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Economics and Property Law[◇]

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Abstract. This essay shows how the economics of property rights can be used to understand fundamental features of property law and related extra-legal institutions. It examines both the rationale for legal doctrine and the effects of legal doctrine regarding the exercise, enforcement, and transfer of rights. It also examines various property rights regimes including open access, private ownership, common property, and state property. Property law is understood as a system of societal rules designed to create incentives for people to maintain and invest in assets, which in turn leads to specialization and trade.

Suggested JEL Codes: D23, D62, K11, K23

Property law is the body of court enforced rules that governs the establishment, use, and transfer of rights to land and those assets attached to it such as air, minerals, water, and wildlife. In economic terms, property rights are defined as the (expected) ability of an economic agent to freely use an asset (Allen, 1999; Barzel, 1997; Lueck and Miceli, 2006; Shavell, 2004) and represent a social institution that creates incentives to use, to maintain, and to invest in assets. Property rights may or may not be enforced by courts; and because the actions of courts are costly legal rights are but a subset of economic property rights. In addition to law and regulations, property rights may be enforced by custom and norms (see, for example, Ellickson, 1991) and by markets through repeated transactions.

Property rights, transaction costs, and the Coase Theorem

Consider Coase's (1960) famous example of the rancher and farmer. The rancher's cattle stray onto the farmer's land causing crop damage. The rancher's profit, $\pi(h)$ and the amount of crop damage $d(h)$ are functions of the rancher's herd size h , so the first-best optimal herd size, h^*

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maximizes $\pi(h)-d(h)$ and h^* solves $\pi'(h)=d'(h)$. This is also the choice made by a single farmer-rancher, Coase's 'sole owner' case. If the rancher initially has the economic (and legal) right to impose crop damage without penalty, he would choose the herd size to maximize $\pi(h)$, adding cattle until $\pi'(h)=0$, which implies $h' > h^*$. The farmer would be willing to pay up to $d'(h)$, his marginal damage, for each steer that the farmer removes from the herd in order to avoid crop damage, while the rancher would accept any amount greater than his marginal profit, $\pi'(h)$.

If transaction costs are zero, the parties will instantly contract to reduce the herd to the efficient size. The farmer will purchase the rights to the straying cattle, and if the farmer had the initial rights the situation would be reversed: either way the outcome is first-best. This is the Coase Theorem: *When transaction costs are zero the allocation of resources will be efficient regardless of the initial assignment of property rights.* But transaction costs are not zero and thus property rights are not perfectly defined (Allen, 1999; Barzel, 1997; Lueck and Miceli, 2006) so property law becomes important in defining rights and determining the allocation of assets. Indeed, Coase's (1960) discussion of nuisance law suggests an economic logic to the law in its assignment of property rights among various parties to these disputes.

Property rights: taxonomy and models

Property law recognizes several fundamental property rights regimes: private property, open access, common property, and state property (Lueck and Miceli, 2006). Property law also recognizes mixed regimes. Consider a fixed asset (such as a plot of land) used with a variable input (x) to produce a market output ($Y=f(x)$). If the input price is w , then the first-best use ($x^*(w)$) must maximize $R = f(x) - wx$ and satisfy $f'(x) = w$. The first-best value of the land is

$$V^* = \int_0^{\infty} R^*(x^*, t)e^{-rt} dt, \text{ where } r \text{ is the discount rate.}$$

If there is 'open access' for n individuals, then output is $Y = f(\sum_{i=1}^n x_i)$ where x_i is the effort of the i^{th} individual, $f(\cdot) > 0$ and $f''(\cdot) < 0$, and the opportunity cost of effort is w_i . Each person can only capture (and own) the output in proportion to his share of effort, so each solves:

$$\max_{x_i} R_i = f^i(x_i) - w_i x_i \quad \text{subject to} \quad f^i = \left[\frac{x_i}{\sum_{i=1}^n x_i} \right] f(\sum_{i=1}^n x_i) \quad (1)$$

On the assumption that users are homogeneous ($w_i = w_j$ for all $i \neq j$), the Nash open access equilibrium is $x = x^{oa}(n, w_1, \dots, w_n)$, which satisfies

$$\left(\frac{n-1}{n} \right) \left(\frac{f(\sum_{i=1}^n x_i)}{\sum_{i=1}^n x_i} \right) - \left(\frac{1}{n} \right) f'(\sum_{i=1}^n x_i) = w_i, \quad i = 1, \dots, n. \quad (2)$$

In the limiting case as $n \rightarrow \infty$, (2) becomes $f(\sum_{i=1}^n x_i) / \sum_{i=1}^n x_i = w$ which is the famous ‘average product rule’ (Gordon, 1954; Cheung, 1970; Brooks et al., 1999). The limiting case implies that rents are completely dissipated, or $\sum_{i=1}^n R_i = \sum_{i=1}^n [f^i(x^{oa}) - wx^{oa}] = 0$ and the present value of the asset is also zero, $V^{oa} = \int_0^{\infty} R(x^{oa}, t) e^{-rt} dt = 0$. With heterogeneous costs, the infra-marginal users earn rents and have incentives to maintain open access regime (Libecap, 1989).

With private property the owner chooses $x^* < x^{oa}$ and generates $V^* > V^{oa} = 0$. Private ownership also creates incentives for optimal asset maintenance and investment (Bohn and Deacon, 2000). Let future output be $Y_{t+1} = f(x_t)$, where x_t is current investment, available at a market wage of w . and the interest rate is r . The first-best use of the input (x_t^*) must maximize $R = f(x_t)/(1+r) - wx_t$ and satisfy $f'(x_t)/(1+r) = w_t$. If $\pi \in [0,1]$ is the probability of expropriation (because of imperfect rights) of the future output, then an owner will maximize $R = f(x_t) [(1-\pi)/(1+r)] - wx_t$. The solution ($x_t^\pi < x_t^*$) satisfies $f'(x_t) [(1-\pi)/(1+r)] = w_t$ and implies less than first-best investment. Pure open access means that no investor could claim future output ($\pi = 1$), so $x_t^{oa} = 0$, and the rent from investment also equals zero. This lack of incentive to invest is essentially the problem of the ‘anti-commons’ described by Heller (1998) and formalized by Buchanan and Yoon (2000).

Common property is exclusive ownership by a group and may arise out of explicit private contracting (for example, unitized oil reservoirs) or out of custom (for example, common pastures); it may have legal (for example, riparian water rights) or regulatory (for example, hunting regulations) bases that have implicit contractual origins. Common property is well documented for natural resource stocks in less developed economies (Bailey, 1992; Ostrom, 1990). It is also seen in modern ‘common interest communities’ (such as condominiums, homeowner’s associations) where residents use quasi-governments to maintain common areas (such as pools, open space) and provide local public goods (Dwyer and Menell, 1998).

Contracting to form common property creates a group that can realize economies of enforcing exclusive rights. Equal sharing is a typical internal allocation rule; it avoids costs of measuring and enforcing individual use but still leads to overuse compared with first-best. With equal sharing rules a homogeneous membership maximizes the present value of a common property resource (Lueck, 1994; 1995).

Governments own vast amounts of land, buildings, and capital equipment. State property rights are governed by administrative agencies, and the range of property rights regimes incorporates aspects of the three major types: private property, common property, and open access. State property rights commonly – and often severely – limit the transferability of rights, perhaps to limit the moral hazard incentives of agency bureaucrats. The relevant law for state property has its origins in common law (for example, mining on federal land is a first-possession rule) but is primarily governed by statutes and regulations, all shaped by bureaucrats, interest groups, and politicians.

Real property regimes tend to mix the four fundamental types: open access, private property, common property, and state property (Barzel, 1982; 1997; Eggertsson; 1990; Ellickson, 1993; Kaplow and Shavell, 1996; Merrill and Smith, 2000; Rose, 1998; Stake, 1999), implicitly recognizing that assets are a collection of valuable attributes. A rancher’s land is not typically completely private: the streams running through the property may be open access for fishing or recreation; the grass may be a lease from a federal agency with mineral rights held by yet another private party. Similar scenarios are found in residential and commercial real estate, and Bailey (1992) found a mixture of ownership regimes among aboriginal peoples. Smith’s (2000) study of the common field system of medieval Europe is a rare study of the underlying economic logic of a mixed property regime.

Origin of property rights

In law and custom, first possession is the dominant method of establishing rights, be it to the *flow* of output from a *stock* or to the stock itself (Lueck, 1995). Let $R(x(t))$ be the flow of benefits from an asset, where $x(t)$ is a variable input supplied at time t , r is the interest rate, and $g < r$ is the rate at which $R(t)$ grows over time. The first-best, full-information outcome is

$$V^{FB} = \int_{t=0}^{\infty} R(x^*(t))e^{-(r-g)t} dt, \quad (3)$$

where $x^*(t)$ is the optimal input level.

Under first possession the asset's first claimant obtains exclusive rights to the temporal flow of rents, $\int_0^\infty R^*(t)dt$. Since establishing a bona fide claim will be costly and because $g < r$, property rights to the asset will emerge as the value of the asset increases (Demsetz, 1967). Along these lines an entire literature has developed to explain the 'evolution of property rights' or, more generally, the determinants – both temporal and cross section – of property rights regimes (Lueck and Miceli, 2006; Rose, 1998). This literature, mostly empirical, notes that property rights regimes can move in both directions (to and away from private property), that property rights regimes can move among mixed regimes, and that political and other institutions also shape the choice of property regimes.

Returning to first possession, a single claimant will choose the claiming time to maximize

$$V^S = \int_t^\infty [R(x^*(t))e^{-(r-g)t} dt] - Ce^{-rt}, \quad (4)$$

where C is the cost of enforcing the claim and t is the time at which ownership of the stock (and the temporal flow of output) is established. The optimal time to establish ownership is when the present value of the asset's flow equals the present value of the opportunity cost of establishing rights at t^S , or $R^* e^{-(r-g)t^S} = rCe^{-rt^S}$. The asset value falls short of first-best, or $V^S < V^{FB}$, because the costs of establishing ownership delay ownership and production to t^S from $t = 0$.

First possession can dissipate value when there is unconstrained competition among homogenous claimants (Barzel, 1968; Mortensen, 1982). A competitive rush to claim rights causes ownership to be established at exactly the time t^R when the present value of the rental flow at t^R equals the present value of the entire costs of establishing ownership at t^R , or when $R^* e^{-(r-g)t^R} / (r - g) = Ce^{-rt^R}$. In this 'race equilibrium' rights are established at t^R , where $t^R < t^S$ since $t^R = (\ln(r-g) + \ln C - \ln R)/g$ and $t^S = (\ln r + \ln C - \ln R)/g$, and the rental stream is fully dissipated; or

$$V^R = \int_{t^R}^\infty [R(x^*(t))e^{-(r-g)t} dt] - Ce^{-rt^R} = 0. \quad (5)$$

Heterogeneity among claimants can reduce, or eliminate, dissipation (Barzel, 1994; Lueck, 1995). If there are two competitors (i and j) with possession costs $C_i < C_j$, and neither party knows the other's costs, then i gains ownership just before j makes a claim, at $t^i = t^R - \epsilon$, and

earns rent equal to the present discounted value of his cost advantage. The key implication is that, as the differential between the two lowest cost claimants ($C_j - C_i$) increases, the level of dissipation will decrease. With complete information there is no dissipation because only the low-cost claimant has a positive expected pay-off in a race (Fudenberg et al., 1983; Harris and Vickers, 1985).

If the costs of enforcing a claim to the asset are prohibitive, ownership may be established only by capturing or ‘reducing to possession’ a flow from the asset. The legal term ‘rule of capture’ describes this derivative of the rule of first possession. Wildlife and crude oil are the classic examples: ownership is established only when a hunter bags a pheasant or when a barrel of oil is brought to the surface. The stock itself (that is, the pheasant population or oil reservoir) remains unowned. The new ‘race’ is to claim the present flow $R(t)$ and leads to open access dissipation (Epstein, 1986; Lueck, 1995) since no one owns the asset’s entire stream of flows, $\int_0^{\infty} R(t)dt$. The formal analysis is static rather than inter-temporal as in the asset claim race, and is identical to the open access model developed above in equation (2).

Property law implicitly recognizes the two potential paths of dissipation – racing and over-exploitation – and is structured to limit such dissipation (Dharmapala and Pitchford, 2002; Lueck, 1995; 1998). Where first possession rules establish ownership in a resource stock, first possession tends to be defined so that valid claims are made at low cost and before dissipating races begin, thus exploiting claimant heterogeneity. Also, the transfer of rights to the resource is allowed, routinely reflecting security of ownership in the corpus. Where the rule of capture emerges (for example, oil and wildlife) access to the resource tends to be limited through legal, contractual, or regulatory methods. As well, the transfer of rights to capturable flows tends to be restricted in order to limit overuse of the asset itself.

Externalities and property law: nuisance, trespass and zoning

Externalities arise because property rights to at least some of the attributes of an asset will be imperfect and thus generate problems of open access or moral hazard. Land externalities are ubiquitous because any parcel (except an island) will have neighbouring owners and because related resources (for example, air, noise, minerals, water) do not tend to coincide with the surface ownership boundaries. Property law addresses externalities through doctrines of trespass, nuisance, servitudes, and through regulatory zoning.

Consider, à la Coase (1960), a railroad whose trains emit sparks that occasionally set fire to adjacent farmland. The number of trains is n_T and the number of farms is n_F , resulting in crop damage of $n_T n_F D(x, y)$, where D is the damage (reduced crop value per acre) each train causes, x is the cost of precaution per train, and y is the cost of precaution by each farmer. Assume $D_x < 0$, $D_y < 0$, $D_{xx} > 0$, and $D_{yy} > 0$. The marginal benefits are $b_T(n_T)$ and $b_F(n_F)$, where $b_j' < 0, j = T, F$. The total value of the two activities is

$$W = \int_0^{n_T} b_T(n_T) du + \int_0^{n_F} b_F(n_F) dz - [n_T n_F D(x, y) + n_T x + n_F y] \quad (6)$$

If the numbers of trains and farms are fixed, as in tort models (Shavell, 1980) that hold ‘activity levels’ fixed, the optimal precaution choices (x^*, y^*) that maximize (6) are $n_F D_x(x, y) + 1 = 0$ and $n_T D_y(x, y) + 1 = 0$. If the number of trains and farms (n_T, n_F) is endogenous, the resulting first-order conditions are $b_T(n_T) - [n_F D(x, y) + x] = 0$ and $b_F(n_F) - [n_T D(x, y) + y] = 0$.

Remedies for externalities can be viewed as a choice between ‘property rules’ and ‘liability rules’ (Calabresi and Melamed, 1972; Polinsky, 1980). Under property rules, rights holders can refuse any unwanted infringements of their rights, enforceable by injunctions (or criminal sanctions in the case of theft). Property rules thus form the legal basis for voluntary (market) exchange of rights. With liability rules, however, owners can only seek monetary compensation in the form of damages. Liability rules thus form the basis for court-ordered or non-consensual transactions. The choice between the two rules turns on transaction costs, particularly the costs of contracting, the costs of court adjudication, and legal administration. When contracting costs are relatively low, property rules are preferred because they ensure that all transactions are mutually beneficial. When contracting costs are high (for example, in public nuisance cases), property rules may prevent otherwise efficient transactions from occurring. Liability rules have an advantage because courts can force an efficient transfer. This advantage of liability rules must be weighed against the possibility of court error in setting damages, and, because liability rules require courts to establish the initial terms of a transaction by setting damages, the administrative costs of using this rule will likely be higher than under a property rule (Kaplow and Shavell, 1996).

In the railroad-farmer case, if liability is strict the railroad must pay full compensation regardless of its level of precaution. Strict liability induces efficient precaution by the railroad, but farmers are fully compensated and thus have no incentive for precaution. Negligence, which

holds the railroad liable for damages only if it takes less than the efficient level of abatement, will induce both parties to take efficient care. Neither rule, however, will achieve first-best railroad and farm activity levels. In general, liability rules cannot create first-best incentives because of the constraint that what one party pays the other must receive. This is an example of the *paradox of compensation* which is also found in tort law and contract law remedies (Cooter, 1985). It can be avoided by ‘decoupling’ liability and compensation, or by using a contract or compensation mechanism that defines and enforces the optimal choices for both parties.

Trespass (for example, squatting, boundary encroachment) and nuisance (for example, air, water, noise pollution) doctrines are the primary common law responses to externalities. The primary remedy under trespass is an injunction, a property rule. The remedy under nuisance law is more complicated. A landowner can obtain relief only if the invasion is substantial, and even then he may have to be satisfied with money damages (a liability rule). If a landowner wishes the harm to be enjoined, he must meet the further legal standard of showing that the harm outweighs the benefit of the nuisance-creating activity. The trespass-nuisance distinction can be understood as a property-liability rule choice (Merrill, 1998). Trespass ordinarily involves a small number of parties where the intruder is easily identifiable, so contracting costs tend to be low and property rules are likely optimal. Nuisance often involves large numbers or sources of harm that are difficult to identify, so liability rules are likely optimal.

Zoning is a common legal response to urban land externalities. The economic rationale for zoning is that ‘similar land uses have no (or only small) external effects on each other whereas dissimilar land uses may have large effects’ (White, 1975), creating what the common law calls a ‘public nuisance’. Ellickson (1973) argues that zoning may have administrative and enforcement costs that often exceed the saved ‘nuisance costs’. A private alternative to zoning is the use of land use servitudes (for example, covenants, easements) that impose limits on what landowners can do with their property. Such restrictions are frequently observed in condominiums, homeowner associations, and other ‘common interest communities’ (Dwyer and Menell, 1998; Hansmann, 1991). The economic function of these restrictions is twofold: to overcome free rider problems in the provision of certain jointly consumed amenities; and to internalize neighbourhood and rental externalities.

Public trust, public property and public use

The ancient doctrine of 'public trust' grants ownership of navigable rivers, shorelines, and the open sea to the public. It is judicially created common property, or sometimes open access. In its traditional application the public trust asset was a public good. When an asset is a public good, unrestricted access will not cause dissipation from overuse of the resource, but it could lead to underinvestment. When the resource has private good characteristics, unrestricted access can trigger the rule of capture and creates a classic open access problem, possibly causing resource degradation through overuse. Some courts have recently extended the doctrine into environmental assets, such as beaches, lakes, stream access and wildlife.

Large-scale projects like dams, railroads and highways often involve the assembly of a large contiguous parcel of land from relatively small and separately owned parcels. Developers face a potential holdout problem because, once assembly becomes public information, parcel owners might hold out for prices in excess of their true valuations, endangering completion of an otherwise efficient project. One solution is to force sales by replacing property rule protection of each owner's land with liability rule protection. This is the economic justification for the eminent domain power of the state (Posner, 2003), which has common law origins. The 'takings' clause of the Fifth Amendment of the US Constitution explicitly grants such eminent domain power for 'public use' but requires 'just compensation', which courts have interpreted to mean 'fair market value'. Since subjective value is part of the opportunity cost of a taking, failure to compensate for it potentially results in excessive acquisition of land by the government, though one study (Munch, 1979) found that high-valued properties were overcompensated, while owners of low-valued properties were undercompensated.

A large literature has studied the link between compensation and investment decisions of landowners (Blume, Rubinfeld and Shapiro, 1984; Fischel and Shapiro, 1988). Suppose there are many parcels, each worth $V(x)$ if the landowner makes an irreversible investment x , where $V' > 0$ and $V'' < 0$. The land also yields a public benefit of $B(y)$, where y is the number of parcels taken and $B' > 0$, $B'' < 0$. Compensation of $C(x)$ will be paid for each parcel taken, where $C(x) \geq 0$, $C' \geq 0$, and total compensation is $yC(x)$. Landowners choose x given the anticipated behaviour of the government and the compensation rule; then the government chooses y and pays $C(x)$. The first-best choices (x^*, y^*) maximize $B(y) + (1-y)V(x) - x$, the sum of private and public benefits, and must satisfy $(1-y)V'(x) - I = 0$ and $B'(y) - V(x) = 0$. If the taking is exogenous, y is fixed

and the landowner will maximize $(1-y)V(x) + yC(x) - x$, which must satisfy $(1-y)V'(x) + yC'(x) - 1 = 0$ and also gives x^l as the solution. This means that compensation must be lump sum ($C'(x)=0$) to ensure that $x^l=x^*$; a positive relationship between x and compensation creates over-investment moral hazard (another example of the paradox of compensation). Thus no compensation ($C(x)=0$ for all x) is efficient, although any lump sum rule is consistent with efficiency. The efficiency of zero compensation, however, depends on assumptions about government behaviour.

Government regulations often restrict land uses without depriving the owner of title (for example, zoning laws, environmental regulations). Historically, courts have granted broad powers to enact such regulations but, when a regulation becomes especially burdensome, the affected landowner may claim that a ‘regulatory taking’ has occurred and seek compensation. As above, the trade-off for regulatory takings concerns the efficiency of the land use decision on the one hand and the regulatory decision on the other. Miceli and Segerson (1994; 1996) propose the following compensation rule, where y is a landowner’s lost value from the regulation:

$$C = \begin{cases} 0, & \text{if } y \leq y^* \\ V(x), & \text{if } y > y^*. \end{cases} \quad (7)$$

Like a negligence rule in tort law, this rule requires full compensation if the government over-regulates ($y > y^*$) but requires no compensation otherwise ($y \leq y^*$). It also establishes a standard that is economically equivalent to the common law definition of a nuisance (an activity that is efficiently prohibited), and hence is consistent with the threshold for compensation implied by the nuisance exception.

Inalienability of property rights

Posner (2003: 75) notes, ‘the law should, in principle, make property rights freely transferable in order to allow resources to move to their most highly valued uses and to foster the optimal configuration of assets.’ Yet there are many legal restrictions that limit the alienability of property: body parts, children, voting, military service, cultural artifacts, endangered animal species, the right to freedom (laws against slavery), certain natural resources and state property.

The dominant economic reason for restrictions on alienability is that externalities can arise from transfers (Barzel, 1997; Epstein, 1985; Rose-Ackerman, 1985; Posner, 2003) if the rights to the assets are not well-defined with respect to the stock (and its stream of flows over

time). This generates a rationale for limiting, even prohibiting, certain transfers of the claimed flows in order to protect the asset and its value. For example, the widespread prohibition on trade in wild game is likely to be such a case (Lueck, 1989; 1998), though even here limits on markets can potentially deter the formation of property rights. Restrictions on the sale of children may have a similar rationale: a market for children (or game) would lead to ‘poaching’ of kids (or animals) for which property rights enforcement is extremely costly.

Another reason for restricting transfers is asymmetric information, particularly that leading to adverse selection (Rose-Ackerman 1998). Adverse selection can potentially dry up markets where product quality cannot be observed prior to purchase. Similar restrictions on the types of property servitudes allowed (such as limits on ‘negative and in gross’ easements) might be explained by reference to asymmetric information (Dnes and Lueck, 2006). Legal scholars have argued that limitations on servitudes prevent ‘clogging title’ (Gray and Gray, 2000). Consider the market for land of two types: fee simple (that is, unencumbered) and land encumbered with servitude. Assume that only the seller knows whether the land is encumbered. Buyers do not have this information but know only that one-half of the land is encumbered. The value of an unencumbered plot is V^f , while the value of the encumbered plots is $V^s < V^f$. Given the information asymmetry, buyers will pay only the expected value of a plot, $EV = (V^s + V^f)/2 < V^f$. Following Akerlof (1970) and related literature, this means there will be no market equilibrium for the unencumbered plots; that is, only ‘low-quality’ encumbered plots will be present in the market. Institutions that provide information (such as title recording and registration systems) could eliminate asymmetry and even alter the law of property by allowing an expanded set of servitudes.

Summary

Economic analysis reveals a fundamental logic to the main doctrines and features of property law (Lueck and Miceli, 2006). The observed structure of property rights and property law can be best understood as a system designed to create incentives for people to maintain and invest in assets, which in turn leads to specialization and trade. Among the most important remaining issues for study is a systematic analysis of how the law addresses the use and transfer of complex assets.

See also contract theory; law and economics; tragedy of the commons; transaction costs.

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