *See* Ellickson, *supra* note 50, at 738 & n.202.

113. For greater elaboration of the put-call parity formula, see JOHN HULL, OPTIONS, FUTURES, AND OTHER DERIVATIVE SECURITIES 110–16 (1989).

114. In the absence of bargaining, the payoffs under the two rules differ by exactly the amount of this transfer. In the presence of bargaining, the expected payoffs of all types differ by this amount.

This discussion of reverse liability and compensated injunction rules illustrates that various permutations of liability rule options will induce either the plaintiff or the defendant to reveal information about her valuation. Just as traditional liability rules can induce plaintiff partitioning, we have shown that both reverse liability and compensated injunction rules can induce defendant partitioning. Thus, these latter rules are more likely to be appropriate when the defendant's private information about his valuation predominates in Coasean negotiations.[115]

C. *The Perverse Effects of Tailoring Liability*

In the previous sections, we illustrated the information-forcing effect of dividing the claims to an entitlement by giving a defendant (the potential taker) an option to take nonconsensually and pay a fixed liability amount. Here, we ask a slightly different but equally important question: How does the court's ability to "tailor" a remedy to the specific litigants' characteristics affect this result?

At first, we expected that greater accuracy by the court in tailoring either its liability determinations or the amount of damages would produce more efficient outcomes;[116] after all, by tailoring its decisions to the specific circumstances of a legal dispute, the court would be able to induce more efficient taking when bargaining failed.[117] We were wrong. Tailoring can exacerbate strategic impediments to bargaining because tailoring gives the parties private information about the legal consequences of nonconsensual taking. For instance, if the court were to match the level of damages to the precise magnitude of the plaintiff's injury (v_x in our example), the plaintiff would know more than the defendant about the legal consequences of a nonconsensual taking. Though the defendant would still own a call option, he would not know its exercise price.

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115. It would also be possible to construct an alternative liability scheme that induced plaintiff partitioning by endowing the defendant with both the entitlement and a put option to sell the entitlement to the plaintiff for a fixed price. This scheme would be equivalent to a reverse liability rule, but the identities of the plaintiff and the defendant would be switched so that in the pollution context, the polluter would have a right to pollute and an option to sell its right to pollute to its downwind neighbor for a fixed amount of money.

116. This belief, as a default proposition, seems almost axiomatic in the law-and-economics literature. *See, e.g.*, STEVEN SHAVELL, ECONOMIC ANALYSIS OF ACCIDENT LAW 127 (1987) ("It has been implicit all along that if liable parties pay for the actual level of losses they cause, they will be led to act optimally under liability rules."); *see* POSNER, *supra* note 1, at 62 n.5 (noting that property rules are likely to predominate over liability rules if courts cannot compute damages with reasonable accuracy); *see also* A. Mitchell Polinsky, *Resolving Nuisance Disputes: The Simple Economics of Injunctive and Damage Remedies*, 32 STAN. L. REV. 1075, 1112 (1980) (discussing optimality of property rules when court cannot observe parties' valuations).

117. This rationale is consistent with what Cooter has referred to as the "Normative Hobbes Theorem: Structure the law to minimize the harm caused by failures in private agreements." COOTER & ULEN, *supra* note 1, at 99.

In this Section, we argue that the added dimension of private information that tailoring introduces can seriously hamper the bargaining process. Exact tailoring of *damages* gives the plaintiff a form of "perfect insurance" against bargaining breakdown because the plaintiff's noncooperative payoff is unaffected by the defendant's decision to take nonconsensually. Conversely, if the court were to fix its *liability* determination in a contingent fashion, making the defendant liable (under a negligence-like standard) if his private valuation was subsequently found to be insufficient to justify the taking, the defendant would have private information about whether the court would eventually find him liable. As such, if the defendant knew that he would satisfy the negligence standard, he would now have perfect insurance against bargaining breakdown. In this Section, we consider each of these possibilities within the bargaining framework defined above to show that tailoring can reduce the incentives for plaintiffs under a liability rule to partition themselves affirmatively into high- and low-valuing groups. We stress, however, that even with tailored legal rules, we would never expect to see a low-valuing plaintiff make (or accept) an offer to bribe a defendant not to take the entitlement, and we would never expect to see a high-valuing plaintiff make (or accept) an offer to sell her entitlement for less than the damage amount. Therefore, while tailoring may induce a larger range of plaintiffs to refrain from trade, it is still true that any observed offers by a plaintiff credibly signal information about her relative valuation.

1. *Tailored Damages*

Suppose that instead of awarding the plaintiff an untailored damage amount as in our analysis above, the court was able to "pierce" the plaintiff's private information at trial, awarding her actual damages of v_π.[118] As mentioned above, tailoring the amount of damages gives the plaintiff private information about the consequences of a taking. The defendant has an option to take, but is unsure of the exercise price. This type of uncertainty often exists in contractual settings. For example, a consumer who has promised to purchase a new automobile from a dealership may know that the dealership will be liable for lost profits if she breaches the contract and thus takes the seller's contractual entitlement, but the consumer as a potential defendant usually does not know the size of the dealer's profits.[119]

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118. This is still the case with strict liability. We briefly discuss a "tailored" damages award under a negligence regime below. *See infra* part II.C.2.

When bargaining is not allowed, such a tailored damages award yields an expected social surplus of $55, just as would intermediate fixed damages with no bargaining. The expected damages award $E(v_\pi) = \$50$. Hence, in the absence of bargaining, the defendant will take only if $v_\Delta \geq \$50$, and thus the $60 defendant will be the only type to take.

119. *See, e.g.*, Victor P. Goldberg, *An Economic Analysis of the Lost-Volume Retail Seller*, 57 S. CAL. L. REV. 283, 295–96 (1984); *see also* Ian Ayres, *Fair Driving: Gender and Race Discrimination in Retail*

Tailoring the amount of liability reduces plaintiffs' incentive to reveal information. A plaintiff can no longer credibly signal whether her valuation is greater or less than the damage amount because tailoring makes the damage amount equal each plaintiff's valuation. This kind of tailoring thus decreases plaintiffs' incentives to engage in Coasean negotiations. In particular, because the tailored damages perfectly compensate a plaintiff for a nonconsensual taking, the plaintiff has nothing to gain from discouraging such a taking.

Plaintiffs with valuations greater than $60 know that they will never be able to sell their entitlements to defendants (whose highest value is $60), and because tailoring provides "taking insurance" they never have an incentive to pay defendants not to take. Accordingly, there is a large class of plaintiffs with relatively high valuations who are indifferent between expressing interest in the two types of bargaining because they know that they will never come to terms with a defendant.

As shown in the Appendix, this model of tailored damages produces a unique equilibrium outcome in which there is much less Coasean trade.[120] Under an untailored liability rule, 30% of plaintiffs succeed in reaching a pre-taking agreement, but under a tailored liability rule only 10% of the plaintiffs trade. In this equilibrium the $60 defendants abstain from bargaining and take nonconsensually, and the $40 defendants buy the entitlement (for $20) from plaintiffs with valuations less than $20. In equilibrium, plaintiffs with valuations of less than $20 have an affirmative incentive to express an interest in selling their entitlement, but tailoring destroys the incentive of all other plaintiffs to bargain because they know *ex ante* that they will not come to terms with either type of defendant. Accordingly, plaintiffs with valuations greater than $20 simply refrain from bargaining if expressing an interest costs even an infinitesimal amount.

Since tailoring eliminates plaintiffs' incentives to bribe defendants not to take, it exacerbates the number of inefficient nonconsensual takings. As shown in Figure 6, under an untailored liability rule, plaintiffs with valuations greater than $85 deterred inefficient takings by bribing defendants not to take. Under a tailored liability rule, however, high-valuing plaintiffs have no incentive to stop these inefficient takings, and the $60 defendants rationally choose not to make serious offers.[121]

Figure 6 also shows that tailoring the liability rule induces more entitlement sales from low-valuing plaintiffs to $40 defendants. Under an

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Car Negotiations, 104 HARV. L. REV. 817, 818 (1991) (showing that market competition did not eliminate racial and gender discrimination in retail car market).

120. *See infra* app. at pp. 1114–15. Because a large class of plaintiffs is indifferent between expressing interest in a particular kind of Coasean bargain, there are many equilibrium strategies that can produce this unique outcome.

121. The Appendix shows that $60 defendants would rather simply take and pay an expected damage amount of $50 than bargain. *See id.*

untailored rule, low-valuing plaintiffs are reluctant to accept offers to sell their entitlements because they know that half of the offers come from $60 defendants who will take nonconsensually and pay $50. This reluctance causes only plaintiffs with valuations of less than $15 to accept offers from plaintiffs to buy at $32.50. In contrast, under a tailored rule, the plaintiffs know that only $40 defendants will make offers to buy and that these defendants will not take nonconsensually if bargaining fails. Hence, under a tailored rule, the $20 offer (made by a $40 defendant) will be accepted by any plaintiffs with lower valuations.

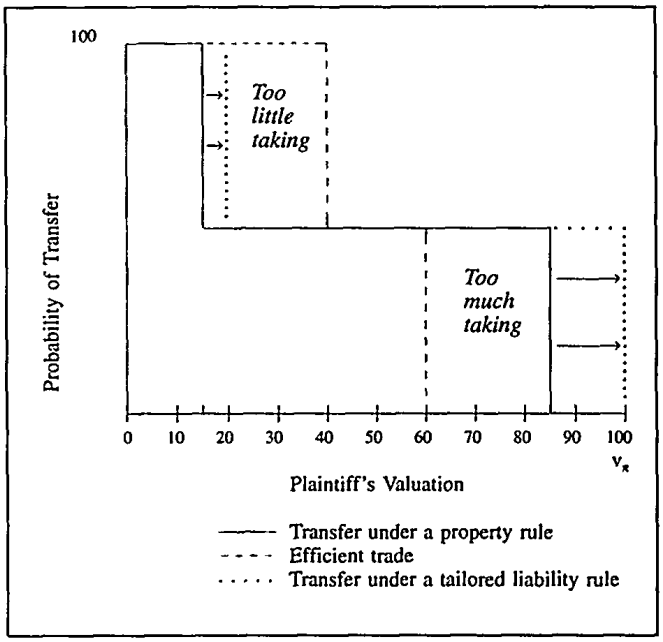

FIGURE 6. *Effect of Tailoring Damages on the Probability of Transfer*

Tailoring thus encourages plaintiffs to engage in one type of Coasean bargain (selling their entitlement), but eliminates their opportunity to engage in the other type of bargain (bribing the defendant not to take). These two effects are not merely offsetting. The expected surplus under a tailored liability rule ($58)[122] is less than that produced under *either* a property rule ($59.75) or the untailored liability rule ($59.88). Moreover, tailoring induces more nonconsensual takings. Under untailored liability regimes, 35% of the negotiations end with nonconsensual takings, as opposed to 50% under tailored liability regimes. Thus, untailored rules are likely to save on court costs both

122. $60 with probability 1/2 (i.e., when the $60 plaintiff obtains); if the $40 plaintiff emerges (again with probability 1/2), there is a $40 social surplus 20% of the time and a $60 surplus the other 80% of the time. The $60 comes from the expected value of v_x given $v_x>20$. *See supra* note 102, tbl. 5.

by reducing the number of decisions and by reducing the costs per decision.[123] In sum, tailoring decreases trade, increases nonconsensual taking, and decreases welfare. These findings highlight the unique benefits of untailored liability rules. Scholars arguing in favor of property rules have seen that the equitable impulse to tailor damages *ex post* may impede efficient negotiation[124]—after all, property damages are typically not tailored to make the plaintiff whole—but the academy has failed to see that untailored liability rules can predominate over both property rules or tailored forms of liability protection.[125]

2. *Tailored Liability (a.k.a. The Negligence Standard)*

Another way that courts can institute tailored awards is not by tailoring the damage amount, but by tailoring the determination of liability. The most common manifestation of such an approach is the familiar negligence standard that Judge Hand articulated in the classic *United States v. Carroll Towing Co.*[126] Under such a standard, the defendant must pay damages to the plaintiff if the court finds that the defendant acted "unreasonably." An important indication of reasonableness is whether the defendant's benefit from taking outweighs the plaintiff's expected cost. Accordingly, we consider a permutation of the model in which the defendant is liable only if the value he gains through taking (v_Δ) is less than the plaintiff's expected damages at the time of the taking.[127] In the current example, since the plaintiff's damages are distributed uniformly between $0 and $100, the negligence standard is $50. Thus, under this standard, the $40 defendant will be judged negligent when he takes, but the $60 defendant who takes will be judged to have acted reasonably and hence will incur no liability. To concentrate on the element of tailored liability rather than tailored damages, let us assume for now that the court imposes fixed damages of $50 if it finds the defendant negligent.[128] In our earlier discussions, the defendant was strictly liable for any nonconsensual taking; here, however, the court conditions—i.e., tailors—the determination of

123. Talley has shown in a formal model that with litigation costs, untailored rules can produce even more negotiations. Talley, *supra* note 43, at 1229–33. The intuition behind this argument is that when litigation costs are a "credible threat," they can act as an effective "tax" on strategic behavior. The prospect of bearing this tax reduces each party's marginal incentive to misrepresent her valuation.

124. Haddock et al., *supra* note 18, at 8–9.

125. *But see* Kathryn E. Spier, *Settlement Bargaining and the Design of Damage Awards*, 10 J. L. ECON. & ORGANIZATION 84, 85 (1994) (finding that untailored rules produce more bargaining than tailored rules and can be more efficient when litigation costs are small).

126. 159 F.2d 169, 173 (2d Cir. 1947).

127. Note that this efficiency criterion is a manifestation of Judge Hand's now famous $PL \geq B$ criterion for negligence, where here $P = 1$, $L = E(v_x)$, and $B = v_\Delta$. *See* POSNER, *supra* note 1, at 147–49.

128. As it turns out, even if the court tailored the damage amount to equal the plaintiff's actual damages, v_x, the outcome would be exactly the same from an efficiency standpoint. *See infra* app. at pp. 1114–15. Moreover, the results presented below do not change qualitatively when the fixed liability amount takes on other values.

liability to the facts of the case. The negligence standard gives the defendants private information about who owns the entitlement. The $60 defendants know that they own the property, and the $40 defendants know that they have no legal claim to the property. Crucially, however, a plaintiff, in bargaining with a particular defendant, does not know whether she has a legal claim in the entitlement.

There are, once again, two potential types of transactions that might occur under a negligence standard: First, a high-valuing plaintiff might bribe the non-negligent $60 defendant to abstain from taking; second, a low-valuing plaintiff might sell her entitlement to a $40 defendant, who, absent negotiation, would never take. As it turns out, however, using a negligence standard to tailor the issue of liability destroys the parties' ability to engage in the first type of transaction. Even though a high-valuing plaintiff would want to bribe $60 defendants, the plaintiff cannot determine whether it is bribing a $40 or $60 defendant. Indeed, the $40 defendant will pretend to be a $60 defendant in an attempt to sell what he does not have—a credible threat to take. The plaintiff's uncertainty about whether she is bribing a low-valuing or high-valuing defendant reduces the amount that the plaintiff is willing to pay as a bribe. For example, even the highest-valuing plaintiff would only be willing to pay a $50 bribe.[129] Because a $60 defendant is never liable, however, such a defendant would not offer to sell his right to take for less than $60. As with tailored damage amounts, the tailored negligence standard eliminates plaintiffs' ability to bribe defendants not to take.

In fact, the Appendix shows that tailoring the issue of liability in this negligence model produces the same unique equilibrium outcome as the tailored damages model in the previous Section: Because plaintiffs will never bribe defendants not to take, the $60 defendants will abstain from serious bargaining and simply take nonconsensually; $40 defendants buy the entitlement for $20 from those plaintiffs whose valuations are less than $20.

Tailoring once again decreases a plaintiff's incentive to reveal her type. Although plaintiffs with valuations less than $20 still have an affirmative incentive to express an interest in selling their entitlement, those 80% of plaintiffs with valuations higher than $20 know that in equilibrium they will not be able to engage in either type of Coasean trade. The tailoring of legal consequences under the negligence standard accordingly makes high-valuing plaintiffs indifferent between expressing an interest in the two types of trade. As with tailored damages, high-valuing plaintiffs do not have an *affirmative* incentive to express an interest in selling their entitlement, but they become indifferent to making this implicit misrepresentation. And if there were any cost to expressing an initial interest, 80% of plaintiffs would remain silent.

129. The plaintiff whose valuation is v_x will accept that offer if and only if her net gain from the bribe (v_x-σ) exceeds his expected payoff absent negotiation ($v_x/2$).

Both tailoring damages and tailoring liability give one of the bargainers private information about the consequences of nonconsensual taking: When the amount of damages is tailored, the plaintiff has private information about the exercise price of defendant's call option. When the class of defendants who are liable is tailored under a negligence standard, the defendant has private information about who owns the entitlement. Bargainers with private information have a strong incentive to extract an "informational rent" by demanding more favorable terms. In this context, tailoring the consequences of nonconsensual taking causes the parties to change their demands concerning Coasean bribes not to take: Tailored damages rules give the high-valuing plaintiffs additional information and therefore reduce their willingness to pay a bribe (to $0 because the plaintiff would be made whole by any nonconsensual taking); tailored liability rules give the $60 defendants additional information and therefore increase the bribe that they demand, because these defendants incur no liability if they take. In both cases, tailoring amplifies the informational asymmetry and undermines plaintiffs' ability to make efficient Coasean bribes.[130]

Many commentators have suggested that, as a normative issue,

- liability rules are preferable only when transaction costs make contracting prohibitively expensive; and,
- when invoked, liability rules should be tailored to replicate the transactions that parties would have made.[131]

This Section has cast doubt on both of these assertions. We have shown that liability rules can induce more Coasean agreements than property rules and thus might be used even when transaction costs are not prohibitively high. But we have also shown that tailoring legal rules to be contingent on private information can exacerbate bargaining inefficiency. This Section thus not only

130. A rule that tailors both liability and damages—incorporating both a $50 negligence standard and imposing liability in the amount of v_x—produces the same equilibrium outcome. Under this doubly tailored scheme, the $60 defendant, as before, is never negligent and values his position at $60. The $40 defendant is always negligent and expects to pay $E(v_x) = \$50$ if he takes noncooperatively. Thus, his reservation utility is 0. Finally, the plaintiff's reservation value reflects an uncompensated taking half of the time and no taking the other half of the time, thus giving $v_x/2$. As discussed in the Appendix, even though there are a number of equilibrium strategy profiles under this legal rule, the only differences in strategy occur with plaintiff types who are never destined to make a bargain; thus, the bargaining *outcome* will be the same for all these equilibria. *See infra* app. at pp. 1114–15.

131. *See, e.g.*, COOTER & ULEN, *supra* note 1, at 107 (supporting first proposition); POSNER, *supra* note 1, at 55–57, 62 n.5. Judge Posner also argues that transaction costs are much more likely to be large with numerous parties. *Id.* at 55. The implication of this position is that property rights are more likely to be socially optimal in the case of bilateral monopolies (as long as the bilateral monopolies themselves do not have a large number of parties involved). In this Article, we argue that this view overlooks the problems of information costs, which can cut the other way: When markets are "thin," information costs are often an extremely pernicious form of transaction costs. In such situations, liability rules have efficiency-enhancing qualities.

expands the classes of cases where liability rules might be appropriate, but also challenges the accepted notion that liability rules should be tailored to replicate the transactions that the parties would otherwise make.[132]

III. "FRACTIONAL" PROPERTY ENTITLEMENTS AND COASEAN IDENTITY CRISES

Up to this point, we have shown that dividing an entitlement by protecting it with a liability rule may be more efficient because entitlement holders may have an incentive to signal whether they value the entitlement more or less than the damage amount. Varying the degree of protection, however, is not the only theoretical axis for Solomonic division. This Part focuses on how specific ownership structures can also facilitate Coasean bargaining through four different types of fractional divisions along probabilistic, temporal, physical, and activity-level dimensions. We argue that these fractional ownership structures can also curb or even eliminate the strategic inefficiencies attributed to bargaining under private information.

The intuition behind the efficiency of fractional property rights is similar to the rationale for dividing ownership in a traditional partnership buy-sell agreement. Partnerships (and close corporations) with two owners often have dissolution provisions that force the instigating owner to name a firm value and then let the other owner choose whether to buy (the other owner's share) or sell (its own share of the firm). Because the party naming the value does not know whether it is the seller or the buyer, it is less likely to misrepresent its valuation. In fact, Peter Cramton, Robert Gibbon, and Paul Klemperer have shown that as long as the ownership shares of the firm are divided fairly evenly, the buy-sell agreement can induce efficient dissolution.[133]

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132. This result is similar to the finding that contractual default rules that fail to replicate the provisions that the parties would have made can induce the parties to reveal information and bargain more efficiently. *See* Ayres & Gertner, *supra* note 55, at 91.

133. *See* Peter Cramton et al., *Dissolving a Partnership Efficiently*, 55 ECONOMETRICA 615 (1987). This result depends, *inter alia*, on sufficient liquidity among the partners, so that all can choose whether to buy if the named price is too low.

This kind of identity crisis is also present in one traditional method of dividing a dessert between two children: One child cuts, and the other child chooses which piece to take. Because the cutting child knows that the choosing child will pick the larger piece, the dominant cutting strategy is to divide the cake evenly. *See, e.g.*, ROGER FISHER & WILLIAM URY, GETTING TO YES: NEGOTIATING AGREEMENT WITHOUT GIVING IN 86–87 (Bruce Patton ed., 2d ed. 1991). Notice that in this cake-cutting example, however, the identity crisis is used to ensure an equitable division and not an efficient allocation: Even if the one child values the entire cake more than the other, this decision rule will lead to an even division of the cake. (Allocational efficiency only results if the children have identical diminishing marginal utilities for cake).

Another common example of how the identity crisis ensures allocational efficiency arises in informal gambling arrangements: Two friends who want to bet on a sporting event agree that one person will choose the point spread, and the other person will then choose which side of the bet to take. Again, because the person choosing the point spread does not know whether she is offering to buy or to sell, she has a strong incentive to state her actual expectation.

As discussed in Part II, academics have long recognized that private valuations can significantly inhibit efficient trade as sellers "shade up" and buyers "shade down" their private valuations.[134] This Part shows that, just as in a buy-sell agreement, the mere existence of private information need not always result in inefficient behavior, and the consequent loss of potential gains to trade, when bargaining occurs in the shadow of "fractional" property rights. In particular, we show that partial entitlements tend to mitigate the adverse incentive for individuals to bargain deceptively, because the attendant ownership structure creates ambiguity *a priori* about who ultimately will be the buyer and the seller.[135] As a consequence of this ambiguity, the players are uncertain about whether they should overstate or understate their valuations during bargaining. The parties' respective "identity crisis"—not knowing whether they will end up as buyers or sellers—can induce them to distort their true valuations less than they would if one party owned an undivided, or fee simple, property interest in the underlying asset. The identity crisis that these partial property rights create, we argue, can result in substantial efficiency gains, and even in "first best" outcomes.

A. *Probabilistic Divisions*

We first examine the effect of allocating property rights probabilistically. A probabilistic property rule randomly awards one of the litigants an undivided property right according to some publicly known probability distribution. Such a situation might occur when there is underlying uncertainty about the court's opinion in a case of first impression, or when a legal rule reflects contingent

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134. *See* Kalyan Chatterjee & William Samuelson, *Bargaining Under Incomplete Information*, 31 OPERATIONS RES. 835 (1983); Roger Myerson & Mark Satterthwaite, *Efficient Mechanisms for Bilateral Trading*, 29 J. ECON. THEORY 265 (1983).

135. The results in this Section are presaged by the seminal work of Johnston, *supra* note 29, *see* Cramton et al., *supra* note 133; *see also* Talley, *supra* note 43 (applying variation of this notion explicitly to renegotiation of liquidated damages clauses). Johnston's work on this topic uses a model of one-sided incomplete information (with the plaintiff), and a two-period skimming model that is derived from Drew Fudenberg & Jean Tirole, *Sequential Bargaining with Incomplete Information*, 50 REV. ECON. STUD. 221 (1983). Johnston compares three types of property rules: one in which the property rule is clearly assigned *ex ante*; another in which the property right assignment depends on a judicial balancing test *ex post*; and a final one in which the judicial balancing test is "imprecise" (in a rather precise way). He finds that the last entitlement system is the only one (under certain conditions) that supports equilibria entailing efficient Coasean transactions (e.g., the defendant "buys" the entitlement only when it is efficient for him to do so). *See* Johnston, *supra* note 29.

Johnston clearly identifies the "countervailing incentives" effect that divided entitlements might have, which produces the possibility that either party can be a buyer or a seller. *Id.* at 6–7. Yet while his model partially illustrates this fundamental insight, it allows only for "buy offers" from the defendant; the rules of his game do not allow offers to sell. Our model diverges from his in allowing either party to "purchase" the other party's share of the underlying legal asset.

Our model also differs from Johnston's approach in one other major way. While he concentrates on the beneficial role of "*ex post* balancing" as a source of efficiency enhancing, we broaden the application of this analysis to include legal entitlements that are "partial" in nature, but that need not be reduced to "*ex post* balancing." In fact, the rules we analyze here are completely clear from the *ex ante* stage.

"standards" rather than rules.[136] Litigation, as is well recognized, can also involve significant uncertainty about court outcomes.[137] We show in this Section that such probabilistic entitlements can create a "countervailing effect" upon bargainers' respective incentives to lie: The bargainers still would like to shade their representations of value,[138] but uncertain ownership dampens the degree of misrepresentation that occurs.[139]

As in the canonical example given earlier, we suppose that both parties' private valuations (v_π and v_Δ) vary between $0 and $100 with uniform probability density. Absent a negotiated agreement, the court randomly awards undivided ownership of the entitlement; this assignment is injunctive in nature. For simplicity, suppose the court flips the analogue of a "loaded coin"[140] to determine ownership: The plaintiff receives the entitlement with probability q, and the defendant receives the entitlement with probability (1-q), where q is some number between 0 and 1.[141] Note that when $q = 0$, it is common knowledge that the court will award the defendant an undivided interest in the entitlement, and when $q = 1$, the plaintiff has clear ownership. This loaded coin analogy has a natural legal interpretation: Increasingly large values of q correspond to greater degrees of "pro-plaintiff" bias among the courts determining property entitlements.[142]

Before moving on, it is important to note that the probability distribution that the court uses is *common knowledge* to both parties. The negligence

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136. Johnston explicitly discusses the differences in bargaining behavior under rules versus standards. Johnston, *supra* note 29, at 9–28. For a description of his results in relation to ours, see *supra* note 135.

137. *See, e.g.*, COOTER & ULEN, *supra* note 1, at 490–91.

138. With liability rules, the parties knew which way to shade, but the existence of the liability call option created a ceiling to the plaintiff's overstatement of her valuation of the entitlement and a floor to the plaintiff's understatement of her valuation of the call option.

139. *See* Brown & Ayres, *supra* note 15, at 347 (showing that commitment to break off bargaining creates countervailing incentive in "solicit offer" mediation game); Johnston, *supra* note 29, at 8; *see also* Merges, *supra* note 39, at 25–28 (arguing that probabilistic use of "reverse doctrine of equivalents" in patent law can induce settlement).

140. The exact nature of the coin's bias—i.e., that we get "heads" with probability q and "tails" with probability (1-q)—must be common knowledge.

141. Jon Elster has similarly suggested that courts might use a coin toss to resolve child custody disputes between divorcing parents who are both found to be fit. ELSTER, *supra* note 6, at 163. In contrast to our theory, Elster's proposal of probabilistic custody awards is not made to promote bargaining, but because the divorcing couple cannot reach consensual agreement, and because the court cannot rationally divine which parent would better serve the interests of the children. *Id.* at 134–50. Indeed, Elster argues that even when an optimal procedure for awarding custody exists, divorcing couples are unlikely to agree to use it:

> [The optimal procedure] could be derived on the basis of (a) the threat point, (b) the utilities associated with the pure outcomes and (c) the particular solution concept adopted. Each of these, however, would lend itself to strategic or nonstrategic posturing or misrepresentation. . . . [The parties] might exaggerate the extent to which they would suffer if their preferred outcome were not chosen.

Id. at 169. Elster does not explore, however, the possibility that probabilistic court determination might induce more consensual resolution prior to trial.

142. Also, note that we can think of q as a long-run frequency that the parties view as a probability. Thus, q might simply refer to a lack of uniformity among jurisdictions, or, more appropriately, among judges within one jurisdiction. In general, then, this type of probabilistic entitlement gives the plaintiff an "inside" option of qv_π, and the defendant an exit option of $(1-q)v_\Delta$.

standard also created uncertainty about who owned the legal entitlement, but under a tailored liability rule, the defendant had private information about whether its taking would give rise to any liability. Here, by contrast, the court's probabilistic division of the underlying asset is publicly known.[143]

Given this probabilistic legal "shadow," we can stylize a bargaining game that will illustrate how probabilistic entitlements can induce more truthful representations. The bargaining game is a type of "double auction" that is fairly familiar in the bargaining literature.[144] It begins with each party simultaneously submitting a "report" of her valuation (which need not be truthful[145]), which the court will use—along with the report of the other party—to determine (1) who ultimately receives absolute ownership, and (2) the price of purchasing the other party's probabilistic share in the underlying asset. Each of the parties' reports thus represents an offer to be bound by certain terms of trade if the other side submits a mirror-image offer: Each of the offerors agrees to sell all claims to the entitlement if her reported valuation is lower, and she agrees to buy if her reported offer is higher.[146] *Crucial to this analysis is that when the parties submit their bids, each is uncertain about whether her report will ultimately represent an offer to buy or to sell.*[147] The party submitting the highest bid becomes the "buyer" of the entitlement and receives the entitlement in full, but in return she must pay the "seller" a purchase price for the entitlement. We assume that the price is calculated by "splitting the difference" between the two reports (i.e., averaging them), and then *discounting* that amount by the seller's initial probabilistic share in the

143. This conclusion is consistent with Johnston's finding that "*ex post* balancing" becomes more efficient when judicial error is introduced. *See* Johnston, *supra* note 29, at 8.

Our assumption that the bargainers' assessment of adjudication is the same also diverges from many litigation models that predict settlement unless the litigants are overly optimistic about their prospects in court. *See, e.g.*, POSNER, *supra* note 1, at 436; John P. Gould, *The Economics of Legal Conflicts*, 2 J LEGAL STUD. 279, 285–88 (1973). In those models, the likelihood of agreement turns only on the degree of agreement about the plaintiff's prospect of winning at trial, not on the agreed probability level. Thus, in a world where the parties have private assessments about the likely amount of damages, the optimism model predicts that if the parties agree on the probability of a plaintiff trial victory, the likelihood of settlement should not depend on whether this agreed probability is 50% or 100%. Allowing the parties to negotiate before a taking, however, changes this result. This Section shows that a 50% probability might increase the likelihood of a consensual resolution, compared to non-probabilistic allocation.

144. *See* Chatterjee & Samuelson, *supra* note 134, at 837–38; Kennan & Wilson, *supra* note 47, at 88.

145. This procedure is closely related to examples of "bargaining mechanisms" analyzed elsewhere. *See, e.g.*, Myerson & Satterthwaite, *supra* note 134; Talley, *supra* note 43; Kathryn Spier, Optimal Mechanisms for Pretrial Bargaining (1989) (unpublished manuscript, on file with authors).

146. The use of an analogous simultaneous-offers mechanism can be found in Brown & Ayres, *supra* note 15. While the exchange of these simultaneous incomplete offers restricts the parties to a highly stylized form of bargaining, the beneficial countervailing effect of obscuring the buyer's and seller's identities carries over to other bargaining games. For example, Cramton, Gibbons, and Klemperer note that the efficiency results of our stylized game carry over to more generalized rules, such as not "splitting the difference" between the parties' bids, but rather using a weighted average with weight k between 0 and 1 (often called a "k + 1 price auction"). Cramton et al., *supra* note 133, at 624–25.

147. Note that this uncertainty is not always present, such as when $q = 0$ or 1, or when v_s or v_b is on an extreme. The presence of this uncertainty for at least *some* player types, however, is what generates our identity crisis result.

property right. Thus, assume for example that q = 1/2 (thus giving each party an equal chance at winning in court), and that the plaintiff submits a report of $50 while the defendant bids $30; the above rules mandate that the plaintiff shall receive an undivided ownership interest, but that she must compensate the defendant with $20 in return.[148]

Calculating the equilibrium strategies of this game is somewhat technical, and we therefore relegate it to the Appendix.[149] The core result is that the plaintiff will buy the defendant's probabilistic claim to the entitlement if and only if:

$$v_\pi \geq v_\Delta + 25 - 50q.$$

In all other cases, the defendant will buy the plaintiff's probabilistic claim. From the above expression, it is possible to "describe" the extent of inefficiency for any probabilistic division (i.e., any value of q). First, notice that when the plaintiff has no chance of winning in court (q = 0), she will "purchase" the entitlement from the defendant only when v_π exceeds v_Δ by 25. Symmetrically, when q = 1—corresponding to absolute plaintiff bias—the defendant will purchase only when v_Δ exceeds v_π by $25.[150] In both cases, this $25 bid-ask spread prevents plaintiffs and defendants from consummating transactions that could improve social efficiency. The total social surplus in this case is equal to $64.06. When the plaintiff and the defendant each have a 50% chance of winning in court (q = 1/2), however, the plaintiff purchases the defendant's probabilistic claim if and only if the plaintiff has a high valuation ($v_\pi \geq v_\Delta$); this is *precisely* the condition for efficiency—i.e., that the party valuing the legal entitlement the most should possess it. As Figure 7 illustrates, the probabilistic division of q = 1/2 maximizes expected social welfare, which in this case is equal to its first-best level of $66.67.[151]

148. This $20 amount is simply the average of the bids ($40) multiplied by the probability of the defendant prevailing in court (or 1/2).

149. *See infra* app. at pp. 1116–17. The equilibrium derived in the Appendix is the unique *symmetric* and *monotone equilibrium*. By "symmetric," we mean the equilibria that entail identical strategies for the two same-type players when they are in similar positions. For instance, a symmetric equilibrium mandates that a plaintiff with valuation of $25 when q = 1/4 should have the same strategy as a defendant with valuation of $25 when q = 3/4. By monotone, we mean that the equilibrium strategies imply that both players' reports should increase (weakly) as their private valuations increase. There are a number of asymmetric and nonmonotonic equilibria of this game, but the intuitive appeal of the symmetric equilibrium leads us to believe that it is the most plausible. *See* Chatterjee & Samuelson, *supra* note 134, at 849–50.

150. This result is well recognized in Brown & Ayres, *supra* note 15, at 342; Chatterjee & Samuelson, *supra* note 134, at 839–42.

151. The equations from which these figures are calculated are provided *infra* app. at pp. 1116–17.

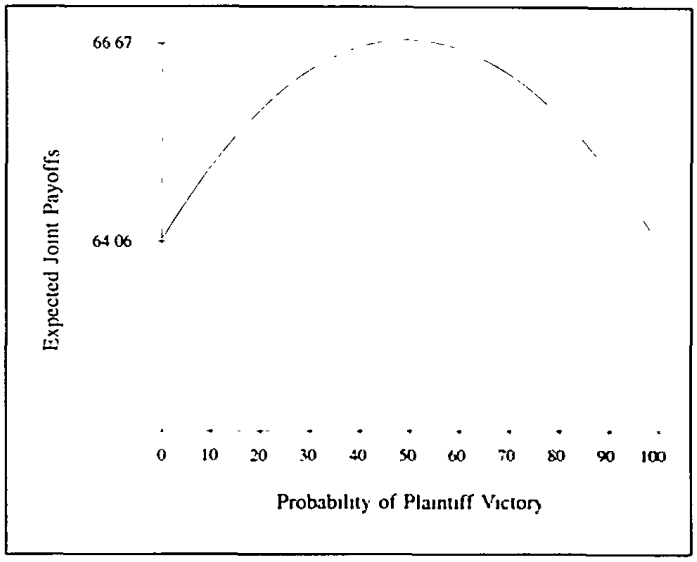

FIGURE 7. *Effect of Varying the Plaintiff's Fractional Entitlement on Expected Joint Payoffs*

The identity-crisis intuition for the efficiency effect of probabilistic divisions is different from the information-forcing intuition for liability rules discussed in Part II. Under a liability rule regime, even though there are two types of Coasean bargains, each plaintiff is interested in only one of the two types. We showed in Part II that plaintiffs credibly signal whether their valuation is above or below the damage amount by expressing an interest in one of the two types of trade. The willingness of plaintiffs to so signal enhances efficiency by (1) eliminating some of the private information, and (2) bounding the range of offers and bids that the defendant can propose, thereby decreasing the defendant's "room to lie" (even though he still has the incentive to lie). In contrast, probabilistic entitlements, along with other forms of fractional entitlements, do not necessarily induce either party to "self-select" into discrete groups, nor does such an entitlement system constrain either party's "room" to exaggerate her valuation. Rather, the identity crisis—uncertainty about whether a bargainer will ultimately become a buyer or a seller—reduces both parties' *incentives* to lie.[152]

152. This assertion does not imply that the parties do not distort their valuations at all. Indeed, when q = 1/2, *low*-valuing parties will perceive themselves as likely sellers and thus will slightly overstate their private valuations. Conversely, *high*-valuing parties will perceive themselves as likely sellers and will slightly understate their valuations.

For instance, consider the optimal report of the plaintiff π in this game

$$r_\pi^*(v_\pi) = \tfrac{2}{3}v_\pi + \tfrac{25}{3} + \tfrac{50q}{3}$$

When q = 1/2, it is easy to confirm that $v_\pi < r_\pi^*(v_\pi)$ whenever $v_\pi < 50$, and $v_\pi > r_\pi^*(v_\pi)$ whenever $v_\pi > 50$. When $v_\pi = 50$, the plaintiff tells the truth. Even with some lying, first-best efficiency is possible. *See* Cramton et al., *supra* note 133, at 624.

Although probabilistic entitlements have a strong efficiency advantage, they bring a number of significant procedural and philosophical disadvantages. While we discuss most of these at length later, one disadvantage stands out in particular. Sustaining a probabilistic property rights system forces the courts to eschew rulelike decision making so as to preserve the random outcomes that induce Coasean efficiency. As many have noted, however, legal standards often evolve inexorably toward rules.[153] Indeed, the legal system's use of analogy and precedent is inconsistent with a decision-making process that ultimately resembles a flip of a coin. On the other hand, the committing of legal decision making to juries operating under vague instructions, or even unarticulated demands for equity, might be seen as an existing mechanism that resists the pull toward predictability.

B. *Activity-Level Divisions*[154]

Thus far, we have assumed for simplicity that the defendant's act of taking is binary, or "all-or-nothing," in nature. Either the defendant breaches, or he does not; either the factory pollutes, or it does not; either the product infringes, or it does not. In many real-world applications, however, the defendant may be able to appropriate only a *portion* of the plaintiff's enjoyment of the underlying legal asset.

Examples of such "activity-level" rules abound. In a tort context, for example, a factory that wishes to dump one ton of waste into a river may be endowed with a property right to dump up to one-half a ton. This reduced activity level may rule out certain uses of the river by the surrounding community, such as drinking, but it may not be so damaging as to rule out other uses, such as fishing or lawn watering. Thus, the factory dumping hampers, but does not destroy, the community's enjoyment of the river. In a criminal law environment, speed limits endow drivers with a property right to drive up to sixty-five miles per hour on the highway, but those who drive too fast above the limit may be subject to punitive fines that serve injunctive purposes.[155]

These activity-level limitations that give another user the right to enjoin represent another manifestation of divided entitlements. In the pollution example, the factory owns a property interest in the first one-half ton of

153. *E.g.*, Johnston, *supra* note 29; Louis Kaplow, *Rules vs. Standards: An Economic Analysis*, 42 DUKE L.J. 557, 578–79 (1992). *But see* Rose, *supra* note 27, at 580–90 (illustrating how several laws of property oscillate back and forth between rules and standards).

154. This Section is inspired by Mitchell Polinsky's early insights into Coasean negotiations. *See, e.g.*, Polinsky, *supra* note 19; Polinsky, *supra* note 116.

155. While not all states impose punitive sanctions on speeders, coauthor Talley's empirical observations while driving between California and New Mexico indicate that this phenomenon is prevalent in Arizona. Note, however, that for ordinary speeding fines, the entitlement system is more like the liability rule system analyzed above.

pollution rights, and the residents own the right to enjoin all pollution beyond this amount. This entitlement division once again gives rise to two different types of bargains: The factory may purchase the right to increase the amount of pollution, or the residents may bribe the factory to produce less.[156]

It turns out that we can analyze activity-level limitations by using the previous Section's model of probabilistic assignments. To adopt the tort example as an illustrative device, consider a factory that needs to dispose of one ton of industrial waste. Suppose that the factory would pay up to $\$v_\Delta$ to be able to dump its ton of waste into a local river,[157] and that this valuation is privately known, distributed uniformly between $0 and $100. Suppose a downstream landowner values the unpolluted river at $\$v_\pi$, again privately known and identically distributed.[158] For simplicity, we assume that payoffs to the factory and downstream landowner will be proportional to the percentage of a ton that is released—e.g., if the factory were to dump one-fourth of a ton into the river, the factory's payoff would be $\$v_\Delta/4$ and the landowner's payoff would be $\$3v_\pi/4$.[159]

An undivided property entitlement would endow either the factory or the landowner with unperturbed use of the stream. Under a limited activity-level rule, however, courts might only allow the factory to dump some fraction of the ton of its waste material into the river free of charge and unimpeded by the downstream landowner; beyond that fraction, the landowner is protected by injunctive relief. This limited activity-level rule would allow the factory to bargain for the right to pollute more or allow the downstream landowner to bargain to restrict the factory's right to pollute.

Under these assumptions, activity-level limitations are isomorphic to the probabilistic allocations described above. If we interpret q as the fraction of the ton that the community can enjoin absent a negotiated outcome (rather than a probability), then a double auction procedure will produce the same

156. The speed limit example is less clearly a divided entitlement because (except in Chicago) it is difficult to negotiate with representatives of the state for the right to drive faster.

157. One might interpret v_Δ in this case to represent the amount that the factory knows it would have to pay to dispose of the waste outside the locality.

158. We assume that pollution affects only a single downstream landowner or that the residents of the downstream community have devised a procedural mechanism to overcome free-rider problems. Recall from the Introduction that the division of entitlements *among* parties is not the focus of this Article. Rather, we are concerned with the division of entitlements *between* parties. A number of economists, however, have proposed "pivot mechanisms" that allow for efficient decisions regarding public-good provision. *See, e.g.*, DAVID M. KREPS, A COURSE IN MICROECONOMIC THEORY 704–14 (1991).

159. Implicit in these figures is the assumption of a constant marginal effect of pollution on both parties' payoffs. Hence, for each infinitesimal amount of pollution in the lake, dq, the factory benefits by $v_\Delta dq$ and the community is injured by $v_\pi dq$. In this formulation, the optimal level of pollution is 0 if $v_\Delta < v_\pi$, 1 if $v_\Delta > v_\pi$, and indeterminate if $v_\Delta = v_\pi$. This example is limited in its generality, since it implies that the optimal outcome is generically binary. In fact, such a constant-returns utility structure is not often likely to hold in practice. We conjecture that it is possible to use a slightly different model in which the first-best level of pollution is somewhere on the interior, and that such a model would have the same properties as that discussed in the text.

equilibrium strategies.[160] As before, if either party held an undivided interest in the control of the stream, there would be a $25 bid-ask spread between the buyer and the seller of the right, a spread that would confound efficient Coasean exchanges. Consequently, the best that the legal system can do in this bargaining scheme is to endow the factory with a property right to dump up to one-half ton of waste into the river, and to allow the community to enjoin the dumping of any more than that half ton.

The above example of an activity-level division underscores our assertion that the "identity crisis" phenomenon studied above can occur in non-probabilistic contexts. Indeed, it is possible for an activity-level division to crystalize into a rulelike form through time without adversely affecting the "identity crisis" phenomenon that promotes Coasean efficiency. At least for legal rights that can be taken in part, a system of partial property rights is feasible and exists in various legal contexts.

C. *Temporal and Physical Divisions*

Some entitlements can also be divided temporally or physically. In property and contract law, for example, title to land or a piece of capital equipment is often divided into a term of years held by one party and a remainder interest held by another.[161] Another example is the relationship between an original patentee and an inventor of a "new use" for the patentee's invention, in which the original patentee has monopoly rights over her original invention until expiration, upon which the new use entrant can pursue the distribution, use, and sale of her innovative addition unimpeded.[162] Physical partitions of complementary parcels of land are even more easily accomplished and any joint tenant or tenant in common has a legal right to seek such a partition.

The model used above to examine probabilistic and activity-level divisions maps directly into this situation as well, with only minor alterations. We illustrate this possibility with an example of temporally divided claims to a piece of property. Suppose that the parties' respective entitlement valuations (denoted before as v_π and v_Δ) represent their payoffs *per period* (rather than their aggregate payoff), and that these valuations are distributed uniformly and

160. Given q (which we note must be between 0 and 1), the community's reservation payoff is equal to q times its private valuation, and the factory's payoff equals (1-q) times its private valuation. Since these reservation payoffs are identical to those corresponding to a q-probability assignment of the entitlement to the plaintiff (and a probability assignment of (1-q) to the defendant), the equilibrium strategies must be the same as in the previous Section.

161. Consider, for instance, a fee simple determinable held by A until B reaches her 25th birthday, with the remainder to B.

162. *See, e.g.*, Merges, *supra* note 39, at 5–10 (describing how patent entitlements are divided between original "pioneer" and subsequent "improver" of invention); *infra* part IV.C.1. Note that in the pre-expiration period, the original patentee cannot extend the use of the invention to the entrant's new use if the entrant has patent protection over such a use.

independently between $0 and $10 (rather than between $0 and $100 as before). Absent bargaining, the plaintiff has title to the asset for a certain period of time (call this number t), with the remainder going to the defendant in perpetuity.[163] At an illustrative discount rate of 10%, it is straightforward to show that in present value, each party's privately known payoff from permanent ownership lies uniformly between $0 and $100, just as in our previous example.[164]

The length of the plaintiff's claim to the asset determines, in a sense, what proportion of the asset the plaintiff owns. For example, because of discounting, either the plaintiff or the defendant should be indifferent between receiving a claim to the first 6.93 years or receiving a claim to all subsequent years (in perpetuity).[165] Thus, this temporal division effectively divides the asset between them equally and is analogous to the optimal division of setting q = 1/2 in the probabilistic entitlement model. By varying the term of years from zero to infinity, the entitlement may be partitioned in the same way that probabilistic and activity limitations allowed the entitlement proportions to vary. If the plaintiff and the defendant have different per period valuations, then it will be efficient for the higher valuer to buy the other side's claim to the asset. As in the earlier examples, it turns out that with a 6.93-year partition, the bargaining game outlined in the probabilistic entitlement section will again produce first-best efficiency.

This Part has illustrated numerous ways for efficiency-minded lawmakers to divide an entitlement "fractionally": Probabilistic, activity-level, physical,

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163. The order or exact partitioning of the terms of ownership are not particularly relevant so long as they are mutually exclusive and exhaustive through time, and so long as the parties' enjoyment is not rivalrous through time. For instance, it would be unwise to award a lumber company a term-of-years property interest over an old-growth forest, with the remainder to the spotted owl. The lumber company's initial exploitation of the natural resources would have a profound effect on the enjoyment that the spotted owl might receive after the term expires.

164. The present discounted value of permanent ownership for a party with valuation v_t is equal to

$$PDV_t(v_t,r) = \int_{t=0}^{\infty} v_t e^{-rt}\,dt$$

where r denotes the interest rate. Substituting $r = 1/10$ into the above expression and integrating, the above expression becomes:

$$PDV_t(v_t,r) = \int_{t=0}^{\infty} v_t e^{-t/10}\,dt = 10v_t.$$

Since v_t is assumed to be between $0 and $10 with equal probability, the party's present value of permanent ownership must lie between $0 and $100, again with equal probability.

165. Consider a division set at t^* years. The entitlement holder will value her term-of-years entitlement at exactly half of a fee simple entitlement when and only when:

$$\int_0^{t^*} v_t e^{-t/10}\,dt = \frac{1}{2}\cdot\int_0^{\infty} v_t e^{-t/10}\,dt,$$

which occurs at $t^* = (10)\ln(2) = 6.93$.

and temporal divisions can create an identity crisis that enhances bargaining efficiency. While liability rules channel high- and low-valuing plaintiffs to different types of Coasean bargains, and thereby constrain their "room" to lie, fractional property rights make it difficult for the parties to choose between the different types of Coasean trade, and thereby constrain their incentives to lie. The next Part draws out the implications of these results and also points to limiting principles.

IV. CHOOSING AMONG ENTITLEMENT FORMS

The previous two Parts have illustrated that divided entitlements can enhance welfare by promoting greater revelation of information during bargaining. The ability of liability rules to induce self-selection among entitlement holders and the ability of fractional property rights to create a valuable countervailing incentive for both parties can promote more efficient trade than undivided property protection. Nevertheless, these illustrations alone are of limited guidance to legal policymakers who not only must decide which type of entitlement structure to implement, but also must consider the panoply of other factors that a stylized model inevitably fails to consider. Below, we respond to this shortcoming by adding some relational "flesh" to our theoretical observations.

This Part begins by analyzing the choice between divided and undivided entitlement allocations. In particular, we identify four factors that militate against the efficiency of divided entitlements and suggest that the presence of any one of these factors might undermine the efficiency of divided entitlements in promoting pre-taking trade. Then, assuming that the conditions are ripe for entitlement division, this Part proceeds to examine which type of division is most likely to promote efficient trade.

Before proceeding, however, we remind the reader of an important caveat: Our analysis is restricted to how "efficiency-minded" lawmakers might pursue the narrow goal of maximizing gains from trade. Lawmakers might respond to a myriad of other legitimate policy goals that we do not address explicitly in this Part.[166] Nevertheless, while there is often a conflict between efficiency and equity,[167] divided entitlements can actually further *both* goals. In addition to enhancing efficiency, Solomonic entitlements also tend to equalize, at least among the bargainers, the distribution of wealth (in comparison with undivided entitlements allocated to individuals).

166. For instance, we have assumed throughout that underlying legal rights are "commodifiable" and "commensurable." *See supra* note 37. If they are not, the notion of efficient trade tends to lose its meaning.

167. *See, e.g.*, Richard A. Posner, *Essay: The Efficiency and the Efficacy of Title VII*, 136 U. PA. L. REV. 513, 515–16 (1987) (dismissing argument that Title VII is efficient and pointing to its equity objectives).

A. *Divided vs. Undivided Entitlements: Four Factors Militating Against the Use of Entitlement Division*

While the earlier analysis illustrates *how* divided entitlements might facilitate Coasean trade, we do not conclude that efficiency-minded lawmakers should uniformly reject the "undivided" species of property rules approximated by "fee simple" ownership and forms of strong legal protection. While promoting Coasean trade can be determinative in the choice of entitlement form, this Section identifies other aspects of efficiency that Solomonic allocations might impair. As an initial matter, the structural impediments to pre-taking negotiations might be so great that the facilitating effects of liability rules or partial property rules are not sufficient to induce any bargaining. For example, the class of potential automobile tortfeasors is so large and amorphous that it would be impractical to imagine any sort of legal reform inducing pre-taking negotiation. Thus, dividing entitlements to facilitate Coasean trade will only be appropriate when the transactional barriers to trade can at least be surmounted.[168]

Yet even when this condition is satisfied, so that divided entitlements could potentially mitigate the inefficiencies of bargainers' private valuations, other factors might still make undivided entitlements more efficient. In particular, this Section explores how a Solomonic entitlement can itself exacerbate these alternative forms of transaction costs. We also show how variations on the information structure underlying bargaining and tailored divisions can undermine the incentives that Solomonic bargainers might otherwise have to reveal information. Explicitly, we consider three such exceptions:

(1) *Solomonic entitlements can induce underinvestment.* Divided entitlements can undermine the incentives of any individual to develop an entitlement. For example, under a liability rule regime, the nominal owner might have an inefficiently weak incentive to make asset-specific investments, if she is only likely to recoup a proportion of the benefits in later bargaining.[169]

(2) *Solomonic entitlements can exacerbate the hold-up problem.* If lawmakers misidentify those parties who might have the highest

168. Even if it is inadvisable to use divided entitlements to promote trade, we might still have independent reasons for using them. Insurmountable transaction costs also undermine one of the primary rationales for property rules (i.e., the contractual channeling of goods to the highest-valuing owner). Thus, one of the central insights of Calabresi and Melamed is that when such transaction costs are prohibitively high, liability rules or activity-level limitations might be appropriate. Calabresi & Melamed, *supra* note 12.

169. *See, e.g.*, Benjamin Klein et al., *Vertical Integration, Appropriable Rents, and the Competitive Contracting Process*, 21 J.L. & ECON. 297, 307–24 (1978) (discussing lack of incentive to invest in firm-specific assets when contracting, instead of vertical integration, is employed to secure such assets).

valuations—by (a) allocating Solomonic claims to people who are commonly known to have low valuations, or (b) failing to allocate claims to people who are commonly known to have potentially the highest valuations—then this entitlement division can induce collective-action inefficiency.[170] The holdout problem of multiple parties selling parcels to a single large user, discussed above, is a classic example of this inefficiency.[171]

(3) *Solomonic entitlements can impede competition.* When a potential seller owns an undivided interest in an entitlement, competition among several potential buyers can mitigate the strategic inefficiencies created by the seller's and buyers' private information. Dividing Solomonic claims among the potential buyers can impede this competitive effect. For example, we will show that if each buyer has an option to take the entitlement, a high-valuing seller may be unwilling to bribe all of the potential buyers not to take. Accordingly, divided entitlements are most likely to facilitate trade when the two Solomonic claim holders are bargaining to capture gains of trade that are idiosyncratic to their relationship.[172] Idiosyncratic gains from trade are often present, for example, when people try to renegotiate a contractual obligation[173] or when merchants have made relation-specific investments.[174] More prosaically, Solomonic entitlements might facilitate capturing these "idiosyncratic gains of trade" whenever it is clear that two people are the most efficient trading partners, but it is not clear whether gains from trade exist.[175]

1. *The Underinvestment Trade-Off*

This Article has shown that dividing an entitlement between two bargainers can mitigate the inefficiency caused by the bargainers' private

170. For instance, the FCC traditionally utilized random lotteries—a form of divided entitlement—to allocate rights to new bandwidths in the broadcast spectrum. Because FCC regulations allowed all applicants to enter the lottery, the FCC was bombarded with hundreds of thousands of applications, many from parties that intended only to speculate in the market. The FCC's inability to discriminate between speculators and bona fide prospective owners forced it to spread the ownership shares so thinly that Coasean bargaining was virtually impossible. The FCC has now adopted an auction system to allocate these rights. *See* John McMillan, *Selling Spectrum Rights*, J. ECON. PERSP., Summer 1994, at 145.

171. *See supra* note 1 and accompanying text.

172. In economics terminology, the two negotiators have a "bilateral monopoly" over the creation of these potential gains from trade. POSNER, *supra* note 1, at 55–58.

173. When covering is unavailable, the buyer and seller often can enhance gains of trade by renegotiating an original contract's terms of performance.

174. *See* WILLIAMSON, *supra* note 41, at 54–56.

175. For example, it might be clear that only one of two neighboring landowners is the most valuable owner on a particular easement, but it might not be clear who has the higher valuation.

valuations. The contractual inefficiency caused by such private information is often called "adverse selection."[176] Although adverse selection represents an important cause of inefficiency in bargaining, it is not the only cause. Indeed, contracts often cannot specify types of behavior that increase the expected gains from trade. If courts are unable to observe certain types of hidden behavior, a contractual provision will not be able to mandate efficient performance. In economic terms, these aspects of performance that contract law cannot regulate are often termed "non-contractible,"[177] and the failure to regulate these aspects gives rise to "moral hazard."[178] Moral hazard—i.e., the inability to control individual behavior contractually—can lead to dramatic departures from efficiency.[179]

Attempts to remedy adverse selection often exacerbate moral hazard.[180] This Article's findings provide no exception. In particular, Solomonic entitlements may give bargainers suboptimal prebargaining incentives to make value-enhancing investments. For example, the nominal owner of land is less likely to make efficient improvements on her land if her ownership is protected by an untailored liability rule or a fractional property rule. Divided claims to a single resource can thus lead to a tragedy of the commons, as the multiple claimants engage in the moral hazard of overuse, in not accounting for the effect of their use on other claimants.[181] Even though it would be in the parties' joint interest to develop the asset efficiently, in many contexts the parties do not have a realistic opportunity to bargain before important investment decisions are made, and individual investors cannot be confident that they will receive adequate compensation in subsequent bargaining for prior (marginal) investments.[182] Thus, policymakers often face a trade-off in choosing legal rules to constrain the twin evils. This fundamental tension between adverse selection and moral hazard limits the applicability of Solomonic entitlements, because in many contexts Solomonic entitlements will

176. PAUL MILGROM & JOHN ROBERTS, ECONOMICS, ORGANIZATION AND MANAGEMENT 149 (1992). Adverse selection is often referred to as the problem of "hidden type" or "hidden preferences." *See* Brown & Ayres, *supra* note 15, at 327–28. The term was inspired by the disproportionate tendency for sick persons to obtain insurance. *Id.* at 328 n.14.

177. *See, e.g.*, Ayres & Gertner, *supra* note 74, at 741.

178. The term "moral hazard" originated in the insurance context from the tendency of insured people to take more risk. *See* Brown & Ayres, *supra* note 15, at 328 n.14.

179. *Id.* at 328.

180. *See* Robert H. Gertner & Geoffrey P. Miller, Settlement Escrows 14–33 (Chicago Law & Economics Working Paper No. 25 (2d Series)) (The University of Chicago Law School, 1994) (arguing that settlement escrow may mitigate adverse selection inefficiency but exacerbate moral hazard in claiming activity).

181. *See, e.g.*, POSNER, *supra* note 1, at 63–66; Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (1968).

182. Tailored liability rules have similar drawbacks. Interestingly, however, their shortcomings stem from inefficient *overinvestment* rather than underinvestment. Under tailored liability rules, for instance, the plaintiff is always insured against a taking by the defendant. As such, the plaintiff may have an excessive incentive to make reliance expenditures. *See, e.g.*, Steven Shavell, *Damage Measures for Breach of Contract*, 11 BELL J. ECON. 466, 472 (1980).

produce moral hazard inefficiencies that dwarf any reduction in adverse-selection inefficiency. Allocating an undivided property right to the resource is often the optimal solution.[183]

Nevertheless, the potential for moral-hazard inefficiency is not ubiquitous in equally virulent forms. Divided entitlements are less likely to be efficient when moral-hazard inefficiency is a primary concern, but may still be appropriate when adverse selection is the primary impediment to efficiency. Moreover, to the extent that Solomonic allocations encourage the migration of assets to the highest-valuing user, these allocations can enhance the investment decisions that take place *after* Coasean trade. By producing less efficient bargaining, undivided property rules can lead to less efficient *postbargaining* investments, because if bargaining fails to transfer an asset to the highest valuer, the lower-valuing owner is likely to have a suboptimal incentive to develop the asset after the negotiation. Accordingly, the tension between moral hazard and adverse selection in this context represents a tension between inducing efficient precontractual and postcontractual investment choices.[184]

2. *The Hold-Up Problem*

Lawmakers attempting to implement a Solomonic regime also face a serious "identification" problem. Solomonic negotiations can help a defined set of participating bargainers discover who among them has the highest valuation, but lawmakers may have difficulty determining who the appropriate participants are in this negotiation. This identification problem can give rise to problems of both over- and underinclusiveness. Overinclusiveness arises when Solomonic claims are given to individuals who clearly are not the highest valuers; this can exacerbate bargaining inefficiency, because these claimants have a strong incentive to hold up the negotiations of the serious contenders. When a partial entitlement is given to a person who is not the efficient owner, she will only be a seller, and her traditional incentive to seek an inflated price can impede negotiation among the class of potential ultimate owners. This hold-up problem is exemplified by the difficulty of consensually purchasing a group of adjoining properties to build a stadium or other public projects. An analogous problem of underinclusion results when potentially efficient owners

183. *See, e.g.*, Carol Rose, *The Comedy of the Commons: Custom, Commerce, and Inherently Public Property*, 53 U. CHI. L. REV. 711, 720–21 (1986). To take the fact pattern from *Spur v. Del Webb* as an illustration, it is conceivable to think that the feedlot owner, knowing that its entitlement was subject to a liability option of the growing retirement village, failed to make certain land improvements that would have increased the profitability of the land. Interestingly, however, the investment decision may go the other way if the landowner was protected by a tailored liability right awarding him "expectation-like" damages. In such a case, it is well documented that parties have the incentive to incur too many reliance expenditures. *See* Shavell, *supra* note 182, at 472. These forgone profits, incurred until the point at which Del Webb is clearly identified as the competing user, represent a bona fide and significant economic cost.

184. MILGROM & ROBERTS, *supra* note 176, at 143–47 (describing adverse selection and moral hazard).

are not given Solomonic claims. These excluded bargainers have the traditional incentives to understate their offers. Thus, inartful (over- or underinclusive) conferral of divided entitlements to people who are clearly inefficient owners induces costly transactions as those with low valuations are forced to sell their claims. The potential Coasean benefits of divided entitlements only occur if the partial owners have something real to negotiate about—i.e., if there is uncertainty about who should be the ultimate owner.[185]

Restricting the class of partial owners to the set of potentially highest valuers will be impossible in some contexts. Nevertheless, lawmakers or private parties themselves may be able to identify parties who ultimately may become the highest valuers. For example, the partial ownership interests of partners often coincide with the class of persons who, because of their idiosyncratic knowledge of the business, are most likely to be the highest valuers of the firm. It is instructive that the partners often choose to adopt buy-sell agreements that are strikingly analogous to the bidding mechanism outlined above in our fractional property rights model.[186]

Moreover, even if a divided entitlement scheme "misses" the highest valuer when casting its endowment net, this errant assignment may not, compared to undivided entitlement schemes, create onerous efficiency losses. First, even if the partial property claimants do not include the highest valuer, the Solomonic negotiation will at least facilitate allocating the entitlement to the highest valuer in the Solomonic group. Under an undivided scheme, an errant assignment would frequently entail greater inefficiencies. Second, some contexts naturally suggest a well-defined set of potential owners that may help lawmakers mitigate the problems of over- and underinclusion. A limited set of adjoining landowners, for example, might sufficiently define the set of potentially highest valuers with regard to local omissions or easements for a view.[187]

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185. When this uncertainty is not present, lawmakers could do at least as well by simply allocating the property to the higher valuer. *See, e.g.*, Polinsky, *supra* note 116, at 1111-12.

186. *See supra* part III.

187. At least in some circumstances, allocating partial ownership to a party who is commonly known to have a low valuation, and who would thus be a seller, can still facilitate Coasean trade. For example, consider a house owned by "Low" but subject to an untailored liability rule so that A has an option to buy nonconsensually for $100,000. This liability rule division might facilitate A's negotiations with another potential purchaser, B, because the liability rule allows A to signal credibly a high cost, thereby reducing the amount of Coasean inefficiency from this third-party transaction.

On the other hand, various scholars have explored the proposition that such liability amounts, when high, represent a mechanism for exacting anticompetitive monopoly rents from B, the third party. *See, e.g.*, Phillippe Aghion & Patrick Bolton, *Contracts as a Barrier to Entry*, 77 AM. ECON. REV. 388 (1987).

3. *The Disabling Effects of Correlated Valuations and Tailored Rules*

Besides giving rise to underinvestment and hold-up problems, divided entitlements may sometimes be incapable of inducing bargainers to reveal their private valuations. In this Subsection, we briefly address how structural variations on this model—correlated valuations of the bargainers or tailored legal rules—can undermine the information-inducing quality of Solomonic entitlements.

Both of our earlier models showed that Solomonic entitlement facilitated Coasean trade when the bargainers had "independent valuations." The valuations were independent because one side's knowledge of her own valuation gave her no information about the other side's valuation. In many real-world contexts, however, the bargainers' valuations are often correlated, and one party frequently has better information about her valuation than does the other. For example, in litigation over a taking that has occurred, the plaintiff and the defendant are both trying to estimate the likely monetary outcome at trial. Litigants' valuations are usually correlated, because if one side believes the case is "worth a lot," the other side, at least after discovery, is likely to come to the same conclusion.

Correlated valuations with asymmetric information can create an additional impediment to inducing the revelation of information, because credibly revealing that one has a high valuation will often lead the other side to increase her own valuation and thus narrow the bargaining range.[188] For example, a buyer's revelation of value always tells the seller the maximum that she might demand. When their valuations are correlated, however, a buyer's revelation may also raise the minimum price that the seller is willing to accept. With correlated valuations, then, a buyer may be even more reluctant to reveal her valuation. With correlated valuations, each party has an additional strategic reason to misrepresent her respective valuation: to mislead the other side about her own valuation.

For example, consider again our analysis of bargaining under a liability rule regime. If we instead assume that the plaintiff's and the defendant's valuations are correlated, but that defendants have only an imprecise, initial signal about their valuation, then defendants would rationally try to infer their valuation more precisely from the bargaining behavior of the plaintiff. In this circumstance, plaintiffs might strategically try to misrepresent their valuation, to mislead defendants about the defendants' own valuation. In the earlier

188. While economic models can easily capture the process of updating one's own valuation based on rational inferences of the other side's valuation, psychologists have also explored more extreme adjustments referred to as "reactive devaluations." Lee Ross, *Reactive Devaluation in Negotiation and Conflict Resolution*, *in* BARRIERS TO THE NEGOTIATED RESOLUTION OF CONFLICT (Kenneth Arrow et al. eds., forthcoming 1995) [hereinafter BARRIERS TO RESOLUTION].

liability model, we asserted that low-valuing plaintiffs would never have an incentive to make a serious offer to bribe defendants not to take.[189] It is possible, however, that if defendants have imprecise but correlated valuations, a low-valuing plaintiff might cleverly try to bribe the defendant not to exercise her liability call option. The plaintiff would hope that the defendant would reject the offer, wrongly believing that she (the plaintiff, and thus the defendant as well) had a high valuation, then exercise the option.[190] In the future, we hope to explore this conjecture formally, since it represents the only instance when a plaintiff might have an affirmative strategic incentive to misrepresent whether her valuation was above or below the liability amount.[191] For now, it is sufficient to see that correlated valuations and one-sided information can make the bargainers reluctant to reveal information and thus reduce the potential benefit of Solomonic bargaining.[192]

Correlated valuations, however, are not the only factor that can increase the disincentives to reveal information. As argued above, tailoring legal consequences so that they are contingent on private information can deter parties from revealing the information. For example, giving the plaintiff private information about the size of the liability rule's exercise price by making the damages payment relate to the plaintiff's actual loss in value undermines the plaintiff's otherwise strong incentive to reveal whether her valuation is high or low.[193]

To the extent that equity constrains lawmakers to tailor legal rules to make *ex post* consequences turn on *ex ante* privately held information, divided tailored entitlements are likely to produce relatively less efficient pre-taking negotiations. For example, it may be difficult for a judge to implement an untailored rule such as a $50 liability amount when, by the time of trial, sufficient information has revealed that the defendant actually valued

189. *See supra* part II. Similarly, we asserted that high-valuing plaintiffs would never make a serious offer to sell their entitlement for less than the liability amount.

190. Similarly, a high-valuing plaintiff might strategically offer to sell the entitlement for a low price, again hoping that the defendant would reject the offer but mistakenly choose not to take.

191. Though we do not rule out the possibility that information structures such as the one described in the text can render property rules more efficient than liability rules, we conjecture that the more likely result from this information structure is of the type obtained in the so-called "no-trade" papers in finance. *See, e.g.*, Paul Milgrom & Nancy Stokey, *Information, Trade and Common Knowledge*, 26 J. ECON. THEORY 17 (1982). Essentially, when one party has superior information about the value of the underlying asset, her willingness either to purchase or to sell that asset is a signal to the other, uninformed party that such a transaction would be unwise. Thus, in such environments, we conjecture that autarky might reign regardless of the underlying rule. Interestingly, then, because autarky under liability rules tends to dominate autarky under property rules, *see supra* part II, the existence of correlated information need not prove fatal to the relative wisdom of liability rules.

192. Note, however, that when the players' types are correlated, but each knows her own valuation with precision, both liability rules and property rules are likely to tend toward efficiency as the amount of correlation increases. *See, e.g.*, R. Preston McAfee & Philip J. Reny, *Correlated Information and Mechanism Design*, 60 ECONOMETRICA 395 (1992) (discussing ability of correlated information to induce first-best bargaining).

193. Similarly, giving the defendant private information about who owns the entitlement deterred plaintiffs from partitioning themselves into high- and low-valuing groups.

ownership at $75, and that the plaintiff's lost value was $100. While our theory predicts that courts would adjudicate fewer cases under an untailored liability rule than under a tailored liability rule, it is neither practically nor theoretically possible to continue seeing a limited number of such cases in litigation.[194]

B. *Choosing Among Divided Entitlements*

While the last Section identified conditions under which divided entitlements might induce additional inefficiencies, these potential pitfalls still may not outweigh the Coasean benefits of Solomonic entitlements. At least theoretically, we have shown that a number of different types of divided entitlements can enhance pre-taking negotiations, each for different reasons. Assuming *arguendo*, then, that divided entitlements are beneficial overall, this Section explores which of the various divisions is most likely to be efficient.

A striking result of Part III was that bargaining under fractional property rights could achieve first-best efficiency. The expected payoffs in these models were higher than those in Solomonic bargaining under liability rules (even though liability rule divisions still produced higher gains than undivided property rules). As an initial matter, it seems that fractional property divisions would dominate liability rules as a mechanism for facilitating Coasean trade.

The information-forcing quality of untailored liability rules, however, is much more robust than the beneficial identity crisis that fractional property rules create. We were only able to demonstrate first-best efficiency in an extremely stylized bargaining game with simultaneous offers. While some of the Solomonic benefits of fractional property rules undoubtedly are present in related procedures, the information-forcing quality of liability rules depends on fewer assumptions. Most important, we showed that a plaintiff owning an entitlement protected by a property rule would never offer the "misrepresentative" type of Coasean bargain, regardless of the defendant's expected strategy.[195] Our showing that liability rules make truth telling an

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194. *See generally* Gillian K. Hadfield, *Bias in the Evolution of Legal Rules*, 80 GEO. L.J. 583 (1992) (noting that judges often make decisions that are optimal for the particular case in front of them but not for the population in general).

Our models also have implications for the "rules" versus "standards" debate. For these purposes we adopt Louis Kaplow's cogent definition that: "[T]he only distinction between rules and standards is the extent to which efforts to give content to the law are undertaken before or after individuals act." Kaplow, *supra* note 153, at 560. Under this definition, all of our untailored laws are rulelike; even the probabilistic allocations are rulelike in that there is nothing for the parties to learn about the law before the court's application. Our focus on tailored rules, which make legal consequences contingent on parties' private information, suggests that under Kaplow's scheme a law might be "rulelike" from the perspective of the informed party, but it may be "standardlike" from the perspective of the uninformed party, who will try to infer its content prior to trial. Our assertion is that this asymmetry creates impediments to Coasean trade in particular.

195. As noted above, we need to limit the parties from certain types of extremely irrational play. *See supra* note 59–60 and accompanying text.

iterated dominant strategy suggests that the benefits of liability rules may be much less fragile than fractional property rules equilibria.

Moreover, certain types of partial property divisions may be difficult to implement. Activity-level divisions may not be possible where the competing uses are qualitatively incompatible. For instance, it may be impossible to divide the right to various trees in the Oregon old-growth forests between Union Pacific and the Rocky Mountain spotted owl. Temporal divisions may not be possible either, especially when the activity of the first user of the entitlement is likely to render the resource useless for the next in right.[196]

The feasibility of probabilistic property divisions raises particularly interesting legal issues. For example, the common law process itself may make it difficult to sustain the beneficial effects of probabilistic determinations, since precedents tend to further define the consequences of nonconsensual taking. Although we traditionally conceive of the process of announcing precedent as a public good redounding to the benefit of others, our model perversely suggests that reducing uncertainty may, at least with regard to its effect on pre-taking negotiations, be a public bad.[197] While it is not our goal to apologize for the diverse types of legal uncertainty, the probabilistic entitlement model might force us to reexamine a host of procedures that may have this unintended benefit. For example, cloaking decisions in the opinionless determination of idiosyncratic juries or the unarticulated demands of equity may produce unintended benefits in pretrial bargaining.[198]

In general, the optimal way to divide an entitlement will turn on how the particular divisions interact with the various limiting factors outlined above. For example, Solomonic entitlements may be particularly effective when legal rules respond to the "identification" problem by excluding inefficient owners from the bargaining process. Liability rule divisions tend to do just this: If the state mistakenly grants a probabilistic property right to an individual who is clearly not one of the efficient owners, that individual may inhibit efficient trade by holding up the efficient owner for an inefficient sale price. If, however, the state mistakenly grants a liability call option to someone who

196. Consider a situation in which each of the competing uses leaves the property unusable for anything else for a long time. The underlying legal entitlement might be the ownership of a plot of land in the desert, while the two potential owners are a farmer, who plans to excavate irrigation ditches to grow alfalfa, and a scientific R&D venture that wishes to study the effects of toxic chemical spills in "pristine" desert climates. If one attempted to divide the title to the land temporally, it would be difficult to find a split such that use by the first party would not render the plot useless to the remainderperson.

197. This perspective contrasts with the argument put forth in Owen M. Fiss' much-cited article, *Against Settlement*, 93 YALE L.J. 1073, 1073–78 (1984), that litigants might inefficiently ignore the *positive* externality of precedent when deciding to settle. Our probabilistic property model, in contrast, suggests that precedent may also produce a *negative* externality that litigants may ignore in failing to settle.

198. This list is far from exhaustive. Indeed, the probabilistic entitlement model might provide an unwitting efficiency rationale for various "abstention" doctrines (such as *Pullman* and *Colorado River* abstentions) that avoid resolution by federal courts of ambiguities in state law. *See, e.g.*, PETER W. LOW & JOHN C. JEFFRIES, JR., FEDERAL COURTS AND THE LAW OF FEDERAL-STATE RELATIONS 554–63, 574–83 (3d ed. 1994).

clearly values the property less than the option's exercise price—i.e., the damage amount—then the class of potentially efficient owners can simply ignore any demands from this inefficient owner, because her threat to take nonconsensually is not credible. Thus, liability rule divisions may better allow private parties to limit the problem of overinclusiveness that results from mistaken allocations.

The choice of entitlement division might also reflect appropriate responses to other limiting factors analyzed above. For example, while probabilistic divisions might be hard to sustain over time, liability rules may be less susceptible to *ex post* tailoring: Even if courts feel compelled to tailor the amount of liability to plaintiff's actual loss, the prospect of a probabilistic determination of whether the defendant will be liable may be sufficient to induce more efficient pre-taking negotiation.[199]

C. *Specific Legal Applications*

This Section analyzes some potential legal applications of our theoretical findings. We focus first on intellectual property law, and then more briefly on impossibility and mistake doctrines and legal "dissolutions" of concurrent ownership.

1. *Intellectual Property and Compulsory Licenses*

An area of modern legal practice where entitlement allocation is of paramount importance is the law of intellectual property. Indeed, this field is one of the few in which new property rights emerge on a daily basis, especially within the patent and copyright process. Moreover, the prevalence of patent and copyright licensing is testimony to the pervasiveness of bargaining in the shadow of the extant legal entitlement schemes.

Intellectual property often entails a significant amount of thin-market bargaining. In patent law, a nontrivial amount of bargaining occurs between parties possessing "blocking" patents.[200] For instance, consider the case where an individual has patented a pioneering invention, and a second individual then patents a "new use" that incorporates the pioneering technology. It may be quite profitable for the second individual to market

199. As noted above, the choice between liability and reverse liability rules could turn in part on which party's private information is the greatest impediment to Coasean trade. The party with the *least* amount of private information should receive a liability call or put option so as to exploit maximally the "partitioning" of the opposite party. Thus, reverse liability rules are appropriate when inducing defendant partitioning is the primary concern, while liability rules are appropriate when inducing plaintiff partitioning is the primary concern. For example, in a competitive market, a seller's cost of performance may be readily inferred from the market price, so endowing the seller as promisor/defendant with a liability call option (to breach and pay damages) may induce better Coasean trade.

200. This Subsection draws heavily upon Merges, *supra* note 39.

products that use this improvement patent, but because U.S. patent law grants property protection to the pioneer patent,[201] the improver cannot market her invention without first negotiating a licensing agreement with the incumbent.

This situation, though seemingly stylized, is not uncommon. An oft-cited example is the stalemate in the early-twentieth-century negotiations between the Marconi Wireless & Telegraph Company and AT&T over patents in radio technology.[202] Marconi, the pioneer, owned a series of patents disclosing an oscillating radio diode, which was then a fundamental component of transmission technology. AT&T, on the other hand, was a licensee to a radical improvement, disclosed in the "de Forest" patents for an oscillating triode, which incorporated Marconi's pioneering technology. After a court had established Marconi's dominant status, thus giving it a property right over its diode technology,[203] the parties attempted to negotiate a licensing agreement to merge their respective technologies. Their bargaining efforts, replete with strategic behavior, were largely unsuccessful. In fact, the parties did not reach an agreement for nearly ten years, and even then it was largely motivated by the government's creation of RCA. Many have estimated that the impasse squandered an annual surplus in the tens of millions of dollars and delayed numerous other advances in radio technology.

The property-like protection that patent law gives to innovators may well have contributed to the deadlock in the Marconi–de Forest negotiations. Our analysis suggests that, at least in analogous circumstances, a liability-like regime might induce more efficient allocations by facilitating truthful revelation more rapidly, thereby minimizing costly delay. Such a system would likely take the form of a "compulsory licensing" scheme, giving the improver an option to infringe the pioneer's patent in exchange for a fee determined by a licensing tribunal. Current U.S. patent law generally eschews such approaches, except for *sui generis* patents in nuclear power and environmental engineering technologies. In various Asian and European nations, however, compulsory licensing exists for just such a pioneer/improver circumstance.[204]

A number of groups have long opposed compulsory patent licensing in the United States, the most vocal of which is (perhaps not surprisingly) patent attorneys. Among academics, however, common objections to such schemes include arguments that licensing tribunals are notoriously bad at correctly

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201. *See, e.g.*, 35 U.S.C. § 283 (1988).

202. For an extensive analysis of the radio history, see GEORGE H. DOUGLAS, THE EARLY DAYS OF RADIO BROADCASTING (1987).

203. *See* Marconi Wireless & Tel. Co. v. DeForest Am. Co., 236 F 942 (S.D N Y 1916), *aff'd*, 243 F. 560 (2d Cir. 1917).

204. *See* Gianna Julian-Arnold, *International Compulsory Licensing: The Rationales and the Reality*, 33 IDEA 349 (1987) (noting that blocking patents are one of three most common conditions for compulsory licensing abroad). Countries that have compulsory licensing provisions in such instances include Australia, China, France, Japan, the Netherlands, New Zealand, and Switzerland *See* Merges, *supra* note 39, at 34–36 & nn.57–59.

"pricing" the licensing fees.[205] As our arguments illustrate, however, these arguments may lose their force when one allows for bargaining in the shadow of the compulsory licensing regime. Indeed, the inability of a court to tailor a damages award and the existence of litigation costs can often improve the ability of the parties to reach a consensual, efficient agreement on their own terms, not those dictated by the underlying liability rule.[206] Moreover, restricting the compulsory licensing to the pioneer/improver context might be a rational way for government to respond to the identification problem—because the two parties involved in the initial innovation may, at least as a first approximation, be the most efficient developers as well.

2. *Mistake, Impossibility, Frustration, and Bargaining over Efficient Breach*

Another set of potential applications for our results arises in the contract doctrines of mutual mistake, impossibility, and frustration. While formally distinct, all of these doctrines address situations in which the "state of the world" at the time of contractual performance differs vastly from what the parties had anticipated during their initial contract bargaining. In such instances, it is often no longer clear whether continued performance of the contract would be efficient, as the promisor may value breaching more than the promisee values performance. Moreover, in the absence of any excuse doctrines, should an adversely affected party breach, the typical damages measures may be wholly out of phase with the underlying state of the world, thereby giving one party an "effective" property right.[207] Thus, when such an unanticipated contingency occurs, there is a strong argument for inducing the parties to reconsider jointly, through renegotiation, the prudence of continued performance. Private information can often impede this renegotiation process, however, so structuring the law to lubricate the bargaining—via Solomonic divisions—may be one mechanism for encouraging efficient breach.[208]

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205. *See, e.g.*, Merges, *supra* note 39, at 30–32.

206. There is some soft empirical support for this proposition as well. Despite the compulsory licensing schemes in these countries, Merges reports an unusually low incidence of royalty proceedings, suggesting that the parties are largely successful at bargaining around the default liability rule. *See id.* at 35.

207. *See supra* text accompanying notes 48–49 (discussing how misaligned or "extreme" damage amount can give rise to property-like rule). One can see how such a situation might come about in, say, the classic frustration case of Krell v. Henry, 2 K.B. 740 (C.A. 1903), in which the frustration doctrine was used to nullify a subletting agreement for property overlooking the planned route of a royal processional. Reliance or expectation damages may well have given the lessor an effective property right over performance.

208. That efficient breach of contract is an important goal of contract law is virtually indisputable. *See* COOTER & ULEN, *supra* note 1, at 290.

Consider, for instance, the doctrine of mutual mistake first articulated in the classic and still-popular case of *Sherwood v. Walker*.[209] The dispute in *Walker* centered on whether a contract for the sale of a cow should be nullified upon the discovery by the parties that the cow—which was mutually thought to be infertile—was in fact pregnant. Reversing the trial court's enforcement of the contract, the Michigan Supreme Court found that when the "nature" of the contracted exchange changes dramatically, either party has a legitimate right to refuse performance and seek nullification. Interestingly, however, both the *Walker* court and many courts since have applied the mistake doctrine somewhat randomly.[210] The Restatement does not substantially help to resolve the line-drawing ambiguities. Section 152 states that nullification under the mistake doctrine is warranted so long as there is a failure of a "basic assumption," and so long as the adversely affected party does not "bear[] the risk" of mistake.[211] Both of these standards are decidedly unclear, as is the notion of what types of mistake are mutual.[212] These ambiguities have led a number of commentators to conclude that the standards governing the mistake doctrine are "confused beyond reconciliation."[213]

The current legal standards for excuse are suggestive of our analysis in two ways. First, given the lack of clear standards governing the mistake doctrine, the legal landscape arguably gives rise to a particular type of Solomonic division studied above: probabilistic property rights. Indeed, if courts must operate within a hazy set of irreconcilable legal standards when applying the mistake doctrine, then their ultimate decisions may fall victim to arbitrariness and randomness. To the extent that this randomness approximates a legal "coin flip" over the entitlement, the parties may see themselves each as owning a probabilistic or fractional share of the respective rights over breach or performance. This muddy default legal rule may thereby engender more efficient renegotiation of the contract than would occur if the impossibility doctrine were more crystalline.

Second, the failure of a "basic assumption" requirement may help to solve the identification problem of overinclusiveness by limiting the court's effective coin flipping to circumstances in which it is no longer clear whether the promisee values performance more than the promisor. The legal rule may prohibit promisors—whose *ex ante* assent signals that they value their performance less than the promisee—from opportunistically holding up

209. 33 N.W. 919 (Mich. 1887).

210. *See* Eric Rasmusen & Ian Ayres, *Mutual Mistake and Unilateral Mistake in Contract Law*, 22 J. LEGAL STUD. 309, 312 (1993) (noting that "courts are left puzzled about when to void for mistake," and citing continued puzzlement in current casebooks). Even Judge Morse in *Walker* noted the difficulty in line drawing: "I know that this is a close question, and the dividing line between the adjudicated cases is not easily discerned." Sherwood v. Walker, 33 N.W. at 923.

211. RESTATEMENT (SECOND) OF CONTRACTS § 152 (1981).

212. Rasmusen & Ayres, *supra* note 210, at 311–12.

213. *E.g.*, ARTHUR ROSETT, CONTRACT LAW AND ITS APPLICATION 669 (5th ed. 1994).

promisees. The occurrence of some unexpected event, however, may so undermine the court's confidence that there are gains of trade at any price, that the legal system may wish to use probabilistic discharge to encourage more efficient renegotiations. A similar analysis may apply to the doctrines of impossibility and frustration, where the unanticipated state of the world was not caused by mistaken impressions during contracting, but by dramatic and unanticipated changes in the world after execution of the contract. In these situations as well, a probabilistic application of excuse doctrine may facilitate efficient renegotiation.[214]

The current legal standards, however, may not effectively respond to the identification problem of underinclusiveness.[215] While the "basic assumption" requirement may be sufficient to establish that either the promisor or the promisee may have the *higher* valuation, this requirement is not sufficient to establish that one of the two bargainers has the *highest* valuation among a larger class of potential owners. For example, in *Sherwood v. Walker*, a third party might have been the efficient owner of the pregnant cow. Inducing Solomonic bargaining between the two litigants is less likely to be efficient if potentially efficient owners are not given a Solomonic share. This reasoning suggests that the probabilistic rescission might only be appropriate when there are idiosyncratic gains from trade—say, because of deal-specific investments—that create conditions of "bilateral monopoly."[216]

3. *Concurrent Ownership and Dissolutions*

The legal rules governing concurrent ownership[217] of property may also promote Solomonic bargaining. While concurrent ownership normally arises in ongoing, cooperative relationships (especially tenancy by the entirety, which is an artifact of marriage), the law by necessity must respond to rivalrous claims of use by concurrent owners. Solomonic entitlements may be especially appropriate in these contexts because the intimate relationship that gave rise to the concurrent ownership may also cause the concurrent owners to place an idiosyncratic, above-market value on the property. For example, two spouses may subjectively value their summer home, where they reared their children, much more than potential third-party buyers, and yet it might be unclear which

214. *See* Rasmusen & Ayres, *supra* note 210, at 310–14. This list of renegotiation-facilitating contractual doctrines is not exhaustive. *See, e.g.*, Talley, *supra* note 43 (discussing rule against penalty enforcement as another form of bargain-inducing device).

215. This paragraph incorporates a probing question by Richard Epstein and thoughtful comments by Richard Craswell.

216. When there is a competitive market for the promised performance, certain rescission will not lead to inefficiency if the original seller after rescission can simply sell to the highest bidder.

217. There are three traditional forms of concurrent ownership of property: tenancy in common, joint tenancy, and tenancy by the entirety. *See* A. JAMES CASNER & W. BARTON LEACH, CASES AND TEXT ON PROPERTY 251–55 (3d ed. 1984).

spouse values the home more, since at all prior times their use of the house was nonrivalrous.

The common law has developed a number of ways of resolving conflicting claims of concurrent owners. Most basically, a tenant in common or a joint tenant often can obtain a physical partition of the property. We have already shown that a physical division of property can create an identity crisis, because at the outset of negotiations a claimant would not know whether she would ultimately sell her share or buy the other party's share. The mere option of obtaining a physical partition can have the same effect as an actual physical division, because each party would know that in the absence of an agreement on buying or selling this partition option, an actual physical partition would be the ultimate result. Indeed, the prospect of judicial partitioning may induce even more bargaining than an existing partition, since the parties will be uncertain, *ex ante*, about who will get what parts. If the court might benightedly divide the land in a way that reduces its use to each of the claimants, then the parties would have even more incentives to resolve the dispute themselves.

Courts have also forced a tenant in common to compensate her co-owners for disproportionate use of concurrently owned property.[218] Such rulings effectively create liability rule options: A tenant may take the benefit of certain uses, but only if she compensates her cotenant. To the extent that the court's determination of the damages deviates from the cotenant's valuation, our analysis in Part II suggests that this legal rule will induce cotenants to disclose whether their valuation is above or below the damage amount. Accordingly, this legal rule may effectuate Solomonic negotiations.

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The analysis in this Part is far from exhaustive. Its primary purpose is to illustrate that Solomonic allocations should neither predominate in all legal categories nor define a null set. Nonetheless, the fact that there are many divisions that may promote more efficient Coasean bargaining than clear property rules calls into question many "settled" notions about the

218. McKnight v. Basilides, 143 P.2d 307, 315 (Wash. 1943) ("No practical or reasonable argument can be advanced for allowing one in possession to reap a financial benefit by occupying property owned in common without paying for his personal use of that part of the property owned by his cotenants.")

law[219]—including blanket condemnation of entitlement allocations that are indeterminate or weakly protected.

V. CONCLUSION

Emerging academic disciplines frequently use "extreme cases" as instructional benchmarks. Law and economics is no exception. Over the last thirty-five years, law and economics has produced two fundamental insights about the relationship between legal entitlements and consensual trade, each stemming from diametric assumptions about the world.[220] First, Coase showed that when transacting is costless, the choice between property and liability rules does not affect the attainment of efficiency.[221] Second, Calabresi and Melamed followed by showing that when transaction costs make consensual transfer prohibitively expensive, liability rules, which allow for nonnegotiated transfer, are likely to dominate property rules.[222]

This Article has ventured further into the economic purgatory between the findings of Coase and of Calabresi and Melamed.[223] In this intermediate region, where transaction costs are positive but not prohibitive, law-and-

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219. For example, it is possible that the current departures from the absolute priority rule represent a move toward a divided entitlement scheme for a firm's assets, which can lead to more efficient taking negotiations. *See generally* Douglas G. Baird & Thomas H. Jackson, *Bargaining After the Fall and the Contours of the Absolute Priority Rule*, 55 U. CHI. L. REV. 738 (1988) (documenting this movement).

Our analysis might also provide an additional rationale for Easterbrook and Fischel's argument that courts should require target managers to be passive in response to hostile takeover attempts. *See* Frank H. Easterbrook & Daniel R. Fischel, *The Proper Role of a Target's Management in Responding to a Tender Offer*, 94 HARV. L. REV. 1161 (1981). Haddock, Macey, and McChesney persuasively criticized this target passivity requirement by explicitly arguing that the entitlements of target shareholders should be protected by a property rule instead of the Easterbrook-Fischel liability rule (which in essence would give raiders a call option to take over the firm). David D. Haddock et al., *Property Rights in Assets and Resistance to Tender Offers*, 73 VA. L. REV. 701 (1987). Our analysis suggests that analogizing the passivity proposal to a liability rule does not doom its application. To the contrary, target passivity might induce target managers to reveal whether they believe the company is worth more than the tender offer—at least if the targets were allowed to bribe the hostile bidder to cease and desist. *See* Jonathan R. Macey & Fred S. McChesney, *A Theoretical Analysis of Corporate Greenmail*, 95 YALE L.J. 13 (1985).

220. Interestingly, the evolution of the economics of competition follows a similar track, with initial concentration on the polar environments of perfect competition and monopoly. Only recently have models of oligopoly and monopolistic competition breached the more realistic middle ground between these polar benchmarks.

221. *See* Coase, *supra* note 5. Though Coase never articulated this proposition verbatim in that article, most scholars have attributed it to him since. *See, e.g.*, COOTER & ULEN, *supra* note 1, at 105 & n.15; Calabresi & Melamed, *supra* note 12, at 1094 (attributing to Coase the notion that "[in] the absence of transaction costs, Pareto optimality or economic efficiency will occur regardless of the initial entitlement").

222. Just as Coase did not explicitly articulate the Coase theorem, *see supra* note 221, Calabresi and Melamed left it to others to state explicitly this fundamental implication of their analysis. *See* POSNER, *supra* note 1; Haddock et al., *supra* note 18; Kronman, *supra* note 19.

223. The insights of this Article fit nicely with the seminal insights of Robert Cooter, *The Cost of Coase*, 11 J. LEGAL STUD. 1 (1982). Cooter hypothesized that the normative task of the law was to find an optimal trade-off between "Coasean" concerns about lubricating consensual trade, and "Hobbesian" concerns about allocating legal entitlements when trade collapses. *See id.* at 19–20. Liability rules have often been perceived as serving the second of these goals quite well but generally failing to serve the first. Our analysis, however, illustrates that these two concerns need not conflict. Liability rules can, at least in dealing with private information, serve *both* objectives better than property rules.

economics scholars have firmly favored the use of undivided entitlements—i.e., clear, fee simple allocations protected by property rules—to "force" parties to negotiate.[224] But the near-universal acceptance of this proposition by academics (including ourselves until recently) is a little puzzling. If liability rules can promote efficient contracting in a world without transaction costs, why was it clear that property rules should dominate when transaction costs increase slightly?[225] At a minimum, this Article shows that the preference for undivided property rules in low-transaction-cost settings should no longer rest on the naive notion that property rules are superior at channeling people toward efficient Coasean trade. We have shown that a host of Solomonic entitlement divisions—including liability rules and fractional property entitlements—can induce pre-taking negotiations superior to those of undivided property rules.[226]

Two distinct families of entitlement division can engender more truthful bargaining. Fractional ownership structures might induce honest bargaining by obscuring the titular boundary between buyer and seller during a negotiation. For example, if a court is equally likely to rule that either a factory or a neighboring laundry is entitled to control the amount of factory pollution, then the factory may be unsure whether it should try to buy the laundry's right to

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224. *See supra* notes 27–28 and accompanying text.

225. Louis Kaplow and Steven Shavell ask the same question, but focus on a different margin—decreases in transaction costs from a prohibitively high level. In their discussion of harmful externalities, they assert:

> [T]he liability rule is superior when there is no bargaining. That is, before any bargaining occurs, at the beginning of the "race" between the types of rule, the liability rule is ahead of the property rules. Hence, we would expect that after imperfect bargaining occurs, the liability rule should remain ahead of the property rules. This would be true unless bargaining were for some reason to result in mutually beneficial agreements substantially more often under the property rules than under the liability rule.

Kaplow & Shavell, *supra* note 101, at 25–26. This explanation correctly identifies how, *ceteris paribus*, liability rules can mitigate the consequences of failed bargaining. Following Cooter, this might be characterized as a "Hobbesian" rationale for liability rules. *See supra* note 223. In this Article, we have tried to expose a "Coasean" rationale for liability rules as well: By inducing bargainers to reveal information, liability rules may "result in mutually beneficial agreements substantially more often" than property rules. Thus, liability rules may be more able than property rules to serve the joint purpose of lubricating bilateral negotiations and mitigating the consequences of failed bargaining.

The failure of the academy to ask the question in the text may lie, in part, in the fact that Calabresi and Melamed succeeded too well in showing that liability rules were appropriate for high transaction cost contexts, and also because most Coasean bargaining examples were explained in terms of property rights. *But cf.* SCOTT & LESLIE, *supra* note 43, at 101–03 (discussing Coasean bargaining around gap-filling legal rules). While the law-and-economics community knows the Coase theorem by heart, legal scholars have largely ignored how the Coasean impulse to internalize externalities would affect liability rules and other forms of entitlement divisions. *See generally* John J. Donohue III, *Opting for the British Rule, or If Posner and Shavell Can't Remember the Coase Theorem, Who Will?*, 104 HARV. L. REV. 1093 (1991) (arguing that Coasean implications have been overlooked in other areas as well).

226. Ellickson has cogently shown why the law has placed immutable constraints on the "excessive decomposition" of bundles. *See* Ellickson, *supra* note 4, at 1374 ("A landowner can reveal incapacity not just by swinging an axe at an antique armoire but also by splintering rights in a fee simple bundle into bits that are far less valuable than the pre-splintered whole."). Our Article, however, suggests that the law might also worry about excessive *composition* of entitlement claims.

stop the pollution, or to sell its own right to pollute.[227] A similar characterization holds for the laundry. Because of this "identity crisis," the bargainers will not know whether they should strategically inflate their offers (*qua* sellers) or deflate their offers (*qua* buyers). As a consequence, the parties may distort their offers less, so more efficient trade can occur.

Additionally, liability rules have an information-forcing quality that has heretofore gone unnoticed: They can induce entitlement holders to signal credible information about their valuation. Under a liability rule, high-valuing owners never offer to sell their entitlement, and low-valuing owners never offer to bribe potential appropriators not to take. Consequently, the type of transaction that the owner willingly offers credibly signals her relative valuation.[228] Liability rules thus can cause entitlement holders to partition themselves into two valuation groups,[229] thereby reducing the aggregate amount of private information and increasing Coasean efficiency. We showed that this result is remarkably robust, in that the owner's incentive to reveal her relative valuation is independent of either side's behavior[230] or specific assumptions about the form of the bargaining game.

The academy's failure to view liability rules as catalysts (rather than substitutes) for bargaining has led it not only to misprescribe *when* such rules are appropriate, but also to misprescribe what *type* of liability rules are optimal. Numerous scholars have argued that liability rules should be tailored to replicate the transaction the individual litigants might have made had they bargained.[231] We have demonstrated, however, that when private information is the dominant transaction cost, tailored rules can actually impede efficient bargaining by making bargainers more reluctant to reveal information. Tailored damages give the plaintiff added information about the default "price" for a taking, while tailored liability gives the defendant added information about whether such damages will ever be assessed. This additional dimension of private information actually forecloses the possibility that both species of

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227. *See* Johnston, *supra* note 29, at 6–7.

228. For instance, if an entitlement-holding plaintiff makes the statement, "I am interested in selling you my entitlement," the defendant knows that only a low-valuing plaintiff could have made such a statement. Conversely, if the plaintiff makes the statement: "I am interested in buying your option to take," the defendant knows that only a high-valuing plaintiff could have made such a statement. *See supra* part II.B.3.

In Part II, we also showed that reverse liability rules can analogously induce potential takers ("defendants" model) to reveal whether their valuations are greater than or less than the damage amount. *See supra* part II.B.4.

229. If it is costly to make Coasean offers, entitlement holders will often partition themselves into three groups: high-valuing owners, who will offer defendants a bribe not to take; low-valuing owners, who will offer to sell their entitlement for a price below the damage amount; and intermediate-valuing owners, who will refrain from either type of bargaining. For a more thorough description of intermediate-valuing owners, see *supra* note 89.

230. For a slight caveat to this assertion, see *supra* note 60.

231. *See, e.g.*, POSNER, *supra* note 1, at 62 n.5 (noting that when courts assess damages inaccurately, liability rules may not be beneficial vis-à-vis property rules); Calabresi & Melamed, *supra* note 12, at 1125 (pointing out that liability rules "approximat[e] . . . the value of the object to its original owner").

Coasean bargains will occur under liability rules.[232] Thus, while tailored liability rules may be appropriate when transaction costs make bargaining impracticable, lawmakers choosing liability rules to facilitate trade should be careful not to make the legal rule contingent on the parties' private information.

The ability of Solomonic entitlements such as untailored liability rules to facilitate Coasean trade is starkly at odds with the accepted wisdom that property rules are "market-encouraging" when transaction costs are low.[233] Property rules and liability rules may thus run neck and neck in a Coasean horse race, even when transaction costs are low;[234] and when private information is the major source of inefficiency, liability rules and other divided entitlement forms may hold the lead.[235]

While our arguments favoring divided entitlements arise from an economic concern about the ways that private information can impede negotiation,[236] these arguments also dovetail nicely with theories of psychological barriers to negotiation. Several experiments have shown that people tend to value an object more once they identify the property as their own, and that this "endowment" or "framing" effect is independent of any attachments that might develop over time.[237] For example, in an oft-cited experiment, Daniel Kahneman, Jack Knetsch, and Richard Thaler explored subjects' willingness to buy or sell a coffee mug. The authors gave one group (the "buyers") the opportunity to "buy" a mug instead of giving them monetary compensation for participating in the experiment. They gave the other group (the "sellers") an initial "endowment" of the mug as a gift at the beginning of the experiment, then gave them the chance to sell their newly acquired property.[238] The authors found that the sellers' valuations were more than double the buyers'

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232. Indeed, as we showed in Part II, tailoring of either damages or liability in our model reduces to zero the probability that the plaintiff would buy the defendant's call option. *See supra* text accompanying notes 116–31.

233. *See, e.g.*, Levmore, *supra* note 17, at 83–84.

234. We demonstrated these results in models with a precise definition of transaction costs. Instead of artificially assuming a fixed cost of contracting, *see, e.g.*, Ayres & Gertner, *supra* note 74, at 732–33, the models in this Article highlight the real-world inefficiencies caused by bargainers' private information.

235. Even when transaction costs are low, the choice of the efficient entitlement form may be significant. The amounts of social inefficiency are not bounded above by the costs of contracting. *See id.*

236. For an analogous exploration of the adverse selection inefficiency in bargaining, see Brown & Ayres, *supra* note 15, at 331–35.

237. *See, e.g.*, David Kahneman & Amos Tversky, *Advances in Prospect Theory: Cumulative Uncertainty*, 9 J. RISK & UNCERTAINTY (forthcoming 1994); David Kahneman & Amos Tversky, *Conflict Resolution: A Cognitive Perspective*, *in* BARRIERS TO RESOLUTION, *supra* note 188.

238. Daniel Kahneman et al., *Experimental Tests of the Endowment Effect and the Coase Theorem*, 98 J. POL. ECON. 1325 (1990) [hereinafter Kahneman et al., *Experimental Tests*]; *see also* Daniel Kahneman et al., *The Endowment Effect, Loss Aversion, and Status Quo Bias*, 5 J. ECON. PERSP., Winter 1991, at 193, 194–97 (1991) (describing this and similar experiments); George Loewenstein & Samuel Issacharoff, *Source Dependence in the Valuation of Objects*, 7 J. BEHAVIORAL DECISION MAKING 157 (1994) (finding that means by which people obtain objects impacts valuation of their property); Amos Tversky & Daniel Kahneman, *Loss Aversion in Riskless Choice: A Reference Dependent Model*, 106 Q.J. ECON. 1039 (1991).

valuations, even though the experiment presented the subjects with an identical economic choice.[239] This type of framing effect can impede trade by narrowing the set of mutually acceptable prices.[240] But divided entitlements may mitigate such cognitive barriers: As emphasized above, probabilistic entitlements obscure the identity of the buyer and the seller, so we might predict that this entitlement division would reduce, or even eliminate, ownership bias. Similarly, if the parties understood that in a liability rule regime, the nominal owner's claim was subject to another's call option, then the adverse cognitive effects might be less severe.[241]

Our conclusion that uncertain and weakly protected entitlements might produce more efficient trade than undivided property rights runs counter to deeply held but possibly unexamined beliefs. For a large range of applications, undivided property rules remain the most efficient scheme; yet our analysis suggests that the justification for undivided property rules cannot reside in the simple (*a priori*) assertion that undivided entitlements promote more efficient trade. Undivided entitlements sometimes may be preferable for a number of traditional reasons: As many commentators have seen, property regimes may produce superior incentives to create and develop wealth. Or, as suggested above, undivided claims may be appropriate because Solomonic regimes cannot adequately identify and exclude low-valuing claimants who would hold up beneficial trade.[242] Our earlier list of contraindicators is not exhaustive.[243] Nevertheless, the ubiquitous claim that strong property regimes promote trade, and are therefore most effective at eliciting the parties' revealed

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239. *See* Kahneman et al., *Experimental Tests*, *supra* note 238, at 1338.

240. The endowment effect as a barrier to trade may not be inconsistent with efficiency if the divergent preferences of the endowed and unendowed bargainers are taken at face value. *See* Daniel S. Levy & David Friedman, *The Revenge of the Redwoods?: Reconsidering Property Rights and the Economic Allocation of Natural Resources*, 61 U. CHI. L. REV. 493, 506–15 (1994) (describing circumstances in which endowment bias may be consistent with rational decision making).

241. Divided entitlements, however, are unlikely to facilitate value-enhancing trade if the costs of negotiation, or "toll costs," are the sole impediment to Coasean efficiency. Divided entitlements, such as liability rules, may be efficient if toll costs are sufficiently high, but divided entitlements are not likely to produce more consensual trade than property rules when there is no informational or psychological barrier to trade.

242. Solomonic regimes may be particularly difficult to sustain over time. The teleological rationale for Solomonic entitlements is reunification of the entitlement in the hands of the highest valuer. Solomonic divisions therefore are intended to be transitory allocations. After Solomonic negotiations produce undivided entitlements, subsequent events may create uncertainty about who is the highest valuer. It may be difficult for a Solomonic regime to divide an entitlement repeatedly among ensuing generations of potential owners, and the prospect of continual reallocations may undermine initial bargainers' incentives to purchase.

243. Undivided property rule allocations might foster competition among multiple sellers or buyers. For example, technical economic models have explored the effects on bargaining outcomes of an increase in the number of parties. *See, e.g.*, Thomas A. Gresik & Mark A. Satterthwaite, *The Rate at Which a Simple Market Converges to Efficiency as the Number of Traders Increases: An Asymptotic Result for Optimal Trading Mechanisms*, 48 J. ECON. THEORY 304 (1989); Robert Wilson, *Incentive Efficiency of Double Auctions*, 53 ECONOMETRICA 1101 (1985). But there are many contexts in which two (or a small set of) parties have bilateral (or multilateral) control over the allocation of idiosyncratic gains from trade. Moreover, divided entitlement allocations may not be inconsistent with competition. For example, giving a buyer call options on multiple sellers may facilitate competition, in part by destabilizing seller collusion.

preference, does not withstand close analysis. The Coasean impulse to bargain transcends many entitlement structures and may even be strongest when claims are divided among the class of potentially efficient owners.

APPENDIX

A. *Derivation of Liability Rule Results*

This portion of the Appendix derives the equilibrium outcomes of the stylized bargaining game considered in Part II. Recalling our notation, let v_π denote the plaintiff's valuation, and let v_Δ denote the defendant's valuation. v_π is assumed to be distributed uniformly on [0,100], while v_Δ is a discrete and independent random variable, distributed on [40,60] with equal (1/2) probabilities. As an evaluative measuring stick, consider the expected social welfare associated with a "first-best" allocation (ESW^{fb}), in which the highest valuer always receives the entitlement:[244]

$$ESW^{fb} = \tfrac{1}{2}[\$40 \cdot Pr\{v_\pi < \$40\} + E\{v_\pi | v_\pi \geq \$40\} \cdot Pr\{v_\pi \geq \$40\}] + \tfrac{1}{2}[\$60 \cdot Pr\{v_\pi < \$60\} + E\{v_\pi | v_\pi \geq \$60\} \cdot Pr\{v_\pi \geq \$60\}].$$

Given the assumed distributions, it is straightforward to calculate the value of ESW^{fb} to be $63.00.

We consider a game of bargaining under incomplete information that has the following rules. In the first stage of the game, the plaintiff is allowed to send a "signal" to the defendant indicating which type of transaction she would like to enter. The plaintiff can either signal "Mβ" (or "make me a buy offer for my entitlement"), or she can send the signal "Mσ" (or "make me a sell offer on your call option"). After hearing the signal, the defendant makes the requested type of offer: Either he offers to buy the plaintiff's entitlement for some amount β, or he offers to sell the plaintiff his option position for some demanded amount σ.[245] This is a take-it-or-leave-it offer.

Upon hearing either offer, the plaintiff may either accept it (A_i) or reject it (R_i), where $i = \beta,\sigma$. If the plaintiff who signaled Mβ accepts the defendant's buy offer β, then the plaintiff receives a payoff of β (she sells her entitlement but gets the offered price $β), and the defendant gets a payoff of v_Δ-β (he enjoys undivided interest in the entitlement, but must pay $β). Conversely, if the Mβ signaling plaintiff rejects, then the players enter the "noncooperative" litigation game that they would play in the absence of bargaining: The defendant can play "Take" or "No Take," corresponding to a decision whether

244. Note that since $v_\pi \sim U[0,100]$, the density of v_π must be 1/100 over that interval.

245. Though we constrain the defendant to make the requested type of offer, the truth of the plaintiff's signal would actually be enough to induce the defendant to make that type of offer even if the rules did not constrain him. It is therefore quite simple to transform this game into a true "cheap talk" model. In their recent manuscript, Kaplow and Shavell assert a model where such pre-bid signaling is not permitted. Their model therefore does not detect any bargaining-facilitating effects of liability rules, stressing instead the "Hobbesian"—or autarkic—rationale for liability rules. *See* Kaplow & Shavell, *supra* note 101, at 28 n.31 ("[W]e expect the liability rule to be superior to property rules because, under a liability rule there is a lessor need for the parties to engage in bargaining.").

or not, upon bargaining breakdown, he will induce a nonconsensual transfer of the entitlement. If the defendant decides not to take, then the plaintiff enjoys her private valuation v_π, while the defendant gets nothing. Conversely, if the defendant does take, the plaintiff can play either "Suit" or "No Suit." If the plaintiff files suit, she is assumed to win with probability one (i.e., there is no judicial "error" as such) and collect the $D in damages. A similar description follows the path subsequent to a plaintiff signal of "Mσ."

As Harsanyi has shown,[246] because this is a game of incomplete information, it can be modeled as a game of imperfect information through the introduction of a "nature" player (player number 0 in the text) who initially chooses the player types (v_π, v_Δ). A course representation of the extensive form of the bargaining game is contained in Figure A1.

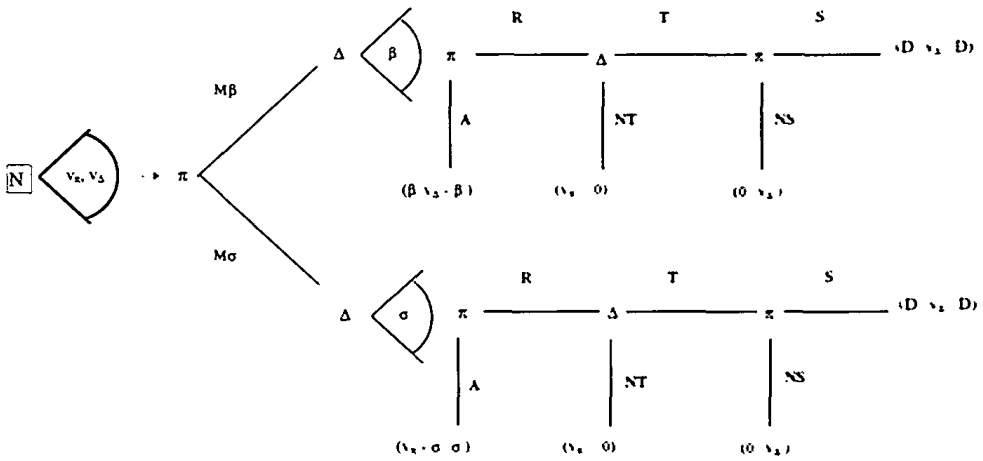

FIGURE A1. *Extensive Form Representation of Bargaining Game for Liability and Property Rules*

Note that this representation is "course" because it shows only a representative branch of the "continuation game" after nature has chosen the player types. There is in actuality a continuum of those branches. Moreover, because each player is aware only of her type, neither is completely certain which branch she is in (though each can rule out certain branches). This means that this

246. *See* John C. Harsanyi, *Games with Incomplete Information Played by "Bayesian" Players, I-III*, 14 MGMT. SCI. 159 (1967).

game has no singleton information sets, as is usually the case in signaling games.[247]

Upon inspection of this game, it is immediately clear that, should the game progress to the right-most decision node, a rational plaintiff will always file suit no matter what the size of the liability amount, so long as $D \geq 0$, which we henceforth assume. Thus, any perfect Bayesian equilibrium (PBE) must call for the plaintiff to play "Suit" on or off the equilibrium path. Working backward, it becomes apparent that the defendant's decision whether to "take" depends on whether his valuation is above or below the liability amount D. There are thus three relevant intervals for D: $D \leq \$40$, $\$40 < D \leq \$60$, and $D > \$60$. Although the text compares only damage amounts of $100 and $50, for clarity we analyze all the relevant cases below *ad seriatim*. Before proceeding, however, the reader should note that when $D > \$60$, the liability rule effectively reproduces a pro-plaintiff property right, since no defendant would take absent a consensual transaction. Conversely, when $D < \$40$, the law gives a theoretical equivalent of a property right to the defendant (albeit combined with a type of lump-sum transfer to the plaintiff).[248]

In each case, we will establish our main assertion: that rational plaintiffs for whom $v_\pi \leq D$ never have an incentive to play $M\sigma$ (which would signal a desire to bribe the defendant not to take), and plaintiffs for whom $v_\pi > D$ never have an incentive to play $M\beta$ (which would signal a desire to transfer entitlement to the defendant consensually). We use the notion of "rationalizability"—the Bayesian cousin of iterated strict dominance—to make this point. We will then calculate the equilibrium strategies under each case.

Case (a): D > $60

> PROPOSITION 1A: When $D > \$60$, all perfect Bayesian outcomes of the above signaling game are supported by a "partitioning" strategy of the plaintiff types, where the plaintiff signals $M\beta$ if $v_\pi \leq D$ and signals $M\sigma$ if $v_\pi > D$.

The proof of this proposition is as follows. We first note that any perfect Bayesian equilibrium must involve "rationalizable" strategies—i.e., strategies that survive iterated removal of irrational actions.[249] (Note that for two-player

247. Because of the technical difficulty in doing so, we have not attempted to represent the players' information sets in the above diagram. Nevertheless, they must be considered as a component of any signaling equilibrium.

248. Noting this point again is important, since it exposes the fact that a "true" liability rule (in a strategic sense) depends on the defendant's value as well as the plaintiff's. It is therefore somewhat uninstructive to think of liability rules and bargaining solely in terms of damage amounts that depend only on plaintiffs' valuations.

249. *See* B. Douglas Bernheim, *Rationalizable Strategic Behavior*, 52 ECONOMETRICA 1007, 1016 (1984); David G. Pearce, *Rationalizable Strategic Behavior and the Problem of Perfection*, 52 ECONOMETRICA 1029, 1035 (1984).

games like this one, rationalizability is equivalent to iterated strict dominance). We therefore consider the set of rationalizable strategies in the game depicted above for D > $60.

When D exceeds $60, no rational defendant would ever play "Take" should the game proceed that far. Indeed, so doing would induce the plaintiff to sue with probability one (as we noted above), thereby giving the defendant a negative payoff. Thus, the parties know that absent a negotiated solution, the plaintiff's payoff must be v_π and the defendant's payoff will be 0 (regardless of his type).

Given this structure of "reservation utilities," we now work back to the bargaining stages. Consider first the branches of the game where the defendant offers to buy the plaintiff's entitlement for $\$\beta$. A plaintiff will accept this bid only if it exceeds her reservation utility v_π. Since the plaintiff's valuation, however, can take on any value between $0 and $100, acceptance is always a rationalizable action with positive probability. Iterating back, the defendant realizes that the plaintiff could rationally accept any positive bid with at least some probability. But under no circumstances will the defendant be willing to bid more than $60 for the plaintiff's entitlement (the largest valuation the defendant could have). Thus, the interval between $0 and $60 represents the range of rationalizable defendant buy offers β. Iterating back once more, it is clear that plaintiffs for whom v_π > $60 will never receive an acceptable bid by the defendant (and they thus will receive only their reservation value v_π, since no bargains are possible). Plaintiffs whose valuations are less than $60, however, stand to increase their payoffs above their reservation value of v_π by reporting $M\beta$.

Now consider branches in the game where the defendant offers to sell his call option to the plaintiff for an amount σ. Notice that when D > $60 the plaintiff knows that the defendant will never exercise the call option in equilibrium. Thus, the defendant really has nothing to sell, and acceptance of the defendant's demand is rationalizable only when σ = $0. This leaves the defendant in this branch indifferent between selling for $0 and making a frivolous offer (anything greater than zero). Thus, all offers by the defendant are equally rationalizable here, and all have the same outcome—the plaintiff gets her reservation utility v_π, and the defendant gets a zero payoff.

Finally, consider the plaintiff's choice whether to play $M\beta$ or $M\sigma$. As we have stated above, plaintiffs for whom $v_\pi \leq$ $60 stand to increase their payoffs (above v_π) by reporting $M\beta$. Thus, for these plaintiffs this strategy is the only rationalizable strategy and must be part of any perfect Bayesian equilibrium. On the other hand, all plaintiffs for whom v_π > $60 know that reaching nontrivial consensual transactions of either kind is impossible. They therefore resign themselves to receiving v_π in equilibrium. As such, these "high" plaintiffs are indifferent between reporting $M\beta$ and $M\sigma$. Moreover, the

defendant is unaffected by their ultimate decision, since he knows that his market consists only of plaintiffs for whom $v_\pi \leq \$60$.

This establishes our assertion from the text (at least for $D > \$60$) that plaintiffs whose valuation is less than the liability amount D have no affirmative incentive to signal anything other than $M\beta$, and those whose valuation exceeds the damage amount have no affirmative incentive to signal anything other than $M\sigma$. It also completes the proof of the proposition. To determine the perfect Bayesian equilibrium *outcomes* of this game, one can concentrate solely on equilibria where the plaintiff signals $M\beta$ if and only if $v_\pi \leq D$ and $M\sigma$ if and only if $v_\pi > D$. Although this constraint truncates the set of equilibrium strategy profiles of the game, it prunes only those strategy profiles that are "outcome irrelevant," in that it coerces a particular signal only from indifferent players who were destined not to consummate any Coasean bargains in the first place. Similar reasoning applies to the other two relevant intervals of D.

Imposing this behavior on the plaintiff types, then, it is extremely straightforward to calculate the equilibrium strategies and outcomes for $D > \$60$. It turns out that in this case there is a unique perfect Bayesian outcome (albeit supported by a number of strategy profiles). A representative profile looks like the following. Any defendant who receives the signal $M\sigma$ replies with a "nonserious" bid of $\sigma = \sigma^* > \$0$, which the plaintiff rejects, giving the players respective payoffs of v_π and 0. Conversely, when the defendant receives a signal of $M\beta$, he sets his buy offer β at the point that maximizes his continuation payoff. Noting that a plaintiff will accept any bid β that is greater than her reservation value v_π, the defendant maximizes the following:

$$Max_{\beta \in [0, v_\Delta]} \; Pr\{v_\pi \leq \beta \mid v_\pi \leq D\} \cdot [v_\Delta - \beta] \; + \; Pr\{v_\pi > \beta \mid v_\pi \leq D\} \cdot 0.$$

Using the fact that $v_\pi \sim U[0,100]$, the first-order conditions of this maximization problem imply that the optimal bid function, $\beta^*(v_\Delta)$, is given by

$$\beta^*(v_\Delta) = \frac{v_\Delta}{2},$$

for $v_\Delta = \$40, \$60$, which is the typical result obtained in a panoply of take-it-or-leave-it games with a distinct buyer and seller. In fact, this result is what we would expect for $D > \$60$, since such an entitlement is effectively a pro-plaintiff property rule. The above equation immediately produces the result given in Part II of the text for a "property rule" protection for the plaintiff; i.e., a \$60 defendant bids \$30 for the plaintiff's entitlement, while a \$40 defendant bids \$20. As one can see, this is a partially "separating" equilibrium in which defendants completely reveal their private information through their bid. The

expected social welfare ($ESW^{D>60}$) associated with this strategy profile, as well as all other perfect Bayesian profiles, is $59.75.

Case (b): D ≤ $40

Just as in the previous case, this case supports our partitioning hypothesis. Because of the similarity in the approach to the case of D > $60, however, we state the following proposition without proof.

> PROPOSITION 1B: When D ≤ $40, all perfect Bayesian outcomes of the above signaling game are supported by a "partitioning" strategy of the plaintiff types, where the plaintiff signals Mβ if $v_\pi \leq D$ and signals Mσ if $v_\pi > D$.

In contrast to the previous example, when D ≤ $40 it is common knowledge that, absent a negotiated agreement, the defendant will take with probability one. Thus, the reservation utilities for the plaintiff and defendant are $D and $($v_\Delta$-D), respectively. Once again assuming this partitioning behavior on behalf of the plaintiff, it is straightforward to calculate the equilibrium outcomes of this game. A representative strategy profile looks like the following. Any defendant who receives a signal of Mβ replies with a "nonserious" buy offer of $\beta = \beta^{**} <$ $D, which the plaintiff promptly rejects (since she knows that she can get $D through litigation), and the parties each receive their respective reservation values. If the defendant receives the signal of Mσ, however, he sets his sell offer σ at the point that maximizes his continuation payoff. Noting that a plaintiff will accept any offer σ that ensures that her postpurchase payoff (v_π-σ) is greater than her reservation value $D, the defendant maximizes the following:

$$Max_{\sigma \in [0, v_\Delta]} \; Pr\{v_\pi - \sigma \geq D | v_\pi \geq D\} \cdot \sigma \; + \; Pr\{v_\pi - \sigma < D | v_\pi \geq D\} \cdot [v_\Delta - D].$$

The first-order conditions of this maximization problem imply that the optimal ask function, $\sigma^{**}(v_\Delta)$, is given by

$$\sigma^{**}(v_\Delta) = \frac{(v_\Delta \cdot 100)}{2} - D,$$

for v_Δ = $40, $60. The above equation immediately produces the result given in Part II of the text for "property rule" protection for the defendant, a case not discussed explicitly in the text. Note that this equilibrium is also separating, since the different types of defendants make different sell offers. The expected social welfare ($ESW^{D \leq 40}$) associated with this strategy profile, as well as all other perfect Bayesian profiles, is $59.75, just like the earlier case.

Case (c): $40 < D ≤ $60.

As in the previous two cases, this interval also supports our partitioning hypothesis. And once again, because of the similarity in the approach to the case of D > $60, we state the following proposition without proof:

> PROPOSITION 1C: When $40 < D ≤ $60, all perfect Bayesian outcomes of the above signaling game are supported by a "partitioning" strategy of the plaintiff types, where the plaintiff signals Mβ if $v_\pi ≤ D$ and signals Mσ if $v_\pi > D$.

This is probably the most interesting of the three cases, since absent negotiation, the defendant types are destined to take different actions. Low-valuing defendants will not take while high-valuing defendants will take and pay the liability amount. This gives $40 defendants and $60 defendants reservation utilities of $0 and $(60-D), respectively. The plaintiff's reservation value, as given in Part II of the text, is $(v_π/2 + D/2).

We can now calculate the equilibrium outcome for this intermediate range of damage amounts. Since this game has no equilibria involving mixed strategies by the defendant in making buy offers β or sell offers σ,[250] we concentrate on characterizing a possible pure strategy equilibrium.

Unlike the previous two cases, there are now two nontrivial types of transactions that can occur. These transactions, labeled Coasean bargains #1 and #2 in the text, take the following forms. In the first, the defendant offers to sell his call option to the plaintiff at a price of σ. The plaintiff is interested in such a transaction, however, only if she thinks she is buying out the position of a $60 defendant; for the $40 defendant does not present a threat to take, and therefore has nothing to sell. Consequently, if the defendant ever submits a sell offer that reveals him to be a $40 defendant, the plaintiff will surely reject that offer. Note further, however, that the $40 defendant would *like* to have his sell offer accepted by the plaintiff, as acceptance would give him a payoff of σ rather than a sure payoff of $0 should no agreement be reached.

In a similar vein, the second type of Coasean bargain entails the defendant offering to buy the plaintiff's entitlement for a price of β, which is less than the liability amount of $D. The plaintiff is interested in such a transaction, however, only if she thinks she is selling to a $40 defendant, who otherwise would not take; the $60 defendant is not an attractive trading partner for this type of transaction, since negotiation failure would result in a nonconsensual taking by this defendant, but would garner the plaintiff a payoff of $D—more than any rationalizable value of β. Consequently, if the defendant ever submits

250. We do not attempt to prove this here. A more rigorous analysis appears in a separate piece by coauthor Talley that also takes a more general approach to bargaining in the shadow of default entitlements. *See* Talley, *supra* note 14, at 7–13.

a buy offer that reveals him to be a $60 defendant, the plaintiff will surely reject that offer. Once again, however, the $60 defendant would *like* to have his bid accepted by the plaintiff, as acceptance would lower the price that he would otherwise have to pay for a nonconsensual taking (since $\beta \leq D$). Given the above reasoning, we immediately arrive at the following corollary:

> COROLLARY 1: For $D \in (40,60]$, all pure strategy perfect Bayesian equilibria of bargaining game Γ involve complete pooling among the defendant types in choosing β and σ.

The above corollary allows us to limit our attention to equilibria of Γ in which the optimal bidding strategies for each defendant type are equal (i.e., $\beta^{**}(40) = \beta^{**}(60) \equiv \beta^{**}$) and the optimal sell offers of each defendant type are equal (i.e., $\sigma^{**}(40) = \sigma^{**}(60) \equiv \sigma^{**}$).

While the above results allow us to parse down significantly the various types of equilibria in this game, it turns out that the concept of Bayesian perfection is not capable of narrowing down the class of equilibria beyond the reach of Proposition 1a and Corollary 1. Indeed, for every hypothetical PBE involving pooled strategies σ^{**} and β^{**}, the sustainability of that equilibrium depends on the reaction of the plaintiff to *deviations* from the pooled offering strategies.[251] In the previous two cases, the plaintiff's reactions were easy to gauge, since she did not care which type of defendant issued a bid or ask; beliefs were irrelevant. In this case, however, the plaintiff has a vested interest in knowing whether a deviating offer was issued by a high- or low-valuing defendant. Because the concept of PBE does not specify an off-equilibrium belief structure, one cannot pin down a unique PBE. Thus, we have:

> COROLLARY 2: For $D \in (40,60]$, there is a continuum of pure strategy perfect Bayesian equilibria of bargaining game Γ involving pooled offers of σ^{**} and β^{**}.

Unfortunately, even some of the immediately obvious refinements to the PBE concept do not yield unique equilibria. The belief restrictions of sequential equilibrium[252] and even the added restriction of equilibrium domination[253] are insufficient to establish unique equilibrium.

The stronger refinement notion of "divinity,"[254] however, is immensely helpful, and it turns out that imposing the requirements of divinity allows us to pin down a single equilibrium outcome. In fact, this equilibrium outcome has an intuitively appealing form:

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251. Clearly, along the equilibrium path, the plaintiff places a 1/2 probability that β^{**} or σ^{**} is sent by a $40 defendant.

252. *See* David M. Kreps & Robert Wilson, *Sequential Equilibria*, 50 ECONOMETRICA 863 (1982).

253. *See generally* Cho & Kreps, *supra* note 91.

254. *See generally* Banks & Sobel, *supra* note 91.

PROPOSITION 2: For $D \in (40,60]$, there is a unique divine equilibrium outcome involving pooled pure strategy offers, σ^{**} and β^{**}, that correspond to the most-preferred PBE strategy of the high- and low-valuing defendants, respectively.[255]

Proposition 2 provides a convenient recipe for calculating the equilibrium offers of the defendant types. More important, Proposition 2 is extremely intuitive. As noted above, each of the two possible Coasean transactions will entail one bona fide offeror type (the $60 defendant in the case of sell offers σ, and the $40 defendant in the case of buy offers β), and one "pretender" who mimics the bona fide type's behavior. Proposition 2 states that the unique divine equilibrium of this game allows the $60 defendant to make his most-preferred sell offer σ, given that the $40 defendant will mimic that offer; and it allows the $40 defendant to make his most-preferred buy offer β, given that the $60 defendant will mimic that offer. This equilibrium coincides with a slightly different strategic situation in which the bona fide offeror in each case specifies his price first, and is then copied by the "pretender."[256]

Thus, consider the "optimal" offers for the bona fide type under each branch of the game Γ. Suppose first that the plaintiff signals $M\beta$, indicating that her valuation is below D, and that she is interested in perhaps selling her entitlement for $\beta \leq D$. By Corollaries 1 and 2, we know that the equilibrium must involve a pooled bid β from both types of defendants. Upon receiving this bid, the plaintiff knows that rejecting it will give her an expected payoff of $(v_\pi + D)/2$, and thus the probability that she accepts this bid is given by

$$Pr\{\pi \text{ accepts } \beta\} = Pr\{\beta \geq \frac{(v_\pi + D)}{2} \mid v_\pi \leq D\} = \frac{2\beta - D}{D}.$$

Accordingly, the pooled bid that maximizes the expected return of the "bona fide" bidder type (v_Δ = $40) is the value of β that solves

$$Max_{\beta \in [0,40]} [\frac{2\beta - D}{D}] \cdot [40 - \beta].$$

As is easily confirmed, the first-order conditions of this maximization problem imply that the equilibrium pooled bid of the defendant is

$$\beta^{**} = 20 + \frac{D}{4},$$

which is equal to $32.50 when D = $50, the result given in the text.

A similar analysis applies to deriving the pooled equilibrium sell offer σ^{**}. Here, we find that the optimal offer for the "bona fide" $60 defendant is

255. The proof of this Proposition is omitted.

256. The driving force behind this equilibrium is the fact that off-equilibrium beliefs are such that any rationalizable deviation from the equilibrium behavior induces a belief that it came from either type with a 1/2 probability.

$$\sigma^{**} = 55 - \frac{3D}{4},$$

which is equal to $17.50 when D = $50, as given in the text.

Piecing the three regions together, we can plot the relationship between expected social welfare and information costs.

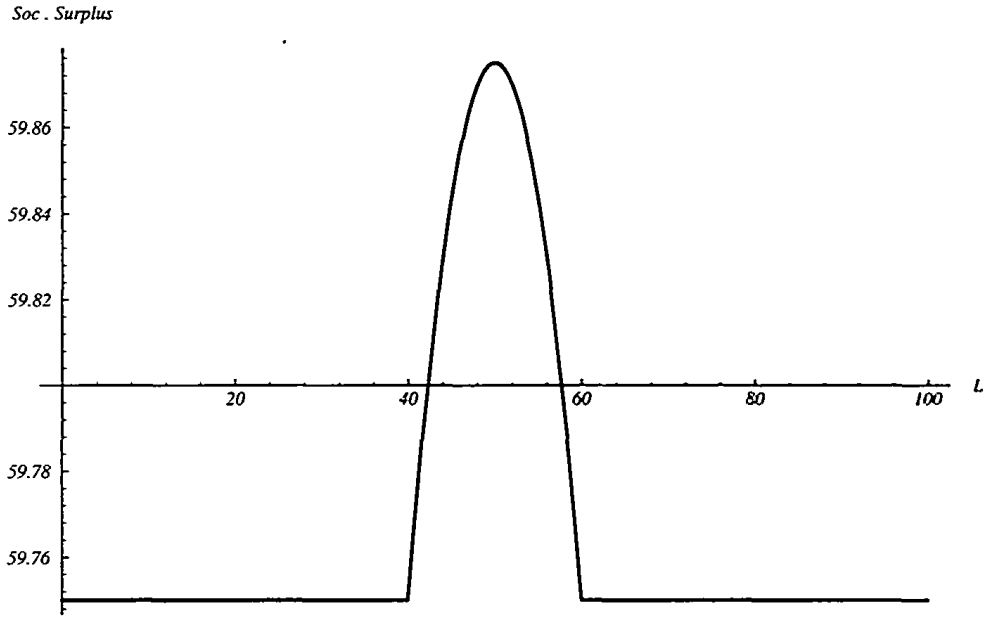

FIGURE A2. *Expected Social Welfare for Different Damage Amounts*

From Figure A2, one can see that social welfare has a "single-peaked" quality, in which welfare does not depend on D for all values of D that are less than $40 or greater than $60. These all represent "property-like" protections, since they ensure, respectively, that the defendant will always take, or that the defendant will never take absent a consensual transfer. For damage amounts that are more intermediate in nature, however (i.e., between $40 and $60), the welfare function is parabolic in shape, and its global maximum occurs at D = $50. Here, expected social welfare is equal to $59.875. Thus, expected social welfare increases continuously from the same value as property-like rights to a maximum at the mean valuation for the parties ($50).

B. *The Perverse Effects of Tailoring*

Below, we briefly show how the above model can be used to derive the results from the Section on "tailored" liability rules.[257] We consider tailored negligence and liability separately.

1. *Tailored Damages*

Suppose that instead of a fixed liability amount, the court awarded the plaintiff her valuation v_π. The defendant, on the other hand, will take only if his valuation v_Δ exceeds the expectation of the plaintiff's damages (or \$50). Thus, the \$40 defendant expects a payoff of \$0 absent bargaining, while the \$60 defendant expects a payoff of \$10 (= \$60-\$50) absent bargaining.

Tailored damages effectively give the plaintiff a form of "perfect insurance" against a taking by the defendant. As such, the plaintiff will never wish to pay a positive amount to discourage a taking by the defendant. Indeed, paying the defendant not to take could only earn the plaintiff her private valuation less the cost of the bribe. Thus, it is rationalizable for all types of plaintiff to play $M\beta$ in the first stage of the game.

Assuming, then, that all plaintiffs play $M\beta$, let us construct the (unique) perfect Bayesian outcome of the bargaining game within this legal environment. Because the plaintiff is guaranteed her private valuation, she is unconcerned whether the defendant's bid, β, reveals that the defendant is high- or low-valuing. The only factor influencing π's decision is whether the bid exceeds her private valuation v_π.

The \$40 defendant (who as noted receives nothing absent bargaining) will set his bid so as to maximize his expected net revenue:

$$Max_{\beta \geq 0} \frac{\beta}{100} \cdot [40-\beta],$$

which is maximized at β = \$20.

The \$60 defendant, on the other hand, faces a more complex decision. As mentioned above, absent bargaining, the \$60 defendant will take, willingly bearing the expected \$50 liability payment. If the \$60 defendant makes a bid to buy the plaintiff's entitlement, however, then the defendant ultimately might decide not to take for one of two reasons. Either (1) the plaintiff will have accepted the defendant's bid β, or (2) the plaintiff will have rejected his bid, but his "updated" assessment of the type of plaintiff he faces induces him to abstain from taking. Thus, the \$60 defendant chooses β to maximize the following:

257. *See supra* part II.C.

$$Max_{\beta \geq 0} \frac{\beta}{100} \cdot [60 - \beta] + \frac{100-\beta}{100}[Max\{0, 60 - E\{v_\pi | v_\pi > \beta\}\}],$$

or, equivalently,

$$Max_{\beta \geq 0} \frac{\beta}{100} \cdot [60 - \beta] + \frac{100-\beta}{100}[Max\{0, 10 - \beta/2\}].$$

Analyzing the cases of $\beta \leq \$20$ and $\beta > \$40$ separately, we find that there are two local maxima of this objective function, but that the global maximum occurs at $\beta = 0$—a nonserious bid. We thus have the result outlined in the text for tailored damages. The expected social surplus in this case is \$58 (= (.5)\$60 + .5[(.2)\$40 + (.8)\$60]).

2. *Tailored Liability*

Consider now the case of tailored liability, in which the court imposes damages of \$50 on a defendant whenever he is found to be negligent (*i.e.*, $v_\Delta < E\{v_\pi\}$). In such a situation, the \$60 defendant is never found to be negligent, and therefore always takes absent bargaining, paying no damages. The \$40 defendant, on the other hand, is always found to be negligent, and thus never takes absent bargaining. Consequently, the plaintiff's expected payoff absent bargaining is $v_\pi/2$ (i.e., 0 and v_π, each with probability 1/2).

When the plaintiff plays $M\beta$ in the first round, she may expect serious offers only from the \$40 defendant. Indeed, the \$60 defendant is in a similar situation to the plaintiff in the previous Section: He receives his valuation regardless of whether a transaction is made. Upon playing $M\beta$, then the plaintiff proceeds as if she is facing a \$40 defendant. Thus, the \$40 defendant will enter a bid of \$20 (just as before), with the \$60 defendant once again entering a frivolous bid of \$0.

On the other hand, should the plaintiff play $M\sigma$, then the \$60 defendant might be interested in such a transaction. The \$60 defendant, however, will offer to sell his right to take for no less than \$60. Clearly, there is a potential here for a Coasean improvement. Unfortunately, when the plaintiff plays $M\sigma$, the \$40 defendant has the incentive to mimic the behavior of the \$60 defendant. Consequently, the plaintiff hearing a sale offer of σ will only accept it if her postcontractual payoff, $v_\pi - \sigma$, exceeds her expected reservation utility, $v_\pi/2$. Equivalently, it is easily verified that no plaintiff whose valuation is at most \$100 is willing to accept any sell demand in excess of \$50. Since the only bona fide seller in this situation is the \$60 defendant, then *no such transactions are ever made.* We can thus conclude that the only types of plaintiffs who are not indifferent between $M\beta$ and $M\sigma$ are those for whom $v_\pi \leq \$20$. We therefore have the same equilibrium outcome we had in the case of tailored damages. Once again, the expected social surplus is \$58.

C. *Derivation of Fractional Property Rule Results*[258]

This Section derives the results from the fraction model of Part III. Recall from the text that the reservation utilities of the two players are qv_π for the plaintiff and $(1-q)v_\Delta$ for the defendant. Further, recall that the allocation and pricing rule associated with reports of r_π and r_Δ as described in the text is as follows: If $r_\pi \geq r_\Delta$, then π receives the injunctive right, but must pay Δ a price of

$$(1-q)\cdot\left(\frac{r_\pi + r_\Delta}{2}\right).$$

Conversely, if $r_\Delta > r_\pi$, then Δ receives the injunctive right, but must pay π an price of

$$(q)\cdot\left(\frac{r_\pi + r_\Delta}{2}\right).$$

In equilibrium, suppose that the players adopt a reporting strategy $r_i(v_i)$, where $i = \pi,\Delta$. Let $g_\pi(.)$ and $g_\Delta(.)$ represent the density of r_π and r_Δ, respectively, with $G_\pi(.)$ and $G_\Delta(.)$ representing the respective cumulative distribution functions, and r-upper bar and r-lower bar representing the supremum and infimum of the equilibrium bids. The plaintiff's net gain in making his report r_π is given by

$$R_\pi(r_\pi|v_\pi) = \int_{\underline{r_\pi}}^{\overline{r_\Delta}} \left[\frac{q}{2}(r_\pi + r_\Delta) - qv_\pi\right] dG_\Delta(r_\Delta) + \int_{\underline{r_\Delta}}^{r_\pi} \left[(1-q)v_\pi - \frac{(1-q)}{2}(r_\pi + r_\Delta)\right] dG_\Delta(r_\Delta).$$

Similarly, the defendant's net gain in making her report r_Δ is given by

$$R_\Delta(r_\Delta|v_\Delta) = \int_{\underline{r_\pi}}^{r_\Delta} \left[qv_\Delta - \frac{q}{2}(r_\pi + r_\Delta)\right] dG_\pi(r_\pi) + \int_{r_\Delta}^{\overline{r_\pi}} \left[\frac{(1-q)}{2}(r_\pi + r_\Delta) - (1-q)v_\Delta\right] dG_\pi(r_\pi).$$

The first-order conditions associated with maximizing the above functions are, respectively:

258. The analysis below follows Chatterjee & Samuelson, *supra* note 134, and Cramton et al., *supra* note 133.

$$(v_\pi - r_\pi)g_\Delta(r_\pi) + \frac{q}{2} - \frac{1}{2}G_\Delta(r_\pi) = 0,$$

$$(v_\Delta - r_\Delta)g_\pi(r_\Delta) + \frac{(1-q)}{2} - \frac{1}{2}G_\pi(r_\Delta) = 0.$$

It is possible to solve these differential equations, though not uniquely,[259] and arrive at the following equilibrium strategies:

$$r_\pi^*(v_\pi) = \frac{2}{3}v_\pi + \frac{25}{3} + \frac{50q}{3},$$

$$r_\Delta^*(v_\Delta) = \frac{2}{3}v_\Delta + 25 - \frac{50q}{3}.$$

Using these optimal reports for the parties, we can conclude that π receives the entitlement if and only if

$$r_\pi^*(v_\pi) \geq r_\Delta^*(v_\Delta),$$

or, equivalently, when

$$v_\pi \geq v_\Delta + 25 - 50q.$$

This is the equation given in the text.

259. *See* Chatterjee & Samuelson, *supra* note 134, at 842.