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Oren Bar-Gill
Harvard Law School

Nicola Persico
Kellogg School of Management

ARTICLES

BOUNDED RATIONALITY AND THE THEORY OF PROPERTY

Oren Bar-Gill and Nicola Persico***

Strong, property rule protection—implemented via injunctions, criminal sanctions, and supercompensatory damages—is a defining aspect of property. What is the theoretical justification for property rule protection? The conventional answer has to do with the alleged shortcomings of the weaker liability rule alternative: it is widely held that liability rule protection—implemented via compensatory damages—would interfere with efficient exchange and jeopardize the market system. We show that these concerns are overstated and that exchange efficiency generally obtains in a liability rule regime—but only when the parties are perfectly rational. When the standard rationality assumption is replaced with a more realistic bounded rationality assumption, liability rules no longer support exchange efficiency. Bounded rationality thus emerges as a foundational element in the theory of property.

* William J. Friedman and Alicia Townsend Friedman Professor of Law and Economics, Harvard Law School (email: bargill@law.harvard.edu).

** Professor of Managerial Economics and Decision Sciences, Kellogg School of Management (email: nicola@nicolapersico.com). We thank Ronen Avraham, Omri Ben-Shahar, Oliver Board, Rick Brooks, Ryan Bubb, Peter DiCola, Richard Epstein, Lee Fennell, Clay Gillette, David Gilo, Howell Jackson, Louis Kaplow, Lewis Kornhauser, Saul Levmore, Anup Malani, Yoram Margalioth, Alan Miller, Roger Myerson, Dotan Oliar, Gideon Parchomovsky, Michele Piccione, Ariel Porat, Eric Posner, Phil Reny, Ariel Rubinstein, Ira Rubinstein, Steve Shavell, Peter Siegelman, Joseph Singer, Henry Smith, Holger Spamann, Kathy Strandburg, Balazs Szentes, Eric Talley, Joel Watson, Asher Wolinsky, Stephane Wolton, and conference and workshop participants at Haifa University, Harvard University, New York University, Northwestern University, Tel-Aviv University, University of Chicago, University of Connecticut, the Annual Meeting of the American Law and Economics Association, and the Theoretical Law and Economics Conference for helpful comments. Michelle Adler provided excellent research assistance.

INTRODUCTION

Property rights are commonly enforced by property rules, which are characterized by injunctive relief for the right holder and harsh sanctions for the infringer. Indeed, any theory of property must explain and justify the link between property rights and property rules. In this Article, we argue that the conventional justification fails. This failure can be attributed to the standard assumption that parties are perfectly rational. When the rationality assumption is relaxed, a novel justification emerges for the dominance of property rules. Bounded rationality provides the hitherto underappreciated foundation for the theory of property.

Consider the following example: After hours of hard work at the library, you leave your laptop on the table and step outside for a well-deserved break. Working at a nearby table, I lift my head and see the laptop. I walk over, pick it up, and place it in my backpack. I have taken your laptop without your consent. What are the legal consequences? If I am caught, I will be forced to return the laptop to you. I might also be prosecuted for theft and subjected to a criminal sanction. Your property right to the laptop is protected by a "property rule." Such a rule, characterized by injunctive relief and harsh sanctions, provides you, the right holder, with strong protection.[1] The alter-

1 The dispossessed owner is uniformly entitled to injunctive relief. *See, e.g.*, MASS. GEN. LAWS ANN. ch. 247, § 7 (West 2018) (describing a replevin action for goods unlawfully taken or detained); MINN. STAT. ANN. § 542.06 (West 2016) (discussing the venue for an action of replevin "to recover the possession of personal property wrongfully taken"); N.Y. C.P.L.R. § 7103 (McKinney 2018) (describing how a person may reclaim a chattel, meaning his or her personal property); WIS. STAT. ANN. § 810.02 (West 2018) (directing a return of property to the plaintiff in a replevin action prior to a final judgment if certain requirements are met). To be precise, the remedy under a claim of replevin is not precisely an injunctive remedy, but a slightly different type of in-kind remedy. Moreover, intentional encroachment of personal property without the owner's consent is criminally sanctioned as theft. *See, e.g.*, IDAHO CODE ANN. § 18-2403 (West 2018) ("A person steals property and commits theft when, with intent to deprive another of property or to appropriate the same to himself or to a third person, he wrongfully takes, obtains or withholds such property from an owner thereof."); TEX. PENAL CODE ANN. § 31.03 (West 2017) (defining theft as when "[a] person commits an offense if he unlawfully appropriates property with intent to deprive the owner of property"); *see also* CAL. PENAL CODE § 484 (West 2018); *Criminal Code Amendment (Theft, Fraud, Bribery and Related Offences) Act 2000* (Cth) pt 7.2 (Austl.); Theft Act 1968, c. 60 (Eng. & Wales). The clear preference for property rule protection of owners' rights is prevalent in every jurisdiction that we are aware of. Around the world, the unlawful taking of another's property is defined as theft, or larceny, and is punishable by law as a criminal offense. *See* THE HANDBOOK OF COMPARATIVE CRIMINAL LAW (Kevin Jon Heller & Markus D. Dubber eds., 2011) (discussing the definition of "theft" in different countries). While the definitions differ in some ways, all jurisdictions define the unlawful appropriation of objects as a criminal offense. In particular, see *id.* at 590 (discussing theft under U.S. law); *id.* at 40–41 (discussing larceny under article 162 of the Argentinian criminal code); *id.* at 125 n.219 (discussing theft under article 322 of the Canadian criminal code); *id.* at 168 (discussing chapter 5 of the Chinese criminal code, which defines the crime of "[p]roperty [e]ncroachments"); *id.* at 200 (discussing theft under article 311 of the Egyptian penal code, referring only to the taking of moveable property); *id.* at 232–33

native mode of protection, "liability rule protection," is much weaker. It requires only that the perpetrator, the taker, pay compensatory damages to the right holder.[2] While prevalent in other legal contexts, liability rules are seldom used to protect property rights in tangible personal property. I, the thief, cannot keep your laptop and just pay some damages that a court thinks sufficiently compensate you, the laptop's owner.[3]

Property rule protection is inexorably linked with the very notion of property. Injunctive relief and specific performance, through which property rules are characteristically implemented, have a long association with common-law property rights.[4] Many view the right to exclude as the defining characteristic of property.[5] And injunctive relief, the quintessential property

(discussing theft under articles 311-1 to 311-16 of the French penal code); *id.* at 278 (discussing theft under chapter 19, section 242 of the German penal code); *id.* at 311 (discussing theft under section 378 of the Indian penal code); *id.* at 342–43 (discussing theft under the Iranian law, interpreting the Quran and articles 197–203 Islamic penal code of the Islamic Republic of Iran); *id.* at 409 (discussing theft under chapter 36 (articles 235–45) of Japanese criminal code); *id.* at 440 (discussing theft under sections 158 and 161 of the Russian Federation criminal code); *id.* at 476–79 (discussing theft under South African common law); *id.* at 520 (discussing larceny under article 234 of the Spanish criminal code); *id.* at 551 (discussing theft in England under the Theft Act 1968).

2 *See* Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089, 1092 (1972); Louis Kaplow & Steven Shavell, *Property Rules Versus Liability Rules: An Economic Analysis*, 109 HARV. L. REV. 713, 757 (1996).

3 The distinction between property rules and liability rules was first proposed by Calabresi and Melamed in their pathbreaking article. *See generally* Calabresi & Melamed, *supra* note 2. This seminal contribution has spawned some of the most influential law review articles and books in the last fifty years. *See, e.g.*, IAN AYRES, OPTIONAL LAW: THE STRUCTURE OF LEGAL ENTITLEMENTS (2005) (analyzing liability rules as real options); Ian Ayres & Eric Talley, *Solomonic Bargaining: Dividing a Legal Entitlement to Facilitate Coasean Trade*, 104 YALE L.J. 1027 (1995) (studying of the effects of liability rules on bargaining behavior); Oren Bar-Gill & Lucian Arye Bebchuk, *Consent and Exchange*, 39 J. LEGAL STUD. 375 (2010) (offering an ex ante efficiency justification for property rules in an exchange setting); Lucian Arye Bebchuk, *Property Rights and Liability Rules: The Ex Ante View of the Cathedral*, 100 MICH. L. REV. 601 (2001) (analyzing the ex ante efficiency effects of property rules and liability rules); Kaplow & Shavell, *supra* note 2 (providing a systematic assessment of the relative efficiency of property rules and liability rules).

4 *See* Thomas W. Merrill & Henry E. Smith, Essay, *What Happened to Property in Law and Economics?*, 111 YALE. L.J. 357, 381 (2001) (describing Calabresi and Melamed's "property rules" as "related to the doctrines of specific performance and injunctive relief, remedies that have a long association with common-law property rights"); *see also* Daniel Friedmann, *The Efficient Breach Fallacy*, 18 J. LEGAL STUD. 1 (1989); Anthony T. Kronman, *Specific Performance*, 45 U. CHI. L. REV. 351 (1978); Alan Schwartz, *The Case for Specific Performance*, 89 YALE L.J. 271 (1979).

5 *See, e.g.*, Richard A. Epstein, *Takings, Exclusivity and Speech: The Legacy of* PruneYard v. Robins, 64 U. CHI. L. REV. 21, 22 (1997) ("[I]t is difficult to conceive of any property as private if the right to exclude is rejected."); Thomas W. Merrill, Essay, *Property and the Right to Exclude*, 77 NEB. L. REV. 730, 748 (1998) ("[T]he right to exclude seems always to accompany the right to property when and if the right becomes possessory.").

rule remedy, is seen as the natural way to enforce the right to exclude.[6] Modern property scholarship similarly associates property rights with property rule protection.[7] The economic literature on property rights assumes, without question, that these rights must be protected by property rules. Indeed, an entire literature on trade and exchange in a market economy presumes that entitlements can only change hands if the original right holder consents—namely, that the penalty for involuntary transfer is prohibitively harsh.[8] Calabresi and Melamed, in their seminal contribution, succinctly summarized the foundational relationship between property rights and property rules: "[M]uch of what is generally called private property can be viewed as an entitlement which is protected by a property rule."[9] It is no happenstance that property rules and property rights share an adjective.

A theory of property must, therefore, explain the key role of property rule protection. Why the harsh penalty for the laptop thief? Why can I not take your laptop and pay compensatory damages? The standard answers, we argue, are unsatisfactory. Conventional wisdom justifies the dominance of property rules by arguing that strong property rights—namely, property rights protected by property rules—are the backbone of the market system, that property rules are necessary for efficient exchange, and that the market system would crumble if we replace strong property rights with weaker liability rule protection. We challenge this conventional wisdom. We show that efficiency generally obtains in a liability rule regime as long as we maintain the standard rationality assumption (which underlies the conventional argument).

We then develop our new, bounded rationality theory of property. We show that when the conventional rationality assumption is replaced with a more realistic bounded rationality assumption, the concerns about liability rules resurface. In a liability rule regime, consecutive rounds of takings, or threats to take, are inevitable, and efficiency depends on the parties' ability to anticipate these future interactions and account for them when buying and selling property. Liability rules impose unrealistic demands on boundedly rational parties who struggle to anticipate the future implications of present actions and cannot think more than a few steps ahead. Thus, liability rules are efficient in an ideal world populated by perfectly rational parties, but not in the real world. Property rules do not require such a high level of sophistication. They support efficient exchange between boundedly rational, as well

6 *See, e.g.*, Abraham Bell & Gideon Parchomovsky, *A Theory of Property*, 90 CORNELL L. REV. 531, 598 (2005) ("Indeed, so powerful is the notion of the right to exclude in property conceptions, that Calabresi and Melamed have labeled the injunctive defense of entitlements as a property rule." (citing Calabresi & Melamed, *supra* note 2, at 1105–06)).

7 *See, e.g.*, *id.* at 589; Henry E. Smith, *Property and Property Rules*, 79 N.Y.U. L. REV. 1719 (2004).

8 *See, e.g.*, OLIVER HART, FIRMS, CONTRACTS, AND FINANCIAL STRUCTURE (1995) (a prominent contribution to the property rights theory in economics); Bar-Gill & Bebchuk, *supra* note 3 (noting that property rules, or mutual consent rules, are the implicitly assumed background rules of the market economy).

9 *See* Calabresi & Melamed, *supra* note 2, at 1105.

as perfectly rational, parties. Robustness to bounded rationality proves to be a foundational difference between property rules and liability rules. And so, bounded rationality becomes a key element of property theory.

Before proceeding further, a methodological note is in order: ours is a consequentialist theory of property. Since property rules are fundamental building blocks of our market economy, it seems important to develop, and defend, such a consequentialist, efficiency-oriented theory. This is not meant to exclude or undermine nonconsequentialist arguments (e.g., autonomy-based arguments) for the dominance of property rules.

The remainder of this Article is organized as follows. Part I sets the stage by uncovering the essential link between property and time. Many assets are durable; they exist and produce value over time. This essential feature of property triggers the concern about recurring takings in a liability rule regime—a concern which underlies the conventional justification for property rules as well as our bounded rationality theory of property. Part II presents the conventional justification for property rules, under the standard rational choice assumptions, and shows why this justification fails. Part III relaxes the perfect rationality assumption and develops our novel bounded rationality theory of property. Part IV considers several extensions and objections. It explores the effects of transaction costs on the relative efficiency of property rules and liability rules. It confronts the objection that not all assets are durable. It discusses the implications of property rules (as compared to liability rules) for ex ante efficiency, as opposed to ex post exchange efficiency. And it engages, albeit briefly, with nonconsequentialist theories of property.

I. Property and Time

The quintessential objects of property theory are assets whose value stretches over multiple periods of time. Land and real estate last for many years, if not indefinitely. Personal property, like a car or a laptop computer, produce value for long periods of time. Intangible property—the object of intellectual property rights—exists over spans of years, which are, sometimes, defined by law.[10] Time, in the sense of asset durability, is a defining feature of property. And a convincing theory of property should account for the role of time. Indeed, the conventional argument for property rule protection is based, in large part, on the alleged failure of liability rules to support the efficient allocation of assets over time.

Property rules constitute the backbone of the market system and guide interactions between many parties over many time periods. Accordingly, both the conventional justification for property rule protection and our novel, bounded rationality justification are based on a multiperiod model of repeat interactions among multiple actors. In this Part, we set the stage for this multiperiod analysis. We begin, in Section I.A, by developing some basic

10 This is not to say that all assets are durable. Some, like a cooked meal or time-sensitive information, are short-lived.

intuitions using a simple, one-period model. This unrealistic, single-period analysis serves to highlight the importance of time—of the multiple periods that measure the life span and value of property. Then, in Section I.B, we turn to the multiperiod model. The challenge for liability rules—both under the conventional approach and in our bounded rationality theory—begins with a concern about recurring takings. Over multiple periods, an asset that is protected by a liability rule might be the subject of recurring takings. We identify three distinct scenarios where recurring takings may threaten the efficiency of liability rules and thus provide a theoretical foundation for the dominance of property rules.[11]

A. One-Period Model

Consider a simple one-period model. At the beginning of the single period, the asset is held by Owner. Taker then appears and threatens to take the asset from Owner. Owner values the asset at $100. Assume that, in any negotiations between Owner and Taker, Owner has all the bargaining power.[12] Further, assume that such negotiations are not hindered by transaction costs ("TCs"). Indeed, if we think of the choice between property rules and liability rules as determining the ground rules for the market system, and if we think that the market facilitates low-cost transacting, then it seems reasonable to focus initially on the low-TCs case. We consider the high-TCs case in Section IV.A.

In the one-period model, the Coase Theorem applies with full force, guaranteeing efficient exchanges with both property rules and liability rules. With a property rule, Coasean bargaining ensures that assets efficiently move from a low-valuation Owner to a high-valuation Taker. For example, if Owner values the asset at $100 and Taker values it at $110, the parties will agree on a mutually beneficial trade: Taker will get the asset and pay Owner a price of $110 (assuming, recall, that Owner has all the bargaining power). The property rule also guarantees that the asset will not move from a high-valuation Owner to a low-valuation Taker. For example, if Owner values the asset at $100 and Taker values it at $90, the asset will remain with Owner. Indeed, Taker will not even bother to approach Owner.

With a liability rule, low TCs similarly ensure efficiency. Concerns about the efficiency of liability rules are based on the undercompensation problem. When a court enforces a liability rule, there is a risk that damages awarded would not fully capture Owner's valuation. In particular, while it is (relatively) easy for the court to ascertain the objective market value of the taken asset, it is much more difficult for the court to ascertain the subjective, idiosyncratic value that the dispossessed Owner may have derived from the asset.

11 The existence of short-lived assets does not undermine a theory of property that is based on the susceptibility of durable assets to recursive takings. *See infra* Section IV.B.

12 This assumption is made for expositional convenience only. The analysis and results hold for any allocation of bargaining power. *See* Oren Bar-Gill & Nicola Persico, *Exchange Efficiency with Weak Ownership Rights*, 8 AM. ECON. J. 230 (2016).

Since courts are likely to underestimate, or ignore completely, such subjective-value components, liability rules will generally be undercompensatory.[13]

The efficiency concern is that, with undercompensation, a low-valuation Taker might take the asset from a high-valuation Owner. In a single-period model, with low TCs, this concern is substantially limited by the possibility of Coasean bargaining: the high-valuation Owner would prevent the inefficient taking by bribing the low-valuation (potential) Taker. Revisit our example where Owner values the asset at $100 and Taker values it at $90, and assume that the court sets damages at $60. Taker arrives and threatens to take the asset. Taker gains 90 – 60 = $30 by taking the asset (he enjoys a use value of $90 and pays damages of $60). Therefore, assuming that Owner has all the bargaining power, she will pay Taker an amount equal to $30 to prevent a taking. We will sometimes refer to such a payment as a "bribe." Owner's expected payoff is 100 – 30 = $70, and she gets to keep the asset, which is the efficient outcome. Note that, for Owner, a payoff of $70 is better than the alternative of getting $60 in damages.[14]

Thus, in the one-period model, with low TCs, property rules and liability rules are equally efficient. This model cannot explain the dominance of property rules. The question is whether the equal-efficiency result continues to hold when we move beyond the single-period model and, instead of a one-shot takings threat, Owner faces the prospect of recurring takings. We begin to address this question in Section I.B.

B. Multiple Periods: Recurring Takings

There is no question about the efficiency of liability rules in the single-period model (with low TCs). The concern about liability rules, on which the case for property rules is based, arises in the more realistic, multiperiod model. Specifically, with multiple periods, liability rules allow for recurring takings. And while Coasean bargaining can surely prevent a single inefficient taking in a one-period model, it is not clear whether Coasean bargaining can effectively deal with the recurring takings problem that arises in a multiperiod model.

We begin by delineating the scope of the multiperiod analysis. The recurring takings problem arises in three distinct scenarios (which are not

13 *See* Calabresi & Melamed, *supra* note 2, at 1106–07, 1108; Kaplow & Shavell, *supra* note 2, at 730–32. The analysis below requires predictable undercompensation, namely, that Owner and Taker anticipate that damages would be undercompensatory. Such predictable undercompensation is likely when (1) some value component is observable (to both parties) but not verifiable to a court, and (2) when certain doctrinal rules restrict Owner's recovery.

14 We assume, as is common in the literature, that Coasean bargains are specifically enforced. Note that there is no inconsistency in assuming specific performance of the Coasean bargain (namely, a property rule), while studying the efficiency properties of property rule versus liability rule protection of the possessory interests in the underlying asset. In any event, the analysis would follow through if the bribe contract were enforced with accurate expectation damages or with stipulated damages.

mutually exclusive). The most prominent is the "multiple-takers" scenario, where in each period a new taker appears and threatens to take Owner's asset. Even if Owner would pay a Coasean bribe to avoid an inefficient taking by one taker, Owner might not be willing to pay multiple bribes to multiple takers. And so, liability rules might result in inefficient takings.

In the second scenario, Owner faces only one taker, but this single taker appears in period 1, and then again in period 2, and in period 3, etc. In each period, this same taker threatens to take Owner's asset. And while Owner would pay the taker once, she might not be willing to pay again and again and again. We call this the "reappearing-taker" scenario.[15]

The third scenario, like the second, involves only two parties—Owner and Taker. But while the second scenario focuses on one-directional takings, i.e., Taker always threatens to take the asset from Owner, in the third scenario Owner can take back an asset that was previously taken by Taker. And so, in this "reciprocal-takings" scenario, we can have multiple rounds of back-and-forth takings, where Taker takes from Owner, Owner takes the asset back, Taker takes again, and so on. Such back-and-forth would constitute a clear disadvantage of a liability rule regime, if only because neither party has an opportunity to enjoy uninterrupted use of the asset for any period of time.

In each of the three scenarios, the problem of recurring takings prevents liability rules from ensuring an efficient allocation of assets, according to the conventional view.[16] And, in each of the three scenarios, the problem of recurring takings practically disappears when we correct an important oversight of the conventional argument. With this correction, liability rules emerge as equal to property rules in their ability to ensure the efficient allocation of assets. We develop these arguments in Part II below. The (corrected) conventional analysis cannot justify the dominance of property rules and thus fails as a foundation for a theory of property, as long as we maintain the conventional assumption of perfect rationality. In Part III, we relax the rationality assumption and develop our bounded rationality theory of property, which rests on a "revival" of the recurring takings problem.

We present our critique of the conventional argument and our novel bounded rationality theory, focusing on the multiple-takers scenario. The analysis of the remaining two scenarios is similar and thus relegated to the Appendix.

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15 This second scenario, where a single taker reappears time and time again, reflects a failure of contractual commitment. When the taker arrives in period 1 and negotiates with Owner, the Coasean bargain should include a commitment by the taker not to take, ever. The problem is that such long-term commitments are difficult to enforce.

16 The multiple-takers scenario and the reciprocal-takings scenario were identified and analyzed in Kaplow & Shavell, *supra* note 2, at 765–67 (multiple takers), 767–68 (reciprocal takings). The reciprocal-takings scenario was also analyzed by Ian Ayres and Jack Balkin in their work on higher-order liability rules. *See* Ian Ayres & J.M. Balkin, Essay, *Legal Entitlements as Auctions: Property Rules, Liability Rules, and Beyond*, 106 YALE L.J. 703 (1996). To the best of our knowledge, we are the first to identify and analyze the reappearing-taker scenario.

II. THE CONVENTIONAL JUSTIFICATION, AND ITS FAILURE

The owner of a durable asset is susceptible to the multiple-takers problem. According to the conventional argument, this concern about recurring takings over multiple periods prevents liability rules from supporting efficient exchange, thus justifying the dominance of property rules. We show that, when the conventional rationality assumption is maintained, these concerns do not pose a serious challenge to efficient exchange in a liability rule regime. The conventional analysis does not justify the dominance of property rules and thus fails as a foundation for a theory of property.

Our account of the conventional justification for property rules, and its failure, assumes that TCs are low and that negotiations can proceed without hindrance. As noted above, the choice between property rules and liability rules determines the ground rules for the market system, and the market is believed to facilitate low-cost transacting. (We consider the high-TCs case in Section IV.A.) It may be thought, based on the Coase Theorem, that the choice between property rules and liability rules does not matter for efficiency.[17] While this irrelevance result holds in a one-period model, it does not extend to the multiperiod analysis. Indeed, a main contribution of this Article is to expose the limits of the Coase Theorem in multiperiod, sequential bargaining scenarios.[18]

A. The Multiple-Takers Problem

In an important article, Kaplow and Shavell argue that, with liability rules, Coasean bargaining does not guarantee efficiency.[19] Specifically, Kaplow and Shavell assert that the Coasean solution would not work when, instead of one potential taker (Taker), there are multiple potential takers (Taker, Taker 2, Taker 3 . . .)—all with valuations lower than Owner's. Indeed, if the court, through its low, undercompensatory damages, sets a "bargain price" for the asset, we can expect many takers to show up and challenge Owner's possession. And, while Owner would be willing to pay one bribe to Taker to avoid a taking, it would make no sense for Owner to pay multiple (10, 100, even 1000) bribes to multiple takers. Owner would thus give up the asset to Taker in the first period. The multiple-takers argument

17 *See* R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 2–15, 39–44 (1960). Specifically, Coase showed that, when transaction costs are low (namely, close to zero), assets will gravitate, through bargaining, toward their efficient use, regardless of how the law allocates initial entitlements. *Id.* Relying on Coase's fundamental insight, Kaplow and Shavell argued that when transaction costs are low, property rule protection and liability rule protection (including with undercompensatory damages) are equally efficient. Kaplow & Shavell, *supra* note 2, at 720 ("We next compare property and liability rules when transaction costs are low, in which case parties can bargain with each other about potential externalities. As Coase emphasized, if there are no obstacles to the consummation of mutually beneficial bargains, it will make no difference what the legal regime is; thus, it will be irrelevant whether property rules or liability rules apply.").

18 *See infra* Section II.E.

19 *See* Kaplow & Shavell, *supra* note 2, at 765–67.

thus seems to identify a real problem with liability rules, and thus offers an explanation for the dominance of property rule protection.

It turns out, however, that the multiple-takers argument needs to be qualified. Consider the period 1 bargaining between Owner and Taker. Both parties know that if bargaining fails and Taker takes the asset, then in the next period, Taker 2 would threaten to take the asset from Taker. Taker would then lose the asset or pay a bribe to Taker 2 (to prevent a period 2 taking). Either way, the value to Taker of a period 1 taking is lower than it would otherwise be. Accordingly, the bribe that Owner must pay Taker in the period 1 bargaining is smaller than the bribe that Owner paid Taker in the one-period, single-taker model—small enough that Owner would be willing to pay it. Indeed, it can be shown that an efficient equilibrium exists in the multiple-takers model, where Owner retains possession of the asset in all periods, paying a small bribe to each potential taker.[20] The multiple-takers problem does not pose a serious challenge to the efficiency of liability rules and thus cannot justify the dominance of property rules.

We develop these arguments more formally below. We note that, in Kaplow and Shavell's influential discussion, the multiple-takers problem is only one part of an overall convincing case for property rule protection. We refer to other aspects of their analysis in Part IV below.

B. Framework of Analysis

Consider a simple, two-period model (without any discounting). At the beginning of period 1, the asset is held by Owner. In period 1, Taker appears and threatens to take the asset from Owner. Owner values the asset at $100 per period (namely, Owner enjoys a use value of $100 per period). Taker values the asset at $90 per period. In period 2, another party, Taker 2, appears. Taker 2 values the asset at $90 per period. If Owner holds the asset at the beginning of period 2, Taker 2 threatens to take the asset from Owner. If Taker holds the asset at the beginning of period 2, Taker 2 threatens to take the asset from Taker.[21]

Under the prevailing liability rule, a party who takes an asset from its current owner must pay damages of $60 per period (to capture the undercompensation problem). This means, for example, that if Taker 2 takes the asset from Owner in period 2, then he will pay damages of $60; and if Taker takes the asset from Owner in period 1, thus depriving Owner of two periods worth of use, then he will pay damages of 2*60 = $120. When a taker appears, the current holder of the asset can bargain with the potential taker in attempt to avoid the taking. We assume that in the bargaining between the current holder of the asset and the potential taker, the current holder

20 *See* Bar-Gill & Persico, *supra* note 12, at 245–55; Kaplow & Shavell, *supra* note 2, at 766 n.167 (acknowledging that the first taker's incentive to take should be weaker if the first taker expects to be himself subject to a taking by the second taker).

21 We assume that takers appear sequentially. Different concerns might arise if takers were to appear simultaneously and fight over the asset.

has all the bargaining power and therefore can make a take-it-or-leave-it offer to the potential taker.[22]

C. Efficiency with Multiple Takers

To analyze the strategic interaction between Owner, Taker, and Taker 2, we proceed by backward induction, starting with period 2. At the beginning of period 2, the asset is held either by Owner or by Taker. Taker 2 arrives and threatens to take the asset from its current holder. If Taker 2 takes the asset, he gets a payoff of 90 – 60 = $30. Therefore, Owner or Taker will pay a bribe of $30 to avoid a taking. (For Owner, 100 – 30 > 60; for Taker, 90 – 30 = 60.[23])

Going back to period 1, Taker arrives and threatens to take the asset from Owner. If Taker takes the asset, he gets a payoff of: 2*90 – 2*60 – 30 = $30 (he enjoys a use value of $90 for both periods, pays damages of 2*60 for depriving Owner of two periods' worth of use, and pays a bribe of $30 to Taker 2 in period 2). Therefore, Owner will pay a bribe of $30 to avoid a taking. Owner's expected payoff is: 2*100 – 30 – 30 = $140 (she enjoys a use value of $100 for both periods and pays a bribe of $30 in each period) and she gets to keep the asset, which is the efficient outcome. Note that, for Owner, a payoff of $140 is better than the alternative of getting 2*60 = $120 in damages.

The multiple-takers problem was supposed to knock out liability rules and thus provide a justification for property rules. We have seen, however, that this argument fails. The conventional theory of property requires major revision.

D. The (Inconsequential) Limits of Efficiency

Our analysis shows that the multiple-takers problem, which afflicts liability rules, is not as severe as previously thought, and thus cannot provide a justification for property rules. Importantly, we do not claim that exchange efficiency always obtains with liability rules. Indeed, we identify a condition that underlies the efficiency result—that the bargaining environment does not provide a large advantage to low-valuation parties. Yet, we argue that this condition is generally satisfied. And so, our prior conclusion holds, the multiple-takers problem cannot justify the dominance of property rules.

The story in Section II.C is an optimistic one. Through a sequence of bilateral bargains exchange efficiency is assured, despite the multiple-takers

22 In a companion piece, we generalize this simple framework—to allow for *N* periods (with the possibility of discounting), different valuations, different damages, and different allocations of bargaining power. *See* Bar-Gill & Persico, *supra* note 12, at 237–47.

23 Taker, if he holds the asset at the beginning of period 2, is indifferent between (i) losing the asset and getting damages of $60, and (ii) keeping the asset and paying a bribe of $30 (90 – 30 = 60). We will assume that Taker pays the bribe and keeps the asset. But the analysis also follows through if we choose the opposite assumption, namely, that Taker loses the asset and gets damages.

problem. This happy outcome, however, is not guaranteed. It relies on the following condition: the bargaining environment does not provide a large advantage to low-valuation parties. When the bargaining environment provides a large advantage to low-valuation parties, then efficiency might not prevail. Low-valuation parties will use this advantage to take possession of assets that should be left in the hands of high-valuation parties. This observation, however, while theoretically interesting, is of limited practical relevance for the choice between property rules and liability rules.

How could the bargaining environment (significantly) favor low-valuation parties? There are three possible answers:

1. The bargaining power of low-valuation parties is significantly stronger than the bargaining power of high-valuation parties.
2. High-valuation parties are significantly more vulnerable to a taking than low-valuation parties.
3. Low-valuation parties receive significantly higher damages than high-valuation parties following a taking.

In the Appendix we illustrate how these three sources of advantage for low-valuation parties can undermine efficient exchange with liability rules. Still, these limits on the efficiency of liability rules cannot revive the conventional argument.

The first source of inefficiency, bargaining power that is inversely correlated with valuation, applies to both property rules and liability rules and thus undermines the efficiency of both equally. The other two, vulnerability to a taking and damages that are inversely correlated with valuation, apply only to liability rules, but their practical importance is limited.[24] If low-valuation parties are less vulnerable to a taking, then efficient exchange might be prevented.[25] But there is no reason to believe that valuation would be inversely correlated with vulnerability. Indeed, high-valuation parties are likely to invest more in protecting their assets, namely, in reducing their vulnerability

24 The zero-transaction-cost assumption and the zero-litigation-cost assumption ensure that there will be no taking in a property rule regime. Therefore, the question of vulnerability to a taking is irrelevant in a property rule regime. The question of damages is similarly irrelevant in a property rule regime.

25 In our example, assume that the high-valuation Owner is vulnerable to a period 2 taking, as before, but the low-valuation Taker is not. Namely, in period 2, if the asset is held by Owner, Taker 2 arrives and threatens to take the asset. But if the asset is held by Taker, secured in Taker's vault, Taker 2 cannot threaten to take the asset. Now, in period 1, if Taker takes the asset from Owner, he gets a payoff of \$60, instead of \$30, because he does not need to bribe Taker 2 in period 2. Therefore, Owner would have to pay a bribe of \$60 to avoid the period 1 taking. But this would leave Owner with an expected payoff of only 2*100 – 60 – 30 = \$110 (she enjoys a use value of \$100 for both periods and pays a bribe of \$60 in period 1 plus another bribe of \$30 in period 2). And so, Owner would prefer to surrender the asset to Taker and get 2*60 = \$120 in damages. In this scenario, the asset inefficiently moves to the lower-valuation party.

to a taking.[26] Also, if low-valuation parties expect higher damages, then efficient exchange might be prevented. But, again, there is no reason to believe that valuation would be inversely correlated with the amount of damages. Damages awards in a liability rule regime are designed to compensate the entitlement holder.[27] This compensatory goal is achieved by tracking the valuation of the entitlement holder. Of course, courts might err in assessing this valuation. But it is very unlikely that they would systematically award higher damages for lower-valuation parties and lower damages for higher-valuation parties.[28] In sum, the identified limits of efficiency, while theoretically interesting, are of (relatively) modest practical significance. Therefore, they cannot explain the dominance of property rules.

E. Beyond Coase

We have seen that liability rules support an efficient outcome in the multiple-takers case. Is this result surprising? Would not the Coase Theorem, properly understood, predict this efficiency result? After all, the Coase Theorem is not limited to two parties. It guarantees efficiency with multiple parties as well.[29] The answer is no. The Coase Theorem does not predict our efficiency result.

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26 *See also infra* Section IV.D. Vulnerability to a taking also depends on how the asset is to be used. For example, a party who parks her car in a secure garage is less vulnerable to a taking than a party who parks her car on a public street. And a party who uses her laptop at home or at the office is less vulnerable to a taking than a party who uses her laptop on airplanes or at conferences. Public uses generally increase vulnerability to a taking, whereas private uses generally decrease vulnerability to a taking. If high-valuation parties are more likely to use assets in public and low-valuation parties are more likely to use assets in private, then vulnerability to a taking might be inversely correlated with valuation. It is also possible that some parties plan short-term uses (or uses that entail quick depreciation of the asset), while others plan long-term uses (or uses that entail slow depreciation of the asset). Short-term use suggests less vulnerability to a taking, since the party finishes using the asset before it can be taken. If high-valuation parties are more likely to have long-term uses and low-valuation parties are more likely to have short-term uses, then vulnerability to a taking might be inversely correlated with valuation.

27 *See* Calabresi & Melamed, *supra* note 2, at 1092.

28 In practice, actual damages payments might be limited by the insolvency of the taker. If low-valuation parties were more likely to be insolvent, then damages would be inversely correlated with valuation.

29 There are limits to the general Coasean efficiency result when there are more than two parties. *See, e.g.*, Varouj A. Aivazian & Jeffrey L. Callen, *The Coase Theorem and the Empty Core*, 24 J.L. & ECON. 175, 175–81 (1981) (applying the "core" solution concept from cooperative game theory and showing that, in some cases, bargaining games with more than two players do not have a solution); Avinash Dixit & Mancur Olson, *Does Voluntary Participation Undermine the Coase Theorem?*, 76 J. PUB. ECON. 309 (2000) (showing potential problems with the Coasean model of efficiency in a simple public-good model because of noncooperative contribution equilibrium from issues such as free riding); Thomas J. Miceli & Kathleen Segerson, *A Bargaining Model of Holdouts and Takings*, 9 AM. L. & ECON. REV. 160 (2007) (discussing the holdout problem in multiparty bargaining as a justification for govern-

While applicable to multiple-party scenarios, the Coase Theorem requires a grand ex ante bargain, with all affected parties sitting at the bargaining table.[30] But in our framework, and in the real world, the initial owner and all potential takers do not sit and bargain together. There is no single "grand bargain." Rather, we have a series of bilateral bargains—between Owner and Taker, Taker and Taker 2, Taker 2 and Taker 3, etc.[31] We show that such a series of bilateral bargains suffices. Efficiency does not require one grand bargain. In this sense, our efficiency result goes beyond the Coase Theorem.

Importantly, this extension to the Coase Theorem requires an extra assumption (beyond the standard Coasean zero TCs assumption)—that the bargaining environment does not provide a large advantage to low-valuation parties.[32] Alternatively, we have identified a new category of transaction costs—costs that are inherent to sequential bargaining.

F. Taking Stock

We see that the multiple-takers problem, and recurring takings more generally, do not pose a major threat to efficient exchange under a liability rule regime, and thus do not explain the dominance of property rules. But these efficiency results rely on the rationality assumption. In Part III, we relax the conventional rationality assumption, introduce the reality of bounded rationality, and show how this reality forces us to rethink the comparison between property rules and liability rules.

III. Bounded Rationality

Thus far, the thrust of the argument has been to question conventional concerns about liability rules. We now change course and argue for a revitalization of these concerns. To do so, however, we must relax one of the fundamental assumptions of the conventional analysis (an assumption that we

ment's eminent domain laws). On the "empty core" debate, see also R.H. Coase, *The Coase Theorem and the Empty Core: A Comment*, 24 J.L. & Econ. 183, 183–87 (1981).

30 *See, e.g.*, Elizabeth Hoffman & Matthew L. Spitzer, *Experimental Tests of the Coase Theorem with Large Bargaining Groups*, 15 J. Legal Stud. 149, 161 (1986) ("Naturally occurring bargains may not occur or be efficient if large groups cannot get organized to sit down together . . . ."). The Coasean "grand bargain" is sometimes described in the game theory literature as simultaneous bargaining among the different parties. *See, e.g.*, Varouj A. Aivazian & Jeffrey L. Callen, *The Core, Transaction Costs, and the Coase Theorem*, 14 Const. Pol. Econ. 287, 294–96 (2003) (showing that, when the core is not empty, simultaneous bargaining will result in an efficient outcome, whereas sequential bargaining might not).

31 Or between Owner and Taker, Owner and Taker 2, Owner and Taker 3, etc. Or some other sequence of bilateral bargains.

32 In some sense, this extra assumption is also inherent in the Coasean grand bargain idea: if the grand bargain is offered to all parties on a take-it-or-leave-it basis, then there is no advantage to low-valuation parties. If the ex ante multiparty negotiations took place using a different protocol—e.g., a series of bilateral negotiations—then we might get inefficiency, as in our model.

retained in challenging the conventional analysis)—the rationality assumption. In the preceding analysis, we assumed that all parties are perfectly rational. Indeed, the efficiency results described above rely on the assumption that all parties are hyperrational, that they can reason through a complex, sequential game—Taker needs to understand that in period 2, he will need to bribe Taker 2, and he also needs to calculate this bribe based on the benefit to Taker 2 from taking the asset, a benefit that is influenced by the bribe that Taker 2 would have to pay Taker 3 and so forth. But it is well known that the average person cannot think more than a few steps ahead.[33] The introduction of bounded rationality "revives" the multiple-takers problem, and with it, the disadvantage of liability rules. (We thus view our bounded rationality theory as validating Kaplow and Shavell's basic insight about the multiple-takers problem.) The justification for property rule protection, and by extension the theory of property, needs bounded rationality as a foundational component.

In Section III.A, we develop this argument and show that bounded rationality undermines efficiency in a liability rule regime. Then, in Section III.B, we explain why bounded rationality does not pose a similar challenge in a property rule regime. We thus conclude that bounded rationality provides the key missing piece for a consequentialist theory of property. In developing our bounded rationality theory of property, we focused on a particular deviation from the perfect rationality benchmark, namely, on parties' limited ability to reason multiple steps into the future and account for anticipated actions and reactions in present-time negotiations. We emphasize this limited foresight deviation, because it interacts with the fundamental relationship between property and time. In Section III.C, we defend our notion of bounded rationality and briefly consider other, competing notions.

A. The Inefficiency of Liability Rules

In the rational-choice, multiple-takers model, a major driver for efficiency was the parties' ability to look ahead, foresee future bargaining interactions, and account for them in the period 1 negotiations. Assuming such a

33 Economists developed a theoretical model, the Level-*k* Reasoning Model, that formally incorporates a limited number (*k*) of steps that individuals consider. *See* Rosemarie Nagel, *Unraveling in Guessing Games: An Experimental Study*, 85 AM. ECON. REV. 1313, 1313 (1995); Dale O. Stahl & Paul W. Wilson, *On Players' Models of Other Players: Theory and Experimental Evidence*, 10 GAMES & ECON. BEHAV. 218 (1995). The model allows for players with different levels of sophistication: Level-0 players make uniform choices based on a simple decision rule; Level-1 players are more sophisticated, choosing the optimal strategic response to Level-0 players; Level-2 players are able to choose the best response to Level-1 players' strategy and so forth. The authors also subjected the theoretical model to experimental investigation, finding that subjects rarely think more than three steps ahead (or, more accurately, the experimental results were consistent with subjects using Level-3 reasoning at most). To be precise, the Level-*k* Reasoning Model measures the "depth" of reasoning in a simultaneous-move game, which is related, but not identical to the "thinking ahead" notion in our dynamic takings game.

high level of sophistication is often unrealistic, especially when we move from our two-period setup to a world with a large number of sequential interactions. We now illustrate how bounded rationality can compromise the efficiency of liability rules, even within our two-period setting.

In the perfect rationality model, Owner and Taker, in their period 1 negotiations, realize that if Taker takes the asset, he will have to pay a bribe of $30 to Taker 2 in period 2. This reduces the bribe that Taker demands in period 1. Specifically, Owner pays a bribe of $30 to Taker in period 1 and a bribe of $30 to Taker 2 in period 2, for an overall expected payoff of 2*100 – 2*30 = $140. Since this payoff is greater than the damages alternative, 2*60 = $120, Owner pays the bribes and keeps the asset, as is efficient.[34]

What if a naïve Taker, in the period 1 negotiations with Owner, does not account for the bribe that Taker would have to pay Taker 2 in period 2? This shortsightedness would increase the period 1 bribe that Taker demands by $30, from $30 to $60. While Taker is naïve, Owner remains sophisticated and realizes that she will pay a second bribe of $30 in period 2. Owner's overall payoff would thus be 2*100 – 60 – 30 = $110. This payoff is smaller than the damages alternative, 2*60 = $120, and thus Owner would give up the asset in period 1—an inefficient outcome. When Taker is naïve, but Owner is sophisticated, exchange efficiency is compromised.

What if both Taker and Owner are naïve? If both parties are naïve, then efficiency is restored. Taker's shortsightedness increases the period 1 bribe that Taker demands, because Taker ignores the period 2 bribe that he will pay. And Owner's shortsightedness increases the period 1 bribe that Owner is willing to pay, because Owner similarly ignores the period 2 bribe that she will pay. The expected payoff of the shortsighted Owner would thus be 2*100 – 60 = $140, larger than the damages alternative, 2*60 = $120. Owner would thus pay the bribe, $60, and retain the asset in period 1, as is efficient. When Taker 2 "surprisingly" appears in period 2, Owner would pay a second bribe, $30, and retain the asset.[35] The efficient outcome would obtain, but Owner would lose: she would end up paying a total bribe of 60 + 30 = $90, which would leave her with an expected payoff of 2*100 – 90 = $110, which is less than the damages alternative, 2*60 = $120.

We considered the case where both parties are sophisticated (the standard, rational-choice model). We considered the case where Taker is naïve and Owner is sophisticated. And we considered the case where both parties are naïve. To complete the analysis, we note that efficiency pertains also when Taker is sophisticated and Owner is naïve. In this final case, Taker

34 *See supra* Section II.C.

35 This outcome would obtain if, in period 2, Owner rationally ignores the large period 1 bribe as a sunk cost and compares the payoff from paying the bribe and retaining the asset, 100 – 30 = $70, to the payoff from giving up the asset and getting $60 in damages. The same outcome obtains, if an irrational Owner, suffering from the common sunk cost fallacy, does not ignore the large period 1 bribe. For this Owner, paying an extra $30 bribe to Taker 2 results in an overall payoff of 2*100 – 60 – 30 = $110. The alternative of giving up the asset to Taker 2 leaves Owner with 100 – 60 + 60 = $100.

demands little and Owner is willing to pay much, so a deal is reached and the asset stays with Owner, as is efficient.

In a more general model, with many owners and takers, there will be some sophisticated owners and some naïve owners, and some sophisticated takers and some naïve takers. In this general model, some portion of the Owner-Taker interactions will involve a naïve Taker and a sophisticated Owner, and result in inefficient exchange. When the bounded rationality seasoning is added to the multiple-takers stew, liability rules cannot guarantee the efficient allocation of assets.

B. The Efficiency of Property Rules

We have seen that bounded rationality interferes with the efficiency of liability rules. What about property rules? If bounded rationality is to provide a justification for property rules, then property rules should be immune against bounded rationality—they should be able to support efficient exchange even when the parties are boundedly rational. And indeed, they do. In a realistic, multiperiod model, liability rules ensure efficient exchange only if the parties can think many steps ahead, anticipate future takings and future bribe payments, and incorporate these predictions in their current decisions. Property rules do not require such superhuman sophistication.

When Owner is the high-valuation user, property rules ensure efficiency simply by protecting Owner from any taking and from the need to pay bribes. In our example, Owner valued the asset at $100 per period, whereas Taker and Taker 2 valued it at only $90 per period. In a property rule regime, the takers will not bother to approach Owner, and the asset will remain with the high-valuation user, as is efficient.

The challenge in a property rule regime is where the initial owner is not the high-valuation user. Consider the following example. Owner values the asset at $90 per period, whereas Taker and Taker 2 value it at $100 per period. At the beginning of period 1, Taker will approach Owner and negotiate a sale of the asset. If we assume, as before, that Owner has all the bargaining power, then the parties will agree on a price of 2*100 = $200 and the asset will move to Taker, the high-valuation user. And, in period 2, Taker 2 will not bother to approach Taker. Importantly, in the period 1 bargaining between Owner and Taker, the parties do not need to anticipate any future interaction with Taker 2.

To make things even harder for the property rule regime, assume that Owner values the asset at $80 per period, Taker values it at $85 per period, and Taker 2 values it at $100 per period. Here the parties' sophistication could matter. Assume initially that both Owner and Taker are perfectly rational. We solve by backward induction: At the beginning of period 2, if Owner holds the asset, she will sell it to Taker 2 for $100. And if Taker holds the asset, he will similarly sell it to Taker 2 for $100. Moving back to period 1, Taker will approach Owner and negotiate a sale of the asset. The value of the asset to Owner is 80 + 100 = $180. The value of the asset to Taker is 85 + 100 = $185. If Owner has all the bargaining power, then the parties will

agree on a price of $185 and the asset will move to Taker. Thus the asset moves from Owner to Taker to Taker 2, as is efficient.

The efficient outcome also obtains when both Owner and Taker are naïve and do not anticipate the arrival of Taker 2. At the beginning of period 1, Taker will approach Owner and negotiate a sale of the asset. If we assume, as before, that Owner has all the bargaining power, then the parties will agree on a price of 2*85 = $170 and the asset will move to Taker. Then, at the beginning of period 2, Taker 2 will approach Taker and negotiate a sale of the asset. If the current owner, Taker, has all the bargaining power, then the parties will agree on a price of $100 and the asset will move to Taker 2. Once again the asset ends up with the high-valuation user, as is efficient.

The potential problem arises when Owner is sophisticated and Taker is naïve.[36] In the period 1 negotiations the sophisticated Owner values the asset at 80 + 100 = $180, whereas the naïve Taker values the asset at 2*85 = $170. Since the minimum amount that Owner is willing to accept exceeds the maximum amount that Taker is willing to pay, the asset will not be sold. During period 1, it will remain with the low-valuation Owner, and an efficiency cost of 85 – 80 = $5 will be incurred. (At the beginning of period 2, Owner will sell the asset to Taker 2 for $100 and so, at least, the asset will eventually move to Taker 2, as is efficient.)

It would appear that bounded rationality might cause inefficiency in a property rule regime, as it did in a liability rule regime. But, in fact, there is good reason to believe that the risk of inefficient allocation is much smaller in a property rule regime. First, the naïve Taker will likely be informed by Owner about the expected arrival of Taker 2. Taker will be happy to hear this good news, as it increases the value of the asset to Taker. This is very different from the situation in the liability rule regime, where the pending arrival of Taker 2 is bad news for Taker and reduces Taker's payoff. Also, in the property rule regime, if Taker is reluctant to believe in Taker 2's imminent arrival, Owner could assuage Taker's concerns with a simple warranty—a promise to return a portion of the sale price if Taker 2 does not arrive and thus the asset becomes less valuable than expected. It is difficult to imagine a similar contractual solution in a liability rule regime.[37]

There is an even simpler, and quite common, solution to the potential inefficiency that bounded rationality creates in a property rule regime: the parties can transform the multiperiod problem into a single-period problem. Specifically, if Taker does not believe that Taker 2 will arrive in the next period, Owner can lease the asset to Taker for a single period—for period 1. Then, at the end of period 1, the asset returns to Owner who can sell it to Taker 2. The single-period-lease option ensures that the asset is used by

36 This was also the problematic case in a liability rules regime. *See supra* Section III.A.

37 The problem there was that the naïve Taker demanded an excessive bribe. Would Owner offer a smaller bribe and a promise of an additional bribe if Taker 2 does not arrive? Another impediment to this solution is that Owner has an incentive to try and prevent the arrival of Taker 2 (whereas, in the property rule regime, both parties benefit from Taker 2's arrival).

Taker in period 1 and then by Taker 2 in period 2, as is efficient. Again, it is difficult to imagine a similar solution in a liability rule regime.

We thus conclude that bounded rationality interferes with efficient exchange in a liability rule regime but not in a property rule regime. This result provides the missing justification for property rule protection and places bounded rationality at the foundation of our new theory of property.

C. More Irrationality?

Our theory of property assumes that parties are not perfectly rational. But, while there are many possible deviations from perfect rationality,[38] our theory assumes a particular, limited foresight deviation. A perfectly rational party can anticipate all future moves and countermoves, over multiple periods, and account for this complex future when making decisions in the present. Of course, ordinary people, and even chess masters, cannot live up to this ideal. Considerable evidence, as well as casual observation, suggests that most people cannot reason more than a few steps ahead.[39] This limited foresight drives our bounded rationality theory of property. In a liability rule regime, a naïve Taker who fails to anticipate the arrival of future takers demands a bribe that Owner will not pay, resulting in an inefficient taking. Our focus on limited foresight is not arbitrary. We did not randomly select one of many possible deviations from perfect rationality. Nor did we set out to search for the one deviation that would justify property rule protection. Rather, limited foresight is naturally invoked by the fundamental relationship between property and time. When an asset's effective life spans multiple periods, an ability to reason forward in time through all of these future periods is necessary to ensure allocative efficiency in a liability rule regime. And, as a corollary, limited foresight interferes with the efficient workings of the liability rule and thus provides an argument for property rule protection.

Still, limited foresight is but one manifestation of imperfect rationality. As noted above, there are many other documented deviations from perfect rationality. A critic may thus call for more irrationality. But the mere existence of other deviations from perfect rationality does not make these deviations relevant for a bounded rationality theory of property. Other manifestations of imperfect rationality are important only if they provide a systematic advantage for liability rules, and only if this advantage is large enough to outweigh the advantage that limited foresight provides for property rules. Given the large number of documented deviations from perfect rationality, we cannot rule out *a priori* the existence of a bias or misperception that could mount an effective challenge to our theory of property. We do argue that, given the natural relevance and prominence of the limited foresight deviation and the substantial advantage that property rules enjoy

38 *See, e.g.*, CHOICES, VALUES, AND FRAMES (Daniel Kahneman & Amos Tversky eds., 2000); JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES (Daniel Kahneman et al. eds., 1982); DANIEL KAHNEMAN, THINKING, FAST AND SLOW (2011).

39 *See supra* note 33.

when parties have limited foresight, the burden is on the critic to identify another deviation that strongly points in the opposite direction. Until then, our bounded rationality theory of property stands.

IV. Extensions and Objections

We offer the bounded rationality theory as the most plausible consequentialist theory of property. We now consider several extensions and objections to this novel theory. Our analysis thus far assumed that transaction costs are low, which we deem plausible in a market setting. Nevertheless, it is useful to also consider the high-TCs case (with a broad definition of TCs that includes asymmetric information as an impediment to efficient bargaining). We show, in Section IV.A, that when TCs are high, either regime—a property rule regime or a liability rule regime—can be more efficient, and thus high TCs do not provide an explanation for the dominance of property rules. In Section IV.B, we address a challenge pertaining to our assumptions about time and the durability of assets. Our theory, like the conventional account that we dispel, rests on the susceptibility of durable assets to recurring takings. While much of property is long-lived or, at least, survives long enough to trigger the recurring takings problem, some assets are short-lived. We argue that this observation does not undermine a theory of property that is based on the recurring takings problem.

Another extension shifts the focus of the analysis from ex post exchange efficiency to ex ante efficiency. We consider, in Section IV.C, several ex ante efficiency effects of the choice between property rules and liability rules. We show that bounded rationality exacerbates some ex ante efficiency concerns about liability rules and reduces others. We conclude that ex ante efficiency analysis should be incorporated into a comprehensive, consequentialist theory of property. Finally, in Section IV.D, we consider an objection to our consequentialist framework—the claim that a better theory of property can be derived from nonconsequentialist, deontological principles. Without denying the force of nonconsequentialist explanations, we argue that when a legal rule provides the backbone of the market system, a consequentialist economic theory is needed—to supplement, not supplant, any nonconsequentialist theory.

A. High Transaction Costs

Thus far, we have focused on the low-TCs case. While low TCs facilitate bargaining and trade and thus help assets gravitate toward their high-value uses, we have shown that low TCs alone do not guarantee an efficient allocation of assets, especially when parties are boundedly rational. In this low-TCs, bounded rationality setting, property rules are more efficient than liability rules. We justified the low-TCs assumption by reference to the market setting, which facilitates low-cost transacting. But TCs are not always low and, arguably, the choice between property rules and liability rules is particularly important in the high-TCs case, where we cannot count on bargaining and

trade to facilitate the efficient allocation of assets. Which rule should be preferred in a high-TCs setting? Does the high-TCs case provide an alternative explanation for the dominance of property rules? We show that it does not.

When TCs are high, a potential seller (Owner) and a potential buyer (Taker) might fail to agree on a mutually beneficial trade.[40] In this high-TCs case, liability rules actually hold an important efficiency advantage vis-à-vis property rules. With a perfectly enforced liability rule, where damages are set precisely equal to Owner's valuation of the asset, exchange efficiency is guaranteed: Taker will take the asset if and only if Taker values it more than Owner. Take our running example, where Owner values the asset at $100. In this example, perfectly compensatory damages would equal $100. If Taker values the asset at $90, he will not take the asset, since the $90 benefit is lower than the $100 cost in damages payments. This is the efficient outcome: the asset stays with Owner who values it more. On the other hand, if Taker values the asset at $110, he will take the asset, since the $110 benefit exceeds the $100 cost in damages payments. Such a taking facilitates an efficient transfer of the asset from a low-valuation Owner to a high-valuation Taker. The unilateral taking replaces costly bargaining and thus avoids the high TCs. With a property rule, costly bargaining cannot be avoided and high TCs might even prevent an efficient transfer of the asset from a low-valuation user to a high-valuation user.[41]

But this advantage of liability rules assumes that damages are perfectly compensatory. And, as we have seen in the real world, damages are often undercompensatory.[42] When damages are undercompensatory, there is a risk of inefficient taking—Taker might take the asset even if he values it less than Owner. Assume, for example, that an imperfectly informed court sets damages at $60. Now, Taker will take the asset, even if he values it at $90, since the $90 benefit exceeds the $60 cost in damages payments. Therefore in the high-TCs case, liability rules might lead to inefficient transfers of assets from a high-valuation Owner to a low-valuation Taker. (In the low-TCs case, such inefficient transfers were avoided through Coasean bargaining.) Property rules prevent such inefficient transfers. But as we have seen, they also prevent efficient transfers. There is no reason to believe that one efficiency cost always dominates the other. Therefore, the high-TCs case does not explain the dominance of property rules.[43]

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40 Or they might incur substantial costs before they agree on a mutually beneficial trade.

41 *See* Calabresi & Melamed, *supra* note 2, at 1106–07, 1119. Liability rules result in first-best efficiency only if the following two unrealistic assumptions hold: (1) damages are perfectly compensatory, and (2) the liability rule is perfectly enforced in the sense that every infringement is costlessly adjudicated. *See id.* These assumptions are relaxed below.

42 *See supra* Section I.A.

43 We have seen that when high TCs prevent efficient Coasean bargaining, liability rules might lead to inefficient transfers, whereas property rules might prevent efficient transfers. The comparison between liability rules and property rules remains indeterminate when TCs are high, but not high enough to prevent bargaining. In such cases, property rules lead to costly Coasean bargaining—to guarantee efficient exchange, and liability

Introducing asymmetric information, perhaps the most important type of transaction cost, does not resolve the indeterminacy. Kaplow and Shavell argue that asymmetric information leads to inefficient outcomes under both property rules and liability rules and conclude: "[I]t may be that either rule is better . . . ."[44] There is a debate in the literature about whether liability rules facilitate bargaining in the presence of asymmetric information.[45] Litigation costs, which can be viewed as a type of transaction cost, should also be taken into account. It is not clear, however, if this factor favors property rules or rather liability rules. In a liability rule regime, courts may need to engage in costly assessment of damages. In a property rule regime, an injunction remedy implicates potentially high monitoring costs, and the cost of enforcing criminal sanctions can be even higher. And to the extent that a property rule is implemented via punitive or treble damages, these monetary awards must be assessed, like compensatory damages in a liability rule regime. We also note that the overall importance of litigation costs may be substantially limited by the possibility of pretrial settlements.[46]

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rules lead to costly Coasean bargaining—to avoid inefficient taking. Either rule can be more efficient. It depends on whether we think the current owner's valuation is above average or below average. Over time, assets can be expected to gravitate to higher-value users; and so, a property rule should become more efficient. *Cf.* Kaplow & Shavell, *supra* note 2, at 759–63 (arguing that owners generally enjoy higher value than takers).

44 Kaplow & Shavell, *supra* note 2, at 764. If current owners are assumed to enjoy higher values such that asset transfers are rarely efficient, then property rules would be superior since the cost of failed bargaining, due to asymmetric information, would be small. *See id.* Under liability rules, bargaining also would be needed to prevent inefficient transfers, so the cost of failed bargaining would be larger. *See id.*

45 *Compare* Ayres & Talley, *supra* note 3, at 1039–47 (arguing that liability rules can be superior to property rules, as they reduce information asymmetry), *with* Louis Kaplow & Steven Shavell, Comment, *Do Liability Rules Facilitate Bargaining? A Reply to Ayres and Talley*, 105 YALE L.J. 221 (1995) (arguing that property rules can be superior to liability rules also when information is asymmetric).

46 Pretrial settlements are very common. *See, e.g.*, Theodore Eisenberg & Charlotte Lanvers, *What Is the Settlement Rate and Why Should We Care?*, 6 J. EMPIRICAL LEGAL STUD. 111, 130 (2009) (finding that in the Eastern District of Pennsylvania, 65.3% of contract cases and 87.2% of tort cases settled before trial, and that in the Northern District of Georgia, 72.5% of contract cases and a 63.8% of tort case were resolved through pretrial settlements); Gillian K. Hadfield, *Where Have All the Trials Gone? Settlements, Nontrial Adjudications, and Statistical Artifacts in the Changing Disposition of Federal Civil Cases*, 1 J. EMPIRICAL LEGAL STUD. 705, 732 (2004) (of a sample of cases that reached final termination prior to trial in federal district court in 2000, 59.7% ended due to settlement); Jonathan D. Glater, *Study Finds Settling Is Better than Going to Trial*, N.Y. TIMES (Aug. 8, 2008), https://www.nytimes.com/2008/08/08/business/08law.html (citing study that found an 80%–92% settlement rate); James Hirby, *What Percentage of Lawsuits Settle Before Trial? What Are Some Statistics on Personal Injury Settlements?*, LAW DICTIONARY, https://thelawdictionary.org/article/what-percentage-of-lawsuits-settle-before-trial-what-are-some-statistics-on-personal-injury-settlements/ (last visited Nov. 12, 2018).

B. Nondurable Assets

The recurring takings problem, which underlies both the conventional justification for property rule protection and our bounded rationality theory of property, is relevant only to assets that exist long enough to trigger recurring takings. Since some assets are short-lived, can we base a general theory of property on the recurring takings problem? The answer, we think, is yes, for two reasons: First, as a quantitative matter, most assets persist long enough to trigger recurring takings. Second, the observation that some assets are short-lived does not undermine a theory of property rule protection that is based on the recurring takings problem, unless it is argued that liability rules have a particular advantage in protecting short-lived assets. We are aware of no such argument.

We begin with the quantitative reason. It is important to emphasize that a theory based on the recurring takings problem does not need to assume assets that exist and produce value for many years. The effective life span of an asset can be days, even hours; nevertheless, the asset might be subject to recurring takings. A large majority of assets satisfy this minimal longevity requirement. This is not to say that there are no assets that are particularly short-lived, like a cooked meal or time-sensitive information, only that such assets occupy a relatively small area in the broad domain of property. A general theory of property need not relate to each and every asset that can be the object of property rights.

But even if there were many short-lived assets that are not subject to recurring takings, this still would not undermine a theory of property that is based on the recurring takings problem. In particular, if the recurring takings problem provides an argument against liability rules, and thus in favor of property rule protection, for durable assets, then the prevalence of short-lived assets would pose a real challenge for a theory of property only if liability rules hold a particular advantage for short-lived assets. We are unaware of any claim that liability rules enjoy such an advantage.

In some sense, the question of scope should not be aimed at the temporal dimension of durability. Durability is only a proxy for whether the asset is subject to the recurring takings problem. It is true that short-lived assets are not subject to recurring takings. But some durable assets are also not subject to recurring takings, or to any taking for that matter. Consider a car that is always parked in a secure garage or an heirloom stored in a safe-deposit box. Our two responses to the scope question apply despite this reframing. On the quantitative side, a theory based on the recurring takings problem is valid as long as a sufficiently large number of assets are subject to the threat of recurring takings. And, even if many assets are not subject to such a threat, a theory based on the recurring takings problem is valid since liability rules do not hold a particular advantage for assets that are not subject to recurring takings.

C. Ex Ante Efficiency

Our focus so far has been on ex post exchange efficiency. The question was whether property rules are better at facilitating the movement of assets from low- to high-valuation users, and at preventing the movement of assets from high- to low-valuation users. Another important difference between property rules and liability rules has to do not with ex post efficiency, but rather with ex ante efficiency. We now review three prominent ex ante efficiency arguments. Bounded rationality exacerbates some ex ante efficiency concerns about liability rules, and reduces others. Overall, ex ante efficiency analysis should be incorporated into a comprehensive consequentialist theory of property.

1. Investments in Taking and Anti-Taking Technologies

The first set of ex ante efficiency concerns traces back to the analytical similarity between taking, with an undercompensatory liability rule, and theft. Theft is inefficient because it induces wasteful investments—both by asset owners who invest in anti-theft defenses (bigger fences, bigger locks, etc.) and by thieves who try to overcome these defenses. With an undercompensatory liability rule, owners feel vulnerable and thus invest, inefficiently, in anti-taking technologies. And potential takers, lured by the low "price" that an undercompensatory liability rule promises, invest inefficiently in taking technologies. These investments create no social value. Indeed, they constitute a potentially large disadvantage of liability rules.[47] We revisit these important ex ante arguments in light of the preceding analysis (in Parts II and III).

Assume that an asset is initially held by Owner. Taker must decide how much to invest in taking technologies. If Taker knows that Taker 2 can take from him in the next period, then Taker's incentive to invest in such taking technologies would be reduced. In the basic single-taker model, there is one taker with a strong incentive to invest in taking technologies. In the multiple-takers model, there are many takers, but each with a weak incentive to invest in taking technologies. It is not *a priori* clear which scenario generates more wasteful investments. It is similarly not clear whether Owner faces a greater threat of taking in the single-taker or multiple-takers scenario. If the threat of taking is smaller in the multiple-takers scenario, then the existence of multiple takers would counterintuitively reduce Owner's incentive to make wasteful investments in anti-taking technologies. But note that, in the multiple-takers scenario, Taker 1 will also invest in anti-taking technologies (to protect against a taking by Taker 2) and so will Taker 2 (to protect against a taking by Taker 3). These wasteful investments add to the efficiency concerns about liability rules.[48]

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47 *See* Kaplow & Shavell, *supra* note 2, at 722–23.

48 There is another interesting interaction between this ex ante argument and the ex post analysis of the multiple-takers problem in Part II. One condition for efficient exchange, recall, is that high-valuation parties are not significantly more vulnerable to a

These observations assumed perfect rationality. And they must be revisited when parties are boundedly rational. A naïve taker's incentive to invest in taking technologies would not be reduced by the prospect of a subsequent taking. The multiple-takers problem thus results in a multiplication of wasteful investments in taking technologies. (On the bright side, naïve takers would not invest in anti-taking technologies.) Anticipating this enhanced threat, a sophisticated Owner would increase her investment in anti-taking technologies. A naïve Owner would invest less in anti-taking technologies.

Investment in taking and anti-taking technologies are socially wasteful. Such investments, when motivated by undercompensatory liability rules, provide a potentially powerful explanation for the dominance of property rules. This explanation, which can be bolstered by bounded rationality, adds an important element to a consequentialist theory of property.

2. Investments in Improving Assets

A second ex ante concern about undercompensatory liability rules is that they would induce inefficiently low investments in improving assets. In essence, owners who expect that their assets will be taken with some probability would make inefficiently low investments in improving their assets. While this ex ante concern provides a potentially powerful argument against liability rules, the complete analysis is, once again, more subtle.

The investment efficiency argument focuses on investments made by the current owner. Indeed, property rules induce more investment by owners. But potential takers can also make investments that would increase the value of the asset post-taking. Such investments are especially important in environments where exchange efficiency requires that the asset change hands often (e.g., since the identity of the high-valuation user changes often). Liability rules can be better than property rules at inducing investments by potential takers.[49] More generally, once we recognize the bilateral nature of the investment problem—that both the current owner and the potential taker can invest—it is obvious that property rules can rarely induce optimal investments and, in any event, need not be better than liability rules.

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taking as compared to low-valuation parties. We now see that vulnerability to a taking can arise endogenously when different parties invest different amounts in anti-taking technologies. Indeed, if high-valuation parties are more likely to invest in anti-taking technologies, thus becoming less vulnerable to a taking, these investments would tend to enhance exchange efficiency. High-valuation parties will tend to invest more in anti-taking technologies if the undercompensation problem is more severe for these parties. This seems likely. Even with a constant percentage of undercompensation (e.g., damages equal to 60% of the asset's actual value, which are equivalent to an undercompensation rate of 40%), the loss would be larger for a high-valuation party (e.g., 40% of $1000 is greater than 40% of $800).

49 *See* Bebchuk, *supra* note 3. Investments by takers are especially important in the intellectual property context. *See, e.g.*, Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and the Patent Law*, 5 J. ECON. PERSP. 29 (1991).

The problem is analogous to the hold-up problem studied in the contract theory literature. That literature explores the relative efficiency of allocating ownership rights to one party or the other.[50] The basic insight is that the party who gets the ownership right will invest more, while the party who does not get the ownership right will invest less.[51] The contract theory literature, however, (implicitly) assumes that the ownership rights to be allocated must be protected by property rules. Investment efficiency can be improved when the allocated ownership rights are protected by liability rules.

Even focusing on investments made by the current owner, property rules, and also fully compensatory liability rules, would lead to inefficient, excessive investment when exchange efficiency requires that the asset change hands with some positive probability. Consider a fully compensatory liability rule. With full compensation, the owner expects the same payoff with and without a taking. The owner will thus invest as if the probability of a taking is zero. But this level of investment would be excessive. Since in the event of a taking the investment goes to waste, the optimal investment must be reduced to account for the probability of a taking.[52] When full compensation leads to excessive investment, an undercompensatory liability rule may be better.

The basic argument is that property rules provide better incentives to invest in improving assets. We have seen that this argument requires some qualification. The introduction of bounded rationality further qualifies the argument against liability rules. The basic concern, recall, is that a fear of taking would dilute the owner's incentive to invest in improving her asset. This concern is mitigated, when a naïve owner underestimates the likelihood of a taking.

3. Entry and Exit Decisions

A third set of ex ante efficiency concerns implicate the structure of the market and its viability. In many markets, sellers-owners and buyers-takers must decide whether to enter or exit the market. These entry and exit decisions will depend on the legal rule; in a liability rule regime, they will depend on the expected damages that the court will award when the asset is taken. In particular, buyers-takers who anticipate undercompensation will enter the market, even those with low valuations who generate inefficient exchanges (transfers from high-valuation sellers to low-valuation buyers). More troubling, sellers-owners who anticipate undercompensation will exit the market.

Indeed, an unraveling dynamic might lead to the complete collapse of the market. To see why, assume that court-awarded damages evolve to approximate the average valuation among all sellers in the market. Sellers

50 *See, e.g.*, HART, *supra* note 8.

51 *See id.* at 6.

52 *See* Louis Kaplow, *An Economic Analysis of Legal Transitions*, 99 HARV. L. REV. 509, 527–32 (1986). Note that optimal investment must be reduced to account for the probability of a taking only to the extent that the taker does not benefit from the investment. *Id.*

with above-average valuations who expect to be undercompensated will exit the market. Over time, the level of damages will go down, reflecting the lower valuations of remaining sellers. But then sellers with valuations above this lower average will expect to be undercompensated and exit. Damages will again adjust downward. And so on.[53]

The potential distortions in entry and exit decisions depend on a relatively high level of sophistication among sellers and buyers. The introduction of bounded rationality reduces the extent of these distortions.

4. Taking Stock

The ex ante efficiency analysis identified several disadvantages of liability rules. They induce wasteful investments in taking and anti-taking technologies. They discourage owners from investing in improving their assets. And they distort entry and exit decisions. Bounded rationality might exacerbate the first disadvantage, but likely reduces concerns about the other two. Overall, ex ante efficiency arguments remain important and should be incorporated into a general, consequentialist theory of property.

D. Nonconsequentialist Theories

Ours is a consequentialist theory of property. It may be thought that the true justification for property rule protection rests not on a consequentialist, efficiency theory, but rather on a nonconsequentialist theory. Liability rules, so the argument goes, permit nonconsensual takings, which are an affront to the owner's autonomy. To protect this autonomy interest, strong property rule protection is necessary.[54] We are happy to embrace this autonomy argument. Our claim is that, even if an autonomy theory can explain the dominance of property rule protection, our consequentialist explanation would still be of interest. The choice between property rules and liability rules implicates the very foundations of the market economy. An institutional design choice with such far-reaching economic consequences demands a consequentialist, efficiency-based justification.

CONCLUSION

Property rights are often protected by property rules. Indeed, the very idea of a property right is inexorably linked to the notion of strong, property rule protection. And yet, from a consequentialist, efficiency perspective, the preference for property rules is far from obvious. The conventional explana-

53 *See* Bar-Gill & Bebchuk, *supra* note 3, at 378–80.

54 *See* Kaplow & Shavell, *supra* note 2, at 766–67 (discussing the superiority of property rules to liability rules as property rule protection prevents the owners from paying bribes to prevent nonconsensual takings); *cf.* AYN RAND, CAPITALISM: THE UNKNOWN IDEAL 11 (1966) ("Capitalism is a social system based on the recognition of individual rights, including property rights, in which all property is privately owned."); Bar-Gill & Bebchuk, *supra* note 3, at 376 (recognizing the traditional nonconsequential justification for limiting the applicability of the restitution rule because of "the potential buyer's autonomy").

tion for the dominance of property rules, at least the explanation that focuses on ex post exchange efficiency, fails on its own terms when assessed under the conventional assumption of perfect rationality. We replace the perfect rationality assumption with a more realistic assumption of bounded rationality and show that, when parties are boundedly rational, property rules emerge as the more efficient regime. Bounded rationality thus provides the missing component for a consequentialist theory of property.

APPENDIX

This Appendix contains two Parts. In Appendix Part I, we elaborate on the discussion in Section II.D. and illustrate the limits of the efficiency results derived in the perfect rationality model. In Appendix Part II, we provide a comprehensive analysis of the two recurring takings scenarios that were mentioned but not analyzed in the text: the reappearing-taker scenario and the reciprocal-takings scenario.

I. THE LIMITS OF EFFICIENCY

In Section II.D, we argued that, even in a perfect rationality model, efficiency is guaranteed in a liability rule regime only if the bargaining environment does not provide a significant advantage to low-valuation parties. We identified three possible sources for such an advantage: (a) the bargaining power of low-valuation parties is significantly stronger than the bargaining power of high-valuation parties; (b) high-valuation parties are significantly more vulnerable to a taking than low-valuation parties; and (c) low-valuation parties receive significantly higher damages than high-valuation parties following a taking. We now analyze each of these three sources and show how they might lead to inefficient allocations.

A. Bargaining Power Inversely Correlated with Valuation

Assume, as before, that Owner has a valuation of $100 per period and Taker has a valuation of $90 per period. But now assume that Taker 2 has a valuation of $70 per period. Damages are $60 per period, as before. The key assumption concerns bargaining power. Assume, as before, that in the period 1 bargaining, between Owner and Taker, Owner can make a take-it-or-leave-it offer. But now assume that Owner, the highest-valuation user, has no bargaining power when negotiating with Taker 2 in period 2. Specifically, assume that Taker 2 can make a take-it-or-leave-it offer to Owner. In contrast, assume that Taker, whose valuation is lower than Owner's, has all the bargaining power when negotiating with Taker 2 in period 2. Specifically, assume that Taker can make a take-it-or-leave-it offer to Taker 2.

As before, we proceed by backward induction, starting with period 2. At the beginning of period 2, the asset is held either by Owner or by Taker. Taker 2 arrives and threatens to take the asset from its current holder. If the asset is held by Owner and Taker 2 takes the asset, then Owner gets a payoff of $60, as compared to a payoff of $100 if there is no taking. Therefore, Owner would be willing to pay up to $40 to avoid a taking. And, since Taker 2 has all the bargaining power, Owner will pay a bribe of $40 and keep the asset. (For Taker 2, $40 > 70 - 60$.) If the asset is held by Taker, and Taker 2 takes the asset, then Taker 2 gets a payoff of $70 - 60 = \$10$. Therefore, since Taker has all the bargaining power, Taker will pay a bribe of $10 and keep the asset. (For Taker, $90 - 10 > 60$.)

Going back to period 1, Taker arrives and threatens to take the asset from Owner. If Taker takes the asset, he gets a payoff of: $2*90 - 2*60 - 10 =$

$50 (he enjoys a use value of $90 for both periods, pays damages of 2*60 for depriving Owner of two periods' worth of use, and pays a bribe of 10 to Taker 2 in period 2). Therefore, Owner would have to pay a bribe of $50 to avoid a taking. But this would leave Owner with an expected payoff of: 2*100 – 50 – 40 = $110 (she enjoys a use value of 100 for both periods and pays a bribe of 50 in period 1 and a bribe of 40 in period 2). Owner is better off surrendering the asset to Taker and getting damages of 2*60 = $120. We get an inefficient outcome: the asset moves from the party with the higher valuation, Owner, to a party with a lower valuation, Taker.

Coasean bargaining fails because the asset is more valuable to Taker than it is to Owner, even though Owner's use value is larger. The asset is more valuable to Taker because of his superior bargaining power vis-à-vis Taker 2. While Owner will have to pay Taker 2 a bribe of $40, Taker will pay only $10.

As noted above, when bargaining power is inversely related to valuation, property rule protection also cannot guarantee efficiency. To see why, assume that Taker 2 has a valuation of $120 per period. In period 2, if the asset is held by Owner, Owner will sell it to Taker 2 for a price of $100 (recall that Taker 2 has all the bargaining power vis-à-vis Owner). If the asset is held by Taker, Taker will sell it to Taker 2 for $120 (recall that Taker has all the bargaining power vis-à-vis Taker 2). Therefore, in period 1, the asset is worth 2*100 = $200 to Owner, and 90 + 120 = $210 to Taker. This means that, in period 1, Owner will sell the asset to Taker for $210. Once again, we get an inefficient outcome: the asset moves from the party with the higher valuation, Owner, to a party with a lower valuation, Taker.

B. Vulnerability to Taking Inversely Correlated with Valuation

Since the question of vulnerability to a taking is relevant only in a liability rule regime, our analysis in this Appendix Section focuses on liability rules. We return to our baseline model, where Owner has a valuation of $100 per period and both Taker and Taker 2 have a valuation of $90 per period; and where the current holder of the asset has all the bargaining power. We introduce heterogeneous vulnerability by assuming that, in period 2, if Owner holds the asset, she will definitely face a taking threat from Taker 2; but if Taker holds the asset, he will face a taking threat with a probability of 20%.

As before, we proceed by backward induction, starting with period 2. At the beginning of period 2, the asset is held either by Owner or by Taker. Taker 2 may arrive and threaten to take the asset. If Taker 2 takes the asset, he gets a payoff of 90 – 60 = $30. Therefore, Owner or Taker will pay a bribe of $30 to avoid a taking. (For Owner, 100 – 30 > 60; for Taker, 90 – 30 = 60.) Note, however, that while Owner will pay this bribe with 100% certainty if she holds the asset at the beginning of period 2, Taker will pay this bribe with a probability of only 20%.

Going back to period 1, Taker arrives and threatens to take the asset from Owner. If Taker takes the asset, he gets a payoff of:

2*90 – 2*60 – 0.2*30 = $54 (he enjoys a use value of $90 for both periods, pays damages of 2*60 for depriving Owner of two periods' worth of use, and with a probability of 20% pays a bribe of 30 to Taker 2 in period 2). Therefore, Owner would have to pay a bribe of $54 to avoid a taking. But this would leave Owner with an expected payoff of 2*100 – 54 – 30 = $116. Owner is better off surrendering the asset to Taker and getting the damages of 2*60 = $120. We get an inefficient outcome: the asset moves from the party with the higher valuation, Owner, to a party with a lower valuation, Taker.

Coasean bargaining fails because the asset is more valuable to Taker than it is to Owner, even though Owner's use value is larger. The asset is more valuable to Taker, because he is less vulnerable to a taking in period 2.[55]

C. Damages Inversely Correlated with Valuation

Since the question of damages is relevant only in a liability rule regime, our analysis in this Appendix Section focuses on liability rules. We return to our baseline model, where both Owner and Taker face a taking threat in period 2 with a 100% probability. We assume, however, that while Owner still gets damages of $60 per period if the asset is taken from her, Taker gets damages of $85 per period if the asset is taken from him.

As before, we proceed by backward induction, starting with period 2. At the beginning of period 2, the asset is held either by Owner or by Taker. Taker 2 arrives and threatens to take the asset. If Owner holds the asset and Taker 2 takes it, Taker 2 gets a payoff of 90 – 60 = $30. Therefore, Owner will pay a bribe of $30 to avoid a taking. (For Owner, 100 – 30 > 60.) If, however, Taker holds the asset and Taker 2 takes it, Taker 2 gets a payoff of 90 – 85 = $5. Therefore, Taker will pay a bribe of $5 to avoid a taking. (For Taker, 90 – 5 = 85.)

Going back to period 1, Taker arrives and threatens to take the asset from Owner. If Taker takes the asset, he gets a payoff of: 2*90 – 2*60 – 5 = $55 (he enjoys a use value of 90 for both periods, pays damages of 2*60 for depriving Owner of two periods' worth of use, and pays a bribe of 5 to Taker 2 in period 2). Therefore, Owner would have to pay a bribe of $55 to avoid a taking. But this would leave Owner with an expected payoff of 2*100 – 55 – 30 = $115. Owner is better off surrendering the asset to Taker and getting the damages of 2*60 = $120. We get an inefficient outcome: the asset moves from the party with the higher valuation, Owner, to a party with a lower valuation, Taker.

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55 The scenario analyzed in this Section resembles the case of a bully who takes from others, whereas no one dares take from him. The resemblance, however, is only superficial. Our analysis assumes a strong state, with an effectively enforced criminal law. Under this assumption, physical strength provides a limited advantage. The analysis is quite different in the absence of a strong state. *Cf.* Michele Piccione & Ariel Rubinstein, *Equilibrium in the Jungle*, 117 ECON. J. 883, 884–85 (2007); Michele Piccione & Ariel Rubinstein, *The Curse of Wealth and Power*, 117 J. ECON. THEORY 119, 119–20 (2004).

Coasean bargaining fails, because the asset is more valuable to Taker than it is to Owner, even though Owner's use value is larger. The asset is more valuable to Taker, because the law affords Taker greater protection against a period 2 taking. Namely, while both Owner and Taker are equally vulnerable to a taking, by Taker 2, in period 2, Taker expects to receive substantially larger damages; and this bolsters his bargaining position vis-à-vis Taker 2.

II. Recurring Takings Continued: Reappearing Taker and Reciprocal Takings

In Section I.B., we identified three recurring takings scenarios: multiple takers, reappearing taker, and reciprocal takings. The analysis focused on the multiple-takers scenario. In this Appendix Part, we offer a comprehensive analysis of the reappearing-taker scenario and the reciprocal-takings scenario. Appendix Section II.A adopts the perfect rationality assumption, restates the conventional justification for property rules, and presents our critique of the conventional justification. Appendix Section II.B replaces the conventional, perfect-rationality assumption with a bounded rationality assumption and develops our bounded rationality theory of property.

A. The Conventional Justification and Its Failure

The body of the Article focused on the multiple-takers problem—a pillar of the conventional explanation for the dominance of property rules—and identified large cracks in this pillar. We now consider two related problems: the reappearing-taker problem and the reciprocal-takings problem. They, too, appear to support the dominance of property rules, but upon closer look do not.

Consider the reappearing-taker problem first. Return to the basic setting with one Owner and one Taker. The traditional account posits that if Owner bribes Taker in period 1, Taker goes away and does not return. The assumption is that, in exchange for the bribe, Taker commits not to take, ever. What if such perfect commitment was impossible? What if Taker could reappear in period 2 and again threaten to take the asset, and then again in period 3, and so forth? As in the multiple-takers case, it seems that Owner would not be willing to pay multiple bribes—here, all bribes would be paid to (the same) Taker—and just let Taker take the asset in period 1. But, once again, the no-commitment problem is not as severe as it might initially appear. Anticipating the payment of future bribes reduces the magnitude of the bribe in the current period. With perfect commitment, Owner pays one large bribe. With no commitment, Owner pays a series of small bribes. Either way the asset stays with Owner, as is efficient.

Next consider the reciprocal-takings problem. Focusing, again, on the basic setting with one Owner and one Taker, the traditional account posits that the game ends when Taker takes the asset. But if the asset is taken (and after Taker pays the undercompensatory damages), Owner will have an

incentive to retake the asset (and pay undercompensatory damages to Taker). Taker will then want to take the asset again. And so on. Such back-and-forth would constitute a clear disadvantage of a liability rule regime. But, again, the problem can be avoided through Coasean bargaining. The prospect of reciprocal takings reduces the value to Taker of a period 1 taking, such that Owner can prevent the initial taking with a relatively small bribe.

We now derive these results more formally.

1. Framework of Analysis

The framework is similar to the one developed in Section II.B. Consider a simple, two-period model (without any discounting). At the beginning of period 1, the asset is held by Owner. In period 1, Taker appears and threatens to take the asset from Owner. Owner values the asset at $100 per period (namely, Owner enjoys a use value of $100 per period). Taker values the asset at $90 per period.

The differences arise when we move to period 2. We describe the period 2 interactions separately for the reappearing-taker and reciprocal-takings problems:

> *Reappearing taker.* If Taker took the asset from Owner in period 1, Taker enjoys secure possession of the asset in period 2. If Taker did not take the asset in period 1, Taker reappears in period 2 and again threatens to take the asset from Owner. In other words, in the period 1 bargaining between Owner and Taker, Taker cannot commit to refrain from threatening to take the asset once again in period 2.
>
> *Reciprocal takings.* If Taker took the asset from Owner in period 1, in period 2 Owner takes the asset back. In other words, Owner can become a taker—taking is reciprocal. (If Taker did not take the asset in period 1, Owner enjoys secure possession of the asset in period 2.)

The basic model had one period and one taker. The multiple-takers model had two periods and two takers, with a different taker appearing in each period. The reappearing-taker model has two periods and one taker, but this taker can appear in both periods. The reciprocal-takings model also has two periods and one taker, but the initial owner can become a taker in the second period. As before, we assume that, in the bargaining between the current holder of the asset and the potential taker, the current holder has all the bargaining power and therefore can make a take-it-or-leave-it offer to the potential taker.

2. Efficiency Results

In Section II.C., we showed that liability rules support efficient exchange in the multiple-takers case. We now show that liability rules support efficient exchange also in the reappearing-taker and reciprocal-takings cases.

a. Reappearing Taker

The basic model had one period and one taker. When moving from a single-period to a two-period model, a preliminary question concerns the ability of the taker to commit, in the first period, not to take the asset in the second period. We begin with a baseline, perfect commitment model, and then turn to the no-commitment, reappearing-taker model. We show that the efficient outcome obtains under both models—the commitment question turns out to be irrelevant.

Perfect commitment. Taker can threaten to take the asset in period 1. If, in period 1, Taker accepts a bribe and agrees not to take the asset, he will not reappear in period 2 (and thus will not again threaten to take the asset). In this situation, Taker gains 2*90 – 2*60 = $60 by taking the asset in period 1. Therefore, assuming that Owner has all the bargaining power, she will pay Taker an amount equal to $60 to prevent a taking. Owner's expected payoff is 2*100 – 60 = $140, and she gets to keep the asset which is the efficient outcome. Note that, for Owner, a payoff of $140 is better than the alternative of getting 2*60 = $120 in damages.

No commitment. Now Taker cannot commit to refrain from taking the asset in period 2. To analyze the strategic interaction between Owner and Taker, we proceed by backward induction, starting with period 2. At the beginning of period 2, the asset is held either by Owner or by Taker. If the asset is held by Taker, then Taker enjoys secure possession in period 2 and a payoff of $90. If the asset is held by Owner, Taker arrives and threatens to take the asset. If Taker takes the asset, he gets a payoff of 90 – 60 = $30. Therefore, Owner will pay a bribe of $30 to avoid a taking. (For Owner, 100 – 30 > 60.)

Going back to period 1, Taker arrives and threatens to take the asset from Owner. If Taker takes the asset, he gets a payoff of 2*90 – 2*60 = $60; if he does not take the asset he gets a payoff of 90 – 60 = $30 (his expected period 2 bribe). Therefore, assuming that Owner has all the bargaining power, she will pay the difference between Taker's taking payoff and no-taking payoff—a $30 bribe—to avoid a period 1 taking.

Overall, Owner's expected payoff is 2*100 – 2*30 = $140. She gets to keep the asset during both periods, enjoying a use value of 2*100, but pays a bribe of $30 twice—in period 1 and in period 2. The asset stays with its high-value user, Owner, which is the efficient outcome. Note that for Owner a payoff of $140 is better than the alternative of getting 2*60 = $120 in damages. Also note that the outcome is very similar to the perfect commitment outcome. The only difference is that with perfect commitment Owner pays a single bribe of $60 in period 1, whereas with no commitment Owner pays two bribes of $30 each.

b. Reciprocal Takings

We next consider the reciprocal-takings scenario. Here, as before, we have only two parties, Owner and Taker. The situation is similar to the perfect commitment scenario, except that now, if Taker took the asset in period 1, Owner can retake it in period 2.

To analyze the strategic interaction between Owner and Taker, we proceed by backward induction, starting with period 2. At the beginning of period 2, the asset is held either by Owner or by Taker. If the asset is held by Owner, then Owner enjoys secure possession in period 2 and a payoff of $100. If the asset is held by Taker, Owner will threaten to take back the asset. If Owner takes the asset, he gets a payoff of 100 – 60 = $40. Therefore, Taker will need to pay a bribe of $40 to avoid a taking, which would leave Taker with a payoff of 90 – 40 = $50. Since this payoff is smaller than the damages award of $60, Taker will decline to pay the necessary bribe, and Owner will take the asset.

Going back to period 1, Taker arrives and threatens to take the asset from Owner. If Taker takes the asset, he gets a payoff of: 90 – 2*60 + 60 = $30 (he enjoys a use value of 90 for period 1, pays damages of 2*60 for depriving Owner of two-periods' worth of use, and gets damages of $60 in period 2 when Owner retakes the asset). Therefore, Owner will pay a bribe of $30 to avoid a taking. Owner's expected payoff is 2*100 – 30 = $170, and she gets to keep the asset, which is the efficient outcome. Note that, for Owner, a payoff of $170 is better than the alternative of getting 2*60 = $120 in damages.

3. Unconditional Efficiency

We have seen that efficiency obtains in the reappearing-taker and reciprocal-takings cases. In the multiple-takers case, the efficiency result relied on the assumption that the bargaining environment does not provide a large advantage to low-valuation parties. This assumption is not necessary in the reappearing-taker and reciprocal-takings cases. The efficiency results are unconditional. The intuition harkens back to the Coase Theorem and to our discussion in Section II.E. In the multiple-takers case, we had three parties (and in reality, many more). When all parties cannot sit at the same (ex ante) bargaining table, the Coase Theorem does not apply and our extension of the Theorem requires an extra assumption—that the bargaining environment does not provide a large advantage to low-valuation parties. In the reappearing-taker and reciprocal-takings cases, there are only two parties. These parties, when they bargain in period 1, account for their future interaction in period 2. The Coase Theorem applies and efficiency obtains as long as transaction costs are held at zero; no extra assumption is required.

We next illustrate the unconditional efficiency result. In the multiple-takers case, efficiency is compromised when the bargaining environment provides a large advantage to low-valuation parties. We saw three possible sources for such an advantage:

1. Low-valuation parties have significantly stronger bargaining power.
2. Low-valuation parties are significantly less vulnerable to a taking.
3. Low-valuation parties receive significantly higher damages following a taking.

Take the first source—bargaining power that is inversely correlated with valuation—and verify that it does not stand in the way of an efficient outcome in the reappearing-taker and reciprocal-takings cases. Specifically, replace the assumption that the current holder of the asset has all the bargaining power with the assumption that the low-valuation Taker has all the bargaining power. Starting with the reappearing-taker case, we proceed by backward induction. At the beginning of period 2, the asset is held either by Owner or by Taker. If the asset is held by Taker, then Taker enjoys secure possession in period 2 and a payoff of $90. If the asset is held by Owner, Taker arrives and threatens to take the asset. If Taker takes the asset, Owner gets a payoff of $60. Therefore, Owner will pay a bribe of 100 – 60 = $40 to avoid a taking. (For Taker, 40 > 90 – 60.) Going back to period 1, Taker arrives and threatens to take the asset from Owner. If Taker takes the asset, Owner gets a payoff of 2*60 = $120; if he does not take the asset Owner gets a payoff of 2*100 – 40 = $160. Therefore, assuming that Taker has all the bargaining power, Owner will pay the difference between her taking payoff and no-taking payoff—a $40 bribe—to avoid a period 1 taking. When bargaining power shifts to the Taker, the Owner pays higher bribes, but efficiency still obtains: the asset stays with its high-value user, Owner.

Similar results obtain in the reciprocal-takings case. The period 2 analysis is unaffected by the shift in bargaining power: If the asset is held by Owner, then Owner enjoys secure possession in period 2 and a payoff of $100. If the asset is held by Taker, Owner will take the asset and pay damages of $60 to Taker. Going back to period 1, Taker arrives and threatens to take the asset from Owner. If Taker takes the asset, Owner gets a payoff of 2*60 + 100 – 60 = $160 (he gets damages of 2*60 in period 1, and in period 2 enjoys a use value of 100 and pays damages of 60); if he does not take the asset Owner gets a payoff of 2*100. Therefore, Owner will pay a bribe of $40 to avoid a taking. Owner's expected payoff is: 2*100 – 40 = $160, and she gets to keep the asset which is the efficient outcome.

The two remaining sources of advantage also do not interfere with exchange efficiency. We leave it to the reader to verify this result numerically. We do note that these sources of advantage are conceptually irrelevant in the reappearing-taker case since only Owner is subject to a taking, and, therefore, it is meaningless to compare vulnerability to a taking of high- versus low-valuation parties; similarly, it is meaningless to compare damages payments received by high- versus low-valuation parties.

B. Bounded Rationality

We have shown that the reappearing-taker and reciprocal-takings problems do not interfere with exchange efficiency in a liability rule regime,

when parties are perfectly rational. In the reappearing-taker case, as in the multiple-takers case, relaxing the rationality assumption resurrects concerns about whether liability rules can support exchange efficiency. Bounded rationality does not raise efficiency concerns in the reciprocal-takings case.

1. Reappearing Taker

In the perfect rationality model, Owner and Taker, in their period 1 negotiations, realize that, if Taker does not take the asset in period 1, he will reappear in period 2 and extract a bribe of $30. This reduces the bribe that Taker gets in period 1. Specifically, Owner pays a bribe of $30 to Taker in period 1 and a bribe of $30 to Taker in period 2, for an overall expected payoff of 2*100 – 2*30 = $140. Since this payoff is greater than the damages alternative, 2*60 = $120, Owner pays the bribes and keeps the asset, as is efficient.

What if a naïve Taker, in the period 1 negotiations with Owner, does not account for the bribe that he will get in period 2? This shortsightedness would increase the period 1 bribe that Taker demands by $30, from $30 to $60. While Taker is naïve, Owner remains sophisticated and realizes that she will pay a second bribe of $30 in period 2. Owner's overall payoff would thus be 2*100 – 60 – 30 = $110. This payoff is smaller than the damages alternative, 2*60 = $120, and thus Owner would give up the asset in period 1—an inefficient outcome. When Taker is naïve, but Owner is sophisticated, exchange efficiency is compromised.

What if both Taker and Owner are naïve? If both parties are naïve, then efficiency is restored. Taker's shortsightedness increases the period 1 bribe that Taker demands, because Taker ignores the period 2 bribe that he will get. And Owner's shortsightedness increases the period 1 bribe that Owner is willing to pay, because Owner similarly ignores the period 2 bribe that she will pay. The expected payoff of the shortsighted Owner would thus be 2*100 – 60 = $140, larger than the damages alternative, 2*60 = $120. Owner would thus pay the bribe, $60, and retain the asset in period 1, as is efficient. When Taker "surprisingly" reappears in period 2, Owner would pay a second bribe, $30, and retain the asset. The efficient outcome would obtain, but Owner would lose: she would end up paying a total bribe of 60 + 30 = $90, which would leave her with an expected payoff of 2*100 – 90 = $110, less than the damages alternative, 2*60 = $120. Efficiency is also achieved when Taker is sophisticated and Owner is naïve.

In a more general model, with many owners and takers, there will be some sophisticated owners and some naïve owners, and some sophisticated takers and some naïve takers. In this general model, some portion of the Owner-Taker interactions will involve a naïve Taker and a sophisticated Owner, and result in inefficient exchange. When some parties are boundedly rational, liability rules cannot guarantee efficient exchange in the reappearing-taker scenario.

2. Reciprocal Takings

Bounded rationality has a more limited effect in the reciprocal-takings case. In the perfect rationality model, Owner and Taker, in their period 1 negotiations, realize that, if Taker takes the asset, he will then lose the asset in period 2 (when Owner retakes it). This reduces the bribe that Taker gets in period 1. Specifically, Owner pays a bribe of 90 – 2*60 + 60 = $30.

What if a naïve Taker, in the period 1 negotiations with Owner, does not account for the fact that he will lose the asset to Owner in period 2? This shortsightedness would increase the period 1 bribe that Taker demands by $30, from 30 to 2*90 – 2*60 = $60. While Taker is naïve, Owner remains sophisticated and realizes that she will retake the asset in period 2 (and pay damages of $60). Owner's overall payoff would thus be 2*100 – 60 = $140. This payoff is still larger than the damages alternative, 2*60 = $120, and thus Owner would pay the bribe and keep the asset in period 1—an efficient outcome.

It is difficult to imagine a naïve Owner in the reciprocal-takings scenario; even a less sophisticated Owner should understand that she will retake the asset in the next period. (Unlike in the multiple-takers and reappearing-taker scenarios, Owner need not anticipate the behavior of other parties.) Moreover, Owner's shortsightedness would have no effect on the period 1 bargaining, because the period 2 retaking is off the equilibrium path. The expected payoff of the shortsighted Owner would still be 2*100 – 60 = $140. The efficient outcome obtains regardless of the parties' sophistication.