SIX

THE ECONOMICS OF PROPERTY LAW

Property is perhaps the most fundamental area of the common law. It is also basic to economics in that property rights are essential for exchange. In this chapter and the next, I develop an economic analysis of property law. This chapter focuses on the legal protection of property rights, the transfer of property rights between private individuals (both voluntary and involuntary), and the law with regard to incompatible property rights (or externalities).

I begin the analysis with the fundamental distinction between property rules and liability rules, which forms the basis for much of the economic analysis of property. The key to the distinction is the interaction between *consent* as the basis for mutually beneficial exchange and the *transaction costs* associated with obtaining consent. Consensual exchange is governed by property rules, and nonconsensual exchange is governed by liability rules. Thus, property rules ensure that exchanges are Pareto-efficient (i.e., both parties are made at least as well off), but if transaction costs are high, they may preclude some efficient exchanges from being completed. In that case, liability rules can facilitate exchange by removing the requirement of consent and replacing it with a coerced exchange according to terms set by the court.

With this distinction in mind, I first examine the problem of controlling external costs associated with incompatible, or overlapping, property rights. I consider the efficiency of several methods, including money damages, taxes, subsidies, zoning, and covenants. I then turn to the legal rules governing land transfer between private individuals. I first consider the merits of different methods for protecting and transferring title to land, especially in relation to the possibility of past errors or fraud in the line of title. I then examine situations in which involuntary transfer of land, for example under the statutory doctrine of adverse possession, might be economically desirable.

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1. Property Rules and Liability Rules

The discussion of the Coase theorem in chapter 1 concerned the efficiency of the *assignment* of property rights, or entitlements, in externality situations. The basic conclusions were that when bargaining between the parties is possible, the efficient assignment of entitlements will be achieved regardless of the initial assignment; whereas if bargaining is not possible, the initial assignment is important for efficiency. The assignment of entitlements is not the whole story, however. The rules for protecting that assignment are also important, since they dictate the circumstances under which subsequent transfers of entitlements can take place. The two basic rules for protecting entitlements are property rules and liability rules.[1]

The distinction between property rules and liability rules was first drawn by Calabresi and Melamed (1972).[2] To illustrate the distinction, consider party A who holds an entitlement protected by a property rule. Another party B can only acquire that entitlement by first obtaining A's consent, as when B purchases the entitlement. If instead A's entitlement is protected by a liability rule, B can acquire it without A's consent, provided B is willing to pay damages in an amount set by the court. The exchange is therefore nonconsensual.

Removing A's right to consent does two things. First, it prevents A from refusing exchanges that are not mutually beneficial. Although mutually beneficial exchanges can still be assured by setting compensation appropriately, in practice this is difficult because A's subjective value is unobservable. Courts therefore generally resort to awarding compensation equal to fair market value, which almost surely understates A's valuation. As a result, inefficient exchanges are possible. The second consequence of removing A's right to consent is that it prevents A from being able to bargain for a share of the surplus from the transaction. Although this does not reduce efficiency per se, it is unfair from A's perspective.

Liability rules may nevertheless improve efficiency because, if transaction costs between A and B are high, consensual exchanges that are mutually beneficial may be foregone. When this is true, a coerced exchange can enhance value by avoiding transaction costs. The optimal rule for protecting entitlements therefore balances the transaction costs associated with property rules against the potential for inefficient exchange under liability rules. When transaction costs are low, the balance tips in favor of property rules, and when transaction costs are high, it tips in favor of liability rules (Calabresi and Melamed, 1972).

The principles underlying this distinction between property and liability rules are well illustrated by the case of *Boomer* v. *Atlantic Cement Co.*[3] The defendant was a large cement company whose operation caused damages to nearby residents. The residents brought suit for an injunction to halt the operation of the company, but the court ruled instead that the company could continue operation provided that it pay damages to the residents. Thus, the court protected the residents' right to be free from damages with a liability rule rather than a

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property rule. This choice is consistent with the conclusions of Calabresi and Melamed because transaction costs between the residents and the cement company presumably were high owing to the large number of residents. Thus, the effect of an injunction (property-rule protection of the residents' right) may well have been shutdown of the plant, whether or not that was the efficient result.

1.1. Protection of Possessory Interests in Property

Ownership of personal and real property is ordinarily protected by a property rule;[4] that is, individuals cannot take land or personal property without the owner's consent.[5] This is generally viewed as efficient given that exchange of property between individuals ordinarily involves low transaction costs. Thus, giving the possessor the right of consent to any exchange does not represent an impediment to bargaining. And, as noted above, it protects the possessor's subjective valuation of the property in question, which is not guaranteed by a liability rule (especially if compensation is based on fair market value).

Although the preceding argument suggests that property rules are preferred to liability rules when transaction costs are low, the Coase theorem says that property rules and liability rules should be equally efficient. The claim that liability rules may lead to inefficient exchanges if compensation is set too low is based on the implicit assumption that the possessor of the property will never bargain with potential takers. But if transaction costs are low, such bargaining is always possible and will lead to the efficient result. Suppose, for example, that the possessor of an object values it at \$100, but any other individual can take it from him by paying its market value, \$80. Suppose the taker values the object at \$90. He will therefore take it inefficiently. However, note that the possessor will pay the taker up to \$20 to refrain from taking it, and the taker will accept any amount greater than \$10 = 90 − 80. A bargain is therefore possible whereby the possessor (efficiently) retains possession.

The preceding argument that property rules and liability rules are equally efficient methods for protecting entitlements to objects when transaction costs are low does not explain the predominance of property rules in actual practice. Kaplow and Shavell (1996) argue, however, that this simple example misses a fundamental impediment to bargaining under a liability rule as compared to a property rule when compensation is set too low. The problem is that the possessor will face innumerable potential takers who value the object more than its market value but less than the possessor. Since the possessor will find it infeasible to bribe all of them in the manner described above, the object will be inefficiently taken. The source of this problem is twofold: first, the object is undervalued by the court; and second, there is unlimited "entry" of takers.[6] Property rules prevent this problem by allowing the possessor to refuse inefficient transfers rather than having to pay bribes to prevent them. This will deter entry of takers who value the property less than the owner.

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1.2. External Costs: The Laws of Trespass and Nuisance

I now turn to the problem of protecting an individual's entitlement to be free from external costs.[7] In this section, I focus specifically on the laws of trespass and nuisance, which govern costs imposed on landowners. In the next section, I undertake a broader, more theoretical analysis of various approaches for controlling externalities in general.

One of the fundamental rights associated with ownership of land (or any piece of property) is the right to exclude others from its use. Unwanted intrusions onto one's land are governed either by the law of trespass or the law of nuisance. Under the law of trespass the landowner can generally obtain an injunction preventing future intrusions, regardless of their nature. In contrast, under the law of nuisance, the landowner can typically obtain relief (either an injunction or damages) only by showing that the harm is substantial and that the interference is unreasonable.[8]

Merrill (1985) has provided an economic theory that seeks to explain this difference in the treatment of unwanted intrusions under trespass and nuisance.[9] The key to the argument is the transaction cost between the parties to the dispute. Both the Coase theorem and the preceding discussion of property rules and liability rules suggest that when transaction costs are low, it is efficient for the parties to resolve incompatibilities on their own, via consensual exchange. This is facilitated by court enforcement of entitlements by property rules. However, when transaction costs are high, we have seen that involuntary exchange may be more conductive to efficiency. In this case, courts should take a more active role by coercing exchange at a prescribed price.

According to Merrill's argument, the difference between trespass and nuisance fits broadly into this dichotomy: when transaction costs are low, the law of trespass should govern, and when transaction costs are high, the law of nuisance should govern. This categorization conforms with the above theory in that trespass imposes injunctive relief for the plaintiff, *regardless* of the circumstance of the intrusion. Thus, it is like a property rule. If the intrusion is cost-justified (i.e., efficient), then, given, low transaction costs, the defendant and plaintiff presumably will strike a mutually acceptable bargain that allows the defendant to continue the activity. If, however, the intrusion is inefficient, the defendant will honor the injunction and cease the activity.

As for nuisance law, it conforms to the above theory in that the court adopts a balancing, or reasonableness, test before imposing a remedy. This reflects greater court intervention in resolving the dispute, owing to the fact that transaction costs may inhibit resolution by the parties on a voluntary (consensual) basis. Although this argument is complicated a bit by the fact that both damages and injunctions are available under nuisance law (thus, the analysis does not fit neatly into the property rule-liability rule framework), both remedies are available only after a balancing test by the court to determine the reasonableness (i.e., efficiency) of the nuisance-creating activity.[10]

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TABLE 6.1 Thresholds Distinguishing Trespass and Nuisance

Trespass	Nuisance
Defendant's act occurred on plaintiff's land	Defendant's act occurred on defendant's land
Harm is 'direct'	Harm is 'indirect'
Invasion by 'tangible' matter	Invasion by 'intangible' matter
Interference with 'exclusive possession' of land	Interference with 'use and enjoyment' of land*

*If the interference with use and enjoyment becomes severe, it amounts to 'constructive' interference with exclusive possession and is governed by trespass (Merrill, 1985).

As a broad test of the theory, Merrill (1985) examined the various thresholds that the common law has set to distinguish the spheres of trespass and nuisance. If the theory is correct, these thresholds ought to distinguish roughly between low and high transaction cost intrusions. Table 6.1 lists several of these thresholds. Clearly the correlation is not exact, but these thresholds provide at least some support for the view that the law is attempting to distinguish between high and low transaction cost intrusions.

2. Controlling Externalities: Formal Analysis

This section develops a more complete and formal analysis of the efficiency of property rules, liability rules, taxes and/or subsidies, and other methods for controlling externalities. To be concrete, I will consider the familiar case of a factory that emits smoke, causing damage to a neighboring laundry. Let $D(x)$ be the dollar amount of damage the laundry suffers per unit of time, which is a function of the dollar spending on abatement by the factory, denoted x. (Assume for now that the laundry cannot take any steps to reduce its damage.) In this simple setting, the only efficiency question concerns the choice of abatement by the factory. The socially optimal amount of abatement minimizes the sum of the cost of abatement plus the damages suffered by the laundry, or $x + D(x)$. The first-order condition for optimal abatement is thus

$$1 = -D'(x). \tag{6.1}$$

Let x^* be the solution to (6.1), as illustrated in figure 6.1. (Note the similarity of this problem to the simple accident model of chapter 2, where abatement corresponds to care.)

2.1. Tax-Subsidy Approach

The traditional approach to resolving externalities of this sort is to use Pigouvian taxes or subsidies.[11] According to this approach, the government imposes a tax on, or pays a subsidy to, the polluter in such a way that the polluter internalizes the externality and chooses the socially optimal level of abatement. This is

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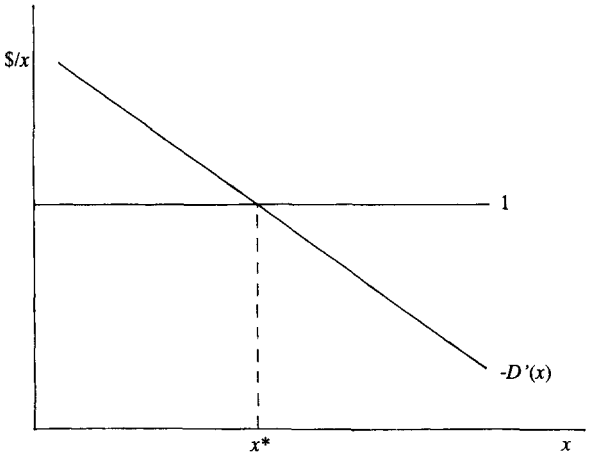


FIGURE 6.1 Efficient abatement of an externality.

accomplished by ensuring that the marginal tax is equal to the marginal external damages ($t' = D'$), or that the marginal subsidy is equal to the negative of the marginal external damages ($s' = -D'$), at the optimal abatement level. As long as this is true, the actual form of the tax or subsidy schedule is irrelevant for efficiency, although it will clearly matter for distribution of wealth. Also unimportant in the current version of the model is whether the laundry is compensated for its damages; again this is only a distributional issue (assuming no income effects). In more general versions of the problem, however, both of these issues become important for efficiency, as we shall see.

2.2. Liability Rules

The liability approach to controlling externalities requires the party suffering the damage (the laundry) to bring a nuisance suit in hopes of collecting damages or obtaining an injunction. I have already provided a general discussion of the choice between damages and injunctions (liability rules and property rules) based on transaction costs. Here I focus on the incentives they create for efficient abatement of externalities.

Since one function of damages is to compensate the victim, the polluter's liability is typically set equal to the victim's actual damages, $L(x) = D(x)$. Clearly, this form of liability will induce the factory to engage in optimal abatement for the same reason that strict liability induces injurers to take optimal care in accident settings. The analogy to torts also suggests that a negligence form of liability will induce optimal abatement by the factory. (Recall that nuisance law uses a type of negligence, or balancing test, before imposing liability or injunctive relief.) The difference between strict liability and negligence is that the victim does not receive compensation under negligence if the polluter engages

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in optimal abatement. In the current version of the model, this difference again is purely distributional, but it will matter for efficiency below.

Notice that the discussion of liability to this point has implicitly assumed that the victim (the laundry) has a right, or an "entitlement," to be free from pollution.[12] Suppose instead that the factory initially has the right to pollute. Perhaps the factory was preexisting and was therefore awarded the right to pollute under the common law doctrine of "coming to the nuisance" (Wittman, 1980). This change in the entitlement point, however, does not preclude the use of liability rules for achieving optimal abatement. Specifically, suppose that in this case, the laundry can compel abatement by the factory as long as it (the laundry) pays the factory's "damages," or its cost of abatement. Thus, $L = x$ for the laundry, and its problem is to choose x to minimize $L + D(x) = x + D(x)$, which results in the optimal choice of x.

Although the solution just suggested seems odd in comparison to the solution in which the polluter is liable, it serves to demonstrate the symmetry of the problem and the fact that the polluter and the pollutee simultaneously "cause" the harm (Coase, 1960). Moreover, it is not as unrealistic a solution as one might suppose, as illustrated by the case of *Spur Industries, Inc.* v. *Del E. Webb Development Co.*[13] This case concerned a developer who brought a nuisance suit against the owner of a feedlot in an effort to shut it down owing to its foul odor. The court granted the developer's request, but because the feed lot was preexisting (the developer had encroached on it), it required the developer to pay the owner's cost of relocating. If we view the feedlot's relocation as abatement of the externality, then this solution is identical to that just described. This case and the *Boomer* case are therefore both examples of externalities resolved by liability rules, but they differ in terms of the initial assignments of entitlements.

2.3. Property Rules

Recall that property rules differ from liability rules in that either party can block a movement away from the initial assignment of rights. That is, each party can seek and enforce an injunction against the other party. As noted above, if transaction costs are high, the efficient outcome will arise therefore only if the initial assignment is efficient. If the initial assignment is not efficient and transaction costs are low, the Coase theorem tells us that the parties will be able to improve their positions by bargaining.

To illustrate, suppose that the laundry initially has the right to be free from pollution. It can therefore obtain an injunction requiring the factory to abate the pollution completely. The factory, however, can seek to purchase rights to pollute from the laundry. At the margin, the maximum amount it will pay is \$1 per unit of abatement that it saves. The laundry, on the other hand, will accept no less than its marginal damages, or $-D'(x)$ per unit of the reduction in x. A transfer of pollution rights will therefore be mutually beneficial as long as $-D'(x) < 1$, or for all x to the right of x^* in figure 6.1. If all gains from exchange

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are exhausted, the factory will purchase pollution rights to the point where $-D'(x) = 1$, which is the efficient point.

Now consider the case where the factory initially has the right to pollute. In this case, the factory is free to pollute (i.e., to set $x = 0$) unless the laundry purchases the right by paying the factory to undertake abatement. The maximum amount the laundry will pay for an increment in abatement is $-D'(x)$, its marginal damages, and the minimum amount the factory will accept to increase abatement by one unit is \$1, its marginal abatement cost. Thus, the laundry will purchase abatement as long as $-D'(x) > 1$, which is true to the left of x^* in figure 6.1. Again, the efficient outcome is achieved if the parties exhaust all gains from bargaining.[14]

Thus, both property rules and liability rules potentially achieve the efficient outcome. The difference is that, under liability rules, bargaining between the parties is not necessary because the court sets the price of the exchange. As for the initial entitlement point, its impact is solely distributional under both types of rules and therefore does not affect marginal abatement incentives.

2.4. Bilateral-Care Externalities

In this section I consider briefly how the preceding analysis is affected if the victim of the externality also has the ability to abate the damages. Specifically, suppose that the damages suffered by the laundry are now $D(x,y)$, where x continues to be the factory's abatement expenditures and y is the laundry's abatement expenditures (White and Wittman, 1979). Assume that

$$D_x < 0, D_{xx} > 0, D_y < 0, D_{yy} > 0, D_{xy} > 0. \tag{6.2}$$

The social problem in this case is to choose x and y to minimize $x + y + D(x,y)$. The first-order conditions are thus

$$1 = -D_x(x) \tag{6.3}$$

and

$$1 = -D_y(y). \tag{6.4}$$

Consider first the tax-subsidy approach. Let $t(x,y)$ be the tax (or subsidy) schedule faced by the factory. As in the unilateral-care case, as long as the marginal tax is such that $t_x = D_x$, the factory will choose the optimal level of abatement, given the level of abatement chosen by the laundry. At the same time, the laundry will also choose the optimal level of abatement, provided that either it does not receive compensation for its damages or the compensation is a lump sum (i.e., independent of its choice of y). The tax-subsidy approach induces both parties to choose optimal abatement because both are fully liable for the damages at the margin.

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Now consider liability rules. In this case, we know from our analysis of tort law that strict liability will induce optimal abatement by the factory (given y), but it will not induce optimal abatement by the laundry, given that the laundry receives full compensation for its damages. However, a negligence rule will induce both parties to choose optimal abatement because the injurer avoids liability by choosing optimal abatement (provided that the due standard is set at x^*), thereby making the victim responsible for its own damages.[15]

Finally, consider property rules. As long as bargaining between the parties is costless, the conclusion from above is not changed by the possibility of victim care—namely, the parties will trade property rights until the efficient outcome is achieved.[16]

2.5. Long Run Efficiency

The analysis so far has concentrated on efficient abatement of the externality, assuming that the number of parties involved was fixed. We may characterize this as short-run efficiency. In the long run, however, entry and exit of polluters and victims is possible, a process that will also affect the severity of the externality. An examination of long-run efficiency in this context is therefore important because, as several authors have pointed out, not all of the rules that induce efficient abatement in the short run create the correct entry-exit incentives in the long run (Frech, 1979; White and Wittman, 1979). The reason is that entry-exit incentives depend on the distribution of wealth or profits, and, as noted, different rules create different distributions.[17]

To examine long-run efficiency in a formal manner, we need to amend the simple model to allow entry and exit of factories and laundries.[18] Thus, let n_f and n_l be the number of factories and laundries in operation, respectively, and let q_f and q_l be the output levels for each factory and laundry. Also, let $P^f(n_f q_f)$ and $P^l(n_l q_l)$ be the inverse demand curves for the two industries, which are downward sloping, and let $C^f(q_f)$ and $C^l(q_l)$ be the production costs for each of the two types of firms. $D(x)$ is now defined to be the external cost emitted per factory, so $n_f D(x)$ is the total external cost emitted and x is abatement per factory. The model is therefore one of unilateral care, and the externality is assumed to be independent of the output levels of the factories (for simplicity).

Assume that each laundry in operation incurs the full external cost—that is, the externality is a pure public "bad." Thus, the total external damage incurred by the laundries collectively is $n_l n_f D(x)$. The social problem is to choose the output levels of each type of firm, the number of each type of firm, and the level of abatement per factory, to maximize social welfare, which is given by[19]

$$W = \int_0^{n_f q_f} P^f(z)dz + \int_0^{n_l q_l} P^l(u)du - n_f C^f(q_f) - n_l C^l(q_l) - n_f n_l D(x) - n_f x. \quad (6.5)$$

Since we are interested in optimal abatement and entry rather than the output of each firm (given that damages are independent of output levels), I consider

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only the choices of x, n_f, and n_l. The first-order conditions for these variables, respectively, are:

$$-n_l D'(x) = 1 \tag{6.6}$$

$$P^f(n_f q_f)q_f - C^f(q_f) - n_l D(x) - x = 0 \tag{6.7}$$

$$P^l(n_l q_l)q_l - C^l(q_l) - n_f D(x) = 0. \tag{6.8}$$

Condition (6.6) determines optimal abatement per factory. Note that it is a standard Samuelson condition for a pure public good (i.e., the sum of the marginal benefits equals marginal costs). Conditions (6.7) and (6.8) are zero profit conditions that determine optimal entry. Both include damages, given that entry of either type of firm increases total external costs.

Now consider the determination of these variables in a competitive equilibrium under various cost-internalization rules. Consider first the tax-subsidy approach. As noted above, both taxes and subsidies induce optimal abatement by the factory as long as the marginal tax or subsidy equals marginal damages. In the case of a tax, this requires that $t'(x) = n_l D'(x)$. As for the entry decision, only a tax equal to the full damages will lead to the correct number of factories. Specifically, if $t(x) = n_l D(x)$, then the profit per factory is

$$\pi^f = P^f q_f - C^f(q_f) - n_l D(x) - x. \tag{6.9}$$

Comparing (6.9) and (6.7) shows that, if factories enter until profit is zero, the number of firms will be optimal. The number of laundries will also be optimal provided that they are not compensated for their damages out of the tax revenue. Specifically, in the absence of compensation, the profit per laundry is

$$\pi^l = P^l q_l - C^l(q_l) - n_f D(x). \tag{6.10}$$

which, compared to (6.8), shows that, if laundries enter until they earn zero profit, the number of laundries will be efficient.

In contrast to a tax, a subsidy will not lead to efficient entry. There will be too many factories because they will not face the full damages that their entry imposes—indeed, they receive a payment for entering. As for laundries, even though they do face the full damages of $n_f D(x)$ under the subsidy (again assuming they are not compensated), too few will enter because n_f in (6.10) is too large.

Now consider liability rules. Note first that under a strict liability rule, too many laundries will enter because they are fully compensated for their damages. Thus, they ignore the impact that their entry has on total damages. Although each factory faces full liability of $n_l D(x)$, this amount will be too high in equilibrium because of the excessive number of laundries. Thus, too few factories will enter the industry, and each will undertake too much abatement, although abatement is efficient given the number of laundries—see (6.6).

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A negligence rule will induce factories to undertake optimal abatement (given that the due standard is set at x^*), but it will result in entry of too many factories because, by undertaking optimal abatement, they avoid liability (Polinsky, 1980b). On the other hand, laundries will bear the full amount of damages, $n_f D(x^*)$, but too few will enter because n_f is too large. In general, therefore, liability rules do not result in correct entry-exit decisions because they do not create bilateral responsibility for damages.

Finally, consider the situation under property rules. Recall that under property rules, the ultimate allocation of resources results from bargaining between the parties over rights to pollute. Bargaining begins from an initial entitlement point, or assignment of rights. Thus, suppose that laundries as a group initially have the right to be free from pollution. For example, suppose that shares of the right are equally distributed among the optimal number of laundries in the industry. In order for factories to enter and pollute, they have to purchase rights from the laundries. Frech (1979) shows that, if transaction costs are low, this scenario leads to efficient abatement by factories, and efficient entry of both factories and laundries. The same result holds if the factories initially have the right to pollute, and laundries have to purchase the right to be free from pollution.

Rather than demonstrate these results formally, I will provide an intuitive explanation of why property rules lead to efficient long-run decisions while liability rules do not.[20] Consider the situation under strict liability. In this case, any laundry entering the industry is fully compensated for its damages and therefore ignores the marginal contribution to total damages resulting from its entry. The right to compensation is therefore not exclusive, but is available to any potential entrant. Thus, entry occurs until the value of that right is driven to zero. This is not true under property rules because, once rights to pollution (or freedom from pollution) are allocated (either to polluters or victims), entrants can obtain them only by purchasing them from a holder. Entry is therefore not excessive because in equilibrium, the price of obtaining a right upon entry will reflect the social cost of entry.

Holderness (1989) has illustrated this difference between liability rules and property rules in the long run by distinguishing between *open* and *closed* classes of right holders. When a right is assigned to an open class, a share of the right can be freely obtained by entry into the class because, by definition, entry is unrestricted. This is the case under liability rules where, for example, mere entry into the laundry business confers on the entrant the right to compensation. (Liability rules need not create open classes, however, if entrants do not automatically receive compensation.)[21] Alternatively, if a right is assigned to a closed class, entry is not free; a share of the right can be obtained only by purchasing it. This resembles the situation under property rules. An example of a situation where a right is assigned to a closed class is when a regulation "runs with the land" because in that case the right can be obtained only by purchasing the land, the price of which will capitalize the value of the right.[22]

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2.6. Zoning, Covenants, and Nuisance Law

The most common response to the presence of externalities in the land market is zoning. Nearly all U.S. cities have some form of zoning regulations,[23] which typically take the form of land-use restrictions within designated areas, as well as more detailed structural restrictions.[24] The economic theory of zoning, according to White (1975, p. 32) is based on the fact that "similar land uses have no (or only small) external effects on each other whereas dissimilar land uses may have large effects."[25]

The pervasiveness of zoning does not necessarily imply, however, that it is an efficient response to land market externalities in all cases. According to Ellickson (1973), for example, the high administrative and enforcement costs of zoning will often exceed the resulting reductions in "nuisance costs," thereby making the system inefficient.[26] The existence of inefficient regulations per se would not be a major concern, however, if the penalty for violation were an appropriate fine. In that case, landowners could simply choose to violate inefficient regulations by paying the fine, thereby leading to an efficient outcome. In this way zoning would function like a liability rule. However, the fact that zoning ordinances are more like property rules, in that they require compliance, forecloses this route to efficient land use.

Zoning represents a form of public regulation of externalities. There are also private forms of control, the most common of which are land-use covenants and nuisance law. Land-use covenants typically take the form of deed restrictions and are most commonly imposed by a developer restricting the types of activities that all subsequent deed holders can undertake. Thus, deed restrictions "run with the land." This aspect of covenants is important because it avoids the high transaction costs that would be incurred if new entrants into the neighborhood had to negotiate contracts anew with all existing owners. And, because the developer generally puts the covenants in place before he sells off the individual parcels, he has an incentive to structure them efficiently in pursuing his objective of maximizing the market value of the development as a whole (Hughes and Turnbull, 1996). Thus, in terms of efficiency, covenants represent a good alternative to zoning in controlling externalities, at least for land that is undeveloped and initially owned by a single individual (Ellickson, 1973, p. 717).

In contrast, covenants and other forms of private bargaining are not good methods for controlling externalities in established urban areas where land ownership is highly fragmented. Although immediate neighbors may be able to resolve minor disputes between themselves in an efficient manner through Coasian bargaining, high transaction costs are likely to prevent this remedy on the scale of the neighborhood as a whole (Ellickson, 1973, p. 718; White 1975, p. 32). In this case, centralized controls like zoning are generally superior to private bargaining (assuming that the regulations assign rights more efficiently than the status quo).[27]

As we have already seen, nuisance law represents another private mechanism for internalizing externalities. Ellickson (1973) has argued that nuisance law is

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particularly useful in the case of localized harms where costs are concentrated on a few individuals. However, it is not effective in the case of dispersed harms because of the free-rider problem. In that case, no one individual will suffer enough harm to make it worthwhile to initiate a lawsuit, even though the aggregate harm may exceed the cost of litigation (Landes and Posner, 1987, chap. 2). In this case, public regulation again may be a better alternative.

3. Land Transfer

Efficiency dictates that resources should move into the hands of the highest valuing user. Thus, from an economic perspective, an important function of property law is to facilitate such transfers.[28] This is principally done by protecting the rights of property owners (as established by previous consensual transfer) against competing claims. In this section, I examine the factors that determine the most efficient system for determining and enforcing title to land.

3.1. Voluntary Transfers of Land

3.1.1. POSSESSION VERSUS FILING SYSTEMS FOR ESTABLISHING TITLE

In a world of perfect information about all previous transfers of a piece of property, the law should simply enforce the rights of the current possessor, given the knowledge that all previous transfers were consensual. When there is uncertainty about whether a fraudulent (nonconsensual) transfer occurred in the past, however, the law confronts a tradeoff. Should it protect the rights of the current possessor (who acquired the property legitimately), or the last possessor prior to the break in the chain of consensual transfers? A rule that protects the possessor limits the information necessary for an exchange to occur—in particular, a buyer need not inquire into the entire history of transactions involving the property to establish his right to ownership—but it subjects current owners to the risk of losing their property in a nonconsensual transfer.

Baird and Jackson (1984) have argued that the Anglo-American system of property conveyance is sensitive to this tradeoff. They compare a system where title is established by mere possession to a system that relies on public records of property transactions that can be used to trace the history of a title—referred to as a filing system. On the one hand, a possession-based system makes it easy to identify, and transact with, the rightful owner, but it raises the likelihood of theft or other fraudulent conveyance. Filing systems, on the other hand, reduce the likelihood of nonconsensual transfer, but they are costly to administer (an examination of the title history is generally necessary), thereby increasing the transaction cost of a transfer.

The optimal system depends on the magnitude of the various costs and benefits for particular types of property. Land is the prototypical type of property for which a filing system is preferred. Land is stationary and not transferred often, both of which hold down the administrative costs of a filing system. More-

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over, shared ownership at a point in time or over time is often desirable, making it costly to rely on possession alone as evidence of ownership. (The later discussion of the doctrine of adverse possession illustrates this point.) In contrast, personal property is less well suited to a filing system, especially goods that are easily mobile and homogeneous.[29] In this case, the best description of the property is the identity of the possessor. Henceforth, I will focus on land and filing systems for real estate.

3.1.2. FILING SYSTEMS AND TITLE INSURANCE

Two types of filing systems have been employed in the United States. The most common is the *recording system*, which maintains a record of the entire sequence of consensual transfers of a piece of property. This record serves as *evidence* to a prospective buyer that the current possessor has good title, but it does not *establish* title. In particular, if a flaw in the line of title is discovered (owing, for example, to a theft or recording error), the current owner is at risk of losing the property to the last rightful owner. As protection against this possibility, property owners typically purchase title insurance.

The other system that has been used in some states in the U.S., the Torrens system, *establishes* (registers) that the current possessor has title to the property against all future claims. This system therefore resembles one based on possession. It differs, however, in that, prior to registration, an effort is made to determine if a defect in the title exists; after registration, if a claimant appears, he or she can obtain compensation from a public fund created out of registration fees.

The primary difference between these two systems (leaving aside institutional details) is this: under the recording system (with title insurance), in the event of a legitimate claim the claimant receives the property and the current owner receives monetary compensation, whereas under the Torrens system, the claimant receives compensation and the current owner retains the property.[30] The question is whether this difference matters from an economic perspective. The remainder of this section addresses this question.[31]

A simple graphical analysis can be used to compare the impact of the two systems. I consider two parties, the *current owner* of the property and a *claimant*. The owner has utility $U_o(W_o, L_o)$ where W_o is the owner's initial wealth and L_o is his holding of land. I assume that (W_o, L_o) is optimal in that it maximizes the owner's utility subject to his budget line as shown by point A in figure 6.2. (Note that the slope of the budget line is the negative of the market price of land, p.)[32] The convexity of the owner's indifference curves indicates that he does not view land and wealth as perfect substitutes. For example, the minimum amount he would accept in wealth to surrender his entire holding of land is given by the segment DW_o in figure 6.2, which is clearly greater than its market value, BW_o.[33] Thus, if the owner were to lose his land and receive its market value, his utility would fall from U_o^1 to U_o^2, as shown in figure 6.2.

The difference between these outcomes represents the owner's subjective valuation of the land. Presumably, this value grows over time as the owner

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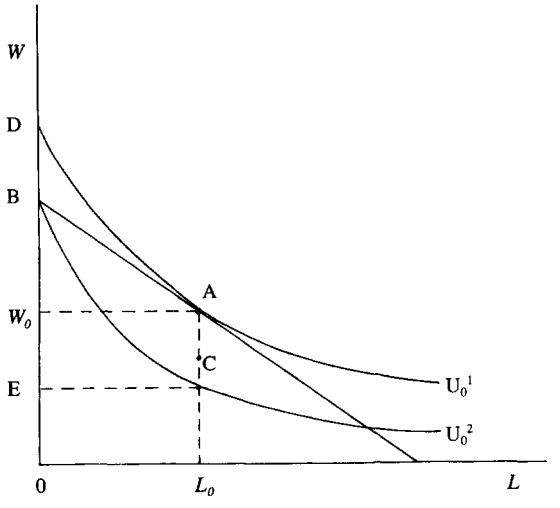


FIGURE 6.2 Utility of a landowner before (A) and after (B) loss of property given market-value compensation.

continues to occupy the land (i.e., the indifference curve becomes more convex). As Oliver Wendell Holmes observed, "man, like a tree in the cleft of a rock, gradually shapes roots to its surroundings, and when the roots have grown to a certain size, can't be displaced without cutting at his life."[34] Of course, protection of subjective value is one of the main economic functions of a system based on consensual transfer of property (i.e., one based on property rules).[35]

Now consider the claimant. The claimant also has utility defined over wealth and land, $U_c(W, L)$. Since she is not the current occupier of the land in question, her initial point is (W_c, O) as shown in figure 6.3, yielding utility U_c^1. In contrast to the occupant's indifference curves, the claimant's indifference curves are drawn as straight lines, reflecting the fact that she views land (specifically, the piece of land in question) and wealth as perfect substitutes. Although this is extreme, it captures the idea that the impact of occupation creates an attachment to the land beyond its mere equivalent in wealth. To the claimant, who has possibly never occupied the land (e.g., she may be an heir of a previous legitimate owner), acquisition of the land is simply a way to acquire wealth (in an amount equal to its market value).

The implication of this form of the claimant's preferences is that she is indifferent between acquiring the land, which would move her to point B in figure 6.3, and receiving compensation equal to its market value, which would put her at point A. Both options increase her utility by the same amount, namely, from U_c^1 to U_c^2.

The analysis to this point shows that a system that leaves the land in the hands of the current owner and awards monetary compensation (equal to its market value) to the claimant (point A in the two figures) is Pareto-superior to one that awards the land to the claimant and monetary compensation to the current possessor (point B). Specifically, the current owner is strictly better off

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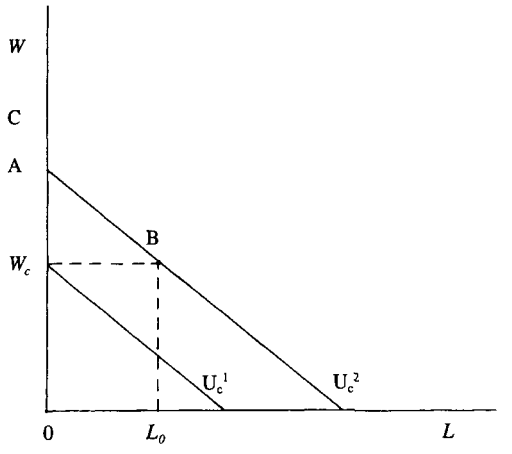


FIGURE 6.3 Utility of a claimant after acquiring land (B) or its market value (A).

retaining the land compared to receipt of its market value (A versus B), whereas the claimant is indifferent between the two options. Point B, however, is probably not the final outcome when the claimant receives the land. In particular, the displaced owner will likely buy back the land. To see why, note that beginning from point B in figure 6.2, the maximum amount the owner would pay to reacquire the land is given by segment BE. This amount clearly exceeds its market value, BW_o, which is the minimum amount the claimant would accept to surrender the land. Thus, a mutually beneficial exchange is possible whereby the original possessor reacquires the land from the claimant.

The particular outcome after the exchange depends on how the parties share the surplus; one possible outcome is given by point C in the two graphs. The relevant comparison between the two land-transfer systems is thus between points A and C: A is the outcome under the system that awards the land to the owner, and C is the outcome under the system that awards the land to the claimant.

The conclusions of this analysis are as follows. First, each party strictly prefers the system that awards the land to him or her. I have already shown that this is true for the original owner (he prefers A to C in figure 6.2). It is also true for the claimant, despite the fact that she values the land at its market value, because, if she is awarded the land, she is able to obtain a share of the owner's subjective valuation of the land (above the market value) when she sells it back to the owner (as reflected by the distance between C and A in figure 6.3). Second, under both systems, the land ends up in the hands of the party who values it most (the owner), provided transaction costs are low. This, of course, is simply an illustration of the Coase theorem (Coase, 1960).

In reality, transactions are not costless, in which case the most efficient allocation of rights should minimize the impact of transaction costs on resource allocation. This suggests that awarding the land to the original owner-possessor

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is preferred to awarding it to the claimant, because such a system requires fewer transactions for the land to end up with the highest valuing user (by hypothesis, the original owner).[36] The fact that the predominant system in the United States (the recording system) does not conform to this conclusion suggests that the goal of the system is to protect the interests of legitimate claimants over current (innocent) owners, even when this outcome conflicts with efficiency.

3.1.3. INCENTIVES FOR LAND INVESTMENT

The preceding discussion of systems for protecting title to land focused on maximizing the value of land through exchange. In this section, I examine how they affect the incentives of landowners to increase the value of land through investment in improvements, given the risk of a future claim against the property.

Let $V(x)$ be the value of a piece of land after x dollars have been invested in improvements, where $V' > 0$ and $V'' < 0$. In the absence of risk, the landowner will choose the level of investment to maximize $V(x) - x$, yielding the first-order condition

$$V'(x) - 1 = 0. \tag{6.11}$$

Let x^* be the resulting risk-free level of investment. Suppose, however, that a claim will arise with probability θ. In the presence of this risk, the landowner's level of investment will depend on the land title system in place. Consider two systems: under system A the landowner retains title to the land and improvements, and under system B the landowner loses title to the land and improvements but may receive indemnification. Clearly, system A will induce the landowner to make the optimal level of investment in the land because he faces no risk of losing it. System B, however, confronts the landowner with the risk of losing the land. Thus, in the absence of indemnification, he will choose x to maximize $(1 - \theta)V(x) - x$, which yields the first-order condition

$$(1 - \theta)V'(x) - 1 = 0. \tag{6.12}$$

The landowner therefore underinvests in the land given $\theta > 0$.

Suppose, however, that under system B the landowner purchases title insurance under which he is reimbursed for the full value of the property in the event of a claim.[37] In this case, the landowner chooses x to maximize

$$V(x) - x - p \tag{6.13}$$

where p is the insurance premium. Note that if the landowner views p as fixed at the time he chooses x, then he makes the optimal investment choice in this case.[38] Thus, investment incentives are equally efficient under system A and system B with full insurance.[39]

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3.2. Adverse Possession

The final topic in this chapter concerns the acquisition of title to land by adverse possession. Under this doctrine, the occupier of a piece of land other than the true owner can acquire title if the owner does not raise an objection to the occupation within a statutorily set period of years.[40] Thus, adverse possession is in effect a statute of limitations on the owner's right to seek a remedy for trespass. As such, it is a form of involuntary transfer of land (though the owner's failure to raise an objection may be interpreted as a form of implied consent). In addition to occupying the land continuously for the statutorily required period of time, a would-be owner's possession must be open, notorious, exclusive, and hostile to the owner's interests, and also represent a claim of a right to the land.[41]

The usual economic justifications for this doctrine are that it lowers the transaction costs of clearing title to land, and that it prevents owners from leaving land idle for long periods of time (Cooter and Ulen, 1988, pp. 154–157). Although both of these arguments are consistent with the economic goal of facilitating the exchange of property, they conflict with the above argument that in cases of trespass, transaction costs are typically low. Thus, the parties can be expected to achieve efficiency through bargaining, an outcome best promoted by the court's enforcing (rather than transferring) property rights. Moreover, the fact that land is left "idle" by the current owner does not imply per se that it is being used suboptimally. These conclusions suggest that an alternative theory of adverse possession is called for. The remainder of this chapter provides such a theory.[42]

The typical adverse-possession case involves a boundary dispute between adjacent landowners. For example, suppose owner A wishes to build a structure on a portion of his land near his boundary with B, but the exact location of the boundary is uncertain. In particular, suppose there is a strip of land whose ownership is in doubt. Let m be the value of that land to A prior to development, and let n be the value to B, where $m > n$. Thus, if it were known prior to development that B owned the land, A would purchase it for a price $p \in [n, m]$, assuming low transaction costs.

Now suppose that the value of the land to A *after* development is $V > m$, where the excess of V over m reflects irreversibilities in the development process. As a result, if it were discovered after development that B owned the land, the maximum amount A would pay to acquire it would increase to V. The difference $V - m$ therefore represents an "appropriable quasi-rent" (Klein, Crawford, and Alchian, 1978). Because of this quasi-rent, it is desirable for the parties to determine ownership of the disputed strip of land before A develops in order to facilitate efficient land use and avoid wasteful rent-seeking expenditures after the fact.

Although determination of the boundary prior to development is preferable, it is inevitable that errors will occur, either because A is convinced that the land is his due to an error in a previous survey or because the current survey results in an error. Alternatively, A may encroach intentionally, a strategy that will figure

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prominently later. In the case of an error, the next best outcome is for B to correct the error in a timely fashion—that is, to "mitigate" A's error efficiently. However, this creates a problem owing to the fact that A's valuation of the land in question will presumably grow over time, both because he will possibly increase his investment in the property and because his subjective "attachment" to the property will increase in less tangible ways (as described by the Holmes quote earlier). Thus, B may not in general have an incentive to correct A's error in an efficient (timely) manner because by waiting B can extract a higher payment as A's valuation grows.

The theory of adverse possession I will offer views the doctrine as a solution to these problems associated with boundary errors. According to the theory, the doctrine is structured to create incentives for A to avoid boundary errors prior to investing in development (the first-best solution), but at the same time to maintain incentives for B to mitigate errors in a timely manner after A has developed (the second-best solution). (Note that this view of adverse possession resembles the analysis of tort rules in the context of sequential-care accidents as discussed in chapter 3.)

To examine this dual function of adverse possession, note that B's ability to appropriate quasi-rents from A derives from B's right to eject A from the land if B discovers that B owns it after A has developed. This is because B's land is protected by a property rule that allows B to exclude others from its use. Thus, one way to prevent B from extracting quasi-rents after A develops in error is to protect B's land instead by a liability rule in cases of boundary encroachment. In this case, if B discovers A's encroachment, A can acquire title to the land without B's consent simply by paying its market value.

Although this solution prevents rent seeking and delayed discovery of errors by B, it creates problems in terms of A's incentives. First, it eliminates A's incentive to discover errors before developing. Clearly, A would prefer a coerced exchange of the land at market value after the fact rather than having to bargain with B before the fact. Second, it creates an incentive for A to encroach *intentionally* on B's land in an effort to acquire it more cheaply than by bargaining with A. Thus, liability rule protection, like last clear chance in torts (see chapter 3), creates good incentives for the party moving second, but bad incentives for the party moving first.

As an alternative solution, consider a rule that protects B's land in the event of encroachment with a *time-limited* property rule. Under this solution, B retains the right to eject A from the land if a bargain is not reached, but only for a limited period of time, after which A acquires title and therefore cannot be ejected. Broadly speaking, this rule captures the essential structure of adverse possession.

A time-limited property rule has two advantages over an unlimited property rule. First, it gives B an incentive to correct errors in a timely manner; second, it limits bargaining costs between A and B. It is not as good as a liability rule in this regard because B can still extract quasi-rents before the property rule expires. However, this possibility serves the useful purpose of providing A with an incentive to avoid boundary errors in the first place. That incentive takes the

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form of a penalty on A for failing to discover errors—namely, the possible payment of (limited) quasi-rents to B.

Note that, because the magnitude of the quasi-rents increases over time, the expected amount of this penalty increases with the length of time the property rule is in place. Thus, a longer limit improves the incentives for A to discover errors in the first place, but a shorter period improves the incentives for B to correct errors in a timely fashion. The optimal limit thus balances these two effects.

The preceding results can be illustrated with a simple model. Consider first the incentive of B to discover a boundary error following development by A near B's boundary. Let s be the cost of a survey to ascertain the true boundary, and let r be B's prior assessment that A has encroached on B's land. Recall that the value of the development to A *after* construction is $V > m$. Thus, if B expects to extract a payment equal to the full value of the land to A in the event of an error, B will survey in hopes of discovering an error if

$$rV > s. \tag{6.14}$$

In addition, since we assumed V is increasing over time, B has an incentive to delay reporting the error in an effort to increase V. A time limit on B's property-rule protection reduces the severity of this problem. Let a be the probability that B will conduct a survey (i.e., the probability that (6.14) holds).

Now consider A's decision to survey *before* developing, given a. Recall that p is the price A pays if he discovers that the land is B's and bargains with B to purchase it before developing. Also let q be A's prior assessment of the probability that the land is his. The expected value to A of surveying before developing is therefore

$$-s + qV + (1 - q)(V - p) = V - (1 - q)p - s. \tag{6.15}$$

If instead A develops without first surveying, his expected value is

$$qV + (1 - q)(1 - a)V. \tag{6.16}$$

Therefore A will survey if (6.15) exceeds (6.16), or if

$$(1 - q)(aV - p) > s. \tag{6.17}$$

The tradeoff underlying the optimal time limit on B's property rule can be seen by examining (6.17) and (6.14). Note that as the time limit is reduced, (6.17) is less likely to hold, both because V's growth is limited and because a is smaller (i.e., by (6.14) B is less likely to survey the smaller is V). The time limit must therefore be long enough so that aV is large enough to give A an incentive to survey prior to developing (the first-best solution). However, the limit should not be too long in order to give B an incentive to discover and correct errors in a timely manner (the second-best solution). The optimal limit balances these two

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effects. Condition (6.17) also shows the problem with protecting B's land with a liability rule after an error is discovered. Specifically, if A could acquire the land for its market value p without having to bargain with B, then (6.17) would never hold.

I conclude this discussion by suggesting that the requirements for adverse possession listed earlier conform broadly with the foregoing theory. Consider first the requirement that possession be hostile and under a claim of right. Hostility in this context means that possession is contrary to the wishes of the owner. There has been some debate, however, about whether the possessor's *intent* matters. In particular, the so-called Maine rule says that mistaken possession is *not* sufficiently hostile to the owner's right—that is, intent is required—whereas the newer Connecticut rule holds that the possessor's state of mind is immaterial.[43] Note that under either rule, an intentional encroacher should prevail. Nevertheless, a recent study of adverse possession cases by Helmholz (1983) found that, when there is evidence that the encroacher intentionally took possession in an effort to acquire title, the court has generally ruled *against* awarding title (assuming all other requirements are met), whereas in the event of a good-faith error they have ruled in favor of awarding title.

Although these results conflict with the stated law concerning intent, they are consistent with the theory here. Recall in particular that the function of protecting B's land with a time-limited property rule was to penalize A for boundary "errors," the penalty being extraction of quasi-rents by B. The time limit puts an upper bound on this penalty as a way to prevent excessive rent extraction by B after the fact. In the case of intentional encroachment, providing B with an incentive to correct errors ex post is less important than deterring A ex ante. Thus, it is desirable to increase the penalty on A by extending the duration of B's property rule, which is exactly what the court is doing in denying title after the "ordinary" statutory period has elapsed.

Adverse possession also requires that possession be actual, open, notorious, and exclusive. These requirements clearly are designed to give the true owner an ample opportunity to discover the possessor's encroachment and correct the error in a timely manner. There is one instance, however, where actual possession is not necessary for possession to ripen into title. That is where the possessor has "color of title," or a document that appears to confer title but that is defective. In most states, color of title eases the acquisition of title by adverse possession, and in some states it is required. This is consistent with the theory, first, because color of title reduces the likelihood that encroachment is an intentional attempt to circumvent the market; and second, because it is more likely that the possessor will have invested in the land (i.e., V will be larger), making him more susceptible to quasi-rent extraction after the fact.

Finally, possession must be continuous for the statutory period. This is also consistent with the theory, in that periodic abandonment by the possessor is a sign that he has not invested significantly in the land (i.e., extraction of quasi-rents is not a serious problem) and that he did not occupy it in error. While abandonment breaks the continuity of possession, sale does not. Specifically, buyers are allowed to "tack" their period of occupancy to that of previous

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owners in order to satisfy the statutory period.[44] This also makes sense because, unlike abandonment, the act of sale does *not* necessarily signal an absence of quasi-rents, and, moreover, sale by the possessor is a clear sign to the true owner of the possessor's claim of title. Thus, it provides an opportunity to correct good-faith errors.

4. Summary

This chapter has been primarily concerned with how the law deals with the problem of incompatible property rights, or what economists call externalities. I began the analysis by drawing the distinction between property rules and liability rules since it is fundamental to the economic analysis of property. The idea behind the distinction is that, when transaction costs are low, voluntary exchange based on property rules should be the primary mechanism for transferring rights, even when incompatibilities exist. However, when transaction costs are high, incompatibilities can lead to inefficiency, so coerced exchange based on liability rules may be desirable. It is interesting to note how this distinction tracks the boundary between contracts (voluntary transfer of rights under property rules) and torts (involuntary transfer of rights under liability rules).

Given this theoretical view of property rights, I evaluated the efficiency of several actual methods for dealing with overlapping property rights, including nuisance law, trespass, Pigouvian taxes and subsidies, zoning, and land use covenants. I also examined legal rules governing the transfer of land between private individuals, both through voluntary and involuntary means. In the next chapter, I will extend the analysis of property to examine the relationship between private individuals and the government.

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