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Private Property, Public Use, and Just Compensation: The Economics of Eminent Domain

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Abstract

The eminent domain clause of the U.S. Constitution concerns the limits of the governments right to take private property for public use. The economic literature on this issue has examined (1) the proper scope of this power as embodied by the 'public use' requirement, (2) the appropriate definition, and implications, of 'just compensation,' and (3) the impact of eminent domain on land use incentives of owners whose land is subject to a taking risk. This essay reviews this literature and draws implications for our understanding of eminent domain law.

Journal of Economic Literature Classification: K11, R52

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Private Property, Public Use, and Just Compensation: The Economics of Eminent Domain

1. Introduction

The Fifth Amendment of the U.S. Constitution says that the government shall not take private property for public use without paying just compensation.¹ This provision, referred to as the eminent domain, or takings, clause, has generated an enormous amount of case law and scholarly literature aimed at determining exactly what sort of government actions constitute a compensable taking, and what amount of compensation should be paid when they do. Economists have made a substantial contribution to this debate regarding both the proper scope of takings and the conditions under which compensation should be paid.

The takings clause has two key components: (1) the public use requirement, and (2) the just compensation requirement. These components serve to restrict the conditions under which the government can take private property. The public use requirement restricts when the taking of private property is justified. In terms of efficiency, government intervention in the market is justified for providing public goods and regulating externalities. In its role as a public good provider, the government often seeks to use eminent domain to acquire the necessary land, an action that seems acceptable based on the plain meaning of the eminent domain clause, given that the land is being put to “public use.” However, economists have argued that the proper justification for takings is to overcome the holdout problem associated with land assembly, which suggests that eminent domain should not be used for all public projects, only those

¹ The actual clause reads: “nor shall private property be taken for public use, without just compensation.”

involving assembly. More controversially, it implies that eminent domain should also be available for private projects requiring assembly, as in the case of urban renewal. The recent Supreme Court decision in *Kelo v. New London*² reflects this logic.

The second component of the takings clause, that users of eminent domain must pay “just compensation,” specifies the terms under which private property can be taken. These terms can affect both the distribution of the benefits and costs associated with the taking, and the incentives parties face. Courts have defined just compensation to be the fair market value of the taken property. Although it might appear that this requirement protects the interests of private property owners, many have argued that this measure under-compensates owners because it does not reflect the amount they would accept in a consensual sale. It therefore creates the risk of excessive transfer of private property to public use, as well as raising questions of fairness. The difficulty with using the owner’s true reservation price as the measure of compensation, however, is that it is unobservable, which creates the countervailing risk of opportunism by sellers. Thus, the market-value measure represents a practical compromise.

Eminent domain is typically couched in terms of physical acquisitions of property, for which compensation is universally required by courts. Much more pervasive, however, are government regulations that restrict the use of private property without physically acquiring it. Examples include zoning, environmental and safety regulations, historic landmark designation, and laws promoting equal opportunity for disabled or other disadvantaged groups. Historically, courts have granted governments broad police power to enact such regulations in the public interest without triggering the need for compensation. Occasionally, however, a regulation goes so far in reducing the

² 125 S.Ct. 2655, 545 U.S. 469 (2005).

value of a regulated property that the owner seeks to have the regulation declared a “regulatory taking” for which compensation is due.³

From an economic perspective, there is no substantive difference between a government action that involves an outright seizure of property for purposes of providing a public good, and one that merely regulates that property for purposes of preventing an external harm (Kaplow, 1986; Hermalin, 1995). In both cases, the government imposes a cost on the landowner in order to provide a social benefit, where the action is justified on efficiency grounds only if the gain (whether in the form of a benefit conferred or a harm prevented) exceeds the cost. From a legal perspective, however, the question of whether compensation is due is treated quite differently in the two types of cases—it is virtually always required for physical acquisitions (however slight), but is rarely required for regulations.

While much of the discussion of just compensation for takings has addressed its “justness,” most recent economic analyses have focused on a different aspect of the compensation question—namely, whether the payment of compensation creates a moral hazard problem that causes landowners to overinvest in land that may be suitable for public use. (This literature does not distinguish between physical and regulatory takings.) The key result in this area, due originally to Blume, Rubinfeld, and Shapiro (1984), says that compensation must be lump sum in order to prevent moral hazard. A corollary of this conclusion is that zero compensation is efficient.

While the economic logic of this “no compensation result” is unassailable—it represents a direct application of standard results from the economics of insurance—it has understandably generated considerable controversy because of the perceived

³ Such claims take the form of so-called “inverse condemnation suits.”

unfairness of the proposal, as well as its apparent inconsistency with the constitutional requirement of just compensation (at least in the case of seizure). As a result, several counterarguments have emerged to justify compensation, including the need to restrain excessive government takings, the perverse incentives that a no-compensation rule creates for the timing of development, the insurance benefits that compensation provides to risk-averse landowners, and the “demoralization costs” that arise when compensation is not paid. The conclusions from these studies shed considerable light on takings law, particularly in the area of regulatory takings.

In this essay, we present an overview of the economics of eminent domain. We begin in Section 2 with a brief review of the relevant case law, both for physical acquisitions and for regulatory takings. We then survey the academic literature that examines eminent domain from an economic perspective. Section 3 considers the economic justification for eminent domain, focusing on the public use requirement and the land assembly problem. Section 4 examines the just compensation requirement, focusing primarily on its distributional implications. Section 5 then surveys the literature on the impact of compensation on the incentives of landowners to invest in property subject to a taking or regulatory risk, and also of the government to exercise its taking or regulatory powers. Finally, Section 6 summarizes our conclusions. Throughout the essay, we draw on a simple modeling framework that can be readily adapted to address various issues that have been discussed in the literature. This allows us to examine these issues within a common paradigm.

2. An Overview of the Case Law

2.1. Physical Acquisitions

As noted above, physical acquisitions of land universally require compensation.⁴ The question then becomes, what is the proper amount of compensation? The Constitution requires just compensation, which the courts have interpreted to be the fair market value of the taken property. What constitutes market value, however, is sometimes open to interpretation. For example, following the assassination of President Kennedy in 1963, the government took title to various personal possessions of Lee Harvey Oswald as part of its evidence collection. The statute authorizing this action required that just compensation be paid to his widow. The question arose as to what constituted the fair market value of these items. The district court awarded \$3,000, based on the fair market value of items that were “similar in kind” to the items taken. However, the appeals court increased the award to over \$17,000, which reflected the market value of the actual items as enhanced by their connection to the infamous crime.⁵ Similarly, in 1997 the government took possession of the “Zapruder film,” a home video that captured the assassination on film, declaring it a public record. Again, the question arose as to the fair market value of the film. In this case, a three judge panel awarded the family \$16 million in compensation. The point is that it is not clear how one should determine fair market value in such cases.

While the legal definition of just compensation is, at least in principle, settled law, the question of what constitutes public use is not. Although the law is clear that it includes the provision of public goods such as parks, roads, and hospitals, the extent to which public use also includes a broader set of actions aimed at increasing public well-

⁴ See *Loretto v. Teleprompter Manhattan CATV*, 423 N.E.2d 320 (1981), reversed 458 U.S. 419 (1982).

⁵ See *Porter v. United States*, 473 F.2d 1329 (5th Cir. 1973), and *Adelstein* (1974).

being has been open to debate. This question arises most notably in the case law involving the use of eminent domain to acquire land for use in private projects with some purported social benefits such as economic redevelopment.

In general, the courts have upheld the right of the government to use eminent domain for economic redevelopment projects. An early case establishing this principle was *Berman v. Parker* (348 U.S. 26, 1954), which involved a redevelopment plan by Washington, D.C., that sought to eliminate blight and redesign neighborhoods. The Supreme Court found that all property in the designated area, including non-blighted property, could be taken by eminent domain, since redevelopment of the entire area was in the public interest. Similarly, in *Poletown Neighborhood Council v. City of Detroit* (304 N.W.2d 455, 410 Mich. 616, 1981), the Michigan Supreme Court allowed the city to condemn an entire ethnic neighborhood in order to clear the way for a new General Motors assembly plant. The Court argued that, although the intended use of the acquired land was private, the public use requirement was satisfied by the new jobs and tax revenue that the plant would provide.

In *Hawaii Housing Authority v. Midkiff* (467 U.S. 229, 1984), the Supreme Court upheld the Hawaii Land Reform Act, which allowed the use of eminent domain to transfer land from lessors to lessees. In this case, the statute sought to correct a land market inefficiency stemming from an extraordinary concentration of landownership that prevented the “normal functioning of the State’s residential land market.” In its ruling, the Court noted that “government does not itself have to use property to legitimate a

taking; it is the taking's purpose, and not its mechanics, that must pass muster under the Public Use Clause."⁶

Recently, the Supreme Court revisited the question of what constitutes public use in *Kelo v. New London* (125 S.Ct. 2655, 545 U.S. 469, 2005). The case concerned a development plan adopted by the city of New London in 2000 aimed at revitalizing the distressed downtown and waterfront areas of the city. The plan included taking the needed land from unwilling sellers, several of whom filed suit to block the condemnation of their homes. The Connecticut Supreme Court found for the city, arguing that the planned development satisfied the public use requirements of both the State and U.S. Constitutions. In 2005 the U.S. Supreme Court agreed.

Although there is considerable case law establishing the basic principle that public use includes private uses with public benefits, courts have not universally accepted this principle. For example, in 2004 – just a year before *Kelo* – the Michigan Supreme Court reversed its holding in *Poletown*. In *Wayne v. Haycock* (684 N.W.2d 765, 471 Mich. 445, 2004) the Court emphatically rejected its earlier argument that a private taking can satisfy the public use requirement merely by demonstrating a general economic benefit of the project to the community. It argued that its ruling in *Poletown* was contrary to the fundamental protection of property rights afforded by the Constitution. These two conflicting opinions from the same court reveal the lack of consensus among judges regarding the exact meaning of public use.

2.2 Regulatory Takings

The case law on regulatory takings has established several principles for determining when a government regulation constitutes a taking for which compensation is due. These

⁶ See LacCroix and Rose (1995) for an economic analysis of this case.

include: (1) the noxious use doctrine, (2) the diminution of value test, (3) the existence of investment-backed expectations, (4) the existence of a reciprocity of advantage, and (5) the nuisance exception. This section provides a brief overview of the key cases that established these principles.

The noxious use doctrine was established in 1887 in *Mugler v. Kansas* (123 U.S. 623, 1887). The case involved a challenge to a Kansas state law prohibiting the operation of breweries because they were public nuisances. In this case, the Supreme Court ruled that the government could act under its police power to prevent activities that are “injurious to the health, morals, or safety of the community,” so-called “noxious uses,” without the need to pay compensation for any associated reduction in land value.

In 1922 the Court altered this position in the famous case of *Pennsylvania Coal Co. v. Mahon* (260 U.S. 393, 1922) when it established the “diminution of value” test. The case challenged a Pennsylvania statute that prohibited coal companies from any mining that threatened the safety of surface owners due to cave-ins. The Court ruled that a regulation that “goes too far” in reducing the value of a landowner’s property constitutes a taking and hence requires compensation, even when the regulation seeks to prevent public harm. This case marked a watershed in takings law because, previously, takings were usually limited to physical acquisitions of property by the government; until then, most efforts to obtain compensation for “mere regulations” had failed, due in large part to the noxious use doctrine.

However, the Court in *Pennsylvania Coal* did not articulate a test for determining when a regulation had gone too far, leaving it instead to be determined on a case-by-case basis. The Court did not argue for a general rule of compensation because it recognized

that the government “could hardly go on if to some extent values incident to property could not be diminished without paying for every such change in the law” (*Pennsylvania Coal v. Mahon* 1922, p. 413). At the same time, however, it acknowledged that a rule of no compensation for regulations would, given “the natural tendency of human nature,” result in overregulation until “at last private property disappear[ed].” Thus, the diminution of value standard was meant to balance the costs of compensation (a stifled government) against the benefits of compensation (protection of private property and a limitation of government excess).

In 1978 the Court added a third factor to the consideration of whether a government regulation constitutes a taking, namely, whether it interferes with “distinct, investment-backed expectations” of the landowner. This factor is similar to the diminution of value test in that it considers the effect of the regulation on the landowner (as opposed to the nuisance exception, which focuses on the purpose of the regulation). The case, *Penn Central Transportation Co. v. City of New York* (366 N.E.2d 1271, N.Y. 1977; affirmed 438 U.S. 104, 1978), involved the question of whether the City of New York could prevent the owners of Grand Central Terminal from erecting an office tower over the terminal by declaring it an historical landmark. The Court held that it could, without being obliged to pay compensation.

A dissenting opinion in the *Penn Central* case suggested a fourth factor for consideration, which the Court subsequently adopted in the 1980 case of *Agins v. Tiburon* (157 Cal.Rptr. 373, 1979; affirmed 447 U.S. 255, 1980). In this case, the Court held that a landowner subject to a zoning ordinance “will share with other owners the benefits and burdens of the city’s exercise of its police power. In assessing the fairness

of zoning ordinances, these benefits must be considered along with any diminution in market value that the appellants might suffer” (*Agins v. Tiburon*, 1980, p. 262). In adopting this view, the Court embraced the argument from the *Penn Central* dissent that “a taking does not take place if the prohibition applies across a broad cross section of land and thereby ‘secure[s] an average reciprocity of advantage’.”

Finally, in 1992, the Court added another consideration for determining whether a regulation would constitute a taking. The so-called “nuisance exception” stated that government regulations that prohibit activities that would not be allowed under a state’s common law of nuisance would not require compensation, regardless of their impact on the landowner. The case, *Lucas v. South Carolina Coastal Council* (112 S.Ct. 2886, 505 U.S. 1003, 1992), concerned a developer who had purchased two identical beachfront lots with the intent of developing them for residential use. Although development was permitted at the time the lots were purchased, the State subsequently passed a law that prohibited development, prompting the developer to seek compensation under the takings clause. The South Carolina Supreme Court ruled in favor of the State, based on the broad regulatory powers that have been granted to state and local governments, but the U.S. Supreme Court reversed the decision and found that compensation was due. The reversal invoked the diminution of value principle, arguing that the law deprived the landowner of “all economically beneficial use.” However, the Court included a provision that, if the state could show that the prohibited activity would also be prohibited under the common law of nuisance, it could avoid paying compensation. This gave rise to the “nuisance exception,” which mirrors the noxious use doctrine.

This brief overview of case law has identified a number of factors that the courts have considered in implementing the takings clause of the Constitution. We turn next to the question of what economics can contribute to our understanding of these and related factors.

3. The Public Use Requirement and Land Assembly

On its face, the public use requirement would seem to limit the use of eminent domain to government provision of public goods like highways or parks. This interpretation has appeal both in terms of the plain meaning of the phrase, and the well-accepted role of the government in providing public goods. On closer examination, however, it turns out to be inconsistent, both with economic theory, and, as evidenced by the case law, with the way courts have decided public use cases. The goal of this section is therefore to develop the proper economic interpretation of public use. The discussion, which is based on the classic examination of this question by Merrill (1986), involves distinguishing between the free rider problem associated with public goods, and the holdout problem associated with land assembly (Cohen, 1991).

3.1. Public Goods and the Free Rider Problem

Public goods have the characteristic that once they are provided, their benefits are available to all consumers, including those who have not contributed to the cost of provision.⁷ Because of this non-excludability, or free-rider, problem, providers expect to have difficulty in exacting payment from consumers, which leads to underprovision of such goods by the private market. Efficiency therefore dictates that the government should either subsidize public goods, or take over their provision altogether, and then use

⁷ See generally Atkinson and Stiglitz (1980, ch. 16).

its tax powers to coerce payment from consumers. In this sense, government provision and financing of public goods requires a kind of “forced purchase” by consumers.

Although the free-rider problem provides a justification for government provision of public goods, it does not by itself justify the acquisition of land by eminent domain. For this, we turn to a second economic problem, namely, land assembly and the holdout problem.

3.2. Land Assembly and the Holdout Problem

Some large-scale projects require the assembly of several contiguous parcels of land whose ownership is dispersed. Examples include public projects like highways and parks, but also private projects like railroads and commercial developments. The problem facing providers in these cases is that, once the assembly becomes public knowledge, each landowner realizes that he or she can impose substantial costs on the developer by refusing to sell. Imagine, for example, that a road builder has decided on the optimal path for a highway and has assembled several parcels along the route. The refusal of any one owner to sell would greatly increase the cost of completing the project, if not preventing it from being completed altogether (the proverbial “highway to nowhere”). This knowledge confers significant monopoly power on landowners, who can hold out for prices significantly in excess of their true valuations.⁸

To further illustrate the nature and implications of the holdout problem, consider the following simple model.⁹ Suppose a developer wishes to acquire two adjacent parcels

⁸ For a general discussion of the holdout problem, see Cohen (1991) and Posner (2003, p. 55). For a more formal analysis, see Strange (1995). Shavell (2007) shows that eminent domain may be justified even when owners do not behave strategically to exploit their monopoly power. The mere fact that owners vary in their reservation prices, which the assembler cannot observe, may preclude market acquisition when the number of owners is large and all parcels are necessary for the project to proceed.

⁹ The model is based on Dixit and Olson (2000), Menezes and Pitchford (2001), and Miceli and Segerson (2007).

of land to complete a project worth V dollars. Each parcel is worth v dollars individually to its owner (and to the developer), but

$$V > 2v, \tag{1}$$

reflecting the value of assembly. Suppose that bargaining between the developer and the landowners can take place at two distinct time periods: “now” and “later.” The developer can proceed if he acquires both parcels now, one now and one later, or both later, but he incurs a cost of delay equal to δ dollars for each parcel acquired later.¹⁰ Assume, however, that

$$V - 2\delta > 2v, \tag{2}$$

so the project is profitable even if acquisition of both parcels is delayed. After period two, though, the project becomes infeasible.

Proceeding in reverse sequence of time, we first consider the case where both sellers refused to sell in the first period (i.e., both were holdouts). Since it is in all parties interests to reach an agreement in the second period (for after that, there is no surplus to divide), we assume that both owners sell (Cohen, 1991, p. 354). For simplicity, we assume that the sellers obtain all of the surplus from the project, which they split evenly.¹¹ Thus, each receives a price of $V/2 - \delta$. By the same logic, if both sell in period one, they each receive a price of $V/2$. Clearly, therefore, the sellers are better off if both sell in period one because this saves on the cost of delay.

¹⁰ This specification reflects an implicit assumption that early acquisition of one parcel provides some benefits to the developer. In other cases, it may not be feasible to commence the project until all parcels are acquired. When this is true, it would not be appropriate to treat the costs of delay as proportional to the number of holdouts (as we do here). Miceli and Segerson (2007) show that under this alternative scenario, a joint holdout is still a possible equilibrium (though it is not the only one).

¹¹ Miceli and Segerson (2007) consider the more general case where the parties split the surplus according to the Nash bargaining solution. None of the results depends on how the surplus is divided.

Now consider the case where one seller sells in period one, say for P_1 , while the other holds out. If the developer then acquires the second parcel in period two for P_2 , his return is $V - \delta - P_1 - P_2$, but if he fails, his return is $v - P_1$. Equating these returns and solving for P_2 yields the maximum he will pay for the second parcel:

$$P_2 = V - \delta - v. \tag{3}$$

Finally, consider the determination of P_1 . Substituting (3) into the developer's return for the overall project, setting the result equal to zero, and solving for P_1 yields

$$P_1 = v. \tag{4}$$

Comparison of (3) and (4) reveals that $P_2 > P_1$ by (2). Thus, being the lone holdout in period two is better than being the lone seller in period one. Condition (2) also implies that $V - \delta - v > V/2$ (that is, it is better to be the lone seller in period two than to sell jointly in period one), while (1) implies $V - \delta - v > V/2 - \delta$ (that is, it is better to be the lone seller in period two than to sell jointly in period two).

Given these relationships, we can now determine the equilibrium strategies of the sellers. The payoff matrix for this game is shown in Table 1,¹² from which it is easy to verify that the game has the structure of a Prisoner's Dilemma. Thus, the dominant strategy for both players is to sell "later" (that is, hold out), while the joint optimum is for both to sell "now."¹³

[Table 1 here]

It is worth noting that delay would not occur in this model if the developer were seeking to acquire a single parcel because the seller would gain no advantage by waiting

¹² Note that although the model involves two periods, we can treat it as a one-shot game given that we have assumed that any sellers who held out in period one (i.e., played "later") will sell in period two.

¹³ The same result arises if the sellers enter sequentially. In that case, the unique subgame perfect Nash equilibrium is a joint holdout.

to sell. Thus, the holdout problem is a result of strategic behavior by sellers during the “entry game” rather than a breakdown in bargaining per se. This illustrates the often misunderstood point that a true holdout problem can only occur in cases of land assembly (Miceli and Segerson, 2007).¹⁴

One solution to the problem of holdouts is to allow “forced sales;” that is, to take away an owner’s right to refuse to sell at the offered price. The power of eminent domain represents such a forced sale at a price set by the court.¹⁵ The logical implication of our discussion of the holdout problem, therefore, is that the power of eminent domain should be granted to any developer, public or private, engaged in assembly, a conclusion that seems contrary to the plain meaning of public use. We address this dilemma in the next section.

3.3. The Means-Ends Distinction and Public Use

In his analysis of public use, Merrill (1986) refers to the argument that the government alone should have the takings power, and only then when it is providing a public good, as the “ends approach” to public use because it concerns the use to which the land will be put. In contrast, the “means approach” deals with the manner in which the land is acquired—specifically, whether or not assembly is involved. Our discussion of public goods and land assembly has shown that these are separable problems: not all public goods require assembly, and not all projects requiring assembly are public goods. This observation suggests the following taxonomy of cases:

¹⁴ The exact nature of the social cost of the holdout problem is unclear in the literature. Some have described it as a problem of monopoly (Posner, 2003, p. 55; Knetsch and Borchering, 1979, p. 244), while others have characterized it in terms of transaction costs or breakdowns in bargaining (Shavell, 2004, p. 125). The monopoly argument seems to suggest that projects involving holdouts will be underprovided (due to the overpricing of land), while the bargaining cost approach tends to focus on delay as the primary source of inefficiency (Fischel, 1995a, p. 68). The simple model here is obviously of the latter type.

¹⁵ Eminent domain is therefore an example of a “liability rule” (Calabresi and Melamed, 1972).

- I. private good, no assembly
- II. public good, assembly
- III. public good, no assembly
- IV. private good, assembly

Consider first case I, which involves a private good with no assembly. An example is a transaction involving the sale of a single parcel from one party to another. In this case, neither the ends approach nor the means approach justifies the use of eminent domain, a conclusion that is consistent with economic efficiency since there is no market failure. Thus, the transaction should go through the private market, even if one of the parties to the transaction is the government.¹⁶

Case II represents the opposite extreme in the sense that there is both a public good and an assembly problem. The prototypical example is a public highway. Here, both the means and ends approaches indicate that the use of eminent domain is justified. Ulen (1992), in his dual constraint model, urges that eminent domain should only be available in this case. The subsequent discussion will suggest, however, that this may be overly limiting.

Consider next case III, which involves a public good without assembly. An example might be when a local government needs to acquire a single parcel of land to build a police station. In this case, the means and ends approaches yield opposing conclusions: while the ends approach would allow the use of eminent domain (because police protection is a public good), the means approach would not (because there is no assembly involved). Based on our above discussion, it should be apparent that, while it is

¹⁶ Calabresi and Melamed (1972) would therefore say that the owners have “property rule” protection of their land in the sense that they can refuse any offer deemed unacceptable.

appropriate to use taxation to raise the necessary funds to acquire the land (what we referred to as a forced purchase), the government should not be allowed to force the sale. Rather, it should have to acquire the land in a consensual transaction. To allow the government to use eminent domain to acquire the necessary land in this case would be no more justified than allowing it to conscript police officers.¹⁷

Even if courts invoke the ends approach and allow the use of eminent domain in these types of cases, Merrill (1986) suggests that the use of this power will be “self-limiting” owing to the high costs of by-passing the market. As Fischel (1995a, p. 74) observes, “In markets lacking the holdout problem, in which eminent domain would be inappropriate, the transaction costs of using the market are typically less than that of using eminent domain. Thus, the budget preserving instincts of government agencies may usually be depended upon to limit eminent domain where there are no holdouts.” The risk of excessive use of eminent domain in case III therefore seems low, though this is ultimately an empirical question.

Finally, consider case IV, which involves a private good requiring land assembly. Examples include large real estate developments and urban renewal. Here, the means approach justifies the use of eminent domain, while the ends approach does not. This represents the case where economic logic comes into conflict with the plain meaning of public use. Our survey of the case law, however, showed that courts have tended to act in accordance with the means approach by awarding the power of eminent domain to private parties who face significant holdout problems. In doing so, though, they often take pains to justify their decisions using the ends approach (the existence of public

¹⁷ See Fischel (1996), who compares the military draft to takings.

benefits), even though the proper economic basis is the means approach (the need for land assembly).

The *Kelo* case is a good example of this strategy since the Court, in arriving at its decision, emphasized the significant spillover benefits in the form of jobs and tax revenues, despite the largely private nature of the development. Merrill (1986, p. 67) notes that this strategy is not unusual; courts often seek to justify their extension of the takings power to private parties using the ends approach, given that this seems more consistent with the plain meaning of the public use requirement.

From a broader perspective, the willingness of courts to allow “private takings” is not an anomaly (and is not controversial) in other areas of the law. For example, in contract law, the most common remedy for breach of contract is money damages, which essentially allows a contractor to renege on his or her promised performance without first obtaining the other party’s consent, provided that the breaching party is willing to pay damages set by the court.¹⁸ Similarly, nuisance law often allows polluters to continue to inflict harm on others provided that they are willing to pay the damages suffered by victims.¹⁹ As Cooter (1985) has shown, these cases are indistinguishable in economic terms from coercive takings under eminent domain.

Finally, Kelly (2006) offers an opposing perspective on the interpretation of public use. He argues that two factors justify limiting the use of eminent domain to government (public) projects (i.e., case II). First, private developers generally have the ability to use secret buying agents as a way of avoiding the holdout problem, whereas the

¹⁸ The amount of the damages is usually set equal to the value of performance to the victim of the breach—so-called expectation damages (Cooter, 1985).

¹⁹ The classic case of this sort is *Boomer v. Atlantic Cement Co.*, 26 N.Y.2d 219, 309 N.Y.s.2d 312, 257 N.E.2d 870 (1970), which many have characterized as a private taking (Fischel, 1995a, pp. 75-77; Goldberg, 1985).

government, because of its need for openness, does not. (Fischel (1995, p. 70) makes a similar point.) Second, the concentrated benefits from private use of eminent domain create the threat of rent seeking and corruption in the political process as developers seek to acquire the power of condemnation. In contrast, such a threat is less severe for truly public projects because the benefits are widely dispersed. Based on these arguments, Kelly sees a legitimate basis for distinguishing between public and private projects when determining the proper scope of eminent domain.

4. Just compensation

The second requirement for the use of eminent domain is that the government must pay “just compensation” to owners whose land is taken. As noted, courts have interpreted this to mean fair market value, but there is good reason to believe that this measure is systematically less than the amount owners would ask for their land in a consensual transaction. The difference reflects the owners’ “subjective value.”²⁰

The idea can be easily illustrated in a simple supply-demand diagram as shown in Figure 1. The equilibrium price in this market, P^* , can be interpreted as the market value for a certain class of property because it represents the price at which those parcels between 0 and Q^* have sold in consensual transactions. In contrast, parcels to the right of Q^* did not sell because the reservation prices of the owners exceeded the equilibrium price. Now suppose one of the owners who did not sell is forced to sell at P^* . Such a sale

²⁰ As Posner (2003, p. 56) notes, “the exercise of eminent domain power is really a tax; it taxes away subjective values.” Epstein (1985) draws the opposite conclusion: namely, that taxes are a form of taking (as discussed in Section 5.3 below). But see Munch (1976), who conducted an empirical study of the use of eminent domain for an urban renewal project in Chicago and found that owners of high-valued properties were actually overcompensated, while owners of low-valued properties were under-compensated.

imposes a loss on that owner equal to the vertical difference between the relevant point on the supply curve (that owner's reservation price) and P^* . This difference represents the owner's subjective value. In this sense, fair market value must necessarily undercompensate unwilling sellers.

[Figure 1 here]

Beyond the theory, there is substantial experimental evidence for the divergence between a property's market value and the owner's reservation price for that property, what Fischel calls the "offer-ask disparity"²¹. An obvious response is simply to substitute the owner's reservation (or asking) price for market value as the measure of compensation. The problem, of course, is that this value is unobservable and hence creates the risk of opportunism by owners (in particular, the holdout problem). Indeed, Knetsch and Borcharding (1979) note that many jurisdictions in Canada formerly used "value to the owner" as the basis for compensation but abandoned it in favor of market value for exactly this reason.

Richard Epstein has argued that the loss that market-value compensation imposes on those owners whose land is taken is only justified if the surplus from the resulting transfer of resources is widely distributed. This argument, which is based on fairness rather than efficiency, reflects Epstein's view that "the compensation requirement of the eminent domain clause is as much concerned with the distribution of gains and losses between persons as with their aggregate amount" (Epstein, 1985, p. 115). In the case where the land being taken is used to provide a public good, this distributional requirement is generally satisfied because the benefits are, by definition, widely realized. It is less likely that this will be true, however, for "private takings" because the benefits

²¹ See (Fischel, 1995a, pp. 207-208; 1995b) and Knetsch and Borcharding (1979).

are generally concentrated into the hands of a few private interests (the spillover benefits notwithstanding). In this case, Epstein argues that “the public use requirement is satisfied only when efforts are made to replicate in the transfer the same distribution of costs and benefits that is found with normal public goods” (Epstein, 1985, p. 174).

To illustrate his point, Epstein (1985, p. 174) offers the example of the New Hampshire Mill Act, which allowed would-be mill builders to flood upstream property without first obtaining the owners’ consent, provided that the mill builders paid owners 150 percent of their market value. The Act thus permitted the private use of eminent domain based on the logic of the means approach (given the likely existence of a holdout problem), but required mill builders to pay above-market compensation in an apparent effort, albeit imperfect, to protect the subjective value of landowners (and possibly to award them some of the surplus from the transaction). This example illustrates Epstein’s view that the definition of just compensation cannot be separated from that of public use in establishing the proper scope of eminent domain.

The extent to which benefits are widely or narrowly distributed might also explain why courts have typically treated physical acquisitions and regulatory takings differently, granting compensation in the former case (as required by the Constitution) but not generally in the latter. In this vein, Epstein (1985, Ch. 14) notes that just compensation need not always be monetary; in some cases it may be in-kind. For example, zoning regulations that impose a cost on a particular landowner by depriving him of certain harmful uses of his land simultaneously prevent others from imposing the same harm on him. In this way, the regulation provides reciprocal benefits that serve as implicit compensation to landowners for the loss of certain rights. If the regulation is efficient,

society is made better off, and no one landowner is asked to bear disproportionate costs.²² (Note that this reflects the principle of an “average reciprocity of advantage” established in *Agins v. Tiburon*.)

In the case of physical takings, in contrast, it is more likely that owners whose land is taken will bear costs for which in-kind compensation is not present or is insufficient. The requirement of just compensation therefore necessitates the payment of monetary compensation to these owners. However, Epstein argues that the need to impose taxes on other landowners in order to finance the compensation is itself a form of taking for which just compensation is also due, though in most cases this is satisfied by the in-kind compensation that taxpayers receive from the public project being produced by the land from the original taking. (This “transaction” represents the “forced purchase” described above.)

Based on this argument, Fischel (1995a, 211) has conjectured that landowners whose land is subject to a takings risk, but who are also taxpayers and consumers of public goods, may have viewed market-value compensation as the best way to balance their twin concerns about undercompensation in the event of a taking against the higher taxes that would be necessary if a more generous compensation rule were put in place. According to this argument, using fair market value as the definition of just compensation may be about right. We return to this logic in the discussion of constitutional choice models of compensation in Section 5.3 below.

²² Epstein argues that such regulations serve the same function as the common law of nuisance, which limits the uses to which owners can put their land without triggering compensation (reflecting the “nuisance exception” from *Lucas*). The logic also resembles that underlying condominium contracts and restrictive land covenants (Cannaday, 1994; Hughes and Turnbull 1996).

Despite its practicality, market value has the important drawback that, because it undervalues private property, it potentially leads to excessive transfers of private property to public use. (Note that this is the flip side of the holdout problem, which, because it potentially leads to overpricing by owners, results in too little acquisition.) We return to this issue in Section 5.2.2 below. As noted, however, the transaction costs of using eminent domain may more than make up for this undervaluation, thus mitigating the problem of over-acquisition.

5. Land Use Incentives and the Compensation Question

To this point, we have focused on economic theories of the scope of eminent domain. The primary contribution of more recent economic scholarship, however, has been to examine the incentives of the compensation rule on the land use decisions of property owners. The seminal article in this area is by Blume, Rubinfeld, and Shapiro (1984) (subsequently BRS), who first derived the so-called “no compensation result.” Specifically, BRS showed that paying full, market value compensation is inefficient because it creates a moral hazard problem that causes landowners to overinvest in land that may be suitable for government regulation or seizure. Because of the controversial nature of this conclusion, however, several counterarguments have emerged to justify compensation.

This part of the essay begins by deriving the BRS result in a simplified setting, and then reviews the various responses to it. For reasons noted above, the analysis does not distinguish between physical takings and regulations (partial takings).

5.1. The Basic Model

The BRS no-compensation result can be derived using the following simple model. Let

$V(x)$ = the market value of a parcel of land after x dollars have been invested,

$V > 0, V'' < 0$;

p = the probability that the land will be taken for public use;

B = the value of land in public use if taken;

$C(x)$ = the amount of compensation paid to the landowner in the event of a taking.

For now, we assume that both p and B are fixed (that is, the taking decision and the resulting public benefit are exogenous), and we place no a priori restrictions on $C(x)$. In this setting, the only economic decision by landowners is the choice of how much to invest in their land. We assume that this investment is irreversible, and that it must be made before the taking decision occurs, for otherwise, the owner could simply wait until the taking decision is made and only invest if the land is not taken. This assumption is not restrictive in the sense that private land is always at risk of being taken or regulated.

Consider first the social optimum. This is the level of investment that maximizes the expected social value of the land:

$$(1-p)V(x) + pB - x. \tag{5}$$

The resulting first-order condition is

$$(1-p)V'(x) - 1 = 0, \tag{6}$$

which says that the expected marginal value of investment should be set equal to the marginal cost, where $1-p$ is the probability that no taking will occur. Note that the level of investment implied by (6), denoted x^* , is less than the amount that maximizes $V(x)-x$, which is what the landowner would invest if the probability of a taking were zero.

Now consider the choice of x actually made by landowner facing the possibility of a taking. This maximizes the expected private value of the land:

$$(1-p)V(x) + pC(x) - x, \quad (7)$$

which, unlike (5), depends on the compensation rule. The resulting first-order condition is

$$(1-p)V'(x) + pC'(x) - 1 = 0. \quad (8)$$

Comparison of (6) and (8) immediately shows that $C' = 0$ is necessary for efficiency. That is, compensation must be lump sum, a special case of which is zero compensation, or $C(x) = 0$. The explanation for this result is that compensation creates a moral hazard problem. That is, if landowners expect to be fully compensated for their losses in the event of a taking (i.e., if $C = V(x)$), they will ignore the possibility that the land might be taken, thereby rendering their investment socially worthless. As a result of ignoring this possibility, they will overinvest.

Although this conclusion is based on well-known results from the economics of insurance, it has received considerable attention, both because of its lack of appeal on fairness grounds, and the fact that it contradicts the constitutional requirement of just compensation. The following sections therefore extend the basic model to take account of various arguments in favor of compensation.

5.2. Endogenous Probability of a Taking

An oft-stated justification for compensation is that it is necessary to prevent the government from acquiring too much land for public use (Johnson, 1977). To introduce this consideration into the above model, we need to be explicit about the behavior of the government. Several behavioral assumptions have been made.

5.2.1. Benevolent Government

Assume initially that the government makes its taking decisions to maximize social welfare. Such a government is said to be benevolent (Hermalin, 1995) or “Pigovian” (Fischel and Shapiro, 1989). To incorporate this factor into the above model, we need to endogenize the probability of a taking. To that end, we now let the value of the land in public use, B , be a random variable whose value is realized after the landowner has invested in his land but before the government makes its taking decision. Let $F(B)$ be the distribution function of B , which is known by both the landowner and the government. When the government is benevolent, it will take the land if and only if the realized value of the public project exceeds the value of the land in private use; that is, if and only if $B \geq V(x)$. This criterion maximizes the ex post value of the land, given x . At the time the landowner must invest, however, he or she can only compute the probability of a taking, which is given by $1 - F(V(x))$.

Since the government acts efficiently by assumption, we continue to focus solely on the landowner’s choice of x . The expected social value of the land in this case is given by

$$F(V(x))V(x) + \int_{V(x)}^{\infty} B dF(B) - x. \quad (9)$$

The resulting first-order condition for x is

$$F(V(x))V'(x) - 1 = 0, \quad (10)$$

which is identical to (6) with $F(V(x)) = 1 - p$. In contrast, the expected private value of the land, corresponding to (7), is

$$F(V(x))V(x) + [1 - F(V(x))]C(x) - x, \quad (11)$$

which yields the first-order condition

$$F(V(x))V'(x) + [1-F(V(x))]C'(x) + F'(V(x))V'(x)[V(x)-C(x)] - 1 = 0. \quad (12)$$

Comparing this condition to (10) shows that $C'=0$ is no longer a sufficient condition for efficiency. Now, in addition to being lump sum, compensation must be *equal to the full value of the land at its efficient level of investment*; that is, $C=V(x^*)$.

It is important to emphasize that this result is *not* a consequence of the need to restrain the government, which we have assumed acts efficiently regardless of the compensation rule. Rather, full compensation is necessary to prevent a second form of moral hazard on the part of landowners that arises from the endogeneity of the probability of a taking. Specifically, given the government's taking criterion, landowners can reduce the probability of a taking by increasing their level of investment. (That is, $1-F(V(x))$ is decreasing in x .) Thus, they will tend to overinvest if they expect to be undercompensated. This effect is captured by the third term on the left-hand side of (12), which is positive if $C < V(x)$. By the same logic, landowners will underinvest if they expect to be overcompensated—i.e., if $C > V(x)$. Setting $C=V(x^*)$ simultaneously eliminates both this and the BRS forms of moral hazard (Miceli, 1991).²³

Hermalin (1995) shows that two other compensation rules will also yield the efficient outcome in this context. Under the first, the government pays owners the full value of the public project in the event of a taking. That is, $C=B$. In this case, a landowner's expected return coincides with the social return in (9), so he or she chooses the efficient level of investment. This rule works because landowners internalize the full

²³ Giammarino and Nosal (2005) also derive this result. Cooter (1985) reaches a similar conclusion in the context of optimal damage remedies for breach of contract.

social value of their land. The drawback, however, is that it awards landowners the entire surplus from the public project, which may strike some as distributionally unfair.²⁴

A second rule that addresses this concern is the “buy-back” rule, which works as follows: whenever the government initiates a taking, the landowner can retain his or her property by paying the government the value of the public project. In effect, the landowner has the option to buy back the seized property for a price equal to B . A rational landowner will therefore exercise this option when $B < V(x)$, and will not exercise it when $B > V(x)$, resulting in an efficient taking decision. As for the investment choice, the landowner will choose x to maximize

$$\int_0^{V(x)} [V(x) - B] dF(B) - x, \quad (13)$$

which yields the first-order condition in (10). Thus, the landowner makes the efficient investment choice as well.

Hermalin (1995, p. 66) characterizes the difference between these two rules as follows: “In an externality setting—which essentially is what a takings problem is—the property right can reside with the citizen, so she is compensated for what is taken; or the property right can reside with the state, so the citizen pays for the privilege of enjoying her benefit.” This argument reflects the logic of the so-called “harm-benefit rule,” which says that compensation is due when the government takes or regulates land for the purpose of providing a social benefit (e.g., a highway or park), but compensation is not due when the government acts to prevent a harm (e.g., a zoning ordinance) (Fischel 1985,

²⁴ One might wonder, based on the preceding argument, why this “overcompensation” does not induce landowners to underinvest in order to increase the probability of a taking. The reason is that the resulting gain, given by $B - V(x)$, is zero at the margin.

pp. 154-155). Sax (1971) and Bromley (1993) have made arguments along similar lines.²⁵

Despite its intuitive appeal, the problem with this argument is the lack of a meaningful economic distinction between a “harm imposed” and a “benefit foregone.” (That is, any foregone benefit can be redefined as a harm, and vice versa.) The difference depends on how property rights are assigned, and Hermalin’s two rules show that the efficient outcome can be achieved under either assignment, reflecting the Coase Theorem (Coase, 1960).

Fischel (1985, pp. 158-161), however, proposes a way to justify the logic of the harm-benefit rule by appealing to transaction costs.²⁶ In particular, Fischel defines what he calls a “normal behavior standard,” which represents a baseline assignment of property rights as defined by what landowners can “reasonably” expect to be able to do with their property.²⁷ Given this standard, compensation is due for any government actions that compel landowners to exceed normal behavior (e.g., leaving their land undeveloped to provide the community with open space), but it is not due for actions that compel them to comply with normal behavior (e.g., not emitting hazardous waste). The role of transaction costs in this framework is that it sets normal behavior as the “zero compensation point,” which presumably minimizes the cost of achieving compliance because most landowners will engage in normal behavior automatically (i.e., without the need for government action).

²⁵ In an earlier paper, Sax (1964) proposed a different criterion, namely, that the government should have to pay compensation when it acquires property rights for its own use (as when it provides a public good), but it should not be required to pay when it acts as a mediator between private parties (as when it uses zoning to resolve an incompatible land use problem).

²⁶ Fischel’s proposal reflects an application of arguments first made by Ellickson (1973, 1977) in the context of zoning.

²⁷ In the economic analysis of law, the legal standard of reasonableness is usually interpreted to mean efficiency in the sense that it compels individuals to take account, not only of their private costs and benefits, but also of any external effects that their actions might have. See generally Miceli and Segerson (1996, p.72) and the discussion of the compensation rule in (14) below.

Wittman (1984) also proposes a compensation rule based on transaction costs, but focuses instead on the behavior of the government. Specifically, he argues that transaction costs are minimized if compensation is only paid when the government acts inefficiently, because “we would expect the government to act efficiently more often than not” (p. 74). We consider a formalized version of this rule (though with a different rationale) below.

5.2.2. Non-Benevolent Government

Many would argue that it is unrealistic to assume that the government automatically makes the efficient taking decision. More realistic models instead view the government as acting to further the interests of the majority, which implies that the interests of those individuals whose land is subject to a taking or regulation will often be ignored, absent a requirement of compensation.²⁸ A government that only considers the dollar (or budgetary) cost of a taking (as opposed to its true opportunity cost) is sometimes said to have “fiscal illusion” (BRS, 1984, p. 88; Johnson, 1977).

We formalize the idea of fiscal illusion by supposing that the government takes a parcel of land if and only if its value in public use exceeds the required amount of compensation; that is, if and only if $B \geq C(x)$. This criterion suggests that the taking decision will only be efficient if $C(x) = V(x)$, or if full compensation is paid. The obvious problem with the requirement, however, is that it sets up a trade-off between moral hazard and fiscal illusion. One solution is to adopt the lump sum compensation rule derived above; that is, $C = V(x^*)$. Since compensation is lump sum, there is no moral

²⁸ Giammarino and Nosal (2005) consider a more general model of government “moral hazard” in which the government may respond to different constituencies. In this context, they conclude (not surprisingly) that some amount of compensation, generally linked to the market value of the land being taken, is necessary to achieve an efficient outcome.

hazard problem, and because it is full (in equilibrium), the government will only take the land when it is efficient to do so (Miceli, 1991).

Alternatively, consider the two rules proposed by Hermalin. Since we have already seen that both induce the efficient level of investment, the only question is whether they also induce the government to act efficiently. Recall that under the first, the government pays the landowner the full social value of the project, B . This rule will leave the government indifferent between taking the land and not taking it, regardless of the realized value of B . The landowner, however, will only want the taking to occur if $B \geq V(x)$, which is the efficient condition. Thus, the taking decision will be efficient under this rule if the government, when indifferent, accedes to the wishes of the landowner. In this sense, the rule is weakly efficient regarding the government's taking decision.

Consider next the buy-back rule. Under this rule, recall, the government never has to pay compensation, so if it has fiscal illusion, it will initiate a taking whenever $B > 0$. However, the landowner will pay B and retain ownership if $V(x) > B$. Thus, the land will pass into public use if and only if that is the efficient outcome.²⁹

As a final option when the government has fiscal illusion, consider the "threshold rule" proposed by Miceli and Segerson (1994, 1996). Under this rule, the government pays full compensation if it acts inefficiently to take or regulate the land, but pays zero compensation if it acts efficiently. Formally, this rule can be written

²⁹ Note that both of these rules require the landowner to observe, or the government to reveal, the value of B . Hermalin shows that when this is not true, there nevertheless exists a compensation rule that achieves both the efficient level of investment and the efficient taking decision. However, the rule may sometimes require payment from the landowner to the government. If such payments are not allowed, then the first-best outcome is not attainable.

$$C = \begin{cases} V(x), & \text{if } B < V(x^*) \\ 0, & \text{if } B \geq V(x^*). \end{cases} \quad (14)$$

The efficiency of this rule can be established as follows.³⁰ First, assuming that landowners invest in the efficient level of x , the government has an incentive to take or regulate the land only when it is efficient to do so because it wishes to avoid paying full compensation, which would result in a net loss of $B - V(x^*)$ when the taking is inefficient (ie., when $B < V(x^*)$). As a result, landowners will anticipate that only efficient takings (regulations) will occur, and that compensation in these cases will be zero. Thus, they will choose x^* . This logic establishes that the Nash equilibrium is efficient regarding both the land use and taking decisions.³¹

As a positive matter, the appeal of the rule in (14) is that it goes a long way toward explaining actual legal doctrine, especially in the area of regulatory takings where compensation is not often required. Most obviously, the rule resembles the diminution of value test from *Pennsylvania Coal Co. v. Mahon* (1922) because it establishes a threshold for determining when compensation is due. Recall that the Court only vaguely defined this to be the point at which a regulation “goes too far,” whereas the rule in (14) suggests a natural threshold based on the efficiency of the regulation. Specifically, compensation will only be due when the regulation is *inefficiently imposed*.

In addition, the rule in (14) provides an alternative baseline for defining the zero compensation point under the harm-benefit rule. Seen in this light, Fischel’s “normal

³⁰ For a more formal proof, see Miceli and Segerson (1994), and Lueck and Miceli (2007). Miceli and Segerson also prove the efficiency of an alternative version of (14) in which compensation is full if the landowner invested efficiently and the land is subsequently taken, but zero if he or she overinvested. (The difference between the two rules is therefore purely distributional.) This rule is of less interest than that in (14) because it is not very descriptive of actual law, as the discussion in the text will illustrate.

³¹ In this sense, the efficiency of this rule resembles the efficiency of various negligence rules in bilateral care models of tort law. See, generally, Shavell (2004, Ch. 8).

behavior” standard can be interpreted to represent land uses that are efficient. Thus, regulations that efficiently require landowners to cease engaging in harmful activities (sub-normal uses) would not trigger compensation according to (14), whereas regulations that inefficiently interfere with normal behavior would. The noxious use doctrine can likewise be interpreted in light of (14). Specifically, if we define noxious uses to be those activities that are efficiently regulated, then the denial of compensation for such activities is consistent with (14) (and hence is not a contradiction of the diminution of value test).³²

Similarly, we can interpret the nuisance exception from *Lucas* in light of (14). Recall that under this provision, the government can avoid paying compensation for a regulation, despite its impact on the landowner, if the regulation prevents an activity that would constitute a nuisance under the state’s common law. According to the law of torts, a nuisance is an activity that is unreasonable in the sense that “the amount of the harm done outweighs the benefits served by the conduct” (Keeton, et al., 1984, p. 630). Thus, the threshold for zero compensation implied by the “nuisance exception” is exactly that embodied in (14).

As a final point regarding the rule in (14), consider the case of *Keystone Bituminous Coal Assn. v. DeBenedictus* (480 U.S. 470), which the Supreme Court decided in 1987. The striking thing about this case is that the facts are remarkably similar to those in *Pennsylvania Coal* (the case again involved a state law requiring coal companies to leave sufficient coal in the ground to prevent cave-ins), yet the Court ruled that in this case, compensation was *not* due. This apparent contradiction of the earlier

³² Seen in this perspective, Holmes’s ruling in *Pennsylvania Coal* did not “overturn” the noxious use doctrine (as claimed in a dissenting opinion by Brandeis), and hence did not represent the fundamental break in the law that it is often portrayed as. (See, for example, Friedman (1986), who called the case a watershed in takings law.)

ruling, however, can be understood as arising from changing economic values, rather than from a change in the law. As Fischel (1995a, p. 48) notes, “In 1922, anthracite coal was immensely valuable” while “The value of the surface real estate was not so high.” In other words, it is reasonable to suppose that the regulation was not efficiently imposed at that time. In contrast, “By the 1960’s, general growth in personal incomes had driven up the demand for housing and a pleasant environment. Technological changes over the same period had reduced concern over extraction of coal, because many substitutes for it had been developed.” Thus, the regulation was now efficient, so no compensation was due. Seen in this light, the apparently conflicting decisions in *Pennsylvania Coal* and *Keystone* (like the diminution of value test and noxious use doctrine) are reconcilable by the rule in (14).

5.3. Constitutional Choice Models

There is another class of takings models, referred to as constitutional choice models, that envision individuals designing the compensation rule from behind a veil of ignorance regarding which particular parcels will be taken. In this context, all landowners are at risk of being takings victims, given that rational individuals realize that it will be efficient for the government to expropriate some fraction of private land for public use. At the same time, they recognize that the funds necessary to pay compensation must be raised through taxation. Thus, in designing the compensation rule, rational landowners will presumably take into account both sides of the public budget and therefore will not be overly stingy (for fear that their land will be taken), or overly generous (to avoid excessive tax liability).³³

³³ See Fischel (1995a, p. 211) and Epstein (1985, p. 196).

The first model to take this approach was by Fischel and Shapiro (1989), who extended the basic BRS model as follows. Let

n = the total number of (identical) parcels subject to a taking risk;

s = the number of parcels actually taken for public use;

$B(s)$ = the social value of the land taken, $B' > 0$, $B'' < 0$;

T = the per-person tax liability.

All other variables are defined as above. We assume that the public benefit, $B(s)$, is a pure public good whose benefits are enjoyed by all landowners, including those whose land is taken, and we also assume that all landowners pay T . (Thus, takings victims will receive net compensation of $C - T$.)³⁴ Finally, we assume that the parcels to be taken are randomly chosen.³⁵ Thus, we can define the probability that a given parcel will be taken to be $p = s/n$. It follows that the probability that a parcel will not be taken is $1 - p = (n - s)/n$.

Given this model, we can write the realized wealth of owners whose land is not taken as

$$w_N = V(x) - T + B(s) - x, \quad (15)$$

and of owners whose land is taken as

$$w_T = C - T + B(s) - x. \quad (16)$$

Thus, a landowner's expected wealth is

$$E(w) = (1 - p)V(x) + pC - T + B(s) - x. \quad (17)$$

³⁴ These assumptions are inessential to the conclusions of the model. For example, we could just as easily assume that only those landowners whose land is not taken receive B and/or pay taxes. (The only effect of the change would be on the calculation of T .)

³⁵ Note that this is not inconsistent with assembly of contiguous parcels provided that the location of the public project (or projects) is not known a priori by landowners.

The public budget must be balanced, which requires that in equilibrium, $nT=sC$ (assuming that compensation for takings is the only expense). Given the definition of p , this may also be written

$$T = pC. \tag{18}$$

Fischel and Shapiro (1989) assume that compensation is specified as a fraction of the market value of an owner's land, or $C=\alpha V(x)$, $0 \leq \alpha \leq 1$, where α is chosen by landowners at the hypothetical constitutional convention. According to this rule, compensation depends on each landowner's *actual* choice of x . In contrast, they assume that individual taxes are based on the *equilibrium* level of capital invested; that is, $T=p\alpha V(x_e)$ (given (18)). Thus, landowners view taxes as lump sum. Making the appropriate substitutions in (17) and rearranging, we obtain

$$E(w) = (1-p)V(x) + p\alpha[V(x)-V(x_e)] + B(s) - x. \tag{19}$$

Landowners choose x to maximize (19), taking s , α , and x_e as given. The resulting first-order condition is

$$(1-p+\alpha p)V'(x) - 1 = 0. \tag{20}$$

Denote the solution to (20) by $x_e(\alpha)$. It follows immediately that efficient investment requires $\alpha=0$, or that compensation must be zero, which is simply the BRS result. More generally, (20) implies that x_e is increasing in α .

Whether or not zero compensation is optimal, however, depends on how s , the number of parcels taken, is determined. If it is either fixed (what Fischel and Shapiro call an "inexorable" government), or is determined by a benevolent (Pigovian) government, then moral hazard is the only consideration, and α should be set at zero. However, if the government is majoritarian and cares only about the welfare of owners whose land is not

taken, then zero compensation will not generally be optimal because some compensation will be necessary to limit excessive takings.

Note first that the optimal level of s maximizes the aggregate welfare of all citizens, given by

$$nB(s) + (n-s)V(x) - nx. \quad (21)$$

The first-order condition therefore implies

$$B'(s) = V(x)/n, \quad (22)$$

which is simply the Samuelson condition for a pure public good. In the case of a majoritarian government, landowners whose land will not be taken are assumed to be in the majority and hence will choose s to maximize their wealth, as given by (15), subject to the balanced budget condition in (18) and the compensation rule, $C=\alpha V(x)$.³⁶ After making the relevant substitutions and differentiating, we obtain the first-order condition

$$B'(s) = \alpha V(x)/n, \quad (23)$$

from which it follows that the government's choice of s is decreasing in α (given $B''<0$). That is, the majority will authorize fewer takings as the amount of compensation increases. Further, comparing (23) and (22) shows that $\alpha=1$ (full compensation) is necessary for the taking decision to be efficient. Fischel and Shapiro (1989) show that in this context, the optimal (second-best) compensation rule involves partial compensation (i.e., $0<\alpha<1$) so as to balance the moral hazard problem against the cost of excessive takings.

5.3.1. *Alternative Compensation and Tax Rules*

³⁶ This approach assumes that, unlike the design of the compensation rule, public spending decisions cannot be chosen from behind a veil of ignorance.

This “partial compensation” result hinged on the specific form of the compensation rule assumed by Fischel and Shapiro. Nosal (2001) adopted their constitutional choice framework, but re-defined compensation to be equal to the *average* market value of all properties in society. That is,

$$C = \frac{1}{n} \sum_{j=1}^n V(x_j). \quad (24)$$

Since landowners are identical, they will all choose the same level of investment, so that *in equilibrium*, compensation will equal the full market value of any taken properties.

Taxes continue to be defined by the balanced budget condition in (18).

As in Fischel and Shapiro (1989), landowners in Nosal’s model choose how much to invest in their land to maximize their expected wealth as given by (17). Landowner i therefore chooses x_i to solve

$$(1-p)V'(x_i) + p(\partial C/\partial x_i) - \partial T/\partial x_i - 1 = 0, \quad (25)$$

taking as given all other landowners’ choices of x . Note that from (24),

$\partial C/\partial x_i = V'(x_i)/n > 0$, so the compensation rule distorts the investment choice as in Fischel and Shapiro (1989). However, in contrast to their model, taxes are not lump-sum. Rather, (18) implies that $\partial T/\partial x_i = p(\partial C/\partial x_i)$. Thus, taxes are also distortionary, but the balanced budget condition ensures that the distortions exactly offset. As a result, (25) reduces to the efficient condition, and $x_i = x^*$ for all i .

As for the choice of s , Nosal assumes that a randomly chosen landowner acts as the “government,” and chooses the amount of land to take without knowing which particular parcels will be taken. (Thus, his land may be one of the targeted parcels.) He therefore chooses s to maximize expected wealth in (17), subject to the compensation rule and balanced budget. Recalling that $p = s/n$, this yields the first-order condition

$$-V/n + C/n - \partial T/\partial s + B'(s) = 0. \quad (26)$$

Since (18) implies that $\partial T/\partial s = C/n$, this condition reduces to (22), and the efficient level of s is also chosen.

Nosal's result is important because it shows that the legal requirement of full, market value compensation is consistent with efficiency. His compensation rule remains inconsistent with actual practice, however, because it is not based on the market value of *individual* properties. (Thus, if parcels differ, some owners would be overcompensated in equilibrium and others undercompensated.) In this sense, the specification in Fischel and Shapiro (1989) is closer to reality. Neither model, however, allows for a divergence between the market value of land and its subjective value to the owner, as discussed in Section 4 above.

To address this shortcoming, we define $M(x)$ to be the market value of a parcel as a function of the investment level, x , where $M \geq 0$, and redefine $V(x)$ to be its subjective value to the owner, where $M(x) \leq V(x)$ for all x . Since $V(x)$ is unobservable to the court, compensation must be based on M . Thus, following Fischel and Shapiro (1989), we define $C = \alpha M(x)$, where $0 \leq \alpha \leq 1$.

Taxation is also treated in an unrealistic way by both Fischel and Shapiro and Nosal. To reflect actual practice, we suppose that taxes are based on the assessed values of individual parcels, where the assessed value is some fraction of the market value. For simplicity, we will treat the two as the same. Thus, each landowner faces a tax liability of $T = tM(x)$, where t is the uniform property tax rate. In this case, (17) becomes

$$E(w) = (1-p)V(x) + p\alpha M(x) - tM(x) + B(s) - x, \quad (27)$$

and the first-order condition for x is

$$(1-p)V'(x) + (p\alpha-t)M'(x) - 1 = 0. \quad (28)$$

The balanced budget condition in this model, given identical landowners, is $ntM(x)=sC=s\alpha M(x)$, which implies that $t=p\alpha$. Thus, the second term in (28) vanishes, resulting in the efficient level of investment *for any value of α* .³⁷ In other words, the compensation rule turns out to be irrelevant with respect to the landowner's investment choice. Similar reasoning shows that the first-order condition for s implied by (27) reduces to (22) for any value of α . Thus, the number of parcels taken is also efficient, regardless of the compensation rule.

The reason for this surprising conclusion is that the compensation and tax distortions built into the model exactly offset through the balanced budget condition.³⁸ This logic reflects Epstein's (1985, p. 196) contention, discussed above, that taxes and takings are equivalent in the sense that both are non-consensual government seizures of property that are justifiable only if compensation of some form is paid. In the current model (as in Nosal's model), this compensation implicitly occurs through the public budget, given that landowners are simultaneously taxpayers and potential takings victims. Thus, any increase in taxes is exactly offset by the higher expected compensation, and vice versa.³⁹ The idea is similar to the macroeconomic concept of Ricardian equivalence.

5.4. The Timing of Development

³⁷ The result continues to hold for non-identical landowners.

³⁸ In a different context, Hamilton (1975) derived a similar conclusion. Specifically, he showed that in the Tiebout model of local public good provision, property taxes are not distortionary if communities are homogeneous in terms of taxable property. The reason is that the public budget transforms the property tax into a benefit tax. As a result, no free-riding is possible, and so landowners' housing choices are not distorted by the property tax. Hamilton argues that zoning will generally be needed to support this outcome.

³⁹ Note that our conclusion that the compensation rule is irrelevant therefore does not support Fischel's conjecture that individuals, acting from behind a veil of ignorance, would choose market-value compensation (see Section 4 above). It does, however, reflect the logic of his argument.

To this point, we have assumed that the *timing* of the landowner's investment decision does not affect the desirability or feasibility of the government's taking decision. In many contexts, this assumption is unwarranted. For example, in the case of physical takings, the government may favor undeveloped land for public projects so as to save on the cost of demolishing existing structures. Thus, landowners may be able to lower the chance that their land will be taken by investing pre-maturely. Similarly, a landowner may be able to pre-empt a regulatory threat by investing early, for example, by clear-cutting a stand of timber before an endangered species is discovered there, or by filling in a piece of land before it is declared a wetland. Several authors have examined the impact of the compensation rule on the timing of development.⁴⁰ The general conclusion of these studies is that *zero* compensation is inefficient because it increases the opportunity cost of waiting to develop, even when that is the efficient option.

To illustrate this effect, we need to add a dynamic element to the above model. Thus, let V_N be the net present value to a landowner of developing now, and let V_L be the net present value of developing later. Assume that $V_L > V_N$, so it is privately optimal to wait. Further, suppose that, if the land is not developed in the initial period, then with probability p it will yield a social benefit, B , in the next period (for example, provision of habitat for an endangered species).⁴¹ We assume that if this benefit is realized, $B > V_L$, so that it is also socially optimal not to develop the land in that period. However, if the benefit is not realized, the land can still be developed. In this setting, it is socially

⁴⁰ See Miceli and Segerson (1996, Ch. 8), Innes (1997), Riddiough (1997), Turnbull (2002), and Lueck and Michael (2003).

⁴¹ We could equivalently assume that development now potentially gives rise to an external cost, E , in the next period (for example, destruction of the habitat of an endangered species). This reflects the equivalence, noted above, between a harm imposed and a benefit foregone.

optimal for the landowner to refrain from developing the land in the initial period if and only if $pB+(1-p)V_L > V_N$, or if and only if

$$p(B-V_L) + (V_L-V_N) > 0, \quad (29)$$

which holds by construction.

Now consider the landowner's private decision. Suppose that if he does not develop in period one and the social benefit is realized, the government will take the land and pay compensation of C . However, if he or she develops in period one, there is no possibility of a taking. Given these options, the landowner will choose to wait if and only if $pC+(1-p)V_L > V_N$, or if and only if

$$p(C-V_L) + (V_L-V_N) > 0. \quad (30)$$

Comparison of (29) and (30) shows that $C=B$ is necessary to ensure that the landowner makes the socially optimal decision to wait. In contrast, $C=0$ may cause the landowner to develop inefficiently early. Note that this result is similar to the above result that compensation is necessary to prevent overinvestment when the landowner's investment decision affects the probability of a taking.

5.5. Risk Aversion and Compensation

The preceding models have all treated landowners as risk-neutral, but the fact that most landowners buy insurance against the risk of loss of their property from fire, flood, or defective title, suggests that they are in fact risk averse. Blume and Rubinfeld (1984) therefore argue that, since private insurance is not available for takings, the government

should provide it in the form of compensation.⁴² It is easy to derive this result in the context of the above model.

Suppose that landowners have utility over wealth given by $U(w)$, where $U' > 0$ and $U'' < 0$. If wealth in the “no-taking” and “taking” states are given by (15) and (16), and p is the (fixed) probability of a taking, then the landowner’s expected utility is given by

$$EU = (1-p)U(w_N) + pU(w_T). \quad (31)$$

Ignoring for now the landowner’s investment choice, we can derive the optimal compensation rule by maximizing (31) subject to the balanced budget condition in (18). The resulting first-order condition is

$$U'(w_N) = U'(w_T), \quad (32)$$

from which it follows that $w_T = w_N$. Examination of (15) and (16) shows that $C = V$, or compensation should be full. In this context, compensation serves as full insurance that allocates risk efficiently across possible states.

Of course, the problem with this full-insurance policy is that it once again re-introduces the moral hazard problem. As before, one solution is simply to make compensation lump-sum; that is, set it equal to the full value of the land at the landowner’s optimal level of investment. As an alternative, we show in the Appendix that partial compensation is an optimal (second-best) policy.⁴³

5.6. Michelman’s Approach to Takings

⁴² Kaplow (1986) argues against compensation on the grounds that that private insurance would be superior to government-provided insurance, but he does not attempt to explain why private insurance for takings is not available. See the discussion of this point in Fischel and Shapiro (1988, pp. 286-287).

⁴³ This solution reflects the standard trade-off between risk-sharing and moral hazard present in many principal-agent problems. See, for example, Holmstrom (1979). Note, therefore, that the trade-off is different from that which yields the partial compensation result in Fischel and Shapiro (1989).

Perhaps the most influential takings article from outside of the economics literature is by Michelman (1967). This article is nevertheless of interest to economists because it proposes a utilitarian standard for takings that depends on three factors: efficiency gains, demoralization costs, and settlement costs. Efficiency gains represent the dollar value of the “excess of benefits produced by a [government] measure over losses inflicted by it” (p. 1214). Michelman argues, however, that existence of this gain alone is not sufficient for a public project to go forward. In addition, the government must take account of the demoralization and settlement costs associated with the acquisition of the necessary property. Demoralization costs are

defined as the total of (1) the dollar value necessary to offset disutilities which accrue to losers and their sympathizers specifically from the realization that no compensation is offered, and (2) the present capitalized dollar value of lost production ... caused by demoralization of uncompensated losers, their sympathizers, and other observers disturbed by the thought that they themselves may be subject to similar treatment on some other occasion (p. 1214).

In short, demoralization costs are the costs of *not* paying compensation.

Offsetting this are the settlement costs of paying compensation, which Michelman defines to be “the dollar value of the time, effort, and resources which would be required in order to reach compensation settlements adequate to avoid demoralizations costs” (p. 1214). Putting all of these factors together, Michelman concludes that the project should go forward if and only if the efficiency gains exceed the minimum of the settlement and demoralization costs, one of which must be paid.⁴⁴

⁴⁴ Symbolically, the project should only go forward if and only if $B-C > \min(S, D)$, where $B-C$ represents the efficiency gains, S is the settlement cost, and D is the demoralization cost. Fischel (1995a, pp. 147-148)

In terms of the formal economic models surveyed above, settlement costs (the costs of paying compensation) include the transaction costs associated with condemnation, which generally are not trivial (recall that we argued in Section 3.3 that they are often large enough to discourage use of eminent domain), as well as the costs associated with moral hazard.⁴⁵ The counterpart to demoralization costs is the fear that people have of being exploited by a majoritarian government, as captured by the above models of a non-benevolent government (Fischel and Shapiro, 1988, p. 285). In this sense, the basic trade-off between moral hazard and fiscal illusion emphasized in much of the economic literature since BRS was anticipated by Michelman.

5.6.1. Does Capitalization Eliminate the Need for Compensation?

A different, and seemingly persuasive, argument against compensation is also attributable to Michelman. Consider a landowner who purchased a piece of land in the face of a public debate about a possible regulation that would prevent future development.

Michelman argues that if the regulation is subsequently imposed, the landowner has no claim for compensation for the lost value because the price he paid for the land should have been discounted to reflect the threatened regulation. Thus, the landowner “got exactly what he meant to buy,” and paying him compensation for the loss would be equivalent to reimbursing the purchaser of a losing lottery ticket (p. 1238).

and Fischel and Shapiro (1988) note that Michelman’s criterion falls between Pareto and Kaldor-Hicks. Since Pareto requires that all losers must be compensated, the project would only go forward if $B-C > S$, whereas Michelman would allow those projects to go forward for which $B-C < S$ provided that $B-C > D$ (which of course can only be true if $D < S$). In this sense, Michelman is more permissive than Pareto. In contrast, Kaldor-Hicks would allow any project for which $B-C > 0$, which makes Michelman less permissive than Kaldor-Hicks given that $\min(S, D) > 0$.

⁴⁵ Fischel and Shapiro (1988, p. 283-5) note that moral hazard is often wrongly counted as a demoralization cost.

This argument is so appealing that it has found its way into the law. For example, in *HFH Ltd. v. Superior Court*,⁴⁶ the court said that “The long settled state of zoning law renders the possibility of change in zoning clearly foreseeable to ... purchasers of property, who discount their estimate of its value by the probability of such a change.” The logic of this argument is irrefutable, to a point. To illustrate, suppose that the unrestricted value of the land is V_U , the restricted value is V_R , where $V_U > V_R$, p is the probability that the restriction will be enacted, and C is the expected compensation. The amount that a rational buyer would be willing to pay for the land in the face of the regulatory threat is thus

$$p(V_R + C) + (1-p)V_U. \tag{33}$$

The price therefore fully capitalizes the expected amount of compensation. For example, if compensation were zero, the price would be discounted by the expected loss, $p(V_U - V_R)$. Consequently, the buyer would suffer no loss if the regulation occurs (other than the loss suffered by anyone who loses a fair bet). Michelman would therefore conclude that demoralization costs are zero in this case.

The problem with this argument is that it ignores the interests of the seller.⁴⁷ Notice, in particular, that in the absence of a regulatory threat, the seller would expect to receive a price of V_U for his land, but once the regulatory threat is announced, the price immediately falls to the amount in (33). The resulting “loss” to the seller is the difference

⁴⁶ 542 P.2d 237 (1975). The notion that landowner expectations matter for compensation is also exemplified by the ruling in *Penn Central Transportation Co. v. City of New York* (438 U.S. 104, 1978), which held, in part, that compensation is due if a regulation interferes with “distinct investment-backed expectations” of the owner.

⁴⁷ See Epstein (1985, pp. 151-158), Fischel and Shapiro (1988, pp. 287-289), and Fischel (1995a, pp. 194-197).

$$p(V_U - V_R - C), \tag{34}$$

which is only zero if compensation is full (i.e., if $C = V_U - V_R$). Capitalization therefore does *not* eliminate the need for compensation. It merely shifts the loss (and the accompanying demoralization costs) to the party whose ownership pre-dated the announced regulation. Note, however, that this conclusion is not necessarily an argument for paying compensation to all property owners at the moment that a regulatory threat first arises, as this policy would be very costly to implement. Rather, it is sufficient to pay compensation only to those owners whose land is actually regulated, given that the sale price capitalizes the expected compensation.

6. Conclusion

The eminent domain clause of the Fifth Amendment is ultimately about the limits of government intervention in the land market. The case law and scholarly literature on this subject are vast, touching on many issues. Economic theory, by focusing primarily on efficiency, can shed much light on the various dimensions of the debate. Our survey of the economics literature has yielded the following conclusions:

1. The correct economic justification for the forced sale of property under eminent domain is the holdout problem associated with land assembly. This conclusion implies, first, that eminent domain should not be used for public projects that don't involve assembly, and second, that it should be available for private projects, like urban renewal, that do. The high transaction costs of using eminent domain probably limit its overuse in the former case, while courts have historically permitted its use by private developers in

the latter case. When courts do allow the private use of eminent domain, however, they generally justify it by citing the substantial spillover benefits from the project, rather than the holdout problem, as the rationale. This has led to considerable confusion in this area of law.

2. Just compensation has been defined by courts to be the fair market value of the taken property. There is good reason to believe, however, that this measure undercompensates landowners relative to what they would have accepted in a consensual sale. While this may create the risk of excessive takings by the government, the use of a “value to the owner” measure would create the opposite problem of too few takings owing to the holdout problem. Market value compensation therefore represents a practical compromise measure.

3. Physical takings and regulations are treated quite differently by the law in terms of when compensation is due. In particular, it is always due in the former case but rarely in the latter. Economic theory, however, does not justify this distinction, as regulations are merely “partial takings.” One way to understand the different treatment is the notion that regulations like zoning apply broadly to most properties in a jurisdiction, thereby providing reciprocal (in-kind) compensation to landowners. In contrast, physical takings generally single-out a few landowners to bear substantial costs, so monetary compensation, financed by taxes on all other owners, is needed to satisfy the just compensation requirement. In this way, a forced sale on one side of the public ledger (eminent domain) is offset by a forced purchase on the other (taxation).

4. Economic models have shown that payment of full, market-value compensation leads to a moral hazard problem that causes landowners to overinvest in their property.

This can be eliminated by lump sum compensation, which includes zero compensation as a special case. However, the inconsistency of this “no-compensation result” with the constitutional requirement of just compensation, as well as its perceived unfairness, has produced several counterarguments. These include: the need to prevent excessive government takings, the need to forestall premature or preemptive development, the insurance benefits of compensation for risk-averse landowners, and the demoralization costs of not paying compensation.

Appendix

This appendix proves that when landowners are risk averse and can also invest in their land, the optimal (second best) compensation rule involves partial compensation. To illustrate, let the compensation rule take the form $C=\alpha V(x)$, where $0\leq\alpha\leq 1$. In making their investment choices, landowners maximize (31), taking α , and the tax payment T , as given. The resulting first-order condition is given by

$$(1-p)U'(w_N)(V'(x)-1) + pU'(w_T)(\alpha V'-1) = 0, \quad (\text{A1})$$

where w_N and w_T are defined by (15) and (16). Let $\hat{x}(\alpha)$ denote the solution to (A1).

Note that when $\alpha=1$ (full compensation), (A1) implies $V'(x)-1=0$, which is the moral hazard outcome, but when $\alpha=0$, $V'(x)-1>0$, resulting in a lower level of investment.

Now consider the value of α that landowners would choose at a hypothetical constitutional convention, knowing their future investment behavior. This involves choosing the value of α that maximizes (31), subject to $\hat{x}(\alpha)$ and the balanced budget in (18). After canceling terms using (A1) and rearranging, we obtain the following derivative

$$\begin{aligned} \frac{\partial EU}{\partial \alpha} = & -p\alpha V'(x)[(1-p)U'(w_N)+pU'(w_T)] \left(\frac{\partial \hat{x}}{\partial \alpha} \right) \\ & + (1-p)pV(x)[U'(w_T)-U'(w_N)]. \end{aligned} \quad (\text{A2})$$

To prove that $\alpha^*>0$, set $\alpha=0$ in (A2). The result is

$$\frac{\partial EU}{\partial \alpha} = (1-p)pV(x)[U'(w_T)-U'(w_N)] > 0, \quad (\text{A3})$$

where the sign follows from the facts that $U''<0$ and $w_N>w_T$ when $\alpha=0$. Thus, α^* cannot be zero.

Now set $\alpha=1$. Since $w_N=w_T=w$ in this case, the second term in (A2) drops out, while the first term collapses to

$$\frac{\partial EU}{\partial \alpha} = -pV'(x)U'(w)\left(\frac{\partial \hat{x}}{\partial \alpha}\right). \quad (\text{A4})$$

It is possible to show that when $\alpha=1$, $\partial \hat{x} / \partial \alpha > 0$, which implies that (A4) is negative.

This proves that $\alpha^* < 1$. Combining this with the previous result establishes that $0 < \alpha^* < 1$, as claimed.

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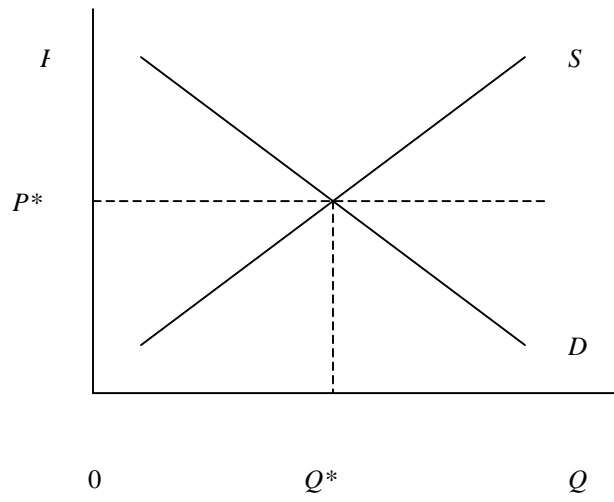


Figure 1.
Divergence between market value and reservation price for owners of unsold properties.

		Seller 2	
		Now	Later
Seller 1	Now	$V/2, V/2$	$v, V-\delta-v$
	Later	$V-\delta-v, v$	$V/2-\delta, V/2-\delta$

Table 1.
Payoff matrix for the sellers' entry game.