OPTIONAL LAW IN PROPERTY: THEORETICAL CRITIQUES AND A NEW VIEW OF THE CATHEDRAL

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ABSTRACT
Since Calabresi & Melamed’s seminal article on property rules and liability rules, numerous law and economic articles have debated the efficiency of these two rules. Many of the follow-up articles

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contend that Calabresi & Melamed are wrong in arguing that property rules are more efficient when transaction costs are low. Put-option liability rules and other sub-types of liability rules have been developed, and they are claimed to be superior to property rules. As several property scholars have pointed out, however, the shadow examples in this so-called optional law literature are not property laws, and they have contended that property rules should be the default in property law. Building on this line of literature, this article argues that Calabresi & Melamed are actually correct—property rules are indeed more efficient than liability rules in property law in a low transaction-cost setting, because property rules better harness private information. In addition, this article develops a theory as to when call-option liability rules might be more efficient. This article also argues that Rules 3 and 4 are either unnecessary concepts or inefficient entitlement protection rules in the area of property, and that put-option liability rules are less efficient than call-option liability rules in property, because calls utilize private information better than puts. Finally, this article contends that liability rules are intrinsically different from financial options and legal options; thus, the option analogy is better avoided.

INTRODUCTION

Guido Calabresi & Douglas Melamed, in their seminal 1972 Harvard Law Review article, advance a unifying framework of private law. Since then, many legal minds have contributed to expand the framework and debated which rule under what conditions is more efficient. In this article, I call the whole body of literature the “optional law” literature.

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1 See the Appendix for an expanded explanation of efficiency.
2 In plain language, option is a contract that gives the buyer of the option to purchase or sell a specified thing or right to the seller of the option at or before a specified date at the “strike price” (also called the exercise price). The buyer of the option generally pays a price to the seller at the time of the option transaction. The option to
To start, the optional law literature centers around the assignment of entitlement and the efficiency of six prototypical entitlement protection rules. In Calabresi & Melamed’s classic resident setting, with a “pollutee” resident versus “the polluter” factory, as shown in Table 1, Rules 1 and 3 (the property rules) assign the entitlement to one of the parties, who can determine how to use the resource. The other party can change this use only through voluntary exchanges with the entitlement holder. Rules 2 and 4 (the “call-option liability rules”) allow non-holders to take the entitlement if they compensate the loss of the holders. Rules 5 and 6 (the “put-option liability rules”) allow the holders of the entitlement to force others to purchase the entitlement.

Consider the pollution example: Under Rule 1, the residents can enjoin the factory from polluting; put differently, to continue operating and polluting, the factory has to acquire the consent of the residents. Under Rule 2, the factory can pollute without the residents’ consents, as long as the factory compensates the residents (generally at the court-specified amount). (Eminent domain is also a prime example for Rule 2) Under Rule 3, as the entitlement is assigned to the factory, it has the privilege to pollute; to shut down the factory, the residents have to buy the factory out. Under Rule 4, the factory can pollute, but the residents can stop the operation of the factory and reimburse the factory for its losses. Under Rule 5, the factory can choose to stop polluting and request the residents to compensate the factory for its losses. Under Rule 6, the residents are entitled to clean air, but they can request the factory to pollute and pay them.

Purchase is called the call (option), whereas the option to sell is called the put (option). See infra Part I.

I call this optional law literature because Ian Ayres, one of the most important contributors to this literature wrote a book called “optional law,” synthesizing the theory. See generally Ian Ayres, Optional Law: The Structure of Legal Entitlements (2005).
The application of this Rules 1–6 framework goes beyond nuisance. Indeed, as the prior literature contends, any private law issue with two parties can be analyzed with this general framework. No wonder the Calabresi & Melamed article has been cited more than 1100 times, according to the Web of Science database.

Calabresi & Melamed coined the term “property rule” to refer to Rules 1 and 3 because “much of what is generally called private property can be viewed as an entitlement which is protected by a property rule.” In other words, property law is featured by the property rule. An injunction to evict trespassers or to stop nuisance is a case in point. In the past two decades, however, the term “property rule” is in danger of becoming a misnomer that confuses, rather than illuminates. Ian Ayres and many others claim that property rules are less efficient than liability rules (Rules 2, 4, 5, and 6 above), even in the field of property law, when transaction costs

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4 Kaplow & Shavell define the property rule in the following way: “[t]he state guarantees property right assignments against infringement through the threatened use of its police powers.” Louis Kaplow & Steven Shavell, Property Rules Versus Liability Rules: An Economic Analysis, 109 HARV. L. REV. 713, 715 (1996).


6 According to Ayres & Balkin, “[a] liability rule gives at least one party an option to take an entitlement non-consensually and pay the entitlement owner some exercise price.” Ian Ayres & J.M. Balkin, Legal Entitlements as Auctions: Property Rules, Liability Rules, and Beyond, 106 YALE L.J. 703, 704 (1996).
This article critically reviews the optional law literature and argues that in the field of physical property law, property rules are generally superior to liability rules in terms of efficiency. Calabresi & Melamed are correct in naming the rule and identifying its efficiency.

This article is not a naïve, blanket endorsement of Calabresi & Melamed. While they are generally correct in identifying the efficient traits of property rules, their four rules are not equally useful in property law, and their characterization of the issue, with entitlement assignment as the first step, blurs the nature of most property disputes. Even in the law of nuisance, the entitlements in property disputes (such as ownership, fee simple, lesser property interests, etc.) have already been assigned, in whole (most cases) or in part (nuisance). The court’s job is not to first determine who owns Blackacre. Rather, given that Blackacre and most other resources are owned (by a particular person or the state), courts determine whether to issue injunctions to protect Blackacre’s owner (Rule 1) or to order the infringer to compensate the owner for her losses (Rule 2).8

The Calabresi & Melamed framework and the add-ons by later scholars suggest a symmetrical structure of property entitlement. This article, by contrast, prefers depicting Rule 1 as the center and default, and characterizing Rules 2, 3, 4, and 5 as different ways the original owners can lose their properties to others non-consensually. Rule 6 is the exceptional rule that gives original owners an extra choice to force a sale on others. This less fancy version of entitlement delineation highlights Rule 1 as the baseline rule in property, and emphasizes the five other rules as less common alternatives to Rule 1 that legislatures or courts can draw on to adjust

7 See Ayres, supra note 3, at 9.
8 In other words, in the field of property, even in nuisance law, it is unnecessary to think in terms of Rules 3 and 4. Rather, property entitlements can be structured with Rules 1 and 2. See infra Part II.
entitlements when Rule 1 does not produce the most efficient result. As cautioned above, Rules 3, 4, 5, and 6 are rarely used in property law, and even their rare appearance cannot pass efficiency muster in most circumstances.

To bolster the “Rule 1 center” theory, this article will make a series of theoretical\(^9\) and empirical\(^10\) claims to demonstrate why the optional law theories fail to attain efficiency in property. This article thus is not a theme and variations built on one core argument. Rather, all arguments, albeit sometimes independently, underpin the conclusion that the efficient traits of the property rule have been under-valued, if not misunderstood, in the optional law literature. The normative posture of this article is that the entitlement protection framework in property should be designed to enhance efficiency, which is a composite judgment of productive efficiency and allocative efficiency.\(^11\)

The gists of my arguments are as follows: Several authors have advanced Rules 5 and 6, and used the concepts of financial options (calls and puts) to unify the various liability rules.\(^12\) While Rules 5 and 6 could be useful in contract or intellectual property law or on a voluntary basis, these put-option rules, if imposed by statutes or judge-made laws, generally create perverse incentives in physical property law (including real estate law and personal property law).\(^13\) This tendency to encourage inefficient behaviors is why

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\(^9\) My theoretical critiques apply to prior analyses that are theoretically unsound. See infra Parts III & IV.

\(^10\) My empirical critiques point out the gap between what theorists assume and how the real-world legal system is designed. See infra Part IV.B.; infra note 75, at 797; infra note 76, at 842.

\(^11\) For the definitions of productive efficiency and allocative efficiency and their relationships, see Appendix.


\(^13\) See infra Part III.
there are very few real-world property doctrines that exemplify put-option rules. Those that do are arguably less efficient than alternative doctrines that stick to property rules or call-option liability rules because calls harness private information better than puts, and because courts tend to inaccurately assess property value.\textsuperscript{14} Furthermore, linking entitlement protection rules with calls and puts is theoretically unsound, as options transacted in the financial markets, options imposed by law, and the liability rules described by Calabresi \& Melamed have three nuanced yet important differences— 1) whether they are paid or free, voluntary or not; 2) whether they are \textit{in rem}, \textit{in personam}, or against certain people; and 3) whether their “strike price” is pre-determined and consciously perceived by the “option holders.”\textsuperscript{15} Analogizing what one learns from the financial markets to entitlement protections leads one astray—but that is perhaps one of the reasons liability rules have been mistakenly considered superior to property rules in “the law of things.”\textsuperscript{16}

In property law, property rules are generally more efficient than liability rules, because (perhaps surprising to some) the former better harnesses private information by relying on consensual agreements to transfer resources.\textsuperscript{17} Nevertheless, a property law system that adopts nothing but property rules probably will not maximize social welfare. Indeed, liability rules might be more efficient than property rules when transaction costs are high; when transferring entitlements would promote allocative efficiency; when ex ante investments are not important; and when the nature of the case makes courts less likely to commit adjudicatory errors under

\begin{itemize}
\item \textsuperscript{14} See infra Part III.
\item \textsuperscript{15} See infra Part I.
\item \textsuperscript{16} For arguments of property as a law of things, see generally Henry E. Smith, \textit{Property as the Law of Things}, 125 HARV. L. REV. 1691 (2012).
\item \textsuperscript{17} See infra Part IV. But cf. Ayres, supra note 7, at 183.
\end{itemize}
liability rules. In some circumstances, the liability rule is the only feasible choice.\textsuperscript{18} The rest of this article is structured as follows: Part I explains the three critical distinctions among financial options, legal options, and liability rules, and argues that the analogy of options does a disservice to the understanding of the nature of property entitlement and its protection rules. Part II explains why Rules 3 and 4 are of very limited use in property law, as Rules 1 and 2 alone cover much ground. Part III compares puts and calls in property law and argues that puts are generally less efficient than calls in the law of things. Part IV backs up Calabresi & Melamed’s argument that the property rule is more efficient than the liability rule when transaction costs are low, based on the counterintuitive observation that the property rule better harnesses private information. Part IV also shows why the mathematical proof in Kaplow & Shavell’s famous work\textsuperscript{19} which demonstrates the superiority of the liability rule is inapplicable in property law. Part V advances a framework of five factors that identifies the scenarios in which Rule 2 could be more efficient than Rule 1. A short conclusion recapitulates the major arguments.

I. THE FINANCIAL OPTION, THE LEGAL OPTION, AND THE LIABILITY RULE ARE DIFFERENT

Since Morris’ 1993 article,\textsuperscript{20} liability rules have been linked with financial-market options. Scholars, particularly Ian Ayres and his co-authors in a series of articles and then a book,\textsuperscript{21} expanded the

\begin{footnotesize}
\textsuperscript{18} See infra Part V.
\textsuperscript{19} See Kaplow & Shavell, supra note 4, at 775–79.
\textsuperscript{20} See generally Morris, supra note 12.
\textsuperscript{21} See generally Ayres, supra note 12; AYRES, supra note 3; Ayres & Balkin, supra note 6; Ian Ayres & Paul M. Goldbart, Optimal Delegation and Decoupling in the Design of Liability Rules, 100 MICH. L. REV. 1 (2001); Ian Ayres & Paul M. Goldbart, Correlated Values in the Theory of Property and Liability Rules, 32 J. LEGAL STUD. 121 (2003); Ian
typology of liability rules as options (see Table 1). These authors view most, if not all, legal rules and entitlements from the perspective of optional law. This article, however, argues that while analogizing options with liability rules is interesting and broadens our view, in property law at least, this analogy has also blurred the nature and function of compensation. Below I use “call options” as an example and argue that the Rule-2 liability rule found in property doctrines, call options transacted in the financial markets (hereinafter “financial options”), and call options in the optional law literature (hereinafter “legal options”) are different in three important aspects. As shown in Table 2, they differ in the number of parties affected; how and when the option strike price (or compensation) is determined; and whether the option is sold or enacted with a requirement for payment. Therefore, analogizing liability rules with options should be avoided, at least in property law.

A. Free and Involuntary versus Paid and Voluntary Options

Financial options differ from legal options and liability rules in two ways. First, whether option holders paid for the option and whether owners voluntarily sold the option. Financial options are not distributed for free, whereas in the optional law literature and the liability rule regime, options are pre-assigned or re-assigned, and option holders do not have to pay. In addition, financial opt-
tions are transacted on a voluntary basis, whereas legal options and liability rules are realized through legal stipulations, though owners may be aware of the existence of legal options and liability rules beforehand. In other words, financial options are contracts entered into voluntarily, while legal options and liability rules are mandatory laws.

This first distinction boils down to voluntariness. An owner who voluntarily enters into an option contract usually charges a certain amount of money, though she can give the option away “for free” but get something else back. In addition, when a legal option or the liability rule is imposed on an owner, the owner usually is not compensated by the option holder for the option itself, though it is certainly feasible for lawmakers to stipulate such compensation.

B. DIFFERENT PERCEIVED STRIKE PRICE

The second major distinction lies in the timing of determining “strike prices” and thus the “perceived prices.” Strike prices for financial options are determined ex ante; thus, owners of financial options, when exercising their calls, are able to compare the value of the assets with the actual strike price. Strike prices for legal options are determined ex post, often by the court. Hence, holders of legal options make decisions by comparing the value of the assets with their expected price—the price they expect the court to set. When the

24 Scott & Triantis point out the implicitness of contractual option. Still, the two parties enter into the contract voluntarily, and the contract price (in an efficient market) probably reflects the value of the options. See Robert E. Scott & George G. Triantis, Embedded Options and the Case against Compensation in Contract Law, 104 COLUM. L. REV. 1428, 1456–59 (2004).

25 Strike prices (also called exercise prices) are the prices owners/buyers of options have to pay to the sellers of options.

26 “Perceived prices” is not a term of arts. This article uses the perceived price to refer to the price option owners think they have to pay. For financial options, the perceived prices are the strike prices, as they are pre-determined. For legal options, the perceived prices are the option owner’s estimate of how much compensation courts will require her to pay.
expected prices are set accurately and the prices are correctly recognized by option owners, actual strike prices and expected strike prices converge. Nevertheless, as elaborated below, because accurate judicial assessment of property value is often infeasible, expected prices often deviate from actual prices.

Liability rules in property law do not always work like legal options. When Rule 2 is applied to good-faith agents, they, by definition, do not consciously compare the value of the assets with any price. In their calculus, they have incurred the cost of, say, purchasing the entitlements, and the cost is sunk. Put differently, good-faith agents are not aware that they are exercising an option of any sort.27

When Rule 2 is applied to bad-faith agents, infringements (such as intentional possession of others’ land) happen first, and then the strike prices of exercising the calls (such as compensation) are ascertained ex post, again usually by the court. Here, liability rules function like legal options. In both regimes, unlike in financial options, call options are not always exercised because the option holders value the entitlements more than the title holder.28 Rather, option holders may infringe because they miscalculate the price (due to, for example, over- or under-estimating the court-set compensation, or the court’s setting the compensation too high or too low). Therefore, not all infringements under the liability rule regime are efficient.

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27 Ayres and his co-author do recognize that their optional law theory concerns only intentional taking. See Ayres & Goldbart, supra note 21, at 15.

28 For similar arguments, see Lee Anne Fennell, Property and Half-Torts, 116 YALE L.J. 1400, 1428 (2007) (pointing that in law, unlike in financial options, the strike price is not readily discernible); Carol M. Rose, The Shadow of the Cathedral, 106 YALE L.J. 2175, 2181–82 (1997) (distinguishing the differences between financial options and options in the property context, particularly from the viewpoint of the entitlement holders).
C. Number of Parties Affected

Financial options, legal options, and liability rules are also different in the number of parties they can be enforced against. Financial options are in personam. That is, option holders can only use options against the parties who sold them those very options. Financial options are contracts, while liability rules are legally mandated.

Whether legal options are in personam or in rem (that is, good against an individual or good against the world) is unclear. Because the optional law literature never specifically limits the applicability of legal options, it is fair to infer that legal options are implicitly presumed to be more than in personam, if not outright in rem. In rem legal options, however, present enormous opportunities to extort.29 An owner of in rem put options can threaten to exercise the put against many lower-valuing non-owners and collect ransom.30 A group of non-owners can, one by one, threaten to exercise their respective call options against owners who value their properties more than the court-determined compensation.31 Legal options, therefore, are an uneasy fit in the structure of property.

By contrast, liability rules found in property doctrines only apply between certain parties under certain conditions.32 Liability

30 For example, I, with an in rem put option, can threaten all my neighbors to force them to buy my broken bicycle at a price courts will ascertain after the fact.
31 Thus, an in rem call option such as Levmore’s self-assessment mechanism, in which anyone can buy other’s land at the owner’s self-assessed value, would have to deal with this endless threat problem. See Saul Levmore, Self-Assessed Valuation Systems for Tort and Other Law, 68 VA. L. REV. 771, 782 (1982).
rules, as compared to legal options, fit more easily into the structure of property rights, which are exclusion-based, *in rem*, and a structured bundle of relationships. Namely, the relation between owners and certain people over the resource in question features liability rules, but the relationship between the owner and most others in the world features property rules (or, the right to exclude).

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More broadly, financial options, legal options, and liability rules have different institutional functions. Financial options, on one end of the spectrum, are one specific type of contract, the purposes of which are to hedge risks or speculate, but not to, say, re-dress allocative efficiency. Liability rules, such as eminent domain and tort compensation, concern nothing regarding hedging risks and speculation—though, notably, the liability rule itself is a hodgepodge of diverse legal doctrines that address different issues. By contrast, the most fitting example of an Ayresian legal option may be a commercial contract. The option perspective of commercial contracts serves to induce both parties to make efficient breach or performance decisions—again, not entirely the same as the hedge, compensation, and deterrence functions of liability rules and financial options. In short, it is not clear whether the analogy between options and legal rules is a stepping-stone or a stumbling block to a better understanding of property law.

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35 See id. at 29–30.

36 I thank Tom Merrill for this excellent point.
II. LIMITED USEFULNESS OF RULES 3 AND 4 IN PROPERTY

Calabresi & Melamed’s framework involves a two-step thought process: First, how entitlements should be assigned and second, how then to protect it.37 As for the first step, the literature generally focuses on how the court assigns entitlements. Nevertheless, the status quo ante in a typical property law dispute is that the property interests in the things under dispute (such as ownership, usufruct, and mortgage) are already owned or held by a certain party.38 Put differently, the entitlements are already assigned when the cases appear in court. The court does not have much room to re-assign entitlements from the original owner to a new owner. Therefore, the first step (assigning entitlements) is usually skipped in property law. In the second step, the court does sometimes adjust the protection protocols for entitlements. No wonder the prior literature focuses on the second step, or the property rules versus liability rule debate.39

Table 2: Comparison of financial call option, legal call option, and liability rule in property law

<table>
<thead>
<tr>
<th></th>
<th>Financial call option</th>
<th>Legal call option</th>
<th>Liability rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option holders pay to acquire option?</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Owners voluntarily sell option?</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>When exercising “options”...</td>
<td>Compare value with expected price</td>
<td>Compare value with expected price</td>
<td>Good-faith: do not compare value with price</td>
</tr>
<tr>
<td>Effort</td>
<td>In personus</td>
<td>In rem</td>
<td>Against certain people</td>
</tr>
<tr>
<td>Institutional function</td>
<td>Hedging risks, inducing efficient breach or performance decisions</td>
<td>Hedging a hedge of diverse doctrines with different functions</td>
<td></td>
</tr>
</tbody>
</table>
Rules 3 and 4 are rarely used in property law. And rightfully so. As elaborated in this Part, there are strong economic reasons to favor Rule 2 over Rules 3 and 4 in adjusting entitlements. This is perhaps why the court rarely reassigns the entitlement from the original owner to a new owner without requiring the latter to compensate the former. Indeed, this would constitute a “judicial takings” without just compensation.40

Section A offers a revised optional law framework that better fits property issues. Sections B and C explain why nuisance and airplane overflight, two issues that have been characterized as embodying Rule 3, can be conceptualized otherwise. Finally, Section D argues that in any case Rule 2 tends to be more efficient than Rules 3 and 4.

A. A REVISED OPTIONAL LAW FRAMEWORK

Below I twist the Calabresi & Melamed framework to better fit property law issues. Following the cautions by Carol Rose,41 I disclose that the shadow examples of this article are ownership (fee simple absolute) and the various property forms (servitude, usufruct, life estate, etc.), although I also account for nuisance issues and scenarios in which only a few sticks in the ownership bundle are chipped away.42 Under my framework (see Table 3), the definitions of the property rule and the liability rule (calls or puts) are the

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40 See generally the recent U.S. Supreme Court case Stop the Beach Renourishment v. Fla. Dep’t of Envtl. Prot., 560 U.S. 2606 (2010), for the idea of judicial takings. For reflections on this case and the judicial takings doctrine, see, e.g., Lior Strahilevitz & Eduardo M. Peñalver, Judicial Takings or Due Process?, 97 CORNELL L. REV. 305 (2012); Richard A. Epstein, Littoral Rights under the Takings Doctrine: The Clash Between the Ius Naturale and Stop the Beach Renourishment, 6 DUKE J. CONTEMP. L. & PUB. POL’Y 37–74 (2011).

41 See Rose, supra note 28, at 2176–77 (discussing the nature of “shadow” examples, which are driving the analysis of Cathedral).

same, but importantly, I change the description of the entitlement holders. Now Rules 1, 2, and 6 are entitlement protection rules for “owner/holder of property interests” (hereinafter, owner), whereas Rules 3, 4, and 5 protect the entitlements of “original non-owners.” “Non-owners” in this article refers to the parties who do not own or hold property interests until either the court re-assigns entitlements to them or they pay compensation to gain entitlements. This amendment is feasible—indeed, necessary—because, as argued above, entitlements generally have been allocated when a property dispute appears in courts.

More concretely, the six rules in property law work in the following way: Rule 1 refers to the property rule protection of the original owner, whose right to exclude protect her property interests. Rule 2 refers to the liability rule protection of the original owner; that is, the original “non-owner” can acquire entitlements through paying compensation. Eminent domain is still the best example for this rule. Rule 3 and Rule 4 mean that non-owners acquire for free the entitlement through judicial re-assignments, and the entitlement is protected by the property rule and the call-option liability rule, respectively. Rules 3 and 4 as defined here are used much less frequently in property law than Rules 1 and 2.43 Under Rule 5, the original owners not only see their entitlements taken away, the party who receives the entitlement can come back and force them to pay to get it back. It is like a thief who steals a car and subsequently forces the car owner to pay ransom to retrieve it (the owner may succumb because her baby is in the car, for example). The accession

43I cannot think of an example of Rules 3 and 4 being implemented in American or European property law. I have considered depicting the adverse possession doctrine as a Rule 3, but eventually dropped this idea and instead characterize it as a flipping of Rule 1 before and after the statute of limitation runs. I thank Tom Merrill for this point. If adverse possession is characterized as a Rule 3, as a descriptive matter, Rule 3 would still be useful, but I will argue that adverse possession qua Rule 3 is less efficient than adverse possession qua Rule 2. A full-blown discussion of this issue is deferred to my working paper on adverse possession.
doctrine, which is acquiring property by adding value, is a prime example of Rule 6. A skilled carpenter can improve other people’s movable property and demand compensation—this is essentially forcing others to purchase his labor.

<table>
<thead>
<tr>
<th>Entitlement holders</th>
<th>Property Rule</th>
<th>Liability Rule: Call option</th>
<th>Liability Rule: Put option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original owners</td>
<td>Rule 1</td>
<td>Rule 2</td>
<td>Rule 6</td>
</tr>
<tr>
<td>Original non-owners</td>
<td>Rule 3</td>
<td>Rule 4</td>
<td>Rule 5</td>
</tr>
</tbody>
</table>

Granted, property rights are incomplete; not all resources have been “propertized.” Thus, the status quo ante is not always one party as the owner of the resource in question. In some cases (for example, parties litigating over uses of open-access commons), neither party might be presumed to have an edge in the status quo ante. But then no matter who acquires the entitlement, we can call the property rule protection of it Rule 1, rather than Rule 3, for it is more intuitive to consider the party as the original owner (from the time courts allocate the entitlement), not the original non-owner.

Put differently, what was understood to be the first step of the Calabresi & Melamed framework—“initial” allocation of entitlements by the judiciary—is in fact “intermediate” allocation of entitlements, as courts in developed countries deal with property cases after the legislature has allocated property rights. The allocation of entitlement is intermediate in nature because the decision is made before the entitlement protection rule is set but after the initial legislative decisions. The property laws and courts in developed coun-

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44 For economic analysis of the accession doctrine, see Yun-chien Chang, An Economic and Comparative Analysis of Specificatio (the Accession Doctrine), 39 EUR. J. L. & ECON. 225 (2015).

45 Similar arguments apply when the legislature is designing the property rights system from scratch.
tries, however, do not re-allocate entitlements in the middle stage, as elaborated below. That said, my critique here does not suggest that, conceptually and descriptively, the entitlement allocation stage and Rules 3 and 4 are never useful. As Shitong Qiao points out, the Shenzhen government in China, in dealing with unlawful constructions (“small properties”), has used five of the six legal options to solve the issue. The Chinese phenomenon might be unique, as the government (not the court) owns the land, allocates entitlements, and determines the entitlement protection rule. It takes a trinity in a developing country in which property rights are unclear to make the optional law framework useful. In a developed country, I doubt Rules 3 and 4 are conceptually necessary.

B. NUISANCE LAW IN THE VIEW OF RULES 1 AND 2

The terms Rules 3 and 4 need not be used even in nuisance law. One may contend that nuisance law—which Ronald Coase’s *The Problem of Social Costs*, Calabresi & Melamed’s article, and others’ work use to illustrate their points—is a perfect example of how entitlements can be unassigned in property law, and at the same time the terms Rules 3 and 4 seem to have been employed usefully. While I agree that in nuisance law one could consider entitlements as subject to (re-)assignment by the court, Rules 3 and 4 are still unnecessary concepts. Instead, Rules 1 and 2 and the theory of property as a structured bundle of relations can be used to delineate entitlement assignments.

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46 See Shitong Qiao, *Small Property, Adverse Possession and Legal Entitlements*, in *LAW AND ECON. OF POSSESSION* 19 (Yun-chien Chang ed. 2015) (forthcoming) (arguing that Rule 2 is the most effective approach to solve the small property conundrum).
48 See Calabresi & Melamed, supra note 5.
49 See Chang & Smith, supra note 34, at 21–30.
More specifically, ownership as a whole is never subject to reassignment in nuisance law; only certain use rights (to paraphrase the popular parlance, a few sticks in the “ownership bundle”) are.50 Both parties in nuisance lawsuits are owners (typically, landowners) or at least authorized users of the resource. Thus, what is in conflict in nuisance law are the two rights to exclude held by each of the two parties.51 Take the polluters versus residents scenario (see Table 1) as an example: The factory owns the land and, according to the ad coelum rule, holds the exclusive right to use the air and airspace above the land; ditto for the residents. If air, polluted or clean, were stationary, there would be no nuisance dispute.52 In reality, of course, air flows. Consequently, when polluters emit, they unavoidably influence the residents’ exclusive use of “their” (originally clean) air. The court can favor either party’s use plan and protect it with either the property rule or the liability rule. Since generally each party’s right to exclude is otherwise protected by the property rule, both parties can be said to have their entitlements (in other aspects) protected by Rule 1. Following this logic, either party whose use plan regarding the air is disfavored by the court can be said to have that particular entitlement protected by Rule 2 or have no entitlement at all, depending on whether compensation is required.53 Hence, Rules 3 and 4 are not necessary for delineating the property rights in the nuisance scenario.

50 I should emphasize that I do not think property is a bundle of rights/sticks. See id. Rather, the bundle of rights/sticks analogy better describes “ownership.” I developed this idea in Chang, supra note 42.


52 My point relates to Fennell’s work on property and half-torts. That is, emitting fumes is “risky inputs,” but it does not necessarily create “harmful outcomes.” See generally Fennell, supra note 28.

53 Merrill emphasizes that trespass is available only to “possessing” owners. Owners could be ruled by courts as not having the entitlement over the column of space above the land if they do not build a skyscraper. See Thomas W. Merrill,
Moreover, as Henry Smith points out, the terms Rules 3 and 4 suggest that they are symmetrical with Rules 1 and 2, while the nuisance law is “radically asymmetric,” because the polluters have the privilege but not the right to pollute, as the residents do not have a duty to accept pollution. Rather, the residents can utilize self-help, such as a giant fan to fend off pollutants. By contrast, under Rule 1 (and 2), owners (non-owners) have the right to exclude (take with compensation), not just the privilege. Using Rules 3 and 4 in nuisance law is thus not only unnecessary but also misleading.

A better way to conceptualize entitlements in nuisance law is to think in terms of “(involuntary) governance strategy” and “property as a structured bundle of relations.” Exclusion and the property rule are the default in property law, and exclusion is the nature of relations between property rights holders and most others in the world. Involuntary governance is imposed (by statutes or common law doctrines) between certain pairs of property right holders over certain uses of resource—that is, governance is imposed in certain relations and/or in certain contexts—and it generally limits one party’s right to exclude, with or without mandating the other party to compensate.

More specifically, under my property theory, in nuisance law, when the resident can enjoin the factory, the resident’s right to exclude is in full swing, while the factory has no entitlement. If the factory can pollute as long as it compensates the resident, the resi-

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55 See Chang & Smith, supra note 34; Smith, supra note 33.

dent’s entitlement is subject to the involuntary governance strategy that nonetheless guarantees redress of losses, whereas the factory has the privilege to pollute. Finally, if the factory only emits negligible pollutants and is not considered a nuisance, the resident’s right to exclude is again softened by the governance strategy—Richard Epstein calls it the live-and-let-live rule— or the resident can even be considered as having no entitlement against the factory regarding de minimis intrusion. Here the factory again has the privilege to pollute trivially. In sum, Rules 3 and 4 need not be invoked to describe nuisance law, and my delineation better fits within the framework of property law.

C. AIRPLANE OVERFLIGHT: RULE 3 OR NO ENTITLEMENT?

The airplane overflight law that carves out an exception to the *ad coelom* rule appears to be an example of Rule 3, but I argue that the terminology of Rule 3 is still unnecessary for describing the law in optional terms. The law states that an aircraft owner has a right, not just a privilege, to fly over others’ land, as no landowner would be allowed to block the airspace or interfere with the navigation of aircraft. Several theories could justify the airplane overflight law. One theory, proposed by Richard Epstein, argues that landowners receive “implicit in-kind compensation.” In this view, the airplane overflight law exemplifies Rule 2, with the compensation to each landowner canceling out. Another theory, adopted in *United States v. Causby*, argues that aircraft fly in public navigable airspace. Ac-

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60 See Epstein, *supra* note 57, at 154.
61 328 U.S. 256 (1946).
According to this theory, countless aircraft owners could be thought of as holding a temporary Rule 3 right against countless landowners. I prefer to think in terms of property as a structured bundle of relations, in which landowners’ right to exclude certain parties (such as aircraft owners) is replaced by the governance rule that allows “certain” types of flights— that is, in this particular relation, landowners have no entitlement against aircraft owners. Entitlement holders are today often defined by regulatory statutes. Commercial airlines that operate their flights according to aviation regulations hold such entitlements, while a private owner of a helicopter may not have the right to fly over others’ real properties at 5 meters above ground. In short, using the term Rule 3 is not inevitable in airplane overflight law.

D. RULE 2 IS MORE EFFICIENT THAN RULES 3 AND 4

The preceding section argues that Rules 3 and 4 are often conceptually misleading and unnecessary. This section argues that the conventionally understood Rules 3 and 4 are less efficient than Rule 2. I will focus on Rule 2 versus Rule 3, favoring the former for efficiency reasons elaborated below.

First, Rule 2, requiring the non-owners to compensate, ensures that non-owners value the resource at least as much as its fair market value, while Rule 3 does not. When the court decides whether to re-assign entitlements, theoretically, Rule 2 and Rule 3 are the major choices. Under Rule 2, the original non-owner has to pay, whereas under Rule 3, the original non-owner gets the entitlement for free. If information costs are low, the court can generally ascertain whether the original owners or the original non-owners are higher-valuers.

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62 As for Rule 2 versus Rule 4, Rule 4 contains all the undesirable features that Rule 3 has, and thus would be generally less efficient than Rule 2, too. For other criticism of Rule 4, see James E. Krier & Stewart J. Schwab, Property Rules and Liability Rules: The Cathedral in Another Light, 70 N.Y.U. L. REV. 440, 467–68 (1995); Epstein, supra note 57.
and make the correct allocative decision. Both Rule 2 and Rule 3 would produce allocative efficiency, and from an ex post perspective, compensation under Rule 2 only affects income distribution. Nevertheless, information costs are often high, and the court is not always able to verify the reservation prices of both sides. Here, Rule 2 has an edge, because the non-owner under Rule 2 reveals her reservation price (higher than the court-assessed fair market value) by offering to pay compensation to the owner. If the non-owner is lower-valuing, she would not attempt to take the entitlement. By contrast, under Rule 3, no mechanism reveals any value information about the non-owner. Thus, entitlement transfers under Rule 2 are more likely than those under Rule 3 to produce allocative efficiency by facilitating bargaining and settlement.

Granted, notwithstanding the high information costs, as Thomas Merrill argues, as long as transaction costs are low, any entitlement allocation and protection rule will, through post-litigation voluntary transactions, lead to allocatively efficient results. That is, whether the court adopts Rule 2 or Rule 3, eventually resources will be owned by highest-valuers. Nevertheless, transactions are never costless. Rule 2, as compared to Rule 3, saves transaction expenses.

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63 Over-investment is not a serious problem. Takings with fair market value compensation exemplify Rule 2, whereas takings with zero compensation exemplify Rule 3. The latter is advocated in the takings literature due to the concern over over-investment when compensation is not lump-sum. See generally Lawrence Blume & Daniel L. Rubinfeld, Compensation for Takings: An Economic Analysis, 72 CAL. L. REV. 569 (1984). Nevertheless, as I argue in another work, fair market value of condemned real estates is generally assessed in ways that make them largely lump-sum. See YUNCHIEN CHANG, PRIVATE PROPERTY AND TAKINGS COMPENSATION: THEORETICAL FRAMEWORK AND EMPIRICAL ANALYSIS (2013). Thus, Rule 2, as compared to Rule 3, would not induce landowners to over-invest.


65 I assume that the judicial decision-making costs of administering Rule 2 and Rule 3 are the same, because theoretically it is difficult to tell which one is higher. Under Rule 2, it certainly requires some efforts of the judges to determine the
Rule 2 filters out more lower-valuing non-owners from claiming the entitlements than Rule 3 does (Rule 3 screens out very few, if any, as the original owner is not required to demonstrate their use values through paying). Thus, under Rule 3, there are more transactions of original owners buying back from subsequent owners who acquire the entitlement through entitlement adjustment. While allocative efficiency is restored after such transactions, some of the transaction costs under Rule 3 would have been saved had Rule 2 been adopted. Rule 2, therefore, reduces social waste.

Furthermore, if original owners suffer from “sunk cost fallacy,”^66 the original owner is less likely under Rule 3 than under Rule 2 to buy back the entitlement (both given that the original owner values the resource more than the original non-owner), because the original owner would not want to “pay twice” for the same resource. The result, however, is allocatively inefficient.

Finally, from an ex ante viewpoint, Rule 2 also appears to be more efficient than Rule 3. Under Rule 3, the prospect of losing the entitlements without any compensation decreases owners’ incentives to invest (thus reducing property value) and increases owners’ expenses on prevention, which are socially wasteful. Under Rule 2, owners lose less, and thus the value declines less, and prevention costs are lower. In addition, Rule 2 is more likely than Rule 3 to incentivize non-owners to try to strike a voluntary deal with owners, as the compensation paid under Rule 2 could be just slightly lower than the price paid through voluntary transactions, and the litigation costs may be higher than the combination of bargaining costs.

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^66 Put differently, Rule 2 and Rule 3 may both attain allocative efficiency, but Rule 2 is more productively efficient (in churning out allocative efficiency) than Rule 3.

^67 See DANIEL KAHNEMAN, THINKING, FAST AND SLOW 342–46 (2011). A rational person should not concern herself with expenses already spent, just like one should not cry over spilt milk. Sunk cost fallacy describes the phenomenon that many people still take into account sunk costs when making decisions.
and the price difference. Voluntary exchanges usually ensure allocative efficiency without intervention from the court. Thus, Rule 2 once again gains an edge over Rule 3 by facilitating more voluntary transactions.

In sum, this Part demonstrates that Rules 3 and 4 are much less conceptually useful than Rules 1 and 2; in addition, Rule 2 is more efficient than Rules 3 and 4. The next Part will argue that Rules 5 and 6 are inferior to Rules 2 and 4 in terms of efficiency.

III. PUTS ARE RARELY NEEDED IN PROPERTY

Initially, put legal options were not part of the optional law theory. With contributions from several prominent scholars, put options have been seriously considered by legal scholars as a new way to adjust entitlements to pursue efficiency and distributional goals. Ian Ayres even claims that calls and puts are symmetrical in enhancing efficiency. Property scholars, however, generally frown upon put options. This part argues that these property scholars’ concerns are well grounded, as puts are less likely than calls (and the property rule) to attain allocative efficiency.

68 See generally Ayres, supra note 12; Krier & Schwab, supra note 62; Levmore, supra note 12; Morris, supra note 12.
69 See Ayres, supra note 3, at 6.
70 See Rose, supra note 28; Epstein, Protecting Property Rights, supra note 32; Epstein, Cathedral, supra note 56; Smith, supra note 32.
71 Bar-Gill & Bebchuk use a formal mathematical model to demonstrate that, from an ex ante viewpoint, Rule 1 (what they call “mutual consent rule”) is generally more efficient than Rule 6 (what they call “restitution rule”), because the latter rule induces entry by inefficient, low-quality sellers and forces some buyers (who would have stayed in the market had Rule 1 been the norm) to exit the market. See Oren Bar-Gill & Lucian Arye Bebchuk, Consent and Exchange, 39 J. LEGAL STUD. 375 (2010).
A. AYRESIAN RULE 6 IS NOT A PUT-OPTION RULE

Before criticizing the put-option liability rules, it is worth clarifying the difference between the Rule 6 as delineated by Ayres (hereinafter Ayresian Rule 6) and a typical Rule 6 (a put-option liability rule that protects the entitlement of the owner; see Table 3). The Ayresian Rule 6 is neither a typical Rule 6 nor a put, if the put option means forced purchase.\textsuperscript{73} In Ayres’s own words, under (Ayresian) Rule 6, “[a] court might allow a resident to enjoin pollution, but also give the resident the option of waiving his injunctive rights in return for damages from the polluter.”\textsuperscript{74} Hence, the Ayresian Rule 6 is not a typical forced purchase rule, but rather a choice between Rule 1 (injunction) and Rule 2 (compensation).\textsuperscript{75} The Ayresian Rule 6 is implicitly premised on the condition that the polluter has polluted.\textsuperscript{76} The resident cannot randomly designate a person as polluter and collect damages from her—if the resident could, the Ayresian Rule 6 would resemble a financial put. Given that the

\textsuperscript{73} Were puts and calls indeed symmetrical, as Ayres repeatedly argues, any person could be subject to a put option, just as any person could strike a call option against the original owner. See Ayres, supra note 3.

\textsuperscript{74} See Ayres, supra note 12, at 797.

\textsuperscript{75} Richard Epstein interprets the Ayresian Rule 6 as Rule 1, because the property rule protection gives the original property owner the choice between damages and injunctive relief. This Epsteinian view may not be the mainstream interpretation of Rule 1. Nonetheless, even in the mainstream view, it would be conceptually clearer just to label the Ayresian Rule 6 as an either-or rule or a mixture of Rule 1 and Rule 2, and leave the term Rule 6 to label a real put-option rule (if it ever exists). See Epstein, supra, Protecting Property Rights, note 32, at 842.

\textsuperscript{76} As Richard Epstein points out, the Ayresian puts are only given to property owners against wrongdoers. See id. at 845.
polluter has “taken” the entitlement of the resident, that is, has polluted, the resident’s asking for payment of market value more resembles requesting compensation from an infringer under Rule 2 than forcing a stranger to purchase certain entitlements.

The asymmetry between Rule 5 and Ayresian Rule 6 is the major reason that only the latter can be found in the real world.\textsuperscript{77} In contrast to the Ayresian Rule 6, Rule 5 is indeed a put-option, or force-sale rule, as the polluter can force the resident to purchase the right to pollute when the resident does NOT interfere with the factory’s operation. Due to the apparent undesirable traits of Rule 5 (a double jeopardy—losing entitlements for a while and later forced to buy them back—for the original owner),\textsuperscript{78} it is not surprising that one cannot find a real-world example of Rule 5 in property law. A few property doctrines exemplify the Ayresian Rule 6, as discussed below, but a real-world example of a forced purchase rule is also hard to come by.

Not all Ayresian Rule-6 doctrines are welfare-increasing. One example is the boundary encroachment law.\textsuperscript{79} When Dora’s house sits partially on Phil’s land, Phil is entitled to either tear down the encroaching construction or demand bad-faith Dora to buy the land underneath the construction.\textsuperscript{80} As Ayres recognizes, the put op-

\textsuperscript{77} See Ayres, supra note 12, at 817.

\textsuperscript{78} See Epstein, Protecting Property Rights, supra note 32, at 844–45.

\textsuperscript{79} Ayres & Goldbart also use boundary encroachment as an example of a “dual chooser rule,” under which the plaintiff (encroacher) has a call option and the defendant (owner) has a put option. The doctrine, however, does not work like their model. First, in Ayres & Goldbart’s words, the encroacher only “signals a willingness to buy property,” but the encroacher does not actually “strike” and reveal that her value is higher than the exercise price. Moreover, in the “intentional encroachment” cases discussed by Ayres & Goldbart, the law does NOT award the bad-faith encroacher with a call option, as the owner can insist on tearing down the encroaching construction. Finally, the owner’s put option is contingent on the trespass, but it works to force the encroacher to purchase the encroached land, not to neutralize the encroacher’s (non-existent) call option. See Ayres & Goldbart, supra note 21, at 35–37.

\textsuperscript{80} See Ayres, supra note 12, at 815–16.

\textsuperscript{81} See id. at 816.
tion here has little value for Phil, as Phil can increase his payoff by demanding an injunction and then bargain for a larger payment with Dora. From a social standpoint, moving from Rule 1 to Rule 6 does not seem to increase social welfare. If the encroaching part of Dora’s house is worth more than the land underneath, Dora would have every reason to strike a deal with Phil in order to avoid demolition, and Phil, who may strategically hold out, would be the source of high transaction costs that impede a trade. Giving Phil an extra put option to “force” Dora to purchase (exactly what Dora plans to do voluntarily and desperately) does not make economic sense. Besides, if the encroaching part of Dora’s house is worth less than the land, Dora would rather tear down the overreaching part (perhaps just a separate garage) than buy the land. Facing Rule 1, Dora can do just that. Facing Rule 6, Dora may be forced to purchase the land, and Dora does not necessarily value it more than Phil, as demonstrated above. Thus, in the boundary encroachment problem, as in other property issues, Ayresian Rule 6 is unlikely to enhance allocative efficiency.

Below I critique the prototypical put-option rules (i.e. forced sale and forced purchase rules), to demonstrate that puts have very little, if any, place in property laws.

B. PUTS ARE LESS EFFICIENT THAN CALLS

Calls are more efficient than puts primarily because the option strike price in property law is determined by the value of an external thing, not the expected value of the holder or non-holder of the

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82 But cf. AYRES, supra note 3, at 28.
83 Whether Dora will be forced to purchase the land, no matter whether she has torn down the house before the court verdict, depends on how the law is designed. In other words, in a purely legal put option setting, the option is “triggered” once Dora’s house encroaches Phil’s land, but whether the option will be extinguished once the construction is removed is unclear in the optional law literature.
entitlements, as Ayres’s theory would require.\textsuperscript{84} More specifically, when a property dispute requires compensation, the court will generally ascertain the fair market value of the thing in question. Total property value ("economic value"), however, equals fair market value plus "subjective value."\textsuperscript{85} That is, the owner’s economic value must be greater than or equal to the fair market value.\textsuperscript{86} The value

\textsuperscript{84} See Ayres, supra note 3, at 20–21, 42-43.

As a result, the court is unlikely to implement higher-order liability rules (see generally Ayres & Balkin, supra note 6) in property law, as the compensation in each round of “auction” would remain the same, rather than being elevated (see generally Ayres & Goldbart, supra note 21), unless the exogenous market value changes drastically.

\textsuperscript{85} For the definition of subjective value, see Blume & Rubinfeld, supra note 63, at 619; Lee Anne Fennell, Taking Eminent Domain Apart, 2004 Mich. St. L. REV. 957, 963–65 (2004); Thomas J. Miceli & Kathleen Segerson, Private Property, Public Use, and Just Compensation: The Economics of Eminent Domain 20 (2007). Subjective value is sometimes called the “consumer’s surplus” (see, e.g., James E. Krier & Christopher Serkin, Public Ruses, 2004 Mich. St. L. REV. 859, 866 (2004)) or “subjective premium” (see, e.g., Thomas W. Merrill & Henry E. Smith, The Oxford Introductions to U.S. Law: Property 249 (2010)). Subjective value is subjective and unbeknownst to third parties, and that is why the Court generally ignores it in assessing property value for compensation purposes. Several scholars have designed mechanisms to induce accurate assessment of economic value; see e.g., Abraham Bell & Gideon Parchomovsky, Taking Compensation Private, 59 STAN. L. REV. 871 (2007); Emerson M.S. Niou & Guofu Tan, An Analysis of Dr. Sun Yat-Sen’s Self-Assessment Scheme for Land Taxation, 78 PUB. CHOICE 103 (1994); Florenz Plassmann & T. Nicolaus Tideman, Accurate Valuation in the Absence of Markets, 36 PUB. FIN. REV. 334 (2008); Florenz Plassmann & T. Nicolaus Tideman, Marginal Cost Pricing and Eminent Domain, 7 FOUND. & TREND. MICROECON. 1 (2011); T. Nicolaus Tideman, Three Approaches to Improving Urban Land Use (1969) (Ph.D. Dissertation, University of Chicago); Levmore, supra note 12. I have demonstrated that these models are unlikely to do the trick. See Yun-chien Chang, Economic Value or Fair Market Value: What Form of Takings Compensation Is Efficient?, 20 SUP. CT. ECON. REV. 35 (2012); Chang, supra note 63.

\textsuperscript{86} Following the literature (see, e.g., Fennell, supra note 85, at 963; Thomas W. Merrill, Incomplete Compensation for Takings Regulatory Expropriations in International Law, 11 N.Y.U. ENVTL. L.J. 110, 119 (2002)), I assume that owners value their property at least at fair market value; otherwise landowners would have already sold the property, unless transaction costs are higher than the gains from trade. But cf. Brian Angelo Lee, Just Undercompensation: The Idiosyncratic Premium in Eminent Domain, 113 COLUM. L. REV. 593 (2013).
of the resource (if it is a commodity) for most non-owners, on the other hand, is probably below fair market value, otherwise non-owners would have bought the resource in the market, if transaction costs were not too high. Those who do value it more than fair market value are the potential buyers in this context.

Given these reasonable assumptions (owner’s value ⩾ fair market value ⩾ non-owner’s value) that hold most of the time, calls can better harness private information than puts, because calls utilize valuation information from both parties, while puts utilize valuation information only regarding the original owner. More specifically, in a call-option regime, the court-assessed fair market value informs us of the lower boundary of the owner’s value, and call options provide private information regarding how non-owners value the resource. That is, if the calls are exercised (not exercised), the original non-owners value the entitlement more (less) than its fair market value.

By contrast, in a put option regime, the court-determined fair market value again is the benchmark for the original owner’s lower-boundary value, but the owner-held put options only reveal whether the owner values the entitlement more or less than such court-set value (or, if the estimated fair market value is very accurate, whether the owner has positive subjective value). Yet the private information regarding non-owners’ value is neither revealed nor utilized. With valuation information from both parties, a call option regime is more likely to induce efficient entitlement transfers than a put option regime. Indeed, as Row I in Table 4 demonstrates, when subjective value is zero and the assessed fair market value is accur-

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87 If there is no close substitute for this resource, non-owners being non-owners shows that they value the resource less than owners’ economic value (instead of fair market value).

88 For the rare scenarios in which fair market value could be higher than economic value, see Lee Anne Fennell, Just Enough, 113 COLUM. L. REV. SIDE BAR 109, 116 (2013).
rate, calls are always allocatively efficient, while puts are sometimes allocatively inefficient, at least right after the option is exercised.

Put differently, often more than one non-owner can exercise the call-liability rule, but the non-owner who is ready to compensate at fair market value and actually take titles is not randomly picked. Instead, the entitlement taker, at least a bad-faith one, is likely to be higher-valuing than the original owner. By contrast, the original owner who exercises the put option tends to choose parties with the financial wherewithal to pay. As a result, the non-owner who is forced to purchase is less likely than those under call regimes to be higher-valuing than the original owner. This is one argument against the contention that legal calls and legal puts could be symmetrical in property law.

Granted, if transaction costs are low, resources will ultimately flow to the party who values it most, and any allocative inefficiency is temporary. Nevertheless, as emphasized above, exercising options, transferring entitlements, consummating transactions are never cost-free.\(^9\) Any allocatively inefficient entitlement transfer that arises from ill-advised legal options wastes resource and reduces social welfare.\(^9\)

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\(^{90}\) Harold Demsetz points out that efficiency is served even when transaction costs block post-litigation exchange, as “[a]n efficient economic system is one that makes the most of scarce resources within whatever constraints are handed down to it by courts and legislature.” Harold Demsetz, *The Problem of Social Cost: What Problem? A Critique of the Reasoning of A.C. Pigou and R.H. Coase*, 7 Rev. L. & Econ. 1, 9 (2011). The goal of this legal work is to improve the “constraints.” Thus, my view is consistent with Demsetz’s. For extended discussions, see Lee Anne Fennell, *The Problem of Resource Access*, 126 Harv. L. Rev. 1471 (2013). I clarify the meaning of efficiency in property law in the Appendix.
The discussion so far assumes that the court is able to assess fair market value accurately, but it is not always the case in practice. My prior empirical work finds that courts often appraise fair market value too highly or too lowly. The effects of inaccurate assessment on calls and puts are asymmetrical, making calls again more efficient than puts (see Rows II and III in Table 4).

Finally, when subjective value is positive, the court-assessed compensation based on fair market value underestimates the owner’s total value. As Row III in Table 4 suggests, calls and puts are both likely to lead to an inefficient exercise (or lack of) of options. This is one reason property rules should be used as the default in a positive information cost world with low transaction costs. Property rules guarantee efficient allocation of resources (more on this later), whereas calls and puts do not.

To make the above claims more persuasive and clearer, I discuss the efficiency of calls and puts that are exercised or not exercised when the court over-, under-, or accurately assesses property value in more detail below. The cells refer to the different scenarios demonstrated in Table 4, which assumes that the owner’s subjective value is zero to simplify the narration.

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91 See Krier & Schwab, supra note 62, at 453–455. Henry Smith also points out that option holders under liability rule regimes have incentive to “game” the system by strategically manipulating or misrepresenting how much they value the resource. See Smith, supra note 32, at 1778.


93 See Smith, supra note 32, at 1774; Krier & Schwab, supra note 62, at 457.

94 For the distinction between the closely related information costs and transaction costs, see Douglas W. Allen, Transaction Costs, in ENCYCLOPEDIA OF LAW AND ECONOMICS, VOL. I. THE HISTORY AND METHODOLOGY OF LAW AND ECONOMICS 893, 906–07 (Boudewijn Bouckaert & Gerrit De Geest eds., 2000). Here, the main problem is that the Court does not have sufficient information to assess the subjective value; thus, it is an information cost problem, not a transaction cost problem.
Table 4: Efficiency of Exercised and Not Exercised Calls and Puts

<table>
<thead>
<tr>
<th>Court’s estimate of property value</th>
<th>Option types</th>
<th>Calls</th>
<th></th>
<th>Puts</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Exercised</td>
<td>Not exercised</td>
<td>Exercised</td>
<td>Not exercised</td>
</tr>
<tr>
<td>I. Accurate</td>
<td></td>
<td>(1) Efficient</td>
<td>Efficient</td>
<td>(4) Likely inefficient</td>
<td>Likely efficient</td>
</tr>
<tr>
<td>II. Too high</td>
<td></td>
<td>(2) Efficient</td>
<td>Likely efficient</td>
<td>(5) Likely inefficient (option will be exercised).</td>
<td></td>
</tr>
<tr>
<td>III. Too low</td>
<td>(3) Likely inefficient</td>
<td>Likely efficient</td>
<td>(6) (option will not be exercised).</td>
<td>Likely efficient</td>
<td></td>
</tr>
</tbody>
</table>

Cell (1): When the court accurately assesses fair market value, the strike price of the call option is set at the owner’s value. Thus, exercising (not exercising) the call option by non-owners suggests that non-owners value the resource more (less) than current owners, and it is thus efficient.

Cell (2): If the court overestimates fair market value, the non-owner’s voluntary exercising of her call option is efficient. Nevertheless, the non-owner’s not exercising her call option is sometimes inefficient, as the non-owner’s value can be lower than the overestimated fair market value but higher than the owner’s true value. Overall, this cell produces welfare-increasing results.

Cell (3): If the court underestimates fair market value, non-owners who exercise the call option are buying on the cheap. Since, as assumed above, most non-owners value the property at less than fair market value, exercising (not exercising) the call options is generally inefficient (efficient). Because exercising is the likely result, inefficiency will often be the feature of call options when property value is under-estimated.

Cell (4): When the court accurately assesses fair market value, owners exercise the put option only if they value the resource at about fair market value and perhaps need cash. They do not sell

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95 See Fennell, supra note 88, at 112–13.
the resource because of positive transaction costs. It is, however, unclear how much non-owners value the resource. Non-owners could be higher-valuing but unable to acquire the resource due to high transaction costs. Non-owners, however, could instead value the resource below fair market value, and this is exactly why they did not purchase the resource in the first place. Hence, exercising the put option can be efficient or inefficient. If transaction costs are not very high, the non-owner is more likely to be lower-valuing than higher-valuing; thus, title transfer would be allocatively inefficient.

Cell (5): If the court overestimates fair market value, owners are likely to exercise the put options, leading to inefficient resource allocation, since most non-owners value the resource at less than fair market value, not to mention the overblown court-estimated value. Not exercising the put option is efficient most of the time, but the owner has no incentive to stop. In short, inefficiency is the outcome when over-estimation joins with put options.

Cell (6): If the court underestimates fair market value, unless the non-owner happens to be one of the few persons who value the property more than the owner, not exercising the put option is likely to be efficient. Indeed, owners have no incentive to exercise the put option. Thus, the put option is useless in this context, because it will never be exercised.

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In short, I argue that because of the inefficient traits of put options in the area of property, one finds few real-world examples of puts in property law. Of course, this is not to deny that in the domain of property law, one can find put or put-like arrangements,

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96 If the assumption of zero subjective value is lifted, owners may not exercise the option because their economic value is higher than the overestimated fair market value.
especially when the free-riding problem lurks in the background.97 For example, some courts in the U.S. hold that “co-owners are obligated to share the costs of ‘necessary’ repairs.”98 This is essentially one co-tenant who makes “necessary” repairs forcing other co-tenants to purchase the increased value of the co-owned thing, resembling Rule 6. Nonetheless, one still cannot find an example in which an owner of a certain estate can force a random person to purchase the owner’s property interest. Hence, (compulsory) put options are rarely used in property law, and rightfully so.

In sum, this Part argues that put options, embodied in Rules 5 and 6, are less efficient than the call options, embodied in Rules 2 and 4. The next Part will demonstrate that when transaction costs are low, Rule 1 is more efficient than Rule 2. This implies that under the same conditions, Rule 1 is more efficient than Rules 5 and 6.

IV. RULE 1 IS MORE EFFICIENT THAN RULE 2 WHEN TRANSACTION COSTS ARE LOW

Calabresi & Melamed famously argue that when transaction costs are low, property rules are more efficient than liability rules. Judge Posner generally follows this stance,99 and Cooter & Ulen accept this maxim with some refinements.100 Keith Hylton argues that when defensive actions and expenses are taken into account,101 property rules are generally superior to liability rules when transaction costs are low. Daphna Lewinsohn-Zamir makes a case for the

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97 I thank Ariel Porat for nailing this point home to me.
98 JOSEPH WILLIAM SINGER, PROPERTY 360–61 (3d ed. 2010). See also Porat, supra note 72, at 196.
99 See RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 86–89 (8th ed. 2010).
100 See ROBERT COOTER & THOMAS ULEN, LAW AND ECONOMICS 100–01 (6th ed. 2012).
property rule over the liability rule\textsuperscript{102} based on behavioral and experimental results. Several prominent law-and-economics scholars famously counter that as long as the compensation under liability rules is set at the “average” (or “expected”) value of the non-option holder (or the owner, in property law), liability rules are, “on average,” superior to property rules.\textsuperscript{103} This Part counters that Calabresi & Melamed’s original insights apply in property law—when transaction costs are low, property rules tend to be more efficient than liability rules.\textsuperscript{104}

A. THE PROPERTY RULE BETTER Harnesses PRIVATE INFORMATION

In property law, property rules harness private information, not liability rules.\textsuperscript{105} Following Douglas Allen,\textsuperscript{106} I distinguish between transaction costs and information costs—the latter being the prerequisite for (but different from) the former (more on this in the Appendix). In a low transaction cost world, information cost can be high. Specifically, the subjective value of property owners is private information, and ascertaining its amount is costly for non-owners.


\textsuperscript{103} See Kaplow & Shavell, supra note 4; Ayres & Talley, supra note 21, at 235; Ayres & Goldbart, supra note 21, at 20; Ayres, supra note 3.

\textsuperscript{104} Cf. Richard A. Epstein, Intellectual Property and the Law of Contract: The Case against 'Efficient Breach,' 9 Eur. Rev. of Contract L. 345 (2013) (arguing that in contract law, the efficient breach theory (embodying Rule 2) is flawed in many aspects). If liability rules are indeed more efficient than property rules in most scenarios, how can the neoclassical economic theory sustain, since this claim depends on the condition that the Court’s visible hand can better harness private information than the market under the property rule and voluntary exchange?

\textsuperscript{105} Ronen Avraham reaches the opposite conclusion because he assumes that voluntary transactions between parties are not feasible (that is, transaction costs are very high) and that courts can accurately determine the correct amount of damages. Both assumptions are not always realistic and loosened in this article. See generally Ronen Avraham, Modular Liability Rules, 24 Int’l Rev. L. & Econ. 269 (2004).

such as potential buyers and courts. Under the property rule protection, potential buyers have to bargain with the owners. If an owner accepts the quoted price, it reveals the private information that the owner’s subjective value plus market value is lower than the quoted price, and no deal suggests that the offered price is not high enough. Under the liability rule protection, the prerequisite for harnessing the call-option holder’s private information is to set the exercise price of the call option correctly, but the court’s information costs in getting this job done are very high. Therefore, property rules can harness private information without the court’s intervention, while call-option liability rules can harness private information only if the court harnesses owner’s private information first. Ayres and his coauthors’ optional-law proposals are often impractical, as the simplest single-chooser, first-order liability rule has information cost problems. If in practice the expected value of a non-option holder cannot be systematically ascertained accurately, the claim that liability rules are superior is doubtful. If the expected value can be appraised accurately, but only with high information costs, attainment of allocative efficiency may be more likely under liability rules—nevertheless, the total social welfare (taking into account the court’s information costs and litigation costs) is not necessarily higher under the liability rules than under the property rules.107

B. LIMITATION OF KAPLOW AND SHAVELL’S AVERAGE COMPENSATION THESIS

Kaplow & Shavell’s claim that liability rules are “on average” superior to property rules108 cannot be generalized to most property

107 That is, a well-functioning liability rule is an expensive “product” that is not necessarily worth buying. See Appendix for a discussion of how to combine judgment of production efficiency and allocative efficiency in property law.

108 See Kaplow & Shavell, supra note 4, at 719. Note that in another part of their article, Kaplow & Shavell also favor the “use of property rules for protection of possessory rights in things.” See supra at 723.
law issues. Kaplow & Shavell use a mathematical model to demonstrate that liability rules are superior to property rules in the context of “harmful externalities” under certain conditions, including compensation being set at the average harm.\(^\text{109}\) Henry Smith criticized this claim as treating uncertainty as risk and assuming away the difficulty of assessing compensation (even on average) accurately in property law.\(^\text{110}\) I would add two further counter-arguments. Firstly, because courts often assume subjective value is non-existent, they generally set the compensation below the owner’s true losses. Secondly, the first-order condition of Kaplow & Shavell’s model is minimizing harm and prevention cost, while the normative goal of property law also includes allocative efficiency, which is not considered in the model. Hence, one should not jump from the assumption that compensation is on average set correctly to the conclusion that liability rules are superior in property law.

C. A STYLIZED EXAMPLE

Summing up the arguments above, the following stylized, numeric example further demonstrates that when only allocative efficiency is considered and transaction costs are low, property rules dominate liability rules: Suppose half of the residents at Condo X value their bicycles at $60 and half at $40, so the average value is $50. Residents at Condo Y do not own bicycles but like to steal bicycles parked in front of Condo X. Further assume that under the liability rule regime, whenever residents at Condo Y steal those bicycles, the amount of compensation is set at the average value, $50. Stealing by residents at Condo Y will be allocatively efficient when the bicycles are owned by those residents that value the bicycles at $40 (Row C in Table 5), and residents at Condo Y, if refraining from stealing, increase social welfare when the bicycles that would have

\(^{109}\) See Kaplow & Shavell, supra note 4, at 776–79.

\(^{110}\) See Smith, supra note 32, at 1726.
been stolen are owned by residents at Condo X that value their iron horses at $60 (Row B in Table 5). The readers can easily tell that in the other two types of scenarios (Row A and Row D in Table 5), non-owners’ infringement decisions are inefficient.

By contrast, when property rules are implemented and transaction costs are lower than the gains from trade, property rules always induce efficient allocation, as shown in Table 6. No matter how much residents in Condo X values their bicycles, titles transfer only when residents in Condo Y value them more and offer a price that surpasses the former’s economic value. Property rules fail the allocative efficiency test only when transaction costs are higher than the gains from trade. That means only the marginal cases (in which both parties’ economic value approximate each other) remain allocatively inefficient, and the magnitude of the inefficiency (which equals the differences in economic values and is at most as large as the amount of transaction costs) is small.

<table>
<thead>
<tr>
<th>Owner’s economic value</th>
<th>Non-owner’s economic value</th>
<th>Exercise price of call option</th>
<th>Non-owner exercises call option?</th>
<th>Efficient allocation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A  40</td>
<td>45</td>
<td>50</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>B  60</td>
<td>45</td>
<td>50</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>C  40</td>
<td>55</td>
<td>50</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>D  60</td>
<td>55</td>
<td>50</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Owner’s economic value</th>
<th>Non-owner’s economic value</th>
<th>Bargaining range</th>
<th>Voluntary transfer of title?</th>
<th>Efficient allocation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A  40</td>
<td>45</td>
<td>40–45</td>
<td>Yes*</td>
<td>Yes†</td>
</tr>
<tr>
<td>B  60</td>
<td>45</td>
<td>N/A</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>C  40</td>
<td>55</td>
<td>40–55</td>
<td>Yes*</td>
<td>Yes†</td>
</tr>
<tr>
<td>D  60</td>
<td>55</td>
<td>N/A</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Note*: I assume that transaction costs are between 0 and 5.
†: If transaction costs > 5, voluntary transfer will fail to go through, and the allocation will be inefficient.
In sum, this Part contends that the insight proposed by Calabresi and Melamed—when transaction costs are low, the property rule is more efficient than the liability rule—is correct. In other words, Rule 1 should be preferred when voluntary exchanges between parties are feasible. The next Part will lay out the conditions under which Rule 2 would be superior to Rule 1 as far as efficiency is concerned.

V. A Framework for Preferring Rule 2

It should be clear by now that optional law in the field of property is mostly about the choice between Rule 1 and Rule 2 (or a mixture of both rules), with the former as the default rule. The preceding section has emphasized that when transaction costs are low, Rule 1 is justifiably used as the default. When transaction costs are sufficiently high, Rule 1 is not always more efficient than Rule 2. This Part points out several variables that should be taken into account when the court or the legislature considers moving from Rule 1 to Rule 2.

A. Transaction Costs Are High

The prerequisite for even considering the use of Rule 2 is high transaction costs. Several important sub-types of transaction costs in property law—bargaining costs, verification costs, and preven-

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111 Tom Merrill has urged me to go even further, dismantling the whole Calabresi and Melamed framework, as the liability rule misleadingly mixes together rules with different functions, such as prices for property exchange and tort damages for deterrence. Thus, the liability rule is an unhelpful generalization of discrete phenomena. I am inclined to agree. I do not push on this point here because this article focuses on property law, not all private laws. In any case, we would need terminology to describe what are now called the property rule or Rule 1, and the liability rule or Rule 2. The liability rule is a misnomer in property law, but the compensation mechanism is surely needed in certain contexts, as I demonstrate below.

112 Verification costs, admittedly, can often be thought of as a sub-type of information costs.
tion costs—are worth considering in more detail. First, when bargaining costs are high enough to impede many potentially efficient trades (due to, for example, owner’s monopoly power or strategic behavior), the liability rule becomes more likely to induce allocatively efficient transactions. Note that if bargaining costs are the reason to adopt the liability rule, the property doctrine need not enable option holders to acquire the entire entitlement or entitlement of the optimal scale. In some contexts, as in access to landlocked land, a limited Rule 2 is sufficient to reduce bargaining costs and facilitate further voluntary transactions.\footnote{See Yun-Chien Chang, Access to Landlocked Land: A Case for a Hybrid of Property and Liability Rules, 14-16 (working paper) (2013) (available at http://ssrn.com/abstract=1986739).}

Another example would be necessity.\footnote{See, e.g., Epstein, Cathedral, supra note 56, at 2106–11 (The necessity setting is discussed at length.).} In cases like Vincent v. Lake Erie Transportation Co.\footnote{124 N.W. 221 (Minn. 1910).} and Ploof v. Putnam,\footnote{71 A. 188 (Vt. 1908).} the ship owners and the dock owners may not have had ample time to strike a deal before the storm hit, and the dock owners’ strong bargaining power would have made bargaining costs high anyway. Case law holds that the ship owner can moor in the dock without the consent of the dock owner, but must compensate the dock owner for the loss. The ship owners, however, only acquired temporary entitlement (during the storm). That is, the liability rule applied here is limited.

Second, other things being equal, if the identity of the owners and the content of the property rights can be verified at low costs, the property rule is preferred. Liability rules then gain an edge when the verification cost may surpass its benefit.\footnote{See Stewart E. Sterk, Property Rules, Liability Rules, and Uncertainty About Property Rights, 106 Mich. L. Rev. 1286, 1304 (2008) (“compared with a liability-rule regime, a property-rule regime creates excessive incentives to search even when search costs are high, the probability of encroachment is relatively low, and the likely}
happen when verification costs are high; the probability of infringement is low; and the likely harm to the property owner is low or reversible. For example, regarding boundary encroachment cases, in places where a metes-and-bound registration system is used,\textsuperscript{118} the content of the property rights (land size and boundary) often has to be verified with high costs. By contrast, in places like Taiwan, where anyone can check the boundary of any land parcel on her smart phone, verification costs are much lower. Other things being equal, there is a stronger reason to use Rule 1 in the latter case, and Rule 2 can be adopted in the former to reduce verification costs and as a safety valve.\textsuperscript{119}

Third, when owners have incentives to fend off trespassers but prevention costs are high, property rules have an advantage. Rule 2 is rarely unconditional in property law—even the eminent domain power (a Rule 2 power) is constitutionally constrained by the public use requirement—rather, certain prerequisites (for instance, “inadvertent” encroachment over the boundary) must hold. To prevent non-owners from fulfilling these requirements, owners will employ self-help, such as installing extra locks, but such actions are potentially socially wasteful.\textsuperscript{120} From an ex ante viewpoint, the lower the prevention costs, the more Rule 2 is justified.

B. TRANSFERRING ENTITLEMENTS PROMOTES ALLOCATIVE EFFICIENCY

In adopting Rule 2, the legislature or the court should have strong evidence for presuming that original non-owners value the

\begin{footnotesize}
\textsuperscript{120} See Smith, \textit{supra} note 32, at 1786.
\end{footnotesize}
entitlements more than the original owners. For example, in the access to landlocked land context, the landlocked owner usually values the passage to a public road more than her neighbors.\textsuperscript{121} If owners are clearly higher-valuing, the law should stick with the default Rule 1. Granted, a multiple-order liability rule\textsuperscript{122} may lead to the same result, but the costs involved in the re-takings are wasteful.\textsuperscript{123}

Courts can also look for other evidence that indicates the non-owner values the thing in question more than the owner. For instance, if the non-owner conducts good-faith ex ante bargaining with the owner, reaching certain agreements, but an honest error makes the non-owner an infringer ex post, courts may adopt Rule 2 over Rule 1.\textsuperscript{124} A concrete example can be drawn from the boundary encroachment context. Suppose the neighbor (non-owner) acquires a use right of part of Blackacre from its owner to build a high-rise, but after completion of construction, it is found that the brand new condominium extends one inch across the boundary line.\textsuperscript{125} The court could prefer the use of Rule 2 because it is a “safety valve” for equity,\textsuperscript{126} and also because the good-faith, ex ante, and successful deal signals that the non-owner is the higher-valuer, and thus adopting the liability rule is allocatively efficient.

\begin{flushright}
\textsuperscript{121} See Chang, supra note 113, at 13.
\textsuperscript{122} See generally Ayres & Balkin, supra note 6.
\textsuperscript{123} See Smith, supra note 32, at 1789.
\textsuperscript{124} I thank Victor Goldberg for this idea.
\textsuperscript{125} E.g., Pile v. Pedrick II, 167 Pa. 296, 300 (1895) (Pedrick unintentionally built a wall that projected onto Pile’s land by $\frac{1}{8}$ inches. There was no ex ante bargaining). See generally Chang, supra note 113, for discussions of why the property rule may not be the best solution in this case or in Pile v. Pedrick II.
\textsuperscript{126} See Smith, supra note 119, at 2-3.
\end{flushright}
C. EX ANTE INVESTMENT NOT IMPORTANT

When ex ante investment is critical to enhancing the property’s market value,\textsuperscript{127} including developing information about the asset,\textsuperscript{128} property rules should be preferred, as property rules better protect the premium above fair market value.\textsuperscript{129} However, not all resources are constantly invested and contain unveiled secrets. Land value can be increased through proper investments, but the value of a Swatch cannot. \textit{Ceteris paribus}, there is a stronger reason to adopt Rule 2 in the latter case.\textsuperscript{130}

D. COURTS MAKE FEWER ERRORS

Courts are not always perfect appraisers of property value, and, as demonstrated above, when courts systematically under-assess property value, liability rules do not perform well.\textsuperscript{131} Personal properties, especially commodities, tend to have a clear fair market value, and their owners generally do not attach high subjective val-

\textsuperscript{127} For instance, a farmer’s ex ante investment is the organic fertilizer he uses, the fertility-friendly crops he chooses to grow, and the time he spends on knowing better the soil, the surrounding aqua system, and the weather. Making good investment choices increase the market value of the farm.

\textsuperscript{128} See Smith, \textit{supra} note 32, at 1777 (an actor “will have more of an incentive to invest in…developing information about” an asset through property rules).

\textsuperscript{129} See Bar-Gill & Bebchuk, \textit{supra} note 71, at 380 (discussing the negative ex ante effects of Rule 2); Fennell, \textit{supra} note 90, at 1507. \textit{But cf. Ayres, supra} note 3, at 186 (under the option perspective, liability rules increase \textit{ex ante} investment incentives and efficiency); Oren Bar-Gill & Nicola Persico, \textit{Exchange Efficiency with Weak Property Rights} 27 (Law & Econ. Research Paper Series Working Paper, Paper No. 12-35, 2012), available at http://ssrn.com/abstract=2161659 (arguing that, given that investment cannot be transferred to any future possessor of assets, and that both the current owner and the potential taker can invest on the assets in question, property rules are not “per-se” efficient. This is especially relevant in IP).

\textsuperscript{130} Granted, new technologies may create new ways to increase the value of commodities, but they do the same thing to land as well.

\textsuperscript{131} See Ayres & Goldbart, \textit{supra} note 21, at 63.
ue to them. By contrast, the value of residential real properties is not always easily identifiable, particularly in sparsely populated regions, and their owners usually attach a higher subjective value. Other things being equal, Rule 2 tends to perform better regarding chattels than real estate.

As pointed out before, judicial assessment costs often positively correlate with transaction costs. When this is the case, high transaction costs do not warrant the use of liability rules, as erroneous property compensation would lead to resource misallocation. Nevertheless, there are cases where one could easily ascertain the property value through the use of, say, hedonic regression models ex post by the court, but asymmetric bargaining power and other factors might have impeded bargaining, for example in the context of access to landlocked land. That is, when transaction costs are high but judicial assessment costs are low, Rule 2 could be preferable.

Another variable that should be taken into account is whether the errors made by the court in assessing property value are correlated (or, put differently, the errors are common in assessing the value of the conflicting uses). The liability rule has an advantage over the property rule when the errors are negatively correlated or uncorrelated. When the uses by both parties are distinct, the values of the resource for both parties are less likely to be correlated,

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132 Of course, owners often attach subjective value to unique personal properties, like paintings by Vincent Van Gogh.
133 See Krier & Schwab, supra note 62, at 459.
135 See Brooks, supra note 56, at 311-14. In Brooks’ example, if one is to judge whether A or B is taller, but only the upper half of their bodies are visible, it would be difficult to evaluate the absolute height of A and B—the errors are correlated. Nonetheless, it is not difficult to see who is higher, as long as one knows A and B stand on the same ground, and A and B stand shoulder-to-shoulder. Under the property rule, the judge only has to compare the relative height, while under the liability rule, because of the need to assess compensation, the judge has to know the absolute height.
136 See Brooks, supra note 56, at 294.
and thus the judicial adjudication costs under the liability rule are lower than those under the property rule, favoring the former.\textsuperscript{137}

E. WHEN LIABILITY RULE IS THE ONLY CHOICE

When the things in question are damaged or ruined, the liability rule is the best the law can do.\textsuperscript{138} The property rule, usually leading to an injunction, is only useful when the property rights can return to the \textit{status quo ante}, but all the king’s injunctions cannot put Humpty Dumpty together again. The German property jurisprudence usefully distinguishes disposals into \textit{de jure} disposal and \textit{de facto} disposal. \textit{De jure} disposal occurs when the disposed property can be recovered—for example, a non-owner sells a watch to a third party. By contrast, \textit{de facto} disposal occurs when it cannot—for instance, a non-owner eats another’s cake or burns another’s car without the owner’s consent, eliminating the owner’s property rights on the cake and the car.\textsuperscript{139} Generally, \textit{de facto} disposal can only be dealt with by the liability rule. Granted, if the property rule is considered a call option whose exercise price is extremely high,\textsuperscript{140} the \textit{de facto} disposer can be mandated to pay high punitive damages. High exercise prices, however, may over-deter and induce potential \textit{de facto} disposers to be too cautious. Thus, high punitive damages are not always desirable, at least when the \textit{de facto} disposal is unintentional.

Gideon Parchomovsky and Alex Stein proposed “propertized compensation,” which is a “damage measure that sets compensation equal to the owner’s pre-trespass asking price,” to be employed

\textsuperscript{137} See Brooks, supra note 56, at 294.

\textsuperscript{138} See Rose, supra note 28, at 2181. See also Fennell, supra note 28, at 1434 (arguing that because the state’s physical coercion is not applied in time to prevent the entitlement violation, some other remedies have to be applied).

\textsuperscript{139} The closest American term to \textit{de facto} disposal would be “conversion” in its original, narrower meaning.

\textsuperscript{140} See AYRES, supra note 3.
primarily in intentional trespass. Their proposal would narrow the domain of “inevitable liability rules,” but under Parchomovsky & Stein’s strict evidentiary requirement, market-value compensation (the ordinary liability rule regime) is still often the only feasible choice.

CONCLUSION

The major argument of this article is that Rule 1 (a type of property rule) should indeed be the default in property law, especially when transaction costs are low, because the property rule harnesses private information better than the liability rule (both the call and put forms), a point long ignored or incorrectly criticized in the prior literature. Rule 2 (a type of liability rule) can be more efficient than the property rule when the following are true: transaction costs are high; non-owners are likely higher-valuing; ex ante investment is not important; and courts assess property value fairly accurately. Also, sometimes the property rule is simply infeasible ex post, leaving the liability rule as the only option. Notably, these arguments tend to favor Rule 2 in personal properties, while preferring Rule 1 in real properties.

Other than Rules 1 and 2, other rules should be relegated in the analytical framework. Rules 3 and 4 are more confusing than useful, and their existence misleadingly suggests a symmetry that does not exist in real-world private law. Rules 5 and 6 are rarely used in law, and even when they are, they do not function like a mandatory financial put option. We should celebrate a creative legal rule resembling Rules 3–6 when it can enhance efficiency. The optional law literature, however, elevates the less important Rules 3–6 to the equal footing of Rules 1–2 and fails to give proper credits to Rules 1

and 2, in particular Rule 1. As this article has hopefully demonstrated, Rules 1 and 2 should have the last laugh.

Property law is built mainly on Rule 1 (the property rule), with occasional support by Rule 2 (the liability rule). To economize on property concepts,\(^{142}\) perhaps thinking just in terms of the property rule versus the liability rule (both in singular forms) in property issues relieves the “System 2”\(^{143}\) in our brain of an unnecessary burden, and leads to clearer thinking. The plain vanilla terminology of the property rule and the liability rule are more accurate and can direct property scholarship to the right track—examining property doctrines one by one to ascertain whether the default property rule should be maintained or the liability rule is warranted.


\(^{143}\) See generally KAHNEMAN, *supra* note 67.
Appendix: The Definition of Efficiency in Property Law and Economics

In this Appendix, I clarify the role and concept of efficiency in property law and economics. Specifically, I point out how four types of efficiency—allocative efficiency, production efficiency, Pareto efficiency, and Kaldor-Hicks efficiency—can be distinguished and how to use them to deal with property issues.

Let’s start with allocative efficiency. At least two definitions of allocative efficiency are used in property law and economics, one narrow, one broad. The narrow version of allocative efficiency concerns whether the thing or resource in question has been assigned or transferred to the higher-valuing party. If not, it is considered (allocatively) inefficient, as Coase and many others have done (explicitly or implicitly).144 Harold Demsetz has critiqued Coase and others for not taking into account transaction costs in the calculus of (allocative) efficiency.145 In Demsetz’s view, the economic system has done its best to re-allocate resource given the entitlement assignment and the level of transaction costs. Thus, Demsetz (implicitly) takes the broader view of (allocative) efficiency, under which the transaction costs and the value of the things are both taken into account. Following this definition, Demsetz contends that the economic system is efficient even when the things in question are not in the hand of higher-valuing parties.146

If allocative efficiency hovers the mind of policymakers, production efficiency is the mundane problem that most economic agents care about—how a firm can reduce costs while manufactur-

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145 See HAROLD DEMSETZ, FROM ECONOMIC MAN TO ECONOMIC SYSTEM: ESSAYS ON HUMAN BEHAVIOR AND THE INSTITUTIONS OF CAPITALISM 109–14 (2008); Demsetz, supra note 90, at 8–9.

146 See DEMSETZ, supra note 145, at 113.
ing similar- or better-quality products. Property economic lawyers, indeed most law and economics experts, rarely discuss production efficiency, as it is a topic better left for pure economists. Demsetz brings production efficiency into the foreground by characterizing the transaction as a product, and pointing out that transactions should be purchased only when they are worth the costs.147 Fennell extends Demsetz’s point and depicts “transaction cost reduction” as a product that the law should purchase only when it is productively efficient to do so—namely, if the resources put into reducing transaction costs worth more than the reduced transaction costs, the law should not attempt to curtail transaction costs.148

Fennell’s approach149 is more in line with the property law and economics literature since Coase’s 1960 seminal work,150 and, from a legal perspective, provides a better framework for policymakers and scholars to evaluate whether and where the overall efficiency of the legal system can be improved. As Fennell points out, while Demsetz takes law as given, lawyers do not.151 It is thus better to adopt the narrow version of allocative efficiency, in combination with the idea of “transaction cost reduction” as a product, to evaluate whether to tinker with the property system. That is, allocative efficiency and production efficiency are distinct concepts that are both useful in property law and economics. The former measures the value of resources in private parties, whereas the latter considers whether public actions should be taken to alter the costs of resource access.152

To clarify how to use the idea of allocative efficiency and production efficiency, to spot problematic property doctrines, and to

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147 See id. at 109–10.
148 See Fennell, supra note 90, at 1502.
149 See id. at 1526–27.
150 See Coase, supra note 47.
151 See Fennell, supra note 90, at 1480–82.
152 I assume that cost-effective private actions to reduce resource access costs will be taken.
demonstrate their relationships with Pareto efficiency and Kaldor-Hicks efficiency, I offer a three-step thinking module:

Step 1: Scholars and policymakers analyze the entitlement (re-)assignment and protection mechanism\(^{153}\) regarding certain property issues to see whether the property mechanism tends to enable higher-valuers to receive property rights.\(^{154}\) If the answer is positive, it is allocatively efficient. Nonetheless, from ex ante and/or ex post perspective,\(^{155}\) the allocative efficiency might not have been attained in a productively efficient fashion (more on this below). If the answer is negative, it is allocatively inefficient, but the policymakers do not necessarily have to take actions.

Step 2: Scholars and policymakers analyze bargaining environments to see whether transaction costs are too high to prevent voluntary deals. As Coase famously pointed out,\(^{156}\) if the transaction costs are sufficiently low (like zero), ensuing transactions will correct the allocative inefficiency arising from ill-conceived entitlement design. If, however, transaction costs are high, the allocative inefficiency persists.\(^{157}\) Here, again, the policymakers do not necessarily have to take actions.\(^{158}\)

Step 3: Scholars and policymakers can evaluate whether it is cost-effective to change the entitlement structure (Step 1) or amend

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\(^{153}\) The classic literature in entitlement assignment and protection mechanism is Calabresi & Melamed; See Calabresi & Melamed, supra note 5.

\(^{154}\) Fennell, supra note 28; Calabresi & Melamed, supra note 5. For example, in a prior work, I have analyzed whether the accession doctrine tends to transfer resource to the party who values it more. See Chang, supra note 44.


\(^{156}\) See Coase, supra note 47.

\(^{157}\) See id.

the bargaining environment (Step 2). Generally, the entitlement structure can be changed by new statutes or new Supreme Court decisions, and sometimes the bargaining environment can be altered as well. For instance, moving from a private titling system of real estate to a registration system reduces information cost and thus may increase the number and frequency of transactions, leading to more allocative efficiency. But the critical point is that the product (new entitlement structure or reduced transaction cost) should only be purchased when its value surpasses its expense. As Demsetz demonstrates, the property right system is not always superior to commons, as it takes resources to set up and maintain a formal property system. Benito Arruñada points out that, due to the high cost of setting up and maintaining a registration system, private titling or recording could be more (productively) efficient than registration. Therefore, allocative inefficiency should be redressed by law only when it is productively efficient to do so. This registration example can also explain why allocative efficiency at Step 1 is not always desirable. From an ex ante viewpoint (before there is any formal titling mechanism), a registration system may be too expensive to establish, even taking into account the benefits thereafter brought by clearer titles, which increase the value of land. Once the registration system is in place, the daily (marginal) operation cost may be small, so that—since sunk costs are sunk—ex post allocative efficiency can be attained in a cost-effective manner. But it

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159 In one of my prior works, I analyzed whether a hybrid of the property rule and the liability rule can reduce the asymmetric bargaining power between landlocked owners and their neighbors. See Chang, supra note 113.


162 Id. at 139-44.
is also possible that the daily operation costs are still large, so that superior allocative efficiency is not worth pursuing. Policymakers may consider switching to the lower-cost recording system.\footnote{163}{Indeed, several jurisdictions in the U.S. have converted from registration system to the recording system.}

What about Pareto efficiency and Kaldor-Hicks efficiency? These two criteria are used to evaluate the welfare changes between two states of the world, or, more concretely, between two entitlement regimes or between two bargaining environments. According to the Pareto criterion, if no one loses and someone gains, it is efficient. Kaldor-Hicks criterion, also called the potential Pareto criterion, requires that winner’s gains are larger than the loser’s losses, and no actual compensation is required.\footnote{164}{See POSNER, supra note 99, at 17–20.} Changes in entitlement regimes and bargaining environments are rarely, if ever, Pareto-improving, as someone would be losing, and thus violating the Pareto criterion.\footnote{165}{Cf. MATTHEW D. ADLER & ERIC A. POSNER, NEW FOUNDATIONS OF COST-BENEFIT ANALYSIS 5 (2006) (“[T]he Pareto principle is too strong—few, if any, government projects would satisfy it.”). For criticism that Pareto criterion requires interpersonal comparison that is unlikely to be widely acceptable, see RICHARD O. ZERBE, ECONOMIC EFFICIENCY IN LAW AND ECONOMICS 3 (2001).}

Kaldor-Hicks efficiency is more practically useful than the Pareto efficiency. In property law and economics, however, Kaldor-Hicks efficiency generally overlaps with allocative efficiency. Neither criteria mandates winners (higher-valuers) to actually compensate losers (lower-valuers).\footnote{166}{Though only when the two parties reach a voluntary deal will we be confident that it is indeed efficient. See POSNER, supra note 89, at 20.} Neither test explicitly incorporates production efficiency. That is, judgments of Kaldor-Hicks or allocative efficiency are independent of the question whether the net gains in terms of winners’ gains (or their willingness to pay) minus losers’ losses (or their willingness to accept) can outweigh the social costs of, say, engineering a new entitlement regime. More im-
portantly, it is efficient under both tests when the gained value of a higher-valuer outweighs the lost value of a lower-valuer. Thus, in property law and economics, it should be safe to choose either allocative efficiency or Kaldor-Hicks efficiency in making policy judgments. I prefer allocative efficiency, though I recognize that the latter is more easily applied in other legal contexts, due to the way it is defined.

To recapitulate, property law and economists should keep in mind both allocative efficiency and production efficiency. The determination of economic efficiency is unified, though. If certain resources are allocated inefficiently, but changing the relevant property doctrine is too expensive, the status quo is still efficient. If improving the property doctrine in question were sufficiently low-cost—yet policymakers have not taken actions—it would be inefficient. Even when resources are allocatively efficient, there still might be room for improvement, if the marginal costs of continuing to purchase allocative efficiency are higher than the marginal benefits—it would be inefficient not to take actions. Though ultimately property law and economics would render a single judgment on economic efficiency, as this Appendix hopes to demonstrate, it is useful to spell out the components of the seemingly single-minded determination of efficiency, and to lay out a thinking module. With common and clearer terminologies in efficiency, property law and economic scholarship could go on to the next level.

167 The presence of “loss aversion” would complicate the calculation of values or willingness to pay/accept, but this needs not concern us here. For loss aversion, see, e.g., KAHNEMAN, supra note 67, at 282–86; RICHARD H. THALER & CASS R. SUNSTEIN, NUDGE: IMPROVING DECISIONS ABOUT HEALTH, WEALTH, AND HAPPINESS 33–34 (2008).