Chapter 7
Involuntary Transfers and Regulation of Property

Adverse Possession

The theory of adverse possession described here is based on the presence of offsetting risks to the ownership of land. The first risk arises from the possibility of past claims by previous owners who were deprived of their title through fraud or error. A time limit on such claims limits this risk to current owners. Let $p(t)$ be the risk of such a claim, where t is the duration of the prior owner's property right. We assume that $p'(t)>0$ and $p(0)=0$. The other risk is that the current owner may himself be displaced by a squatter. This possibility can be reduced by periodic monitoring of the property to eject squatters or correct boundary errors. A longer time limit on the owner's property right lowers this cost by reducing the frequency of monitoring. Formally, let $m(t)$ be the cost of monitoring that the owner must expend to retain title with certainty, where $m'(t)<0$ and $m(\infty)=0$.

Now suppose the current owner contemplates investing in the land. Let $V(x)$ be the market value of an investment of x dollars, where $V'>0$, $V''<0$. Given uncertainty, the owner will choose x to maximize the expected value, $(1-p(t))[V(x)-m(t)]-x$, taking t as given. This yields the first order condition

$$(1-p(t))V'(x) - 1 = 0, \qquad (7.1)$$

which defines the optimal investment, $x^*(t)$, as a function of the time limit, where $\partial x^*/\partial t = p'V'/(1-p)V''<0$.

Given this characterization of the landowner's problem, we can derive the optimal duration of property rights as the value of t that maximizes the social value of land net of monitoring costs:

$$V(x^*(t)) - x^*(t) - m(t). \qquad (7.2)$$

Differentiating (7.2) and substituting from (7.1) yields

$$p(t)V'(x)(\partial x^*/\partial t) = m'(t). \qquad (7.3)$$

Thus, the optimal time limit balances the detrimental effect of longer t on investment incentives (the left-hand side) against the savings in monitoring costs (the right-hand side).

The Mistaken Improver Problem

The analysis to this point has treated the probability of a claim as a function only of the statutory period, but owners can lower the risk of a claim by surveying their property prior to development to detect boundary errors. Suppose that a survey reveals ownership with certainty. If the developer turns out to be the owner, he can proceed with development as if there were no risk of a loss. However, if someone else is revealed to be the owner, the developer can bargain to purchase the land if it is more valuable in the developed state. In this way, the value of the land is maximized. Determining ownership is costly, however, which may make it more profitable for the developer to proceed without a survey. This raises the possibility of mistaken improvement of another's property—the so-called *mistaken improver problem*.

Let V be the market value of the improved land, and let p be the probability, prior to survey, that the land is owned by someone else who values it in its unimproved state at R. Further, suppose that R is unobservable to the developer but is known to be distributed by the function $F(R)$. If the developer surveys at cost s prior to developing, the expected value of the land is $(1–p)V + pE\max[V,R] – s$, or

$$(1-p)V + p[F(V)V + \int_V^\infty R dF(R) \; - s \qquad (7.4)$$

If, however, the developer proceeds without a survey, the value of the land is fixed at V, regardless of who turns out to be the owner. A survey is therefore socially optimal if (7.4) exceeds V, or if

$$p\int_V^\infty (R - V) dF(R) > s \qquad (7.5)$$

The left-hand side of this condition is the expected benefit of avoiding irreversible improvement of land that may be owned by someone else and is more valuable in its unimproved state. As shown in the text, the law of mistaken improvement in most states aligns the developer's private incentive to conduct a survey with this social condition.

The Holdout Problem

The holdout problem is the primary economic justification for allowing the government to force transactions using eminent domain. The exact nature of the social cost associated with holdouts is unclear in the literature. Some authors have described it as a problem of monopoly, while others have characterized it in terms of transaction costs or breakdowns in bargaining. 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. The simple model to be developed here highlights the cost of delay.

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

$$V>2v, \tag{7.6}$$

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 _ dollars for each parcel acquired later. Assume, however, that

$$V–2\_>2v. \tag{7.7}$$

Thus, 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), assume that both owners sell. Without loss of generality, we allow the sellers to obtain all of the surplus from the project, which they split evenly. Thus, each receives a price of $V/2–\_$. 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.

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 $V–\_–P_1–P_2$, 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:

$$P_2 = V - \_ - v. \tag{7.8}$$

Finally, consider the determination of P_1. Substituting (7.8) into the developer’s return for the overall project, setting the result equal to zero, and solving for P_1 yields

$$P_1 = v. \tag{7.9}$$

Comparison of (7.8) and (7.9) reveals that $P_2>P_1$ by (7.7). Thus, being the lone holdout in period two is better than being the lone seller in period one. Condition (7.7) also implies that $V - \_ - v>V/2$ (that is, it is better to be the lone seller in period two than to sell jointly in period one), while (7.6) implies $V - \_ - v> V/2–\_$ (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,[1] 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."

		Seller 2: Now	Seller 2: Later
Seller 1	Now	$V/2,\ V/2$	$v,\ V–\_–v$
	Later	$V–\_–v,\ v$	$V/2–\_,\ V/2–\_$

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

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 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.

Compensation for Takings: A Generalized Model

One of the primary contributions of the economics literature on takings law has been to argue that paying compensation for takings (or regulations) may lead to inefficient land use incentives. To illustrate, consider a parcel of land worth $V(x)$ if the landowner makes an irreversible investment of x dollars, where $V'>0$, $V''<0$. The land may also be valuable for public use, yielding a benefit of $B(y)$, where y is the fraction of the land taken. Setting $y=1$, therefore, represents a taking of the entire parcel. Alternatively, $y<1$ may be interpreted as the probability of a taking, or as the fraction the parcel's value that is extinguished by a regulation. In any case, $0\leq y\leq 1$, and $B'>0$, $B''<0$.

If the land is taken or regulated, suppose that compensation of $C(x)$ will be paid in proportion to the fraction taken—that is, $yC(x)$ will be paid for an expected loss of a fraction y of the land—where $C(x)\geq 0$ and $C'\geq 0$. The time sequence is that the landowner

[1] 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.

chooses x given the anticipated behavior of the government (i.e., its choice of y) and the compensation rule; then, the government chooses y and pays $C(x)$.

The social optimum. The socially optimal choices of x and y maximize $B(y)+(1-y)V(x)-x$. The resulting first order conditions are

$$(1-y)V'(x) - 1 = 0 \tag{7.10}$$

$$B'(y) - V(x) = 0. \tag{7.11}$$

Together, these conditions determine x^* and y^*. Also note for future reference that (7.11) defines the function $y^*(x)$, which is be the government's optimal taking decision for any given x. Differentiating (7.11) yields

$$\frac{\partial y^*}{\partial x} = \frac{V'}{B''} < 0. \tag{7.12}$$

Thus, the amount of land it is optimal for the government to take is decreasing in the landowner's investment because it higher x increases the opportunity cost of a taking.

Actual investment and taking decisions. Now consider the decisions made separately by each party. We consider three different scenarios regarding the government's behavior. In the first, the government's decision is exogenous (that is, y is fixed), while the landowner chooses x to maximize $(1-y)V(x) + pC(x) - x$. The first order condition is

$$(1-y)V'(x) + pC'(x) - 1 = 0. \tag{7.13}$$

Comparing this to condition (7.10) shows that $C'=0$ is necessary for the landowner to invest efficiently. That is, compensation must be lump sum. It follows that no compensation ($C(x)=0$) is efficient, but any positive lump sum amount will also work. This is the famous "no compensation" result.

We now show that this result does not hold up under different assumptions about the government's behavior. Suppose, for example, that the government chooses y to maximize social welfare. (That is, it is benevolent.) Formally, it chooses $y^*(x)$ for any x. The landowner's objective remains the same as above, but he rationally accounts for the dependence of y on his choice of x. Thus, the first order condition defining x in this case is

$$(1-y)V'(x) + yC'(x) - [V(x) - C(x)](\partial y^*/\partial x) - 1 = 0. \tag{7.14}$$

Compensation must again be lump sum, but zero compensation is no longer consistent with efficiency. This is reflected by the third term in (7.14), which, given (7.12), implies that the landowner will overinvest if $C(x)<V(x)$ and underinvest if $C(x)>V(x)$. Intuitively, if the landowner expects to be undercompensated in the event of a taking, he will increase his investment in order to lower the probability of a taking. Conversely, if he expects to be overcompensated, he will underinvest in order to raise the probability of a taking.

This version of the model embodies two sources of moral hazard for the landowner. The first is the threat of overinvestment if compensation is an increasing function of x (the basis for the no-compensation result above), while the second is the effect of x on the government's taking decision. One compensation rule that resolves both problems and induces both an efficient level of investment and the efficient taking decision is $C=V(x^*)$. That is, compensation is set at the full value of the land evaluated at the efficient level of investment.

In the final scenario, the government is not benevolent but instead acts on behalf of the majority (those who receive the benefits of the taking) while ignoring the costs to the individual property owners, except to the extent that it must pay them compensation. Such a government is said to have "fiscal illusion" in that it only cares about dollar costs. In this case, the government chooses y to maximize $B(y)–yC(x),$ which yields the first order condition

$$B'(y) - C(x) = 0. \qquad (7.15)$$

This defines the function $y^g(x)$ whose characteristics depend on the nature of the compensation rule. The landowner maximizes the same objective function as above, yielding the same first order condition as in (7.14), except that $\partial y^*/\partial x$ is replaced by $\partial y^g/\partial x$. Note that the compensation rule, $C=V(x^*)$, will again yield both the efficient level of landowner investment and the efficient taking decision by the government.

Now consider an alternative compensation rule that also induces efficient behavior by both the landowner and the government:

$$C = \begin{cases} 0, & \text{if } y \leq y^* \\ V(x), & \text{if } y > y^* \end{cases} \qquad (7.16)$$

Note that this rule is conditional on the behavior of the government: specifically, it requires the government to pay full compensation if it takes too much land, but requires no compensation if the government takes no more than the efficient amount.

To prove that (x^*,y^*) is a Nash equilibrium when this rule is in place, suppose that $x=x^*$. Then, the government's optimal response is to choose y^*. First, note that it will never choose $y<y^*$ since $B'>0$, and it will prefer y^* to $y>y^*$ since $B(y^*)>B(y^*)-y^*V(x^*)\geq \max_{y>y^*} B(y)-yV(x^*)$. Now suppose that $y=y^*$. Since in that case $C=0$, the landowner chooses x to maximize $(1-y^*)V(x)-x$, which yields x^*. This establishes the claim.

One advantage of the rule in (7.16) over the unconditional compensation rule $C=V(x^*)$, which also yields an efficient outcome, is that the conditional rule will result in fewer takings claims (and hence lower administrative costs) because landowners only expect to be compensated, and hence will only file a claim, if the government acts inefficiently. Another advantage is that the rule in (7.16) is more descriptive of actual takings law in cases involving government regulations (so-called regulatory takings), which constitute the vast majority of takings claims. For example, it closely resembles the "diminution of value" test and the "nuisance exception," both of which are conditional rules that limit compensation to cases of excessive regulatory action.