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# THE COASE THEOREM AND CALIFORNIA ANIMAL TRESPASS LAW

KENNETH R. VOGEL\*

## I. INTRODUCTION

THE modern study of law and economics is often the study of transaction costs.<sup>1</sup> Sometimes the inquiry is normative, and the question is which assignment of rights will minimize transaction costs and thus promote overall social welfare. Sometimes the inquiry is positive and asks what effect different rights assignments have had on the behavior of the parties whose conduct the law governed. In his pathbreaking paper "The Problem of Social Cost,"<sup>2</sup> Ronald Coase used the classic conflict between the rancher and the farmer to illustrate the central role that these transaction costs played. In this paper I return to this problem not only from a normative—analytical—but also from a positive—historical—point of view.

Until 1960, when Coase published "The Problem of Social Cost," causation was a fairly settled issue for lawyers and economists interested in

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<sup>1</sup> The term "transaction costs" is used here in the broadest possible sense as any technical market failure or public good that would prevent the attainment of an internal social optimum. Often transaction costs are defined to be only those costs that increase the costs of negotiating or enforcing a contract. For a thorough development of the concept of transaction costs, see Oliver E. Williamson, *Markets and Hierarchies: Analysis and Antitrust Implications* (1975).

<sup>2</sup> Ronald Coase, *The Problem of Social Cost*, 3 *J. Law & Econ.* 1 (1960). For an extensive list of the literature that has analyzed the Coase theorem, see Elizabeth Hoffman & Matthew L. Spitzer, *The Coase Theorem: Some Experimental Tests*, 25 *J. Law & Econ.* 73 (1982).

the problem of externalities. It seemed clear that a generator of externalities would be the cause of resulting harm. For example, if a firm manufacturing steel also emitted smoke that damaged the laundry next door, the smoke from the steel mill was said to cause harm to the laundry. It was also agreed that the proper party for the law to influence, if there were a significant enough reason for the state to be involved, would be that generator, although there was some disagreement whether the proper means was regulation, prohibition, or taxation.<sup>3</sup>

Coase changed the nature of the discussion by his far-reaching insight that the nature of causation is a reciprocal phenomenon, so that either the generator or the receptor could be considered to be the cause of the harm. In the previous example, the laundry also caused the damage by operating its business in proximity to the steel mill. To avoid the harm, the steel mill could shut down or adopt antipollution measures. Alternatively, the laundry could move or do all its work in an enclosed space. In principle, if causation is reciprocal, it becomes equally appropriate for the government to assign rights, or taxes and subsidies, to either party. In fact, Coase went so far as to postulate that in a well-functioning market system<sup>4</sup> identical production would result regardless of the original assignment of rights. Coase showed that, except for income or wealth effects in consumption,<sup>5</sup> it would be a matter of complete indifference to whom the rights are assigned, except to the affected parties' wealth.

The next section of the paper, through a discussion of nonconvexities and transactional asymmetries, examines the circumstances in which an original assignment of rights can prevent the parties from bargaining incrementally to a social optimum. The third section presents a historical analysis. It examines the way in which the assignment of rights between farmers and cattle ranchers influenced their behavior in a discrete time and place: California in the last half of the nineteenth century. It contains a discussion of the various types of laws that were used to regulate the conflict between farmers and ranchers and demonstrates the shift with time toward greater protection of farmers. The third section reports the results of a standard regression analysis to confirm the central theoretical

<sup>3</sup> For the original discussion of the use of taxation in controlling externalities, see A. C. Pigou, *The Economics of Welfare*, 172 *et seq.* & 192-96 (1952). For an application of the three rules to the assignment of rights when externalities occur, see also A. Mitchell Polinsky, *Controlling Externalities and Protecting Entitlements: Property Rights, Liability Rule, and Tax-Subsidy Approaches*, 8 *J. Legal Stud.* 1 (1979).

<sup>4</sup> This has been interpreted as a system with no transaction costs by the voluminous post-Coasean literature; see, for example, Richard O. Zerbe, Jr., *The Problem of Social Cost in Retrospect*, 2 *Research in L. & Econ.* 83 (1980).

<sup>5</sup> When the income of consumers changes, they will purchase a different bundle of goods. More wealthy consumers are more likely to consume meat and less likely to eat potatoes.

point: the original assignment of rights does matter in a consistent foreseeable way. The assignment of rights toward the farmer tended systematically to increase the overall levels of production.

## II. NONCONVEXITIES AND TRANSACTIONAL ASYMMETRIES IN THE BARGAINING PROCESS

Given Coase's assumptions, the search for ideal property right configurations<sup>6</sup> becomes a search for entitlements that advance overall efficiency (defined as some Pareto superior state in which one person has been made better off without making anyone worse off). Yet, apart from minimizing transaction costs, there appear to be no accepted criteria for directing the behavior of government in the design of property rights systems. Because it is not clear when transaction costs will be minimized, it is difficult to justify any general legal entitlements.

Applied to the example of the steel plant and the laundry, Coase's views make it problematic whether the sound legal regime allows the steel mill the unbridled right to pollute or entitles the laundry to be free from the pollution. In yet another classic example close to the historical concerns of this paper, it becomes unclear whether the rancher should have the privilege of allowing his cattle to wander on the farmer's land or whether the farmer should have the right to exclude everyone, including cattle ranchers, from using his land without his permission. Both situations do have this parallel. The harm inflicted by the steel mill or the rancher on the laundry or the farmer is a direct consequence of the acts of the mill or the rancher. In contrast, if the legal entitlement is given to the farmer or the laundry, the harm inflicted on the steel mill or the rancher requires the intervention of the legal system.

The essence of Coase's hypothesis is that, in the absence of transaction costs, the parties will trade for the right to interfere more (to emit more smoke over the laundry or to have more cattle trespass over more of the farmer's land) or to be freer from interference (to have less smoke or to have fewer cattle trespassing over less land). By taking this right, whichever way it is defined, into account, its full opportunity cost will be realized. If Coase is correct, the parties will trade until the final, equilibrium allocation of rights and duties between them is efficient. Efficiency means some Pareto optimal state in which no one can be made better off without making someone worse off.

<sup>6</sup> The conditions for an efficient system of property rights are universality, transferability, and exclusivity, according to Posner. See Richard A. Posner, *Economic Analysis of Law*, ch. 2 (2d ed. 1977). For the limits on transferability, see Richard A. Epstein, *Why Restrain Alienation?* 85 *Colum. L. Rev.* 970 (1985).

There have been a number of criticisms of this hypothesis, three of which are useful for testing its limits. The first comes from ordinary language theorists like Epstein. Epstein (among others) has suggested that efficiency is at best a second-stage consideration. It should be considered only after decisions on fairness have been reached.<sup>7</sup> Epstein criticizes Coase's concept of causation, which implies that a joint condition of the two parties is usually necessary for the creation of any harm. He uses Coase's own language, which differentiates between the causing agent (subject of the sentence) and the harmed party (object of the sentence): "[A] confectioner the noise and vibration from whose machinery *disturbed* a doctor"; "straying cattle which *destroy* crops on neighbouring land." He then notes that it is only by the use of the legal system that the doctor could harm the confectioner or the farmer could harm the rancher; therefore the situations do not truly exhibit the causal reciprocity that Coase insists they have. However, Epstein does not then give a "simple semantic equivalent to the concept of causation." Rather he gives four distinct paradigmatic cases: "A hit B"; "A frightened B"; "A compelled B to hit C"; and "A created the dangerous condition that resulted in harm to B."<sup>8</sup>

What ties Epstein's cases together can best be understood as the liberty enhancing goals of freedom from force and from falsehood.<sup>9</sup> Epstein believes that an animal trespass rule should allow a cause of action on the grounds of "your cattle ate my crops," although it is not clear what kind of assumption of risk defense would be allowed for failure to fence or from planting too close to the fence.<sup>10</sup> Unfortunately, Epstein's theory does not lend itself to any simple general theory of nonreciprocity, which is needed to define the limits of Coase. Therefore, in an attempt to make the ordinary language criticism of Coase more explicit, an analysis of two additional sources of development, from the law-and-economics literature, may be useful.

The second view comes out of the transaction costs approach. It was propounded by Coase and developed by Wittman.<sup>11</sup> Wittman added the

<sup>7</sup> Richard A. Epstein, *A Theory of Strict Liability*, 2 J. Legal Stud. 151, 152 (1973).

<sup>8</sup> *Id.* at 164-77. For criticisms of Epstein's paradigmatic analysis, see John Borgo, *Causal Paradigms in Tort Law*, 8 J. Legal Stud. 419 (1979); Richard W. Wright, *Causation in Tort Law*, 73 Calif. L. Rev. 1735, 1750-58 (1985).

<sup>9</sup> Richard A. Epstein, *Causation and Corrective Justice: A Reply to Two Critics*, 8 J. Legal Stud. 477, 489 (1979).

<sup>10</sup> Richard A. Epstein, Charles O. Gregory, & Harry Kalven, Jr., *Cases and Materials on Torts*, 566-67 (4th ed. 1984).

<sup>11</sup> See, for example, Donald Wittman, *Liability for Harm or Restitution for Benefit?* 13 J. Legal Stud. 57 (1984).

concept that transaction costs may be asymmetrical depending on who is assigned the entitlement. Wittman argues that the assignment of entitlements serves as a "baseline" from which one can measure the extent of relevant harm or benefit. He shows that, in the presence of administrative (transaction) cost asymmetries, the choice of a baseline may affect the equilibrium. Any baseline that has relatively high transaction costs, making it difficult to measure the proper compensation, will ordinarily be inappropriate. Wittman's method for assigning property rights then turns out to be rather straightforward: "One first asks what is the most efficient outcome; then one asks which liability scheme involves the lowest court administrative costs."<sup>12</sup>

Note that this method does have the disadvantage that the policymaker (judge or legislator) must know which is the most efficient outcome in order to assign initial entitlements (the baseline). Where the original baseline is inappropriate, inefficient outcomes will be the consequence. The likelihood of finding the right baseline will be further clouded once the class of permissible baselines is allowed to include intermediate positions. One must know not only who the proper party should be but also what the appropriate standard of care should be before deciding on the efficient entitlement. For example, when a railroad emits sparks while it travels near a farm with stacked hay, the decision maker (judge) must decide not only whether the farmer has a right to be free from sparks or the railroad has the right to emit sparks but must also pass on the intermediate rules (such as recovery only under negligence or recovery unless the farmer has been contributorily negligent) to determine which outcome is preferred. All this analysis is needed just to decide to whom the entitlement should be given (to decide what is the cause of harm).

There is no way in the Wittman methodology to separate the proper person to be given the right from the proper standard to be used. One cannot first decide that the farmer should have a right to be free from sparks and then decide that that right should be limited to circumstances of railroad negligence because of the possibility of high transaction costs. Many hidden pitfalls may beset the Wittman methodology notwithstanding its seeming theoretical appeal and simplicity. It is therefore apparently not a likely candidate for explicating Epstein's ordinary language criticism of Coase.

The third criticism of the application of the Coase hypothesis also uses the possibility of asymmetries to explain the reasons for assigning entitlements to one party rather than the other. Rather than conventional bargaining or informational transaction costs, this theory is developed from

<sup>12</sup> *Id.* at 65.

the concept of nonconvexity. Nonconvexities arise in the presence of externalities and public goods. In geometrical terms a space is convex if one can draw a line between any two points within the space without leaving the space. Similarly, the space is said to be nonconvex when there is a set of points within the space that can be connected only by leaving the space. The importance of the distinction between convex and nonconvex spaces is this: where the space is nonconvex, a barrier against optimal trades may arise. Stated otherwise, in the absence of convexity in its production function, a firm that is willing to make marginal adjustments may not realize that an alternative use of its resources will ultimately increase its production. This result occurs because the information the firm receives from comparing the price of a purchase or sale with its marginal rate of transformation between input and product will give the false information that further marginal adjustments toward the optimum will decrease profits. The decision maker will, thus, never get the proper information from marginal prices, which is what microeconomic theory assumes.<sup>13</sup> Only if a firm operates in the convex part of its production set will it receive the proper signals from prices. Similar results will be true for a consumer if his consumption set is nonconvex.

In the typical case used by economists—a trade of market goods between two parties—the trading space will be convex. Nonconvexities arise in the presence of externalities. A common example of an externality resulting in a nonconvex trading space is the case of the steel mill and the laundry. As the steel mill marginally increases its production from zero, adding smoke to the atmosphere, it begins marginally to decrease the quality (value) of the output of a neighboring laundry. The smoke is considered an externality for two reasons. The first is that normally there is no market for smoke: no consumer would pay to be able to consume more. All that is required to eliminate this aspect of the problem is to assign an entitlement to the smoke. Then either the mill will pay to produce more, or consumers (the laundry) will pay to consume less. The second reason is that the market may fail to reach an optimum even once the right has been assigned.

There are two reasons for this market failure. The first is that bargaining (transaction) costs may be higher in this market than in the typical market. These costs could arise, for example, because of costs of negotiations necessitated by having only two parties and a unique situation or difficulty in exchanging information (on the quantity of smoke emitted). The second reason for market failure, the one with which I am concerned, arises because there is no logical limit to the amount of smoke that can be

<sup>13</sup> Harold Varian, *Microeconomic Analysis* 158 *et seq.* (1978).

produced. The mill can increase its production, which will eventually lead to the degradation of the quality of the laundry's service until no one will want to purchase the laundry's service at any price. The mill may even produce more smoke than that. It is this characteristic of the externality that is termed a "nonconvexity."<sup>13</sup>

Where nonconvexities are present, the original assignment of rights becomes critical in determining whether a series of voluntary exchanges can exhaust all the gains from trade.<sup>14</sup> The right must be initially assigned so that the trading takes place in the convex parts of the sets. Otherwise, not even the market system will have low enough transaction costs to achieve the efficient solution. It will be shown that to achieve this condition it is necessary to grant the entitlement to the party whose production function is made nonconvex by interactions with the other party. It is that party who is normally termed the "victim" or the "receptor."

Nonconvexities in production are associated with the existence of externalities or other "public goods." Whenever there is a significant externality due to the interaction of two or more parties, the production (or consumption) space of the receptor (victim) will be nonconvex.<sup>15</sup> Also, when the fundamental nature of a good is public, the normal market system will not achieve optimality.<sup>16</sup> It is only when the market system can achieve optimality that the invariance portion of the Coase theorem will be valid. Then the assignment of entitlements would be irrelevant to efficiency. When the nature of the good can be characterized as public, associated with a nonconvex production or consumption space, then the assignment of rights will matter as the market system will fail to achieve

<sup>14</sup> For the first recognition of this result, see David Shapiro, A Note on Rent and the Coase Theorem, 7 J. Econ. Theory 125 (1974). See also Editorial Addendum to David Shapiro, "A Note on Rent and the Coase Theorem," 14 J. Econ. Theory 221 (1977); and Robert Cooter, How the Law Circumvents Starrett's Nonconvexity, 22 J. Econ. Theory 499 (1980).

<sup>15</sup> David Starrett, Fundamental Nonconvexities in the Theory of Externalities, 4 J. Econ. Theory 180 (1972). Starrett demonstrated that the existence of externalities implies that the production space of the externality receptor will be nonconvex.

<sup>16</sup> This is because the normal optimality condition for a market system is for  $MRS_i = MRT$ . For public goods and externalities the optimality condition is  $\sum_i MRS_i = MRT$  (where  $i$  is a consumer). The problem with public goods is thus not simply the part of the free-rider problem where parties may have incentives to hide their true preferences (which is a clear transaction costs problem). Rather it derives from the nature of the good itself. Even if preferences are truthfully revealed, it may still not be possible to achieve Pareto optimality. For instance, it may be impossible to exclude nonpaying consumers. But even if it were possible, it would be inefficient to do so. This is because there is no additional cost to provide the good to nonpayers. For example, it is possible to scramble satellite broadcasts of cable television, but utility would be increased by not scrambling, as the nonpayers would get a benefit with no loss to any other party. Varian, *supra* note 13, at 207. See also Anthony B. Atkinson & Joseph E. Stiglitz, Lectures on Public Economics 482-89 (1980).



optimality. Thus the legal system becomes most relevant when the nature of the interaction is public. Most of the instances in which public law (rather than private contract) sets the entitlements will probably be in this class of "public goods."

To see how the existence of nonconvexities complicates the process of mutually beneficial exchange, a diagrammatic exposition will be used. We contrast the situations set out in Figure 1, where there is no nonconvexity, with that in Figure 2, where there is one. In Figure 1, the potential gains from trade will be exhausted no matter what the original endowments because the production space is convex. For instance, if producers A and B are both using one input  $L$  (land), in fixed supply between them, in order to produce two outputs,  $X$  and  $Y$ , respectively, they will trade that input as long as their marginal revenue products with respect to that good differ. Equilibrium will occur when the marginal revenue products of A and B for the input  $L$  are equal. In Figure 1, with a fixed amount of  $L$ ,  $L_0$ , A and B will trade until total profit ( $P_x F_x + P_y F_y$ ) is maximized, at  $L^*$ . At that point the terms of trade are along the lines  $rL$  and  $-rL$ , where  $r$  is the price for the input  $L$  (agreed on between A and B in the market process),  $P_x$  is the net price of  $X$ , and  $P_y$  is the net price of  $Y$  (that is, the price net of all input cost except that of  $L$ ). Thus  $P_x F_x$  is the profit from producing  $X$  having taken all costs other than shared  $L$  (land) into account. In the example, as the "production" spaces, defined as the areas under the net profit functions  $P_x F_x$  and  $P_y F_y$ , are strictly convex, it will not matter to the equilibrium allocation what the initial endowments of  $L$  were. Equilibrium will always be achieved at  $L^*$ . The only difference is to the parties' wealth.

If A (producing  $X$ ) has the entitlement, the baseline is on the right of Figure 1. A could use all of  $L$  to produce  $X^-$  and to achieve a profit of  $P_x X^-$ . He could do better by trading with B. If he trades  $(L_0 - L^*)$  to B, he will receive a side payment (in the market for  $L$ ) of  $r(L_0 - L^*)$ . He will also make a profit (not counting the opportunity cost of land) of  $P_x X^*$  for a total profit of  $\rho_x$ .<sup>17</sup> A will make this trade as the  $rL$  price line is greater than his  $P_x F_x$  profit function. B is similarly willing to make this trade. He will improve his condition from zero profit, as there is zero production of  $Y$  ( $P_y F_y = 0$  at  $L_0$ ), to  $\rho_{xy}$  profit<sup>18</sup> on the  $-rL$  price line. B achieves this profit by producing  $Y^*$  (at  $L^*$ ) while paying  $r(L_0 - L)$  for the use of  $(L_0 - L^*)$ .

On the other hand, if B has the entitlement to  $L$ , then the baseline is on the left of Figure 1. B would use all the land to produce  $Y^-$  and receive a profit of  $P_y Y^-$ . B also could do better by trading some land with A. By

<sup>17</sup>  $\rho_x = P_x X^* + r(L_0 - L^*)$ .

<sup>18</sup>  $\rho_{xy} = P_y Y^* - r(L_0 - L^*)$ .

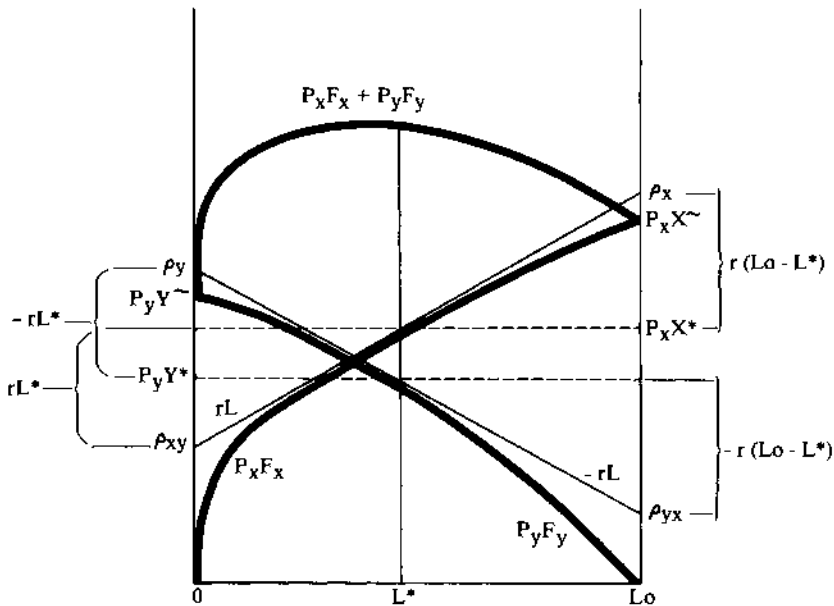


FIGURE 1

trading  $L^*$  to A, B will still receive a profit of  $P_y Y^*$  from producing Y; and B will also receive a payment of  $rL^*$  from A for A's use of L. B therefore has a profit of  $\rho_y$ ,<sup>19</sup> which is greater than  $P_y Y^-$ . The treatment of A is similar to the treatment of B when A had the right to L. As can be seen from this discussion, parties are willing to trade whenever the price line is above their profit function.

Figure 2 shows the impediments to trade when the externality gives rise to a nonconvexity in the production space. This situation can arise whenever the rancher makes a partial use of the farmer's land that is sufficient to prevent economical crop production. Any more intensive use of the land by the rancher will not result in further financial loss to the farmer, yet it will continue to benefit the rancher.

In Figure 2, if  $F$  is the production function of the farmer, it reaches (or asymptotically approaches) zero before all the land is used extensively by the rancher. If this is an accurate description of the production process, then a trade between the farmer and the rancher will yield different equilibria depending on the initial endowments of the rights of the two parties. If all the rights were owned by the farmer, the negotiation process would begin with the status quo baseline at the far left side of Figure 2.

<sup>19</sup>  $\rho_y = P_y Y^* + rL^*$ .

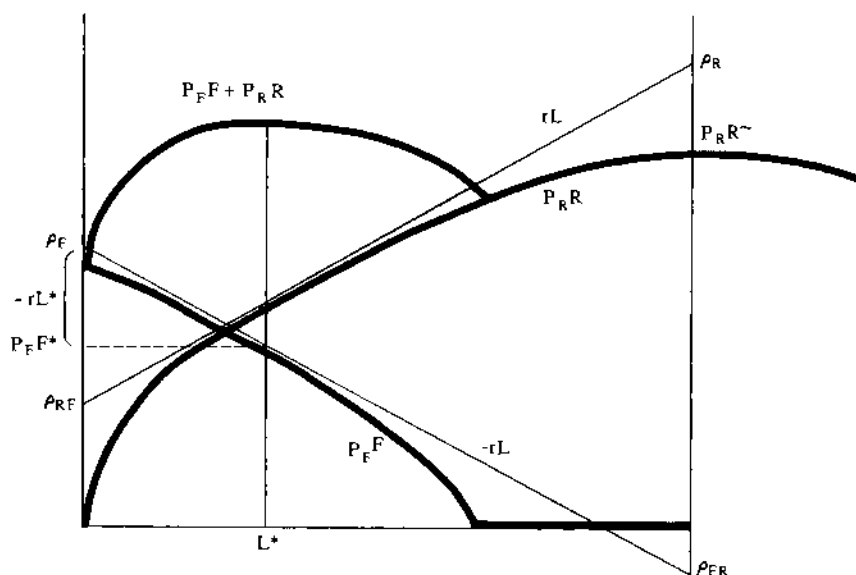


FIGURE 2

The farmer would be willing to trade with the rancher (and vice versa) at the same price of land as before ( $r$ ), and they would reach equilibrium at  $L^*$ . Both parties will have improved their profit by the trade. The farmer will have increased his profit from  $P_F F^*$  (where  $P_F F$  reaches its maximum at the right side of Fig. 2) to  $\rho_F$ .<sup>20</sup> The rancher will also have increased his profit from zero to  $\rho_{RF}$ .

However, if the rancher had the right, his no-trade status quo point would be at the far right side of Figure 2, where his profit is maximized. This is shown as the point at which the  $P_R R$  production function reaches its maximum, at  $P_R R^*$ . The farmer will be unwilling to trade as any trade must cost him more than he will profit from farming. For example, suppose trade were conducted on the efficient  $rL$  and  $-rL$  price lines as before. While the farmer would profit  $P_F F^*$  from farming, he must make a side payment of  $r(L_0 - L^*)$  for the use of the land. The profit of the farmer would thus be negative ( $\rho_{FR}$ ).<sup>21</sup> In this case the side payment exceeds the profit from farming because of the fact that the production function reached zero (and thus became nonconvex) before the externality (the use of land by cattle) reached its most internally profitable amount for the generator. In this case the price line lies below the profit function; thus the

<sup>20</sup>  $\rho_F = P_F F^* + rL^*$ .

<sup>21</sup>  $\rho_{FR} = P_F F^* - r(L_0 - L^*)$ .

TABLE 1  
RELATION BETWEEN NUMBER IN HERD AND CROP LOSS

Number in Herd (Steers)	Total Herd Value (\$)	Value per Additional Steer (\$)	Total Crop Loss (\$ or Tons)	Crop Loss per Additional Steer (\$ or Tons)	Total Value (\$)
1	5	5	1	1	24
2	9	4	3	2	26
3	12	3	6	3	26
4	15	3	10	4	25
5	17	2	15	5	22
6	19	2	20	5	19
7	20	1	20	0	20
8	21	1	20	0	21
9	20	-1	20	0	20

farmer would not be willing to make the trade. Therefore the only way to ensure that the optimal equilibrium will be reached is to give the party with the nonconvexity in its production space, here the farmer, the right to be free from the externality.

A similar and simpler example of the farmer and the rancher in the presence of externality, leading to a nonconvex production function, can be demonstrated by extending Coase's arithmetic example (see Table 1).

As in Coase's example, whether the farmer has the right to exclude or the rancher has the right to use, the optimal number of steers will be three (which is the point at which the additional damage done by the steers equals the additional value of raising an additional steer). As Coase shows, that number will be reached along either bargaining path, from either two or four steers. This solution is identical with the optimal equilibrium that would be reached along either bargaining path in Figure 1 from  $P_y Y^-$  if the farmer has the right or from  $P_x X^-$  if the rancher has the right. If the rancher has the right to trespass and is raising four steers, the fourth steer is worth an additional three dollars to him. However, that steer would cause an additional four dollars in damage to the farmer, who would therefore be willing and able to pay the rancher up to that four dollars to reduce his herd to three. Thus the price of the side payment is greater than the profit for both the farmer and the rancher. Say the side payment price is \$3.75. For the rancher, receiving the payment,  $\$3.75 > \$3.00$ . For the farmer, making the payment,  $-\$3.75 > -\$4.00$ .

If the farmer has the right to exclude and the number of steers is one, the second steer would cause two dollars in damage yet would be worth an additional four dollars to the rancher, so the farmer would accept an offer from the rancher to increase cattle use of his land. Similar marginal moves from zero or five steers can be shown using the same method.

Once the number of cattle goes from six to seven, there is a significant change in the effect of the steers on the farmer. The additional (or marginal) damage caused by additional cattle is zero, as the entire economically recoverable crop has been destroyed.

If the rancher has the right to use all the land (his own and the farmer's), the baseline would be eight steers, as that would maximize the net value of the herd to the rancher at twenty-one dollars. To reduce the herd to seven he would require a payment of at least one dollar, as his value would decrease to twenty dollars; yet the farmer would not be willing or able to pay anything, as he would still have twenty dollars in damage and zero net gain. As in Figure 2, the farmer is unwilling (or unable) to make a trade when the price received is less than the profit increase. In this case the price received would be negative and the profit increase zero.

On the other hand, if the farmer has the right, the baseline would be zero steers, but the farmer would be willing to accept one, two, and then possibly three, as each trade would yield a net increase in the profits of both parties. The nonconvexity prevents bargaining along the marginal bargaining path to reach the optimal allocation if the starting point (the baseline) is in the nonconvex region where the rancher has the privilege to use the land. Yet if the farmer has the right, the parties need trade only in the region where the production function is convex and can bargain to achieve the optimal allocation. Thus nonconvexities due to the presence of externalities may cause suboptimal production if the right is assigned to the externality generator.<sup>22</sup>

Another source of nonconvexity, which may lead to asymmetry of result with different assignments of rights, may be due to large numbers of potential traders. For example, if there are many cattle ranchers, one may think of the trading axis (the *X*-axis in Figures 1 and 2) as being in number of cattle; then a contract with one rancher does not solve the problem of potential nonconvexities if the entitlement is assigned to the ranchers. Any other rancher may still come onto the land and spoil the bargain. On the other hand, large numbers of farmers do not pose a problem even when the farmers hold the entitlement. Any agreement concerns one rancher and one farmer; and if farmer A agrees to allow rancher B to use a portion of his land to depasture B's cattle, then B will enjoy the benefit of that bargain even if farmer C refuses to let B's cattle come onto C's land. Therefore the asymmetry that occurs because of nonconvexity in the two-party contracting situation may be amplified when there are many parties.

<sup>22</sup> For a more rigorous explication of the importance of nonconvexities in the assignment of liability, see Kenneth R. Vogel, *Nonconvexity and Causation* (in press).

### III. A HISTORY OF CALIFORNIA ANIMAL TRESPASS LAW

There is probably no instance in American legal history that better approximates the conditions of the Coase theorem, in which transaction costs were insignificant barriers to bargaining, than the example of cattle trespass. There is also probably no example of cattle trespass law more suitable for an analysis of the predictive power of the Coase theorem than the situation that emerged in nineteenth-century California. The legislature essentially carried out an experiment in the efficacy of various forms of laws concerning the wandering of animals. It varied the statutes concerning animal trespass on a county-by-county basis, slowly proceeding from a statewide rule that allowed animals to trespass to one that gave landowners the right to prohibit trespassing animals and to collect damages, in all but four "grazing" counties.

From 1850 to 1890, over 150 local laws were enacted to adjust the conflicting rights, duties, and desires of farmers and ranchers. An analysis of the developments in agricultural production that occurred after those statutory enactments is consistent with the hypothesis articulated above: the efficiency of a system of entitlements is affected by the "baseline" chosen. It is also shown that, in this study at least, it is more efficient to grant a right to exclude to the receptor of externalities, that is, to the farmer, than it is to grant a privilege of use to the externality producer, the rancher.

The conflict as to the appropriate rule to use continues even today. Elsewhere in this volume Ellickson presents an example of these laws in action in the twentieth century. He extends the notion of rules from formal laws to include informal group norms. One of the results that he presents shows that even when the law permits animal owners to let their cattle trespass, the ranchers in Shasta county have come to the informal norm of behavior that it is inappropriate or unneighborly<sup>23</sup> for this use to occur. Apparently, they are willing to keep the legal rule so that it can be used in a system of strict liability when cattle are damaged in accidents with strangers, as in automobile accidents.<sup>24</sup> Many of Ellickson's criticisms of the "law-and-economics" scholars' "legal centralism" are undoubtedly true. However, it is worth noting that, contrary to the modern evidence in Shasta, not only did the trespass law have significant effects

<sup>23</sup> For the development of the concept of "normalcy" in neighborhood activity regulation, see Robert G. Ellickson, *Alternatives to Zoning: Covenants, Nuisance Rules, and Fines as Land Use Controls*, 40 U. Chi. L. Rev. 681 (1973). This is similar to what I mean by "unneighborly."

<sup>24</sup> Robert C. Ellickson, *A Critique of Economic and Sociological Theories of Social Control*, J. Legal Stud. (in this issue).

on behavior, but it was also an issue of political significance matched only by water rights during the nineteenth century. If it had not been as central to economic and hence political discourse, it is probably true that the law alone would be much less important in its effects on behavior. This would probably be due to the cost to most people of learning the law. Clearly, there remains much need for research to discover the boundaries of when the formal rule of law will be more important as a behavior regulator than those less formal rules, norms, and ethics.<sup>25</sup>

The experiment in the assignment of property rights by the California legislature is investigated because it illustrates an example of a situation in which the assignment of property entitlements appears to have made a difference in the amount of production of the underlying products: crops and animals.

California became a state of the Union in 1850, having developed rapidly because of the Gold Rush of 1849. Before it became a territory of the United States in 1848, California was a territory of Mexico (and, before Mexico existed, a province of Spain). Under Mexican rule the predominant form of economic activity was raising cattle on large tracts of land known as *ranchos*.<sup>26</sup> The products derived from the cattle were numerous. In addition to selling the cattle for beef, the ranchers slaughtered the cattle for tallow and hide and produced dried beef, also known as *carne seca* or jerky. The Gold Rush drastically boosted the population in the northern cities and the mines. For tallow and hide, a steer had been previously worth only \$4.00 a head. The sudden demand for beef increased the price of a head to as high as \$75. The prices beckoned southern ranchers, who undertook drives of five and six hundred miles with a thousand cattle. Indian attacks were not uncommon, cattle rustling was a constant risk, and a sudden storm on the open range could scatter the cattle for miles. A subsequent glut in the cattle market and increased competition from sheep herders drove cattle prices down to their former levels.<sup>27</sup>

The cattle grazed on the vast unfenced range of land, frequently becoming mixed together with neighboring owners' herds. This commingling necessitated rodeos in order to separate the various owners' stock from each other. The procedure for the rodeo was quite formalized.<sup>28</sup> A landowner was required to give four days notice to his neighbors of the time and place of the rodeo so that they could come to collect their cattle.

<sup>25</sup> *Id.*

<sup>26</sup> See generally Robert Glass Cleland, *The Cattle on a Thousand Hills: Southern California, 1850-1870* (1941).

<sup>27</sup> *Id.* at 88-91, 137-42.

<sup>28</sup> *Id.* at 74-80.

Calves that had no brands and that did not follow a mother belonged to the owner of the land on which the rodeo was being held. In addition to roving herds of cattle, large bands of both wild and trained horses grazed on the open range. On occasion, hundreds of the unbroken horses were killed to save the grasses for cattle. Sheep also used the pastures. As sheep raising grew in prominence in the state, sheep occasionally displaced cattle as the stock of the *ranchos*. In 1850, less than 18,000 sheep were reported in California. By 1860 that number had reached 1 million.<sup>29</sup>

After California entered the Union, its first legislature passed an act to enact the common law as the law of the state.<sup>30</sup> It also passed an act that made an exception to the common law in the case of animal trespass. The California legislature largely retained the rules favoring the cattle industry that existed under Mexican rule.<sup>31</sup> The Trespass Act of 1850<sup>32</sup> defined a lawful fence<sup>33</sup> and gave an owner of land who had enclosed his premises with such a fence the right to collect damages that grazing or other animals caused. For a second trespass double damages could be collected. However, if an owner or occupier of land did not fence those animals out with a lawful fence, he had no rights against the owner of the animals or against the animals themselves. Moreover, if the landowner "killed, maimed, or materially hurt" an animal, he was liable for all damage sustained by the animal and for the costs accruing from the suit.<sup>34</sup>

The issue of animal trespass was to become one of the two most bitter in the California legislature in the nineteenth century.<sup>35</sup> The privilege given to animal owners was perhaps the greatest grievance of the farmers and their allies in the San Francisco Chamber of Commerce,<sup>36</sup> who fought

<sup>29</sup> *Id.* at 186-92.

<sup>30</sup> An Act Adopting the Common Law, ch. 41, 1850-53 Compiled Laws Cal. 186.

<sup>31</sup> An Act to Regulate Rodeos, ch. 92, 1850-53 Compiled Laws Cal. 337. Cleland, *supra* note 26, at 74-80, provides an excellent description of these rules in operation.

<sup>32</sup> Ch. 142, 1850-53 Compiled Laws Cal. 793.

<sup>33</sup> "Every inclosure shall be deemed a lawful fence, which is four and a half feet high, if made of stone; and if made of rails, five and a half feet high; if made upon the embankment of a ditch three feet high from the bottom of the ditch, the fence shall be two feet high; said fence to be substantial and reasonably strong, and made so close that stock cannot get their heads through it, and if made to turn small stock, sufficiently tight to keep such stock out. A hedge fence shall be considered a lawful fence if five feet high and sufficiently close to turn stock." *Id.*

<sup>34</sup> *Id.*

<sup>35</sup> The other was water rights. See generally Appendices to the Journals of the Senate and Assembly 1850-90.

<sup>36</sup> The mercantile interests favored the farmers in this dispute because of the type of product that the two agricultural groups produced. Farmers were producing wheat, corn, and other grains as well as vegetables, which were fairly easy to export. Only the tallow and hides of the cattle were exportable, and therefore cattle probably could not yield as high a value per acre as grain. *Id.*



for its repeal from the 1850s through the 1870s. In fact, from 1851 to 1890 well over 150 separate acts changing the property rights regime were enacted by the California legislature. The acts can be categorized in three ways: by county, by animal,<sup>37</sup> and by enforcement mechanism.<sup>38</sup>

The changes were usually enacted for a small group of counties at one time. However, some acts had a statewide scope, while others were limited only to certain townships or portions of a county. Geographically, the scheme of enactments became chaotic. Acts passed concerning a limited area could prejudice farmers on nearby, unprotected land. If a change in law affected only a portion of the county, ranchers could move to another portion with little difficulty. Farmers whose lands were not within the geographic boundaries protected were made to bear the greater burden of subsidizing the cattle industry.

The original enforcement mechanism was the Trespass Act of 1850, a fence-out (hereinafter "fence") law that required landowners to erect a lawful fence to protect their property; without such a fence there would be no liability. The earliest alternative rules allowed the finder of an estrayed animal to "take up" animals found on his land whether or not the land was enclosed by a lawful fence. Under this rule, which will be called a "trespass" law, the landowner would receive only the expenses for caring for the animals until the owner was found or the animal was sold at a public auction.<sup>39</sup> Another type of statute, which will be called an "estray" law, also gave the finder of an estray on his property the right to recover damages that the animal had caused in addition to the expenses granted by the trespass acts.<sup>40</sup>

<sup>37</sup> Separate statutes were passed for each of the grazing animals. Grazing animals included horses, mules, jacks, jennies, hogs, sheep, goats, and cattle (horned and neat). Some statutes concerned only a single class of animal, while others were more general in their application.

<sup>38</sup> These five types of legal rules span much of the range of possible relationships between the parties. In the terms of Calabresi and Melamed, either the property rule or the liability rule is assigned to either the generator or the receptor of the externality. Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 Harv. L. Rev. 1089-1128 (1972). The original property rule was the privilege that owners of animals had of letting their stock roam at large. Polinsky, *supra* note 3, has extended this categorization to include tax-subsidy rules, such as the criminal law.

<sup>39</sup> The earliest example of such a statute is *An Act concerning Estray Animals*, ch. 33, 1851 Cal. Stat. 299, which stated: "§ 1. Every person finding a stray horse, mare, colt, mule, jack, or jenny . . . upon his farm . . . shall, within 5 days, if said animal or animals remain on his farm . . . go before some Justice of the Peace . . . and give . . . a full description . . . and . . . information that will lead to the cause of said animal or animals coming to his farm. . . . *Provided* no animal shall be considered an estray, if the owner is known. § 2. [A]ny person claiming and proving said stray animal or animals that have been posted by this Act shall have restitution of the property so claimed by paying *all costs and such charges* [my emphasis] as may be awarded to the taker up by the Justice of the Peace of his county."

<sup>40</sup> The earliest example of an estray law is *An Act concerning Hogs found Running at*

There were two further categories of statutes that gave the power to take up to the local government. The first of these was a "pound" law under which the municipality or county could appoint an officer to take up and impound estrays. Under these laws the government collected the expenses of caring for the animals.<sup>41</sup> The alternative law gave the local justice of the peace the power to levy a fine in addition to the statutory expenses as an additional "criminal" deterrent to an animal owner who allowed his stock to run at large or to trespass on the lands of another.<sup>42</sup>

### A. Description of Entitlements

*Fence laws* gave a privilege to the rancher to allow his cattle to wander. To prevent damage to his crops, the farmer either had to purchase that privilege from the rancher(s) or had to enclose his own land with a fence meeting the standard set by law. The Trespass Act of 1850 was a strict nonliability statute. If the farmer did not meet all the conditions for a lawful fence, for whatever reason, he could not recover for damaged crops. *Comerford v. Dupuy*<sup>43</sup> illustrates the strictness of the law. Comerford owned a parcel of land that was under cultivation and that was enclosed by a fence on three sides, the fourth side being a steep bluff overlooking the ocean. It was found that the plaintiff's fence on the south side, where the defendant's cattle broke through, was as strong and sub-

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Large in the Counties of Marin, Sacramento, San Francisco, Alameda, Stanislaus, Yuba and Santa Clara, ch. 148, 1856 Cal. Stat. 229: "§ 3. If the owners of such hogs come forward within five days after the time such notices were posted and prove them to be their property, the person taking them up shall deliver them to such owner upon their paying all costs, charges and damages [my emphasis], sustained by reason of their trespassing."

<sup>41</sup> The first pound law enacted was An Act to Prevent Certain Animals from Running at Large in Napa City, ch. 192, 1862 Cal. Stat. 210: "§ 2. If any animals . . . shall be found running at large within the surveyed limits of Napa City . . . it shall be lawful, and it is hereby made the duty of the Sheriff or any Constable of said county, upon being notified thereof by any resident of said town, to take up and impound and keep such animal. . . . § 3. The officer taking up any horse, mule, or horned cattle, shall be entitled to a fee of two dollars each, and one dollar for each day such officer keeps such animal, one dollar for taking up each hog or goat, and fifty cents per day for keeping the same, in each case to date from the time of posting said animals, hogs, or goats."

<sup>42</sup> The first criminal law was An Act Restricting the Herding of Sheep to Certain Pastures in the Counties of Sonoma and Marin, ch. 194, 1857 Cal. Stat. 227: "§ 1. It shall not be lawful for any person, or persons, owning or having charge of any sheep . . . to herd the same, or to permit them to be herded on the land or possessory claim of other than the land or possessory claim of the owner or owners of such sheep. § 2. The owner or owners, or the agents of such owners of sheep, violating the provisions of section first of this Act, on complaint of the party or parties injured, and on conviction thereof before any justice of the peace for the township where either of the interested parties may reside, shall be liable to a fine of not less than twenty-five dollars, nor more than two hundred dollars."

<sup>43</sup> 17 Cal. 308 (1861).

stantial as the statute required.<sup>44</sup> However, twenty feet of the fence was not three feet high, as the statute mandated, and in some places the fence had broken down and had been patched back up. There was a judgment for the defendant under an instruction that, even if the cattle had entered where the fence was lawful, the plaintiff still could not recover<sup>45</sup> if any part of the fence was below the statutory height. The judgment was affirmed on appeal: "We think a party cannot recover for injuries done by cattle of defendant breaking into plaintiff's close, unless the land entered be inclosed by a fence of the character prescribed in the statute, or at least, by an inclosure equivalent to that described in the statute in its capacity to exclude cattle."<sup>46</sup>

However, this did not mean that animal owners had all the rights to use others' land at all times. For instance, there was no strict liability for damages done to animals while they were trespassing, at least not on railroad property. In one case a locomotive struck and killed plaintiff's cow while traveling twenty to twenty-five miles per hour without slowing or blowing the whistle before striking the animal. In spite of the fact that the cow could be seen for a half mile before it was struck, the plaintiff could not recover on strict liability principles. The court used a balancing test, applying normal contributory negligence principles. While the plaintiff had the right to let the cow run at large, the defendant had a right to run cars at their usual times and rates of speed. Therefore, if the plaintiff were to allow his cattle to roam in a place that was extrahazardous, he must exercise an extra degree of care.<sup>47</sup>

*Trespass and estray laws* are types of liability rules in favor of the farmer, the receptor, who receives a right to protect his land and to collect statutory damages for injury done to his right to exclude.<sup>48</sup> Trespass laws allowed the farmer to collect only the expenses he incurred while caring for an estrayed animal. Estray laws allowed those expenses and also permitted recovery for lost crops and damage to the land.

In *Hahn v. Garratt*<sup>49</sup> the plaintiff sought to recover damages caused to his crops by the trespassing of the defendant's cattle under an estray law.

<sup>44</sup> In this case that meant a fence in a ditch. The ditch was three to four feet wide and three feet deep. The fence was on posts eight feet apart with two rails. It was seven feet from outside the ditch to the top rail and five to six feet from the bottom of the ditch to the top rail.

<sup>45</sup> Comerford sued for the value of 407 dozen cabbages and other injuries, totaling \$2,500.

<sup>46</sup> 17 Cal. at 310.

<sup>47</sup> *Richmond v. Sacramento Valley R.R. Co.*, 18 Cal. 351 (1861).

<sup>48</sup> There is no liability rule in favor of the ranchers, except to the extent that farmers who injure animals while taking them up must pay damages under either the trespass or the estray act.

<sup>49</sup> 69 Cal. 146 (1886).

The defendant requested a jury instruction that the plaintiff could not recover unless he showed that the land was enclosed by a fence strong enough to prevent ingress by cattle or that the defendant had intentionally herded his stock on the plaintiff's land. The plaintiff's land was not enclosed; however, an estray act applied to Santa Clara County.<sup>50</sup> The trial court refused the defendant's instruction and instead instructed the jury that in Santa Clara County the owner of land was not required to fence in his land in order to recover damages for injuries caused by trespassing cattle. Rather, in that county the owner of the cattle had the obligation to prevent the trespasses. On appeal, the judgment for the plaintiff was affirmed.<sup>51</sup> The court traced the history of California animal trespass law:

It is claimed for appellant that the rule of the common law of England, which required every man to keep his cattle within his own close, and made him liable in damages for all injuries resulting from their being permitted to range at large, has never prevailed in this state. . . . When the common law was adopted, in 1850, it was made the rule of decision in all the courts of this state. . . . At that time the principal industries of the state were mining and cattle-raising. To encourage and promote these industries, acts were passed by the legislature, before the adoption of the common law, which have been held to be inconsistent with some of its rules. . . . Since then farming and fruit-raising have become important industries, and to encourage and protect them, special acts have been passed for some of the counties, which in effect restored the rules of the common law.<sup>52</sup>

*Pound and criminal laws* also provided some relief for farmers and the citizenry but held it at a distance through tedious procedures and various exceptions to the rule.<sup>53</sup> For instance, in "An Act Supplementary to An Act to Prevent the Trespassing of Animals upon Private Property,"<sup>54</sup> the owner of "trespassed" land had to give the animal's owner five days notice to remove it. If after five days the animal remained, the landowner had to register a complaint with the justice of the peace and give proof of the animal's presence. The justice would then issue an order of removal. If the animal's owner still did not remove it, the justice could impose a fine at his discretion of not less than ten dollars and not more than \$100.

<sup>50</sup> As previously mentioned, many of the acts relating to cattle and land were passed on a county-by-county basis. See text around note 37 *supra*. In this case the applicable statute was An Act concerning Estrays, and Animals Found Running at Large in the County of Santa Clara, ch. 393, 1863 Cal. Stat. 581; *amended by* ch. 411, 1871-72 Cal. Stat. 580.

<sup>51</sup> 69 Cal. 146 (1886).

<sup>52</sup> *Id.* at 147.

<sup>53</sup> Two possible "taxation" schemes are implicit in the pound and criminal laws. However, once again both rules give the right to be free from trespass to landowners and the citizenry and the duty to restrain the animals to the animal owners.

<sup>54</sup> Chapter 411, 1861 Cal. Stat. 474.

The act excepted two categories of animal owners from its operation. The first class exempted was persons driving animals to the market. They had a privilege to linger for two days, after which the landowner could give them their five days' notice. The second group of animal owners excluded from the act was those who owned grazing farms and whose lands were proportionate to the number of their cattle and horses.<sup>55</sup> The minimum statutory proportion of land to animals was 1,200 large cattle and horses to a square league of land.<sup>56</sup> There are no reported cases interpreting these acts. This may imply that they were rarely used or were not of significant importance.

### *B. Effect of Land Use Entitlements on Use*

The Trespass Act of 1850 was unsatisfactory in the eyes of farmers. They were unable to protect their property unless they strictly adhered to the rules for legal fences. The laws perpetuated the domination of land use by ranchers and hindered the development of farming. In a description of a trip from San Diego to Los Angeles in 1858, the Visiting Committee of the State Agricultural Society found

rolling hills covered with wild oats, and with the remains of a heavy crop of clover . . . most perfect succession of hill and valley. . . . [H]ills rise from 100 to 500 feet high with sides sufficiently sloping and tops sufficiently rounding to admit the use of a team and plow almost universally. . . . The soil is generally a rich dark mold, interspersed with districts of volcanic scoria, yellow sand, dark gravel, etc. In the rainy season, and for months succeeding, nothing can exceed the rich green of the growing oats and the fragrance of clover in bloom.<sup>57</sup>

In spite of that glowing report of the possibilities of the land, the committee found many cattle and horses but very few acres under cultivation. Documenting their trip through California, they write of an area about thirty-six miles from San Diego called Guapemita, where of 7,260 acres eighty were enclosed and under cultivation. Further north, they pass the Valley of San Mateo, owned by Pio Pico, containing about fourteen square miles with a large band of cattle and horses. Then follows the Mission of San Juan Capistrano, with "few gardens and small fields." Then they mentioned the Santa Anna Ranch, "a good piece of ground, in ruins, with several acres of corn." Only when they get close to Los

<sup>55</sup> The legislature seemed concerned that animal owners who had a great number of stock but very little land might intrude on their neighbors.

<sup>56</sup> A square league of land equals approximately ten square miles or 6,000 acres.

<sup>57</sup> California State Agricultural Society, Transactions during 1858, Appendix to the Journal of the Senate of California, 10th Sess. (1859) (hereinafter cited as Transactions 1858).

Angeles do they encounter much cultivation, but most of the land is clearly used as open range.<sup>58</sup>

The reason that all farmers and the commercial interests of the state gave for this state of land use was the fence law. In a report of the Agricultural Society in 1863, the problem was clearly posed:

If two adjoining tracts of land, one occupied for stock growing and the other for grain farming, are considered, it will be seen that either one or the other must be fenced, or the grain field will be encroached upon and destroyed by the stock. It is needless, at this point of the illustration, to state that the grain field is incapable of going over upon the stock range and committing deprivations. . . . The greatest obstacle to profitable farming in this State has been the costliness of fences, not only at the outset but for constant repairs.<sup>59</sup>

Wilson Flint estimated that in the central district of the state it would cost approximately ten dollars per acre to fence land. There were at that time 1,959,490 acres under fence in the thirteen counties<sup>60</sup> that he studied; the fencing enclosing those farms thus cost over \$19.5 million. The market value of all stock in those counties (horses, mules, cattle, sheep, and hogs) was only \$8.8 million. "Thus showing that the fences have cost ten million seven hundred and ninety thousand one hundred and twenty-six dollars more than the total value of stock in the district. By this it appears that grain growers could well have afforded to have bought all the stock and given it away for exile and thereby saved [over \$10 million], if they could by doing so have escaped the necessity of erecting fences to protect their grain fields."<sup>61</sup>

It was estimated that "[t]he expense of building and maintaining fences in repair in California . . . are [*sic*] probably greater than any other country in the world." In New York, Erza Cornell estimated that the cost of rail and stake fence was thirty cents a rod or ninety-six dollars per mile. In California, the cheapest fencing (post and plank) cost \$2.19 per rod or

<sup>58</sup> *Id.*

<sup>59</sup> Wilson Flint, California State Agricultural Society, The Fence Question, in Transactions during 1863, 2 Appendix to the Journals of the Senate and Assembly of California, 15th Sess., (1864), at 146, 150.

<sup>60</sup> Alameda, Colusa, Contra Costa, Napa, Sacramento, San Joaquin, San Mateo, Santa Clara, Santa Cruz, Solano, Sonoma, Sutter, and Yolo counties.

<sup>61</sup> Flint, *supra* note 59. An obvious question is why the farmers did not do just that, assuming low transaction costs. The answer is obviously that purchasing cattle from the ranchers would only encourage the ranchers to purchase, breed, or otherwise procure cattle for a second round of deals. Even agreement by the rancher to cease the practice of ranching could not forestall new entrants and would be more expensive to negotiate. Only if the ranchers' land could be burdened by a covenant, forbidding future owners from raising animals, would the farmer be protected.

about \$700 per mile. At the same time, owing to the location of markets, wheat earned \$2.50 per bushel in New York as compared with \$1.20 in California.<sup>62</sup>

The enormous cost of fencing kept the issue of animal trespass in the political arena.<sup>63</sup> Fencing was in fact in such close proportion to the receipts from growing crops that it prevented people from farming. The extra labor and material required to erect and maintain the fences was considered simply as a tax:

It is hardly necessary to state that this enormous . . . tax upon the agricultural interests . . . is thought to be necessary in order that the horses and cattle may be allowed to roam at large upon the public commons as the monarchs of all they survey. Sheep and hogs must be left out of consideration in these estimates, they not being among the privileged classes of quadrupeds. . . . The strangest part of the whole subject is the fact that a very small portion of this stock, or but a little of this field—the commons—around which this fence is built and maintained, belongs to the people whose money and time goes to build and maintain it. And yet, from force of habit, they persistently continue to impose this tax upon themselves in the vain attempt to surround the people's cattle with a *lawful* fence and thus relieve the owners of the expense of a herder, and prevent the cattle from doing damages.<sup>64</sup>

The availability of fencing varied with the region of the state. In northern California near the mountains, wooden fencing was available: "In 7 days we have made 18 hund. [*sic*] Rails & Slats. . . . Mr. McNeil agreed with me to take 2000 Slats at \$8 per hund. and 500 Posts at \$6 per hund."<sup>65</sup> Wooden fences were the superior choice in that area. "Several landholders in Napa Valley are making Wrie [*sic*] fences. . . . But told George that they cost more than a Redwood fence if this be the case I think few will be made as they can't be as good They must be a poor defence [*sic*] versus hogs."<sup>66</sup>

The amount of fencing purchased by Mr. McNeil would construct a

<sup>62</sup> California State Board of Agriculture, Report for the Years 1864–65, 2 Appendix to the Journals of the Senate and Assembly of California, 16th Sess. (1866), at 16 (hereinafter cited as Report).

<sup>63</sup> However, some of the initial changes in the law relating to grazing animals did not come because of the complaints of the grain growers. Rather, the cattle and horse ranchers pressured the legislature during the session of 1857 to pass an act to forbid sheep from being herded or grazed on the lands or possessory claims of others than the owners of such sheep, in the counties of Marin and Sonoma. An Act Restricting the Herding of Sheep to Certain Pastures in the Counties of Sonoma and Marin, ch. 194, 1857 Cal. Stat. 227.

<sup>64</sup> Report, *supra* note 62, at 18.

<sup>65</sup> Anacias Rogers Pond Journal, 1852–62, p. 30, March 25, 1853, Huntington Library, MS HM19384 (hereinafter cited as Pond Journal).

<sup>66</sup> *Id.* at 39, April 30, 1853.

fence approximately one mile long; this would be sufficient to enclose a square parcel of about forty acres at a cost of \$190. However, in southern California, wood was very expensive, and therefore it would not be the fencing material of choice. As an alternative to a wooden fence, a hedge fence was planted by a community of Germans who settled in Anaheim in 1857. From a purchase of 1,200 acres of the Rancho San Juan Cajon de Santa Ana, the community set aside 200 acres for a town and divided the rest into twenty-acre farms: "Forty thousand willow poles, planted eighteen inches apart, were used to make a live fence about the property. The upright cuttings projected six feet above ground; they were 'strengthened by three horizontal poles, and defended by a ditch four feet deep, six feet wide at the top, sloping to a breadth of one foot at the bottom.' The barrier thus formed was so impenetrable that even herds of starving cattle, in times of drought, could not break through it."<sup>67</sup>

It is important to note that one fence surrounded these 1,200 acres inhabited by fifty families. By enclosing the entire property by one fence, the total fence was much shorter and the cost per family much lower.<sup>68</sup>

Even with fencing, there was a limit to its efficacy in restraining large herds. In times of drought thousands of thirst-crazed cattle would press in against the willow fence of Anaheim. Some would break through and have to be shot for the protection of the citizens. Other measures taken to stop the animals included planting thorned shrubs on the outside of the fence and having a mounted guard patrol the perimeter to prevent the intrusions.<sup>69</sup>

In addition to the cost of fencing and patrols and to the economic loss from damages resulting from cattle, the situation in which the farmer had the obligation to protect his land was considered inequitable:

It certainly should be the right of an individual who is in tenancy of a piece of land to enjoy its undisturbed use, particularly when, as an evidence of his good faith and honest intentions toward his neighbors he should give them notice that they need apprehend no encroachment on their domain from himself or anything under his control and with which assurance his neighbor is relieved of the necessity of erecting barricades. Ought not the statute to provide for a mutual pledge between the parties that neither should encroach on the other? Not so in its practice. It

<sup>67</sup> Cleland, *supra* note 26, at 211.

<sup>68</sup> A fence of approximately six miles is required to enclose 1,200 acres in one parcel; even at \$200 per mile that would be \$1,200. On the other hand, enclosing fifty parcels of twenty acres requires approximately fifteen miles of fence or two and one half times as much fence as enclosing the entire area as one cattle-free zone. Anaheim was virtually unique as a large farming settlement in southern California in the 1860s. See Transactions 1858, *supra* note 57.

<sup>69</sup> Lucile E. Dickson, *The Founding and Early History of Anaheim, California*, 11 *Hist. Soc'y S. Cal. Q.* 26, 31 (1919).



compels the party who voluntarily takes a position where he can do no wrong to others to erect costly barricades to protect his own industry, on his own premises, from the wanton aggressions of his neighbors.<sup>70</sup>

Following the enactment of the fence-in laws beginning in the 1860s, wheat farming expanded rapidly. From the late 1860s through the next two decades this change has been described as the most significant agricultural development of the period.<sup>71</sup> In particular, the reference was to the Sacramento and the San Joaquin valleys. Writing in 1875, I. N. Hoag, former secretary of the California State Agricultural Society, describes the agricultural transition that occurred in that region:

These elevated shelves, or plains were originally covered throughout the whole length of the State with a most luxuriant growth of wild oats, frequently standing from eight to ten feet high, through which roamed the year round countless herds of wild cattle. . . . They are now covered each year with vast fields of wheat and barley, and dotted over with villages, and farm houses, and farm establishments. . . . Still back of these plains come the rolling or foothill lands, lying at the feet of the mountain ranges which hem in the great inland valley. . . . Millions of acres of these hills are now occupied as sheep walks and Winter homes for stock cattle and dairies.<sup>72</sup>

The picture presented shows a movement of wheat farming into the valleys and a movement of the stock interests up into the foothills. Keeping in mind that under the fence-out law cattle could graze freely on the lands of others, there are several possible reasons that would explain how wheat farming could develop in an area dominated by cattle ranching. First, the greater availability of lumber in the northern counties may have permitted farmers to enclose their lands. Second, the farmers may have contracted with the ranch owners to keep their cattle more effectively under control. Third, the legislature, by passing a statute that forced ranchers to pay for damages to crops destroyed by wandering cattle, may have given the farmers incentives to plant crops, contrary to the implications of the Coase hypothesis.<sup>73</sup>

<sup>70</sup> Flint, *supra* note 59, at 151. Flint draws an analogy between the rancher and a thief who trains a raven to fly into open windows to seize jewels: "Will it be pretended that it should be obligatory on the owners of these valuables to erect such barriers as would prevent the thieving raven from obtaining access to the coveted articles, and that it would be no felony for the party employing the raven . . . to receive the fruits of the robbery and convert to his own use the proceeds."

<sup>71</sup> Robert Glass Cleland, *From Wilderness to Empire* 324 (1944).

<sup>72</sup> I. N. Hoag, California State Agricultural Society, *Agricultural Review*, in *Transactions during 1874*, 1 Appendix to the Journal of the Senate and Assembly of California, 21st sess. (1875), at 245, 251.

<sup>73</sup> As mentioned in the text at note 39 *supra*, the legislature also provided other types of

The theory that increased availability of lumber for fencing may have led to increased production of wheat in the San Joaquin and Sacramento valleys has some credibility. Although barbed wire was not available until 1874,<sup>74</sup> both those valleys are in the northern part of the state, close to the California forests. Lumber would have been easier to acquire there than in most parts of southern California. Still, even with a greater availability of lumber, the costs of erecting fences were extremely high.<sup>75</sup> In addition to the cost of carrying wood by comparatively primitive methods (by some form of animal driven cart), labor costs were also high. The fences had to be "substantial" to meet legal requirements, meaning that they had to be sufficiently strong to turn stock.<sup>76</sup>

Furthermore, the initial cost of constructing the fences did not end the matter. The fences had to be kept in repair. Wood has a natural tendency to rot, and the fences were subject to the stress of cattle pressing against them. A lamentation of the period illustrates the degree of stress that the cattle could impose: "Common fences are no defense against wild and starving cattle. As the time of harvest approaches, fields require guarding day and night."<sup>77</sup> Journal entries for 1856 from Rancho Azusa illustrate how much effort could be required of a landowner to keep a fence in repair: "[C]arried stakes for Vineyard fence in Small Cart, the Cattle having entered and broken down a peach tree" (November 14);<sup>78</sup> "[c]attle getting into the Vineyard" (November 23);<sup>79</sup> "again cattle in large numbers in the Vineyard, Shut them up in Corral, destroyed a peach tree" (November 25);<sup>80</sup> "people engaged in cutting and hauling stakes for fence of Vineyard" (November 27);<sup>81</sup> "people all engaged in cutting & hauling, Stake and cutting ditch for Vineyard fence" (December 3).<sup>82</sup> This cattle

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enforcement mechanisms to encourage the farming interests or to discourage ranchers from allowing their animals to roam wildly on the lands of others. A criminal law might not give farmers as much of an incentive to plant crops as a liability rule would. Although ranchers would be punished to some extent for failing to keep their animals under control, the fine did not return the crop value to the farmers.

<sup>74</sup> Cleland, *supra* note 26, at 87 n.28. See also Ernest Bogart and Ronald Kemmerer, *Economic History of the American People* 500 (1942).

<sup>75</sup> See text at note 59 *supra*.

<sup>76</sup> This requirement was strictly enforced. See the discussion of *Comerford v. Dupuy* in the text at notes 43-46 *supra*.

<sup>77</sup> Kern County Weekly Courier (Bakersfield) (April 29, 1871), cited in John Ludeke, *The No Fence Law of 1874: Victory for San Joaquin Valley Farmers*, 59 Cal. Hist. Soc'y Q. 98, 108 (1980).

<sup>78</sup> Henry Dalton, 2 Daily Occurances of Azusa 7, Huntington Library, MS DL 1139.

<sup>79</sup> *Id.* at 8.

<sup>80</sup> *Id.*

<sup>81</sup> *Id.*

<sup>82</sup> *Id.* at 10.

invasion at Rancho Azusa continued through December 13. Fence building at Azusa was an ongoing enterprise, with three men constantly engaged in building and repairing fences.<sup>83</sup>

Although there are documented instances of large grain holdings in the valleys,<sup>84</sup> there was also a trend toward the development of small farms.<sup>85</sup> Small farmers were less able to afford the high costs of fencing.<sup>86</sup> Therefore the availability of fencing alone probably does not explain the growth of farming. As the cost of fencing was less per acre for large farmers than it was for small,<sup>87</sup> there must be an alternative explanation for the growth of farming and especially of small farms.

Next I consider the possibility that farmers may have contracted with ranchers to have the ranchers keep their cattle away from crops. In situations in which there was only one owner of stock in a locality, the possibility of such contracts may have existed. One example of such a contract was a lease between Henry Dalton and Jose Ochoa: "[T]he party of the 2 part further covenants that he will not at any time during the existence of the lease permit any Stock whatsoever in quantities over the number of 5 to run on the lands of the Rancho Azusa belonging to the party of the first part."<sup>88</sup>

However, this contract came into existence after the law applying to Los Angeles county had changed to give the entitlement to the farmer. In other situations Dalton was more likely to use the law to protect his lands. Even when he did not have the legal power, Dalton attempted to warn trespassers off his ranch. In a newspaper notice in 1852, Dalton complains: "[P]ersons are in the habit of running cattle and other animals . . . also plundering timber . . . on the lands of Santa Anita and San Francisco"; he therefore warns that he will "henceforth prosecute without distinction all persons found trespassing . . . and allow no permission to be granted except under his own signature."<sup>89</sup>

<sup>83</sup> See generally *id.*

<sup>84</sup> Cleland, *supra* note 71, at 324-29.

<sup>85</sup> Statewide the number of small farms nearly doubled from 1860 to 1880. In 1860, nine million acres were devoted to farming and the average size of a farm was 466 acres. In 1880, seventeen million acres were devoted to farming and the average size of a farm was 462 acres. From 1860 to 1880 the number of farms rose from approximately nineteen thousand to thirty-six thousand. N. P. Chipman, California State Agricultural Society, Annual Address in Transactions during 1886, 3 Appendix to the Journals of the Senate and the Assembly, 27th sess., 187, 197 (1887).

<sup>86</sup> See text at note 68 *supra*.

<sup>87</sup> The size of a farm goes up as the square compared with the length of fence. For example, a 100-acre farm can be enclosed by a 9,000-foot fence, while a ten-acre farm may require 5,000 feet of fence to enclose it.

<sup>88</sup> Henry Dalton, 3 Daily Occurances of Azusa 7, June 19, 1861, Huntington Library, MS DL 1140.

<sup>89</sup> Los Angeles Star (February 14, 1852).

These warnings did not apparently work as long as cattle owners had the right to allow their animals to trespass.<sup>90</sup> Once the law in Los Angeles county favored the farmer,<sup>91</sup> Dalton had more power to use: "Some months since I called the attention of M. Corbitt to the fact of your sheep grazing on my land of S. Francisquito. . . . If perchance you will have no objection to make one a fair compensation for the pasture already consumed and I shall have no objections to making arrangements for their pasturage hereafter, provided we can agree on terms."<sup>92</sup>

One typical situation seems to have been that in which there were numerous cattle ranchers. In such a case, the ability of farmers to contract with cattle ranchers was severely limited. For instance, in Kern County, which is in the southern part of the San Joaquin valley, cattle ranchers from outside the county often pastured their herds within the county. In 1871 it was estimated that there were over 60,000 head of cattle in Kern County that had been driven there by ranchers living in other counties<sup>93</sup> or outside California.

The reason that there were few agreements between farmers and cattle raisers when the cattle raisers had the privilege to trespass can again be traced to nonconvexities. While the large number of ranchers will increase the transaction costs, this is not simply an example of transaction costs that remain high regardless of the original assignment of rights. All that is required to return to the zero transaction costs condition is to change the law to give the right to exclude to the farmer. Then each farmer may negotiate (or not) with one rancher if that rancher considers it to be profitable to use a farmer's land. The nonconvexity in this example comes about as the number of ranchers (not just the number of cattle) may increase without bound, just as there was a nonconvexity in Figure 2 when the number of cattle could increase without being bounded by the convex portion of the production set.

The fence law in essence allowed the land of the state to be held as a commons.<sup>94</sup> As no one needed to own land to raise cattle, many ranchers

<sup>90</sup> For the numerous instances when cattle trespassed on Rancho Azusa, see generally Dalton, *supra* note 78.

<sup>91</sup> See An Act Supplementary to An Act to Prevent the Trespassing of Animals upon Private Property, ch. 411, 1861 Cal. Stat. 474.

<sup>92</sup> Dalton, *supra* note 78.

<sup>93</sup> Ludeke, *supra* note 77, at 108.

<sup>94</sup> The inefficiency of the commons form of ownership is well-known. Garrett Hardin, *Tragedy of the Commons*, 162 *Sci.* 1243 (1968), gives the example of overgrazing in Africa to show the ecological problems that result from a regime under which anyone who wishes to use a resource may do so. John Umbeck, *Might Makes Rights: A Theory of the Formation and Initial Distribution of Property Rights*, 19 *Econ. Inquiry* 38 (1981), in explaining the formation of "property" rights during the Gold Rush of 1849, shows that, when force (might) is used as the allocation mechanism, the resource so assigned is appropriated by the

became nomadic, with no need to worry about using the land efficiently or even paying taxes: "[T]he country has been greatly injured by being overstocked. A great share are owned by persons never intending to either Squat or settle in the state. They should be called Sliders, I am of the opinion that but half or not more than that have ever been assessed I know of parties owning thousands of cattle (& not one acre of land) And have heard them say they were scattered from Colusa to Petaluma in other word in six different Counties."<sup>95</sup>

The fence law is one instance of bargaining costs increasing because of the assignment of entitlements. Clearly, the administrative costs are asymmetrical with respect to the entitlement. A large number of ranchers are potentially users of any plot of land. If a farmer fails to contract with the rancher who actually uses his land, all the payments made to the other ranchers are useless. On the other hand, if the farmer has the entitlement, while cattle may (if a rancher is negligent) wander over the lands of many farmers, every contract made will benefit the rancher who has paid for the right to trespass. They each decrease the damages that must be paid for violating the farmers' entitlements. Changing the right from the rancher to the farmer changes the negotiations from one (farmer) to  $N$  (ranchers) to a simple one (farmer) to one (rancher). Therefore it is not side payments from farmers to ranchers that explain the growth of grain growing in the valleys in the absence of changes in the laws.

Thus we must consider the third theory that can explain the development of the valleys as grain producers: the legislature provided rules giving farmers legal protection against trespassing animals. In an area where mixed use is appropriate, it is more efficient to give the entitlement to the farmer.<sup>96</sup> This is not necessarily because farming is a more appropriate use, but rather because the costs of negotiating rents or calculating damages when the farmer has the entitlement are lower than the costs of calculating lost potential "use value" with  $N$  ranchers, potential users of a plot of land, when the ranchers have the entitlement. To see how changes in the law may have accelerated the development of crop growing

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user who has the comparative advantage in the use of force rather than the use of the resource. Therefore, under that scheme, less of the resource will be allocated to the user with the comparative advantage in productive use, so society has fewer products.

<sup>95</sup> Pond Journal, *supra* note 65, at 74, February 4, 1862.

<sup>96</sup> If ranching (or farming) were the only economically efficient use of land, it would not matter who had the entitlement as (by assumption) there would be no competition between uses. For example, even if farmers had the entitlement to be free from trespassing animals, if it were uneconomical to farm grazing land, farmers would not choose to farm there. If perchance one made the mistake of trying, either ranchers could pay him his expected profit (zero) or would compensate him his expected profit (zero) if they happened to trespass. With no gain from farming or from side payments no one would farm grazing land.

in California, two methodologies are used. First in Section IIIC, a history of the legislative enactments for the counties of Sacramento and San Joaquin<sup>97</sup> is presented in an attempt to convey the extent of changes in the law. Then in Section IV a regression analysis of the effect of changes in the laws on agricultural production is presented to show the relation between the statutory enactments and the changes in agricultural production in a more formal way.

### C. *Changes in the Central Valley*

As early as 1851, the California legislature enacted a trespass law covering the counties of Sacramento and San Joaquin.<sup>98</sup> Farmers could take up stray cattle<sup>99</sup> and receive expenses for their care. However, if the person who took up an animal put it to use,<sup>100</sup> no expenses were permitted for caring for the animal. In addition, farmers had a duty to report estrayed cattle within three months to a justice of the peace, even if they had not taken up the animals. A breach of the duty subjected the farmer to a fine not exceeding the value of the estrayed stock.<sup>101</sup> In 1856, the act was repealed and replaced by a similar enactment that was slightly more favorable to the farmers' interests.<sup>102</sup> If after a year's time the animal had not been claimed, the farmer acquired full rights to it on payment of half the animal's appraised value into the county treasury. Landowners were also relieved of their duty to report estrays that they had not taken up. They continued to have the responsibility of posting notice or notifying the owner if they "took up" an estray.<sup>103</sup>

In 1858, the legislature brought both counties within the scope of an 1857 criminal law forbidding the owners of sheep to herd them on the lands of others.<sup>104</sup> The mandatory fine for herding sheep on another's land

<sup>97</sup> Sacramento and San Joaquin were used as sample counties from the Sacramento and San Joaquin valleys. The acts concerning animal trespass law were passed on a county-by-county basis. Sometimes only certain portions of a county were involved, and sometimes only certain townships were covered by the acts.

<sup>98</sup> An Act concerning Estray Animals, ch. 160, 1850-53 Compiled Laws Cal. 854.

<sup>99</sup> Farmers were not the only class of people entitled to take up cattle, and cattle were not the only class of animal mentioned in the statute. Horses, mules, goats, sheep, and other animals were among those that could be taken up, and nonfarmers could take up an animal if it was found wandering on their premises.

<sup>100</sup> For instance, an estrayed cow could be harnessed to a plow, or it could be milked.

<sup>101</sup> An Act concerning Estray Animals, ch. 160, § 5, 1850-53 Compiled Laws Cal. 854-55.

<sup>102</sup> An Act concerning Estray Animals, ch. 128, 1856 Cal. Stat. 186.

<sup>103</sup> *Id.* at 187.

<sup>104</sup> An Act Restricting the Herding of Sheep to Certain Pastures in the Counties of Sonoma and Marin, ch. 194, 1857 Cal. Stat. 227, amended by ch. 207, 1858 Cal. Stat. 165.

ranged from twenty-five dollars to \$200.<sup>105</sup> In addition, the injured party was awarded a minimum of twenty-five dollars for each day the violation continued. Sheep found trespassing could also be taken up in accordance with the estray laws relating to cattle.<sup>106</sup>

In 1862, the legislature enacted a liability rule<sup>107</sup> in favor of farmers in certain parts of Sacramento County during certain seasons of the year.<sup>108</sup> Farmers could collect damages for all injuries done to their land by trespassing cattle regardless of whether the land was enclosed by a lawful fence. This act protected farmers only from trespasses on cultivated fields during the sowing, planting, growing, and harvesting seasons and until the crops were removed.<sup>109</sup> The legislature applied this rule only to the valley portions of the county: "[T]his Act shall only apply to that portion of Sacramento County lying south of the American River, on the east bank of the Sacramento, and extending from the Sacramento River to the high lands, or to the line of overflow, as designated on the map of Swamp and Overflowed Lands of Sacramento County."<sup>110</sup> In 1866, other portions of Sacramento County received legislative protection from trespassing cattle by an additional estray law that provided for a system of arbitration to determine damages and that stipulated the sums that farmers could collect as expenses for taking up and safely keeping cattle.<sup>111</sup>

Farmers in San Joaquin County, which lies just south of Sacramento County in the Central Valley, received a slightly different system of protection from that afforded farmers in Sacramento County. In 1864, the legislature authorized the county to impound animals wandering in a farmer's enclosure.<sup>112</sup> In addition to receiving damages for injuries to

<sup>105</sup> For Sacramento County a new law dealing with sheep was enacted some years later. It provided a minimum fine of twenty dollars and a maximum fine of fifty. The injured party received at least five cents a head for every day the violation continued. An Act to Restrict Sheep from Being Herded or Running at Large in Sacramento County, ch. 231, 1875-76 Cal. Stat. 305.

<sup>106</sup> *Id.*

<sup>107</sup> An estray law in the terminology of this paper.

<sup>108</sup> An Act for the Better Protection of Farmers in Certain Portions of Sacramento County, ch. 311, 1862 Cal. Stat. 425.

<sup>109</sup> *Id.*

<sup>110</sup> *Id.* The legislature repeatedly amended the laws to change the geographic areas protected. For Sacramento County this amendment process was particularly hectic. Not all the amendments are mentioned in the text. The important legal developments are noted above, but it should be kept in mind that different parts of Sacramento County were covered by different laws at different times.

<sup>111</sup> An Act to Protect Agriculture, and to Prevent the Trespassing of Animals upon Private Property, ch. 361, 1865-66 Cal. Stat. 440.

<sup>112</sup> An Act to Establish and Maintain Public Pounds, for the Better Securing of Estrays and Other Stock, in the County of San Joaquin, ch. 372, 1863-64 Cal. Stat. 418 (hereinafter referred to as Pound Act). Note that the estray laws were still in effect at this time. 1856 Cal.

crops within an enclosure, farmers also were granted expenses of ten cents a mile for driving estrays to the pound and ten cents per estray if the drive to the pound was further than one mile (if less than a mile, it was five cents per head).<sup>113</sup> Farmers were required to post an impound notice in a public place, for which they received twenty-five cents. An additional twenty cents per mile was awarded for transportation from the pound to wherever the notice was posted.<sup>114</sup> An animal owner who attempted to retake his stock while the animals were being driven to the pound or who attempted a pound breach could be fined up to \$100 and could be imprisoned for up to three months.<sup>115</sup>

In 1866, the legislature eliminated the fencing requirement of the impound laws.<sup>116</sup> Farmers could collect damages for injuries to their crops without having first fenced their lands. In addition, the legislature permitted farmers the same fees that the pounds received if the farmer chose to impound an animal on his own property.<sup>117</sup> The amendment applied only to that part of the county north of the Mokelumne River.<sup>118</sup>

In 1872, the legislature gave farmers in San Joaquin County additional protection by eliminating the need for impounding entirely.<sup>119</sup> Farmers could take up animals they found trespassing on their lands and could receive compensation for their keep. Alternatively, they could bring an action for the damage sustained because of the trespass.<sup>120</sup>

Finally, in 1876, both Sacramento and San Joaquin counties were brought within the provisions of an authentic "no fence" law.<sup>121</sup> The legislature made it unlawful for any animal belonging to a given landowner to trespass on the land of another landowner. For such a trespass, the

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Stat. 186. Pound laws relieved the farmer of the burden of caring for estrays. If the farmer did not choose to undertake the drive to the pound, however, he could impound the animal or animals in his own barn or corral.

<sup>113</sup> Pound Act, *supra* note 112, at 420.

<sup>114</sup> *Id.*

<sup>115</sup> *Id.*

<sup>116</sup> An Act Amendatory of and Supplemental to an Act Entitled An Act to Establish and Maintain Public Pounds for the Better Securing of Estrays and Other Stock in the County of San Joaquin, ch. 456, 1865-66 Cal. Stat. 588.

<sup>117</sup> This provision of the act would be brought into play in the event that the county authorities failed to set up a system of pounds. *Id.* at 589. This amounted to fifty cents for each animal impounded, except for sheep, for which only ten cents was allowed. 1863-64 Cal. Stat. at 186.

<sup>118</sup> *Id.* at 589.

<sup>119</sup> An Act to Protect Agriculture and to Prevent the Trespassing of Animals upon Private Property, ch. 407, 1871-72 Cal. Stat. 563.

<sup>120</sup> *Id.* at 565.

<sup>121</sup> An Act concerning Trespassing of Animals upon Private Lands in Certain Counties in the State of California, ch. 136, 1877-78 Cal. Stat. 176.



landowner could recover damages and court costs. Attachment procedures were provided in order to give the plaintiff better security for the payment of a judgment,<sup>122</sup> and no animal was exempt from attachment.<sup>123</sup> Additionally, more effective procedures for actions *in rem* against the animals were established. If an injured party brought an action *in rem* and no interested party answered, a default judgment could be entered ten days from the posting of the summons on the courthouse door.<sup>124</sup>

Changes in the law in Sacramento and San Joaquin counties typified the changes made throughout California. Originally, the laws relating to animals favored the cattle ranchers. As time passed, the legislature recognized that the privilege granted ranchers impeded the development of the state's agricultural resources. To encourage agriculture, the legislature experimented with a variety of rules each of which had differing effects on the production of stocks and crops. It should be clear that it requires a more formal analytic approach to understand the effects of this enormous complexity of statutory enactments. The next section details an econometric model that is used to test whether these enactments had the effect of encouraging more efficient agricultural production.

#### IV. EMPIRICAL ANALYSIS

When California became a territory of the United States in 1848, it was primarily a place where cattle were raised. With the huge increase in population caused by the Gold Rush of 1849, the economic, social, and political processes underwent rapid and radical transformation. California changed from ranching territory into a mining, farming, and mercantile state. The possible causes of the transformation were increases in population, changes in technology, and changes in the law. The question that I am investigating here is the extent to which it was the changes in the law that effected changes in the economic productive life of the area.

Clearly, these adjustments took place as a feedback process. Not only did the law effect the way in which economic production was transformed, but the economic conversions also caused changes in the law. Farming and mercantile interests<sup>125</sup> lobbied the legislature to enact rules that were more favorable to farmers. The statutory enactments pertained to places where there was the most political pressure to change and the least political resistance.<sup>126</sup> This political pressure occurred in large part

<sup>122</sup> *Id.* at 177.

<sup>123</sup> *Id.*

<sup>124</sup> *Id.* at 177-78.

<sup>125</sup> See text at note 36 *supra*.

<sup>126</sup> Ludeke, *supra* note 77.

in those areas where there was increased population of farmers. Given that the production process of ranching in the middle of the nineteenth century allowed cattle to run at large on vast acreages without fences, only in farming would any sizable population produce enough to make profitable use of small plots of land. Therefore increases in population were a cause of both the changes in the law and increases in agricultural production.<sup>127</sup> There is no question that increases in agricultural population encouraged the legislature to change the law.<sup>128</sup>

There is perhaps no real-world example that will come closer to the idealized well-functioning market system envisioned by Coase<sup>129</sup> than this example of the trespass of grazing animals on farmland. The externality is visible, the parties are, at least post hoc, easily identifiable, and it is easy to measure, or use proxies to estimate, the damages. If models based on Coasean analysis are accurate, changes from the Trespass Act<sup>130</sup> to estray laws<sup>131</sup> would have had no significant effect on the relative growth of production of farmers and ranchers.

On the other hand, if changing the negotiating baseline has a significant effect, then changes from fence-out to fence-in laws should increase the production of farm production and the production of all agricultural products.<sup>132</sup> Thus if raisers of stock have the privilege to use land they will not consider the full value of the land. Because of the possible nonconvexity in the production space of the farmer or of some other asymmetry in transaction costs, ranchers will not normally be paid by the farmer to limit their trespass.<sup>133</sup> In fact this was observed as early as 1867: "Instances

<sup>127</sup> The changes in the law also probably occurred against those animals whose owners had the least political power and against those animals that were most likely to cause damage. For an example of the problems that hogs caused, see *Pond Journal*, *supra* note 65, at 39, April 30, 1853.

<sup>128</sup> For a theoretical explanation of the changes in legislation due to the preferences of the electorate, see James M. Buchanan & Gordon Tullock, *The Calculus of Consent: Logical Foundations of Constitutional Democracy* (1962).

<sup>129</sup> Coase, *supra* note 2.

<sup>130</sup> The Trespass Act (a fence-out law) gave a privilege of use to the rancher. See text at notes 43–47 *supra*.

<sup>131</sup> Estray laws give the right to exclude to the landowner and allow the possessor of land to "take up" stray animals. See text at note 48 *supra*.

<sup>132</sup> If the change to the fence-in regime is more efficient than the fence-out regime, not only should the production of crops increase (which could occur merely because of a change in the entitlement if transaction costs were too high to have further trades), but the total production should also increase as land is (by assumption) being devoted to a higher valued use. Therefore, if either total production or the production of crops does not increase following a change in the law, the baseline hypotheses are refuted.

<sup>133</sup> The example of a contract giving a limited right of animals to trespass was limited to a landowner's lease, where the landowner had the statutory right to exclude. See Dalton, *supra* note 88. No contracts were found under the legal regime under which the animal owners had the privilege to use.

can be cited where the rancher who owns cattle by the thousands has purchased of the public domain from eighty to one hundred sixty acres . . . surrounded by thousands of acres of good agricultural land . . . which . . . he uses and enjoys as absolutely as if he had obtained a patent for the whole tract. . . . The herding of large bands of cattle on the unenclosed lands has a tendency to prevent its settlement by permanent farmers."<sup>134</sup>

An understanding of the complexity of factors that were described in the historical materials can be furthered by the use of econometric techniques. To test whether changes in the law had the effect of increasing total and crop production, the following model was estimated:

$$\text{Production} = F[\text{Inputs, costs, legal variables, growth factor, technology (fertility, weather, interaction)}].$$

As the model is attempting to explain whether changes in statutes that apply to individual counties changed the production of agricultural products in each of the counties, all data are collected annually by county.<sup>135</sup>

Annual data were collected by county on the thousands of bushels of each crop harvested.<sup>136</sup> These are the statistics used as a measure of production. The measure of input of land is the number of acres of land cultivated for each crop. Annual data on the number of head of cattle and sheep<sup>137</sup> are also reported and compiled by county as the gauge of production of stock. Most changes in the law are reported as "dummy" variables with a value of zero if the type of law has not been enacted or one if it has.<sup>138</sup>

The measure of the interaction between competing land uses is the density of use within a county. The more intensely that land is used, the more probable it will be that competing uses will be neighbors. Estimation of the effect of growth of population is achieved through the use of time as a variable.<sup>139</sup> Annual data on climate and fertility were not available, so density of crop production was also used as a proxy for fertility and

<sup>134</sup> Committee on Agriculture, Report in Relation to Fencing Agricultural Lands, California Senate, 17th Sess. (1868).

<sup>135</sup> Assessors of the several counties of California collected yearly taxes on land, improvements, personal property, and production. They reported their assessments, or estimates of value and quantity produced, annually to the legislature. The assessments were published annually in appendices to the proceedings of the legislature. All the statutory changes took place from 1850 to 1887; this therefore is the period studied.

<sup>136</sup> The two principal crops were wheat and barley; therefore they are the ones studied.

<sup>137</sup> Cattle and sheep were the two dominant animals raised in California in the nineteenth century.

<sup>138</sup> If the statute applied to only a part of a county, a fraction less than one is used. Unfortunately, as all the other data are reported by county, it is impossible to see the microeffects of the statutes within a county using this methodology.

<sup>139</sup> Other annual measures of population growth were not available.

TABLE 2  
EXPLANATION OF VARIABLES

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WHMA	=	Wheat in thousands of bushels, moving averaged
BAMA	=	Barley in thousands of bushels, moving averaged
CATMA	=	Cattle in thousands of head, moving averaged
SHMA	=	Sheep in thousands of head, moving averaged
WPAC	=	Wheat per acre, moving averaged
BPAC	=	Barley per acre, moving averaged
VPAC	=	Assessed value per acre, moving averaged
YEAR	=	Calendar year, 1854-90
LHT	=	Hog Trespass Law
LHE	=	Hog Estray Law
LHP	=	Hog Pound Law
LHC	=	Hog Criminal Law
LST	=	Sheep Trespass Law
LSE	=	Sheep Estray Law
LSC	=	Sheep Criminal Law
LCT	=	Cattle Trespass Law
LCE	=	Cattle Estray Law
LCC	=	Cattle Criminal Law
LAT	=	All Animal Trespass Law
LAE	=	All Animal Estray Law

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climate factors. In addition, assessed value serves as the measure for the cost of the primary input, land.<sup>140</sup> Because of variability in data collection,<sup>141</sup> all production data are reported as five-year moving averages,<sup>142</sup> which are used to reduce the unexplained variability in the production information (for a list of variables, see Table 2).

The estimated model is a simple linear multiple regression model in which each of the explanatory variables will explain a portion of the variability in the production of  $X$ , where  $X$  is one of the crops or animals studied. The estimated model was a linear model of the form

$$\begin{aligned} XMA = & b_1 + b_2LHE + b_3LHP + b_4LHC + b_5LST + b_6LSC \\ & + b_7LCT + b_8LCE + b_9LCC + b_{10}LAE \\ & + b_{11}YEAR + b_{12}VPAC + b_{13}WPAC + b_{14}BPAC, \end{aligned}$$

<sup>140</sup> This value also takes other inputs into account, such as fencing, corrals; and farm buildings, since they are counted as improvements. It also accounts for the difference in the costs of farm- and rangeland, as farms had a higher assessed value per acre.

<sup>141</sup> This may be due to the fact that assessors apparently used the previous year's assessment over again, or it may be caused by real microchanges in climate or other unexplained factors.

<sup>142</sup> Moving averages were calculated by the formula

$$XMA_t = .1X_{t-2} + .2X_{t-1} + .4X_t + .2X_{t+1} + .1X_{t+2},$$

where  $X$  refers to one of the animals or crops studied. This formula weights the present year ( $t$ ) very strongly (by 40 percent) but allows the years before and after the year studied to smooth some of that unexplained variation.

where  $XMA$  is the moving average for each of the four products studied: wheat, barley, cattle, and sheep production.<sup>143</sup> This equation was estimated using as an observation each of the fifty-four counties that existed in California for up to thirty-seven years, during 1850–87.<sup>144</sup> The estimation results for the complete model are presented in Table 3.

These results are consistent with models that predict that changes in the baseline will affect the equilibrium outcome and are inconsistent with the Coasean hypothesis. Uniformly, the significant coefficients on the legal variables are positive, which implies that changes from fence-out to fence-in laws encouraged the growth of the crop-growing industry. For instance, the coefficient of 170 on LHE, in the equation explaining WHMA, means that a change from the Trespass Act of 1850 to a Hog Estray Law tended to increase the annual production of wheat in a county by 170,000 bushels.

The effect on wheat is quite striking. In a typical county that had all the significant statutes in effect,<sup>145</sup> the production of wheat would have increased by over 1,270,000 bushels. Barley, a less important crop, would have had its annual production increased by a total of over 270,000 bushels in a typical county if every statute that had a significant effect was in force. It must also be noted that there was no trend attributable merely to growth. That is, the effect of YEAR on both crops was negative and for wheat insignificant. These results suggest that the growth of the agricultural sector in California in this period of strong growth can be explained by the efficacy of the changes in animal trespass law.

The results of the equations estimating the effect of the law on cattle production is also consistent with the hypotheses that fence-in laws (the trespass, estray, and criminal statutes) would increase the efficiency of land use in the total of crop growing and animal raising. For cattle there were three statutes that had a significant effect on production: the cattle estray laws and criminal laws regarding cattle and sheep. The total effect of the three laws was to increase the number of cattle in a typical county by about 3,000 head.

<sup>143</sup> A number of the possible legal variables were dropped from the equation because of the high degree of collinearity with other variables:  $R_{LHT,LHE} = .712$ ;  $R_{LSE,LCE} = .680$ ; and  $R_{LAT,LAE} = .748$ . Also, there were separate acts for horses, but they were essentially coterminous with laws relating to cattle:  $R_{LHorseT,LCT} = 1.00$ ;  $R_{LHorseE,LCE} = 0.973$ ; and  $R_{LHorseC,LCC} = 1.00$ .

<sup>144</sup> Not every county existed for the entire period, and many observations had one or more missing values. Any observation with a missing value for any of the included variables was dropped. These two reasons account for about two-thirds of the potential sample of 1,828 observations; therefore there are only 619 complete observations. The model was estimated using ordinary least squares regression, with a pooled cross-sectional time series.

<sup>145</sup> The variables LHE, LHC, LCT, LCE, and LAE were all significant at the 5 percent level or better.

TABLE 3  
REGRESSION RESULTS

EXPLANATORY VARIABLES	DEPENDENT VARIABLES			
	WHMA	BAMA	CATMA	SHMA
LHE	170.49 (3.72)**	82.31 (5.25)**	-1.19 (-1.32)	-15.97 (-2.86)**
LHP	-296.99 (-.95)	-45.59 (-.43)	-4.77 (-.78)	-81.34 (-2.14)**
LHC	81.01 (2.66)**	22.28 (2.14)*	-.79 (-1.32)	-4.74 (-1.28)
LST	-1.49 (-.05)	-1.77 (-.19)	-.35 (-.64)	-1.16 (-.35)
LSC	2.53 (1.60)	1.20 (2.22)*	.08 (2.48)*	-.17 (-.88)
LCT	580.26 (4.19)**	97.17 (2.05)*	-.88 (-.32)	35.62 (2.11)*
LCE	140.02 (1.98)*	35.12 (1.47)	2.77 (1.99)*	-.27 (-.036)
LCC	-2.20 (-.98)	3.71 (4.85)**	.35 (7.96)**	2.13 (7.81)**
LAE	303.02 (5.54)**	68.00 (3.63)**	-1.11 (-1.04)	23.92 (3.59)**
YEAR	-4.30 (-1.11)	-2.96 (-2.27)*	-.12 (-1.55)	1.47 (3.11)**
VPAC	-.00009 (-.63)	-.00003 (-.50)	-.000003 (-1.17)	.000008 (.45)
WPAC	.86 (1.44)	...	-.03 (-2.40)*	-.08 (-1.05)
BPAC	...	.002 (1.63)	.00004 (.52)	.0002 (.46)
Constant	7930.51 (1.10)	5545.54 (2.27)*	234.05 (1.65)*	-2682.18 (-3.05)**
R <sup>2</sup>	.154	.164	.131	.168
F	10.388**	11.120**	8.175**	10.594**
df	12,606	12,606	13,605	13,605

NOTE.—The numbers in parentheses are *t*-statistics. For an explanation of the variables, see Table 2.

\* Significant at the 5 percent level.

\*\* Significant at the 10 percent level.

The laws did not have a consistent effect on the production of sheep. The pound and estray laws that applied to hogs (LHE and LHP) had a negative relation with sheep production. They were associated with a decrease in sheep production of almost 100,000 head in the average county to which they apply. On the other hand, cattle trespass and cattle criminal laws and estray laws that applied to all animals were associated with increases in sheep production. The total increase that can be traced to these laws was approximately 60,000 head. In addition there was a significant positive trend associated with the sheep industry: every year was associated with an additional 1,500 sheep per county.

Changes in the animal trespass laws would be associated with increases in the production of animals if the new laws encouraged ranchers to adopt more efficient techniques. It is clear that the technology of ranching did change during this period of time and that the changes seem to have corresponded to the changes in the law.<sup>146</sup>

A possible explanation of the negative effect of several statutes on sheep production is the expected one (from the "baseline" hypotheses) that laws that sheep raisers viewed as increasing their costs would lead them to decrease production in those areas with higher costs. The efficacy of the laws relating to cattle tended to increase the number of sheep, as cattle and sheep were competing users of pastureland. Those statutes that made it more expensive for cattle ranchers caused them either to decrease production or to decrease their use of open land and substitute hay and fenced pastures. With these changes, the availability of range for sheep would increase.

As the analysis of the regression equations in this section has demonstrated, the simple Coase theorem does not form the basis of an empirically verifiable hypothesis regarding the efficiency of property rights entitlements. Clearly in a zero transaction cost world the Coase theorem would be verified, as it is tautologically true. Any failure of the theorem would always be due to the existence of transaction costs. We are obviously not in that world, so the zero transaction cost version of the theorem is simply not empirically verifiable. Rather, that version of the theorem that posits that the assignment of rights is irrelevant can be rejected in favor of "baseline" theories. These theories acknowledge that the assignment of rights sets the negotiating baseline that affects the equilibrium allocation.

Changes in the law had very consistent positive effects on the production of crops, which is clearly in accord with the theory that giving rights to the receptor would increase its production. Regarding animal production, changes in the law often allowed the production of animals to grow. Otherwise animal production decreased so that agricultural production could increase. This is exactly what one would have expected from theories of property rights entitlement that accept the significance of baselines.

The strong effects of the law on production, shown by the econometric results, thus should be interpreted as a refutation of that application of the Coase theorem that implies that changes in the legal rights of the parties in

<sup>146</sup> See generally Cleland, *supra* note 26, at 87 n.28. See also Ludeke, *supra* note 77, at 109-11, where some ranchers were found to have begun the process of fencing in even before the law encouraged it by giving rights to the farmer.

a property rights dispute have no effect on the equilibrium production of the parties. There are two possible reasons for this result.

The first reason derives from the more commonly held view that in large number bargaining situations the transaction costs become high enough to prevent an efficient bargain from resulting. If this theory is correct, then one must go through a search for the efficient outcome, as detailed by Wittman, to determine how entitlements must be assigned. As mentioned earlier, this procedure is ordinarily very difficult, as the decision maker will ordinarily not have all the correct information or even the correct incentives.<sup>147</sup>

The second reason is derived from the observation that when a significant externality exists the production (or consumption) function of the receptor will be nonconvex. The nonconvexity will also result in a failure of the market system to achieve an optimal result; but this problem occurs only when the generator of the externality is assigned the right. Under this theory it is quite easy to correct the problem: simply assign the entitlement to the externality receptor. While it may still be true that high transaction costs may prevent the optimal equilibrium from being achieved even in this circumstance, we know that the market system cannot achieve optimality as long as the right is assigned to the externality generator. Only if the decision maker is able to use Wittman's methodology is there a reason to depart from the *prima facie* rule that the right should be assigned to the receptor. This result is much the same as what ordinary language theorists, like Epstein, have argued. Only now there is also a technical economic verification for the instance in which the Coase theorem fails.

<sup>147</sup> See text at note 12 *supra*.