Applying Marginal Cost Pricing: Efficiency and Fairness in Takings and Land Assembly, and Accuracy in Assessment, All in One Fell Swoop

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Florenz Plassmann* and T. Nicolaus Tideman†

Abstract:

Government officials who sidestep markets to take private property under eminent domain face obstacles that make it difficult for them to identify socially efficient takings. When they decide that they might take certain properties in the future, they may induce the owners of these properties to invest in their properties inefficiently, to prevent the taking. When they make final decisions about whether to take property, they may not know the property value with enough accuracy to determine whether the taking is socially worthwhile. And when they consider using their powers of eminent domain in urban renewal projects to resolve deadlocks between developers who want to assemble multiple properties and owners who refuse to sell at prices that developers offer, they need to know whether the owners’ refusals to sell constitute true expressions of the value of property to owners or holdout behavior that threatens to prevent socially valuable redevelopment. The thesis of this article is that all of these problems can be resolved in simple and intuitive ways through the application of a single concept—the economic principle of marginal cost pricing. We present two mechanisms that assign, to all parties involved, the marginal costs of their actions, and we show how marginal cost pricing leads to social efficiency in taking cases. Our first mechanism illustrates that a requirement that governments fully compensate owners for their losses—including losses that result from the announcement of the possibility of a future taking—provides government officials with the incentive to announce their best estimates of the probabilities of future takings and owners with the incentive to manage their properties efficiently until final taking decisions are made. Our second mechanism illustrates that marginal cost pricing can provide owners with an incentive to truthfully disclose their own private valuations of their properties. We show that not only does this mechanism enable governments to determine whether it is socially efficient to take these properties while compensating owners for all of their losses, but it also solves the problem of holdouts in land assembly projects without the need for government takings. In contrast to similar mechanisms that have been proposed before, our mechanisms neither require information that is usually unavailable nor intrude on property rights beyond what is inherent in the power of eminent domain. Thus we argue that both mechanisms constitute feasible and attractive opportunities to bring social efficiency to takings.

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## Table of Contents:

**Introduction** ........................................................................................................................................................................... 1  

**I. The Principle of Marginal Cost Pricing** ............................................................................................................................ 12  

**II. Marginal Cost Pricing and Efficient Takings** .......................................................................................................................... 16  

A. Requiring Governments to Bear the Marginal Cost of Their Actions ............................................................... 17  

B. Requiring Property Owners to Bear the Marginal Cost of Their Actions .................................................. 23  

C. Full Compensation for Taking Private Property .......................................................................................... 25  

D. Efficient and Fair Takings ................................................................................................................................. 26  

**III. Marginal Cost Pricing and Accurate Self-Assessment** .......................................................................................... 28  

A. Requiring Property Owners to Bear the Marginal Costs of Over- and Underassessing Their Properties .......................................................................................................................... 28  

B. Accurate Self-Assessment and Efficient Takings ......................................................................................... 33  

C. The Fairness of Self-Assessment in Takings Under Eminent Domain ........................................................ 37  

**IV. Marginal Cost Pricing and Efficient Land Assembly** .......................................................................................... 41  

A. Characterizations of the Problem of Land Assembly and the Holdout Problem ........................................ 41  

B. Resolving the Problem of Land Assembly through Self-Assessment ..................................................... 46  

C. Comparison of Self-Assessment in Land Assembly with Other Methods ................................................... 49  

1. Comparison with Takings under Eminent Domain .................................................................................. 49  

2. Comparison with Other Methods Proposed in the Literature .......................................................... 52  

**Conclusion** ........................................................................................................................................................................... 56
INTRODUCTION

People’s actions are often socially inefficient. Some motorcyclists run their noisy machines through residential areas at night time, although alternative routes are available. Drivers engaged in conversation do not always notice the green traffic light and the long line of waiting cars behind them. Some CEOs make risky decisions that lead to higher bonuses at year’s end but reduce their companies’ long-term financial health. And some government officials implement policies whose social harms exceed their social benefits.

A basic economic insight states that socially efficient behavior results from marginal cost pricing—the requirement that every person or other economic entity bear the full marginal costs of his or its actions. In each of the examples above, the social inefficiency is caused by an actor who does not bear the full marginal cost of his action. The motorcyclist who enjoys the empty roads at nighttime does not consider the anger of the sleepers awakened by his noise. The idle driver who enjoys the conversation ignores the cost of the time of the drivers behind him. The unscrupulous CEO who maximizes his personal gain ignores the cost of his decision on long-term stockholders. And even well-intentioned government officials tend to focus more on the benefits than on the costs of their policies.

1 Economists define a situation as socially inefficient if it is possible to change people’s behavior in a way that makes at least one person better off without making anyone worse off (see Hal Varian, Microeconomic Analysis, second ed. (1978), at 198). We discuss the concept of social efficiency in more detail infra Section I.

2 The standard reference is Harold Hotelling, The General Welfare in Relation to Problems of Taxation and of Railway and Utility Rates, 6 ECONOMETRICA 242 (1938), although the argument can be traced back to Jules Dupuit, De la Mesure de l’Utilité des Travaux Publics, 8 Annales des Ponts et Chaussées, Second series (1844).

Effective remedies for such inefficiencies assign the costs born by others to the persons whose actions cause these costs.\(^4\) The trick in designing such remedies is to identify the instances in which someone pays either more or less than his full marginal cost and design an appropriate and feasible mechanism that restores marginal cost pricing. Fines for noisy behavior at nighttime and for impeding traffic flows, reflecting the costs of awakened sleepers and waiting drivers, lower people’s propensities to engage in such behavior.\(^5\) Tying bonuses to long-term profits raises the cost of ignoring the long-term effects of executive decisions. And requiring governments to bear the marginal costs of their actions ensures that government officials who must remain within their budgets take account of the full costs of their decisions.\(^6\)

In this article, we apply the economic principle of marginal cost pricing to takings under eminent domain.\(^7\) While the power of eminent domain involves many legal, political, and philosophical issues, our interest here is in the social efficiency of government takings.\(^8\) We ask: under what circumstances can we expect government takings to lead to socially

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\(^4\) This is the basic idea behind Pigouvian taxes (levies imposed on each unit of an action with negative externalities at a level equal to the marginal monetary cost of the negative externality at the action’s socially efficient level). See William J. Baumol, *On Taxation and the Control of Externalities*, 62 AMER. ECON. REV. 307 (1972).

\(^5\) The fact that activities that impose costs on others usually provide benefits to the person who undertakes the action indicates that it is not *per se* appropriate to completely eliminate such activities. See, for example, the discussion on the relationship between property and liability rules that has emerged in the wake of Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, And Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089 (1972).


efficient uses of resources, and how can we increase the likelihood that governments take private property if—and only if—such a taking is indeed socially efficient? We describe two mechanisms that address the second question and lead to efficient—and, we argue, fair—takings.

Our introductory comments suggest a straightforward answer to the first question: economic incentives are best aligned to make government takings socially efficient if the parties involved bear the full marginal costs of their actions. The parties involved in a taking event are the property owners whose properties are to be taken, and the government agency engaged in the taking. To identify potential sources of inefficiency, we need to consider the actions of owners and governments at the different stages of a taking event.

The question of whether or not to take private property is rarely a one-time decision; often there is a period of several months or even years between the time when a government agency determines that it might want to take private property for public use at some point in the future, and the time when it decides whether or not to actually take the property. During the span of time in which a property has a noticeably positive probability of being taken, efficient property management requires that the owner consider this probability when he decides how much to invest in his property. The higher the probability that a property may be

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9 Consider three of the most widely discussed taking cases in recent history. *Hawaii Housing Authority vs. Midkiff* (467 U.S. 229 (1984)), *Poletown Neighborhood Council vs. City of Detroit* (304 N.W.2d 455 (1981)), and *Kelo v City of New London* (545 U.S. 469 (2005)). In 1977, the Hawaii Housing Authority identified several parcels for compulsory acquisition. Frank Midkiff filed suit in US District Court in 1979, opposing the compulsory acquisition of his property. Five years later, in 1984, the US Supreme Court decided that the envisaged compulsory acquisition was constitutional. In 1980, the City of Detroit passed the resolution to acquire properties in the Poletown neighborhood through eminent domain. Six months later, in March 1981, the Michigan Supreme Court decided that the taking was constitutional. In October 1980, the City of New London decided to exercise its power of eminent domain to acquire 15 lots as part of its development plan. Five years later, in 2005, the US Supreme Court decided that the City of New London was indeed permitted to exercise this power. In each case, the property owners had to decide whether and how...
taken, the lower, generally, is the efficient level of investment.\textsuperscript{10} When the time comes for the government to make final decisions about whether to take private properties, the government needs to know the private values of these properties, to determine whether the social benefit of the public project that it plans to undertake is large enough to justify the taking.

This implies that there are at least two main causes of potential inefficiency in takings: first, owners who invest either too much or too little before the final taking decision is made alter the social cost of a taking; such inefficient investment might change the government’s decision of whether or not to take the properties.\textsuperscript{11} Second, inaccurate property valuations may lead governments to make inefficient taking decisions.\textsuperscript{12} Note that the two causes of inefficiency are independent of each other. Owners might make inefficiently large investments in their properties solely to increase property values and thereby escape otherwise socially efficient takings even if—and especially if—governments that seek to maximize social welfare were able to observe the true property values.\textsuperscript{13} Conversely, accurate valuation of properties is difficult even if owners have made efficient investment decisions.\textsuperscript{14} This suggests that it is necessary to devise separate remedies for the two causes of inefficiency.

\textsuperscript{10} Investment is efficient if the expected marginal return on the last dollar invested is a dollar, and the expected marginal return generally falls (1) as the amount invested increases and (2) as the probability increases that the investment will bear limited fruits because the property will be taken.


\textsuperscript{12} Inefficient decisions can also occur through error or corruption. The psychological and Public Choice considerations required to address these causes of inefficiency are beyond the scope of this article.

\textsuperscript{13} See Robert Innes, Takings, Compensation, and Equal Treatment for Owners of Developed and Undeveloped Property, 40 J. LAW ECON. 403, 412 – 413 (1997).

\textsuperscript{14} See Donald R. Epley, A Note on the Optimal Selection and Weighting of Comparable Properties, J. REAL ESTATE RES. 175, 177 – 178 (1997).
Quite interestingly, the economics literature on takings has focused on the owners’ investment decisions, while recent legal literature on efficient takings has focused on the question of accurate valuation. The economics literature has analyzed in great detail the relationship between the compensation that owners receive for taken properties and the resulting incentives for owners to invest in their properties. In their seminal 1984 paper, Lawrence Blume, Daniel Rubinfeld, and Perry Shapiro pointed out that paying compensation equal to the value of property at the time of a taking gives owners no incentive to take account of the prospect of a taking, leading to wasteful investment.\footnote{Blume, Rubinfeld, & Shapiro, supra note 11, at 81.} If, on the other hand, compensation is not provided and governments are insensitive to the losses of private asset value that result from takings, then governments will take property wastefully.\footnote{Blume, Rubinfeld, & Shapiro, supra note 11, at 88.} Over the past 25 years, a sizeable literature on the economics of government takings has analyzed compensation rules that improve social welfare; the general consensus is that owners will invest efficiently only if they can expect to obtain at most partial compensation—that is, if owners are compensated for the values that their properties would have had after efficient investment given the probability of a taking, rather than the values that their properties would have had had the government never announced the possibility of a taking.\footnote{See, for example, Blume, Rubinfeld, & Shapiro, supra note 11, 81; Louis Kaplow, An Economic Analysis of Legal Transitions, 99 HARV. L. REV. 509, 529 (1986); William Fischel & Perry Shapiro, A Constitutional Choice Model of Compensation for Takings, 9 INT. REV. LAW ECON. 115, 123 (1989); Thomas J. Miceli, Compensation for the Taking of Land Under Eminent Domain, 147 J. INST. THEORETICAL ECON. 354, 358 – 359 (1991); Thomas J. Miceli & Kathleen Segerson, Regulatory Takings: When Should Compensation be Paid?, 23 J. LEGAL STUD. 749, 757 – 758 (1994); Robert Innes, supra note 13, at 414; Ed Nosal, The Taking of Land: Market Valuation Compensation Should be Paid, 82 J. PUBLIC ECON. 431, 438 (2001). To our knowledge, the only exception is the paper by Benjamin Hermalin, An Economic Analysis of Takings, 11 J. LAW, ECON., ORGAN. 64 (1995). This paper describes a mechanism that leads to full compensation by linking the owner’s compensation to the social benefit of the taking. We discuss Hermalin’s mechanism infra.} However,
common notions of fairness suggest that owners ought to be fully compensated for their losses.\textsuperscript{18} Thus this literature suggests that there is a trade-off between efficiency and fairness in takings.

More recently, several legal scholars have examined the question of how to value properties in taking events.\textsuperscript{19} This literature has emphasized that market valuations, which are commonly used to establish appropriate compensation for taken property, are often significantly below the amounts at which owners value their properties,\textsuperscript{20} and it has analyzed other valuation methods. Most prominently, this literature has considered the possibility that owners can be required to self-assess their properties, and it has examined various mechanisms that provide incentives against over- and underassessment.\textsuperscript{21} The current consensus is that self-assessment mechanisms can lead to more accurate property valuations than third-party


\textsuperscript{21} The standard reference on self-assessment is Saul Levmore, \textit{Self-Assessed Valuation Systems for Tort and Other Law}, 68 VA LAW REV. 771 (1982). However, his article focuses mainly on applications of self-assessment rather than on the conditions that provide incentives for accurate self-assessment. The articles referenced \textit{supra} note 20 consider conditions that improve the accuracy of self-assessment.
assessments; however, none of the mechanisms described in these articles provide incentives to owners to reveal truthfully their private valuations of their properties.

In this article, we show that the principle of marginal cost pricing can resolve both sources of inefficiency in takings and thus advance as well as combine the two hitherto separate strands of literature. With respect to the requirement that owners make efficient investment decisions, we argue that the existing analyses have failed to develop mechanisms that lead to full compensation mainly because they do not consistently apply the principle of marginal cost pricing. Existing compensation rules follow the current state of the law and do not view a government’s announcement of the possibility of a taking as itself a partial taking that requires compensation. However, if announcing the probability of a taking lowers a property’s value and if governments are not required to take this reduction into account—that is, if governments do not have to bear the marginal costs of their actions—then they can be expected to make inefficient taking decisions that lead to at most partial compensation of owners. In Section II of this article we describe a taking mechanism that assigns to each participant in a taking event the marginal costs of his or its actions and show that the application of this mechanism leads to efficient takings for which owners receive full compensation. Following the general notion that fairness in takings requires that owners be fully compensated for their losses, we consider our mechanism to be fair as well as efficient. Thus we argue that there is no tradeoff between efficiency and the common understanding of fairness.

22 See Fennel, supra note 8, at 1404 – 1405; Bell & Parchomovsky, supra note 18, at 317; Bell & Parchomovsky, supra note 19, at 875.

23 See Epstein, supra note 6, at 157, 191 – 192.

24 See Bell & Parchomovsky, supra note 18, at 878 – 881.
To resolve the valuation problem, we describe in Section III of this article a self-assessment mechanism that provides owners with the incentive to reveal honestly the amounts at which they value their properties, and we illustrate how this self-assessment mechanism applies to takings under eminent domain. Our mechanism motivates honest assessments by assigning to owners the exact marginal costs of over- as well as understating their valuations of their properties. Thus marginal cost pricing also eliminates the inefficiency caused by inaccurate assessments of the properties that governments consider taking.

Two attractive characteristics of our pair of mechanisms are that (1) both can be implemented with information that is readily available, and (2) neither mechanism assigns benefits to owners or imposes restrictions on property rights that would reasonably be considered unacceptable. Previous mechanisms that have been described in the economics and legal literature do not have these characteristics. For example, Benjamin Hermalin’s mechanism—the only taking mechanism besides ours that we are aware of that leads to efficient investment as well as full compensation of owners—requires that the compensation that owners receive be linked to the social benefit of the taking.\(^{25}\) However, it is unlikely to be politically acceptable to award compensation in excess of the property’s full value to owners solely because their properties can be used to implement socially valuable projects.\(^{26}\) Similarly, Paul Nieman and Perry Shapiro recently proposed that owners of taken properties should be awarded compensation that equals the average market price of the surrounding

\(^{25}\) Hermalin, supra note 17, at 75, 78.

\(^{26}\) An additional argument against Hermalin’s mechanism is that it is generally difficult for governments to estimate the monetary social benefit of public projects with sufficient accuracy to use it as the basis for owners’ compensation. At best, one can expect governments to determine, with sufficient accuracy, whether or not the social benefit of a taking exceeds the value of the properties that are taken (which is a minimally necessary requirement to determine whether the taking is socially optimal).
properties that are not taken and whose values increase as a result of the public project.\textsuperscript{27} While this compensation rule may be defensible in their stylized setting that assumes that all properties that the government considers taking are identical and that property values are observable, it is much harder to justify compensation payments that are independent of the individual values of taken properties in the realistic case in which property values are not equal.\textsuperscript{28} In fact, the main motivation for the recent legal literature on compensation for takings is that it is inappropriate to ignore the owners’ subjective valuations of their properties when determining the appropriate amounts of compensation. Stylized models that assume that the values of all properties are identical obscure this problem without offering feasible solutions.\textsuperscript{29}

We are aware of two self-assessment mechanisms besides ours that provide owners with the incentive to self-assess their properties honestly. The self-assessment mechanism proposed by Emerson Niou and Guofu Tan requires that governments be able to establish property values accurately through means other than asking their supposedly risk-neutral owners—for example, through an audit.\textsuperscript{30} However, the main motivation for proposing self-assessment for takings is that there is often no way to learn property values other than asking

\begin{itemize}
\item\textsuperscript{27} Paul Nieman & Perry Shapiro, \textit{Efficiency and Fairness: Compensation for Takings}, 28 INT. REV. LAW ECON. 157 (2008).
\item\textsuperscript{28} When properties are not identical and have different values, Paul Nieman and Perry Shapiro’s mechanism overcompensates owners whose properties are valued below average, and undercompensates owners of properties with above-average values.
\item\textsuperscript{29} Thomas Miceli has shown how the results of taking models with respect to the efficiency of compensation mechanisms can depend on the assumptions made about the heterogeneity of properties. See Thomas Miceli, \textit{Public Goods, Taxes, and Takings}, 28 INT. REV. LAW ECON. 287, 289 – 290 (2008).
\item\textsuperscript{30} Emerson M. S. Niou & Guofu Tan, \textit{An Analysis of Dr. Sun Yat-Sen’s Self-Assessment Scheme for Land Taxation}. 87 PUBLIC CHOICE 103 (1994). The mechanism proposed by Bell & Parchomovsky, \textit{supra} note 19, also requires that governments can learn property values through audits. Owners who are found to have submitted exaggerated valuation are required to pay a fine. Bell and Parchamovsky’s mechanism does not provide risk-neutral owners with the incentive to reveal their true property values. It ensures that the difference between the government’s expected total compensation payment and the revenue that the government obtains from fines equals the sum of the values of the taken properties.
\end{itemize}
the owners to reveal their valuations. In contrast, our mechanism works even if owners are the only persons who know their valuations, and it applies to risk-averse as well as risk-neutral owners. The self-assessment mechanism proposed by Gordon Becker, Morris DeGroot, and Jacob Marschak, if applied to takings, would require that owners receive the entire social benefit of the taking.\(^{31}\) As with Hermalin’s taking mechanism, this feature is likely to make this self-assessment mechanism unacceptable for taking cases.

The self-assessment mechanism recently proposed by Abraham Bell and Gideon Parchomovsky does not provide owners with the incentive to reveal their valuations accurately, but it nevertheless requires that owners be prohibited from selling their properties—for the rest of their lives—for any amount below the values that they announce to the government.\(^{32}\) This requirement makes their self-assessment mechanism unattractive because it generates inefficiency when property values fall. Because our two marginal cost pricing mechanisms (a) do not require information that is generally unavailable, (b) assign compensation payments that owners themselves consider acceptable but that are not excessive from a social point of view, and (c) do not generate inefficiency, we argue that they are superior to the mechanisms that have been proposed previously.

Although our primary motivation for introducing the self-assessment mechanism is to resolve the problem of assessing the values of properties that governments may take, it is worth considering another application of this mechanism to taking cases. The public debate about the appropriate extent of government power to take private property has intensified in the wake of

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\(^{32}\) Bell & Parchomovsky, \textit{supra} note 18, 892 – 894. To prevent the life-long ban on sales, the authors suggest that owners who sell their properties above the self-assessed value must remit the difference between the sale price and the self-assessed price to the government.
the 2005 U.S. Supreme Court’s decision in *Kelo v. City of New London*,\(^{33}\) where the court ruled that the City of New London could take property under eminent domain and sell it to a private developer as part of its urban renewal plan. The motivation for government takings in such cases is that takings may solve the problem of land assembly.\(^{34}\) Private developers face this problem when they seek to assemble a number of contiguous small parcels that are owned by different persons into a larger parcel. Such a land assembly project is socially worthwhile if its social net benefit exceeds the sum of the values of the individual properties. The owners may only be willing to sell their properties at prices that together exceed the project’s net benefit, in which case the project should not be implemented. But owners who would be willing to sell their properties at prices below the project’s net benefit if they did not know of the project have an incentive to inflate their valuations, to capture larger shares of the project’s benefits for themselves. If the sum of their inflated valuations exceeds the project’s net benefits, then the developer will not purchase their properties and will thus forego a socially worthwhile project.

Governments can circumvent the holdout problem by taking the properties under eminent domain and selling them to the developer. But to determine whether it is socially efficient to take the properties and implement the developer’s project, the government needs to know the joint value of the properties that it takes.

In Section IV of this article, we show that our self-assessment mechanism not only resolves the uncertainty regarding the property values but also ensures that a developer is able to assemble the properties without government help if—and only if—the value of his project exceeds the sum of the self-assessed property values. Thus our self-assessment mechanism makes efficient land assembly possible without resorting to government takings. Because it

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\(^{33}\) 545 U.S. 469 (2005).

\(^{34}\) See Fennell, *supra* note 8, at 971 – 979.
ensures that owners receive the amounts that they consider adequate compensation for their losses, we argue that the mechanism is fairer than any method under which owners tend to receive amounts that third parties consider adequate. We show that our self-assessment mechanism can be interpreted as an improved variant of Michael Heller and Rick Hills’ recent proposal to establish Land Assembly Districts that replace eminent domain with collective bargaining in land assembly.\(^{35}\)

In summary, the main argument of this article is that marginal cost pricing can resolve at least three different inefficiencies that arise in the context of takings under eminent domain—it can provide incentives for efficient investments before the taking decision is made, provide accurate valuation to ensure socially efficient takings, and it can resolve the problem of land assembly in urban renewal projects while avoiding government takings altogether. Before introducing the two mechanisms in Sections II and III and discussing the application of the self-assessment mechanism to land assembly in Section IV, we offer a brief summary of marginal cost pricing in Section I, to clarify the key component of these mechanisms.

I. THE PRINCIPLE OF MARGINAL COST PRICING

The principle of marginal cost pricing states that people have an incentive to behave efficiently if they bear the full marginal costs of their actions. Economists characterize behavior as “efficient” if there is no potential change that would make some person better off without making at least one other person worse off.\(^{36}\) If those who benefit from a change could offer compensatory payments to everyone who is made worse off, which those who are made worse off would consider adequate compensation, then the change improves efficiency. 


\(^{36}\) See Varian, *supra* note 1.
payment that those who are better off are willing to make is the marginal benefit of the change, expressed in terms of money, and the lowest compensatory payment that those who are worse off consider adequate is the marginal cost of the change, expressed in monetary terms. For example, if a local government estimates the social net benefit of a new public hospital to be $1,000,000, apart from the cost of acquiring the necessary properties, then it should be prepared to offer up to $1,000,000 to acquire those properties. If the property owners regard $900,000 as adequate compensation for losing their properties and for the inconvenience of moving, then the social net benefit of building the hospital is $100,000, and it should be built.

The efficiency of any change is determined solely by the costs and benefits of the change and does not depend on the behavior of those involved. This makes it possible to compare the outcome that results from specified behavior of a person or entity with the efficient outcome, to determine whether or not this behavior leads to the efficient outcome. In the previous example, the efficiency of the redevelopment project does not depend on what the government offers and what the property owners demand, but only on the hospital’s net social benefit and the owners’ genuine valuations of their properties. If the owners do not agree to sell their properties to the government, despite the fact that the sum of the valuations of their properties is only $900,000, and thereby prevent the government from building the hospital, then their behavior leads to a socially inefficient outcome. Similarly, if the government officials insist on offering less than $900,000 for the properties, despite the fact that the hospital’s social benefit is $1,000,000, so that the owners refuse to sell, then the officials’ behavior leads to a socially inefficient outcome.

What characterizes behavior that leads to the socially efficient outcome? A person maximizes his utility if the marginal benefit that he obtains from an activity (for example, the
last bite of cake eaten, the last cigarette smoked, the last dollar invested) equals his marginal cost. If the marginal benefit of the activity exceeds the marginal cost, then the person could increase his utility by undertaking more of the activity. Similarly, he could increase his utility by undertaking less of the activity if the marginal cost exceeds the activity’s marginal benefit. If a person receives the entire benefit and bears the entire cost of an activity, then individual utility maximization leads to social efficiency. A homeowner who contemplates renovating his bathroom bears the entire cost and receives the entire benefit of remodeling, so his decision will be socially efficient. Similarly, a developer who considers redeveloping multiple properties that he already owns will bear the entire cost and receive the entire benefit of the project. Thus his decision about whether or not to undertake the construction is socially efficient as well.37

If, on the other hand, someone else either receives part of the benefit or bears part of the cost, then individual utility maximization generally does not lead to social efficiency, because the person has no incentive to consider the portion of the marginal benefit or marginal cost that accrues to anyone else. If someone else bears part of the marginal cost, then the person will continue with his activity until his marginal benefit equals the share of the marginal cost that he pays, rather than stopping earlier at the point when his marginal benefit equals the entire social marginal cost. The canonic examples describe activities that lead to pollution, but the concept is applicable to all activities. For example, the availability of insurance tends to make those insured less careful because it shifts part of the cost of insured activities to the insurer.

37 For the sake of illustrating the general principle of marginal cost pricing, we assume that the developer has as much information about the project and alternative uses of the land as anybody else, and we assume that the project does not affect the owners of neighboring parcels. Note that the utility of those who will benefit from redevelopment is capitalized in the price at which the developer can either rent or sell the completed project.
which explains the moral hazard problem of all insurances, from the provision of health insurance to government guarantees for mortgage lenders.\textsuperscript{38} In the case of takings under eminent domain, an assurance that the government will fully compensate owners for all improvements if the owner’s property is taken provides owners with the incentive to disregard the probability of a taking and to undertake socially inefficient investments. Raising a person’s individual marginal cost of his action towards the full social marginal cost provides him with the incentive to act more efficiently—raising the deductible for an insurance policy shifts some of the cost of accidents back to the insured and thereby reduces his propensity to over-engage in risky behavior. Similarly, not compensating property owners for their taken properties—regardless of considerations of fairness—ensures that owners bear the marginal cost of overinvesting and thus reduces their inclinations to do so.

In other words, socially inefficient behavior can be explained by the fact that someone bears either more or less than the marginal cost of his action, and social efficiency can be restored by ensuring that all parties bear the full marginal costs of their actions. To provide incentives for efficient behavior one must identify the instances in which someone pays something other than the full marginal cost and then devise a remedy that restores marginal cost pricing. In the next two sections, we show how two applications of the principle of marginal cost pricing can bring efficiency to government takings under eminent domain.

II. MARGINAL COST PRICING AND TAKING UNDER EMINENT DOMAIN

We characterize a taking event as a series of actions undertaken by a government and a property owner.39 If one assumes that governments always act for the benefit of the whole society, then the government will use society’s resources efficiently and designers of taking mechanisms only need to ensure that owners have incentives to invest efficiently during the time of uncertainty. But if it is possible that government officials pursue other goals—for example, they might strive to minimize the budget costs of the projects that they undertake—then it is important to ensure that governments as well as property owners have incentives to behave efficiently.

To understand the characteristics of efficient taking and investment decisions, consider the case in which a government owns the property. The government will consider using one of its properties for a new public project if the expected social benefit from the property’s new use exceeds the expected social benefit from the current plan for its use. Suppose that the government can choose among several of its properties for the new project. The government must decide whether and where to implement the project, while managing all of its properties efficiently in the meantime. The higher the probability that it will use a particular property for the new project, the smaller is the optimal investment in this property before that taking decision is made. Efficiency therefore requires that the government (1) identify the probabilities with which it may use any of its properties for the new project, given the properties’ different efficient uses, (2) invest the efficient amount in each property, given the probability that it may use this property for the new project, and (3) eventually identify the

39 We assume a single property owner to highlight the intuition of our taking mechanism. In Section IV infra, we address the additional problems that arise when a project requires the assembly of properties owned by several persons.
appropriate property for the new project, given the value of each property at the time when the
decision to implement the project is made.

A. Requiring governments to bear the marginal costs of their actions

Now consider the case in which the government does not own the property. The government
affects the use of resources at three times. First, when it determines that, at some point in the
future, it may need to take certain private properties under eminent domain. Second, when it
announces the probabilities of takings to the owners. Third, when it decides whether or not to
take properties. Consider these actions in reverse order.

It is evident that a government’s decision to take a property imposes a cost on its owner
and thereby on society as a whole. A government will make an efficient taking decision only if
it considers the current value of the property at the time of the taking. To highlight the
intuition of our argument, we assume for the rest of Section II that property values are easily
observable and thus common knowledge. In Section III, we address the case in which only
property owners know the true values of their properties, and we show that the socially
desirable characteristics of our pricing mechanism continue to hold under this much more
realistic assumption. Ensuring that governments consider the current value of property at the
time of the taking is most easily achieved by requiring governments to actually pay amounts
equal to these values. This represents the efficiency aspect of “fair compensation.” Because
governments need to take the actual property value into account to make efficient taking
decisions, this payment cannot be, as suggested by some of the economics literature, a lump-
sum payment whose amount had been established at an earlier time, independently of the

40 See, for example, Blume, Rubinfeld, & Shapiro, supra note 11, at 78; Miceli, supra note 17, at 358.
owner’s investment up to the time of the taking.\textsuperscript{41} For example, an efficient decision about whether or not to take a property currently worth $1,500,000 depends only on whether the social value of the public project that can be implemented at this location exceeds this amount. Suppose that the property would only be worth $1,000,000 had the owner invested efficiently. This fact is irrelevant for the question of whether it is socially efficient to replace a property currently worth $1,500,000 with the public project at this time. Thus efficiency requires that the government pay $1,500,000 if it decides to take this property. But because efficiency also requires that the owner not be compensated for inefficiently large investments that might prevent an otherwise socially desirable taking, the owner should not receive the entire payment as compensation; the government should pay $500,000 to someone other than the owner.\textsuperscript{42}

A cost minimizing government that seeks to pay a minimum amount at the time of the taking has an incentive to make the property owner invest as little as possible during the time when it is uncertain about whether the taking will occur. Because owners will invest less if a government announces a higher probability of a taking (and owners are not compensated for investments that are inefficient in view of the announced probability of a taking), governments have an incentive to announce the largest believable probability. But it is inefficient if governments induce owners to invest too little. In such a case, the government would make an efficient taking decision given the owner’s actual investment, while the social benefit would have been higher had the owner invested the efficient amount and had the government, possibly, made a different taking decision. For example, consider a property that the

\textsuperscript{41} Because a lump-sum payment does not depend on the owner’s investment, it ensures that owners bear the full marginal costs of either over- or underinvestment and therefore does not distort the owner’s investment decision. However, as argued in the text, such a lump-sum payment does not lead to efficient taking decisions.

\textsuperscript{42} See infra Section II.B.
government considers taking with a probability of 50 percent, and that will be worth $1,000,000 at the time of the taking decision if the owner takes this probability into account when investing. If the government instead announces a 90 percent probability that it might take the property and the owner invests according to this information, then the property’s value will only be $600,000. If the social value of the public project is $750,000, then it will be efficient ex post to take the property, while taking the property would not have been efficient had the owner known the true probability and invested accordingly.

To devise an incentive that will motivate governments to announce correct probabilities, we begin by noting that governments impose costs on property owners when they announce the possibility that they may take property at some future time. Efficient use of a property that may be taken and whose improvements will be destroyed at that time is likely to differ from the efficient use of a property whose improvements can generate a longer stream of revenues. Whenever the probability of a taking will lower the return from efficient use of property and thereby lower the property’s value, efficiency requires that governments be motivated to take this reduction into account by being required to pay compensation equal to the reduction in the value of the property.\(^\text{43}\)

Of course, the magnitude of the reduction in the value that the property yields depends on the duration of the uncertainty about whether the property will be taken. An uncertainty that lasts only six weeks will be much less costly that an uncertainty that lasts six years. And the government will generally be unable to specify at the time of the announcement how long the uncertainty will last. For this reason, the cost imposed by the uncertainty about whether a

\(^{43}\) The requirement that governments compensate owners for the reduction in property value that result form announcing the probability of a taking is implicit in the compensation rule proposed by Epstein, supra note 6, at 151 – 158.
taking will occur should be considered an imposition for which recurring payments, perhaps monthly, are due.

The requirement that governments pay for the costs that they cause by announcing probabilities of takings is essential for efficient taking decisions because it provides governments with the incentive to identify and announce correct probabilities of future takings and to shorten the durations of uncertainty. A government that needs to decide what probability to announce minimizes its total property acquisition costs when the reduction in the announcement payment that results from a further decrease in the announced probability of a taking is equal to the expected increase in the taking payment that results from additional investment that is induced by the lower probability. Because announcement payments ensure that governments bear the full marginal costs of their actions, such payments give them the same incentive to act when someone else owns the property as they have when they own the property themselves. It is always in an owner’s best interest to correctly identify and act upon the probability of using his own property differently in the future. Hence requiring governments to make announcement payments equal to the expected reduction in the return to owning a property that is caused by the announcements, together with the requirement to pay an amount equal to the value of the property at the time of the taking, provides the appropriate incentive to identify and announce the correct probability of a taking.44

For a numerical illustration, consider the government in the previous example that lowers the compensation that it must pay at the time of the taking from $1,000,000 to $600,000 by announcing a taking probability of 90 percent instead of the true probability of 50 percent. The entries in Table 1 illustrate why the requirement to pay announcement compensation

44 See Tideman & Plassmann, supra note 7, at 482 – 484, for a mathematical proof of this argument.
provides the government with the incentive to announce the true 50 percent. Assume that the
property is currently worth $600,000. If the government had had no plans to take this property,
then the property’s owner would have invested $700,000 today, the property would have been
worth $1,500,000 one year later, and he would have earned $300,000 in the meantime. If the
owner invests taking account of the correct taking probability of 50 percent, then he invests
$200,000, earns $100,000, and his property will be worth $1,000,000 one year later when the
government makes its taking decision. Thus the owner’s loss is $200,000, which the
government must pay as announcement compensation. The expected taking compensation
payment is $1,000,000 * 0.5 = $500,000.

Table 1. Example of Marginal Cost Pricing in Takings

<table>
<thead>
<tr>
<th>Taking probability that the government announces</th>
<th>0%</th>
<th>50%</th>
<th>90%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient investment</td>
<td>$700,000</td>
<td>$200,000</td>
<td>$0</td>
</tr>
<tr>
<td>Property value at time of the taking decision</td>
<td>$1,500,000</td>
<td>$1,000,000</td>
<td>$600,000</td>
</tr>
<tr>
<td>Flow income</td>
<td>$300,000</td>
<td>$100,000</td>
<td>$0</td>
</tr>
<tr>
<td>Benefit of owning the property</td>
<td>$1,100,000</td>
<td>$900,000</td>
<td>$600,000</td>
</tr>
<tr>
<td>Announcement compensation</td>
<td>$0</td>
<td>$200,000</td>
<td>$500,000</td>
</tr>
<tr>
<td>Expected taking compensation</td>
<td>$750,000</td>
<td>$500,000</td>
<td>$300,000</td>
</tr>
<tr>
<td>Total expected compensation</td>
<td>$750,000</td>
<td>$700,000</td>
<td>$800,000</td>
</tr>
</tbody>
</table>

The property’s value at the time of the taking decision and the flow income up to this time
are expressed in present value terms, so that their dollar values can be compared with the
current investment.

45 All values are expressed in present value terms so that they are directly comparable.

46 Given a taking probability of 50 percent, the expected return from investing $200,000 is $100,000 +
($1,000,000 - $600,000) * 0.5 = $300,000, so that the $200,000 investment is efficient. If the numbers
were altered so that the expected return were below the amount invested (for example, if the amount
invested exceeded $300,000, or if the property’s value only increased to an amount below $900,000),
then the numerical example would show that it will be cheaper for the government to announce 90
percent rather than 50 percent and thereby deter the owner from making an inefficient investment.

47 The benefit of owning the property if the probability of a taking is zero is $1,500,000 +$300,000 -
$700,000 = $1,100,000, and it is $1,000,000 + $200,000 - $200,000 = $900,000 if the probability of
taking is 50 percent and the owner can expect to be compensated for efficient but not for inefficient
investments.
However, assume that, if the owner believes that the probability that his property will be taken is 90 percent, then he does not make any investment and does not receive any income from his property, and the property will still be worth $600,000 one year from now.\footnote{We make the assumption that no investment is efficient only for simplicity. What is necessary is that the expected rate of return from efficient investment exceeds the expected rate of return from inefficient investment—that is, as long as the expected rate of return if the owner believes that the probability of a taking differs from 50 percent is less the expected rate of return if he invests according to the true 50 percent probability.} In this case, the government must pay $500,000 announcement compensation,\footnote{This is the difference between the benefit of owning the property if the probability of taking is zero ($1,100,000) and the benefit if the taking probability is 90 percent ($600,000).} and the expected taking compensation is $600,000 * 0.5 = $300,000.\footnote{Regardless of the probability it announces, the government must use the true probability of the taking (50 percent) to calculate the expected taking compensation correctly.} Thus if the government announces the correct probability of 50 percent, then it expects to pay announcement and taking compensation equal to $700,000, while it expects to pay a total of $800,000 if it announces a probability of 90 percent. Similarly, if the government does not inform the property owner of the probability of a taking (it “announces” a probability of 0 percent), then it expects to pay no announcement compensation but taking compensation equal to $1,500,000 * 0.5 = $750,000. The requirement that the government pay the full marginal cost of announcing the probability of a taking as well as the owner’s loss in case of a taking therefore ensures that the government expects to pay more if it announces an incorrect probability.\footnote{Tideman & Plassmann, supra note 7, at 483, show that the government will be strictly worse off when announcing an incorrect probability of taking if the return that owners obtain from additional investment falls with the amount invested (that is, if the marginal return to investment increases at a decreasing rate).} Even though current law does not require governments to compensate owners for the reductions in property values that result
from the announcement of future possible takings,\textsuperscript{52} such announcement compensation is essential to provide governments with the appropriate incentives to act efficiently.

\textbf{B. Requiring property owners to bear the marginal costs of their actions}

We still need to ensure that property owners have the incentive to invest socially efficient amounts. A standard result in the taking literature is that owners will invest efficiently if they are not rewarded for inefficient overinvestments, which can be accomplished by giving them no compensation at all when their properties are taken.\textsuperscript{53} Part of the literature has also asserted that, if society requires that compensation be paid, such compensation must be a lump-sum payment, independent of the owners’ actual investments.\textsuperscript{54} However, as argued supra, lump-sum payments (or no compensation at all) motivate inefficient taking decisions by governments, because they do not require governments to bear the full marginal costs of their actions. If a lump-sum payment whose value is established at the time of the announcement of the probability of a taking exceeds the value of the property at the time of the taking (for example, because the owner has invested inefficiently little), then the government would not be basing its taking decision on the actual property value and might therefore be unwilling to take a property when it would be socially desirable to do so.\textsuperscript{55} To ensure efficient taking decisions,

\footnote{\textsuperscript{52} See Epstein, \textit{supra} note 6, at 157, 191 – 192.}

\footnote{\textsuperscript{53} See, for example, Blume, Rubinfeld, & Shapiro, \textit{supra} note 11, at 80; Miceli, \textit{supra} note 17, at 357; Nosal, \textit{supra} note 17, at 442. Thomas Miceli even argues that paying no compensation is the only compensation rule that leads to efficient investment if landowners’ individual valuations of their properties are not identical. See Miceli, \textit{supra} note 29, at 290.}

\footnote{\textsuperscript{54} See, for example, Blume, Rubinfeld, & Shapiro, \textit{supra} note 11, at 79 and Miceli, \textit{supra} note 17, at 357 – 358.}

\footnote{\textsuperscript{55} To be sure, the requirements that the government pay the actual value of the property and the owner receive a lump sum payment that exceeds the actual value would lead to efficient taking and investment decisions, but such a policy would not lead to overall social efficiency if the lump sum payment exceeds the property’s value and the budget shortfall has to be financed through distorting taxation.}
the government must pay an amount equal to the actual value of the property that it takes, while any compensation payment that an owner receives at the time of the taking must be equal to the smaller of the actual property value at the time of the taking and the value of the property that would have resulted from efficient investment. This ensures that owners bear the full marginal cost of overinvesting.\textsuperscript{56} If an owner has invested too much, so that his property is worth more than it would have been had he invested efficiently, then, to ensure that the government continues to face the full marginal costs of its actions, the government should pay, to someone other than the owner, the difference between the actual property value and the value that would have resulted from efficient investment.

The owner’s return to efficient investment if the probability of a taking is positive is likely to be lower than his return to investment if this probability is zero. Because the amount that the owner can receive as compensation is limited by the value of the property after efficient investment, he has an incentive to overinvest if such overinvestment (1) lowers the probability with which the government takes his property and thereby (2) increases his expected return to investment beyond the amount that he expects to receive as compensation if he invests efficiently and his property is taken.\textsuperscript{57} Such overinvestment leads to social inefficiency because it induces the government to forego socially worthwhile takings and either take different properties whose taking leads to a smaller net social benefit or not implement some public projects at all. Efficiency will again be restored if the owner is required to bear

\textsuperscript{56} At least to the extent that overinvesting does not affect the probability of a taking. \textit{Infra} we address the case in which overinvestment lowers the probability that the government will take a property.

\textsuperscript{57} See Blume, Rubinfeld, & Shapiro, supra note 11, at 84; Innes, supra note 13, at 412; Hermalin, supra note 17, at 70; Robert Innes, \textit{The Economics of Takings and Compensation When Land and Its Public Use Value Are in Private Hands}, 76 LAND ECON. 195, 199 (2000).
the marginal cost of his action, that is, if he has to pay a penalty equal to the reduction in the net social benefit of the project caused by his investment.

Recall that, to illustrate the intuition of marginal cost pricing in takings, we assume in this part of the article that property values and their changes are observable. When this is not the case, owners whose properties have a positive probability of being taken could be required to announce all planned improvements, so that independent appraisers can determine whether the owners’ projects are appropriate under the circumstances.\textsuperscript{58} However, the need for such third-party appraisal is unsatisfying as well. A more satisfying alternative is to use the self-assessment mechanism that we propose in Section III. We show \textit{infra} that this self-assessment mechanism, in conjunction with our taking mechanism, removes all incentives for owners to overinvest in their properties, so that the problem of setting the appropriate fee for overinvestment does not arise.

\textbf{C. Full Compensation for Taking Private Property}

A recurring conclusion in the literature on government taking is that efficient compensation must be less than full compensation, where “full compensation” is the value that the property would have had at the time of the taking if the owner had invested efficiently, based on the expectation that he would keep his property.\textsuperscript{59} Because governments reduce the value of property at two distinct moments in time—first when they announce probabilities of takings, and second when they take property—it is not surprising that a compensation payment at the time of the taking that leads to an efficient taking can account only for the second reduction in

\textsuperscript{58} This solution is similar to the scheme proposed by Miceli & Segerson, \textit{supra} note 17, at 757, where a landowner who wants to invest in his land must announce his intent to invest to a regulatory agency which gives permission only for socially efficient investments.

\textsuperscript{59} See the sources cited in \textit{supra} note 17.
value but not for the first. At the time of the taking, the reduction in property value that results from the earlier announcement of a taking is a sunk cost, and governments will only make efficient taking decisions if, at the time of the taking, they do not have to pay amounts that exceed the actual marginal costs of actual takings.

However, the requirement that governments pay the marginal costs of their actions generates sufficient funds to pay full compensation to property owners, because the present value of the reduction in the return to the property caused by the possibility of a taking plus the property value at the time of the taking if the property owner has invested efficiently in view of the probability of a taking equals the value that the property would have had at the time of the taking if the owner had invested efficiently in the absence of a possibility of a taking. If one considers a reduction in the return to property caused by an announcement of the probability of a taking already a partial taking of private property that requires compensation, then it is appropriate that the owner receive announcement compensation. The requirement that the government pay announcement compensation to the owner therefore not only leads to efficient taking decisions but also ensures that owners are fully compensated for their losses.\(^{60}\)

\textit{D. Efficient and Fair Takings}

It is useful to emphasize the distinction between efficient and fair decisions. Efficiency requires that every person bear the marginal cost of his actions. Fairness is a much more controversial concept. A mechanism can be efficient without being fair, and it can also be fair without being efficient. To provide the incentive for efficient behavior, our taking mechanism requires that governments pay amounts equal to the full value of the properties that

\(^{60}\) See Tideman & Plassmann, \textit{supra} note 7, at 483, for a mathematical proof of this argument.
they take. This implies that sufficient funds for full compensation are available. But efficiency itself does not require that owners receive this amount; efficiency only requires that owners do not receive compensation for investments at the margin. How much an owner ought to receive depends on the socially accepted standard of fairness. Fairness as we understand it requires that everyone receive full compensation for his losses. Because our procedure permits full compensation of property owners, we consider it “fair.”

Our discussion so far has assumed that property values, their changes, and the efficient amount of investment are observable. These are standard assumptions in the economics literature on takings. However, while the ability to observe property values and knowledge of the efficient amount of investment make it straightforward to assign the announcement and taking compensation payments that the government must make, property values are generally not observable, and it is often impossible to even estimate property values with sufficient accuracy. Paul Nieman and Perry Shapiro have pointed out that it is also inappropriate to assume that the efficient amount of investment is observable—if it were observable, then governments could simply mandate that owners make efficient investments. In the following section, we consider the more realistic case, where neither property values nor the efficient

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61 The authors contributing to this literature generally assume that a property’s value depends exclusively on the amount of output that can be produced on the property, and that this homogeneous output is traded in a competitive market so that its price is known (see, for example, Blume, Rubinfeld, & Shapiro, supra note 11, at 73 – 75). Because these assumptions permit the derivation of property value from the observable output and its price, the assumption that property values are observable is defensible in such stylized models. However, in reality, the value of most properties depends mainly on the properties’ locations and on their owners’ subjective attachment to their properties, rather than on the value of marketable output that is produced on each property. By ignoring the fact that property values are generally not observable, these stylized models on takings ignore an important source of inefficiency in government takings.

62 See Epley, supra note 14, at 177 – 178. For additional discussion, see Bell & Parchamovski, supra note 18, at 885 – 990 (2005).

63 Nieman & Shapiro, supra note 27, at 159, 160. The authors nevertheless assume that property values and their changes are observable.
amount of investment are observable, and discuss a self-assessment mechanism based on marginal cost pricing that leads to efficient and fair takings under these circumstances. In this more realistic setting, we also discuss what information is necessary to implement our two mechanisms in practice.

III. MARGINAL COST PRICING AND ACCURATE SELF-ASSESSMENT

A. Requiring Property Owners to Bear the Marginal Costs of Over- and Underassessing Their Properties

It is common practice to base the compensation of owners whose properties are taken on estimates of the market prices of the properties. This practice has two serious shortcomings—first, it is difficult to estimate a property’s market price with sufficient accuracy if neither the property itself nor any near-by comparable properties have been sold in the recent past. Second, and more importantly with regard to the fairness of paying compensation for property that is taken, an estimate of a property’s market price does not necessarily reflect the owner’s attachment to his property. If an owner does not want to sell his property for any amount below $500,000 while no other person would be willing to offer more than $100,000 for this property, then any third-party estimate of the property’s market value is likely to be closer to $100,000 than to $500,000. In such cases, compensation based on the estimate of the property’s market value will not fully compensate the owner for his loss.

64 See, for example, Kimball Laundry Co v. United States, 338 U.S. 1, 5 (1949); United States v. Miller, 317 U.S. 369, 374 (1943); Olson v. United States, 292 U.S. 246, 255 (1934).

65 See the sources cited in supra note 17.

not voluntarily relinquish property that is taken, an appropriate measure of the owner’s loss is the amount at which the owner would be willing to sell his property voluntarily—the owner’s “reservation price.” This reservation price and therefore the value of the property is likely to vary over time; it is higher when the owner regards moving as a nuisance, and it is lower when the owner intends to move and wants to sell his property. Because only the owner knows his subjective reservation price, there is no other way to learn this price than by asking him. This explains the recent interest in self-assessment mechanisms that provide owners with the incentive to honestly disclose their reservation prices.

The principle of marginal cost pricing suggests that a self-interested owner has an incentive to announce his reservation price honestly if he bears the marginal costs of under- as well as overstating this price. A straightforward way to make an owner bear the cost of understating his reservation price is to require that he sell his property if someone offers to buy it at the price that the owner has announced. An owner who values his property at $500,000 but announces a value of $450,000 instead will lose $50,000 and thus bear the full marginal cost of understating his reservation price if someone buys his property at $450,000. A simple method to make overstatements costly is to impose on the owner a penalty—call it a valuation tax—that increases with the amount that the owner announces. However, although self-

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67 More precisely, a property’s value is the reservation price of the person who values the property highest, who can be presumed to be its current owner. Other definitions of value are meaningful as well—for example, it would be meaningful to associate value with opportunity cost and define a property’s value as the reservation price of the person who values the property second highest (which is the opportunity cost of having the property’ owned by its owner). However, defining the value of a good through its opportunity cost creates the puzzle that whenever a buyer is willing to split the gains from trade, he is intentionally paying a price that exceeds the good’s value (the reservation price of the seller). Defining property as the reservation price of the owner is attractive, because it is the only price that nobody considers too low, and at least one person (the owner) does not consider too high.

68 See the sources cited in supra note 20.

69 We discuss the fairness aspect of requiring owners to sell their properties infra Section III.C.
assessments mechanism that require that owners sell their properties at self-assessed prices and pay valuation taxes on these prices have been proposed before, previous authors have generally not paid attention to the fact that arbitrary valuation taxes will only by chance provide incentives for owners to reveal their true reservation prices. A tax that is too low (say, one cent per $1,000,000 of announced value) is unlikely to provide a sufficient penalty for announcing an amount that exceeds the owner’s reservation price, while a tax that is too high (say, $0.50 per $1 of announced value) makes it too expensive for the owner to pay the penalty for honestly disclosing his reservation price. Thus to provide an incentive for accurate self-assessment, it is necessary to calibrate the valuation tax appropriately.

A valuation tax is appropriately calibrated if it assigns to the owner the marginal cost of overstating his reservation price. To understand the intuition behind this claim, consider the owner who values his property at $500,000, and assume that he faces a probability of 1 percent that a natural disaster will destroy his property. The presence of the owner’s property raises the expected social cost of the disaster by $500,000 * 0.01 = $5,000. A standard result in the economics literature on insurance is that a person is willing to insure his property at the full amount if and only if the insurance premium equals his expected loss. If the premium exceeds (is below) his expected loss, then he will insure his property at a lower (higher) amount. Setting the insurance premium equal to the expected loss implies that the owner bears the full marginal social cost of adding his expected claim to the expected claims of all property owners.

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71 This premium is known as the “actuarially fair premium” (see, for example, Varian, supra note 1, at 161 – 162).
owners who acquire insurance against losing their properties in the natural disaster. Thus marginal cost pricing provides an incentive for owners to insure their properties at their true values.

Now assume that there is a probability of 1 percent that somebody will offer to purchase his property at the value that the owner announces. The owner is required to pay a valuation tax at a rate equal to this probability on the amount that he expects to receive from the buyer. View the possibility that somebody acquires the property as the “natural disaster” and the valuation tax payment as the owner’s insurance premium. In analogy to the insurance example, the owner has an incentive to announce that he values his property at $500,000 if he must pay a premium of $5,000 to ensure that he receives $500,000 for his property if somebody buys it. Thus a valuation tax at a rate equal to the probability that he loses his property provides the owner with the incentive to announce honestly the amount at which he values his property. This result also holds for the more realistic case in which the probability that somebody buys the property at the announced value (and therefore the appropriate valuation tax rate on the announced value) falls if the owner announces a higher value.\(^{72}\)

Note that the purpose of the valuation tax is to provide an incentive for owners to refrain from overassessing their properties, rather than to generate government revenue. The government can therefore alleviate the owners’ valuation tax burdens by returning the

\(^{72}\) See Plassmann & Tideman, \textit{supra} note 7, at 346 – 347, for a formal mathematical proof. The result holds for risk-averse owners if the probability that someone buys the property at the announced price does not change with the announced price, and it holds for risk averse as well as risk neutral owners if this probability falls as the owner announces a higher price (which is the more likely relationship). The result does \textit{not} hold for risk-loving owners, because the utility that they obtain from the opportunity to participate in such a valuation game would affect their incentives to reveal their reservation prices. Because most people seem to be risk-averse to some degree, we can expect the mechanism described in the text to hold for the majority of owners. This characteristic of our mechanism answers the concern raised by Amnon Lehavi and Amir Licht that self-assessment may have unintended distributional impacts if the owners’ self-assessed values depend on their degrees of risk aversion (see Amnon Lehavi & Amir N. Licht, \textit{Eminent Domain, Inc}, 107 COLUMBIA L. REV. 1704, 1730 – 1731 (2007)).
valuation tax revenue to the owners as “assessment compensation.” It can do so without distorting incentives by randomly assigning each owner to one of two groups, and dividing the tax proceeds from one group among the members of the other group, in proportion to the assessed values of their properties for property tax purposes. Owners then do not bear any tax burden on average. Because an owner’s valuation tax payment is distributed among the members of the other group, it does not affect the assessment compensation that he receives and therefore does not distort his incentive to reveal his true reservation price.

It is worth emphasizing that this self-assessment mechanism differs substantially from a common method of dissolving partnerships, known as the “shotgun clause” or the “Texas shootout.” Under a shotgun clause, the partner who wants to dissolve the partnership makes an offer to buy the shares of the other partners. The other partners can either accept his offer and sell their shares, or buy the shares of the proposing partner at the per-share price of his offer. Two differences with our mechanism are evident. First, the invocation of a shotgun clause necessarily results in a market transaction (either the proposing partner buys all shares of the other partners, or the other partners buy all shares of the proposing partner), while our self-assessment mechanism does not necessarily lead to a transfer of property. Thus a shotgun clause is not useful for applications in which mandatory transfers of property are undesirable. Second, and more importantly, the proposing partner’s offer reflects both his valuation of the shares that he offers to buy and the possibility of profit on the shares that he already owns.

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As long as the government’s assessments for property tax purposes are independent of the self-assessed values, they do not distort the owners’ incentives to reveal their true reservation prices. Plassmann & Tideman, supra note 7, at 352 – 354, suggest an application of the mechanism for property tax assessments that does not distort owners’ incentives to honestly disclose their reservation prices.
Thus a shot-gun clause does not reveal the proposing partner’s valuation of the shares that he owns.\footnote{See Plassmann & Tideman, supra note 7, at 351, for a mathematical proof of this claim. Because a shotgun clause permits the proposing partner to submit only a single valuation rather than separate valuations of his own and the shares of the other partners, a shotgun clause can at best provide information about how the proposing partner values the entire partnership. Maria-Angeles de Frutos & Thomas Kittsteiner, Efficient Partnership Dissolution Under Buy-Sell Clauses, 39 RAND J. ECON. 184 (2008), show that, if the proposing partner owns half of the partnership, then the proposing partner has an incentive to reveal his valuation of the entire partnership if the submission of an offer is preceded by negotiations of who must propose and who has the advantage of receiving the offer.}

\textbf{B. Accurate Self-assessment and Efficient Takings}

The self-assessment mechanism that we describe \textit{supra} requires a valuation tax at a rate equal to the probability that somebody will buy the property at the self-assessed price, and therefore provides an incentive to owners to honestly reveal their reservation prices only if owners and the government (which sets the tax rate) have identical beliefs about this probability. While this may or may not be the case in other applications of the mechanism, it is likely to be the case if the self-assessment mechanism is used, in conjunction with the taking mechanism that we proposed \textit{supra} in Section II, to assess property values in takings under eminent domain. Recall that our taking mechanism provides cost-minimizing governments with the incentive to estimate, as accurately as they reasonably can, the probabilities that they will take individual properties, and to announce these probabilities to the owners. If only the government—rather than anybody—is permitted to purchase self-assessed properties at the prices that owners disclose, then our taking mechanism ensures that property owners have reason to believe the probabilities that the government announces.\footnote{The self-assessment mechanism will fail if property owners believe that government officials have estimated these probabilities incorrectly. However, there is inherent uncertainty in \textit{any} estimated value. For example, the \textit{Cramér-Rao Lower Bound} indicates the smallest variance that any unbiased estimator of an unknown parameter can have (see Calyampudi Rao, Information and the Accuracy Attainable in
If both the taking mechanism and the self-assessment mechanism are used in a taking event, then the sequence of events is as follows. The first step is that a government agency that seeks to implement a public project identifies the possible locations for future implementation of the project. The government estimates the probabilities with which it will implement the project at each of these locations. The government then approaches the owners of all properties at these locations, informs them of these probabilities, and requires them to reveal their reservation prices. It assures the owners that they will be compensated at these self-assessed prices if the government takes their properties, and informs them that they will have to pay valuation taxes on the values that they announce at rates equal to the probabilities that their properties will be taken and that, whether or not their properties are taken for the project, they will receive one-time compensation for the estimated cost to them of the need to pay the valuation tax, and monthly compensation for the reduced rental value of their property because of the possibility that it may be taken. All owners then announce the amounts of compensation that they consider appropriate if their properties are taken.

Owners have an incentive to announce their reservation prices only if they have reason to believe the probabilities of the taking that the government announces. A cost-minimizing government has an incentive to estimate these probabilities accurately and announce their estimates truthfully only if it is required to compensate owners for the reductions in value that result from the announcement of a possible taking. If the government believes that the appraiser will estimate the required compensation with reasonable accuracy, then it has an incentive to estimate and announce the correct probabilities of takings, and property owners

*the Estimation of Statistical Parameters, 37 Bull. Calcutta Math. Soc. 81 (1945)* and Harald Cramér, *Mathematical Methods of Statistics* (1946)). Our taking mechanism at least provides government officials with the incentive to estimate the probability of a taking as accurately as they can.
therefore have an incentive to reveal their reservation prices honestly. Thus the second step of the taking event is for the government to pay the announcement compensation. While efficiency requires only that the government make these payments (possibly to other government agencies), fairness requires that the owners receive these payments.

The third step of the taking event occurs in the time between the announcement of the possibility of a taking and the final decision about the taking. Property owners know that, if their properties are taken, they will receive the amounts that they have announced. Because neither the amounts of compensation that owners will receive if their properties are taken nor the probabilities with which the government takes any of the properties depend on how much an owner invests, property owners have no incentive to invest anything other than the efficient amounts. Thus full taking compensation payments that are based on the self-assessed values that owners announce lead to efficient investment decisions.

Because the value of property to an owner may change while the decision about a taking is pending, the owner must be allowed to change the stated value if he wishes, which ensures that a taking is based on the actual value of the property to the owner. An owner who increases his stated value increases his valuation tax, while an owner who decreases his stated value decreases his valuation tax.

Note that the self-assessment mechanism only reveals the owners’ reservation prices given the probabilities with which the government will take their properties, which makes it still necessary to rely on third-party assessment to estimate the owners’ reservation prices that were valid before the government announced the possibility of takings. For efficient takings, it is not necessary that the appraiser estimates all property values correctly; efficiency requires only that the government have no reason to believe that the appraiser will systematically either over- or underappraise the properties. Third party assessment can be avoided if the government requires each owner to reveal his reservation prices at different taking probabilities (including probabilities close to zero) before it announces the actual probability of the taking. An owner’s announcement compensation would then be equal to the difference between the owner’s reservation prices at a probability close to zero and at the actual probability. However, owners may prefer third party assessments if they find it too difficult to determine their own reservation prices under multiple probabilities.

This is in contrast to Thomas Miceli’s claim that paying no compensation is the only compensation rule that leads to efficient investment if landowners’ valuations of their properties differ from each other. (See Miceli, supra note 29, at 290).
value receives a rebate. If the government finds that the probabilities of takings change before a final decision is made, it announces the new probabilities. This announcement of changed probabilities does not induce any immediate tax consequence, but it does mean a change in the monthly payments that compensate owners for the reduced rental value that results from being subject to the possibility of a taking, and it requires that the tax consequences of any changes in owners’ valuations be calculated with the revised probabilities.

The final step of the taking event is the resolution of uncertainty when the government decides whether or not to take each property. The owners of the properties that the government decides not to take receive no further compensation. Efficiency requires that, if the government takes a property, it pays the amount that the owner has announced. Fairness—although not efficiency—requires that owners receive these compensation payments for takings.78

In contrast with the discussion in Section II where we assumed that the government can observe property values, the government’s inability to observe property values introduces a potential source of inefficiency. Because the government must rely on a third party appraisal of appropriate announcement compensation, it may either over- or undercompensate owners for announcing that it may take their properties in the future. However, inaccurate announcement compensation mainly affects the fairness of the taking event: either owners are undercompensated for the reduction in property values or the amount that taxpayers must pay

78 Paul Nieman and Perry Shapiro suggest that whether or not a particular taking mechanism is efficient and can be considered fair may depend on the sequence of events. The taking mechanism that they propose leads to efficient and fair takings only if the landowners’ investment decisions and the government’s taking decision are made simultaneously (assuming that the values of all properties are identical and known), but not if landowners make their investment decisions before the government makes its taking decision. See Nieman & Shapiro, supra note 27, at 161 – 162. In contrast, the combination of our two mechanisms leads to efficient and fair takings regardless of whether the investment and taking decisions are made simultaneously or sequentially, and it requires neither identical nor observable property values.
to finance the government’s announcement compensation payments exceeds the value that the
announcement destroys. Inaccurate announcement compensation affects efficiency only if
such inaccuracy either deters an otherwise socially optimal taking or leads the government to
implement a project whose social value is lower than the property values that it destroys.\footnote{79}

\section*{C. The Fairness of Self-assessment in Takings Under Eminent Domain}

One limitation of the self-assessment mechanism is that the mechanism makes it impossible for
an owner to give his property an infinite value—that is, to refuse all offers—because the
owner’s valuation tax liability for property with infinite value would be infinite as well.
However, because the opportunity cost of refusing all offers is infinite, it is unlikely that many
owners would refuse to sell their properties at any price. Even elderly owners who want to
continue living in the home in which they have lived for many years may be moved to sell for
an amount that enables them to make a very large contribution to a cause dear to their hearts—
be that their grandchildren, their church, their community, or medical research. Thus the
impossibility of announcing an infinite reservation price should not be considered a serious
limitation of the mechanism.\footnote{80}

\footnote{79} It is worth keeping in mind that it is impossible to ensure efficient behavior under uncertainty. In
most applications of our mechanisms, the requirement to pay announcement compensation is likely to
add an amount to the government’s overall cost of the taking event that is small in comparison with the
amount that the government must pay as taking compensation. If the estimated social benefit of the
government’s project is so close to the amount to be paid as compensation for the actual taking that
inaccuracies in the announcement compensation payments might alter the government’s decision of
whether or not to take the properties, then it is probably prudent to forego the project altogether, in view
of the likelihood of substantial uncertainty in the estimate of the social benefit of the project.

\footnote{80} Note that, if a high value of properties reduces the likelihood that the government will take the
property, then, ideally, the marginal valuation tax rates fall as owners state higher values. Thus the tax
on property with infinite value would be infinite only if there was a positive probability that the project
that the government seeks to implement has an infinite value as well.
Another limitation of the self-assessment mechanism arises from the fact that property that is taxed is not worth as much as property that is not taxed, so that the mechanism only reveals the owner’s reservation price under the valuation tax. A high tax burden, which may result from sufficiently high taking probabilities, might require some owners to lower their reservation prices for their taxed properties by significant amounts. To reduce this effect of the valuation tax, the mechanism described above specifies that the government will return the tax revenue to the owners in a way that does not distort their incentives to reveal their true reservation prices (see Sections III.A and III.B supra). The net burden on all owners who are not fully compensated is the social cost of learning owners’ reservation prices through the self-assessment mechanism. To further reduce the burden on such owners, the government can provide additional lump-sum assessment compensation to all owners who are subject to the valuation tax. The social cost of the self-assessment mechanism is then the burden on tax payers who finance the additional lump-sum compensation, as well as the excess burden of distortive taxes that are used to raise the necessary funds.

In other applications of the self-assessment mechanism, the requirement that owners sell their properties if someone wants to buy the properties at the owners’ self-assessed prices may be regarded as intrusion on established property rights. However, this concern does not arise in taking cases: if only the government is permitted to buy properties at the owners’ self-assessed prices, then the government will not buy any properties that it would not have taken under eminent domain if the self-assessment mechanism were not in place.81 The requirement to sell therefore constitutes the same intrusion into property rights as eminent domain always

81 Because the government will not acquire properties if their self-assessed values exceed the social benefit of the public project, the government is likely to take fewer properties under the self-assessment mechanism than it would take if it had to compensate owners at the estimated market values of their properties.
entails. Because the self-assessment mechanism ensures that owners receive the amounts at which they would voluntarily sell their properties, rather than amounts that someone else considers reasonable, one can expect that owners would generally prefer the self-assessment mechanism to conventional assessment methods.\(^\text{82}\)

One might object to the self-assessment mechanism on the grounds that owners may have insufficient information to assess the values of their properties. But owners whose local governments assess all properties for property tax purposes can use these values as guidance, and simply add moving costs to these values if they have no reason to doubt their assessments. Governments already use assessed values to determine the compensation that owners will receive if their properties are taken, so this practice does not make owners any worse off under the self-assessment mechanism than they are when governments take their properties under eminent domain.\(^\text{83}\) However, owners who are unwilling to sell their properties at assessed values can state their true reservation prices, thereby ensuring that they will receive compensation for their true losses, rather than amounts that someone else considers reasonable. To eliminate all concerns that owners might consider themselves worse off under the self-

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\(^\text{82}\) Amnon Lehavi and Amir Licht (\textit{supra} note 72, at 1730) emphasize the cost and complexity of monitoring mechanisms as an argument against self-assessment. However, our self-assessment mechanism only requires governments to collect and redistribute valuation taxes on the basis of the self-assessed values. The assessment and collection of such taxes does not require any activity that is not already part of the collection of conventional property taxes, and the owners’ announcements of their reservation prices can occur through existing channels available for appealing property assessments. Even the redistribution of the valuation tax revenue among the owners (see \textit{supra} Section III.A) does not require any information besides the assessment of property values that is already necessary for the collection of conventional property taxes.

\(^\text{83}\) Owners whose properties are taken often receive compensation that exceeds the assessed values of their properties. This practice is necessary because governments acknowledge that owners may value their properties above the assessed values. (See, for example, Abraham Bell, \textit{Private Takings}, U. CHICAGO LAW REV., forthcoming, available at SSRN: http://ssrn.com/abstract=1274083, 64 – 65). Because our self-assessment mechanism permits owners to state at how much more they value their properties, it would be unnecessary to pay an owner who accepts his assessed value more than this amount.
assessment mechanism, the government could offer each owner the choice of using the self-assessment mechanism or accepting a third party assessment of the value of his property. To maintain the incentive of owners to report their valuations accurately, it would be necessary to specify that an assessor was not allowed to use an owner’s valuation to defend the valuation of that property for property tax purposes, although the owner’s valuation could be used to defend the assessed values of other properties in the neighborhood.

Although we have motivated the self-assessment mechanism by its similarity to property insurance, it is worth emphasizing that the mechanism does not amount to government-provided insurance. The essential difference between our mechanism and property insurance is that with property insurance, owners receive compensation from the insurance company, rather than the person whose actions have led to an insurance claim. For example, in the case of a homeowner whose home is destroyed through arson, the insurance company rather than the arsonist compensates the owner for his loss. In contrast, when a property owner self-assesses his property, the entity whose action causes the owner to lose control over his property must compensate the owner for his loss; the government merely administers the valuation tax and enforces the payment of compensation. In the application to takings, the agency that takes the property will have to compensate the owner, not the agency that administers the self-assessments.

The self-assessment mechanism has applications in law beyond takings under eminent domain. One possible application is in tort cases, when owners anticipate substantial losses and believe that courts are likely to award them amounts that do not cover their true losses.\footnote{See Levmore, \textit{supra} note 21, at 810 – 837 for a detailed discussion of the applicability of self-assessment to torts. Self-assessment in torts would be acceptable only if plaintiffs have incentives to self-assess their damages honestly, because tortfeasors would have reason to object to having to pay multiples of the market prices of lost or damaged properties if these payments might not reflect the...}
Such owners could voluntarily self-assess their properties at a private or public valuation company before the tort occurs; this company would collect the premiums and distribute the total revenue, minus a fee for their services, among all owners in a way that does not distort the owners’ incentives to assess their properties honestly, as described above. In tort cases, the court would simply award the plaintiff the self-assessed amount, payable by the tortfeasor. Self-assessment is clearly different from buying insurance against damages, because the valuation companies that collect the premiums do not compensate the owners, and can therefore refund most of the collected premiums back to the owners. The fact that there are private insurance markets for all sorts of accidents and losses indicates that it is possible to estimate the probabilities of accidents and losses and charge the appropriate premiums in ways that are acceptable to those who sell and those who buy insurance.

Another interesting application of the self-assessment mechanism is in urban renewal projects, where governments often use their power of eminent domain to overcome the holdout problem of land assembly. We discuss next how the self-assessment mechanism can solve the holdout problem and make it unnecessary to resort to eminent domain in land assembly projects.

IV. MARGINAL COST PRICING AND EFFICIENT LAND ASSEMBLY

A. Characterizations of the Problem of Land Assembly and the Holdout Problem

Consider a developer who wants to implement a project that requires simultaneous redevelopment of multiple properties with multiple owners. The developer values the combination of these properties at the difference between the present value of the project’s plaintiff’s true losses. Thus use of a mechanism like ours that provides incentive for truthful self-assessment would be essential for the acceptance of self-assessment in torts.
value when finished and the project’s construction costs, including demolition of existing structures. It is socially optimal to implement the project if the value of the assembled properties exceeds the sum of the individual property values. As before, we define the value of property as the reservation price of the owner, which implies that the monetary value of a piece of real estate is the lowest amount at which its owner would be willing to sell it voluntarily to someone who was not interested in assembling multiple parcels.85

Once an owner learns of a land assembly plan, he knows that the developer is almost certainly willing to pay more for the combination of the properties than buyers would pay for the individual properties if they were to be left unassembled. The difference between the values of the assembled and unassembled parcels is the return to assembling the properties. To capture part of the gain from assembling the parcels, every owner has an incentive to demand an amount that exceeds his reservation price.86 The amount that he demands is not his valuation of his property in isolation, but his valuation of his property as part of the area that the developer needs for the project. Governments can ameliorate the holdout problem by taking the properties of such owners under eminent domain. But public takings may lead to the implementation of projects that should not be implemented because their net benefits are smaller than the sum of the owners’ losses. Thus the holdout problem is only a part of the more general problem of land assembly: the problem of ensuring that parcels are assembled if—and only if—the project’s net social benefit exceeds the values of the individual properties.

85 See supra Section III.A.

We define any owner who demands an amount above his reservation price, as defined supra, as a holdout. As long as the sum of the amounts that owners demand is below the amount at which the developer values the assembled parcels, holding out affects only the distribution of the gains from trade and does not lead to inefficient use of land. Holdouts cause social costs when the sum of the amounts that owners demand exceeds the amount at which the developer values the assembled parcels, while the sum of the owners’ reservation prices is below this amount. For example, consider a group of owners who jointly demand $1,000,000 for their properties, although the sum of their reservation prices is only $500,000. This situation does not cause social cost if the developer’s project is worth either more than $1,000,000 or less than $500,000. It causes social cost if the developer’s project is worth between $500,000 and $1,000,000, because then the owners force the developer to either abandon a worthwhile project or implement a less efficient version of the project, either on the subset of parcels than he can acquire or at a less desirable location. Holdout behavior also causes inefficiency when the prospect of encountering holdouts induces potential developers to decline to explore projects that would be profitable if they were explored.

While there is little disagreement that holdouts can be costly, there is considerable disagreement about whether holdout problems have social costs high enough to warrant government intervention. The main difficulty in assessing the social costs of holdout problems is to determine when an owner’s refusal to sell actually constitutes holding out—that is, whether the owner is demanding a high price because he wants to capture part of the return to assembling the land or simply because he values his property highly. The owner is holding out in the former but not in the later case. A holdout can be identified unambiguously only when a
developer and an owner agree on a selling price after the owner had initially demanded a higher price. In all other cases, one has only the owner’s statement about his reservation price.

How likely is it that private bargaining will resolve the holdout problem of land assembly? The economics literature on land assembly has analyzed the motivation of owners to engage in strategic holding out, but has not offered compelling bargaining solutions. One recommendation is that developers maintain as much secrecy as possible about their projects, for example by using dummy buyers acting on the developer’s behalf. However, when owners have rational expectations, games in which developers can as well as games in which developers cannot hide their true intentions may have equilibria that are equally socially undesirable. In addition, communities that seek to undertake urban renewal projects that require land assembly must generally make their intentions public and cannot hide the projects’ locations from their citizens. In the context of reducing urban sprawl, cities may also adopt policies that lower the cost of development in inner cities (for example, through subsidies or tax breaks) as well as policies that increase the cost of development at the urban fringe (for example, through zoning or development fees). However, it is important to keep in mind that


all government regulations, no matter how well intentioned, can have undesirable distortionary consequences.\textsuperscript{92}

The main difficulty in seeking to determine whether private bargaining generally solves the holdout problem of land assembly is that there are no reliable estimates of the frequency of holdout problems. Obtaining such estimates is difficult because a developer who anticipates a costly holdout problem might not attempt to assemble the parcels, so that the possibility of refusing to sell does not even arise. Similarly, if the government can take private properties for development under eminent domain, then the mere threat of invoking eminent domain may induce owners to sell their properties to a developer if they fear that their compensation for taken properties would be below the developer’s offer, thereby creating the appearance that the developer and owners were able to reach voluntary agreements. Conversely, invoking eminent domain precludes any agreement between the developer and the owners that might otherwise have been reached, thereby creating the impression of a holdout problem that bargaining could not resolve. The same appearance of a holdout problem arises whenever a developer decides to implement his project elsewhere after encountering owners who are reluctant to sell, even though he and the owners might have come to an agreement had bargaining continued.

The lack of reliable estimates of the frequency and cost of holdout problems makes it impossible to determine whether private bargaining or government intervention generally minimizes the expected social cost of land assembly. However, the expected cost of relying on private bargaining is highest when holdout problems are most likely to occur. Property owners are most likely to hold out when developers cannot assemble parcels secretly, when all parcels need to be assembled to implement the project, and when owners believe that the value of the

\textsuperscript{92} Geoffrey Turnbull, \textit{The Investment Incentive Effect of Land Use Regulations}, 31 J. REAL ESTATE FINANCE ECON. 357 (2005).
assembled parcels is much higher than that of the unassembled properties. Urban renewal projects are the most likely land assembly projects to meet these criteria, which makes it most relevant to consider alternatives to private bargaining in this context.

Note that the taking mechanism that we describe supra cannot be applied to takings for private development, because the private developer rather than the government must fund the compensation that owners receive if their properties are taken. If the government is not aware of the possibility that a developer intends to develop multiple properties, then it does not announce a probability that it might take private properties and therefore does not have to pay announcement compensation, which is an essential component of the taking mechanism. If, however, the government announces its plan for urban renewal and estimates the probability that private redevelopment will occur, then it can escape having to pay compensation for announcing this probability by announcing a probability of zero. Because the government does not pay compensation for taken properties, it faces no penalty for announcing a probability that is too low. We show next that the self-assessment mechanism that we introduce supra in Section III.A can solve the land assembly problem in urban renewal projects without any need for government takings.

B. Resolving the Problem of Land Assembly through Self-assessment

Land assembly will not be socially efficient if (a) owners can increase the amounts at which they offer to sell their properties when they learn about the developer’s intent to assemble the properties, and (b) developers are motivated to implement inefficient projects because they do not need to pay the owners’ full reservation prices. Thus the key to solving the land assembly problem is to require all parties involved to pay the marginal costs of their actions—that is, to
determine the sum of the owners’ reservation prices and to ensure that developers can assemble the parcels if—and only if—they pay this amount.

Requiring all owners to self-assess their properties under the self-assessment mechanism that we discuss supra provides each owner with the incentive to reveal honestly his reservation price. A developer who wants to assemble multiple parcels can then acquire them by simply paying to each owner the amount that the owner has announced previously. The mechanism solves the holdout problem because owners cannot revise their reservation prices when the developer makes his offer. Because the mechanism provides owners with the incentive to announce their true reservation prices and because the developer will acquire the parcels only if his willingness to pay exceeds the sum of the reservation prices, the mechanism also solves the more general problem of land assembly by ensuring that only worthwhile projects are implemented. Finally, because each owner receives his reservation price when the developer assembles the parcels, the mechanism ensures that owners are fully compensated for their lost properties. Thus our self-assessment mechanism leads to efficient and fair land assembly without any need for government takings.

As discussed supra, owners have an incentive to announce their true reservation prices only if they believe that the valuation tax rate equals the probability that someone will buy their properties. Owners will report amounts above (below) their reservation prices if they believe that these probabilities are larger (smaller) than the marginal valuation tax rates. However, for the purpose of facilitating land assembly for private redevelopment, it is not necessary to require that everybody be able to purchase properties at the owners’ revealed prices; it is only necessary that developers who want to redevelop multiple properties be able to do so. Thus the government only needs to estimate the probability that someone seeks to
acquire and redevelop multiple properties. Because most owners are unlikely to have private information about how attractive their properties are for developers interested in land assembly, they are more likely to agree with a government’s estimate of the probability that the properties will become part of a land assembly than with estimates of the probabilities that someone will acquire individual properties without assembling them. The self-assessment mechanism does not require that the government estimate this probability correctly, but only that owners believe that the government has estimated it correctly and has set the appropriate valuation tax rate.

If governments refund the valuation tax revenue to owners, then the self-assessment mechanism leads to unintended redistribution when governments are unable to measure private property values perfectly, because the governments must refund the revenue from the valuation tax in a way that is not influenced by the amounts that individual owners pay. The lower the probability that someone wants to purchase properties at the self-assessed prices, the lower are the owners’ valuation tax payments and the smaller are the unintended redistributive consequences. Thus requiring owners to sell their properties only to developers who intend to assemble multiple parcels has the advantage of lowering the probability of a mandatory sale

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93 If the government anticipates multiple developers to assemble different groups of parcels (for example, different blocks), then it must estimate the probability of redevelopment for each group separately.

94 The following scheme has a reasonable prospect of generating believable estimates of the probability of redevelopment: an assessor is asked to estimate the probabilities of redevelopment for all groups of parcels in the urban area, and he is paid for each estimate. The public is then invited to offer alternative probabilities of redevelopment. For each property on which the assessor’s probability is not the median of the offered probabilities (one of the two medians in the case of an even total number of estimates), the person who offered the median estimate (a person chosen randomly from those who proposed the median if there is more than one) is chosen to bet on whether there will be development, at odds midway between the assessor’s estimate and the median, with the amount of the bet such that the assessor will exactly lose his fee if he loses the bet. The median of the offered probabilities becomes the official probability.

95 See supra Section III.A.
compared to the case in which anyone is allowed to acquire properties at the self-assessed prices. To keep the amount of redistribution low, the self-assessment mechanism must be adopted at a time when the government identifies the need for urban renewal, but before the advent of a likely developer has increased the probability of land assembly by too much. If the government has already identified a developer who is likely to assemble the parcels, then the valuation tax payments and the resulting degree of redistribution may be so high that owners will object to using the self-assessment mechanism.

C. Comparison of Self-assessment in Land Assembly with Other Methods

Our self-assessment mechanism solves the problem of land assembly because it ensures that multiple properties are redeveloped if—and only if—the project’s net social benefit exceeds the values of the individual properties. Existing methods that address the holdout problem do not solve the problem of land assembly, because they do not ensure that only efficient redevelopment projects are undertaken.

1. Comparison with Takings Under Eminent Domain. – Government takings resolve the holdout problem by eliminating the owners’ rights to refuse to sell their properties at the prices offered. The estimates of property values that are used for eminent domain purposes are generally imprecise, because they do not reflect the personal attachment of owners to their properties, which can lead to socially inefficient takings.

The public debate after the Kelo decision has shown that many people perceive the cost of takings under eminent domain for private redevelopments to be very high. This concern might not weigh so heavily if owners were fully compensated for their losses. But because compensation for takings is based on the government’s estimates of the market values of the
taken properties, owners with strong attachments to their properties receive inadequate compensation. It would be costly to require governments to routinely err on the side of the owners by awarding compensation that exceeded the government’s best guesses of what the taken properties are worth; such policies of overcompensating owners increase the cost of redevelopment and are likely to prevent the implementation of socially desirable projects.

The self-assessment mechanism resolves these difficulties by providing owners with the incentive to reveal the true values that their properties had for them before they knew of proposed land assemblies. Because developers can proceed with their projects only if they pay these revealed values, they will not implement projects with lower values. The self-assessment mechanism therefore increases the likelihood that urban renewal projects will only be implemented if they generate higher values than they destroy.\textsuperscript{96} The self-assessment mechanism also ensures that each owner receives the amount as compensation at which he would have voluntarily sold his property.

When a government relies on eminent domain, it does not need to act until it believes that a socially desirable land assembly is about to fail. Thus with eminent domain, the government incurs costs only when a developer complains about holdouts. At such a time, the government must estimate the social value of the developer’s project and the values of the properties that the developer wants to assemble, decide whether the owners’ refusals to sell constitute indeed a socially costly holdout situation, so that taking the properties is socially desirable, and then possibly take them and pay compensation to the owners. It may also have

\textsuperscript{96} Application of the self-assessment mechanism implies that developers rather than government officials make the ultimate assessment of whether the benefit of redevelopment exceeds the owners’ reservation prices. Because developers are likely to have better information about the value of their projects than government officials have, and because developers are likely to be more motivated than government officials to redevelop properties only if the benefit of redevelopment exceeds the cost of compensating the owners, developers are more likely than government officials to make socially efficient decisions regarding the redevelopment of the properties in question.
to defend its taking decision in court, when owners sue the government because they consider their compensation inadequate.

The self-assessment mechanism, on the other hand, must be put in place before a developer has attempted to assemble any parcels. Thus the government incurs costs of estimating the probability of a land assembly and announcing it to the owners, as well as the cost of collecting the valuation tax and redistributing its proceeds among the owners. It needs to repeat this process periodically to permit owners to reassess their properties when their subjective valuations have changed. The self-assessment mechanism therefore imposes a continuing cost on the government. However, with the exception of estimating the probability of a land assembly, many local governments already undertake these tasks on an annual basis when they collect property taxes and permit owners to contest the values at which their properties are assessed for tax purposes. Thus the marginal cost of implementing the self-assessment mechanism in these communities is fairly small. In addition, unlike the situation with eminent domain, the government does not incur any additional cost when a developer decides to assemble multiple parcels.

One might object to the use of our self-assessment mechanism in land assembly because it requires owners to sell their properties against their will. However, recall that here we are advocating the use of self-assessment for urban redevelopment when the government is already prepared to intrude on private property rights by using eminent domain if it believes that a socially desirable land assembly will fail. In such cases, the self-assessment mechanism does not lead to any additional intrusion on property rights, and it increases the likelihood that only efficient projects are implemented and that all owners receive full compensation for their losses, irrespective of the estimates and assessments of government officials. Of course, if
citizens consider it valuable to have accurate information on property values because, for example, they want a more accurate base for a general property tax, then they can implement our self-assessment mechanism irrespective of any planned urban renewal projects.\footnote{Plassmann & Tideman \textit{supra} note 7, at 352 – 354, describe how one can use the self-assessed values to derive a tax base for a general property tax without distorting the owners’ incentive to reveal their true reservation values.} Under such circumstances, our mechanism would facilitate all land assembly projects.

We have emphasized \textit{supra} that our self-assessment mechanism does not lead to efficient and fair land assembly if owners believe that the government has estimated the probability of a land assembly incorrectly.\footnote{See \textit{supra} Section IV.B.} But neither does government taking under eminent domain lead to efficient and fair land assembly if the government estimates the property values incorrectly. Thus whether citizens prefer their government to use eminent domain or the self-assessment mechanism ought to depend on whether they believe that their government is more likely to correctly estimate the values of all properties or to obtain a believable estimate of the probability of a land assembly. If they do not trust their government to do either with acceptable accuracy, then they must require that all land assembly projects be resolved through bargaining alone, and they must be prepared to bear the cost when holdouts prevent socially beneficial redevelopment.

2. \textit{Comparison with Other Methods Proposed in the Literature.} – The characteristic that makes our self-assessment mechanism attractive and that sets it apart from other mechanisms that have been proposed in the literature is that it provides reliable information about the reservation value of every single owner whose property is part of the planned land assembly. Other proposals that seek to either eliminate takings for land assembly or ameliorate the
valuation problem of takings do not provide information about individual reservation prices, and they therefore do not ensure that only socially efficient renewal projects are undertaken.

Thomas J. Miceli, Kathleen Segerson and C.F. Sirmans have recently proposed a simplified version of our self-assessment mechanism that does not require governments to estimate the probability that a developer wants to redevelop the properties. Their mechanism requires that the government impose a general property tax on all properties, based on its own assessments of the properties’ values. When an owner rejects the developer’s offer to buy his property, the government reassesses the property at the developer’s offer price and the owner pays general property taxes on the new assessed value. The authors show that this scheme provides risk-neutral owners with the incentive to accept offers that exceed their reservation prices. However, a developer who wants to assemble multiple properties is prepared to offer a certain amount for all parcels together, and it is not obvious how this amount ought to be divided among the owners to derive offers for the individual properties. No matter how the amount is divided among the owners, owners whose reservation prices exceed their share of the developer’s offer will reject the offer and prevent implementation of the project, even if the developer’s offer exceeds the sum of all reservation prices. If it were reasonable to believe that all owners value their properties in proportion to their assessed values, then the holdout problem in land assembly could be prevented efficiently by the simple device of a binding majority-rule vote among the owners of the parcels that the developer sought. But such

100 Their use of the general property tax differs from our valuation tax. In their mechanism, an owner who does not receive an offer pays property taxes on an assessed value that is unrelated to the owner’s reservation price, while an owner who rejects an offer pays taxes on an assessed value that does not exceed his reservation price. In contrast, our valuation tax is always imposed on the reservation prices that owners announce.
proportional valuations are unlikely, because an owner’s reservation price depends on the inconvenience of having to sell at a particular time. Even if all owners were to value their properties at their assessed values under identical circumstances, those owners who are unwilling to move when the developer makes his offer will attach a higher value to remaining in their homes than those who had planned to relocate and are glad to receive offers for their properties. Thus for this alternative mechanism to lead to efficient land assembly, there must be some way of estimating the reservation prices of all owners with sufficient precision to divide the developer’s offer in a way that every individual offer exceeds the owner’s reservation price whenever the developer’s offer exceeds the sum of the owners’ reservation prices. But if such precise estimates of the owners’ reservation prices were possible, then there would be much less resistance to government takings, because then the government could easily (1) ensure that it took private properties only when it was socially efficient to do so, and (2) compensate each owner fairly by paying his reservation price.

The recent proposal by Amnon Lehavi and Amir Licht has similar shortcomings.101 The authors propose that governments that want to attract developers acquire the properties in the designated urban renewal zone, using eminent domain if necessary, and grant ownership in these parcels to a newly established Special-Purpose Development Corporation (SPDC). This SPDC then auctions off the properties among interested developers. Owners whose properties have been taken have the choice of either accepting conventional compensation based on third-party estimates of their losses, or receiving shares in the SPDC which distributes the proceeds from the sale of the properties among its shareholders. Lehavi and Licht argue that auctions held by SPDCs provide more accurate information about the market value of the assembled

101 Lehavi & Licht, supra note 72.
properties and are thus likely to provide fairer compensation than conventional compensation mechanisms for owners who hold shares in the SPDC. However, as with the proposal by Miceli, Segerson, and Sirmans, it is not obvious how the shares in the SPDC should be allocated among the owners. Lehavi and Licht propose that shares be allocated according to pre-project estimates of the values of the properties, but such estimates are unlikely to reflect the owners’ true reservation prices (which is, after all, the main reason for the interest in self-assessment mechanisms). And if the owners’ reservation prices are unknown, then the problem reemerges that governments may find it difficult to determine with sufficient accuracy whether or not it is socially optimal to establish an SPDC. Thus while Lehavi and Licht’s proposal solves the problem that holdouts might prevent efficient redevelopment, it neither solves the more general problem of land assembly (because it does not ensure that inefficient redevelopment projects are rejected) nor does it ensure that owners are adequately compensated for their losses when efficient projects are implemented.102

Finally, Michael Heller and Rick Hills recently proposed to establish land assembly districts (LADs) as an alternative to takings under eminent domain.103 Under their proposal, owners whose properties are part of an LAD use a voting mechanism—for example, majority rule—to determine whether or not their properties ought to be sold to a developer. The main drawback of their proposal is that requiring majority rather than unanimous agreement ameliorates the holdout problem but does not solve the general problem of land assembly,

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102 In addition, the SPDC’s auction can only provide reliable information about the market price of the joint properties if multiple developers engage in non-strategic bidding. Often, however, there is only a single developer who shows credible interest in assembling the properties.

103 Heller & Hill, supra note 35.
because it does not ensure that only efficient projects will be implemented. Assume that, for a proposed assembly of ten properties, eight owners value their properties at $200,000 each, two owners value their properties at $500,000 each, and the developer is prepared to pay $2,000,000 for the ten properties. The project should not be implemented because the sum of the owners’ reservation prices exceeds the project’s value, but the project will nevertheless go forward because the amount offered satisfies 80 percent of the LAD’s constituents.

Still, the concept of an LAD is attractive because it provides a general framework for the application of our self-assessment mechanism. Michael Heller and Rick Hills offer a useful outline of the formation of LADs, their jurisdictional rules, and how individual owners can opt out of LADs. If their proposed majority decision is replaced with our self-assessment mechanism, then the concept of an LAD can be used to motivate the requirement that certain owners self-assess their properties. Thus our proposal to use self-assessment in urban renewal projects can be implemented as an improved variant of Heller and Hill’s framework of LADs.

CONCLUSION

The concept of marginal cost pricing has numerous, widely discussed applications in law besides government takings. Guido Calabresi pioneered its application to tort and property

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104 Majority rule ameliorates rather than solves the holdout problem because even a majority of owners may overvalue their properties sufficiently to prevent the implementation of socially efficient projects.


law more than 40 years ago. By no means do we claim that our use of marginal cost pricing is original, nor could we possibly claim that marginal cost pricing can solve all problems. Marginal cost pricing merely provides incentives for efficient use of scarce resources, and it is possible to prove this assertion because efficiency is a well-defined concept. To the extent that there are other goals besides efficiency—for example, fairness—on whose definition there is much less agreement and that may turn out to be incompatible with efficiency, marginal cost pricing may be inappropriate if one places sufficient weight on these other goals relative to efficiency.

Nevertheless, it is interesting that three different strands of literature that seek to improve efficiency in government takings have failed to apply the principle of marginal cost pricing consistently. A possible explanation is that, to resolve inefficiencies in takings and self-assessment, applications of marginal cost pricing need to account for departures from efficient behavior in two directions. In taking cases, governments must have the incentive to neither over- nor understate the probabilities of takings, and owners must have the incentive to neither invest too much nor too little in properties that may be taken. With regard to self-assessment, owners must have the incentive to neither over- nor understate their reservation prices. In contrast, more conventional applications of marginal cost pricing need to account for inefficient behavior in only one direction, which requires a less elaborate incentive mechanism. For example, polluting firms need to be discouraged from polluting too much, but there is no need to deter them from polluting too little. Insurance companies need to consider mechanisms that provide incentives to policy holders to take full account of the risk of their

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108 It is, of course, necessary to ensure that the deterrence is not so strong that it provides incentives to produce less than the socially optimal quantity of pollution.
activities, but insurance companies are generally not concerned that policy holders may be too careful. In reference to our examples in the introduction, motorcyclists need to be encouraged to make fewer nighttime excursions through residential neighborhoods, but there is little concern that they take too few such trips, and the social inefficiency caused by drivers who pay too much attention to traffic lights and neglect their conversations with passengers generally does not warrant public intervention.

Applications of marginal cost pricing that are intended to deter agents from doing either too much or too little of an activity, but not from doing both, can generally employ a single instrument to provide incentives for efficient behavior. Pigouvian taxes on activities that cause pollution, fines for engaging in socially undesirable behavior, and deductibles and co-payments for obtaining medical treatment provide sufficient incentives to reduce socially inefficient activities and behavior. In contrast, applications of marginal cost pricing that seek to deter agents from doing too much as well as from doing too little of an activity need to employ two instruments that generally cannot both be applied directly to the activity in question. The requirement to pay announcement compensation provides an incentive for government officials to overstate the probability of a taking, but only the additional requirement to pay taking compensation prevents them from understating this probability. Similarly, the valuation tax on the self-assessed value at a rate equal to the probability of a taking provides an incentive for owners not to overassess their properties, while the requirement to sell properties at the self-assessed values provides the corresponding incentive against underassessments. In each case, appropriate incentives for truth-telling result from the combination of two separate

\[109\] The social inefficiencies that result from overestimating the risk of activities are the concern of policy makers but not of insurance companies.
instruments.\textsuperscript{110} This additional degree of complexity may have prevented previous authors from applying marginal cost pricing consistently to takings and self-assessment.

Whether one finds our marginal cost pricing mechanisms attractive depends largely on whether one believes that a sufficiently large social benefit may justify the compulsory sale of private property. Neither of our mechanisms intrudes on established property rights any more than eminent domain does, and both mechanisms lead to compensations to property owners that the owners themselves consider appropriate. In addition, and in contrast with previously proposed mechanisms, implementation of our mechanisms requires only information that is generally available. We therefore argue that both mechanisms constitute feasible and attractive improvements to government takings and land assembly in urban renewal projects. However, if one considers the compulsory sale of private property not acceptable under any circumstances, then one must also reject takings under eminent domain and be prepared to tolerate the social inefficiency that can arise when property owners refuse to sell.

\textsuperscript{110} Note that the same argument holds for the owners’ investment decisions: owners of properties that may be taken have no incentive to overinvest if they are not compensated for inefficient investment and if, as it is the case under our self-assessment mechanism, the taking decision does not depend on the owners’ actual levels of investment. Owners have no incentive to underinvest because they bear the full marginal cost of doing so if their properties are not taken—they would own properties that are worth less than they would have been worth under efficient investment. Thus our self-assessment mechanism provides the incentive against overinvestment while the owners’ property rights that permit them to enjoy the fruits of their investments if their properties are not taken provide the corresponding incentive against underinvestment.