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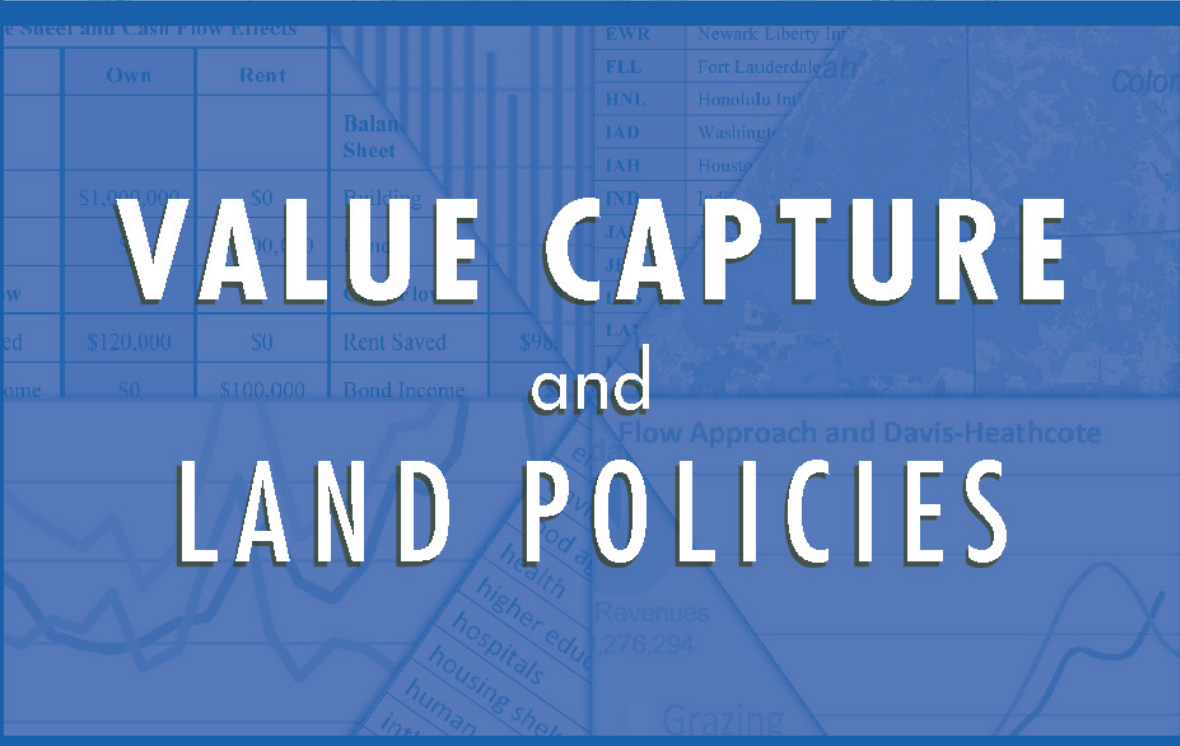
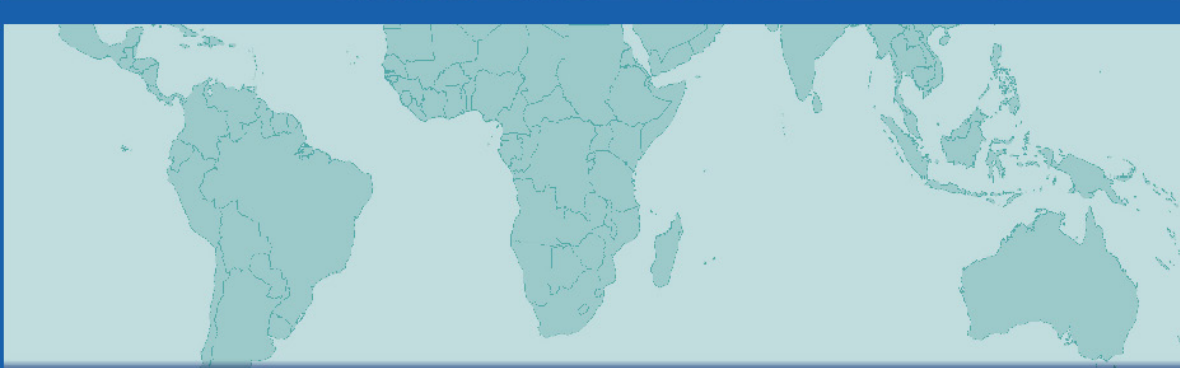
VALUE CAPTURE and LAND POLICIES





Edited by Gregory K. Ingram and Yu-Hung Hong

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Takings and Givings: The Analytics of Land Value Capture and Its Symmetries with Takings Compensation

Perry Shapiro

The U.S. Constitution prohibits takings without just compensation, but it does not prohibit givings without just recovery.[1] In our common law tradition, protection of individual property rights goes back at least as far as the Magna Carta in England (Siegan 2001). The landed barons rebelled against King John and forced concessions that restrained the king in matters of personal property. The king's prerogative in the *Saltpeter* case established early on the sovereign's right to take property, but specified his obligation to compensate the owners (Siegan 2001). There is no body of common law regarding the requirement of landowners to reimburse the sovereign for benefits received, however. This apparent asymmetry has historical roots as well. William the Conqueror meted out land to various nobles as a reward for past service and as part of his plan to defend the realm. In return for this largesse, the nobles were expected to serve and defend the interests of the state. Good and responsible citizenship was the only reimbursement required by the sovereign.

Many prominent thinkers emphasize that mandatory compensation for damages is a powerful way to limit the sovereign's appetite. Hagman and Misczynski

1. Bell and Parchomovsky (2001), who coined the term *givings* as the logical opposite of *takings*, argue that givings recovery is not only fair and efficient, but also a way to deal with the sometimes ill-defined notion of public use.

(1978) point out that requiring government to mitigate private losses causes it to recognize the social costs of its choices and dampen its overzealous enthusiasm for imposing its version of the public good. In effect, requiring government to pay compensation makes it expensive for a benefited majority to gang up on a minority made to suffer by the public choice.

Richard Epstein (2009–2010, 4) writes poetically about

> the vexed questions of deciding when and why certain government actions should be classified compensable events, and others not . . . This distinction is not plucked out of the air. It has a powerful political purpose, which is to downgrade the scope of just compensation requirement so that it does little or nothing to interfere with the ability of land-use planners to implement their vision of the just or sound community without having to compensate any landowner caught in the undertow.

Supreme Court justice Antonin Scalia's dissent in the *Pennell* case[2] covers the same concern:

> The politically attractive feature of regulation is not that it permits wealth transfers to be achieved that could not be achieved otherwise; but rather that it permits them to be achieved "off budget," with relative invisibility and thus relative immunity from normal democratic processes . . . Once the door is open it is not unreasonable to expect price regulation requiring private businesses to give special discounts to senior citizens (no matter how affluent), or to students, the handicapped, or war veterans. Subsidies for these groups may well be a good idea, but because of the operation of the Takings Clause our governmental system has required them to be applied, in general, through the process of taxing and spending, where both economic effects and competing priorities are more evident.

The vision of the Leviathan riding roughshod over landowner rights is a compelling one. Besides the general demoralization[3] of citizens caused by a bully government, there is a problem of inefficient government choices. A government that is not forced to pay for the direct costs of its choices will overreach—for instance, too much land will be condemned, or regulation will be too strict. But it is certainly possible to imagine equally compelling examples of government failing to adapt general-welfare-enhancing policies because of inadequate budgets.

Government, in most of its decision-making functions, is not subject to the same market discipline as are its citizens. It must find compromises among the diverse interests of its constituents, and it must do that without knowing precisely what those interests are. A market or voluntary transaction between two willing agents is presumed to increase the welfare of both. Absent externalities,

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2. *Pennell v. San Jose*, 485 U.S. 1, 22 (1988).

3. A term introduced by Michelman (1967).

commodities are sold at prices that reflect their social value; a purchase indicates that the buyer values the purchased commodity at least as highly as everyone else does. The competitive market equilibrium is efficient, since all resources are put to their most valued use and all agents are as well-off as possible given the welfare of all others. The theory of public markets does not yield such optimistic conclusions.

Erik Lindahl (1958) proposed a market-like mechanism for the provision of public goods—those whose benefits (and costs) are not excludable (that is, the enjoyment by one citizen does not change the enjoyment of any other). In Lindahl's mechanism, individuals are to be charged specific prices exactly equal to their various individual marginal evaluations. Paul Samuelson (1954) added that equating the sum of the individual-specific prices with the marginal cost of production is a necessary condition for the efficient provision of government-provided goods. How can Samuelson's condition be implemented? Individuals reveal their marginal evaluations by accepting market prices, but, as Samuelson challenged, how can we find similar evaluations if there is no market for public goods? Mechanisms have been proposed to induce individuals to reveal their true marginal evaluations (called *preference revelation mechanisms*), but none seem practical to apply to real-world public policy.[4] In spite of the impossibility (or impracticality) of devising a perfect method for providing public goods, Samuelson's analysis does give a standard against which other systems can be compared.

A mechanism is an institutional arrangement (rules of the game, perhaps) designed to achieve certain outcomes. It is natural for an economist to think of a compensation/recovery proposal as a mechanism with consequences for individual choice and social outcomes. That is the focus of this chapter, which opens with some conceptual and practical problems inherent in the design of any compensation/recovery mechanism. An explanation of the efficiency standard used to evaluate mechanisms follows. The subsequent analysis focuses on a canonical case study of a proposed road, meant to represent a wide range of public policies, some requiring physical takings and some not. Public takings and givings and the shortcomings of common compensation/recovery practices are then analyzed, and an ideal mechanism that is both efficient and fair is offered for consideration. The chapter concludes with a property assemblage mechanism ensuring that all landowners are adequately compensated and that all transfers of ownership are efficient.

Conceptual Problems

What constitutes a compensable loss and what a recoverable gain? What should be the losers' compensation and the gainers' charge? For some government

4. The most well-known mechanism was proposed by Grove and Ledyard (1977).

actions, the answer to what is compensable is very clear; for others, it is vague. No one would argue that physical confiscation of property is not a taking and thus not compensable. Some would extend this idea to claim that anything done by government to reduce a person's well-being—for instance, tax assessment—is a taking as well. Most people would agree that government actions often improve individual well-being, but there is likely less agreement about whether individuals should be charged for their government-created good fortune. There is a logical symmetry between takings and givings, but they are generally not regarded as two sides of the same coin.

Both those who believe that damages caused by public actions should be compensable (particularly damages caused by regulatory changes) and those who think that total compensability is a deterrent to important public action, argue that their views promote efficiency. There is truth on both sides, and a properly designed system of windfalls for wipeouts can induce outcomes that are both efficient and equitable. The following examples focus on both equity and efficiency.

COMPENSABILITY

These three stories closely mirror the present reality of takings and givings.

1. You own a motel along Route 66 that generates $100,000 net income annually and has a market value of $2 million. The project to widen Route 66 takes your motel. There is no legal or moral ambiguity: you receive $2 million in compensation for losing your property.
2. You still own the motel, but instead of widening Route 66, the government has decided to build Interstate 40 around your town. As a result, your motel's occupancy rate goes to zero. There seems to be no legal ambiguity here either: you will not be compensated for your $2 million capital loss.
3. A fellow townsperson owns a property close to the proposed off-ramp for Interstate 40. The property had a very small market value before the new highway was proposed, but now it could sell for $4 million. There is, as yet, no legal ambiguity about this: the lucky person whose wealth is enhanced by the project is not obligated to share his windfall with the property owners made poorer by it.

The following three principles are consistent with the facts of these cases:

1. You have a legal right is to the ownership and use of your physical property, not to any income from the property. Said differently, you have a right to the use of the stock, not to the income that flows from it. When use is denied, as it is with a physical taking, compensation is required. In this case, the compensation "makes you whole."
2. The new highway destroys your income as assuredly as the expansion of the old one would. The difference is that you maintain ownership and use of the physical property itself. Life is uncertain, and you are not guaran-

teed an annual income of $100,000 in perpetuity. It is the luck of the draw that finds you suffering the loss—no different, in a moral and popular sense, than losing your property in a flood or at a Las Vegas casino.

3. We all pay to support government, and we expect government to do us good (or at least to do us no harm). Good things that come our way because of a public choice are part of our due (our luck of the draw). A person is not obliged to surrender his lucky gains to compensate others who are unlucky. There may be voluntary charitable contributions or preexisting mutual insurance contracts, but it is not government's place to take from us our good fortune, no matter how much the public choice has contributed to it.

COMPENSATION PROBLEMS

This discussion follows the analysis of Blume, Rubinfeld, and Shapiro (1984).

1. You are evaluating a plan for a major construction project on land that might be condemned for a highway.[5] Your estimated return on the project is 9 percent. The market rate of interest is 8 percent, and the probability that the government will decide to expropriate the property is 20 percent. If the property is condemned, all capital in place will be destroyed. The social (adjusted for the risk of condemnation) rate of return on the project is 7.2 percent,[6] less than the rate of interest. Therefore, pursuing the project is socially inefficient. If you anticipate no compensation if your land is condemned, you anticipate a 7.2 percent return (exactly the social rate) and reject the building project as uneconomical. However, if you expect full compensation for all your losses, the construction is guaranteed a 9 percent return whether or not the road is built, and you decide to go ahead with the project, even though this is a socially inefficient choice.
2. You are evaluating a plan for a major construction project on your land. The estimated return on the project is 7 percent if a proposed highway (which will consume your neighbor's land) is not constructed and 100 percent if it is. The market rate of interest is 8 percent, and there is a 2 percent chance that the highway will be built. The social rate of return on the project is approximately 9 percent. If you are allowed to keep the entire highway-caused increase in market value, your anticipated return is 9 percent as well, and you make the socially efficient choice to go ahead with your project. However, if your return is taxed away by the government

5. This example is borrowed from Usher (1995).

6. Suppose you invest $100 that will pay $109 in one year with probability 0.8 and $0 (equivalent to condemnation without compensation) with probability 0.2. The risk-adjusted rate of return is $0.8(\$9 \div \$100) = 0.072$.

in an attempt to capture the highway-caused increase in your land value, your anticipated return is approximately 5 percent, and you decide not to undertake the investment.

These two stories highlight the symmetry of takings and givings: compensation and/or recovery formulas that depend on capital improvements induce inefficient choices.

1. If landowners are fully compensated for both land and improvements, they will invest too much in improvements. If compensation is independent of their investment choices, private investors will account for the risk of condemnation, and thus the loss of capital, in their investment decisions.
2. If landowners are taxed on the increase in property values, they must return to the government the proportion of the increase that is due to their investment. That property value tax reduces the effective rate of return on capital for the landowners. As a result, they will invest less than is efficient. For a potential giving, private investors will account for the full benefits of their investments if their tax bills are independent of their capital choices.

FAIRNESS

1. There is a 50 percent chance that your property, which lies directly in the path of a proposed highway, will be condemned within the year.[7] If it is taken, all installed capital will be destroyed. An investment of $20,000 financed with a consol[8] will generate a net income of $4,000 per year if the property is not taken. If the property is taken, the $20,000 liability will remain even though there is no income from the property. With an investment of $40,000, the property will generate $5,000 per year net income if not taken. If you choose to invest nothing, your property has no market value. If, however, you choose to invest $20,000, the market value of your property will be $80,000. If you invest $40,000, the value will be $100,000. With the smaller investment, there is a 50 percent chance that your wealth will be $60,000 and a 50 percent chance that it will be –$20,000: your expected wealth is $20,000. With the larger investment, there is a 50 percent chance that your wealth will be $60,000 and a 50 percent chance that it will be –$40,000: your expected wealth is –$10,000. Your best choice is clear: invest $20,000.
2. Your neighbor's land is not needed for the highway: there is no chance that it will be condemned. In fact, the value of his land will be enhanced

7. This follows the analysis of Niemann and Shapiro (2008).

8. A consol is an infinitely lived (nondepreciating) instrument for which the annual payment is only the interest on principal.

> if the highway is constructed. If he invests $20,000, his net income will be $4,000 without the highway or $5,000 with the productivity-enhancing highway. An investment of $40,000 will yield an annual net income of $5,000 without the highway or $10,000 with the highway. With the smaller investment, the market value of his property will be $80,000 without the highway or $100,000 with the highway. With the larger investment, the market value will be $100,000 or $200,000, respectively. His expected wealth with a $20,000 investment is $70,000 and with a $40,000 investment $120,000. Clearly, his best choice is the larger investment.

There is an inherent unfairness in this outcome. Both you and your neighbor are taxpaying citizens, with the same rights to the benefits of government choices. Nonetheless, even the probability of a new highway increases your neighbor's wealth from $60,000 to $120,000, while your wealth moves from $60,000 to $20,000. Your neighbor gets a $20,000 capital gain, and you get a $40,000 capital loss. Why should the government not tax away some of your neighbor's good fortune, say $50,000 worth, and give it to you as compensation? In fact, since the highway announcement has created a net $20,000 capital gain, there is sufficient revenue to leave both you and your neighbor as well-off as you were before the announcement, while retaining up to $20,000 for general public revenue.

PERSONAL VALUE

The home you own is "in the Fort Trumbull neighborhood of New London, Connecticut."[9] You have lived "in a house on Walbach Street that has been in . . . [your] family for over 100 years." You were "born in the house in 1918"; your spouse "moved into the house when . . . [you were] married in 1946. [Your] son lives next door with his family in the house he received as a wedding gift."[10] New London (henceforth, "the city") plans to condemn your property, along with many more, for an assemblage of many contiguous acres and lease the assemblage to a developer at very favorable terms. Doing this will allow the city to increase its tax base, which will result in increased efficiency and consequent increased tax collection. The city will capture the increased land value from the assemblage, and you will be paid the market value of your house in return for the forced surrender of your title to it.

First, it is likely that you value your house much more than the market does. Nonetheless, you and your contiguous neighbors are forced to accept less than personal value as compensation. Furthermore, if the city concludes that the social cost of the proposed assemblage is the simple sum of the individual market prices, it may choose to condemn large blocks of property for an alternative that

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9. This follows the analysis of Grossman, Pincus, and Shapiro (2010).

10. From Justice Sandra Day O'Connor's dissent in *Kelo v. New London* (04-108), 545 U.S. 469 495 (2005).

has a smaller social value than the existing use: the city will be led to make an inefficient choice.

Second, even though the market may undervalue your house, there is some price that would induce you to surrender the title voluntarily. Economists call this the *reservation price*. Suppose you were assured that you would receive this amount if you revealed what it is. No doubt the number you would supply would far exceed the true number. The city, while it may have entered into a long negotiation with a developer for the use of the assembled property, is unlikely to have discovered the true value of the alternative use. The city also might request the developer's value, but it is unlikely to get an honest answer from the developer as well. If the price of the assemblage is proportional to the developer's value, his answer will be severely understated. If the price is not proportional to the developer's value, but the assemblage will not be ceded for development unless the developer's value exceeds the sum of the landowners' values, the developer's answer will be highly inflated.

Economic Preliminaries

An individual's wealth is defined as the market value of his assets minus the value of his debts (assets minus liabilities). The assets produce an annual stream of income, and the liabilities require an annual debt-service outflow.

To keep matters simple, suppose all the debts are financed with consols at a market rate of i. Debts, of size K, are incurred to purchase nondepreciating (infinitely lived) capital. The annual debt service required is iK.

An investor will continue to accumulate debt by adding to capital as long as the addition to annual income exceeds the additional debt service. Since every dollar of additional capital increases annual expenses by i, investment will continue until as the increase in annual income resulting from the last dollar of capital expenditure exceeds i.

It is apparent that the smaller i is, the larger the wealth-maximizing capital choice for all individual investors. If this is the case for every investor, it must be true for the entire economy: the lower i is, the more capital is demanded. With a limited supply of capital, i adjusts to equate the market demand (the sum of individual demands) with the limited supply.

Recognize that the market rate, i, is the value of the last dollar invested by every individual. It is the social marginal cost of capital. Thus, wealth-maximizing investors make efficient choices by equating the value of the capital-induced marginal increase in income to the social marginal cost. Collectively, these individually self-serving decisions maximize the wealth of a society.[11]

The preceding text assumes riskless capital choices—that is, each investor knows, with absolute certainty, the return on every investment. How does this

11. This is the first welfare theorem.

conclusion change if some capital expenditures are risky (as are most)? In fact, the efficiency conclusion remains the same even if some, or all, investments are risky. There are different ways to approach this problem, but I have chosen the simplest one here: the prevailing rate, *i*, remains the social marginal cost of capital.[12] Individual landowners assess the risk and adjust their investment plans to account for it. Holding everything except risk constant, both investor wealth maximization and social efficiency require that risky capital expenditures are smaller than safe ones. In fact, if risks are accurately included in investors' calculations, the private choices will be socially optimal.

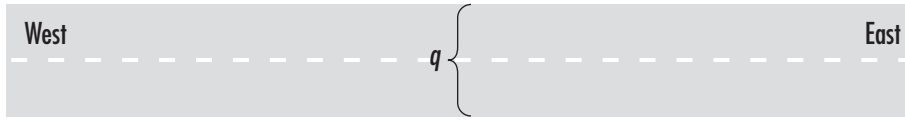
This establishes an efficiency standard against which taking and giving mechanisms can be judged. The level of capital that landowners choose to install on their property will be neither more nor less than is socially efficient. Rules that specify compensation for takings and recovery for givings will induce landowners to make capital choices with an eye not only to market price, *i*, but also to how their investments affect compensation payments and/or recovery expenses.

The Road: A Canonical Case Study

For the analysis that follows, *q* represents the public policy choice. If the decision is either adopting a policy (e.g., a rezoning from agricultural to residential) or not, *q* is either 1 or 0. However, if the decision includes intensity, or severity (e.g., number of acres to rezone from agricultural to residential), *q* can be any real number (in this case, 0 will represent a decision to leave things as they are).

The span of public policies that have land value effects is very large. It is impossible to analyze them all separately, and for most the losses and gains are so diffuse that their effects are difficult to assess. For that reason, let us concentrate on policies that have measurable effects on a closed, easily defined area (a city or a region of moderate size with well-defined boundaries). The construction of a road is used as a metaphor for all public choices with substantial property value effects, as illustrated in figure 3.1.

Figure 3.1
Road from Western to Eastern Boundary



12. In the tradition of financial economics, this might be modeled with a separate rate for every risk class. Many complications are avoided by choosing a fixed *r* as the social marginal cost and leaving the risk analysis to the individual investors.

The public decision is whether or not (and perhaps at what width) to build a road within the illustrated closed region from its western boundary to its eastern boundary. The word *closed* is used to indicate that all externalities (gains in this case) are confined within the regional boundaries. All the land within the region is divided into N equal-size, separately owned parcels, and each parcel is the same (equally productive) except for its ownership. The full gain (e.g., better access to markets) is enjoyed by those whose land lies outside the road's path, and the full loss (losing ownership of land and structures) is confined to those with property taken to make way for the road.

Before we examine public taking decisions and the consequences of compensation (for loss) and recovery (for gain) mechanisms, let us consider the outcome if the road is privately provided. Examination of the private entrepreneurial options gives benchmarks of both process and outcomes for the land value capture options of government. For each of the free market mechanisms described here, there is a government counterpart.

One person owns all the land and leases plots for farming. He knows that the road will improve access to markets, and because of that, it will make his land more valuable. The rent he can charge will increase in proportion to the transportation savings. He also knows that the bigger (wider) the road is, the faster the journey to market will be and the larger the transportation savings. From his perspective, the per acre rent he can charge for his land will increase as he enlarges the road. Ignoring the construction costs, the landowner reckons his cost as the lost rental income from the land that is put under the road. If he wants to maximize his rental income, he will choose his options efficiently so that the lost revenue from the last acre of road width exactly equals the increased rent per acre his land will fetch because of more economical transportation.

In this example, a public good is provided, and the costs are borne by one entity. The public good is the road, from which no farmer is to be excluded (although it could be an excludable good, in which case the landowner would profit from charging a toll for its use). The road confers benefits on the farmers by reducing their transportation costs. The landowner is rewarded with the capture of the value of the conferred benefits through increased rents.

One aspect of this single-owner example is that all the externalities (the givings) benefit the users (the farmers) and are thus captured by the single owner (the landowner). Furthermore, all the costs (the takings) are borne by the owner. Thus, the impacts are proportionate: a single person pays the costs and enjoys the benefits.

Let us assume that the land is leased in perpetuity. Different forms of benefit recovery will be modeled as different tenant charges. For instance, the tenant may pay a fixed annual rent, irrespective of his farming success; he may sharecrop, with the annual payment proportional to revenue; or he may be charged a proportion of the market value of the property. The choice of how rent is charged has consequences for the choices made by both the farmers and the landowner.

Furthermore, the rules for tenant payment to landowners have parallels with the public compensation/recovery mechanisms.

Suppose the landowner charges a fixed annual rent, R. In a competitive market, R is the maximum price an individual farmer is willing to pay. When figuring his willingness to pay, the farmer will consider the crop yield, which in turn depends on the quality of the land (over which he has no control); his investment in permanent capital installations; and the costs of variable factors, including his own time. Capital installations—for instance, permanent structures, grading, and water wells—all become permanent parts of the property. Annual, or variable, costs include, among other things, labor, materials, and marketing. The road will affect all these costs: the better and more efficient transportation is, represented by a larger q, the smaller the variable costs.

The tenant farmer's profits are the revenue from crop sales minus variable and fixed costs. The per acre revenue is the product of the crop's market price, p, and the per acre yield, Q. The yield is a function of the variable factors, x, for which there is a market price, w, and the amount of installed capital, K. The farmer's revenue is the market price of the crop times the yield, pQ. The variable costs increase with the amount produced, but are smaller the larger the capital investment, K, and the width of the road, q, are. Consequently, net revenue, I (annual revenue minus variable costs), increases with K and q as well. From the tenant's point of view, q is fixed. Access to a road of a predetermined size comes with leasing the property. With the discretionary choice of K, the farmer is obliged to an annual debt-service fixed cost of iK. The best investment, K^*, is the one that will maximize the difference between the net revenue and the debt service. It is common to refer to this difference as the quasi-rent.

An example for understanding how K^* is determined is to consider the value of making a very small improvement to the land, one that costs merely \$1. This marginal investment will add i dollars of annual debt service. If the improvement will both increase the yield and reduce the variable costs such that the net revenue will increase by at least i dollars, the \$1 increment to capital will be made because it will result in higher profits. The profit-maximizing value, K^*, is the one that equates the marginal increase in net revenue to the discount rate, i. The maximum profit goal guides the tenant farmer to install an efficient amount of capital.

In equilibrium, competition among tenant farmers for use of the land ensures that the rent received by a landowner is equal to the tenant's quasi-rent. The more efficient the farmers are, the higher the per acre rent. The landowner will choose q to maximize rental income. To understand what this means, suppose the total land area is 10,000 acres and the road consumes 1,000 of those. With a 1,000-acre road, the per acre rent is \$100. Widening the road by the addition of 1 acre would increase the rent to \$100.10. The (marginal) cost of the additional acre is \$100, the revenue lost from pulling 1 acre out of production, and the (marginal) increase in income is \$0.10 per acre for 9,999 acres, or \$999.90. Clearly,

this would be a profitable choice. Thus, the road size is determined by equating the marginal increase in rental income with the marginal cost of withdrawing an additional acre from farm use. The result is that the aggregate rent of the entire area is as large as possible. Another way to express this is that the land is in its highest and best use. The arrangement of a single landowner and competitive farmland markets results in an efficient road size and efficient amounts of installed capital.

Competitive market equilibrium land rent is just one kind of pricing mechanism. The landowner is not required to choose that option. Suppose instead he charged a proportion of the land's market value as rent. It remains in his interest, as in the previous case, to select a road size that maximizes aggregate land value conditional on the amount of tenant farmer investment. The difficulty with a value-based land rent is that farmers are inclined to consider the effect of their capital on the market value of the property, and thus on the rent they must pay. The marginal benefit of an investment is, as in the previous case, the addition to income resulting from a small increase in installed capital. However, the marginal cost is higher. The debt-service cost per unit of capital, i, is only part of the marginal cost. The installation of additional capital makes the property more valuable, which will result in an increase in annual rent. The marginal increase in market value of a property plus the market rate of interest is the marginal cost. Since that is larger than in the previous case, the investment choice is smaller than K^*. With a property-value-based land charge, installed capital investment is smaller than the efficient amount.

Land owned by many different farmers is a variation on the first example. This multitude of farmers represents eager buyers of the more efficient transportation the road could provide. Each would be willing to pay a toll on the road up to the amount of transportation cost savings. The person who buys the right-of-way can charge a toll equal to the maximum that each farmer would be willing to pay. (Here, for simplicity, I am assuming that the road entrepreneur is a perfectly discriminating monopolist.) Whoever builds the road can extract all the surplus generated by the road. This represents a great opportunity for anyone who can assemble the necessary land between the Western (W) and Eastern (E) boundaries.

If the land is singly owned, the purchase represents a duopoly bargain, with the final price lying somewhere between the maximum revenue that can be derived from the toll (if the seller is the dominant bargainer) and the value of the roadbed area as farmland without the road. In this case, it is a simple matter of dividing the surplus: the outcome is an efficient road choice. The process of voluntary exchange, when the road is an excludable good, represents few problems. It can be viewed as an uncoerced taking for which full value is paid and a giving from which full value is captured by the road entrepreneur. But let us change just one fact.

Suppose the potential roadway land is not a singly owned strip, but rather a strip that is subdivided into multiple plots, each owned by a different person.

The entrepreneur who wants to build the road must now bargain with many different owners. If he wants a road of a particular size (perhaps the optimum, or most efficient, size), he must obtain the right-of-way to each contiguous parcel from W to E, with the aggregate area equal to the desired amount of land for the road. The transaction costs of assembling the parcels of land and the potential holdout problems may be so large that no road can be built, even though it would produce considerable efficiency gains for the landowners and profits for the entrepreneur.

The "holdout" problem bedevils the private assemblage of a large number of individually owned properties into a single large plot (Alpern and Durst 1997). A well-documented case is the assemblage of land for the City National Bank building in New York City (Hellman 2004). The assemblage of the necessary contiguous plots was undertaken by specialists at considerable cost. City National Bank, a wealthy corporation, could afford the large transaction costs entailed in putting together the contiguous properties. In other cases, that might not be true. If an assemblage attempt is known, the market will reflect this and acknowledge that the aggregate holding will be far more valuable than the sum of the individual properties. A few in-the-know landowners, recognizing the opportunity, might demand such a high price for their holdings as to render the project economically infeasible. The earliest analysis of this holdout problem was presented by Cournot ([1838] 1960) as one of two polar cases (the other was the familiar noncooperative duopoly). Over the years, the marketing of complementary commodities, such as the contiguous plots of land needed for a road, has attracted much attention. In the late 1990s, Michael Heller (1998) gave it a new, catchy label: the problem of the anticommons.

Public Takings and Givings

When the benefits and costs of a project fall on a single landowner, there is no need for the government to get involved. The single-landowner example is much like a club: membership is required to enjoy the benefits. Think of a specific kind of club, perhaps a gated community, in which the benefits are reflected in land prices. Large-scale developments often include public educational, cultural, and recreational facilities that enhance the value of the residential properties for sale.

The excludable good offers a perfect, albeit very specific, example. It is much like any private good provided by a monopolist. The single-owner example highlights how the mechanism for benefit recovery can have efficiency effects, but it misses some of the important aspects of public provision. The multiple-owner example is closer to a situation justifying government involvement (eminent domain) to avoid excessive transaction costs. But the lessons gained from the private benefit provision and value capture are not fully transferable to the public sector. The relationship between compensation/recovery mechanisms and efficiency is much the same for publicly provided externality-producing goods as it is for

privately provided ones. The important differences are that private provision entails voluntary exchanges and the provider is responsible only to himself (or to his stockholders) and need not answer to the recipients of the benefits or the bearers of the costs (or to the collective sense of justice of the citizenry at large).

The salient feature of the road as a public good is that it produces externalities that, unless captured, lead to inefficiencies. One way to internalize the externalities is for the government to become the owner of all affected properties, through negotiated purchases from individual landowners or condemnation of all externality-affected properties.[13]

The coercion of the compulsory sale of land not directly necessary for a public use is called *excess condemnation*. It is a natural way to internalize all externalities, particularly when the externalities are limited to a well-defined and relatively small geographic area. In excess condemnation, all the properties affected—both those needed for the proposed public project and those merely affected either positively or negatively—are purchased. Applying externality capture to the road from W to E, the government would compensate the owners of all affected properties at the market value at the time of condemnation. However, the use of excess condemnation to capture externality benefits is limited. Thus, it is okay to condemn a remnant plot of land created by a highway if its use is severely limited by its shape, and it is okay to condemn property that borders a highway to ensure that it is used in a way consistent with the highway. It is not, however, okay to condemn property as a way of capturing the externality benefits with a resale when the project is complete. Wholesale condemnation violates the public use specification of the Fifth Amendment (Bender 1929; Hart 1927; Matheson 1969). The courts have ruled that excess condemnation directly related to a project is permissible in some cases.

There is much to recommend excess condemnation as a way of implementing takings and givings. It appears fair because all landowners are treated the same; it does not create winners and losers. Government policy, the q of the road, is chosen to maximize aggregate land values. If the excess land is later sold, the new owners will make efficient capital choices. The problem, in the United States at least, is that taking land in excess of the amount needed for a public project is prohibited.

The Shortcomings of Compensation and Recovery

Current market value is the prescribed compensation for a taking, and *ad valorem property taxes* are the most common form of benefit recovery. Both distort the return on investment and lead to inefficient choices, as is illustrated in the following examples.

13. In Hong Kong, for instance, this is already part of the legal property rights structure (Hong and Lam 1998).

The route map has been published, the funds have been allocated, and the bulldozers are on the backs of trucks heading for your town to begin construction of a new highway. There is no doubt: a highway is to be built, and it will go right through your in-town property, eliminating not only the lot itself, but also all the capital installed on it.

Your property has been legally condemned, and you are to be paid $100,000, irrespective of anything further you do to it. What is the best thing you can do? Simple answer: nothing (no more capital investment), because your compensation will not be affected by any investment in the property. Additional capital expenditures will be a net loss.

Change the scenario: the bulldozers are on their way, but this time you are going to be paid what the state has computed is the market value of your property. It is known that property such as yours will achieve its highest market value of $100,000 if $10,000 worth of capital is installed. Right now, your capital investment is $5,000, and with that the compensation formula estimates a property value of $90,000. What should you do? Spend $5,000 to be rewarded with an additional $10,000. This is so even though the newly installed capital, along with the old, will be destroyed immediately.

You also own another property that just happens to be adjacent to the off- and on-ramps for the new highway. You are assessed $10,000 for the benefits of the new highway to your property. The amount is independent of how much any capital investment might increase the property value. What should you do? Invest the amount that maximizes your net income and, thus, the land value.

Change the scenario: you are going to be assessed 10 percent of the increase in total property value (an ad valorem property tax). You know that the highway department formula, considering the favorable location, figures that with a $100,000 investment, the property will be worth $300,000 more with the highway than without it. The $100,000 is the investment amount that maximizes the property value when the highway is complete. The increase in value is considered a giving of $300,000, for which the government will exact a recovery of $30,000. If you maintain your present capital stock, without further expenditures, the result will be an increase of only $200,000 in value. You must reimburse the government $20,000. So if you invest the highest amount, you will gain $170,000 ($270,000 – $100,000). However, if you maintain your current capital stock, you will gain $180,000 ($200,000 – $20,000). What should you do? Invest nothing in your capital stock.

These scenarios represent a more general problem of compensation for takings and recovery of givings. Inefficiencies arise if the amount paid and/or the amount collected depends on landowner investment. If a landowner's potential compensation and/or tax is computed as a percentage of property value, as is commonly the case, the landowner can game the system. If spending on improvements will increase compensation, the landowner is induced to invest more than is efficient. If spending on improvements will increase the landowner's tax obligation, as it does with the standard ad valorem property tax, the landowner

will invest less than is efficient. The standard mechanisms for compensation and recovery make payments proportional to market values, which causes inefficient distortions in investment choices. The details of these compensation/recovery-induced inefficiencies are detailed in the appendix.

Ideal Mechanism

Even if landowners did not attempt to alter their compensation or taxation fortunes by investing inefficiently, most compensation/recovery schemes create an ethical dilemma. Government, which should be serving all its citizens equally, by its choice of projects improves the lot of some landowners (those whose property values are enhanced by takings), while denying other landowners the benefits of the resulting improvements. One solution to this dilemma, called the ideal mechanism, is presented in detail in the appendix. Following is a brief explanation based on the road example presented earlier.

The road decision creates two types of landowners: the damaged (D) owners of the taken properties and the benefited (B) owners who escape condemnation and enjoy a public-project-induced capital gain. According to the rules of the ideal mechanism, (1) each D owner will receive an amount equal to the market value of his property if it had benefited from the road; (2) payments to the Ds will be financed fully[14] by a fixed-rate tax assessed on each B owner based on the market value of his property minus expenditures on improvements;[15] and (3) the excess amount of recovery assessments minus compensation payments will be retained in the government's general revenue fund.

In the ideal mechanism, there is no benefit for a D to improve his property, since all improvements will be destroyed and his compensation will be the same irrespective of his investments. Thus, he will make the efficient decision to invest nothing. In addition, a D has no incentive to expend resources to escape condemnation, since the value of his property will be the same as it would have been had the property not been taken. As explained in the appendix, allowing B owners to deduct capital expenditures from the market value of their properties to determine tax liability will induce them to make the socially efficient land-improving investment choice.[16] The government is guided in its choice of project size (q in figure 3.1) by its tax collections. The larger the land value gains are, the larger the tax collections, and, consequently, the larger the addition to general revenues. In seeking to enhance the provision of public services in general by maximizing gen-

14. The project is self-financing.

15. This is sometimes called a site tax.

16. This conclusion follows from an assumption of time-constant profit. The picture is more complicated if profits are assumed to increase at a different rate than capital costs. In that case, the ad valorem property tax would affect the timing of investments (Arnott 2005).

eral revenues, the government is led to choose the project size that will maximize net land values—the socially efficient choice.

One of the ethical difficulties with the usual takings and givings procedures is that they create winners and losers. With the ideal mechanism, both the taken and the non-taken end up with the same wealth. But the ideal mechanism flies in the face of a Supreme Court decision. In *United States v. Reynolds*,[17] the Court ruled that it "early recognized that the 'market value' of property condemned can be affected, adversely or favorably, by the imminence of the very public project that makes the condemnation necessary. And it was perceived that to permit compensation to be either reduced or increased because of an alteration in market value attributable to the project itself would not lead to the 'just compensation' that the Constitution requires."[18]

Anticommons

In the preceding examples, landowners care only about their monetary wealth. Limiting consideration only to monetary losses and gains focuses our attention on compensation and recovery without adding the difficult problem of extra-market value. But in many, if not most, takings cases, landowners are forced to cede property for a market value that is less than its personal value to them. In this section, we consider the possibility of assembling three contiguous plots of land. Each plot is owned by a different person, and each person has a different personal value for his or her property. The example is constructed to represent the problem of the anticommons (Heller 2008). According to this theory, property is normally held as inefficiently small plots. The transaction costs of assembling them into efficient size are very large, perhaps so large that voluntary private market assemblage is impossible.

New England City is facing severe financial difficulties: its major employer has moved away, and its tax base is insufficient to maintain adequate public services. As illustrated in figure 3.2,[19] in New England City there are three contiguous plots of land owned by three different people: Wilhelmina Dery, Susette Kelo, and Bill von Winkle. The plots are identical, and each has a market value of $1,000. Mr. von Winkle values his property at $1,000; he is indifferent to either retaining ownership or selling the property at market value. Ms. Kelo values her property at $2,000; if offered at least that amount, she would cede ownership voluntarily. Since the market value is less than her personal value, she will not sell

17. *United States v. Reynolds*, 397 U.S. 14 (1970).

18. Ibid. at 16, citing, for example, *Shoemaker v. United States*, 147 U.S. 282 (1893).

19. This figure illustrates the problem facing a city that must assemble continuous plots of land for some development. The properties were made continuous in this way to parallel the preceding examples. The city name and landowner names were chosen to reflect the larger problem faced by New London, Connecticut. See *Kelo*, 545 U.S. (2005).

Figure 3.2
Hypothetical Assemblage Problem

her property for $1,000. Ms. Dery, who was born in her house and has lived in it continuously for 80 years, has a personal value of $3,000 and is the least likely to sell. The true (social) value of the three plots in their current use is $6,000, the sum of the personal values, while the market value is $3,000. The hypothetical values are summarized in table 3.1.

The mayor of New England City has announced the city's interest in promoting development and its willingness to cooperate with a private firm that will build and operate a toll road through the property now owned by Dery, Kelo, and von Winkle. The road is expected to improve the city's tax base. Three developers indicate interest in the project. Each developer must have the assembled plots; anything less will have no value. With its expertise in road building and management, Xenos Construction is willing to pay at most $4,000 for the three sites. Yardley Corporation anticipates higher profits and is willing to pay at most $9,000 for the sites. Zenith Associates, with many years' experience in dealing with the difficult topography and weather conditions of New England City, has valued the three assembled plots at $12,000.

Given this configuration of values, it is clear what the social optimum is. Zenith will acquire the assembled property, paying at least $6,000, with the proceeds of the sale distributed among von Winkle, Kelo, and Dery, who will receive at least $1,000, $2,000, and $3,000, respectively. In a case like this, it is easy to achieve this optimum if the individual values, both landowners' and developers', are known. But what if these values are not known? Is there a mechanism that will allow us always to achieve the optimum?

First, what if the values exist only in the minds of the individuals? How might the city planner find out what they are? How about asking? Consider the

Table 3.1
Hypothetical Property Values ($)

Landowner Value	Dery	Kelo	von Winkle	Total
Personal value	3,000	2,000	1,000	6,000
Market value	1,000	1,000	1,000	3,000

following: "I have an upper limit to how much I will pay you for your land. Tell me your lower limit, and if that number is smaller than my upper limit, I will pay you an amount that is halfway between your number and mine." What is the most likely response?

Mr. von Winkle might think, *Anything more than $1,000 is great, so if the planner's number is $1,001 and I truthfully reveal my value to him, I will get $1,000.50. But if I announce a larger number, say $1,000.50, I will get $1000.75. If I think there is a good chance that the planner's upper limit price is higher than my value, I will announce an untruthful value.* The potential buyers will likely have a similar reaction. Ask Zenith what the maximum it is willing to pay for the assemblage, and it will probably give a figure lower than its true maximum price. The lesson of this example is that, with no further structure, individuals and corporations usually will not reveal their true personal and reservation values. This is the conclusion of Samuelson's famous article on public goods (Samuelson 1954). It is a problem that vexes all nonmarket transactions.

Even though it is difficult to determine agents' true values, there is a need to go forward with public policy. When there is a perceived public purpose to be served, the government may rightfully acquire property. Traditionally, governments invoke their eminent domain powers to condemn property in order to assemble large, individually owned parcels for some public purpose, such as building a road or slum clearance. Let us examine how that would work in the example.

First, New England City undertakes a cost-benefit study. Using the usual market-based measure, namely, market value, it concludes that the cost of the project is $3,000, irrespective of what it ends up paying the landowners. The city searches for potential developers and finds Zenith. Clearly, a transfer of use from von Winkle, Kelo, and Dery to Zenith is an efficient choice. Zenith's value is higher than the market value, so the city awards the development to it. Von Winkle, Kelo, and Dery are reimbursed the market value of their property (with money taken from community-wide taxation or perhaps from a sale to Zenith for some amount no greater than $12,000). By the usual Kaldor-Hicks criterion, this is the end of the story—a clear gain in efficiency by converting land from one use to another. But there is more going on here than just a simple transfer of land from one use to a more efficient one. Because Ms. Kelo and Ms. Dery are forced to cede their property for less than the personal value, they are made to bear a disproportionate burden in support of the greater good. If they are given an additional $1,000 and $2,000, respectively, some of the "true" costs will be spread among the citizens of New England City (if the purchase is financed with taxpayer money).

The foregoing discussion illustrates one problem with the traditional policy instrument: even if the choice is efficient, its distributional consequence is unfortunate because two landowners suffer losses. And this is the most optimistic outcome. Things could be worse. Suppose the best development opportunity the city discovers is Xenos's offer of $4,000, which exceeds the market value of

existing use. Applying its cost-benefit logic, the city chooses eminent domain condemnation with market value compensation and then awards the development to Xenos. There remains the distributional loss, but in addition, because the true values are not known, the city's decision is inefficient. The city has converted $6,000 worth of land use into $4,000 worth.

Finally, we can reasonably envision the city settling on Yardley Corporation. In this case, the land is transferred to a higher-value use, but not the highest-value. The efficiency loss in this case is the difference between Yardley's $9,000 value and Zenith's $12,000. Additionally, the landowners are made to accept less than full personal value compensation for their displacement.

These examples of common practice highlight a potential shortcoming: individuals are made to surrender their land for a price lower than its personal value. Absent information about true landowner value and/or true development value, inefficient choices are inevitable.

Heller and Hills (2008) and Lehavi and Licht (2007) propose an alternative to eminent domain condemnation with a potential gain in probable efficiency but without the unfortunate distributional consequence. Dery, Kelo, and von Winkle form an assemblage district (perhaps with the coercion of public condemnation if they do not). The three properties are offered as a package at public auction. The auction proceeds are distributed to the three by some rule acceptable to all. Inspired by the auction idea, two coauthors and I proposed an alternative that fleshes out the details of the auction and considers its consequences (Grossman, Pincus, and Shapiro 2010). We label the alternative the Strong Pareto (SP) mechanism, because its use ensures that no participant is made worse off. The SP mechanism is not perfect, but it escapes some of the shortcomings of eminent domain.[20] In particular, its use ensures, first, that no development project is undertaken if its value is lower than the sum of the landowners' personal values, and, second, that the payment to every landowner is at least as large as the personal value. The landowners are asked to reveal their personal values, and the assembled land is offered at an auction with a reserve price—that is, the successful bidder must pay at least the reserve price, or the landowners will retain possession of their plots. Before being required to reveal their personal values, the landowners are assigned shares of whatever price is generated by a successful auction (the auction is a success if it results in a transfer of ownership). The shares are all positive and sum to one. This means that all of the auction revenue is distributed to the landowners. The details of the SP mechanism are as follows:

- Shares of the potential auction revenue are assigned to the landowners.
- The landowners are told that the assembled property will be offered at an auction.

20. In fact, Myerson and Satterthwaite (1981) proved that there is no perfect mechanism for assembling and selling contiguous plots as described in this example.

- Each landowner is to announce a minimum price at which he or she would be willing to cede ownership of the property and is told that the auction reserve is the maximum of the announced value-to-share ratio.
- The auction reserve is never revealed.
- Developers bid on the assembled land.
- The highest bidder acquires the assembled land at the price bid by the second-highest bidder, if the second-highest bid is greater than or equal to the reserve.

Consider the possibility that landowners Dery, Kelo, and von Winkle receive equal shares: each will be paid one-third of the revenue generated by a successful auction. After the share distribution is revealed, each announces his or her personal value. Mr. von Winkle considers that if he reveals his true value, $1,000, and this amount divided by one-third is the largest of the announced value–to–share ratios, the auction reserve will be $3,000. He thinks, *If that is the reserve, I will receive at least my true value if there is a bid of that amount or more. And if there is not such a bid, at least I can retain the land I value at $1,000. If, however, I announce a value less than $1,000, there is a chance that I will lose my land and receive less than it is worth to me as compensation. If I announce a value larger than $1,000, say $1,010, and my announcement determines the reserve (i.e., $1,000 divided by one-third is the largest of all the ratios), the reserve will be $3,030. If the second-highest bid is $3,020, the auction will fail, even though I would have been paid $1,006.67. I am better off accepting that amount than retaining my property.* Ms. Dery and Ms. Kelo use similar reasoning, and each concludes that truthful personal value revelation is in her best interest. Ms. Kelo announces $2,000, and Ms. Dery reveals $3,000. The largest ratio of announced value to share is $9,000, and that is the auction reserve.

Xenos, Yardley, and Zenith are all interested in acquiring the property, and each considers its best bid. Xenos thinks about bidding its maximum price of $4,000. If this is the highest bid, Xenos will acquire the assembled property and pay no more than $3,999.99, the highest possible second-highest bid. If it bids $4,001, it may end up paying $4,000.99, an amount higher than the property's value to Xenos. The developer correctly reasons that if it bids under its maximum amount, it will risk losing a profitable bargain. Similar reasoning convinces all the developers to bid their true maximum values.

With this set of circumstances (landowner values, shares, and developer values), the assembled property is acquired by Zenith, the company that values the use of the assembled property the most, for a price of $9,000. Each landowner is paid at least his or her reservation price. Application of the SP mechanism yields an efficient and fair outcome. In fact, the SP mechanism will always yield a fair outcome—no landowner will cede a property for compensation less than its personal value. And if there is a transfer of ownership, the recipient will always be the one, among all possible recipients, that will put the assembled property into

its highest and best use. These are all good outcomes. However, an unsuccessful auction may occur even if there is a superior development option.

Suppose the share distribution, rather than one-third each, is one-half to Mr. von Winkle, one-third to Ms. Kelo, and one-sixth to Ms. Dery. Each owner announces his or her true personal value, and the auction reserve is $18,000. The second-highest price bid of $9,000 is insufficient for success, and there is no transfer of ownership, even though there is a development option that is of higher value than the existing use.

The SP mechanism has much to recommend it as a tool to apply to the anti-commons problem. It requires no foreknowledge of individual values; it elicits truthful revelation of personal values; it guarantees, if there is a successful auction, that there is an efficient transfer of use (from residential to road in the example); and it ensures a fair and equitable outcome. There are no losers. An unfortunate property of the SP mechanism is that it does not guarantee an efficient outcome. As the previous example demonstrates, many superior projects will be rejected if the pre-auction share distribution is skewed such that the smallest shares are allocated to the property owners with the highest personal values. However, the SP mechanism is the most efficient of all the mechanisms that do not require knowledge of personal values, that ensure only efficient transfers are successful, and that guarantee an equitable (no loser) outcome (Grossman, Pincus, and Shapiro 2010).

The public sector can benefit from the application of the SP mechanism. A community's public revenues can be enhanced by retaining a fraction of the excess of the amount the bidder pays over the minimum amount that must be returned to the landowners. SP is a continuation of a proposal to convert the assemblage of land from a heavy-handed use of eminent domain condemnation to a more open one in which affected landowners might voluntarily participate (Heller and Hills 2008; Lehavi and Licht 2007). As a process for redevelopment, it is novel. However, the auction of assembled public property is not a new idea. The California Highway Department often sells excess property obtained in right-of-way condemnations.[21] Yet from my literature search, it seems that the use of public auctions for large-scale redevelopment has not been tried. Protocols for redevelopment seem to include a much more active participation of the public sector in the development details than would be possible with an auction with open participation.

Conclusions

In theory, takings and givings are mirror-image cousins. In practice, however, they are not. When property is taken for public use, the cost is borne by a small

21. See, for instance, http://www.dot.ca.gov/property/.

number of landowners, while the benefits are enjoyed by an entire community. It is a straightforward matter to identify the damaged parties and to employ a formula for compensating them: reimbursement is the market value of the taken property. If the beneficiaries are many and diffuse, however, it is prohibitively expensive to recover from them the value of the benefits they each enjoy. Implementing a complete system of charges for received benefits and compensation for specific damages is an impossible dream that would involve making public choices conform to the model of an ideal competitive market.

Commonly accepted ethical norms require that compensation be paid for obvious physical invasion of private property. An extension of this fairness standard would require payment from the small number of landowners who obviously benefit from a project. The design of a compensation/recovery mechanism requires some care, for every mechanism influences the decision calculus of the affected landowners. Mechanisms that are based on personal land value induce potentially damaged landowners to overinvest and potentially benefited landowners to underinvest in property-improving capital. This is a serious problem, because both market value compensation and ad valorem property tax recovery are property value based.

Two mechanisms that do not have perverse incentive effects are offered in this chapter. The first, the ideal mechanism, bases compensation on the enhanced value of non-taken property. The second, the SP mechanism, is an auction of multiple assembled properties, with predetermined shares of the final selling price distributed to the landowners. Both mechanisms lead to efficient and fair outcomes.

REFERENCES

Alpern, A., and S. Durst. 1997. *New York's architectural holdouts*. New York: Dover.

Arnott, R. 2005. Neutral property taxation. *Journal of Public Economic Theory* 7(1):27–50.

Bell, A., and G. Parchomovsky. 2001. Givings. *Yale Law Journal* 111:547–618.

Bender, W. H. 1929. Excess condemnation in Wisconsin. *Marquette Law Review* 13(2):69–75.

Blume, L., D. Rubinfeld, and P. Shapiro. 1984. The taking of land: When should compensation be paid? *Quarterly Journal of Economics* 99(1):71–92.

Cournot, A. A. (1838) 1960. *Researches into the mathematical principles of the theory of wealth*. New York: A. M. Kelley.

Epstein, R. A. 2009–2010. Takings law made hard. *Regulation* 32(4):4–8.

Grossman, Z., J. Pincus, and P. Shapiro. 2010. A second-best mechanism for land assembly. Working Paper. Santa Barbara: Department of Economics, University of California. http://www.escholarship.org/uc/item/1dn8g6vk.

Grove, T., and J. Ledyard. 1977. Optimal allocation of public goods: A solution to the "free rider" problem. *Econometrica* 45(4):783–809.

Hagman, D., and D. Misczynski. 1978. *Windfalls for wipeouts: Land value capture and compensation*. Washington, DC: Planner Press.

Hart, F. 1927. Excess condemnation a solution of some problems of urban life. *Marquette Law Review* 11(4):222–234.
Heller, M. A. 1998. The tragedy of the anticommons: Property in the transition from Marx to markets. *Harvard Law Review* 111(3):621–688.
———. 2008. *The gridlock economy.* New York: Basic Books.
Heller, M. A., and R. Hills. 2008. Land assembly districts. *Harvard Law Review* 121(6):1467–1527.
Hellman, P. 2004. *Shaping the skyline: The world according to real estate visionary Julien Studley.* Hoboken, NJ: Wiley.
Hong, Y.-H., and A. H. Lam. 1998. Opportunities and risks of capturing land values under Hong Kong's leasehold system. Working Paper. Cambridge, MA: Lincoln Institute of Land Policy.
Lehavi, A., and A. N. Licht. 2007. Eminent Domain, Inc. *Columbia Law Review* 107(7):1704–1748.
Lindahl, E. 1958. Just taxation: A positive solution. In *Classics in the theory of public finance*, ed. R. A. Musgrave and A. T. Peacock. London: Macmillan.
Matheson, M. J. 1969. Excess condemnation in California: Proposal for statutory and constitutional change. *Southern California Law Review* 42:421–443.
Michelman, F. H. 1967. Property, utility, and fairness: Comments on the ethical foundations of "just compensation law." *Harvard Law Review* 80(6):1165–1258.
Myerson, R. B., and M. A. Satterthwaite. 1981. Efficient mechanisms for bilateral trading. *Journal of Economic Theory* 29(2):265–281.
Niemann, P., and P. Shapiro. 2008. Efficiency and fairness: Compensation for takings. *International Review of Law and Economics* 28(3):157–165.
Samuelson, P. A. 1954. The pure theory of public expenditures. *Review of Economics and Statistics* 36(4):387–389.
Siegan, B. H. 2001. *Property rights: From Magna Carta to Fourteenth Amendment.* New Brunswick, NJ: Transaction.
Usher, D. 1995. Victimization, rent-seeking and just compensation. *Public Choice* 83:1–20.

APPENDIX: FORMAL ANALYSIS OF COMPENSATION/RECOVERY MECHANISMS

Details and Technical Matters

The analysis is based on a model of rational wealth-maximizing individuals. The variables of interest are

q = the public decision;
p = the probability that the public choice will be yes (build the highway, create an agricultural zone, etc.);
K = the landowner's choice of land-specific investment; this is installed capital, which may not be removed from the property;

i = the prevailing rate of interest; all capital expenditures are financed by the sale of a consol (an infinitely lived bond) with an annual debt service of iK;
I = the net income function; net income is total revenue minus current operating costs (including the landowner's opportunity cost). It is a quasi-concave, differentiable function of the amount invested in improvements on the land and the chosen public policy. The relationship between rent, capital, and public policy is described by $I = I(q,x)$;
τ = the tax rate on property value;
T = the tax revenues collected by the government;
$C[L](q,K)$ = the compensation benefit (recovery burden) if the public choice is q; the compensation may or may not depend on the value of invested capital. It is included to allow for the possibility of capital dependence. If there is no government action, $q = 0$, and compensation/recovery is zero: $C(0,K) = L(0,K) = 0$;
$V(q,K)$ = the market value of a property, indicating its dependence on both public policy and the level of investment; and
$SW(q,K)$ = aggregate wealth or social welfare.

Simple Mechanism

There are two types of rational wealth-maximizing landowners: damaged (D) and benefited (B). The Ds face the possibility that their land will be taken. The Bs may benefit from increased land values. The probability that the action will be taken is p, and it is known to everyone (it is common knowledge). There is a schedule that specifies compensation for D owners. The schedule may or may not depend on how much has been invested in improvements on the land, but to allow for investment-affected damages, the compensation schedule is written $C = C(K)$. There is also a schedule $L = L(K)$ that specifies how much the B owners must pay (recovery) if the decision to undertake the proposed action is favorable. Recovery is written as a function of investment to allow for the possibility of investment-related extractions. For this simple example, there are no taxes.

If the landowners make efficient decisions, each will choose an investment that equates the expected marginal productivity of capital with the prevailing social discount rate, i.

$$D: \quad (1-p)I_K(0,K) = i$$

(1) *and*

$$B: \quad (1-p)I_K(0,K) + pI_K(1,K) = i$$

With the published compensation and repayment schedules, landowner wealth is

$$D: \quad (1-p)\frac{I(0,K)}{i} + pC(K) - K$$

(2) *and*

$$B: \quad (1-p)\frac{I(0,K)}{i} + p\left[\frac{I(1,K)}{i} - L(K)\right] - K$$

The necessary conditions for landowner wealth maximization are

$$D: \quad (1-p)I_K(0,K) = r\left(1 - pC_K(K)\right)$$

(3) *and*

$$B: \quad (1-p)I_K(0,K) + pI_K(1,K) = r\left(1 + pL_K(K)\right)$$

Thus, with a known probability of a public decision and no property taxes, efficiency requires that the compensation/recovery schedules are independent of capital expenditures:

$$C_K(K) = L_K(K) = 0. \tag{4}$$

Neither the traditional, and what is considered mandatory, takings compensation nor the proposed beneficiary repayment are independent of landowner investment. The value of the condemned property prior to the public action is mandated as compensation for a taking. That value is

$$C(K) = \frac{I(0,K)}{i} \tag{5}$$

which is clearly not independent of K. It is proposed that the benefited landowner pay a proportion of the increase in land value. If that proportion of value is α, the amount of payment is

$$L(K) = \alpha\left[\frac{I(1,K) - I(0,K)}{i}\right] \tag{6}$$

which is not independent of K either.

Ideal Mechanism

A road is proposed through a region with N individually owned, but otherwise identical plots of land. The route, which describes the center of the road, is

known. There is going to be a choice of q contiguous plots that will determine the road's width. When the choice is made, q landowners will lose their property, and $N - q$ will retain theirs and enjoy the benefit of the newly constructed road.

There are three players, each choosing a different, but integral, quantity. The government chooses q, the beneficiaries choose the capital installed on the untaken property, and the losers choose the investment in improvements on their property. Let us first consider the socially efficient choice for each and then compare the outcome of the game for all three players.

Efficiency requires that both q and K are chosen to maximize aggregate wealth. Since the capital on the taken land will be destroyed, it is obvious that the losing landowners' wealth, without redistributions from the benefited landowners, will be at best zero. It will be negative if there is any investment in improvements on the condemned property. Clearly, the efficient investment on the taken property is zero. The only contribution to aggregate welfare is the wealth generated by the non-taken land. That amount is

$$SW(q,K) = (N-q)\frac{I(q,K) - iK}{i}. \tag{7}$$

Community wealth is written with iK in the numerator to indicate that the capital resource cost can be expressed as the annual debt service or, equivalently, the annual opportunity cost of installed capital. The level of q that maximizes social welfare, conditional on some value of K, is the one that solves the first-order condition

$$(N-q)I_q(q,K) = I(q,K) - iK. \tag{8}$$

For the $N - q$ beneficiary properties, the efficient investment is the one that, for every level of q, satisfies the first-order condition

$$I_K(q,K) = i. \tag{9}$$

The established efficiency conditions can be compared with the outcomes of individual agents acting independently of one another to advance their own goals, given the system of loser compensation and winner recovery.

The ideal mechanism follows the accepted practice of paying market value compensation to each losing landowner, but it adds a bonus equal to the increase in value enjoyed by a landowner whose property is not taken. The benefited landowner is taxed, at a fixed rate τ, on market value minus initial investment, K. The capital-adjusted basis is often called the *site value*. The site value tax is equivalent to an ad valorem property tax and an annual subsidy of τK for each taxpayer. To account for the tax rate and capital deduction, the value of the surviving owner's property is

$$V = \frac{I(q,K) + \tau K}{i + \tau} \tag{10}$$

and the wealth of the benefited landowner is

$$W(q,K) = \frac{I(q,K) + \tau K}{i + t} - K. \tag{11}$$

The first-order necessary condition for wealth-maximizing investment is

$$I_K(q,K) = i. \tag{12}$$

The benefited landowner makes the efficient capital choice. Furthermore, as property values increase, so will individual tax payments, because of public infrastructure expenditures.

As compensation for losing his property, the taken landowner receives V, irrespective of his investment. Since any positive investment will only diminish his wealth, the wealth-maximizing option is to invest nothing. Zero investment is the social optimum as well.

Both the losing landowner and the benefited landowner make efficient choices, conditional on the value of q.

The government's interest is in generating as much revenue as possible to support whatever goals it has. In this case, it levies a tax, at a rate τ, on the site values of the $N - q$ properties. Government revenue is

$$T(q,K) = t(N-q)\big[V(q,K) - K\big]. \tag{13}$$

Substituting the expression for value as the annual rent discounted,

$$T(q,K) = t(N-q)\left[\frac{I(q,K) + tK}{i + t} - K\right] = t(N-q)\left[\frac{I(q,K) - iK}{i + t}\right]. \tag{14}$$

Revenue-maximizing q solves the first-order condition

$$(N-q)I_q(q,K) = I(q,K) - iK \tag{15}$$

which is the exact aggregate wealth-maximizing amount.

Conditional on the choice of q, landowners make the efficient investment choice, K. Simultaneously, conditional on the private investment choices, K, the government makes an efficient road size choice, q. The equilibrium of this three-participant game is both efficient and equitable.