

# PROPERTY IS ONLY ANOTHER NAME FOR MONOPOLY

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## ABSTRACT

The existing system of private property interferes with allocative efficiency by giving owners the power to hold out for excessive prices. We propose a remedy in the form of a tax on property, based on the value self-assessed by its owner at intervals, along with a requirement that the owner sell the property to any third party willing to pay a price equal to the self-assessed value. The tax rate would reflect a tradeoff between gains from allocative efficiency and losses to investment efficiency, likely in the range of 5 to 10 percent annually for most assets. We discuss the detailed design of this system from an economic and legal perspective.

## INTRODUCTION

Property rights of all sorts—in real estate, in shares of corporations, and in radio spectrum, to take three diverse examples—give the owner a monopoly over a resource. It is conventional to think that this monopoly is benign. It gives the owner an incentive to invest in improving the property because she receives the entire payoff from its use or sale. This aligns social and private incentives for investment in property. This thinking plays a role in libertarian defenses of private property and in the influential work of legal economists deriving from the Coase Theorem (see, e.g., Epstein 1997).

However, the monopoly also creates a serious cost that is often overlooked. Because the owner has a monopoly, she will attempt to sell the property at a “monopoly price”, one above the minimum she would be willing to accept for her asset and thus the price she would charge in a market where many

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individuals with similar valuations of substantially identical property to the owner compete to make a sale. Just like a normal monopolist, a property owner sets a price that approximates what the seller thinks that the likely buyer's valuation or reservation price for the property is. Because some buyers will have a valuation that is lower than the announced price but higher than the seller's valuation, some efficient sales will be blocked or delayed. This inhibits the allocation of property to its most valuable uses, a crucial component of a successful market economy. Macroeconomists have found that failure of assets to be reallocated to their most efficient uses is a major drag on aggregate productivity around the world (see our discussion in Subsection 4.2 further).

When this problem is discussed, authors usually refer to it as the "holdout problem", most familiar in the context of development of real property and purchases of mineral rights and other natural resources, where projects can fail because sellers hold out for excessive prices. The problem also arises prominently in transactions over corporate assets, including corporate takeovers, where negotiations often get bogged down in discussions over the transaction price. The Federal Communications Commission has spent the last seven years preparing an auction and property-redefinition procedure to deal with holdout problems that have inhibited the reallocation of spectrum to more efficient uses (Eisenach 2011, p. 88; Kominers & Weyl, 2012, p. 362–63; Milgrom & Segal 2015). In intellectual property, scholars have long understood that monopoly power granted to inventors through patent law interferes with allocative efficiency—exemplified by the "patent troll" controversy (Lemley & Shapiro 2007). But the problem is much more general. In every transaction—home and car sales, sales of ordinary goods, and so on—private property creates bargaining problems that interfere with allocative efficiency. To put this problem starkly: allocative efficiency and thus an efficient market economy is impossible in the presence of private ownership.

This problem was first clearly articulated by the "marginal revolutionaries", Jevons (1871) and Walras (1896), who laid the foundation for modern formal economic analysis. They, together with George (1879), another prominent economist of the late 19th century, believed that the only solution to the monopoly problem was nationalization (through taxation) of many forms of property. Building on their arguments, the socialist economist Lerner (1944) advocated state ownership of property, together with a public "mechanism" that distributed possessory rights of property to users who valued them the most. In his Nobel prize-winning work, Vickrey (1961) (a follower of George) described how an auction could serve that function. Property is owned in common; the government would allocate temporary possessory and control interests in the property (effectively, leases) to the winners of an auction.

Because users would eventually be required to return property to the government, they could not hold out for a monopoly price, or indeed sell their property at all. The modern literature on mechanism design and related work in law and economics, which was initiated by Vickrey's contributions, have further refined our understanding of the monopoly problem with private property, and explored ways in which markets can be designed to mitigate it (e.g., Myerson & Satterthwaite 1983).

However, this literature has ignored the traditional concern with common ownership.<sup>1</sup> As we noted at the outset, the benefit of the monopoly granted by private property rights is that it gives the owner an incentive to invest in the property to enhance its value. If the owner can charge whatever price she wants when she sells the property, she will be compensated for an investment that increases its value, because she can increase the price to reflect the increase in value added by her investment. If she cannot—if she must instead return the property to “society” (meaning, to government officials)—then she has weak incentives to invest in it.<sup>2</sup> Probably for this reason, Vickrey's proposal has never been seriously considered by a government.

Instead, the governments of countries where modern market economies exist have addressed the tension between allocative efficiency and investment efficiency by adopting something like a “mixed regime” that consists of strong private property rights for most ordinary types of property and significant deviations in special cases. These deviations include liability rules in tort law for relatively indirect forms of property-rights violation; adverse possession of unused property; time-limited property rights (generally used for intellectual property, but also for a range of government-leased resources like grazing land); redefinition of property rights in the light of technological change (such as with the radio spectrum discussed above); public ownership in limited cases (e.g., roads); and various jury-rigged forms of government intervention like eminent domain for private uses (see discussion in Subsection 4.3 above). In all of these cases, the deviation from private property reduces the holdout problem and

1 By common ownership, we refer to property of which more than one person has the right to proceeds from a sale. In the case of the Vickrey commons and our proposal, the proceeds from sales are effectively shared by everyone in society according to some rule as we describe in Subsection 2.1. When lawyers use this term, they frequently have in mind an additional feature: the right of more than one person to occupy and control the property. Joint owners of a house both control the house and share the proceeds from the sale. For purposes of this article, we use the term only in the first sense, and exclude the second.

2 As we discuss further below, however, social ownership may promote investment by individuals other than the possessor who may contribute in more diffuse ways, such as through the creation of public goods, to the value of the asset.

thus enhances allocative efficiency, while paying the price in the form of reduced incentives for private investment.

And yet there are serious problems with this mixed regime. First, it does not address the monopoly problem for a huge range of transactions—reallocating mineral rights, haggling over the purchase of a used car, months-long negotiations over house sales, corporate acquisitions that can drag on for years. In these cases, investment efficiency is maintained, but allocative efficiency is sacrificed. Second, where the regime addresses allocative efficiency by deviating from private property, it relies heavily on bureaucratic or judicial valuations to ensure some level of compensation for the forced sale or transfer, or it denies compensation altogether. But the denial of compensation eliminates investment incentives, and imperfect government-supplied valuations and other forms of intervention interfere both with allocative efficiency and investment efficiency. While the deviations from private property may produce better outcomes for society than a system without such deviations, they fall far short of the social optimum. Our present system mixes elements of an extreme form of capitalism with the more naïve forms of central planning.

In this article, we consider a third way, one that involves a system of self-assessed property taxation first proposed by Harberger (1965) for the purposes of raising tax revenue.<sup>3</sup> Under this Harberger tax, as we call it, people periodically report valuations of their property to a government registry; pay property taxes based on these valuations; and are required to sell their property at these valuations to any buyer. A key component of this proposal is that buyers can force sales—limiting a longstanding element of private property, which is that the person who owns property keeps it until she consents to sale. The Harberger tax is a radical departure from our current system of private property in one sense—people are no longer “owners”; they are more like lessees—and yet it at the same time amplifies the operation of the market economy rather than curtailing it. People maintain the freedom to hold onto their property if they are willing to self-assess a high valuation; economic decisions are made by individuals, not by the government; and market competition remains the dominant force in the economy, indeed gains in importance relative to the current system. From a legal standpoint, the Harberger system creates a type of property that replaces the “right to exclude” with a “right to exclude anyone who does not

3 For an early review and criticisms, see Holland & Vaughn (1962, p. 79). The idea was further developed by Saul Levmore (1982), and has received renewed attention in recent years in the law and economics literature; see, e.g. Abramowicz (1999, p. 364–373); Fennell (2005, p. 1444); Lewinsohn-Zamir (2009, p. 1398–1399); Epstein (2014, p. 111). Versions of the tax were also proposed by the Chinese revolutionary and statesman, Sun Yat-sen, at the beginning of the twentieth century, see Niou and Tan (1994), and Maurice Allais (1976, p. 104–106), a Nobel prize-winning French economist, in 1976

pay the self-assessed price”. Another way to think of our proposal is as a kind of “partial ownership”, halfway between private ownership (the current system) and common ownership (the system advocated by Walras, George, and Lerner).

In one sense, our proposal is not new; the Harberger tax has attracted some attention in the law and economics literature, primarily as a means of raising revenue, and related mechanisms have been used extensively in practice in horse racing, mutual insurance arrangements, and the dissolution of partnerships, among other settings (Hall 1986; Cabrales et al. 2003; Brooks et al. 2010). Furthermore, we build our argument on a proposal by one of us (Weyl) and Anthony Zhang (Weyl & Zhang 2017), who prove mathematically the superiority of the Harberger tax under standard economic assumptions. However, none of this work has confronted the many social, legal, and policy issues facing the use of Harberger taxation in practice and thus none has offered a detailed account of how it could offer a broad-scale solution to the monopoly power created by property. This is unfortunate because at a time of increased concerns about the slowdown in productivity growth and the rise in inequality, a reform like Harberger taxation that has the potential to address both problems deserves to be taken seriously.<sup>4</sup> Our primary contribution in this article is, therefore, to put flesh on these bones, use the underlying theory to shed light on themes in the literature on property law, and address the practical, philosophical, and legal challenges that it would meet beyond the relative narrow concerns confronted in the previous literature, which focuses either on the excessively simplified models of economic theory or on very narrow applications where these challenges are less salient.

In Section 1, we set out the theory behind the Harberger tax. We argue that while private property enhances investment efficiency but interferes with allocative efficiency, and common ownership interferes with investment efficiency but enhances allocative efficiency, the Harberger tax optimizes across both forms of efficiency. We also address the magnitude of the optimal Harberger tax, arguing that the rate of taxation will be higher in cases where asset markets are illiquid (asymmetric information about values is rampant) and lower in cases where the value of property depends heavily on investments that are difficult for an outsider to observe.

In Section 2, we address design issues, such as the use of the revenue generated by the tax, the structure of rates charged, etc. In addition, we discuss legal and technological infrastructure that would support the collection of Harberger taxes. We explore the forms that it might take. In Section 3, we discuss some practical challenges, including the redistributive implications of the tax; its

4 See Subsection 2.1 for a discussion of the implications of Harberger taxation for the distribution of income, Gordon (2016), for a discussion of the recent decline in growth and productivity growth, and Piketty (2014), for a discussion of the rise of inequality within wealthy countries.

fairness when people have strong attachments to property; how a regime of “forced sales” may disrupt planning; and how inspections of property can take place. Then in Section 4, we describe how the Harberger tax might work for different types of property. Here, we show areas in which implementation of the Harberger tax would be straightforward (domain names, broadcast spectrum, natural resource leases), and then address some more complicated cases (corporate acquisitions, real property, personal property). A theme of this section is that many of the features of the Harberger tax that people might find objectionable already exist in hidden form in the current mixed system. Furthermore, we argue that several new technologies are making the benefits of Harberger taxation greater and its optimal rate higher, suggesting that the gains from implementing such a system will grow in coming years.

Our arguments reach deep into the roots of economic theory. Nineteenth-century critics of Adam Smith’s theories of the market economy identified private property as one of the chief culprits in what they saw as wasteful economic relationships, as well as systems of domination. While the critics did not identify the monopoly problem in so many terms, their concerns about private property—that those who owned it could extract rents from those who did not—were related to it (Bowles & Edwards 1985, p. 73–83). Many of them—including Saint-Simon, Proudhon, Owen, Fourier, Marx, and Engels—called for common ownership of some sort (Gray 1946). Yet they were never clear about the form that common ownership would take, or how it would address the incentive problems that preoccupied Smith. Even the leading socialist economists of the 20th century—Oskar Lange, Abba Lerner, and Fred Taylor—ignored the problem of implementation, assuming “all that was necessary was a large calculation” to satisfy the equation of general equilibrium theory, in other words, central planning (Lange & Taylor 1938; Lerner 1944). von Mises (1920) and Hayek (1945) pointed out the flaw in this reasoning: central planners lack the information they need to make allocative decisions (Bowles 2004).<sup>5</sup> People’s valuations are private information; the genius of the market is its capacity for disseminating this information from consumers to producers through the price system. The alternative was massive misallocation of resources—the production of goods no one wanted—that was characteristic of real-world socialist economies like that of the Soviet Union.<sup>6</sup>

5 See also Bowles (2004, p. 475–476), for a discussion of the mid-century debates.

6 These critiques would eventually lead modern socialist thinkers to advocate various hybrid economic relationships like workers’ cooperatives, which would have placed production under greater democratic control, and stronger economic rights, which would make workers less dependent on their employers. See Bowles & Gintis (1986) and Nove (1991).

Vickrey (1961) showed that a type of common ownership—one in which the government auctioned use or possessory rights to people—could lead to allocative efficiency. His work helped initiate the literature that became known as “mechanism design” (Hurwicz & Reiter 2006). Two other economists writing in the literature—Myerson & Satterthwaite (1983)—finally identified the monopoly problem in a mathematically rigorous fashion, proving that private property was inconsistent with allocative efficiency. This work, along with Vickrey’s, stimulated a search for efficient market mechanisms, and led to the widespread adoption of auctions for administrative property, especially the radio spectrum (Milgrom 2004).

However, this literature never addressed the problem of investment efficiency. The notion that common ownership can undermine investment in property dates at least back to Aristotle’s *Politics*, but it became a central theme of the economics literature after Garrett Hardin’s observations about the neglect of common resources (Hardin 1968). Formal economic analysis by Sanford Grossman, Oliver Hart, and John Moore emphasized the role of property rights in encouraging owners to make productive investments (Grossman & Hart 1986; Hart & Moore 1990). However, these arguments were met with some skepticism by proponents of the Vickrey and Myerson-Satterthwaite logic. Milgrom (1987) and Rogerson (1992) argued that to the extent that an individual’s investment increases only *her own* use value for a good, a competitive auction provides optimal incentives. Individuals reap the benefits of the investment exactly to the extent that they end up owning the good in the future, which is the only case when it is useful to make the investment. However, as Che & Hausch (1999) argued, most investments benefit future potential owners as well as the owner who makes the investment. They consider a case when the investment is purely “cooperative” in that it raises the buyer’s value rather than that of the seller. In this case, they show that schemes like Vickrey’s perform very poorly, worse in fact than simple property ownership, in encouraging investment.

Meanwhile, a parallel literature in law and economics developed. It originated with Ronald Coase’s classic article, *The Problem of Social Cost* (1960), in which he argued that if transaction costs are low, the allocation of property rights is irrelevant from the standpoint of efficiency, because property will be transferred from lower valued to higher valued uses through bargaining.<sup>7</sup> While a huge amount of controversy has developed over what exactly Coase meant, it is clear that in the hands of many subsequent authors beginning with George

7 Some limited empirical work confirms the lawyer’s intuition that bargaining can be extremely difficult, especially in the sorts of examples that Coase preferred. See Farnsworth (1999).

Stigler's (1966) third edition of *The Theory of Price*, the "Coase Theorem" came to stand for the idea that private bargaining from strong and clearly defined property rights frequently makes regulation unnecessary, particularly when a small number of people are affected by the externality in question, and hence transaction costs are low. In the Coasean world of low transaction costs, the monopoly problem is simply assumed away, which means that private property is optimal because it enhances investment efficiency.<sup>8</sup>

This idea has made its way into the literature on the law and economics of property. The standard view is that private property is "normal" because competitive markets prevent owners from exploiting their formal monopoly power over their property; public ownership and restrictions on private property (in the sense of the owner's power to refuse to alienate the property) are justified in only exceptional cases involving public goods, spillovers, "natural monopolies" (typically meaning cases where market power is very high and price distortions extreme), and assembly problems.<sup>9</sup> Probably under the influence of the Coase theorem, law and economics scholars divide the world into "zero (or low) transaction cost" and "high transaction cost" and claim that regulation (including public ownership) is appropriate only in the latter, leaving private property to prevail in the (implicitly "normal") zone of the former. But the monopoly problem is always a matter of degree; because the monopoly problem is a type of transaction cost, transaction costs are also never zero but instead a matter of degree. This means that advances in technology and the design of institutions, including the Harberger tax itself, may shrink the zone in which private property is superior.

At the same time, scholars writing in the Coasean tradition have understood, from the very beginning, that the state must play a role in facilitating bargains. In their influential early article on property rules and liability rules, Calabresi & Melamed (1972) pointed out that liability rules may be justified when

8 This can be seen in the three major textbooks on law and economics. All three textbooks give great weight to the investment problem as a justification for private property: if private property did not exist, then people would not invest in improving property since they could not be sure that they would profit from the returns on the investment. See Shavell (2004, p. 11–19); Cooter & Ulen (2002, p. 76–81); Posner (2014, p. 40–42). The textbooks give only passing attention to the monopoly problem. While they acknowledge that holdout problems, and related problems of strategic behavior, can interfere with the transfer of property, they largely consider these problems as confined to cases where the use of property affects many people, as in the case of factory pollution.

9 Merrill (2012, p. 91) illustrates this view. After noting that "[a]ll property rights confer a monopoly," he says, "[m]onopolies are troubling only when they confer market power." But monopolies by definition confer market power. What Merrill probably means is that the monopoly created by private property is not a matter of public concern because the market power it confers is relatively limited, which means that expensive antitrust litigation or government regulation will not be justified.



bargaining is not possible.<sup>10</sup> If pollution from a factory harms thousands of people, it may not be possible for the victims to pay the factory to stop, as imagined by Coase. In this case, the courts step in and force a bargain by setting a price equal to the harm suffered by the residents. Judicial valuation would remain minimal for two-party cases on the assumption that judicial valuation is inherently inaccurate, less accurate than the prices set by parties themselves. But Kaplow & Shavell (1996) later showed that liability rules can be superior to property rules even for the two-party case when bargaining is possible, if it is not frictionless.<sup>11</sup> **If judicial valuation is accurate on average, the benefit from being able to force a sale exceeds the cost from inaccurate valuation.** Segal & Whinston (2011) amplify this logic by showing that this more efficient fallback option provides a better basis for bargaining to efficiency. **The reason is that the parties will settle on a price against the background expectation of an on-average accurate judicial valuation.**

However, Segal & Whinston (forthcoming) also show that, unlike shared property rights, **liability rules do not allow full efficiency or eliminate the monopoly problem because judicial valuations, even when accurate on average, are never as accurate as private valuations are.** Furthermore, Kaplow and Shavell argue that such valuations **may not even be accurate on average from the perspective of the traders, as they may both have information unavailable to the court.** In this case, they argue that property rules may be superior to liability rules. Whichever is the case, liability rules leave much to be desired in resolving the monopoly problem.

In recent years, law and economics scholars have begun to look for inspiration in the mechanism design literature. Ayres & Balkin (1996) propose a mechanism that replaces liability rules with what they call “truncated auctions”. A factory, for example, may pollute the property of a neighboring laundry if (i) the factory offers to pay the laundry its expected loss from the pollution, and (ii) the laundry declines to exercise a “take-back option” under which it pays an exercise price of some higher amount. Fennell (2005) proposes a similar mechanism except that the factory, when it exercises its initial option to pay, must also state a price at which the laundry may exercise its option to retake the entitlement. These and related proposals<sup>12</sup> may lessen the monopoly problem

10 See also Cooter (1982) for a broader discussion of the problems with the Coase theorem.

11 Kaplow & Shavell (1996) discuss some suggestions.

12 The literature has ramified into multiple competing proposals along similar lines. See, e.g., Knysh, Goldbart, & Ayres (2004); Bell & Parchomovsky (2005). All of these proposals share the property that they may, under some circumstances, improve the efficiency of allocation, but none do so generally, nor do any of them quantify the protection of investment incentives, or optimally trade off these two objectives.

by enabling the buyer to force the monopolist to transact at a price that reflects the monopolist's private information about its valuation.

However, these mechanisms share several flaws. First, they all rely to a significant extent on judicial valuations and the setting of discretionary prices and thresholds by third parties that may be poorly informed. This implies that these mechanisms may harm allocative efficiency in some cases and will tend to be relatively ineffectual at improving it. Second, to the extent that these mechanisms reveal any private information, they do it *ex post* when much of the opportunity for supplying countervailing incentives is past and then require the entitlement taker to assess a valuation on the spot. This is likely to be more challenging than allowing the entitlement holder, who has held the entitlement for an extended period during which she can reflect on its value, to set the valuation *ex ante*. Third, these proposals tend to undermine investment incentives; liability protection of an asset may actually create an incentive to harm assets in ways that make them less attractive to a prospective taker, unless the objective assessor can correctly perceive the improved value of the asset.<sup>13</sup> Fourth, many of these mechanisms require the buyer of the asset to be fixed and defined in advance (and known to the law), which makes them difficult to apply in the case of most asset markets where the desirable owners of assets emerge dynamically from a large population. Finally, these mechanisms are quite elaborate, making them difficult to imagine implementing in practice and raising concerns about their sensitivity to changes in the environment in which they are analyzed.

As we turn to our proposed Harberger tax, we should acknowledge that, for some readers, it will seem like science fiction, too radical to be taken seriously. But while some applications of the proposal would change ordinary life in surprising and possibly discomfiting ways, other applications—for example, to the broadcast spectrum and natural resource extraction rights—are perfectly ordinary, and only modestly different from approaches that the government already uses. That said, we acknowledge that our discussion is exploratory and that only empirical evidence can resolve questions about whether our system would work well or poorly.

## 1. THEORY

In this section, we discuss the fundamental ideas behind our proposal.<sup>14</sup> We begin by explaining how private ownership interferes with allocative efficiency

13 Fennell's (2011) scheme does this in an even more extreme way, as it gives the entitlement-taker the right to make the offer, giving the taker an incentive to extract all benefit from investment from the entitlement holder.

14 For a more formal treatment, see Weyl & Zhang 2017.

relative to the system of common ownership advocated by Vickrey. Next, we point out that private ownership generates superior incentives for investment. In the final two sections, we show how “partial common ownership”—a mixed version of private and common ownership—optimizes across the two forms of efficiency, and explain how the Harberger tax fulfills this function.

### 1.1 Allocative Efficiency

A central economic problem in a variety of settings is that of ensuring capital—including money, land, machines, and other assets—is allocated to its most productive uses. In traditional economic models, this problem is assumed away: capital assets move to their most productive uses because the people or firms who can use it most productively can pay the highest prices to buy it from those who cannot. However, in the real world this problem of allocative efficiency often takes center stage. As Hoffman (1988) famously argued, England may have industrialized earlier than France and other countries because English law recognized a type of compulsory purchase, called enclosure. Roughly, enclosure allowed expropriation of large areas of land on the urban periphery for use in manufacturing, while no similar system of compulsory purchase existed in France. In modern times, mergers and takeovers of corporations represent a large share of aggregate economic activity, nearly half a trillion dollars each year—and yet they frequently fail because of bargaining impasses (Grossman & Hart 1980; Jensen & Ruback 1983; Shleifer & Vishny 1997). Real estate development is also hampered because it requires the assembly of multiple plots of land whose owners hold out for high prices. The solution is a form of government expropriation—takings for “private use”—which has been enormously controversial (Somin 2009, p. 2108–2114). A final example is the misallocation of usage rights for the electromagnetic spectrum, which the government has tried to cure by introducing auctions (Milgrom 2004; Eisenach 2011, p. 88; Kominers & Weyl 2012; Milgrom & Segal 2015). Hsieh & Klenow (2009) have argued that the misallocation of capital assets to insufficiently productive uses can explain an important part of the differentials in output across countries.

The source of misallocation in all these examples is the same: the owner of private property will “hold out” for a price that the buyer may not be able to pay, leading to delay or a failed transaction even when the buyer can use the property more productively than the owner can. This problem was first identified by Jevons (1871), one of the founders of neo-classical economics. The title of this article is a quote from his 1879 second edition of his classic, *The Theory of Political Economy*. However, this idea takes its sharpest formal manifestation in the classic analysis of Myerson & Satterthwaite (1983) in the early 1980s, for which Myerson eventually won the Nobel prize. Myerson and Satterthwaite

consider a case in which there is a single current owner and single potential buyer for an asset. They show that if it is not known with certainty by both parties that the buyer values that asset more than the seller,<sup>15</sup> and that the seller has an absolute right to refuse to sell if she wishes to, then, assuming both agents act in their economic self-interest, there exists no procedure for bargaining that ensures that the good is transferred to the buyer whenever the buyer values the good more than the seller does, which is what is meant by “allocative efficiency”.

The idea behind this *Myerson–Satterthwaite Theorem* is that if, for example, the seller is asked to make an offer to the buyer, she will typically demand more than her reservation price for the asset because she wishes to maximize her profit on the sale. This will lead some buyers who would have been willing to pay the seller’s reservation value, but are unwilling to pay the price she quotes, to refuse to purchase. The buyer, however, if asked to make an offer to the seller will offer less than her reservation price for purchase, again to enjoy more of the surplus associated with the trade. This will lead some sellers who would have been willing to sell at the buyer’s reservation price to refuse to sell. Both outcomes inefficiently reduce the probability that the asset moves from the lower value user to the higher value user. Any other bargaining protocol involves some combination of the two sides determining the price, or an outsider with no knowledge of the correct price determining it, and thus they all lead to an inefficient reduction in the probability of turnover.

The Myerson–Satterthwaite Theorem would be of only academic interest if its only implication were that it is theoretically impossible to achieve efficient allocation of assets under normal economic conditions. On this view, a dead-weight cost in every transaction is the price of living in a market economy. However, Vickrey (1961) showed that if a good is owned by a whole community of individuals, with equal shares of its rental value being divided among all, the efficient allocation of the asset at any period can be achieved by a simple system of competitive bidding. In the most familiar version of the idea, property is owned in common—and hence managed by the government. The government distributes the right to possess, use, or control property for temporary periods by conducting an English auction, in which the price of the good rises until only one bidder remains. Because the price paid by this bidder conditional on winning the auction is independent of her decision to remain in the auction, she has an incentive to stay in it, and only if, the current price is below her reservation price. This ensures that the winner of the auction is the individual with the greatest reservation price and thus that the asset is allocated efficiently.

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15 In other words, if information is asymmetric.

Imagine, to take a concrete example, that the government owns apartment blocks and auctions off one-year leases to the apartments. Every year, everyone would enter the auction, and the apartments would be reallocated to the people who value them the most. We call this system the “Vickrey Commons”.

Why does a Vickrey Commons achieve allocative efficiency when private ownership does not? The fundamental reason is competition: under Vickrey’s system, all individuals are on even footing; each must outbid the other to achieve control. In contrast, under private ownership the current owner has a monopoly right to retain the good unless she finds it sufficiently profitable to transfer the good to another. This fundamental asymmetry gives her an interest in holding out for a profit while a participant in a Vickrey auction lacks the ability to hold out in this way. In this sense, there is a fundamental tension between two concepts commonly aligned with each other: privately owned property and free competition.

The monopoly problem is most serious when property is illiquid, which typically arises when property is idiosyncratic. Such property is hard to value because it cannot be easily compared to other pieces of property. Thus, it takes a long time for people to agree on a price, if they agree at all, and in the process much effort may be wasted. Artwork is highly illiquid; houses are illiquid; pork bellies and ball bearings are liquid.

## 1.2 Investment Efficiency

The Vickrey Commons has a flaw: it does not give people an incentive to take care of, or invest in, the assets under their control.<sup>16</sup> If a person wishes to retain an asset, she must outbid other potential buyers whenever the asset is returned to the Commons and put up for bid again. This means that if she increases the value of the assets through a private investment, she will be required to pay a higher price to retain it—and that extra amount will offset the increase in value, ensuring that she obtain no return on her investment. Indeed, people do not even have an incentive to invest in maintenance of a good to the extent that the investment maintains the value of the good beyond the next auction. This concern has been almost entirely neglected, to our knowledge, before the work of Weyl & Zhang (2017) in the literature on mechanisms to improve allocative efficiency.

16 Interestingly, the Vickrey Commons, and the systems of common ownership we advocate below, do provide efficient incentives for individuals to make a narrower kind of selfish investment, one augmenting only their own idiosyncratic personal value for the asset and not its objective capital value. Individuals make efficient selfish investments in the Vickrey commons because in situations where they expect to win the auction they capture the full value of these investments, while in situations where they expect to lose the auction, and thus such investments have no value as they will be wasted once a more efficient owner takes over the asset, they do not benefit from them. See Subsection 3.2 below for more detail.

In our example of the apartments, consider the incentive of someone who leases an apartment. The person would like to give the walls a coat of fresh paint. If she does so, the apartment will be worth more both for her and for other potential tenants when the next auction is held. This means that she will need to raise her bid to retain the apartment, or otherwise allow someone else to enjoy the benefit of the new paint job. Yet, she incurs the full cost of the painting. Because she internalizes the costs of any investment she makes in the apartment, but not all the benefit of those investments, her incentive is to neglect the apartment.

By contrast, private property provides optimal incentives for such capital investments because any increase in the value of the asset to both the seller and the potential buyer is perfectly captured by the seller. The owner of an apartment benefits from the fresh coat of paint if she remains in the apartment or, if she sells it, via the price premium that the buyer pays in return for an apartment with new paint. Private property rights enable the owner to capture the return on her investment by charging an increased price. Note, however, that this only provides optimal incentives to the *current possessor* of the asset. If other individuals, in the community, the government or the nation in which the possessor resides may influence the value of the asset, it will not typically be optimal even from an investment perspective for the possessor to own the full value of the asset as shown by Hölmstrom (1982) in his classic study of incentives in teams. We will return to the advantages of Harberger taxation in such settings in Subsection 2.1 further.

In sum, while common ownership allows for efficient allocation, private ownership optimizes incentives for capital investment by the present possessor.

### 1.3 The Case for Partial Common Ownership

A possible response to the argument so far is that private property rights should be used for property where investment incentives are more important than allocative efficiency, and that common property should be used where allocative efficiency is more important than investment efficiency. However, there is a third possibility: “partial” common ownership, where allocative efficiency and investment efficiency are optimized within a single property regime. This possibility is illustrated by an ingenious proposal of Cramton, Gibbons, & Klemperer (1987) in the late 1980s, and elaborated upon by Segal & Whinston (2011).<sup>17</sup>

<sup>17</sup> These ideas have been pursued in the law and economics literature as well; see, e.g., Landeo & Spier (2014a,b).

The basic idea is that by sharing ownership one can deter the exercise of monopoly power.

Consider a partnership of two individuals who no longer wish to work together and seek to dissolve it. Each person submits a bid for the value of the company and the higher bid wins. Whoever wins must buy out the share of the other partner at the average of the two prices. To see how this system gives each partner at least some incentive to be truthful, imagine first the case where the current shares align precisely with the chance that each partner wins. Here, each party has an incentive to bid precisely her reservation value. Suppose that partner A has a 60 percent ownership and anticipates, she will win the bidding process with 60 percent probability. If she raises her bid beyond some level, this increases the amount she must pay with probability 60 percent, but the amount applies to only 40 percent of the total value of the firm as this is the fraction she must buy from her partner. On the contrary, her higher bid also raises the amount she is paid if she loses the auction, which occurs with 40 percent probability but applies to the 60 percent she owns. These two incentives exactly balance and thus she has no incentive to try to manipulate the prices and instead simply bids her reservation value. Even if the shares do not perfectly line up with the chances of each party winning, any degree of shared ownership will dampen the incentive of each partner to exaggerate or understate her value by forcing her to confront the countervailing incentive she faces if she ends up on the opposite side of the deal to the one she anticipated.

An important advantage of this system over the Vickrey Commons, first noted by Weyl & Zhang (2017), is that it preserves investment incentives to some extent. An individual with a 90 percent ownership stake in a partnership still has 90 percent of the incentive to invest that an individual with a 100 percent stake does. If she ends up winning the bidding process, she retains the good (and thus the investment) and must pay only 10 percent of it to her partner for the right to enjoy this value. If she loses the process, her partner pays her 90 percent of the value of the investment to settle. Thus, while the Vickrey Commons gives no one any incentive to invest in the asset, partial common ownership gives all individuals an incentive to invest in proportion to their ownership shares.

Shared ownership is a promising way to organize a partnership. However, the scheme that we described works only for partnerships, a relatively unusual form of ownership. More commonly, the potential purchaser of an asset, such as spectrum or a house, is not known at the time at which the property rights over that asset are established; this purchaser is only revealed perhaps years later when she enters the market for an asset of that sort. Clearly, sharing property rights with a specific potential purchaser is infeasible in such a case as there are many members of the public at large who could end up being this potential

purchaser.<sup>18</sup> In the next section, we describe how the logic behind shared ownership can be applied to such cases.<sup>19</sup>

#### 1.4 The Harberger Tax

The economist Arnold Harberger proposed a simple property tax that was designed to raise revenue in developing countries where institutional capacity was weak. The key to the tax was that property owners were required to “self-assess”—to announce periodically how much they valued their property and pay taxes on the basis of the announced valuation—while being required to sell the property at the self-assessed property if anyone wanted to buy it (Harberger 1965). Tideman (1969) and Levmore (1982) subsequently embellished upon the idea. While they (especially Harberger and Levmore) saw this procedure primarily as a revenue raising mechanism, the Harberger “tax” also constitutes a new kind of private property, a system of partial common ownership that provides incentives closely related to those highlighted by Cramton, Gibbons, Klemperer, Segal, and Whinston.

Under this system, there would be a registry of all assets owned by individuals, which we henceforth refer to as the *cadaster* and anthropomorphize as the enforcer of all the rules of the system.<sup>20</sup> Individuals would list all their

18 Note, however, that just because there are many *potential purchasers at the time at which the property rights are established*, this does not imply that there are many competitors to purchase *at the time the potential purchaser arrives*. This is true for many if not most business and property transactions: at the time one buys one’s house, one typically has no idea who might buy it in the future. However, by the time one is about to conclude a sale, there are usually only one or two plausible purchasers interested in buying it. Thus, a thin market at the point of sale does not imply that the buyer is known at the point of property right design. It is this dynamic evolution of the potential purchaser pool that makes sharing property rights with the public at large, rather than with a specific potential purchaser, both necessary and desirable.

19 In fact, in the case when there is only a single plausible purchaser of the asset, Harberger taxation may end up operating somewhat differently from how we describe it below: the potential purchaser and the possessor will typically have an incentive to collude to allow the possessor to lower her valuation to avoid tax payments, while the potential purchaser agrees that, if she ever does purchase, she will do so at higher price in exchange for a portion of the taxes thus saved. While such a scheme is unstable in many ways (there is always a temptation for the purchaser to simply take the property at the newly lowered valuation, especially given that such collusion could be viewed as illegal), it does not defeat the value of Harberger taxation relative to full ownership because the shadow of Harberger taxation still enhances the bargaining over the sale and thus reallocation of the asset. Thus, while some extreme and fragile forms of bargaining may undermine the revenue raised by Harberger taxation if enforcement against collusion is lax, Harberger taxation still very likely improves allocative efficiency, its primary objective.

20 Of course, a cadaster is inanimate and in many implementations it would be cadastral authorities that would implement the system. However, we choose to view the cadaster itself as an agent because, as we discuss below, our system does not require any discretionary authority and could be implemented using, for example, an algorithm or a distributed/decentralized blockchain to avoid the possibility of the system being abused. As such we prefer to think of the system as either being



possessions in the cadaster with a self-assessed value assigned to them. This self-assessed value would serve two purposes, corresponding to the events of sale and purchase in the Cramton–Gibbons–Klemperer scheme (1987). On the one hand, the owner would be required to sell any asset at the value listed in the cadaster to any buyer willing to pay this price. On the other hand, the owner would pay a tax on the asset at a specified rate.

To see how this tax serves a role like the shared ownership system highlighted by Cramton, Gibbons, and Klemperer, suppose that the annual Harberger tax rate is set equal to the probability that a buyer who values the asset more than the seller materializes in each period. (We call this probability the “turnover rate”, meaning the rate at which the asset moves into another person’s hands.) Suppose that the tax rate and the turnover rate are both 30 percent. If the owner raises her sale price above her reservation value, she benefits from the higher sale price 30 percent of the time—when those higher value buyers turn up. Her benefit from raising the price would thus be  $.3\Delta P$ , where  $\Delta P$  is the increment in the sale price. On the contrary, she must pay the tax of 30 percent which, applied to this incremental value, forces her to pay an additional  $.3\Delta P$ . Thus, the benefit from increasing the price above the reservation price is exactly offset by the cost. The seller also wants to ensure that the asset is not taken from her at less than she is willing to accept for it. She thus will set a price exactly equal to her reservation value, ensuring that exactly the buyers willing to pay more than her reservation value will end up taking the asset. Full allocative efficiency is achieved.<sup>21</sup>

itself the enforcement agent or as an impersonal agent of the broader community rather than vesting any power in central authorities who might abuse or manipulate it, given that our goal is precisely to circumvent the reliance of past systems on arbitrary centralized judicial discretion.

- 21 Note that this argument fails if the owner’s value for the asset is also uncertain, as no tax rate can ever perfectly achieve a turnover rate equal to the efficient turnover rate, as the latter depends on the *ex hypothesi* unknown owner value. Cramton Gibbons & Klemperer (1987) and Segal & Whinston (2011) show that if other bargaining procedures (other than the seller making a take-it-or-leave-it offer) are used and the property rights are shared with the potential purchaser rather than with society at large, full efficiency can be achieved if and only if the fraction of property rights held by the owner equals the turnover rate *conditional on the information known to the potential purchaser*. Because property rights are not shared with the purchaser under Harberger taxation it is unlikely this full efficiency could be achieved, but it does seem probable that Coasean bargaining in the shadow of Harberger taxation will achieve superior outcomes even to those directly yielded by Harberger taxation with purchases based on the posted price. Furthermore, it is very likely that outcomes conditional on Coasean bargaining will be improved by the more efficient fallback position created by Harberger taxation. See Farrell (1987); Ayres & Talley (1995); Kaplow & Shavell (1996); and Segal & Whinston (2014) for arguments that Coasean bargaining, while it improves over fallback positions, achieves greater welfare when the fall back is more efficient. However, we have not formally analyzed such bargaining in the shadow of Harberger taxation, partially because it is highly sensitive to the bargaining procedure chosen; this is an interesting direction for future research.

What of investment efficiency? Suppose that the asset (which, for the sake of simplicity, let us suppose lasts only this year) is currently worth \$100,000 to her and that by investing \$75,000 she can increase its value to \$200,000 to her, but also increase the value that any potential future buyer will place on it by \$100,000 as well. Because the turnover rate has not changed, our logic above indicates that she will, after the investment, list the property in the cadaster at a value of \$200,000. However, this increases her tax bill by \$30,000. Thus, even though the value she gains from the asset regardless of whether the buyer acquires it has now increased by \$100,000, she is forced to pay \$30,000 of this to the cadaster. It will not be worth it, therefore, for her to make the investment of \$75,000 despite this being in the social interest.

But we can improve investment efficiency by adjusting the Harberger tax. If a lower tax rate were charged, say 10 percent, then the owner would still be able to capture \$90,000 of the benefit from the investment. This greatly improves her incentive to invest. Of course, if the Harberger tax is reduced below the turnover rate, the owner will charge a price above her reservation value. By increasing the price beginning at her reservation value she could still capture  $.3\Delta P$  of value from a potential buyer, but she would now be forced to pay only  $.1\Delta P$  to the tax authority. She would thus have an incentive to raise the price.

It might be thought that the loss in allocative efficiency would offset the gain in investment efficiency but—and this is a key point—the truth is the opposite. When the Harberger tax is reduced incrementally to improve investment efficiency, the loss in allocative efficiency is less than the gain in investment efficiency. The reason is that the most valuable sales are ones where the buyer is willing to pay significantly more than the seller is willing to accept. These transactions are the first ones enabled by a reduction in the price. In fact, it can be shown, using standard economic reasoning, that the size of the social loss from monopoly power grows quadratically in the extent of this power. Thus, reducing the markup by a third eliminates close to  $\frac{5}{9} = \frac{3^2 - 2^2}{3^2}$  of the allocative harm from private ownership. Furthermore, in this example the distortion to investment is eliminated. More generally, if we considered all scenarios in which an investment could raise the value of the asset to \$100,000, the only investments that would be deterred by a 10 percent tax are those that cost more than \$90,000 to make. These investments are both rare and not terribly valuable, as the net value they create is small. By the same reasoning as above, it can thus be shown that only roughly one-ninth of the total distortion to investment from the 30 percent tax is caused by a 10 percent tax. Such a policy achieves five-ninths of the allocative benefit of the 30 percent tax at only one-ninth of its cost to investment (Weyl & Zhang 2017, p. 8–9).

Because of this quadratic structure, it is always optimal to have at least a very small Harberger tax. For example, a 1 percent tax will hardly distort investment

at all but can still significantly improve allocative incentives. The owner will self-assess with reasonable accuracy to minimize her tax bill, but she will not be deterred from making valuable investments in the property. It is thus typically optimal to set a moderate tax rate, significantly below turnover rate, that balances these two forces. Weyl & Zhang (2017, p. 3, 19) argue that a 2.5 percent annual rate is likely to be nearly optimal on this basis for a wide range of assets, like factories, natural resources, and houses, where investment plays a significant role but allocation can also be seriously distorted.<sup>22</sup>

We call the Harberger tax an element in a system of *partial common ownership* because the people who possess assets are not owners of private property in the traditional sense. The two most important “sticks” in the bundle of rights that compose private property are the “right to use” and the “right to exclude” (see Merrill 1998). In the Harberger system, both rights are partly transferred from the possessor to the public at large.

First, take the right to use. Under strict private property, all benefits from use accrue to the owner. Under the Harberger system, on the contrary, a fraction of this use value is revealed and transferred to the public through the tax; the higher the tax, the greater the fraction of use value transferred. Weyl and Zhang calculate that a 2.5 percent tax would transfer about a third of use value to the public. Second, consider the right to exclude. In the Harberger system, the “owner” does not enjoy this right vis-à-vis anyone who offers to buy at the self-assessed price. In fact, any member of the public may exclude the current owner in exchange for this price. The lower the price, therefore, the greater is the extent to which the exclusion right is held by the public at large rather than the “owner”. Because the price falls as the tax rises, raising the Harberger tax also shifts the exclusion right to the public at large.

Therefore, we can conceptualize the Harberger system as one in which ownership is shared between the “public” or “society” and the possessor. People are not so much owners of property as “lessees” from society, subject to a special kind of lease that terminates when a higher value user appears, whereupon the lease is automatically transferred to that user. Yet, our system is far from centralized planning. The government does not set prices, allocate resources, or assign people jobs: it plays no role, except to mechanically administer a system of property rights. Indeed, as we will argue further, the government’s role would be more limited than it is today because there is no need for discretionary interventions to solve holdout and other monopoly-related

22 However, as we discuss below, optimal rates will vary across asset classes. How much and how finely they vary is an interesting design question that trades off complexity with optimality, and we turn to this in the next section.

problems an much less need for distortionary and discretionary government taxes to raise revenue for the state.

Before we continue, we should note that Harberger taxation is not the “optimal mechanism” in the sense of the literature on mechanism design.<sup>23</sup> It typically does not achieve full allocative efficiency and certainly may not be optimized to tradeoff investment and allocative efficiency. Optimal mechanisms are often quite elaborate and finely tuned to environmental details that require detailed knowledge and discretion on the part of the designer. The spirit of Harberger taxation is precisely to limit this discretion and create a system that is self enforcing beyond a single tax rate, that can be largely set based upon the observable turnover rate of assets as we discuss in the next section. However, it is notable that Weyl and Zhang find that such a simple system can achieve most of the first-best welfare gains relative to the status quo: in most calibrations Harberger taxation achieves 70 to 90 percent of the maximum possible allocative welfare gains and the investment losses erode only 10 to 20 percent of these gains.<sup>24</sup>

## 2. DESIGN AND TECHNOLOGY

While the theory underlying the Harberger tax as developed by Weyl and Zhang is simple, putting the theory into practice would face some significant challenges. In this section, we discuss how some of these challenges can be overcome through institutional design and application of advances in information technology.

### 2.1 Use of Revenue

Harberger taxation, if implemented at anything like the breadth we suggest, is likely to raise a large pool of revenue, in the range of a third to two-thirds of the return on capital (defined as payments to all nonlabor factors of production) or roughly 10 to 20 percent of national income in most developed countries. In considering how this revenue should be allocated, four considerations are especially salient. First, revenue may be used to offset the distributive effects of the tax by compensating the owners thus expropriated. Second, revenue may be

23 At least since the work of Wilson (1987) mechanism design in economics has moved away from the design of optimal mechanisms and towards the identification of simple mechanisms that are robustly approximately efficient, to avoid fragility and over-fitting, problems formalized in the statistical learning literature by Blumer et al. (1987). See Hartline (2016) for a survey of this approach.

24 Furthermore, as discussed in footnote 22 above, Coasean bargaining in the shadow of Harberger taxation may allow for even greater gains. Modeling the outcome of such bargaining is beyond our scope here, however.

distributed in a manner intended to encourage investments in the value of capital and thus to offset or compensate for the distortion to investment efficiency the tax creates. Third, the revenue may be used to reduce existing inefficiencies by reducing or eliminating other distortionary taxes or providing for public goods. Finally, the revenue might be used to address existing social inequities or injustices that other theories of capital taxation aim at alleviating.

Many potential uses of revenue could kill many birds with one stone. For example, using some revenue from the Harberger tax to reduce distortionary existing capital taxes would encourage investment in a manner that offsets the investment reducing effect of the Harberger tax and would (thereby) offset existing distortionary taxes. At an opposite extreme, using the revenue to fund public goods (at local, regional, or national levels) would nonetheless have a similar logic, as Arnott & Stiglitz (1979) argue, building on the work of Henry George. Public goods play an important role in influencing the value of capital; using Harberger tax revenue to fund public goods not only offsets the undersupply of public goods resulting from the distortionary nature of public good funding, but also provides incentives to local authorities to efficiently provide public goods (viz. invest in capital value). Such public goods may also alleviate inequality in some circumstances.

A more radical use of revenue from a Harberger tax would be to supply a universal basic income. Such a grant would more directly socialize the ownership of capital in the sense that individuals within a community would more directly perceive themselves as receiving an income from the capital of the community. Many economists and political philosophers have called for using capital taxes of various sorts to finance a universal basic income in recent years to remedy the injustices of inequality (Piketty 2014; Van Parijs and Vanderborght, 2017). It might seem that this type of distribution is the only benefit of using the revenue in this manner. However, we believe that such a use would also have important benefits from an investment perspective, if correctly structured. Many individuals other than the current possessor of capital goods influence their value. Neighbors' investment in their properties influence the value of the properties of their neighbors. Workers at firms influence the value of the firm's capital (and are thus often compensated partly in equity). Voters help determine policies and the economic climate that affect returns on capital; unless such voters have a share in the capital stock they may vote for leaders whose plans are destructive of the capital stock, as suggested by the recent rise of populist movements.

In fact, Bengt Hölmstrom's theory of "Moral Hazard in Teams" (1982) suggests that, to maximize capital investments, revenue should be divided among individuals in proportion to the elasticity with which their effort can lead to

**increases in capital value.** It seems very unlikely that the possessor is the only such individual or is infinitely more elastic in her investment than are other individuals or governments. This suggests that the argument we make above, that investment efficiency is maximized by private ownership, significantly understates the value of **Harberger taxation,** which **may increase overall investment by allowing a more efficient sharing of capital rents than is realized under currently imperfect or incomplete contracts created by the difficulty of assessing and privately enforcing sharing of capital value.**

It seems likely that the revenue raised by Harberger taxation will have ancillary benefits beyond the allocative efficiency improvements it induces. This suggests that **rates should be significantly greater than suggested by the simple trading off allocative and investment efficiency.** This suggests that optimal Harberger tax rates, all things considered, are likely close to allocatively optimal rates and thus to empirically observed turnover rates, which Weyl and Zhang find to be roughly 7 percent annually on business assets. Such a tax would collect about 60 percent of capital income in taxes.

## 2.2 Rate Structure

Weyl and Zhang show that **the optimal Harberger tax depends on** two factors: **investment and allocation.** When the value of property depends heavily on investment by the possessor that cannot be independently verified by the cadaster, then the Harberger tax should be relatively low. When the monopoly problem is most significant, the Harberger tax should be relatively high—whatever the natural turnover rate for the asset is. The monopoly problem **tends to be large when the asset turns over frequently** (so that there is a large market for monopoly to distort), **values are widely dispersed among purchasers** (so that the monopoly distortion can cause a lot of waste), **values have a smooth unimodal distribution among possessors** (so that a uniform tax rate is appropriate), **and the asset is complementary with other assets,** implying that monopoly power can be compounded by the leverage of the potential purchaser having already bought complementary properties. The monopoly problem is small in the reverse circumstances. The table below summarizes the tradeoffs.

<b>Factors calling for high tax</b>	<b>Factors calling for a low tax</b>
Frequent asset turnover	High sensitivity to investment/conservation
Widely dispersed valuations of asset	Value to owner consistently grows with time possessed
Potentially complementary with other assets	Value of owners are multi-modal (high unless one “needs to move”)
Smooth decay in asset values for owner	Many close substitutes available

These factors differ across assets. In the case of investment efficiency, the value of some assets is more sensitive to investment than the value of other assets. Many everyday objects (books, pieces of furniture, watches, laptops, ball bearings, and construction material) and business assets (land in city centers, radio spectrum, and durable art works) retain their value with very modest maintenance or none; many objects (perhaps most of personal value) do not increase in value very much if one invests in them, and so people do not bother to. Some personal goods, like automobiles, and most business assets (such as machines, roads, factories, and computers), are subject to routine maintenance schedules that reduce the rate of depreciation or require prudence to avoid excessive exploitation (e.g., fisheries, woodlands, oil fields, etc.). On the contrary, rare antique cars, gardens, and delicate textiles in the personal sphere and corporate reputations, the most advanced machinery and much intellectual property, require constant care to maintain and improve. Holding constant allocative efficiency, the Harberger tax should be lower for the latter goods than for the former.

As for allocative efficiency, this problem is subtler and thus warrants a more detailed discussion. We focus on four factors: the (optimal) frequency of turnover, the spread of values among purchasers, the spread of values among possessors, and the extent to which the asset is a complement with or a substitute for other goods.

Goods that (should) turnover frequently should have higher taxes. There is more to be lost through distorting these goods' reallocation. Some assets—family heirlooms in the personal case and brand names in the corporate case—efficiently should stick with their possessors for long stretches of time. There is little social benefit to placing Harberger taxes on these goods and rates should thus be low. Other assets—gadgets in the personal case, spectrum and high tech equipment in the business case—experience frequent fluctuations in who should be the owner as tastes and productive uses for them change quickly with the advance of technology. Harberger taxes should be high on such assets.

Some assets have very similar values to all potential possessors. High grade corporate bonds, standard issue microwave ovens, cleaning supplies—these are all assets that will have a definite and fixed value to almost any possessor. They thus are poor targets for Harberger taxation and call for low rates. Other assets are unique and have wildly dispersed values. Rare paintings, antiquities, custom-made clothes, specialized machinery, a uniquely situated piece of land or spectrum, and exclusive licenses to operate a public utility will have widely dispersed values across potential purchasers and thus may be subject to extreme market power. Automobiles and most commercial and residential real estate fall in the middle. In very illiquid markets, Harberger taxes—holding constant investment distortion—should approximate the optimal turnover rate

that results from setting the tax rate equal to the turnover rate until the two converge.

Some assets have widely dispersed, even multi-modal, values among current possessors. Family heirlooms are almost priceless—until inherited by an heir who does not care for them; a statue of the CEO of a company may never be worth selling—until the CEO is deposed. These assets have values that are multi-modal and jump around over time. They are not good targets for Harberger taxation as a uniform tax rate does a poor job matching the distribution of optimal tax rates for these assets. Low tax rates are thus desirable. Other assets, we would argue most, have a relatively smooth and smoothly decaying value distribution among current possessors. We tire of many gadgets, artworks, articles of clothing, and piece of furniture we have had too long; businesses lose their edge in exploiting natural resources or managing operations. These assets are good targets for Harberger taxation and call for high tax rates.

Finally, many assets have close substitutes that limit monopoly power. Standard and ubiquitous equipment, commodities, and financial assets are highly liquid and easily substitutable. Harberger taxes on these should be low, though many of them also require no investment so Harberger taxation does little harm. Other assets are not only hard to find substitutes for, but also are highly and uniquely complementary with other assets, exacerbating the harms of market power. Urban land is often most useful when it can be reconfigured, similar issues arise in spectrum as we discuss further, artworks may be most valuable as part of a collection, and season passes are most valuable if next to each other. In these cases, Harberger taxes can reduce or eliminate the sort of massive inefficiencies that usually call for solutions like eminent domain and thus are highly desirable, and should be charged at high rates.

This variation suggests that setting the same tax rate across all assets will yield a suboptimal result and Weyl & Zhang (2017) prove this is true. While a 2.5 percent rate may be roughly optimal when only trading off investment and allocative efficiency and a 7 percent rate when all things are considered (as discussed in the previous subsection) if distinctions are not made between property types, substantial welfare gains can be achieved by tailoring taxes more closely to the relevant type of property.

While finer targeting of tax rates improves efficiency, there are some important concerns in targeting tax rates too finely. First and most worrisome is the possibility that the category into which property is placed may be manipulated by owners to minimize their tax liability. Second, excessively fine targeting will reduce the sample size available to measure the turnover rate and thus may lead to biased estimates or, more problematically, may encourage individuals to raise their reported value to depress turnover and thereby lower the tax rate.



Finally, excessively fine targeting may **make it overly complicated for** individuals to keep track of their tax liability or for the cadaster to choose a whole panoply of tax rates.

In the near term, therefore, we would advocate a relatively coarse system with a **small number of easily distinguishable categories** such as **natural resources, equipment, real estate, corporate securities, general personal property, keepsakes, and heirlooms** (which have a low optimal turnover rate and, therefore, should face a low tax, with some verification to justify placing a good into this category). Such distinctions are commonly made for the purposes of property insurance, and thus it does not seem administratively burdensome to enforce a system of valuation corresponding to these categories. Furthermore, to limit discretion, we would be inclined to support rates within these categories being set per a coarse and easily auditable heuristic, such as the currently observed turnover rate or some proportion to this. Such a system would obviously be **very crude**, but in the near term a **relatively simple** and uniform schedule seems most practical and probably should be **phased in beginning with low rates**. In the longer term, advances in information technology—including **machine learning techniques**—may allow for finer gradations.

### 2.3 Bundling and Quantity Surcharges

Our discussion so far concerns individual assets owned by a person in isolation. Individuals own many different assets. If the value of an asset to its owner is independent of other assets that the person owns, our analysis is unaffected. However, **when assets are complementary with or substitutable for one another to a significant extent, a system that does not account for these relationships will be inefficient.**

Two cases, one of substitutes and one of complements, serve to illustrate the problem. First, consider the complements case. Suppose that a person owns three pieces of a triptych. Each component is individually worth a million dollars to her, but if she owns all three, the components are jointly worth \$10 million to her. If forced to assign a value separately to each part, she would have to put a value of at least \$9 million on each, as this would reflect the value of any component being taken away from her. However, if the owner did this, a potential buyer who values the triptych at \$11 million—more than the owner—would not buy it. The price of \$27 million deters an efficient sale.<sup>25</sup>

25 The buyer could try to buy the pieces sequentially—the first for \$9 million, then the other two for \$1 million each—but this would leave the buyer exposed to the monopoly power of the current owner, who would know that once the first piece was purchased that she could, with high probability, extract at least \$10 million for the additional two pieces, thus leaving the buyer taking a loss on the whole purchase. A Harberger tax would not much dampen this latter effect, as the owner would

Moreover, the owner would end up paying a tax reflecting a \$27 million valuation rather than a \$9 million valuation, and so instead she would lower the price. But then someone with lower valuation, say \$5 million, might buy the triptych—again, an inefficient sale. Thus, the inability of individuals to express complementarities across goods could seriously undermine the efficacy of a Harberger tax regime.

Now consider the case of substitutes. Suppose that an individual owns the two remaining bottles of a rare wine vintage. She is willing to part with either of these two bottles at a price of \$10,000, but it is important to her to retain at least one of them and she would require \$100,000 to be willing to give up the second bottle if she has already sold the first. Again, inefficiencies will arise if she cannot express this type of valuation. If she is forced to put a value on the two bottles separately, she will be afraid if she puts the price too low that both bottles will be taken (simultaneously). But if she sets a high price, she will again be forced to pay an unfairly high tax and she will discourage an efficient sale of a single bottle to a potential owner.

Fortunately, there are ways to deal with each of these problems. First, consider the problem of complementarity. The seller could list only the entirety of the triptych in the cadaster and include no listing for each of the components separately, at a price near or somewhat above \$10 million. This would ensure that only a purchaser willing to disrupt this full value would purchase it from her. If this purchaser viewed the components as strong substitutes—meaning that she values one just as much as two—she could sell one of the components back to the owner at the low price of \$1 million. More broadly, individuals would have the freedom under our regime to package together or apart any property they owned. While individuals would be required to list all their property in the cadaster in some form if they wanted it protected, they could divide these assets within the cadaster in any way they wanted. Only property that was not covered by some cadastral valuation could be taken “for free”. At one extreme, an individual could list her full estate as a single, indivisible unit, and assess a value on it. This would be highly risky if an individual undervalued this estate, however, because a raider could take everything she has and then sell off the components separately. It would also be unprofitable if an individual valued the estate appropriately as it would reduce the individual’s chance to profit on sales of individual items. Weyl and Zhang show that for tax rates below the turnover rate, owners will still assess prices above their personal values and thus will want as many sales as possible to take place.

know that once the first unit was purchased the buyer would be highly likely, much more likely than the tax rate would reflect, to try for the other two pieces.

Thus, in practice individuals would choose to only list as bundled together goods that could not be separated except at great loss. This would also give a natural way to deal with goods being combined or repurposed; while a carpenter might start by reporting a pile of wood as her possession, after building a piece of furniture the wood would be dropped from the cadaster and the piece of furniture (combining many pieces of wood) would take its place. This could allow for substantial flexibility along many dimensions.

For the case of substitutes, the problem is less one of packaging than of being able to express nonlinear surcharges for purchases of multiple goods. This could be implemented by allowing the individual to list in the cadaster nonadditive prices on subsets of goods. The wine owner we described above could state a value of, say, \$15,000 for the first bottle of the two purchased but a price of \$120,000 for the purchase of both bottles. The individual would then pay the tax rate on the total value of the two bottles, \$120,000. If the one bottle is sold, the price of the remaining bottle changes to \$105,000 and for the rest of the time the owner possessed that bottle she would be taxed on a basis of \$105,000. While such a system is perhaps a bit more cumbersome than the packaging system, we expect it to be employed less frequently given that strong substitutabilities such as this are less common and even when they occur it is not very frequent that a purchaser would wish to take all units rather than a subset at one time. Nonetheless, it should not be too difficult to allow individuals to express such nonlinear schedules in cases where they are important.

Obviously, these two cases, of pure complements and pure substitutes, do not represent the set of all possible interactions of values across goods. But for the present, allowing for these basic forms of complementarity and substitutability seems to cover the greatest potential inefficiencies that could occur and those likely to occur most frequently.

## 2.4 User Interface

The efficacy of a system like the one we propose here would depend as much on how easily and seamlessly it is presented to users as on the fundamental incentives it embodies. There are two sides to the presentation of our proposed cadaster: how it appears to current owners, and how it appears to potential buyers.

Current owners would have to report values with some frequency for all their possessions, presenting a tradeoff between convenience and accuracy. If they must report self-assessed valuations frequently, they must undergo the trouble of thinking about how much they value something and of recording the valuation, but if they report infrequently, then valuations will become inaccurate as tastes and budgets change. One approach would be for taxes to accrue in

continuous time based on an annualized tax rate, with individuals having the right to change their valuations at any point in time. This system could be managed through a web interface accessible, for example, by a smartphone application or a web browser. A well-designed interface would likely automatically retrieve information from tracking devices of the sort associated with the “Internet of Things” (Atzori et al. 2010) to help the owner keep track of her possessions. It would be linked to her methods of electronic payment, so that her purchases would automatically be added to the cadaster, at which point she would be asked to assign a value to them.

While some individuals and many businesses would want to carefully weigh each valuation, a sensible system would allow for plugins from third parties, that would offer advice to participants about valuing goods, or default valuations, in an automated way using collaborative filtering and other techniques that form the basis of the ubiquitous recommendation engines. When an owner begins to tire of a piece of property, rather than undertaking large expenses to market and sell the property, she could just begin to lower its price on the cadaster, and eventually someone would take the property from her. Indeed, she could use a program that gradually reduced the price until a sale took place, in effect, conducting a Dutch auction, with the rate of reduction reflecting the owner’s reservation price, liquidity needs, and the prices of other comparable goods in the market.

Tradeoffs would have to be struck between allowing individuals to express a rich range of packaging of goods or substitution patterns and allowing the most common expressions to be made in a seamless and easy way. The details are beyond the scope of this article, but a topic for future work.

On the buyers’ side, a well-designed technology offers significant potential for changing the nature of electronic commerce. A few possibilities that a properly designed system could permit are:

- (i) A real estate developer interested in purchasing multiple plots of land could draw a shape on a map and be immediately told the aggregate price of the whole region. This could be done for a variety of competing sites for a potential development and the information could even be fed to an optimization engine to find the lowest cost development site. This could dramatically reduce the transaction costs of property acquisition, and all this could be done without ever tipping off owners to the buyer’s interest, as all prices would be posted on the electronic cadaster. The holdout problem, the bane of developers everywhere (see, e.g., Fennell 2011), would be solved. The same would be true of similar development problems outside of physical space, such as in the creation of spectrum bands

to be used for the next generation of wireless Internet or searching for the availability of domain names for a potential new company.

- (ii) A buyer interested in a used car could search the cadaster in a manner like how e-commerce sites allow the comparison of a variety of potential purchases from different sellers. Cars would be sorted to make them maximally comparable, both by distance to the buyer and by objective characteristics. One of the worst distortions in our mind from monopoly power is not merely the reduction in turnover, but the time wasted on bargaining.<sup>26</sup> Cars are a leading example of this. In our world, used-car dealerships would shut down, as cars parked on the city streets would effectively become a giant, eBay-style dealership that cuts out the middleman and the wasteful bargaining process.
- (iii) A buyer in the proximity of any object could easily determine its value using an IoT connection between the object and the cadaster app on her smartphone, make an electronic payment, and walk away with it.<sup>27</sup> A buyer could also find the prices of comparable items within a reasonable vicinity.
- (iv) Buyers would quickly be able to determine whether an item was missing from the cadaster, allowing such a buyer to take the item for free, or to notify the authorities who would confiscate the property and give the buyer a bounty.

Implementing such an easily usable system will doubtless come at a cost, in terms of the breadth and flexibility of the system. Allowing expression of maximally rich complementarities and substitution across items might limit the accessibility of user interface or lead to confusion among users. The existing rules of property law appear to reflect such a concern (Merrill 2012), but they also reflect the level of information technology that existed centuries ago. Given the dramatic advances in the sophistication of electronic commerce in recent years, it seems likely a system with substantial flexibility and usability could be built even at present and very likely in the future.

## 2.5 Investment Subsidies

Weyl & Zhang (2017) estimate an optimal Harberger taxation rate well below the allocatively efficient rate based on the assumption that a higher rate—one that maximized allocative efficiency—would create excessive distortion in

26 Which also produces opportunities for race and sex discrimination. See, e.g., Ayres (1991). The Harberger tax, by shielding the identity of the ultimate buyer, would make this type of discrimination impossible.

27 On whether an interval of delay should be built into the system, see Subsection 3.3 below.

investment incentives. However, a higher taxation rate would be viable if the government could independently subsidize investment. Such an approach, if viable, would enhance both allocative and investment efficiency.

To see how such a system could work, suppose that improvements or depreciation to property can be at least approximately observed by the cadaster, and their value to potential purchasers assessed. Property owners would be allowed to deduct that amount (on a refundable basis) from the Harberger tax owed on a property. Because this subsidy replaces the reduction in investment value created by the tax, the system creates no disincentive for investments (Weyl & Zhang 2017, p. 33). A natural approach would be to implement this credit per a depreciation schedule based on when the value created is expected to accrue, with the interpretation that the credits would be inherited by any future purchaser of the asset and thus incorporated into the asset value. However, at present, surveys to determine investment are conducted infrequently, making an up-to-date assessment difficult to conduct and thus objective assessments noisy. Therefore, at present it would likely be necessary to rely, as with investment tax credits, on a combination of random audits with self-reported investments. Such a system might create significant opportunities for gaming and noise, making investment incentives far from perfect and thus continuing to limit optimal Harberger tax rates.

However, we speculate that advances in technology will ameliorate these problems. Nikhil Naik, in collaboration with a variety of colleagues, has developed methods for using Google's Street View images to produce high quality, low cost, high throughput, and frequent assessments of real property values for tax purposes.<sup>28</sup> While these methods are obviously imperfect, even for real property (there may be ways to make real property look good from the outside, while maintaining internal flaws, or to trick the relevant algorithms), they seem a promising basis for making objectively assessed property subsidies that are precise enough to offset the investment deterrents of common ownership.

While this method applies only to real property, improvements in the technology of the so-called "Internet of Things" (IoT) seem likely to make analogous methods practicable for a wide range of property. The goal of the IoT agenda is to allow a wide range of physical objects to be closely monitored and supervised digitally. For example, many vehicles are already monitored by electronic systems, which record distance driven, the quality of driving, and maintenance.<sup>29</sup> It seems likely that in many years, quite accurate evaluations of

28 This work has not yet been published, but for discussions of two other applications of the same techniques, see Naik et al. (2014, p. 793); Naik, Raskar & Hildalgo (2016).

29 These systems are already used by insurance companies and employers. See Lieber (2014).

capital investments, perhaps even more accurate than those carried out by a human potential purchaser, will be available electronically, and thus could be employed by the cadaster.

To see how this approach might work in the context of real estate, imagine that new houses of a certain type and in a certain location require \$4,000 of maintenance per year, on average. The current owner of a house would notify the cadaster whenever the plumber or electrician did maintenance work by emailing the bills to it. The cadaster would verify the claims electronically, relying on sensors in the house that are connected to the Internet. It would then determine the amount by which this maintenance increased the value of the house relative to what it would otherwise have been; say \$10,000. Every year the individual would receive a \$10,000 refundable deduction against her taxes. If the tax rate was 10 percent and the assessed value of her house was \$150,000, her tax would be reduced from \$15,000 to \$14,000. This is an example for standard maintenance but a similar approach could be taken for remodeling. If an algorithmic analysis of visual images concluded that the value of the house had been increased, in a renovation, by \$40,000 per annum for the next 10 years then in each of these years the house would carry with it a \$40,000 refundable deduction against the Harberger taxes owed; at a 10 percent tax rate this would be worth \$4,000 per year.

These observations illustrate an old but important idea: **the optimal form of property rights depends on the technologies that are available to measure, manage, and record the things that people value** (Smith 2012). We speculate that as technologies improve for monitoring investments, there will be a wholesale shift from private property to partial common ownership.

## 2.6 The Role of Information Technology

While a Harberger tax system might prove viable with existing technology, it would benefit greatly from technological advances that are already on the horizon. **The system we propose is both complementary with and the logical extreme of three of the most prominent trends in digital markets in recent years: the “sharing economy”, the “Internet of Things (IoT)”, and “blockchains”.** A primary benefit of the sharing economy is that it ensures that all capital assets are fully utilized by their most valuable users at all points in time, rather than laying idle for long periods; the catchphrase of this movement is “unused value is wasted value”.

However, so far most of the innovations in the sharing economy have been directed to reducing the physical and computational costs of moving goods and making matches; they do not alleviate the problems of market power that our proposal addresses. Uber, for example, only partly addresses allocative

efficiency problems by allowing people who might otherwise buy cars (after costly bargaining) to rely on rideshares (where they “rent” rides based on publicly available prices in a reasonably competitive market that includes other rideshare companies, taxis, and public transportation). But Uber drivers have no ability to take underutilized cars from current owners without a long and messy bargaining process. Thus, Uber’s progress against the monopoly problem is minimal, and could fall to zero if Uber itself ever obtains a monopoly. As we discuss further in Subsection 4.5 further, to take the step we envision, a firm would have to own all the relevant vehicles, and charge membership fees to those interested in purchasing them. Only then would the firm be able to capture the benefits associated with reducing the monopoly distortion. Such a firm would effectively have the sort of broad monopoly power that the state possesses and it is dubious whether it is socially desirable for such a system to be implemented privately for this reason. Nonetheless, the Uber experience is valuable in showing the potential impact of information technology: what it has already accomplished for private institutions would be magnified many times if legal institutions took advantage of these technological innovations as well.

Similarly, the movement in IoT to connect property to the Internet is aligned with our objectives. While so far, this movement has had a limited impact on the marketplace, implementing our system would both accelerate the progress of IoT and be greatly supported by the development of IoT technologies. Individuals would have an incentive to connect their property to the IoT to gain help with valuing goods. For example, individuals might prefer not to attach a valuation to their refrigerator; if the refrigerator were connected to the IoT, an automated system could explore the prices of similar local refrigerators and spit out a default valuation that the owner could adjust or leave alone. IoT technologies would also, as we discuss below, make it easier to monitor tax deductions for investments and recommend potential investments to participants. And allowing automated cataloging of the state of physical objects would play a similar role in helping to determine the appropriate deductions to be given for investment in assets like real estate.

Finally, our proposal fits neatly with the increasing popularity of “smart contracts” on blockchains that offer a mode of governance that is self-enforcing and decentralized. In these systems, most famously epitomized by the recent community “Ethereum” (Robert 2016) contracts are written into the code of a collectively monitored transaction system whose operations are coordinated by the unanimous consent of the participants’ computers. The goal is to avoid allowing discretionary power that is potentially subject to abuse to lie with any central authority. Because our proposal operates through simple rules that could be administered in an automated way, with taxes that are collected



being automatically redistributed in a prespecified manner to participants, it opens perhaps for the first time the possibility of truly decentralized “common ownership” that does not require any discretionary state authority to administer. It is because of this possibility that we anthropomorphized the “cadaster” itself throughout this article; it may soon be possible to administer a system like that the one we describe with very little centralized human oversight. Of course, this is not the only or even necessarily the best form of administration and recent work on such systems has been full of bugs (Economist 2016). But, as with the other technological trends we highlight, there is a natural complementarity between our proposal and these developments in computation.

This all suggests that an important reason why Harberger taxation has not been used in the past is that without modern information technologies it would have been challenging to implement, would have required relatively low tax rates, and would have generated quite limited welfare gains. Conversely, we believe its benefits will grow in coming years. Our framework provides a way to understand and predict the coevolution of market technologies (produced by the private sector) and property rights (produced by the government).

It is important to note, however, that a crucial implicit assumption we have employed here is that while technology will increasingly allow the government to monitor the physical state of assets and help individuals to sort and search through assets, it will not directly allow centralized authorities to observe individuals’ private preferences without their consent. If it did allow this, then the central planning envisioned by Lange, Lerner, and Taylor would become more desirable than the sorts of decentralized market solutions we advocate (see Subsection 4.1 further; see generally Lange (1967, p. 158–61). We do not think that information technology will achieve such “mind-reading” capacity in the near future.

## 2.7 Liabilities

Many assets are partially financed or encumbered by liabilities or other interests and these liabilities are, in turn, typically owned by individuals different from the possessor of the direct asset. The example that comes most easily to mind is that real estate is frequently encumbered with mortgages, leases, easements, covenants and the like. Yet many other, less common or more sophisticated arrangements exist regarding other assets, especially in the business setting. Corporate bonds are liabilities on corporate balance sheets, owned by bondholders; equity, while not technically a liability, controls and earns cash flows from businesses; options written on the stock of the company encumber the stock of the individual who wrote the options, etc.

Such liabilities, and the secondary assets they create, not only imply some additional complexities but also opportunities for a system of Harberger taxation. The opportunity is that liabilities could themselves be subject to the tax, but because they have negative value this would imply a subsidy rather than a tax. Indebted individuals could quote a price for these liabilities that they would be willing to pay for anyone who would be willing to relieve them of this liability. They would have to stand ready to raise this amount if anyone offered to do so, but would receive an annual subsidy (or in practice usually a deduction from the Harberger tax they owe on other assets) corresponding to this liability. This would alleviate a reverse monopoly problem (effectively a monopoly problem) associated with individuals refinancing or otherwise passing on liabilities that they are no longer the efficient bearers of but might hold out on the refinancing of because of their market power. (Keys et al. 2016).<sup>30</sup> More generally, individuals could declare any obligation of theirs that they have the right to transfer to be a “liability” that they receive a deduction for as long as they stand ready to pay another individual to discharge that liability at the self-assessed price.

Furthermore, using this approach to avoid the double or triple taxation of assets on which multiple layers of liabilities and resultant secondary assets are written allows for Harberger taxation to apply and thus aid the efficient allocation not only to the primary underlying asset, but also the secondary assets written on top of it. We highlight the benefits of such a system in the example of corporate equity securities in Subsection 4.3 further.

However, there would also be some subtle design elements in applying Harberger taxation in this manner. Many liabilities are so tightly tied to an asset or to an individual that it would not be appropriate for the liability to be taken on by a new individual who does not possess the asset unless either the owner of the secondary asset controlling that liability consents or the asset the liability encumbers is simultaneously acquired. Yet, this issue does not pose fundamentally different problems than those in Subsection 2.3 above regarding complementarities across assets. When issuing a loan, a lender could (as at present) specify in the terms of the loan the extent and nature of the bundling or unbundling allowed between the loan and the individual or tied asset. If the loan is fully tied to the asset, then any asset purchaser would have to buy the associated liability (or simultaneously purchase the loan itself from the lender to remove it). If the loan is tied to the individual but not to the asset, then the asset could be sold but the lender would have to grant permission for the liability to be transferred. Other more elaborate terms could be included, and

30 See Keys et al. (2016) for evidence of this behavior.

the lender could choose as she wished in her self-assessment of her secondary asset in the loan bundle together these terms or separately assess a value on each one, allowing for the purchase of each by an individual interested in removing a covenant on the loan.

Thus, while Harberger taxation would change the nature of ownership and taxation of sophisticated financial arrangements and would thus allow for greater efficiency, it would not undermine the possibility of sophisticated forms of financing. However, it might to some extent reduce the need for such financing because it would dramatically reduce the liquidity and cash requirements for purchasing assets as it would reduce their capitalized value. We return to this point in Subsection 3.2 further.

### 3. SOME PRACTICAL CHALLENGES

Beyond the broad questions of design, there are several specific practical objections to our proposal that need to be addressed before it could achieve support. While many of these issues would need to be worked out in greater detail over time and with experience, in this section we provide a sketch of how we imagine confronting these challenges and why we do not view them as likely to outweigh the benefits of Harberger taxation.<sup>31</sup>

#### 3.1 Transitional Issues

One possible objection to Harberger taxation is that applying it to existing assets could involve large-scale redistribution of wealth. A 5 to 10 percent annual tax on the stock capital value of an asset would reduce the value of privately held capital by 50 to 75 percent, depending on market interest rates, because the expected future tax payments would be capitalized into the assets' values. The disproportionate owners of capital assets—primarily the wealthy and powerful, as well as anyone else who draws most of their income from capital (including many of the elderly)—would hardly be happy with such a tax. And such a transfer of value from people who worked hard to earn money that they used to buy houses, cars, and treasured items might be regarded as unfair. Hence, the Harberger tax is dead on arrival.

31 We do not address all issues; it is worth flagging here one: the treatment of moveable assets if their current possessors seek to emigrate them or sell them to foreigners living in foreign countries. At one level, the problem is akin to a person who rents a car in the USA, drives it to Canada, and attempts to sell it. This is illegal. But a more sophisticated response would be to require people who seek to move property overseas into an ordinary private property regime to pay the state for its share of the property, effectively in the form of a tax, which would be roughly equal to the expected discounted value of all the taxes the person would have been expected to pay over the useful life of the property if it had remained in the country.

This objection is seriously defective. The Harberger tax creates far more wealth than it depletes, and much of this wealth will flow to the apparent losers. While a homeowner's house will lose value, that person will save on lower prices when she buys a home in the future or rents an apartment. But the more important response is that the way that the gains from Harberger taxation are distributed is, itself, a political question. The public, acting through the government, can choose to compensate people who, on net, lose from Harberger taxation.<sup>32</sup> In Subsection 2.1 above we discussed various ways in which the revenue could be used to achieve such compensation. Indeed, Harberger taxation does not pose any unique transitional issues; any new tax—including a conventional tax on real estate, for example—creates winners and losers. If the transitional shock is too great, the tax can be introduced in stages—starting with administrative property rights that are newly created and hence do not redistribute existing wealth—and with some degree of compensation.

Another worry is that a new tax like the Harberger tax would unsettle the public's expectations about the government's propensity to tax, leading to distortions in their behavior. Although one of the older doctrines in economic thought is that a one-time capital levy does not distort investment behavior because people do not anticipate it, a tax today can create expectations of additional taxes in the future (Eichengreen 1989), and damage the reputation of the government that enacts them, causing lasting damage to economic institutions (Persson & Tabellini. 1994). However, it is widely believed that if a capital tax is imposed for a clear efficiency purpose, rather than redistributive purpose, the chance of its continuing to increase is greatly reduced, because there is no reason its optimal rate will rise over time.<sup>32</sup> The losses to private individuals from the Harberger tax, given that these losses follow from an efficiency rationale, are not basically different from losses on capital resulting from technological progress or any other large-scale change in government policy, including ordinary tax and regulatory changes.

It is thus not clear that there would be any great harm created by the imposition of Harberger taxes on existing assets, even if it involved substantial redistribution.<sup>33</sup> While the desirability of such redistribution is beyond the scope of our analysis here, there have been growing calls in recent years for

32 Given our discussion in Subsection 2.1 above, it may be that the optimal rate will rise over time, but only as the ability to provide deductions for investments improves. Because such deductions would compensate for the increased rates they should not, on average, discourage investment.

33 Obviously, provisions would have to be made to avoid capital flight in anticipation of the levy, as with any capital levy, though the application of the tax over time and thus the capitalization of the tax into asset prices rather than a one-time expropriation would largely mitigate this concern.

such a large-scale redistribution from current private owners of capital to the broader public as we discussed in Subsection 2.1 above. Harberger taxation has the enduring benefit in this regard of ensuring that however large of a part of national income is eventually received by capital, sufficient income will continue to accrue to the public at large to ensure a reasonable distribution of income.

### 3.2 Liquidity and Fairness

Some people may, after holding property for an extended period, develop special attachments to it and yet not have sufficient liquid assets to pay the taxes to preserve it from being taken from them. This concern parallels controversies over eminent domain procedures where an elderly resident, for example, is forced to move out of a house that has been owned by her family for generations, to make way for an apartment block or casino. Any system that weakens people's bonds to personal property might be regarded as unacceptable.

We have four reactions to this objection. First, we do not believe that such attachments are very common, and, more important, we suspect that such attachments will become less common in a world in which most property is not "owned" in the traditional sense. Many people love their cars, but fewer such attachments come into existence when more and more people rely on Uber, Lyft, Zipcar, and public transportation, and this process would be accelerated under Harberger taxation, where a kind of Zipcar model would become the norm rather than exception. People can be train enthusiasts without owning trains.<sup>34</sup> In fact, Weyl and Zhang show that the reduction in incentives to form attachments or otherwise invest in improvements valued only by them and not by future owners created by Harberger taxation always enhance efficiency.<sup>35</sup>

Second, our system would reduce the role of liquidity and resource constraints in stopping individuals from owning property that is valuable to them. Under the present regime, individuals unable to borrow the funds to own a house (or other large property purchase) are forced to rent; even when

34 The idea that people are excessively attached to material possessions has long been a theme of religious leaders and social reformers.

35 Another common objection to Harberger taxation is that possessors may deliberately sabotage the value of an asset to others to allow for a lower tax payment. Weyl and Zhang (2017) also show that this objection is misleading; if the tax rate is below the turnover rate, possessors set prices above their willingness to accept and thus benefit from rather than being harmed by takings. Thus, while their incentives to make their property attractive to others are somewhat muted, they are not eliminated and certainly not reversed. Even if, in a few cases, tax rates are above the asset-specific optimal turnover, issues of sabotage arise in many cases in present law (e.g., the tenant who has been evicted, or the homeowner whose house has been foreclosed on) and egregious examples could be prohibited by law.

borrowing is possible, it imposes great risks on the borrower. Under our system, the prices of assets would be only a quarter to a half of their current level. This would enable individuals to raise a far smaller quantity of cash to gain “ownership”, albeit a more limited form of it. Thus, our system might actually increase the degree of home security on average in a society like the USA where nearly 40 percent of families rent.

Such reductions in housing as an illiquid and lumpy store of wealth might have other benefits, such as limiting the possibility of bubbles, allowing people to move more easily to job opportunities, reducing neighborhood blight, and reducing the financial risk individuals face from fluctuations in housing prices. Furthermore, the dramatic reduction in the price of assets would make the taxes necessary to maintain ownership much more manageable, even for relatively liquidity-constrained (partial) owners. For example, if a tax of 10 percent reduced asset values by two-thirds, the tax would be 10 percent of one-third of the original value. In other words, the fraction of current values the owner would pay each year would only be a little more than 3 percent. This is higher, but not dramatically higher, than current property taxes, which already may have the effects of driving illiquid owners out of their homes (since the wealth they could otherwise use to pay property taxes are locked up in their houses) and is substantially less than the sum of property taxes and mortgage payments on a typical house, which are closer to 6 percent at present.

Third, people could gain the liquidity to make tax payments through insurance schemes offered by private firms. The insurance would cover the tax payments in exchange for a share of the gains if the house were sold at the going price. This could reduce the illiquidity of individuals who own valuable property but wish not to sell it with a high probability. Of course, this would only work if they accepted some chance of selling their home, but would overcome many of the pure liquidity issues.

Finally, a more comprehensive system of insurance against, for example, changing local house prices, could address most of the concerns that changes in asset market prices could force an individual out of their home. Obviously, the same concerns would apply to renters under the present system, and yet in practice this rarely occurs. Most renters do not purchase, if they even have access to, insurance products protecting them against rises in their rent. Our system might effectively make “renting” more common (though it might also allow many renters to move into partial ownership) and would thus be complementary to improvements in the quality of insurance for renters against price changes, such as investments in real estate, or derivatives such as those proposed by Shiller (1993).

### 3.3 Disruption and Planning

Another concern is that many assets are costly to transfer frequently and at unexpected times. Moving is costly, so leases on real property usually have terms of at least one year. It may not be desirable for individuals to be forced to move immediately and unexpectedly out of a property they own. Therefore, for example, even eviction proceedings are complex and may take an extended period. Suddenly losing one's car, personal computer, or desk chair would also be disruptive. Such concerns, however, could be dealt with in a natural way through small changes to the administration of Harberger taxes. One simple change, inspired by the way evictions are treated in current law, would be to give a period of a few months for a current owner to move out of real property or surrender a piece of personal property to a new owner.

A somewhat more significant but still modest change would be to allow owners to declare intervals up to some reasonable limit (say a year or two) during which they wish to maintain ownership. Upon declaring such an interval, the individual would have to declare a value and allow potential purchasers a "last chance" to claim the good before such an interval began. Then, during that interval, the individual would only be allowed to adjust the price (and thus the tax paid) on the asset upward, until the end of the interval. After the end of the interval, downward adjustment would be allowed, along with the opportunity to purchase the good. Additionally, any prospective future owner would have the right to claim the property at the current price at any time during this interval. If such a claim were made, however, the property would not be surrendered until the end of the interval. The current owner would have to continue paying taxes on the property at the purchase price until surrender occurred, at the end of the interval or at an earlier time if the owner felt unexpectedly that she could surrender it earlier. In any case, the owner would be legally prohibited from receiving any consideration for early sale from the prospective buyer, as that would allow her to exercise monopoly power over the right of delay. Some adjustments might have to be made for the time value of money, but we abstract from these for the moment.

Such an adjustment would eliminate the most severe harms associated with "interruptions" in ownership at a relatively limited cost in terms of making assets more illiquid. Furthermore, owners would not have an incentive to declare such illiquid periods unless interruption were costly to them, as such periods would raise their tax burden by making downward price revisions impossible for a time. The ability to lock in a purchase price for a buyer at any time would maintain most of the benefits of avoiding holdout problems and the prohibition on consideration for early sale would avoid most of the costs of

exploiting this rule strategically to exercise monopoly power over potential purchasers.<sup>36</sup>

Finally, we should mention that some readers worry that property owners would find it difficult or impossible to calculate the correct prices, and thus, would constantly take the risk that they will lose some valued piece of property. The cost of obtaining and processing information about the market's demand for one's property would be incurred by everyone on a continuing basis. However, this problem is already a ubiquitous feature of the market economy in which we all operate all the time. Calculating retirement payoffs, choosing among credit instruments, timing the sale of one's house and one's purchase of a replacement house, buying insurance, and so on, are all immensely complicated mathematical problems that no one really tries to solve with exactitude, instead relying on advice or instinct, and potentially incurring tremendous losses or losing opportunities for gain because of error. Government regulations that are justified for helping people avoid mistakes in these cases are, *mutatis mutandis*, appropriate for our proposal as well. Furthermore, the greater availability of information about prevailing asset values created by the market itself would be useful to individuals in deciding on their own valuations. In any case, small misvaluations would not have devastating consequences; individuals would find it relatively easy to ensure their reported values were at least the minimum amount they would be willing to accept to sell and beyond this point the tradeoff is simply between profits on sales and taxes, which decay gradually with small valuation changes.

### 3.4 Inspections and Transfers

A final issue is that before purchasing an asset, many potential buyers will want to inspect it to ensure its quality and fit to their preferences. During such an inspection process, it would clearly be problematic to allow the owner to revise her price in anticipation of an increased chance of being able to exert monopoly power. A reasonable solution would be for prospective buyers to be allowed to freeze the price of a potential purchase to investigate it in exchange for the

36 Some readers have suggested that under the Harberger tax system, rich people could torment less wealthy enemies by forcing purchases of property from them to which they have sentimental attachments, like jewelry. However, if the Harberger tax system is applied to such items, then the tax will be very low because the optimal turnover rate is low, which means that the owner can protect the property by paying a very low tax, and should feel fully compensated if the property is taken, in which case the wealthy person can no more harm her by taking the property than by offering to buy property at the seller's price in the current system. Moreover, it should be kept in mind that similar problems arise under our current system—for example, the spite fence problem—and tort and related doctrines have been developed to address them. The law may need to address these challenges as they arise in a pragmatic fashion but there is no reason that the Harberger system would lend itself to gaming and abuse more than our current system does.



payment of a small fraction of the asset's quoted value (say 1 percent) being made as an irrevocable payment, with this payment being refundable if some clear misrepresentation about the value of the asset were discovered during this process. This hold would persist for a reasonable period necessary for the inspection, and then would lapse. Because the exact percentage that is reasonable and the length of time for a hold that is reasonable depend on the asset in question we leave precise settings of these parameters for future research and empirical experience.

## 4. APPLICATIONS

We begin by discussing the application of our approach in more limited domains where the practical challenges we raised in Section 3 are relatively modest. These areas are the most promising domains for applying our approach in the short term, but also are somewhat narrow, and thus offer a more limited upside. We then turn to corporate assets and acquisitions and traditional property transactions, where our approach will be more controversial, but also offers the greatest potential social benefit. We conclude this section with a discussion of private sector applications to frame the scope and implications of our argument.

### 4.1 Administrative Property and Publicly Owned Assets

#### 4.1.1 Spectrum

Economists have had more influence over the design and allocation of property entitlements to electromagnetic spectrum than over any other kind of property. While spectrum was initially allocated to users on a first-come-first-serve basis aimed at simply allowing the maximum number of broadcasters to use the spectrum, by the late 1920s the Federal Communications Commission began allocating the spectrum based on “public interest” hearings.<sup>37</sup> In 1951, inspired by the same work of Abba Lerner that inspired Vickrey’s interest in auctions, Leo Barzel proposed auctioning use rights while retaining public ownership to ensure competition in these auctions (Herzel 1951). Ronald Coase (1959) first proposed the ideas that came to be known as the “Coase theorem” as a justification for full privatization of the spectrum based on a one-time auction. After years of discussion and a cumbersome experiment with allocating cellular telephony spectrum by lottery during the 1980s, the first spectrum auctions were organized in the 1990s.

37 Our historical narrative here derives from Hazlett (1998).

Because these auctions involved selling off a large collection of diverse rights that might be complementary or substitutable with each other, the design of the auction proved a long and complex process (Milgrom 2004). The eventual format settled on, after detailed consultation with many leading microeconomists, involved simultaneous English (ascending price) auctions on all lots. This design was widely copied around the world and was viewed as reasonably successful, but left two important issues open that became the focus of changes to design and policy making in the decades since.

First, the simultaneous ascending auction can be a problematic format for participants who view different licenses as complementary with one another, such as a cellular carrier trying to establish a national footprint. A participant bidding on a subset of licenses does not know, until she is already stuck buying some of the licenses, what the prices on the other licenses she is pursuing will be. This “exposure” problem stimulated the development of new auctions that allow bidders to express preferences for collections of licenses rather than just individual licenses (Ausubel & Milgrom 2002; Ausubel 2004). However, these auctions have turned out to have their own deficiencies related to potential collusion and predation that make them of questionable practical utility (Levin & Skrzypacz 2016). At present there is both disagreement about the best available format for auctioning these licenses, and a concern that no satisfactory format is currently available. These concerns are acute because, as one of the most influential designers of these auctions, Paul Milgrom, has argued, **private property rights over spectrum make the reallocation of spectrum inefficient and thus make the efficiency of an initial allocation crucial** (Milgrom 2004).

In fact, the second major concern with spectrum policy relates directly to the difficulty of reallocation after an initial assignment. Because of the rapid advance of wireless technologies, new possibilities for using spectrum to supply high speed and broadly available Internet connections have opened in the two decades since the initial auctions. However, **the monopoly power of current license holders—both auction winners and especially those allocated licenses under the older system—has impeded implementation of these new technologies** (Eisenach 2011). This problem has been exacerbated by the fact that many of these new uses require assembling many complementary current licenses to form large contiguous blocks, creating opportunities for holdout by current license owners (Kominers & Weyl 2012).

In 2012, Congress authorized a plan allowing the FCC to buy back spectrum and “repack” the rights of those who refuse to sell to maximize the contiguous spectrum available. The “reverse auction” to buy back these rights is underway as of this writing (Milgrom & Segal 2015). However, nearly a decade elapsed from the time that spectrum reallocation was recognized as clearly necessary to the present. Such delays are widely seen as having placed the USA behind

nations such as Israel, where the next generation of wireless Internet has been available for years. These delays have led to political pressure from a variety of industry groups, such as the Dynamic Spectrum Alliance, calling for reform of the system of spectrum allocation to ensure that innovation is not held back by monopoly power and the bureaucratic process of organizing a centralized auction.

Furthermore, given that the current auction system still entitles owners to refuse to sell their licenses, it does not eliminate all opportunities for socially costly holdout. Empirical analysis by Ulrich Doraszelski and his co-authors (Doraszelski et al. 2016) suggests that recent maneuvers by private equity firms to buy up large numbers of licenses to raise prices in the auction may substantially reduce the revenue raised by the government and spectrum successfully reallocated because of the monopoly power it will convey.

Replacing the current licensing regime with a Harberger tax regime could address many of these concerns. **Once Congress put the Harberger tax regime in place, the tax would create a liquid and far less distorted market for reallocating licenses across users without requiring major additional legislative or administrative actions like those underlying the latest auctions.** This would create flexibility for continuous dynamic reallocation, permitting continual innovation in uses, and the turnover of property to new technology firms.

Moreover, the Harberger tax system would address many of the problems mentioned above. First, the ability to flexibly reallocate spectrum over time would dramatically reduce the harms associated with an imperfect initial auction allocation, alleviating many of the concerns about the format mentioned above. Second, the continual availability of prices on all licenses would reduce the magnitude of potential exposure and holdout problems. Finally, a major challenge in the current spectrum reallocation has been how to implement new uses, while staying within the interference constraints, which exist to ensure that existing users can continue to use the spectrums they own. If rights could be more flexibly decoupled, marketed, and reallocated using methods like those we described in Subsection 2.3 above, it seems likely that private sector innovations in satisfying these constraints could be allowed to improve the allocation well beyond what has been possible through the central direction of the FCC. In turn, the FCC could simply enforce the interference rules; collect the taxes to fund its other activities and return the excess to the treasury (as it does with auctions); and administer a central computerized cadaster of current license holdings.

Furthermore, several factors make the implementation of Harberger taxation in this setting seem reasonably possible. Perhaps most important, the FCC has shown itself open to the use of innovative ideas from economic theory in the design of spectrum licenses and their auctioning. Additionally, some licenses,

especially in rural areas and to channels previously used for military purposes, remain unassigned, and thus could be placed under a new licensing regime if they are eventually auctioned with minimal disruption to existing entitlements. Such relatively limited settings could offer an opportunity for experimentation with new and improved property regimes.

However, even this relatively clean application of the Harberger tax regime faces some practical design challenges. Most important is that it would require a substantial political conflict to force existing license holders, who paid large sums in previous auctions or were grandfathered in under previous systems, to submit to high levels of Harberger taxation that would expropriate those investments. In expanding Harberger taxation beyond new licenses to existing entitlements, some of the concerns we discussed in Subsection 3.1 would arise and some of the solutions we suggested there would have to be deployed.

Another important concern is the treatment of investments that are complementary with broadcasting on a channel. Such investments (broadcasting and tuning equipment, studios for producing programming, etc.) are imperfectly portable across owners of a license and stations from which that owner operates. The natural way to handle this would be to subject all equipment and other complementary investments to Harberger taxation, but allow owners to determine, as in Subsection 3.3, whether to connect or separate these goods. In cases such as equipment tightly coupled to the station, it would likely make sense for a license holder to tie the equipment to the station, as this equipment would be mostly valueless to her if her channel were taken. On the contrary, the broadcast studios and investments in content production are highly tied to the owner and are largely portable across channels; in fact, in the current spectrum reallocation, many television stations are being moved across channels at apparently quite limited cost to the broadcasters. Such investments, however, would be of limited value to a new owner, and thus it would typically be optimal to decouple these from the station. The rates of taxation applied to each of these assets would likely also be different, given that the optimal turnover rate of the channel and broadcast equipment is likely greater than that of assets related to content production.

Furthermore, given the broad regulatory powers the FCC has over broadcasting, it is plausible that it already has the authority to impose taxes on broadcast equipment and content production facilities, though this merits further study. However, even if the FCC lacks this authority at present, it would not be difficult for the FCC to determine the investments that would be subject to this tax. Equipment used directly in broadcasting is highly specialized and can be distinguished easily from other property. Content production facilities and employment relationships may be a bit more nebulous. For example, some content production facilities produce programming for both traditional

broadcast and for internet streaming—should those facilities be taxable by the FCC as part of “broadcasting”? In practice, however, these ambiguities are minor. Most local broadcasters primarily reach audiences via broadcast; a threshold could be set for exemption from the tax for facilities that produce content that overwhelmingly reaches consumers over the Internet. Furthermore, content production is sufficiently unlikely to be tightly complementary with a channel, meaning that exempting content production from the tax would likely cause, at most, a very limited loss of efficiency. This separation of content facilities from broadcast equipment is already implemented in the current regime of spectrum repacking, and thus would not pose substantial administrative concerns, beyond those already appearing at present. Spectrum thus seems a promising first experiment in the use of Harberger taxation with universal compulsory purchase provisions.<sup>38</sup>

#### 4.1.2 *Assigned names and numbers*

Internet domain names enable web users to locate a desired website by typing in an easily remembered string of text into the address bar of their browser. The domain name for Google, for example, is simply [www.google.com](http://www.google.com). Businesses like Google place a great deal of value on possessing domain names that are identical to or like the name of the business, brand, or product. So do governmental units, private organizations, and ordinary individuals.<sup>39</sup>

To obtain a domain name, a person or business applies through various registries. The Internet Corporation for Assigned Names and Numbers administers the domain name system. The system distributes names on a first-come, first-served basis. If Posner applies for [glenweyl.com](http://glenweyl.com) before Weyl does, then Posner “owns” the [glenweyl.com](http://glenweyl.com) domain name. If Weyl wants the domain name badly enough, he must buy it from Posner like any other property.

In the early days of the Internet, this system gave rise to the problem of “cybersquatting” (Lipton 2005). Many corporations were slow to realize the importance of domain names, allowing entrepreneurial individuals to snatch the corresponding domain names before the corporations applied for them and then offer to sell the names to the corporations for an exorbitant price. For example, a fellow named Dennis Toeppen registered the [Panavision.com](http://Panavision.com) domain name and then offered to sell it to Panavision for \$13,000. Toeppen did not have any business interest in the Panavision name other than the desire to extract money from the company. Cybersquatting is a straightforward

38 Rhoni Gericke is currently developing a detailed version of these ideas that works out many of these details.

39 See [ericposner.com](http://ericposner.com) (last visited July 29, 2016); [glenweyl.com](http://glenweyl.com) (last visited July 29, 2016).

example of the type of allocative inefficiency that can arise in a regime of private property. If people like Toepfen can seize domain names and then hold out against the companies and persons who value them the most, then—because of bargaining failure—some portion of domain names will not be allocated to their highest value users. The courts halted cybersquatting through an aggressive (and possibly dubious) interpretation of trademark law, which was subsequently ratified by legislation.<sup>40</sup>

However, cybersquatting is only the most extreme form of behavior that causes allocative inefficiency for domain names. Courts can stop it because the squatter cannot show that the domain name has any intrinsic value to him or her, while it is obvious that a major corporation places a high value on an eponymous domain name. The law has not been able to address other kinds of problems. Consider, for example, the conflict between Delta Airlines, Delta Financial, and DeltaComm Internet Services over the delta.com domain name.<sup>41</sup> The delta.com name was initially acquired in 1993 by DeltaComm Internet Services, apparently for legitimate business reasons—delta is a shortened version of its name. However, DeltaComm was clearly not the highest value user of the name; indeed, the company's website attracted bewildered customers seeking airline tickets. But DeltaComm and Delta could not agree on a price, and DeltaComm sold the domain name to Delta Financial. Delta sued Delta Financial, and eventually the two companies settled, with the domain name ending up in Delta's hands where it belonged. Fans of the Coase Theorem might reflect on the fact that this simple transaction involving two entities took *four years*, and no doubt cost millions of dollars in legal fees (Elliot 2000).<sup>42</sup>

The existing legal regime cannot resolve this problem because all three companies had a legitimate business interest in the delta.com domain name. The only question from a policy perspective was which company valued the name most. To resolve this question in a court, it would be necessary for the judge to determine which company valued the domain name the most. But, as we have explained, the premise of the system of private property is that government officials, like judges are not equipped to make such valuations except in extreme cases exemplified by cybersquatting where it is obvious that one party attaches no value to the property except for its holdout potential.

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40 See *Panavision I*, 938 F. Supp. 616 (C.D. Cal. 1996), *aff'd* 141 F.3d 1316 (9th Cir. 1998); Anticybersquatting Consumer Protection Act of 1999, 15 U.S.C. § 1125(d). The legal developments are described in Lipton (2005), 1369–81.

41 As discussed by Lipton (2005, p. 1406–1407), citing Elliot (2000).

42 For a discussion of the limits of Coasean logic, as applied to domain names, see Chander (2003, pp. 781–791).

The Harberger tax offers a simple and elegant solution to this problem. When DeltaComm initially registered for the domain name, it would have been required to state its valuation to the registry (or, in our system, the cadaster). The Harberger tax gives the domain name owner an incentive not to overstate its valuation. Once Delta had realized the value of the domain name, it would have paid Deltacomm a price equal to Deltacomm's valuation and obtained the domain name. The transaction would have taken a minute rather than four years.

The domain name presents a clear case for the Harberger system because it is unlikely that another company that values delta.com more than Delta does would value the domain name in a way connected to the value of the Delta brand. This means that Delta can invest in publicizing its domain name without much fear that it will lose its investment to a third party. Indeed, DeltaComm's experience shows that a buyer might well be harmed by Delta's investment—bombarded, like DeltaComm by inquiries from people who want to buy airline tickets—unless the buyer was another airline that bought Delta and fully internalized Delta's investments in its brand. Obviously bargaining problems could still arise in such a setting, because Delta's other assets would not be covered by the Harberger tax, which is why we advocate extending it to corporate shares, as we now discuss.

#### 4.1.3 *Natural resources and other publicly owned resources*

Harberger taxation could also be applied to a range of government-owned assets, including natural resources, public facilities, and public corporations. Because the government already owns these resources, and in many cases sells limited use rights to private citizens, implementing our scheme would not disrupt long-established patterns of holdings but simply require changes to the nature of licensing arrangements.

In many cases, such changes would improve investment incentives relative to the *status quo*. Where the *status quo* license design involves fixed terms with complete ownership (or control) during a period, the licensee fully captures the value of any investment (or extraction forbearance) that accrues during the license term but captures none of the benefit accruing after the license expiration. This can lead to large inefficiencies and a strong need for discretionary monitoring and regulation by the government, as licensees have powerful incentives to exploit the asset in the run up to the license expiration. Harberger taxation, by creating a smooth partial property right over long time horizons, offers better investment incentives for every unit of allocative distortion created by the market power necessary to provide them.<sup>43</sup>

43 See Gilbert & Shapiro (1990) for a formalization of this logic in the case of intellectual property.

Applications of this sort are too numerous to describe in the detail. Accordingly, we provide a brief list of some of the most salient applications.

- **Natural resource extraction rights**, including minerals, energy resources, fisheries, and timber. Here the tradeoff determining the optimal level of Harberger taxation in license design is between the need to continuously turn assets over to operators with the lowest costs of extraction, refinement, and marketing (which change over time due to technological innovation, entry, and personnel turnover) and the need to provide incentives both to avoid excessively rapid or intensive exploitation that runs down the long-term value of the asset and to encourage the creation of facilities for extraction and investment in discovery of valuable resources within the leased region.
- Leasing of public lands for activities such as farming and cattle grazing. The tradeoffs here are like those in natural resource extraction rights, but the reasons why turnover across partial owners is needed is usually driven in these cases more by generational change and local knowledge of terrain, rather than technological advances and investments are driven by the regular maintenance and improvement of land.
- Publicly owned or highly regulated capital assets, essential facilities and corporations, which are prevalent in the developing and ex-communist world and significant in many developed mixed economies. These include railways, electricity generation and distribution facilities, telecommunications infrastructure, and postal services. In these cases, both allocative efficiency and investment efficiency are leading concerns and arise in various forms. Innovation, the entrance of new entrepreneurs with novel production technologies or organizational strategies and the natural tendency of existing owners to fall behind the times or become inefficient or lazy all make the periodic turnover of assets to new owners crucial for productive efficiency, as we will discuss further in the next section. On the contrary, investment in research and development, engineering, operations, marketing and advertising are all critical to the productive employment of these assets to maximize their value.
- Public housing, public hospitals, and other public facilities for the provision of private goods which have increasingly been privatized. While currently publicly owned, these facilities are either like public capital goods, as described above or have many of the features of real property and personal property that we detail further.

#### 4.2 Business Assets

While, as we highlighted in the previous subsection, many productive capital assets and natural resources are held by the state, the defining feature of



capitalist economies is that most of the value of such assets resides in the hands of privately held or publicly traded business concerns. Per the decomposition by Matthew Ronglie and others, most capital is held by such concerns (Ronglie 2015). Recent literature in economics suggests the existence of large scale distortions in the allocation of such assets across firms. In a series of influential papers, Chad Syverson has documented the wide dispersion in the productivity with which firms employ assets even within narrowly defined and clearly measured industries and the extent to which this productivity evolves over time (Syverson 2004a,b, 2011). While some researchers have attributed this persistent dispersion to financial constraints on firms, the market power firms hold over their assets is another natural explanation as suggested by Abhijit Banerjee and Benjamin Moll's focus on inefficiencies in asset markets.<sup>44</sup> Furthermore, as we emphasized in Subsection 3.2 above, while it is not a central focus of our analysis, Harberger taxation has the additional benefit of relaxing capital constraints by dramatically lowering the capitalized value of assets.

In the long term, imposing Harberger taxation upon such assets would be essentially the same as the alteration of the licenses for publicly held assets so that they incorporate Harberger taxation. However, because these assets are currently held privately, taxing them could, depending on its implementation, involve significant redistribution as we discussed in Subsection 3.1 above. We will not repeat our discussion from there, except to say that whether such a redistribution is desirable is largely orthogonal to the desirability of our proposal; if it is undesirable, other corporate and business income taxes could be eliminated with the revenue raised to offset the tax change in a manner that would imply at most a very modest redistribution. In their calibration to corporate assets, Weyl and Zhang find that a 2.5 percent rate is robustly near optimal for a range of calibrations. This seems to us a natural starting place for a Harberger tax on corporate assets and would generate roughly revenues needed to eliminate other forms of capital taxation in the USA if it were decided that such a use of revenue is desirable.

### 4.3 Corporate Acquisitions

The system of self-assessed taxation could be extended in many directions. An obvious application is to corporate acquisition. When one corporation (or person or group of people) seeks to take over another corporation, a messy battle frequently ensues. The acquiring corporation must propose a price that is high enough to satisfy the directors and shareholders of the target corporation.

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44 See Moll (2014) for a primarily financial perspective and Banerjee & Moll (2010) for a broader survey.

The directors and shareholders—the sellers—have strong incentives to hold out for a price that is greater than the value of the target corporation standing alone, and this problem is exacerbated by the collective action problem among shareholders, and the conflicts of interest between shareholders, managers, directors, and other stakeholders (Grossman & Hart 1980). The current solution is a messy system of bargaining and voting against the background of judicial appraisal remedies. The irony of this system is that the judicial backstop assumes that a government official—the judge—can make a valuation when the market system is premised on the assumption that the government is incapable of determining values. It is common wisdom that judicial appraisals are questionable or even arbitrary.<sup>45</sup>

Now consider an alternative system. Each stockholder would have to disclose to the cadaster the value she places on each unit of stock she owns. Obviously, she must place a value on the last unit of this stock close to the market value of the stock, given that she can always buy another unit of stock at this price. However, following our discussion of substitutable assets in Section 2.3 above, she may well value inframarginal units of stock above marginal units. For example, owning at least one share of this stock may provide her some diversification or insurance value, which would disappear if the company were entirely acquired by a new owner. She may have a sentimental attachment to the independent existence of the firm. Or she may be a consumer of the firm's products, and believe that if entirely taken over, the firm will act less in her interests. Whatever the reason, she may choose to assess her inframarginal shares above the value of her marginal shares. The stockholders would pay a Harberger tax on these shares and this would not imply double taxation (of corporate assets as well as the financial assets written on them) because the market value of equity thus declared would be deductible by the firm as a liability in aggregate (unless double taxation was desired for some reason).

For concreteness, suppose there are many individuals each owning three shares of a publicly traded company. Owners will set the value for their first share  $v_1$  very close to the value of  $v_1$  set by other individuals. This common value would be, in our world, the analog to the market price for the share. Individuals would update this value frequently as the market price fluctuates using an app that monitors such changes. Thus, an individual interested in buying a third of the company will be able to do so at a price per share of  $v_1$  and anyone buying less than a third of the company will choose to do so by buying the first share offered by every owner. Notice that even before worrying

45 *In re Appraisal of Dell, Inc.*, 2016 Del. Ch. LEXIS 81 (Del. Ch., May 31, 2016) (see also Kanda & Levmore 1985, p. 434).

about acquisitions, this would make the process of transacting shares much simpler than at present. There would be no need for centralized stock markets. Individuals wishing to sell would simply lower  $v_1$  ever so slightly below other individuals' values of  $v_1$  and their shares would be snapped up. Individuals wishing to purchase would simply do so at the lowest set of available values of  $v_1$ . The cadaster itself would act as an always available limit order book. This would also solve the problems of illiquidity and capital valuation that have plagued the markets for a variety of securities, especially during times of financial distress. It would also make accounting and capital regulation much easier and more transparent.

It would also aid in the process of corporate acquisition. Individuals would likely value their second share at a value  $v_2$  significantly higher than the value for their first share  $v_1$ . They would know that anyone choosing to buy this second share would be seeking a majority stake in the company and would thus price this share at the value of losing control of the company for shareholders like herself.<sup>46</sup> This value would presumably be higher than the value of the marginal share, because of both the reduced control and the reduced diversification. Individuals would value their third share  $v_3$  even more highly, as its sale would be associated with the complete acquisition of the firm, and its removal from the market. Thus, the price per share for a controlling stake and for a full acquisition would be increasingly more expensive than for just buying a few shares. Individuals would be taxed on their total valuation of their stake in the company,  $v_1 + v_2 + v_3$ , at a rate equal to the turnover in shares in the simplest setting.<sup>47</sup>

46 An important consideration in this setting is that the chance of any individual's share being pivotal to an acquisition strategy is quite small. Thus, unless the rate of the Harberger tax is set exactly right, distortions to valuations can be quite large; see Mailath & Postlewaite (1990), for a more formal rendition of this argument. This differs from the case of property that is either bought (or at least may be bought) independently, where individuals are quite likely to be pivotal in determining whether a sale proceeds. In those settings, a Harberger tax that is not set perfectly still does quite well, as individuals have a strong incentive to report their values correctly to avoid affecting the chance of sale. When individuals have a very small chance of being pivotal, Harberger taxation is unlikely to be very effective in practice as it will require excessively fine tuning of the tax rates. In these cases, mechanisms based on the assumption that individuals are unlikely to be pivotal (such as the efficient voting mechanism proposed by Lalley & Weyl (2016)) will tend to perform better. For an efficient and practical proposal for these cases that is complementary with our ideas here, see Posner & Weyl (2014). When the pivotality of individuals is intermediate (such as when there is some chance that an individual's second shares will be bought by a purchaser who does not want all shares, but just a large block), some combination of these two approaches will be optimal, such as a baseline of allowing Harberger purchases, but with the right of a purchaser or sufficient owners to trigger a quadratic vote on an offer. This logic also applies to other domains where individuals are unlikely to be pivotal, including some of the externality evaluation examples we discuss below further.

While it would be more expensive per share than buying only a few shares, the process of acquisition would be enormously simplified. Because of the tax, the cost of purchase would exceed the value to current owners of maintaining the corporation's independence by far less than at present or not at all, reducing the premia that inhibit efficient corporate takeovers. More importantly, the elaborate freeze outs, negotiation, and other procedures could be avoided entirely as fair prices for all assets would be publicly available and thus the market for corporate control could be as liquid and low transaction cost as the market for small stakes in firms. The potential acquirer would simply read off the cadaster the price for acquiring the firm and lock these prices in if they were worth paying. The holdout problem would be eliminated; conflicts of interests among stakeholders would no longer cause delay and cost.

To be sure, the system would raise certain questions and come with its own set of costs. Individuals would need to receive real-time advice and automatically update the valuations of their shares to ensure that they do not get bought up when market values change rapidly as a result of trading by individuals with informational advantages. A natural way to ensure such a process worked smoothly would be to slow transactions and the updating of values, for example, only once a day. This might have other benefits in avoiding the costs associated with high-frequency trading, as emphasized by Budish, Cramton, & Shim (2015). Until such systems are in place, individuals would choose to value their shares somewhat above market value to account for changing market conditions, just as Glosten & Milgrom (1985) show market makers do at present to guard against exploitation by informed traders.

#### 4.4 Property Transactions

The most ambitious, though not necessarily the most important (given that business assets are larger in aggregate) application of our approach is to traditional property transactions, as these cover a large range of economic activity and are likely to spark controversy. We now discuss how it would apply to real property, personal property, and to an area where it might yield the greatest benefits, eminent domain.

##### 4.1.1 Real Property

The application of our approach to real property builds on institutions that are largely in place. Currently, when people buy real property they register their

47 In a richer design, marginal shares would be taxed more heavily than inframarginal shares, given that the optimal turnover for these is less frequent (corporate acquisitions are less common than are small transactions), though there would have to be careful design of the definition of these categories to avoid gaming.

ownership in a public recording system.<sup>48</sup> Moreover, in most places people must pay property taxes based on the appraised value of their real property. Our approach adds three elements. First, individuals must report a self-assessed value for their property, which they may update at any time unless a buyer has asked for the price to be frozen so that she can look at the property. The owner's self-assessed valuation would replace the current practice of appraiser-generated valuations. Second, the owner must pay a tax based on his self-assessed valuation. Third, the owner must sell his property to anyone who offers to buy it for the self-assessed value.

While the system may seem radical, it exhibits important continuities with the existing regime of property law. Under the current system, people are not perfectly secure in their rights to real property. Most people who own homes do so subject to mortgages; if they lose their job and miss payments, the holder of the mortgage may force a sale. Even more people are renters and have at best a tenuous claim on retaining their residence past the end of their lease. Everyone is subject to the risk of eminent domain, which allows governments to take real property if they pay a judicially determined "market price". Note that the market price award in eminent domain proceedings will almost certainly be lower than the self-assessed price that an owner would receive under the proposed system because the self-assessed valuation includes one's subjective or idiosyncratic enjoyment of one's real property.<sup>49</sup> People should be indifferent as to whether their property is taken by the government or taken by a private individual. Moreover, people who deeply care about keeping their home can reduce the risk of a (private or public) taking to an extremely low level by announcing a high self-assessment.

Our mechanism would also not be entirely unfamiliar to ordinary people. When people buy insurance, they effectively provide a self-assessed valuation to the insurance company. The premium on the insurance, like the Harberger tax, ensures that people do not exaggerate their valuation—if they do, they must pay a higher premium. At the same time, they will be willing to self-assess a high value and pay a high premium if the insured-against loss is significant enough. Insurance law puts limits on people's freedom to self-assess: it is illegal for insurance companies to cover an amount greater than the anticipated loss. But within this limit, people can buy as little or as much insurance as they want.

An interesting and pertinent example is life insurance. When a person buys life insurance from an insurer, she necessarily reveals to the insurance company her prediction about the economic loss that will be suffered by beneficiaries if

48 See Bell & Parchomovsky (2016), for details.

49 On the pervasiveness of undercompensation in eminent domain proceedings, see Serkin (2005).

the insured dies. This is otherwise private information. The premium cost ensures that the insured will state an accurate prediction, to the best of her ability.

Moreover, various other legal doctrines work in different ways to counter the harmful monopoly effect of private property, and in doing so create the risk that an owner will be effectively forced to sell an entitlement. Consider the following examples:

**4.1.1.1 Liability rules for inadvertent destruction.**—If a neighbor’s tree topples over and crashes into your house, you do not have property rule protection; you are only able to sue for damages under a liability rule. Indeed, damages could be zero if the tree was not maintained negligently. While these legal rules are second nature to a lawyer, they are at variance with monopoly. If the logic of the traditional libertarian position were maintained, the neighbor should have bargained for the right to allow his tree to fall and damage your property; having failed to do so, he would go to jail. But under such a system, people would be reluctant to leave their basements. The liability rule is used to soften monopoly power in settings where it would be prohibitively expensive for people to refrain from infringing on other people’s property rights.

**4.1.1.2 Necessity.**—In a similar vein, the law permits people to intentionally infringe on property rights in emergency situations if they pay the market value of the owner’s loss. In *Vincent v. Lake Erie*,<sup>50</sup> a ship captain secured his ship to a dock despite orders to leave because a storm would have sunk the ship if he had taken it out to sea. The court held that the ship owner must pay only for the damage the ship did to the dock despite the intentional infringement on the dock owner’s property rights. As in the case of inadvertent harm, the necessity rule weakens the monopoly power of the owner to allow for an allocatively efficient transfer—in this case, occupation of the dock from the owner to the ship owner (Cooter & Ulen 2012, p. 100).

**4.1.1.3 Adverse possession.**—The rule of adverse possession (Micel & Sirman 1995, p. 164; Marra 2011, p. 14–15) can also be explained by our framework. When the owner does not object to an overt and hostile use of his property, the owner’s valuation of the property is likely to be low, lower than that of the adverse possessor who has invested in the same property despite the risk that he will not gain title to it. This complicated mix of encroachment and noninterference provides evidence that the transfer is allocatively efficient because the self-assessed value is likely to be close to zero (Fennell 2006). Related doctrines give the public easements over private property over which the public has customarily traveled (Rose 1986, p. 723–727).

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50 109 Minn. 456 (1910).

*4.1.1.4 Air rights and related restrictions.*—Because the common law of property evolved centuries ago, legislatures have from time to time adjusted property rights to reflect new technologies and changing conditions. The most famous example involves air rights. Under the common law, landowners owned rights to the space over their property, extending indefinitely into the ether. With the development of air travel, legislatures passed laws that restricted air rights to the space below the flight paths of airplanes. The legislatures recognized that the value of that space to the landowner is close to zero, but she could use it to extract monopoly rents from airlines. To solve this problem of allocative efficiency, legislatures simply modified the property right (Rule 2014, p. 166). In cases of conflict—where air travel at low heights interfered with enjoyment of one’s property—courts have agreed that the landowner should receive market damages but not the right to block airplanes from flying over their property.<sup>51</sup>

*4.1.1.5 Public trust doctrine and other related public property rights.*—Many types of property are owned publicly, or are subject to public regulations that greatly limit the ability of private individuals to control and exploit the property (Merrill 2012). More than a billion acres of land in the USA are owned by the national government and preserved as wilderness, rangeland, and national parks. Navigable rivers and coastal areas are also typically owned or controlled by the national or state governments. In many states, beaches are publicly owned or open to the public via easements. Governments build roads and either provide drivers with free access or charge a toll. They preserve and regulate fisheries off the coasts. While standard public-good explanations go a long way to explaining these doctrines (Rose 1986; Merrill 2012), they also illustrate our concern with the monopoly problem.

Consider, for example, the widespread government ownership of grazing areas (see Bureau of Land Management 2016). Suppose that pastures flourish without any sort of complicated investment scheme; the only way to “invest” in a pasture is to ensure that it is not destroyed through overgrazing. Further, suppose that experience and expertise can determine optimal grazing in a relatively objective way. We might, therefore, believe that the government need not delegate pastures to private individuals in the form of property rights: the investment problem is simple enough to be solved through a straightforward licensing scheme that limits the number of users. Then the issue is only one of allocative efficiency: ensuring that cattle owners who benefit the most from the pasture are the ones who use it. This can be easily accomplished with an auction

51 See *United States v. Causby*, 328 U.S. 256 (1946).

that grants access to the highest bidders.<sup>52</sup> Through public ownership, efficient allocation is achieved without a sacrifice of investment incentives. A similar argument can be made about fisheries. By contrast, we suspect that investment efficiency for highways is more complicated. The question is not just one of how many cars should drive on a road, but how much money should be invested in maintenance, safety improvements, and the like. This might explain why private toll roads exist alongside public roads.

Property law scholars have long recognized that “public property” doctrines may be justified in part by monopoly problems, including the problem of assembling pieces of privately owned land (often called the holdout problem) and the problem of denial of access that would occur if a single person owned a roadway or navigable river (Rose 1986; Merrill 2012, p. 91–92). A monopoly problem can also arise when one person mistakenly builds on another person’s land (Merrill 2012, p. 96). However, as noted above, it also very much the tendency of the law and economics literature to treat the monopoly problem as exceptional—justifying a limited number of legal exceptions to the dominant paradigm of private property.

**4.1.1.6 Takings for private use.**—Federal takings law limits eminent domain to “public use”, but the Supreme Court has all but read this limitation out of the Constitution. In *Kelo v. New London*, it held that a city could condemn private property to make way for private economic development.<sup>53</sup> While the court’s holding produced a public outcry (Somin 2009, p. 21082114), it endorsed a longstanding government function, which Abraham Bell has aptly called “government-mediated private takings” (Bell 2009, p. 548–549). Not only have cities and states used eminent domain to obtain property which was resold to developers, they have frequently delegated the eminent domain power to private companies, including railroads, bridge builders, and riparian owners who built dams that flooded their neighbors. As Bell persuasive argues, “private takings” are justified when bargaining failures prevent the transfer of property from less valued to more valued uses through private consensual transactions—what we have called the monopoly problem. However, Bell does not come to grips with the serious problem of valuation. He argues that fair market value can be used to value property for “private takings” (*id.*, p. 580–81), as it does for public takings, but market value is not an accurate estimate of the value of property in precisely the circumstances in which private taking power is

52 Under the current system, fees are determined largely by mimicking the market—the public grazing lands exist alongside privately owned fields, which are leased out. See *id.* In a more comprehensive system, in which there is no comparable private market, auctions would need to be used.

53 *Kelo v. City of New London*, 545 U.S. 469 (2005).



justified—when monopoly problems interfere with bargaining. Bell suggests that damages could be set above fair market value to prevent undercompensation, but that just creates the corresponding risk of overcompensation, which blocks value-maximizing sales.

#### 4.2.1 *Personal Property*

Unlike the case of real property, few legal doctrines address the monopoly problem for personal property. Of course, if a person accidentally—rather than intentionally—takes another person’s umbrella, the victim’s remedy is just the return of the umbrella, so in this sense the property right is not as strong as it could be. And in principle, eminent domain is available for personal property. But it is rarely used. We can imagine three reasons for the stricter treatment of personal property. First, it is more likely to trade in a competitive market, so the owner of an umbrella or other object will rarely have more than a trivial amount of market power. Second, many types of personal property are not durable, except trivially—prepared food, for example. On the contrary, people rarely need to invest in everyday types of personal property (except, perhaps, to avoid breaking them), so property rule protection hardly seems necessary. Third, and partly as a result, optimal turnover rates for some types of personal property are likely quite low because individuals develop tight personal attachments to some personal effects.

While personal property is a very small part of the aggregate capital stock, it is worth exploring what the world would look like if the self-assessment tax were applied to personal property if only for the vividness it brings to the underlying problems. We use automobiles as our running example; as durable and valuable goods, they are a good candidate for such a tax. Imagine that when a person buys a car, she registers the title through an app supplied by the government. She also writes down her personal valuation of the car, which (presumably) exceeds the price she paid. The app would periodically ask her to update her valuation of the car. She could also use a setting to allow the app to calculate her valuation by itself using a formula that starts with her valuation but depreciates it over time per usage (a GPS device would automatically register mileage with the app, which would use data from another sensor to record wear and tear on brakes and other components).

Other people could take the car using the same app on their own phones. Suppose someone sees the car parked on the street and likes the way it looks. He scans in the car’s VIN and his app reveals the car’s current valuation. He hits a button and money is transferred from his bank account to the owner’s. He can use his app to unlock the car door, start the engine, and drive away.

Before we address the problems with this plan (many of which will already have occurred to the reader), let us consider the benefits. The days of bargaining with car dealers would be over. The future car dealership would, in effect, be the whole world rather than a building that one must visit. Selling a car would also be immensely easier. One could instruct the app to progressively lower the price until someone pays it. (Potential buyers could set their apps with the specifications and prices they are willing to pay for cars. When a match is made, the location of the car is disclosed to the buyer who can go pick it up.) The currently high transaction costs associated with buying and selling cars would be reduced to zero. And people who develop a sentimental attachment to their car can register a higher self-assessed valuation and pay the additional tax to fend off buyers.

Now let us turn to the problems. What if you drive to a remote location and someone buys your car, leaving you stranded? This problem could be addressed using the approach we outlined in Subsection 3.3 above: allowing individuals to delay delivery of a possession in a prespecified manner and subject to certain rules. Or what if you have some valuable goods or personal documents in your trunk when another person drives off with your car? These documents could simply be listed separately from the car as possessions; the law would require the return of any property not purchased by the buyer. Furthermore, people would come to think of themselves as leasing rather than owning cars, and would be careful about leaving valuables in their cars if they have a low self-assessed value, just as they do when they rent a car from Hertz or Avis, or use a Zipcar. Finally, what if you have developed a sentimental attachment to your car—you have spent years tinkering with the engine and lovingly polishing the chrome fenders? Are you really required to take the risk that someone will drive off with your car?

This last problem was addressed in Subsection 3.2 above. Those of us who care deeply about our automobiles know that there is a small risk that they will be stolen or totaled in an accident. We accept these risks as a part of life. Through a high self-assessment, we can ensure that the risk of someone taking the car is similarly remote—and, in addition, if she does, we can ensure that we will be fully compensated for the sentimental loss.

#### *4.2.3 Eminent Domain and the Problem of Valuation*

One of the great problem of takings law is that of valuation. Courts typically award owners the market value of their property but commentators have complained that in doing so they disregard the subjective valuation of owners, who frequently have sentimental attachment to their houses and neighborhoods (Serkin 2005). In addition, appraised valuations of real property are notoriously

unreliable (Chang 2012a, p. 49–53). As a result, owners are usually undercompensated (Serkin 2005). Under the self-assessment approach, the government would pay the self-assessed valuation, which would reflect the owner's subjective enjoyment of her real property. This was one of the justifications for Levmore's proposal, and for Bell and Parchomovsky's elaborations upon it (Bell & Parchomovsky 2001, 2007).

However, the self-assessment tax would, in fact, make eminent domain significantly less important than it currently is (as Levmore (1982) himself recognized). To see why, observe that eminent domain is most frequently used to put together transportation networks—roads, railroads, canals, and so on. Under our approach, government involvement in constructing these transportation links is no longer necessary because private companies could buy up adjoining plots using the self-assessed valuation. The holdout problem, which is the only justification for government intervention through eminent domain, is solved without government involvement. Not only would Harberger taxation make eminent domain unnecessary; it would also make property assembly more flexible and less socially costly as developers could explore a range of potential sites for their development freely rather than rigidly targeting a site where the value of the targeted plots might be higher than she expects; see Subsection 2.4 above. In fact, while we do not pursue this application further here, this approach could be extended to regulatory takings if individuals could list values for various subentitlements, such as the right to use their land in various ways.

Even under our regime, governments could continue to use “eminent domain”—for example, to obtain property for government buildings, military bases, and other public facilities. However, there would be no distinction between such uses and an ordinary purchase by a private party.

Eminent domain based on self-assessment taxes has been tried, but has been unsuccessful because the probability of a taking is so low that people have a strong incentive to undervalue their property (Chang 2012b). It may be that governments set the multiplier improperly; but the real problem is that if forced sales are extremely rare, people will not take seriously the risk that they will occur, or will have trouble calculating a self-assessment based on a very low and uncertain probability. Furthermore, because government-led eminent domain purchases are usually of large bundles of land, individuals are unlikely to believe themselves pivotal in the assembly and thus have weaker incentives to truthfully reveal their valuation. Individuals are much more likely to be pivotal in the purchase of their individual plot by a private party, creating stronger value revelation incentives, valuations which can then be carried over to the assembly of complementary plots.

#### 4.5 Private Sector Applications

While our primary focus in this article is on applications to property law and public policy, Harberger taxation may also be useful in private settings, such as the design of “sharing economy” platforms and internal markets within corporations. We now briefly discuss these applications, which are not the primary focus of analysis, both to provide additional applications that may require less radical social reform and to illustrate the limits of purely private applications that may explain why Harberger taxation has not yet been broadly adopted in the private sector.

To see how Harberger taxation could be applied privately, it is first useful to consider a naïve potential application that would not be profitable to implement. Suppose a current owner of an asset, say a house, were to offer to sell that house with a Harberger license to a potential future possessor with the stipulation that the current owner making the “sale” would collect the resultant tax revenues. Such a plan would facilitate more efficient turnover and generate both an initial sale revenue for the current owner and a future stream of “rental” payments. However, Weyl and Zhang show that such a strategy *would not* be profitable for the current owner relative to simply optimally auctioning off complete ownership. Intuitively, the benefit of the Harberger tax relative to full ownership accrues to the (potential) future purchasers rather than to the owner. While this would maximize social surplus, it would not maximize the surplus captured by the current monopolistic owner. **Substituting a Harberger license for full ownership is a bit like putting a piece of intellectual property into the public domain: good for the world, but not for the current owner.**

To capture the benefit of Harberger taxation, an individual would have to be able to charge a participation fee to potential future purchasers for the right to be able to exercise the option to purchase embedded in the Harberger license. Combined with the costs of enforcing and administer the cadaster that the Harberger tax system requires, the costs of marketing and obtaining profitable participation in such a service would almost certainly require the “platform” administering it to have access to a large pool of assets. For example, a platform could try to run a town’s real estate on Harberger tax principles, requiring the paying of a poll tax to live in the town and then running all real estate through the Harberger tax system. The benefits of the system should imply individuals are willing to pay to live there for the benefits it brings. Or a platform could buy up many cars or pieces of commercial real estate and offer a “sharing economy” service based on these. While such an idea is an interesting business proposition, the substantial capital it would require to take off perhaps suggests that it is not very surprising that it has not been tried and will not be tried unless

a sufficiently persuasive case is made to a wealthy individual or investment institution.

## 5. IS THE HARBERGER TAX UNCONSTITUTIONAL?

The Harberger tax, if applied prospectively, is clearly constitutional. Imagine that the government decides to subject land that it owns to the Harberger tax. Rather than lease the land out for grazing, it announces that it will “sell” the land subject to the Harberger tax regime under a “Harberger license”. The government could implement the regime by initially auctioning off plots of land. The winners of the auction would periodically self-assess the value of the land and pay a tax based on that value, and be required to transfer the land to anyone who offered to buy it at the self-assessed value. As we have discussed, a similar approach could be put into place for various types of administrative property, such as unallocated spectrum and domain names.

We see no constitutional objection to this arrangement. Property owned under the Harberger tax regime is very like a leasehold. We can think of the owner’s property rights as those of a lessee where the lease provides that the term is unlimited—that is, not for a definite period—but subject to termination whenever a third party offers to pay a higher “rent” (i.e., tax) to the landlord (the government), who exercises the right to reassign the lease to that third party. Since the government can own property and lease it out, and the law of property gives the landlord great freedom in designing the terms of the lease, constitutional law does not bar this arrangement.

But we also envision that Harberger tax regime replacing the current system of property rights—as applied to some or many categories of property—and such a transition would raise questions relating to the Takings clause of the Fifth Amendment. Imagine, for example, that a state government announced that henceforth all real property would be subject to the Harberger tax. Although taxes are not subject to the Takings clause (Peñalver 2004), the Harberger tax is more than a tax. It involves an additional element, the extinction of a significant element of the right to exclude.<sup>54</sup> This right is of considerable value to the owner.

Would the Harberger tax, therefore, violate the Takings clause? We think not. The Harberger tax is a redefinition of property rights of the sort that has occurred many times in American history. For example, early in the

54 From an economic perspective, the forced revelation of the owner’s valuation is also a cost. See *supra*. We suspect a court would not regard this requirement as a property-rights infringement, though we are not sure. On whether private information is property subject to the Takings clause, see *Ruckelshaus v. Monsanto Co.*, 467 U.S. 986 (1984).

Republic, many states abolished the fee tail, converting then-existing entailed estates into fees simple. This change in property law extinguished a valuable right possessed by direct descendants of the original grantee: to obtain the estate in fee tail upon the death of the last holder of the estate in fee tail, regardless of that person's intent. The abolition of the fee tail effected a transfer of wealth to the holders of the estate in fee tail, who were suddenly free to sell the land, or dispose of it in their will as they chose. Nonetheless, the laws abolishing the fee tail were considered constitutionally unproblematic. James Madison himself approved of the abolition of the fee tail in Virginia, and presided over its abolition in federally owned territories while he was president, apparently without believing that the extinction of the fee tail violated the Takings clause (Hart 2001). Madison believed in private property as a general matter but complained that the fee tail resulted in a "too unequal distribution of property, . . . which generated examples in the opulent class inauspicious to the habits of the other classes" (*id.* at 190). Abolition of the existing entails would redistribute wealth and help weaken the rentier class.

While the pecuniary effects of the abolition of the fee tail were probably not large, two other changes in property rights in America were of great significance. The abolition of slavery—of property rights in human beings—effected a massive redistribution of wealth from slave owners to former slaves. And the abolition of coverture transferred a huge amount of wealth (specifically, the entitlement to the wife's wages and the income from the wife's property) from husbands to wives. While the question of whether slave owners could be deprived of their property without compensation gave rise to great controversy that was resolved only by war, the abolition of the property rights of married men seems to have taken place without any debate about its constitutionality under the Takings clause or related state takings clauses.<sup>55</sup> These precedents might be taken to establish a principle that the Takings clause does not apply to redefinitions of property rights, similar in spirit to treatment of taxation under that clause, and very much in the spirit of the view that the Takings clause is intended to prevent "singling out" of individuals to bear public burdens but not to block large-scale changes in the distribution of wealth.<sup>56</sup>

Under modern doctrine, however, an argument could be made that the Harberger tax would count as a regulatory taking that requires compensation. The thickets of the regulatory taking doctrine are too deep for us to enter within

55 We scoured the history books and found nothing on this topic. See, e.g., Hartong (2000); Rabkin (1980); Basch (1982).

56 See, e.g., *Pennell v. City of San Jose*, 485 U.S. 1, 21–22 (Scalia, J., concurring in part and dissenting in part).

the confines of this article (Peñalver 2004). We have found no cases involving anything resembling the Harberger tax, and the standard precedents are too complex and inconsistent to provide a clear basis for evaluating the tax. However, it is reasonably clear that the Harberger tax would satisfy the toothless “public use” requirement because it aims to improve the general welfare. Indeed, the aim of facilitating transfers is like the goal of the Hawaii statute that abolished an oligarchic system of property rights by forcing sales of housing to private citizens, a goal which was approved by the Supreme Court in Hawaii Housing Authority v. Midkiff.<sup>57</sup>

And if a court concluded that the government must pay compensation to those who lost money because of the transition to the Harberger tax, then the efficiency of the regime is such that payment of such compensation would be possible. Still, given the vastness of the sums involved, it would probably be necessary to introduce the Harberger tax gradually, over a period. This could be done by initially applying the tax to limited categories of property, or setting it at a very low rate, and then expanding the categories and increasing the rate over time. The government could also, in principle, sell bonds to finance eminent domain proceedings against property owners, and then auction off the property subject to the Harberger tax, using the proceeds from the auctions and the tax to repay the bonds.

## 6. CONCLUSION

The benefits from a Harberger tax would be massive. To get a rough sense of its value, consider an immobile factory in the rust belt; its owner wants to sell it but still obtains some value from operating it. The owner gains a profit of \$100,000 per month from the factory. Suppose that she expects this payoff to continue into the indefinite future and that the discount rate is 5 percent; this corresponds to a value for the factory of \$2.4 million. Accountants value the factory at \$3.6 million (or a monthly value of \$150,000). Finally, suppose that buyers come along once every three months and have a value for the factory that has the same modal value as the appraised value, but has substantial spread. The owner maximizes her return by listing the factory at a price of \$4.8 million, an amount that compensates her for the expected delay from failing to make sales at a lower price. At this price, it takes two years to sell the factory. A typical person who would have bought the factory if the owner had listed it at \$2.4 million but would not buy at \$4.8 million would value the factory at the appraised value of \$3.6 million. Thus, the factory is suboptimally occupied

57 See also *Kelo v. City of New London*, 545 U.S. 469 (2004).

for 21 months, losing \$5,000 of social value for each of these months or a total of \$105,000.

Suppose this factory gets into a similar situation once every five years; over the life of the factory, the total expected discounted loss from such failure to make efficient transfers of the factory is approximately four times the loss in any single episode or a total of \$420,000 or about 12 percent of the appraised value. Weyl & Zhang's (2017) calculations suggest that this is about twice the loss on a typical business asset in the USA. They furthermore calculate that, at best, Harberger taxation could alleviate 80 percent of these harms and that imposing such a tax (of 2.5 percent per year) would reduce the value of factories by 2 percent because of reduced investment. Thus, they suggest a 2.5 percent tax which they calculate reduces investment value by under 1 percent and still achieves more than 70 percent of the total allocative benefits, thereby overall increasing the value of business assets on average by 5 percent (PropertyWire 2016). As business assets are currently worth greater than \$50 trillion, the benefit of Harberger taxation for such assets alone is more than \$2 trillion. The benefits would be further increased if the tax were applied to automobiles, spectrum, art, and so on, and greater still if one incorporates our "all in" analysis of how the revenue would be used (Subsection 2.1 above). Altogether we believe it is reasonable to expect gains of about 5 percent of income or roughly \$800 billion annually in the USA and roughly \$5 trillion globally.

Yet even beyond these large gains, we believe the scope of the benefits Harberger taxation offers extends to many areas of the law well beyond the standard conceptions of property law. While some of these applications may seem farfetched and are beyond the scope of our main argument, we conclude by speculating on how our proposal may be extended to these other areas of law.

Harberger taxation could be applied to intellectual property rights to deal with the infamous problem of patent thickets and trolls (Eisenberg & Heller 1998). If intellectual property had to be self-assessed and was taxed, with corresponding increases in its duration and possibly even the payment of some of the associated fees to the original inventor to maintain incentives to innovate, this might significantly mitigate the problem of patent trolls buying up swaths of intellectual property just to holdup potential users (Cohen, Gurun, & Kominers 2016). It would also help avoid the holdout problems associated with assembling many complementary intellectual property rights to create standards or products that require many patents together.<sup>58</sup>

58 For a proposal along these lines, see Abramowicz & Duffy (2009, pp. 1598–1600).



Consider also extension of the Harberger tax to rights not to be harmed by pollution or other externalities. Under the current legal system, courts and regulators struggle to determine fair valuations (Posner & Sunstein 2005). Rather than these harms being dealt with by juries and benefit-cost analysis based on econometric estimates of the statistical value of life and other goods, individuals might self-assess the value of various harms to their life or quality of life, being forced to pay taxes based on their self-assessed valuations, and then receiving damages based on these valuations if they are injured as a result of a tort (Aldy & Viscusi 2008). The Harberger tax would solve the problem of valuation in tort cases just as it does for eminent domain cases, allowing regulators and juries to focus on issues of causation.<sup>59</sup>

In the most radical extension, Harberger taxation of human capital could be extended to labor. Individuals could be forced to pay a tax on the self-assessed value of their potential income (the value of their time) rather than being taxed on their actual income. This would eliminate the distortionary effects of labor income taxation and the monopoly power that talented workers exert over employers. Employers who hire this labor would then be forced to pay taxes on the labor they now possess, reducing the market power of employers over labor vis-à-vis another potential employer, which they now possess because of firm-specific investments by workers and related factors.

These extensions, especially the last, raise numerous questions, practical challenges, and philosophical concerns that we cannot confront here. However, at a time when so many social questions are being unsettled by slow economic growth and rising inequality, reform proposals that may once have seemed esoteric should be given serious consideration. This makes them an exciting topic for future research.

## REFERENCES

- Abramowicz, Michael. 1999. The Law-and-Markets Movement. *49 Am. U. L. Rev.* 327–431.
- Abramowicz, Michael & John F. Duffy. 2009. Ending the Patenting Monopoly. *157 U. Pa. L. Rev.* 1541–1611.
- Aldy, Joseph E. & W. Kip Viscusi. 2008. Adjusting the Value of a Statistical Life for Age and Cohort Effects. *90 Rev. Econ. & Stat.* 573–581.

59 Such a system would have to be designed to ensure that whatever individuals were asked to value (such as a chance of death) was something that they were sufficiently likely to be pivotal on. This might be reasonable for mortality risk, but not for the destruction of an endangered species. In the latter cases, efficient voting mechanisms like the Quadratic Voting rule proposed by Lally & Weyl (2016) and Posner & Weyl (2015), are more appropriate.

- Allais, Maurice. 1976. *L'Impôt sur le capital et la réforme monétaire*. Paris: Hermann.
- Arnott, Richard J. & Joseph E. Stiglitz. 1979. Aggregate Land Rents, Expenditure on Public Goods, and Optimal City Size. **93** *Q. J. Econ.* 471–500.
- Ausubel, Lawrence M. & Paul Milgrom. 2002. Ascending Auctions with Package Bidding. **1** *Front. Theor. Econ.* 1–42.
- Ausubel, Lawrence M. 2004. An Efficient Ascending-Bid Auction for Multiple Objects. **94** *Am. Econ. Rev.* 1452–1475.
- Atzori, Luigi, Antonio Iera & Giacomo Morabito. 2010. The Internet of Things: A Survey. **54** *Comput. Net.* 2787–2805.
- Ayres, Ian. 1991. Fair Driving: Gender and Race Discrimination in Retail Car Negotiations. **104** *Harv. L. Rev.* 817–872.
- Ayres, Ian & Eric Talley. 1995. Solomonic Bargaining: Dividing a Legal Entitlement to Facilitate Coasean Trade. **104** *Yale L.J.* 1027–1117.
- Ayres, Ian & J. M. Balkin. 1996. Legal Entitlements as Auctions: Property Rules, Liability Rules, and Beyond. **106** *Yale L.J.* 703–750.
- \* Banerjee, Abhijit V. & Benjamin Moll. 2010. Why Does Misallocation Persist? **2** *Am. J. Econ.* 189–206.
- Basch, Norma. 1982. *In the Eyes of the Law: Women, Marriage, and Property in Nineteenth-Century New York*. Ithaca, New York: Cornell University Press.
- Bell, Abraham. 2009. Private Takings. **76** *U. Chi. L. Rev.* 517–585.
- Bell, Abraham & Gideon Parchomovsky. 2001. Takings Reassessed. **87** *Va. L. Rev.* 277–318.
- . 2005. A Theory of Property. **90** *Cornell L. Rev.* 531–616.
- . 2007. Taking Compensation Private. **59** *Stan. L. Rev.* 871–906.
- . 2016. Of Property and Information. **116** *Colum. L. Rev.* 237–286.
- Blumer, Anselm, Andrzej Ehrenfeucht, David Haussler & Manfred K. Warmuth. 1987. Occam's Razor. **24** *Inform. Process. Lett.* 377–380.
- \* Bowles, Samuel & Edwards, Richard 1985. *Understanding Capitalism: Competition, Command, and Change in the U.S. Economy*. New York: Harper & Row.
- \* Bowles, Samuel & Gintis, Herbert 1986. *Democracy and Capitalism: Property, Community, and the Contradictions of Modern Social Thought*. New York: Routledge.
- Bowles, Samuel. 2004. *Microeconomics: Behavior, Institutions, and Evolution*. Princeton, NJ: Princeton University Press.
- Brooks, Richard R. W., Claudia M. Landeo & Kathryn E. Spier. 2010. Trigger Happy or Gun Shy? Dissolving Common-Value Partnerships with Texas Shootouts. **41** *RAND J. Econ.* 649–673.
- Budish, Eric, Peter Cramton & John Shim. 2015. The High-Frequency Trading Arms Race: Frequent Batch Auctions as a Market Design Response. **130** *Q. J. Econ.* 1547–1621.

- Bureau of Land Management, Fact Sheet on the BLM's Management of Livestock Grazing, Dep't of the Interior (last visited July 29, 2016) <http://www.blm.gov/wo/st/en/prog/grazing.html>.
- Cabrales, Antonio, Antoni Calvó-Armengol & Matthew O. Jackson. 2003. *La Crema: A Case Study of Mutual Fire Insurance*. 111 *J. Polit. Econ.* 425–458.
- Calabresi, Guido & A. Douglas Melamed. 1972. Property Rules, Liability Rules, and Inalienability: One View of the Cathedral. 85 *Harv. L. Rev.* 1089–1128.
- Chander, Anupam. 2003. The New, New Property. 81 *Tex. L. Rev.* 715–797.
- Chang, Yun-Chien. 2012a. Economic Value or Fair Market Value: What Form of Takings Compensation Is Efficient? 20 *Sup. Ct. Econ. Rev.* 35–88.
- . 2012b. Self-Assessment of Takings Compensation: An Empirical Study. 28 *J. L., Econ. & Org.* 265–285.
- Che, Yeon-Koo & Donald B. Hausch. 1999. Cooperative Investments and the Value of Contracting. 89 *Am. Econ. Rev.* 125–147.
- Coase, R.H. 1959. The Federal Communications Commission. 2 *J.L. & Econ.* 1–40.
- \* Coase, R.H. 1960. The Problem of Social Cost. 3 *J. Law & Econ.* 1–44.
- Cohen, Lauren, Umit G. Gurun & Scott D. Kominers. 2016. The Growing Problem of Patent Trolling. 352 *Science* 521–522.
- Cooter, Robert. 1982. The Cost of Coase. 11 *J. Legal Stud.* 1–33.
- Cooter, Robert & Thomas Ulen. 2012. *Law & Economics*, 6th edn. Boston: Addison-Wesley.
- Cramton, Peter, Robert Gibbons & Paul Klemperer. 1987. Dissolving a Partnership Efficiently. 55 *Econometrica* 615–632.
- Doraszelski, Ulrich, Katja Seim, Michael Sinkinson & Peichun Wang. 2016. Ownership Concentration and Strategic Supply Reduction. *Ctr. for Econ. and Pol'y Res.*, Discussion Paper No. DP11173.
- Economist, 2016. Not-so-clever Contracts. *The Economist*. <http://www.economist.com/news/business/21702758-time-being-least-human-judgment-still-better-bet-cold-hearted>.
- Eisenach, Jeffrey A. 2011. Spectrum Reallocation and the National Broadband Plan. 64 *Fed. Comm. L.J.* 87–136.
- Eichengreen, Barry. 1989. The Capital Levy in Theory and Practice. NBER Working Paper No. 3096. <http://www.nber.org/papers/w3096.pdf>.
- Eisenberg, Rebecca S. & Michael A. Heller. 1998. Can Patents Deter Innovation? The Anticommons in Biomedical Research. 280 *Science* 698–701.
- Elliot, Christopher. 2000. No Winner in Delta.com Deal. *Ins. Interact. Travel*.
- Epstein, Richard A. 1997. A Clear View of the Cathedral: The Dominance of Property Rules. 106 *Yale L.J.* 2091–2120.
- . 2014. The Use and Limits of Self-Valuation Systems. 81 *U. Chi. L. Rev.* 109–129.
- [ericposner.com](http://ericposner.com) (last visited July 29, 2016).

- Farnsworth, Ward. 1999. Do Parties to Nuisance Cases Bargain after Judgment? A Glimpse inside the Cathedral. **66** *U. Chi. L. Rev.* 373–436.
- Farrell, Joseph. 1987. Information and the Coase Theorem. *J. Econ. Persp.* 113–129.
- Fennell, Lee Anne. 2005. Revealing Options. **118** *Harv. L. Rev.* 1399–1488.
- . 2006. Efficient Trespass: The Case for "Bad Faith" Adverse Possession. **100** *Nw. L. Rev.* 1037–1096.
- . 2011. Property and Precaution. **4** *J. Tort L.* 1–63.
- \* George, Henry. 1879. *Progress and Poverty*. Boston: E.P. Dutton & Co.
- Gilbert, Richard & Carl Shapiro. 1990. Optimal Patent Length and Breadth. **21** *RAND J. Econ.* 106–112.
- glenweyl.com (last visited July 29, 2016).
- Glosten, Lawrence R. & Paul R. Milgrom. 1985. Bid, Ask and Transaction Prices in a Specialist Market with Heterogeneously Informed Traders. **14** *J. Fin. Econ.* 71–100.
- Gordon, Robert J. 2016. *The Rise and Fall of American Growth: The U.S. Standard of Living since the Civil War*. Princeton, NJ: Princeton University Press.
- Gray, Alexander. 1946. *The Socialist Tradition: Moses to Lenin*. London: The Ballantyne Press.
- Grossman, Sanford J. & Oliver D. Hart. 1980. Takeover Bids, The Free-Rider Problem, and the Theory of the Corporation. **11** *Bell J. Econ.* 42–64.
- . 1986. The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration. **94** *J. Pol. Econ.* 691–719.
- \* Harberger, Arnold C. 1965. Issues of Tax Reform for Latin America. In *Joint Tax Program of the Organization of American States, eds, Fiscal Policy for Economic Growth in Latin America*, 116–121. Baltimore: The Johns Hopkins Press.
- Hariton, David P. 1999. Sorting out the Tangle of Economic Substance. **52** *Tax Law.* 235–273.
- Hartline, Jason D. 2016. Mechanism Design and Approximation. Unpublished Manuscript. <http://jasonhartline.com/MDnA/MDnA-ch1to8.pdf>.
- Hartong, Hendrik. 2000. *Man and Wife in America: A History*. Boston: Harvard University Press.
- Hall, Christopher D. 1986. Market Enforced Information Asymmetry: A study of Claiming Races. **24** *Econom. Inquiry* 271–291.
- Hardin, Garrett. 1968. The Tragedy of the Commons. **162** *Science* 1243–1248.
- Hart, John F. 2001. A Less Proportion of Idle Proprietors: Madison, Property Rights, and the Abolition of Fee Tail. **58** *Wash. & Lee L. Rev.* 167–194.
- Hart, Oliver D. & John Moore. 1990. Property Rights and the Nature of the Firm. **98** *J. Pol. Econ.* 1119–1158.

- Hayek, Friedrich A. 1945. The Use of Knowledge in Society. **35** *Am. Econ. Rev.* 519–530.
- Hazlett, Thomas W. 1998. Assigning Property Rights to Radio Spectrum Users: Why Did FCC License Auctions Take 67 Years? **41** *J.L. & Econ.* 529–576.
- Heller, Michael. 2008. *The Gridlock Economy: How Too Much Ownership Wrecks Markets, Stops Innovation, and Costs Lives*. New York: Basic Books.
- Herzel, Leo. 1951. Public Interest and the Market in Color Television Regulation. **18** *U. Chi. L. Rev.* 802–816.
- Hoffman, Philip T. 1988. Institutions and Agriculture in Old Regime France. **16** *Pol. & Soc’y* 241–264.
- Holland, Daniel M. & William M. Vaughn. 1969. An Evaluation of Self-Assessment under a Property Tax. In Arthur D. Lynn, Jr., ed., *The Property Tax and Its Administration*. Madison, WI: University of Wisconsin Press.
- Hölmstrom, Bengt. 1982. Moral Hazard in Teams. **13** *Bell J. Econ.* 324–340.
- Hsieh, Chang-Tai & Peter J. Klenow. 2009. Misallocation and Manufacturing TFP in China and India. **124** *Q.J. Econ.* 1403–1448.
- Hurwicz, Leonid & Stanley Reiter. 2006. *Designing Economic Mechanisms*. Cambridge: Cambridge University Press.
- Jensen, Michael C. & Richard S. Ruback. 1983. The Market for Corporate Control: The Scientific Evidence. **11** *J. Fin. Econ.* 5–50.
- Jevons, William Stanley. 1871. *The Theory of Political Economy*. London: Macmillan and Co.
- Kanda, Hideki & Saul Levmore. 1985. The Appraisal Remedy and the Goals of Corporate Law. **32** *UCLA L. Rev.* 429–473.
- Kaplow, Louis & Steven Shavell. 1996. Property Rules Versus Liability Rules: An Economic Analysis. **109** *Harv. L. Rev.* 713–790.
- Keys, Benjamin J., Devin G. Pope & Jaren C. Pope. 2016. Failure to Refinance. **122** *J. Fin. Econ.* 482–499.
- Knysh, Sergey I., Paul M. Goldbart & Ian Ayres. 2004. Instantaneous Liability Rule Auctions: The Continuous Extension of Higher-Order Liability Rules. Working Paper, Yale Law School.
- Kominers, Scott Duke & E. Glen Weyl. 2012. Holdout in the Assembly of Complements: A Problem for Market Design. **102** *Am. Econ. Rev.* 360–365.
- Lalley, Stephen P. & Glen Weyl. 2016. Quadratic Voting. Working Paper, Becker Friedman Institute for the University of Chicago.
- Landeo, Claudia M. & Kathryn E. Spier. 2014a. Shotguns and Deadlocks. **31** *Yale J. Reg.* 143–187.
- . 2014b. Irreconcilable Differences: Judicial Resolution of Business Deadlock. **81** *U. Chi. L. Rev.* 203–227.

- Lange, Oskar & Fred M. Taylor. 1938. *On the Economic Theory of Socialism*. New York: McGraw Hill.
- Lange, Oskar. 1967. The Computer and the Market. In C.H. Feinstein ed., *Socialism, Capitalism and Economic Growth: Essays Presented to Maurice Dobb*. Cambridge: Cambridge University Press.
- Lee, Timothy B. 2016. Donald Trump Really Did Try to Take an Elderly Widow's House for a Limousine Parking Lot. *Vox*. <http://www.vox.com/2016/2/7/10931176/donald-trump-eminent-domain>.
- Lemley, Mark A. & Carl Shapiro. 2007. Patent Holdup and Royalty Stacking. **85** *Tex. L. Rev.* 1991–2049.
- Lerner, Abba P. 1944. *The Economics of Control: Principles of Welfare Economics*. New York: The Macmillan Co.
- Levin, Jonathan & Andrzej Skrzypacz. 2016. Properties of Combinatorial Clock Auctions. **106** *Am. Econ Rev.* 2528–2551.
- Levmore, Saul. 1982. Self-Assessed Valuation Systems for Tort and Other Law. **68** *Va. L. Rev.* 771–861 (1982).
- \* Lewinsohn-Zamir, Daphna. 2009. Identifying Intense Preferences. **94** *Cornell L. Rev.* 1391–1458.
- Lieber, Ron. 2014. Lower Your Car Insurance Bill, at the Cost of Some Privacy. *N.Y. Times*. Tideman: Chicago, IL
- Lipton, Jacqueline D. 2005. Beyond Cybersquatting: Taking Domain Name Disputes Past Trademark Policy. **40** *Wake Forest L. Rev.* 1361–1440.
- Lynn, Jr. ed. 1969. *The Property Tax and Its Administration*. Madison, WI: University of Wisconsin Press.
- Mailath, George J. & Andrew Postlewaite. 1990. Asymmetric Information Bargaining Problems with Many Agents. **57** *Rev. Econ. Stud.* 351–367.
- Marra, William C. 2011. Adverse Possession, Takings, and the State. **89** *U. Det. Mercy L. Rev.* 1–34.
- \* Merrill, Thomas W. 1998. Property and the Right to Exclude. **77** *Neb. L. Rev.* 730–755.
- 2012. Private Property and Public Rights, in Research Handbook on the Economics of Property Law. In Kenneth Ayotte & Henry E. Smith, eds, *Research Handbook on the Economics of Property Law*. Northampton, MA: Edward Elgar.
- Miceli, Thomas J. & C.F. Sirmans. 1995. An Economic Theory of Adverse Possession. **15** *Int'l Rev. L. Econ.* 161–173.
- Milgrom, Paul. 1987. Adverse Selection without Hidden Information. Worker Paper No. 8742 (Berkeley: University of California).
- 2004. *Putting Auction Theory to Work*. Cambridge: Cambridge University Press.

- Milgrom, Paul & Ilya Segal. 2015. Deferred-Acceptance Auctions and Radio Spectrum Reallocation. Working Paper, Stanford University Department of Economics.
- Moll, Benjamin. 2014. Productivity Losses from Financial Frictions: Can Self-Financing Undo Capital Misallocation. **104** *Am. Econ. Rev.* 3186–3221.
- Myerson, Roger B. & Mark A. Satterthwaite. 1983. Efficient Mechanisms for Bilateral Trading. **29** *J. Econ. Theory* 265–281.
- Naik, Nikhil, Ramesh Raskar, & Cesar A. Hidalgo. 2016. Cities Are Physical Too: Using Computer Vision to Measure the Quality and Impact of Urban Appearance. **106** *Am. Econ. Rev.* 128–132.
- Naik, Nikhil, Jade Philipoom, Ramesh Raskar & Cesar Hidalgo. 2014. *Streetscore: Predicting the Perceived Safety of One Million Streetscapes*. IEE Conference on Computer Vision and Pattern Recognition Workshops 793–799.
- Niou, Emerson M. S. & Guofu Tan. 1994. An Analysis of Dr. Sun Yat-sen's Self-Assessment Scheme for Land Taxation. **78** *Pub. Choice* 103–114.
- Nove, Alec. 1991. *The Economics of Feasible Socialism Revisited*, 2nd edn. London: Harper Collins Academic.
- Peñalver, Eduardo. 2004. Regulatory Taxings. **104** *Colum. L. Rev.* 2182–2254.
- Persson, Torsten & Guido Tabellini. 1994. Representative Democracy and Capital Taxation. **55** *J. Pub. Econ.* 53–70.
- \* Piketty, Thomas. 2014. *Capital in the Twenty-First Century*. Cambridge, MA: The Belknap Press of Harvard University Press.
- Posner, Eric & Cass R. Sunstein. 2005. Dollars and Death. **72** *U. Chi. L. Rev.* 537–598.
- Posner, Eric & Glen Weyl. 2014. Quadratic Voting as Efficient Corporate Governance. **81** *U. Chi. L. Rev.* 251–272.
- . 2015. Voting Squared: Quadratic Voting in Democratic Politics. **68** *Vand. L. Rev.* 441–500.
- Posner, Richard A. 2014. *Economic Analysis of Law*, 9th edn. New York: Wolters Kluwer Law & Business. 40–42.
- Rabkin, Peggy A. 1980. *Fathers to Daughters: The Legal Foundations of Female Emancipation*. Westport: Greenwood Press.
- Rogerson, William P. 1992. Contractual Solutions to the Hold-Up Problem. **59** *Rev. Econ. Stud.* 777–794.
- Ronglie, Matthew. 2015. *Deciphering the Fall and Rise in the Net Capital Share: Accumulation or Scarcity? Brookings Papers on Economic Activity*.
- Rose, Carol. 1986. The Comedy of the Commons: Custom, Commerce, and Inherently Public Property. **53** *U. Chi. L. Rev.* 711–781.
- Rule, Troy A. 2015. Airspace in an Age of Drones. **95** *B.U. L. Rev.* 155–208.

- Segal, Ilya & Michael D. Whinston. 2011. A Simple Status Quo that Ensures Participation (with Application to Efficient Bargaining). **6** *Theor. Econ.* 109–125.
- . 2014. The Efficiency of Bargaining Under Divided Entitlements. **81** *U. Chi. L. Rev.* 273–289.
- . 2016. Property Rights and the Efficiency of Bargaining. **14** *J. Euro. Econ. Assn* 1287–1328.
- \* Serkin, Christopher. 2005. The Meaning of Value: Assessing Just Compensation for Regulatory Takings. **99** *Nw. U. L. Rev.* 677–742.
- Shavell, Steven. 2004. *Foundations of Economic Analysis of Law*. Cambridge, MA: The Belknap Press of Harvard University Press.
- Shiller, Robert J. 1993. *Macro Markets: Creating Institutions for Managing Society's Largest Economic Risks*. New York: Oxford University Press.
- Shleifer, Andrei & Robert W. Vishny. 1997. A Survey of Corporate Governance. **52** *J. Fin.* 737–783.
- Smith, Henry E. 2012. Property as the Law of Things. **125** *Harv. L. Rev.* 1691–1726.
- Somin, Ilya. 2009. The Limits of Backlash: Assessing the Political Response to Kelo. **93** *Minn. L. Rev.* 2100–2178.
- Spengler, Joseph J. 1950. Vertical Integration and Antitrust Policy. **58** *J. Pol. Econ.* 347–352.
- \* Stigler, George J. 1966. *The Theory of Price*, 3rd edn. New York: Collier Macmillan Publishing.
- Syverson, Chad. 2004a. Market Structure and Productivity: A Concrete Example. **112** *J. Pol. Econ.* 1181–1222.
- . 2004b. Product Substitutability and Productivity Dispersion. **86** *Rev. Econ. & Stat.* 534–550.
- . 2011. What Determines Productivity. **49** *J. Econ. Lit.* 326–365.
- Tideman, Nicholas. 1969. Three Approaches to Improving Urban Land Use. Ph.D. Thesis, University of Chicago.
- \* Van Parijs, Phillippe & Yannick Vanderborght. 2017. *Basic Income: A Radical Proposal for a Free Society and a Sane Economy*. Cambridge, MA: Harvard University Press.
- Vickrey, Willaim. 1961. Counterspeculation, Auctions, and Competitive Sealed Tenders. **16** *J. Fin.* 8–37.
- von Mises, Ludwig. 1920. Die Wirtschaftsrechnung im sozialistischen Gemeinwesen. **47** *Arch. Soz.* 86–121.
- Walras, Léon. 1896. *Études d'économie sociale: Théorie de la Répartition de la Richesse Sociale*. Paris: F. Rouge.
- Weisbach, David A. 2002. Ten Truths about Tax Shelters. **55** *Tax L. Rev.* 215–253.



- ✦ Weyl, E. Glen & Anthony Lee Zhang. 2017. Ownership of the Means of Production. Research Paper No. 765, University of Chicago Coase-Sandor Inst. for Law & Economics.
- Williamson, Oliver E. 1975. *Markets and Hierarchies*. New York: Free Press.
- Wilson, Robert. 1987. Game-Theoretic Analysis of Trading Processes. In Truman F. Bewley, ed., *Advances in Economic Theory*. New York: Cambridge University Press.
- . 2016. Ethereum. Wikipedia, <https://en.wikipedia.org/wiki/Ethereum> (last accessed August 1, 2016).
- Zucman, Gabriel. 2015. *The Hidden Wealth of Nations: The Scourge of Tax Havens*. United States: The University of Chicago Press.