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Economic analyses of the appropriation doctrine are generally based on the assumption that the statutes which specify the doctrine in each state determine water allocation. The thesis is that Oregon statutes do not determine surface water allocation within the state. The argument is based on the existence of rule uncertainty, and proceeds from the examination of a hypothetical property rights system. From a general equilibrium model it is concluded that where a choice of decision rules is inherent in a property rights structure, any conceivable allocation may be achieved. A short survey of jurisprudential scholarship provides the basis in legal theory for the thesis. The argument follows the theory of the American realists, who assert that rule uncertainty is the major feature of law, and that judicial decisions are merely a posteriori rationalizations. From an examination of appellate cases concerning Oregon surface water statutes, it is suggested that there are three classifications of water which a court might choose: appropriated, unappropriated or waste, but the statutes do not determine the choice. Finally, a static analytical model of a hypothetical river basin is used to argue that the three classifications of water allow all possible allocations of surface water in Oregon.

Economic Criteria as Normative Content
in Oregon Surface Water Law

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ECONOMIC THEORY AS NORMATIVE CONTENT
IN OREGON SURFACE WATER LAW

I. INTRODUCTION

In the 19 western states^{1/}, water has historically been a limited resource which has constrained land use. In this environment the appropriation doctrine was developed and adopted by these states as the basis for their property rights system for surface water. Economists studying the appropriation doctrine have tended to view economic criteria for efficient allocation of water as norms which the law should attempt to implement. The only alternative approach to date has been to ask whether the evolutionary development of the doctrine and the resulting allocation can be described as a process of economic optimization. Both the former, normative view and the latter, positive approach rest on the assumption that the statutes and their judicial interpretations (which are generally deemed to be "the law") determine the allocation of water under the appropriation doctrine. In this study, it is argued that Oregon surface water statutes are not normative. The use of the word "normative" in this context is analogous to the use of the term by economists. If the law is normative, it will guide a decision-maker to a ruling, and in that manner determine allocation. The thesis argued here is that Oregon's surface water statutes do not determine the allocation of surface water in Oregon.

Legal History of the Appropriation
Doctrine in Oregon

The appropriation doctrine provides an interesting example of the development of a formal property rights system from customary water

water allocation rules. The development of the appropriation doctrine in Oregon stems primarily from the gold mining operations in California, starting in 1848^{2/}. Each camp or valley developed its own set of rules for water allocation. These different systems had many features in common which were gradually recognized by the courts, although the California legislature only provided for appropriation of water in 1872^{3/}.

In its initial stages, the doctrine was limited to water use upon public land, where the bulk of mining operations took place. An early case, Irwin v. Phillips, 5 Cal. 140 (1855), illustrates the process of court recognition of the allocation method developed by the miners. The issue presented to the court was whether the owner of a canal who diverted water from its natural course through that canal to a mining site had a right against those who subsequently took up riparian mining claims. The court explicitly refers to the practices of the community as a basis for its decision,

"Courts are bound to take notice of the political and social conditions of the country which they judicially rule...a system has been permitted to grow up by the voluntary action and assent of the population, ... if there are, as must be admitted, many things connected with this system, which are crude and undigested, and subject to fluctuation and dispute, there are still some which a universal sense of necessity and propriety have so firmly fixed that they have come to be looked upon as having the force and effect of res judicata. Among those the most important are the rights of miners to be protected in the possession of their selected localities, and the rights of those who, by prior appropriation, have taken the waters from their natural beds...and without which the most important interests of the mineral region would remain without development. So fully recognized have become these rights, that without any specific legislation conferring or confirming them, they are alluded to and spoken of in various acts of legislature in the same manner as if they were rights which had been vested by the most distinct expression of the will of the law makers;..."^{4/}

The court goes on to cite the principle of equity "first in time, first in right" and disposes of the case in favor of the prior appropriator on that basis.

The United States Supreme Court followed the approach of the California Supreme Court in deciding that priority of appropriation gave the better right as between two claimants of water. The Court affirmed the validity of customary water law, noting that

"...The doctrines of the common law declaratory of the rights of riparian owners were, at an early day after discovery of gold, found to be inapplicable...to the necessities of miners, and inadequate to their protection...and he who first connects his own labor to property thus situated and open to general exploitation, docs, in natural justice, acquire a better right to its use and enjoyment than others who have not given such labor. So the miners on public lands throughout the Pacific States and Territories (sic) by their customs, usages and regulations everywhere recognized the inherent justice of this principle: and the principle itself was at an early period recognized by legislation and enforced by the courts in those States and Territories."^{5/}

This case was preceded by Congressional recognition of customary water law in the Act of July 26, 1866^{6/}. That act provided that

"...whenever by priority of possession rights to the use of water for mining, agricultural, manufacturing or other purposes, have vested and accrued, and the same are recognized and acknowledged by the local customs, laws and decisions of courts, the possessors and owners of such vested rights shall be maintained and protected in the same."

The Court, in Gallagher v. Basey^{7/}, explicitly recognized that the Congressional intent behind this statute was to "recognize as valid the customary law with respect to the use of water which had grown up among the occupants of the public land under the peculiar necessities of their condition."^{8/}

The extension of the appropriation doctrine from public lands to private followed much the same evolutionary pattern. First, the courts recognized local customary law, then gradually the customary law was codified by the legislature, leading to the present lengthy water codes. The development of the Oregon statutes is typical. The Oregon Supreme Court first dealt with the issue of customary water law in resolving the conflicting claims of two riparian owners. The upstream riparian owner claimed the right to remove all water from the stream on the basis of a prior appropriation. The downstream owner asserted that the common law riparian doctrine gave him the right to water use. The court held that the doctrine of prior appropriation would apply if that was the local customary law. The statutory authority for this ruling was the Act of July 26, 1866^{9/}, which provided that where prior appropriation was recognized by local custom, law or court decisions, the right asserted would vest as such. The court dismissed the case for lack of proof of local custom, but this was only the first of a number of legislative and judicial decisions which acknowledged the development of customary water law^{10/}.

In 1893, the Oregon Supreme Court referred to local custom in setting out the procedure whereby an appropriator could establish a valid claim, holding that

"The evidence shows that on Willow Creek there was a local custom which required the claimant to file for record with the county clerk a notice of his claim to appropriate the water of a natural stream,..."^{11/}

In Nevada Ditch Co. v. Bennett^{12/}, the court once again recognized local custom relating to notice, and defined beneficial use as a necessary element of appropriation by reference to case law. No statutory authority was invoked for either proposition.

Legislative recognition of local custom in Oregon followed the same piecemeal evolutionary pattern as did the courts. In 1864 a statute was passed recognizing the right of miners to appropriate water following local custom^{13/}. Then the right of a corporation to appropriate and deliver water was legislated^{14/}. Later acts expanded the right of appropriation to all persons, companies or corporations and codified the method of appropriation, and recording of rights^{15/}. A 1909 act made prior appropriation the only method of acquiring water rights and placed the whole procedure under administrative control in the essential form the code has today^{16/}.

Definition of Rule Uncertainty

The key to the statement of the thesis is the definition of rule uncertainty. In this study, the definition of uncertainty proposed by Shannon^{17/} will be used. In this definition, it is supposed that there exists a set of possible events whose probabilities of occurrence are P_1, P_2, \dots, P_n , where only one event can occur. There exists a measure of uncertainty H which is of the form

$$H = -K \sum_{i=1}^n p_i \log p_i$$

where K is a positive constant. Among the properties of this measure is that the maximum uncertainty will exist where the p_i are equal. Further, if the p_i are equal, then $p_i = 1/n$ and H is a monotonically increasing function of n , that is, the larger the number of possible events, the greater the uncertainty.

The focus of this study is on the uncertainty which results from the existence of a choice between applicable rules or interpretations

of rules. When a decision-maker in a legal forum is faced with a choice among n rules, where $p_i \neq 0,1$, then rule uncertainty will exist in the adjudication process.

Jerome Frank argues that there is a second source of uncertainty associated with the legal decision-making process. Fact uncertainty exists when the rule to be applied is certain, such as "drive on the right side of the road" (Frank's example), but the decision cannot be predicted before litigation because it is uncertain which facts will be "found" in the decision process^{18/}.

The distinction between rule uncertainty and fact uncertainty leads Frank to suggest that the study of rule uncertainty is generally restricted to appellate courts, where the facts of a case are not at issue. Those who are primarily interested in fact uncertainty study the trial courts. In the economic study of law it is common to consider as "law" the body of statutes, court opinions, regulations and other materials which constitute the material on which the doctrine of stare decisis is based^{19/}. The hierarchy of authority of these legal materials imposed by the doctrine naturally shift the attention of an analyst toward statutes and their interpretation by appellate courts^{20/}, the rationale being that the decisions of higher courts control those of lower courts. On this basis the economic analyst may take a statute or appellate court ruling as an accurate description of the rule which is applied in that jurisdiction, and so proceed to analyze the economic effects of the rule. Therefore, it is of some interest to study the effect of rule uncertainty in statutes and appellate court decisions on the application of economic theory in the analysis of that body of law. The organization of the study follows.

The effect of different legal rules on resource allocation is one of the major areas in which economic theory has been applied to the analysis of law. The well-known Coase theorem has been the focal point of this discussion in economic literature. This theorem states that the allocation of resources is not affected by the choice of liability rules or property rights. In Chapter II the validity of the Coase theorem in the long run is analyzed in the circumstance where rule uncertainty is introduced into the hypothetical legal framework generally used in the discussion of the Coase theorem. The extended Coase theorem, i.e. the theorem in the long run, was chosen for discussion because the economic model which provides a framework for analysis allows the differentiation of property rights and liability rules. The inclusion of both liability rules and property rights in the hypothetical legal regime assumed for the discussion generates the rule uncertainty defined above. Professor Frech, in the article on which Chapter II is based, concludes that the extended Coase theorem is valid for property rights, but not for liability rules. In this chapter it is argued that these conclusions are dependent on the assumption of rule certainty, an assumption which requires explicit statement.

It is a simple matter to introduce rule uncertainty into a hypothetical legal system, but the question arises whether there is any reason to suspect that the assumption of rule certainty provides an adequate description of existing appellate court decision mechanisms. Legal theorists are divided on this point. Chapter III is a short description of the main body of jurisprudence. The subject is considered as consisting of three major schools: the teleological, analytical and functional. Teleological and analytical theories of law do not consider

rule uncertainty to be part of a theoretical treatment of law, nor do many authors of the functional school. However, a wing of the functional school generally termed the American realists argue that rule uncertainty is the most important characteristic of law.

The existence of rule uncertainty in Oregon surface water statutes is probed in Chapter IV. The argument of that chapter is that "beneficial use", which is the measure of a water right in Oregon, is an antonym of "waste water". An analysis of some appellate cases shows how courts have used the two concepts and the rules associated with them to allocate disputed water. It appears that it is not possible to know a priori whether the disputed water will be classified as waste or as beneficially used water.

The rule uncertainty inherent in the appropriation doctrine in Oregon is investigated by the use of a mathematical programming model in Chapter V. It is there argued that the allocation which optimizes the social revenue from water use (according to the model) could be achieved under Oregon surface water statutes. Comparison of several alternative property rights schemes suggested by other authors shows that no more information would be required for the use of the statutes to optimize revenue than would be required for the use of the alternatives. The most important points of the argument are that the statutes do not require the efficient or optimum allocation and that any allocation may be achieved. From these points it is concluded that Oregon's surface water law statutes are not normative at the appellate level for allocation. Therefore, an economic model will not provide criteria for those statutes.

II. ALLOCATIVE EFFECTS OF PROPERTY RIGHTS STRUCTURES

"Property rights" are defined by Alchian and Allen as "...the expectations a person has that his decision about the uses of certain resources will be effective. The stronger those expectations are upheld, ... the stronger the property right"^{21/}. Exclusivity or right of use and voluntary transferability are the two basic elements of the definition. Transferability refers to the mutuality of the agreement to exchange. A right is transferable in a strong sense if only the parties to the exchange must agree. The right is weakened if the exchange requires the agreement of a third party.

In describing the rules which are used to protect property rights, Calabresi and Malamed distinguish property rules from liability rules^{22/}. A property right is "protected by a property rule to extent that someone who wishes to remove the (property right)^{23/} from its holder must buy it from him in a voluntary transaction in which the value of the entitlement is agreed upon by the seller"^{24/}. The term "voluntary transaction" is used in the same sense as Alchian and Allen use "voluntary transferability"; both terms refer to the absence of any third parties who can exert influence in setting the transfer price. A "liability rule" is used to protect a property right if a person may "destroy the (property rights) if he is willing to pay an objectively determined value for it"^{25/}. In contrast with a property rule, the third party is allowed to set the transfer price. Under a liability rule, the owner of the property right is forced to accept this price without the veto power over the agreement afforded by a property rule.

A surface water right in Oregon does not give title to a corpus of water. An appropriator acquires only a right of diversion and use

of some specific quantity of water which is in the stream at the time of diversion^{26/}. This type of right, termed a usafruct or usafructory right^{27/} is clearly a property right under Alchian and Allen's definition. They note that "property rights are not rights of property; they are rights of people to use property"^{28/}. Therefore, the general discussion of the effect of property rights institutions on resource allocation is directly applicable to Oregon surface water rights.

In the economic literature, the discussion of property rights and their effect on resource allocation centers on the Coase theorem. This theorem states that under certain assumptions, the structure of property rights will not affect resource allocation. The issue of rule certainty, however, has not been discussed in assessing the Coase theorem. The validity of the Coase theorem in the long run is of particular relevance to this study, because there the distinction between property rules and liability rules becomes important. Calbresi and Malamed state that property rights are usually protected by both property and liability rules^{29/}. In this chapter the effect on allocation of rule uncertainty introduced by the inclusion of both types of rules in a conceptual model is analyzed.

The Coase Theorem

Coase gave no formal statement of the theorem which bears his name^{30/}. As a consequence there are many different formulations of the theorem. A small sample will give the reader an idea of the "theorem" which is divined from Coase's article:

- (1) "... if the party imposing external diseconomies and the party suffering them are able and willing to negotiate to their mutual advantage, state intervention is unnecessary to secure optimum resource allocation."^{31/}

(2) "Until recently, orthodox economic theory, following Pigou, had maintained that the cost of a nuisance would not be properly evaluated in the market place unless, among other things, the agent "producing" it were made responsible for damages. In his article on social cost, R.H. Coase proved Pigou wrong by demonstrating the symmetry of marginal costing under alternative assignments of property rights. Specifically, he showed that, whenever the cost of market transactions can be neglected, the "damaging agent" will make the same calculation of marginal cost whether charged with responsibility for damages or not. He went on to argue that assignment of property rights would have no effect on allocation of resources.

George Stigler has since cast the Coase theorem in a more general form: under perfect competition and any assignment of property rights, market transactions between a firm "producing" a nuisance and one "consuming" it will bring about the same composition of output as would have been determined by a single firm engaged in both activities. That is, market transactions will have the same consequences as internal management no matter what the property structure, provided only that costs of transactions are negligible"^{52/}

(3) "The allocation of resources is independent of property rights and liability rules, i.e., the allocative neutrality of rights of the Coase theorem proper."^{53/}

(4) "...if there were (a) no wealth effects on demand, (b) no transactions costs and (c) rights to pollute or control pollution, the allocative solution would be invariant and optimal, regardless of the initial assignment of rights."^{54/}

The essence of the Coase theorem is the argument that the structure of property rights (and liability rules) will have no effect on the allocation of resources, assuming zero transaction costs. The structure of property rights in all these definitions is assumed to be fixed. The rights holder knows from the law which specifies the rights structure what measure of effective control he may expect to exercise.

There is another sense in which the structure of property rights may be considered allocatively neutral which has not been discussed in the economic literature. If the law which appears to determine the right holders expectation of control, and so the rights structure does not determine the allocation of water, the rights structure could again be said to be allocatively neutral. This situation may occur where there is rule uncertainty in the law. The issues of rule uncertainty are implicit throughout Coase's argument, as a summary of the cases he examines will show.

He cites four cases dealing with nuisance which concern the same issue: one party which is causing a pollutant to be emitted which damages the other party. Of the four cases, the polluter won two and the damaged party won two, where all were decided under the same nuisance law.

(1) In the case of Sturges v. Bridgeman^{35/} a doctor brought suit to enjoin the operation of machinery on the neighboring premises on the grounds that the noise and vibration of their operation prevented the effective use of the doctor's examining room. At that time the two pieces of machinery in question had been in operation for 60 and 25 years, respectively. The doctor had occupied his office for eight years, and the examining room was new. The polluter was enjoined.

(2) Fumes from a manufacturer of ammonium sulphate had the unfortunate effect of discoloring the product of a neighboring mat manufacturer. In Cooke v. Forbes,^{36/} the court refused to grant an injunction which prayed for relief from the fumes.

(3) The case of Bryant v. Lefever^{37/} presented a fact situation where an emitter of smoke was prevented from doing so by neighboring construction. The neighbor of the emitter had remodeled his house to

a greater height, and as a consequence, the emitter's chimneys would no longer draw properly and smoked the house. The emitter lost the case, as an injunction was refused.

(4) The final case cited by Coase involved the owners of a tavern who brewed beer in a cellar which was vented out through a nearby well. A neighboring resident blocked the mouth of the well, perhaps because of the odor, and the tavern owner sued to enjoin his behavior. The injunction was granted^{38/}.

The decision in each case was based on the classification of the emission as a nuisance or not. Before the decision in each case, the litigants could have had little idea who would prevail. It seems unlikely that the law determined the expectations of the litigants.

Prosser, on torts, says:

"There is perhaps no more impenetrable jungle in the entire law than that which surrounds the word 'nuisance'. It has meant all things to all men... There is general agreement that it is incapable of any exact or comprehensive definition. Few terms have afforded so excellent an illustration of the familiar tendency of courts to seize upon a catchword as a substitute for any analysis of a problem: the defendant's interference with plaintiff's interest is characterized as a 'nuisance', and there is nothing more to be said."^{39/}

The choice of nuisance law allowed Coase to find a selection of cases with apparently conflicting results, and is interesting in the context of an argument that it makes no difference how rights are assigned. Coase seems to have recognized the issue of rule uncertainty in remarking that

"the reasoning employed by the courts in determining legal rights will often seem strange to an economist because many of the factors on which the decision turns are, to an economist, irrelevant. Because of this, situations which are, from an economic point of view, identical will be treated quite differently by the courts."^{40/}

However, neither Coase nor subsequent writers have discussed the implications of rule uncertainty for the analysis of property rights under actual statutes. The remainder of this chapter shows how the neutrality of property rights structures may be achieved by rule uncertainty as well as by market processes.

The Extended Coase Theorem

Discussion of the Coase theorem has proceeded along two lines-- validity of the theorem in the short run and its validity in the long run. The model used here analyzes the long run, and was chosen because it apparently shows that the Coase theorem is invalid in the long run for liability rules, yet the introduction of rule uncertainty in the model shows that liability rules where the rules are uncertain can result in allocative neutrality.

In a recent article, Frech argued that failure to distinguish between liability rules and property rights is responsible for much of the confusion about the long run validity of the theorem^{41/}. His model provides a convenient analytical framework in which to examine the effect of the introduction of rule uncertainty into the debate.

Frech uses a simple general equilibrium model to compare the effects of different liability rules and property rights assignments. The model is based on the following assumptions.

(1) There are sufficiently large positive transactions costs to prevent merger, but the transactions required by the law (liability rules and property rights) are costless.

(2) The economy is modeled as if there were one individual who consumes all the output and supplies all the labor.

(3) There are only two industries, A and B; B emits pollution to the detriment of A's production.

(4) All firms are identical, and entry and exit is continuous.

(5) Demand functions are downsloping and first and second order conditions hold for the cost functions, allowing the existence of a profit maximization^{42/}.

The utility function of the individual in this economy is

$$U = U(A, B, -L)$$

where A = output of industry A a = output of each firm in industry A

B = output of industry B b = output of each firm in industry B

$-L$ = leisure, L = labor

The individual's utility is subject to the production constraint

$$n^a C^a + n^b C^b - L = 0$$

where n^a, n^b = number of firms in industry a and b, respectively.

C^a = total cost of production of a firm in industry A, and is a function of production costs and pollution damage

C^b = total production cost of a firm in industry B

Since convexity has been assumed, Frech uses a lagrangean function to find the solution of the constrained optimization problem

$$(1) \Psi = U(A, B, -L) - \lambda(n^a C^a + n^b C^b - L).$$

By defining prices as representing the necessary sacrifices of leisure

$$P^a \equiv U_A / U_L, \quad P^b \equiv U_B / U_L$$

where P^a and P^b are the price of the outputs of industry A and B respectively. The use of these definitions and the relation $U_L = \lambda$

allow the first order conditions (subscripts indicate derivatives) to be stated in the following manner:

$$(2) \Psi_A = p^a - C_a^a = 0$$

$$(3) \Psi_B = p^b - C_b^b = 0$$

$$(4) \Psi_{n^a} = p^a - C^a = 0 - \pi^a$$

$$(5) \Psi_n^b = p^b - n^a b C_B^a = \pi^b$$

where a, b = outputs of a single firm in industry A or B, respectively and π^a, π^b = profits of an individual firm in industry A or B.

Equations (2) and (3) require that price equals the marginal social cost, the familiar short run necessary conditions^{43/}. Equations (4) and (5) establish the conditions that must be met to achieve the optimum number of firms in the long run. In both instances, the producers of B are required to take account of the damage inflicted on production of A by their activities. In the short run the producers of B must equate a higher cost which includes damage with output price. The profits of industry B must be similarly reduced in the long run by $n^a b C_B^a$, the marginal cost of production of B in terms of output A.

Frech distinguishes liability rules and property rights in essentially the same manner as Calabresi and Malamed,

"Liability rules...refer to legal rules or regulations which assign liability for all damage created by pollution to either polluting firms or victims. They are general, impersonal rules of law which apply to any polluter or any recipients. Property rights confer exclusive rights to control pollution in a particular basin."^{44/}

The fact that potential entrants are entitled to compensation is emphasized by Frech as the critical element of this distinction. This is clear from the analysis of the liability rules. Where the polluter

is strictly liable for any damage caused, Frech assumes that damages would be set "in a competitive-like way" which would equate the total damage payments to industry A to the marginal damage of the pollution times the total amount of pollution. In this case, equations (6) and (7) give the first order conditions which relate to the long run (short run conditions are identical to (2) and (3)).

$$(6) \quad \Psi_n^a = p^a_a - C^a + C_B^a = 0 = \pi^{b^*}$$

$$(7) \quad \Psi_n^b = p^b_b - C^b - n^a C_B^a = 0 = \pi^{a^*}$$

Equation (6) shows that at long run equilibrium there will be too many firms entering industry B because of damage payments of $b C_B^a$ which all firms in that industry receive. As a result of excessive entry into industry B, damage payments required from firms in industry A lead to exit and result in greater than optimal production in B and suboptimal production in A. Frech argues that although this analysis leads to rejection of the extended Coase theorem, this conclusion may only be applied to liability rules. Under property rules, the theorem is valid.

In applying the model to property rules, Frech assumes that shares are assigned to the optimal number of firms, since a different number would require the analysis of two different types of firms in the same industry, and lead to the same result. In the case where property rights are assigned to recipients, the short run first order conditions are the optimal ones (equations (2) and (3)), and the first order conditions related to the long run are

$$(8) \quad \Psi_n^a = p^a_a - C^a + C_B^a - [C_B^a b + C_B^a (\bar{b} - b)] = 0 = \pi^{a^*}$$

$$(9) \quad \Psi_n^b = p^b_b - C^b - n^a C_B^a = 0 = \pi^{b^*}$$

where \bar{b} is a reference amount of production for possible payments to polluters for abatement. The second term from the right in equation

(8) is the payment received from polluting firms for allowing them to pollute. The right hand term is the opportunity cost of holding the right. That opportunity cost is the payment received plus the payment avoided by holding the right. Frech argues that under the assumption of perfect competition, $\bar{b} = b$, and that the required abatement payments would equal zero. This is on the presumption that an additional firm entering the recipient industry A imposes no additional costs on firms in that industry, therefore, the marginal cost is zero and the abatement price will be equal to the marginal price. Thus after cancelling like terms, equation (8) reduces to the optimum specified in equation (4), leading to the conclusion that assignment of property rights to the recipient industry will lead to the optimum. A similar analysis with the property rights assigned to the polluter yields the same result.

Introduction of Rule Uncertainty

In the analysis outlined above, Frech makes the assumption that rules of both liability and property are clearly defined and never conflicting. In fact, in his analysis, only one rule at a time exists, guaranteeing absolute rule certainty.

To introduce rule uncertainty into the model, consider the case where a rule exists that the polluter is liable for damages to the recipient, but there is also a rule granting the polluter the right to use her property as she sees fit. The short term first order conditions could vary about optimality, depending on which term dominated as a result of the choice of rule to apply in litigation between individual firms or classes of firms. In effect, the conflicting

rules would create two classes of firms in each industry. To simplify the analysis, assume that each firm (including entering firms) knows beforehand which rule will be applied to it in litigation.

The four groups of industries will be:

(1) Recipient industries who receive no liability payments. This is equivalent to granting a property right to pollute to some firms in industry B.

(2) Polluters who bear no liability for pollution as a result of their property right.

(3) Those recipient industries compensated under the liability rules. As above, each entering industry knows that it will receive compensation. The applicable first order condition is equation (6).

(4) Polluters who must pay compensation under the liability rule. The long run first order condition is equation (7).

The first and second group reach long term equilibrium in the manner described above for a property right, at the social optimum. The two groups of firms whose conduct is regulated by the liability rule, as discussed above, would tend to long run equilibrium away from the social optimum. However, the court could adjust the long run equilibrium back to the social optimum by limiting the number of firms who are allowed compensation under the liability rule.

In this simple legal system, the distinction between liability rules and property rights becomes very fuzzy. Liability rules now share the characteristic of exclusivity with property rights, yet some entering firms may yet expect to receive compensation before entry, at least in the short run. At the end of his article, Frech in fact notes that where, for example, the old recipient firms are allowed damages,

but entering firms are not, the liability rule becomes equivalent to the property right rule^{45/}. Thus, Frech's conclusion that "...apparently reasonable liability rules are not equivalent to the assignment of private property rights,"² must be conditioned on the existence of rule certainty in the legal system. If this assumption is relaxed, it is possible to reach the optimum number of firms by selection of the liability or property right rule which allows the correct adjustment to the number of firms. Given this rule configuration, allocational neutrality would be observed only if the first order conditions (2) through (5) are used as the norms which guide the application of a liability and property rights rules. The rules themselves would not determine the decision, and if some norm other than that of the first order conditions were chosen, the Coase theorem would also be invalid in that legal regime.

As the discussion of the extended Coase theorem shows, assumptions about the nature of the legal system are crucial in an economic analysis of any portion of law. There has been very little discussion in economic literature of the effect of different assumptions about law or legal theory on the results of economic analysis. In their turn, scholars of jurisprudence have paid little attention to economic theory in recent times. A brief survey of legal theories and their view of rule uncertainty will be helpful in clarifying just what is meant by "the law" and understanding the assumptions, both implicit and explicit, which are made about it in the economic analysis of property rights.

III. LEGAL THEORY AND THE NORMATIVE CONTENT OF THE LAW

The assumption of rule certainty is implicit in many economic analyses of property rights and liability rules. In the previous chapter it was argued that the use of an economic model to investigate the nature of different hypothetical property rights structures depends on this assumption. In the study of legal systems, jurisprudence, the issue of the existence of rule uncertainty is commonly debated as the existence of normative content in the law. "Normative" may be defined by reference to the definition of rule uncertainty. Where an event is defined as the selection of one rule or interpretation, the law may be said to be normative if it is a determinant of the probability of occurrence (p_i) of the event.

One of the problems that legal theory must address is the positive fact that in almost every conflict submitted to an authority for resolution at the appellate level, the decision maker is faced with a choice among different rules and their interpretations. The way in which a legal theory explains the choice made by the decision maker is a primary feature which distinguishes different theories and schools of legal thought. With at least 2,500 years of writings on jurisprudence (starting with the classical Greeks), it is beyond the scope of this paper to give an overview of all the different schools of legal theory and the scholars associated with them. It is sufficient for the purposes of the argument developed here to examine the treatment of rule uncertainty and the implications for the use of economic theory representative of different schools of jurisprudential thought.

Paton^{46/} divides theories of law into three schools: analytical, functional and teleological. The analytical school is characterized by a study of the elements of the law (e.g., statutes, cases, administrative rules) and their relationships. It is in the logical relationship among parts of the law that (it is hypothesized) one may find certain rules which describe the law and are akin to physical laws in that they are invariant throughout the whole corpus of law. The teleological school attempts to analyze law by pursuing the ultimate ends law should follow, such as justice, truth, morality, etc. Paton describes the functional school as accepting as its primary doctrine the notion that the reason for law to exist at all is to provide a method of dealing with social problems, and that one must understand the problems to which law is addressed in order to understand the law itself. The emphasis is on the ends served by the law.

The Analytical School

The pure theory of law propounded by Kelson provides a representative theory from the analytical school. Kelson attempted to remove all reference to psychology, sociology, ethics and political theory from the discussion of law, thus the "purity" of his theoretical formulation^{47/}. In analyzing the law, one must look to the law as it is manifested in statutes, judicial opinions, administrative decisions and any other norm which has the force of state sanction. To Kelson, coercion was a key concept in the definition of a norm, and legal norms were the only subject matter of jurisprudence. He defined a norm as that which made certain acts legal or illegal by stating that "something ought to be or ought to happen, especially that a human being ought to

behave in a certain way"^{48/}. In this scheme, the law is viewed as a hierarchy of norms, the lower norms derived from the upper ones, and all ultimately derived from a "basic norm" which cannot itself be derived. This "basic norm" must be assumed as an "Initial Hypothesis". For example, in the American legal system, the basic norm requires adherence to the United States constitution. The constitution provides a framework for statutory and customary law, which in turn prescribe rules for administrative, judicial and private activity. The objective of the legal theorist is then to analyze the logical relationships among the norms, without reference to social, historical or economic explanations of their existence.

In the pure theory of law, there is no rule uncertainty. When a state officer selects an interpretation of a norm for application in a specific case, an "individual norm" is created. There is never an admission that there may be logical contradictions between rules or that there may be no structure of norms requiring the choice of one interpretation in preference to another. This process of creating individual norms from more general norms is called "concretization". Law is created by the process of concretization by individual decisions, but concerns of justice, ethics or economics are useful only in choosing the general norms created by the legislature.

Kelson's work is an extreme example of analytical legal theory, yet the emphasis on the structure of legal rules remains a characteristic of the analytical school^{49/}. Following the tenets of analytical jurisprudence, economic theory could be used to compare alternative formulations of norms, but once enacted, the law is purely normative. The probabilities of occurrence of the set of possible events are either one or zero. The law is not a source of uncertainty, and the

rule uncertainty hypothesized in Chapter II would not be relevant to an accurate description of property rights law.

The Teleological School

Natural law theories and value-oriented jurisprudence are the two main branches of the teleological school. The common characteristic of these theories is a belief in a higher, absolute law or values on which positive law should be based. Natural law is the most ancient of all jurisprudential theories, and has appeared in many incarnations throughout the history of jurisprudence. One of Aristotle's statements gives an idea of what is meant by natural law:

Natural justice is that which everywhere has the same force and does not exist by the people thinking this or that. Legal justice is that which is originally indifferent but when it has been laid down is not indifferent; e.g., that a prisoner's ransom shall be a mina or that a goat and not two sheep shall be sacrificed and again all the laws are passed for particular cases.^{50/}

Aristotle's rigid view of the existence of a higher, universal law has been modified, especially in recent times, to the theory that different communities all have some set of fundamental values, not necessarily identical, which laws and authoritative decisions are measured against^{51/}. The natural law theories derive their rules from universal norms, and insist on the normative content of those rules in the manner of the analytical school.

Value-oriented jurisprudence relies on the assumption of certain values which the legal system should promote, rather than underlying "natural" laws. A recent theory, the "policy science" of Laswell and McDougal^{52/}, is based on the assumption that a value is a "desired-event".

The values suggested by them are power, wealth, well-being, enlightenment (finding and disseminating knowledge), skill, affection, rectitude and respect. Law is one aspect of the power value, and as such, its purpose is to promote the other values with regard to the whole community. The primary goal is to promote the democratization of these values, a view which perhaps represents the opinion of the authors rather than an impartial observation. The overriding goal of democratization may provide some normative direction for the law, and economics could provide a partial measure of the democratization of the wealth value. But, given the other values (which are said to be only representative and not an exhaustive list), a purely economic evaluation of the law would provide little direction. Economic theory may provide information as to whether maximum production was being achieved by the use of a given legal strategy, such as property rights or liability rules, but in view of the several values which law is supposed to try and achieve, economic criteria would be only a small part of the standard to which law would be compared. The assumption that law is normative is implicit in the use of law to promote given values. The law directs individual behavior, therefore the "values" which one wishes to promote provide the normative content.

Other value-oriented theories of law seem to have no economic content. Cahn views decisions as intuitive ethical responses^{53/}, while Rawls presents a theory which attacks any sort of maximization. He asserts that "justice is the first virtue of social institutions..." and that "...the rights secured by justice are not subject to political bargaining or to the calculus of social interests^{54/}". It appears that an analysis of the economic effects of the use of either property rights

or liability rules would not be relevant if justice (as imagined by Rawls) were the standard by which those rights and rules would be evaluated. In Frech's model of property rights and liability rules, the only consideration is maximization of social welfare. Rawls explicitly rejects this approach in asserting that the theory of justice "does not allow that the sacrifices imposed on a few are outweighed by the larger sum of advantages enjoyed by many"^{55/}. Thus when Frech argues that alternative assignments of property rights "merely affect the distribution of wealth...but, there is no effect on either the marginal conditions or the total profits which affect entry"^{56/}, he is ending his analysis at the point where Rawls would begin. In this, as in other natural law theories, the only rule uncertainty is the difference between a higher standard and positive law, that is, the imperfection of human positive law. The positive law is normative in the attempt to order human affairs after the "natural" law.

The Functional School

In the functional school of jurisprudence, Paton includes the sociology of law, sociological jurisprudence, and the realist movement. To keep the nomenclature consistent, the adjective "sociological" will only be used in references to sociological jurisprudence.

Paton defines the sociology of law as an attempt

"to create a science of social life as a whole and to cover a great part of general sociology and political science. The emphasis of the study is on society and law as a mere manifestation..."^{57/}

By emphasizing the analysis of society as a whole to understand the law, the sociologists of law tend to discount the value of studying the body of the positive law at all. For example, Ehrlich states that "the

center of gravity of legal development lies not in legislation nor in juristic science, not in judicial decision, but in society itself^{58/}. Ehrlich contrasted norms of decision which governed conflict resolution with norms of organization. Norms of organization are a function of the society, and govern the actions of an individual. In his view, the "facts of law" which underlie the legal rules (norms of decision) are usage, domination, possession and declaration of will. The four facts may require any degree of enforcement or any baroque interpretation of a legal rule, but apparently society will provide rule certainty. However, to return to the extended Coase theorem, the debate about whether liability rules and/or property rights result in a divergence of private and social cost would be irrelevant. That debate is essentially an application of economic criteria to different legal rules which are used as policy instruments to alleviate the effects of an external diseconomy. Where the rules are determined by society as a result of other forces, such as the four "facts" of Ehrlich, liability rules and property rules may serve quite different ends.

The sociological jurisprudence of Pound may be differentiated from the sociology of law by its emphasis on law and the relation of law to society. Pound would study the affect of law on society, while the sociologist would expect that society determined the law. In his view, the causal connection runs from law to society, in the sociologist's view from society to law.

Pound argued that law was an instrument of "social engineering" in that its normative element allowed law-makers to choose the direction of societal development based on the classification and balancing of social interests. An often quoted statement of Pound's contains his basic view of the law:

For the purpose of understanding the law of today I am content with a picture satisfying as much of the whole body of human wants as we may with the least sacrifice. I am content to think of law as a social institution to satisfy social wants--the claims and demands and expectations involved in the existence of civilized society--by giving effect to as much as we may with the least sacrifice, so far as such wants may be satisfied or such claims given effect by an ordering of human conduct through politically organized society. For present purposes I am content to see in legal history the record of a continually wider recognizing and satisfying of human wants or claims or desires through social control; a more embracing and more effective securing of social interests; a continually more complete and effective elimination of waste and precluding of friction in human enjoyment of the goods of existence--in short, a continually more efficacious social engineering.^{59/}

The contribution of the sociological school to jurisprudence was to explicitly recognize the use of law to achieve societal goals^{60/}. Pound attempted to catalogue the interest served by law, but argued that no ordering was possible or desirable, since society's needs were continually changing^{61/}.

As brief a summary of jurisprudence as this probably raises more questions than it answers. However, in spite of its brevity, it should be clear that all of the writers of jurisprudence discussed above would approve of any use of economic theory as only a standard or a method of comparison of different interpretations of alternative rules. In all of the analyses of law within the areas of jurisprudential thought mentioned above, the law has a normative content. In Kelson's view, the law is absolutely normative. In natural law theory, the law is normative in the pursuit of justice, morality, etc. The sociologists of law would have the law's normative content be a result of the workings of the society that produced it. Sociological

jurisprudence argues that the law is used to set norms of conduct which allow the achievement of social goals. It is not discussed, or even acknowledged that a set of interpretations may exist where the rule structure of the law provides no guide. The question arises, then, whether a lack of normative content may be observed in actual legal systems. The hypothetical rule uncertainty introduced into the model in Chapter II does not exist in the legal theories discussed above. However, a small group of scholars has argued that the central feature in a description of law is the lack of normative content.

The American Realist Movement

The last portion of jurisprudential scholarship which will be addressed here, the American realist movement, took as its basic premise the assumption that law has no normative content. This movement is characterized as a radical wing of the functionalist school^{62/}. The definition of law given by Holmes provides the starting point for many realist scholars:

If you want to know the law and nothing else, you must look at it as a bad man, who cares only for the material consequences which such knowledge enables him to predict, not as a good one, who finds his reasons for conduct, whether inside the law or out of it, in the vaguer sanctions of conscience. Take the fundamental question, what constitutes the law...you will find some text writers telling you that it is something different from which is decided by the courts of Massachusetts or England, that it is a system of reason, that it is a deduction from principles of ethics or admitted action, or what not which may or may not coincide with the decisions. But if we take the view of our friend the bad man we shall find that he does not care two straws for the axioms or deductions, but that he does want to know what the Massachusetts or English courts are likely to do in fact. I am much of his mind. The prophecies of what the courts will do in fact, and nothing more pretentious are what I mean by the law.^{63/}

The emphasis on prediction is the major feature of realist legal analysis, and as will be discussed below, the key to the difference in the application of economic theory in the alternative settings of rule certainty or uncertainty.

Karl Llewellyn argued that rules of law were relatively unimportant in legal decisions, and asserted that "the theory that rules decide cases seems for a century to have fooled, not only library-ridden recluses, but judges"^{64/}. Although there is no realist "school", Llewellyn gives several points upon which realists tend to agree, the most important of which follow^{65/}.

(1) The conception of law in flux, of moving law and of judicial creation of law.

(2) Law is a means to social ends, and needs to be evaluated with respect to its purpose and its effects.

(3) Society is in flux, and the law typically lags behind, requiring constant re-evaluation of the law.

(4) In analyzing law, what IS should be the sole concern of the observer, with no reference to any conceptions of what OUGHT to be.

(5) "Distrust of traditional legal rules and concepts insofar as they purport to describe what either courts or people are actually doing."

(6) "...distrust of the theory that traditional prescriptive rule-formulations are the heavily operative factor in producing court decisions.

From these common beliefs, the realists argue along three main lines:^{66/}

(1) Judicial opinions are viewed as rationalizations which do not mirror the decision process. They should be viewed "rather as trained lawyers' arguments made by judges (after the decision has been reached), intended to make the decision seem plausible, legally decent, legally right, to make it seem, indeed, legally inevitable..."

(2) The realists discriminate among rules with reference to their relative significance, e.g., rules which affect many and those which affect few.

(3) They search for correlations of fact-situation and outcome to determine when the courts choose one of several competing legal arguments.

In general, the realist position puts great importance on the examination of social effects of a decision, similar to the sociological writers. The crucial difference between the realists and the other views of law discussed in this study, is their insistence on the importance of the lack of normative content of the law in many situations. Llewellyn sums up by saying that all three lines of argument by the realist set out above "...converge to a single point: there is less possibility of accurate prediction of what courts will do than the traditional rules would lead us to suppose (and what possibility there is must be found outside these same traditional rules)"^{67/}.

The implication of accepting a view of law which considers law normative as opposed to adopting the realist position can be seen by considering once again the model used to examine the extended Coase theorem in Chapter II. If the sociological position is taken, that is, that the law is normative, Frech's analysis stands as he wrote it. There will be no rule uncertainty to deal with, and economic theory

provides a measure of the social costs and benefits resulting from the promulgation of liability rules or establishment of property rights.

If the realist position is adopted, then the analysis of rule uncertainty becomes relevant to what one would expect to see in an actual legal regime. Recall that in Frech's model there was one consumer who supplied all the labor. In the absence of rule uncertainty, it is not necessary to consider the function of a judiciary. However, where rule uncertainty exists, there must be a mechanism for application of the rules. If the individual who is both all consumption and all labor is also the judiciary, then in the presence of rule uncertainty one would expect that the social optimum would be achieved, since that person would manipulate the rules to maximize its own utility, as assumed in Frech's model.

In a model where the law is normative, economic theory provides criteria for the evaluation of the effect of different rules. Where the law is not normative, economic theory provides a method of predicting the decision rules which would be used by the decision maker to achieve maximum utility, but provides no criteria for the structure of property rights. One can see that in the highly simplified circumstances of the Frech model, the nature of the legal system may make the application of economic criteria to that legal system inappropriate. If the legal rules are not normative, then what was viewed as a criterion becomes "the law" in the sense of prediction which Holmes used as a definition of law.

As noted above, there is general disagreement about the normative content of law. Yet, the existence of rule uncertainty determines the use of economic models in evaluating the structure of property rights.

To this point, the discussion has been limited to hypothetical property rights structures and abstract notions of "the law" as a whole. The next chapter addresses the existence of rule uncertainty in Oregon surface water statutes.

IV. NORMATIVE CONTENT OF
OREGON SURFACE WATER STATUTES

The argument in this chapter is an application of the realist theory of law to Oregon surface water law. The basis of the argument is in the definitions of the terms "waste water" and "beneficial use". These two terms, as defined by the Oregon courts are antonyms. There is no waste where water is beneficially used. Yet, Oregon statutes allow the appropriation and recapture of waste water. Thus, the courts may classify water as appropriate,^d unappropriated or waste. The bulk of Chapter IV concerns appellate definition of the terms "waste water" and "beneficial use", wherein it is argued that these definitions may be manipulated by the courts to classify disputed water as any of the three categories at their discretion.

Basic Rules of Oregon Water Law

Before approaching appellate interpretations of Oregon's surface water statutes, it may be helpful to summarize the statutes which set out the appropriation doctrine in Oregon.

Under the appropriation doctrine, a water right is described by the amount of water appropriated, the priority of the appropriation, and the place of use of the water. These properties are defined in Oregon by the following three rules:

- (1) Beneficial use shall be the basis, the measure and the limit of all rights to the use of water in this state.
(Hereinafter cited as beneficial use rule.)^{68/}
- (2) First in time is first in right.^{69/}
- (3) A water right is appurtenant to the place of use for which it was established.^{70/}

A right is established by an appropriator by first applying for a permit to the Oregon Water Resources Department (WRD). Upon a determination that no existing water right will be injured by the proposed appropriation, a permit is issued by the WRD which allows the appropriator to divert and use water as the works are completed. Construction work must be "prosecuted with reasonable diligence" and completed within a reasonable time. Upon completion of the application of the water to a beneficial use, a certificate is issued and the right vests in the appropriator. Once a certificate has been issued, the right may be transferred^{71/}.

A water right is considered abandoned if an appropriator "ceases or fails to use the water appropriated for a period of five years," and the right to divert will cease^{72/}.

These rules specify the parameters of a static water system of water rights. One of the more important features of the appropriation doctrine is the rights of transfer mechanism. The next section summarizes the Oregon statutes relating to surface water rights transfers.

Oregon Water Rights Transfer Rules

A water rights transfer is statutorily defined as any change in use, place of use or point of diversion^{73/}. The rules for the transfer of a water right require the absolute protection of other water rights before the transfer is allowed. The statutes governing transfers may be summarized as follows:

- (1) Any change in use, place of use or point of diversion must be approved by the Water Resources Division.^{74/}

(2) If no objections are filed to the proposed change after public notice has been given, the director may approve the change without a hearing.^{75/}

(3) If a hearing is held, the Water Resources Director must make a finding that "the proposed change can be affected without injury to existing rights" in order to approve the change.^{76/}

Upon compliance with the procedure set out in ORS 540.520 and 540.530, the owner of a water right may change the use, place of use or point of diversion without losing the established priority of the right^{77/}.

Beneficial Use Rule

The term "beneficial use" refers to both the purpose for which the water is used and the measure of the extent of the right. The statutes allow water to be diverted for any purpose which would not "impair or be detrimental to the public interest"^{78/}. Several uses are listed, including "irrigation, domestic use, municipal water supply, power development, public recreation, protection of commercial and game fishing and wildlife, fire protection, mining, industrial purposes, navigation, scenic attraction or any other beneficial use to which the water may be applied for which it may have a special value to the public"^{79/}.

An appropriator is allowed to divert only the amount of water which can be beneficially used^{80/}. When the quantity diverted for a particular use is no longer required, that water becomes available to other appropriators^{81/}. The amount of water which is beneficially used

is that which meets the reasonable requirements of the diverter, including losses from evaporation and seepage^{82/}. Downstream appropriators may demand that water which is unreasonably used be left in the channel to be applied to their own uses^{83/}. An additional requirement is that the use be economical as well as beneficial was established by the court soon after the codification of the appropriation doctrine in the state^{84/}.

To summarize, the measure of a water right in Oregon is limited to the amount of reasonable, economical, beneficial use. The appropriator is also required to prevent unreasonable or unnecessary waste^{85/}. In cases where the Water Resources Director judges that a proposed use is prejudicial to the public interest, the Water Policy Review Board is required to have regard for "the prevention of wasteful, uneconomical, impracticable, or unreasonable use of the waters involved"^{86/}.

Appellate Definition of Waste Water

The term "waste" appears eight times in Oregon's surface water statutes, and is used both as an adjective and a verb^{87/}. The former usage occurs in a statute which provides that waste water from a diversion may be appropriated, and that the person on whose land the water first appears has the right to that water. That is, an appropriator is entitled to recapture waste water from his appropriation^{88/}.

As an example of the statutory usage of "waste" as a verb, the statutes require that no person shall "willfully waste water to the detriment of another"^{89/}. The definition of "waste water" is almost exclusively judicial, and forms the basis for an argument that there are several circumstances where these statutes are not normative.

The following discussion shows how Oregon appellate courts have defined "waste water". In each case it is the classification of the disputed water as either unappropriated or waste that determines the outcome.

Hough v. Porter

The owner of a 160 acre tract was granted the right to water which was termed "waste and seepage" from adjoining farms. The courts said that what was called "waste water" was in fact unappropriated water, since "there would be no waste water if those above follow the economic methods required by law". On this basis the court granted the owner the right to 80 inches per year of water for application to the tract.

In a criticism of this holding which was quoted by the court in a later case, Kinney argued that the claimant of waste water acquired only a temporary right to "whatever water escapes from the works or lands of others and cannot find its way back to the natural stream from which it was taken"^{90/}. Under this interpretation, an appropriation of waste water does not give the right to a specific amount of water.

Vaughn v. Kolb

The City of Baker constructed several reservoirs and held certificates for water rights for the supply of water for domestic needs. The reservoirs held more than required for the city's needs, and it was customary for the city to release the excess. The city was deemed a nominal party in a dispute between downstream appropriators of the excess water. The court quoted the brief of the counsel

for the city with approval:

"...the municipality had absolute control over the disposition of its surplus water, even to the extent of selling the same for irrigation purposes." (emphasis added)^{91/}

At the start of the opinion, however, the court referred to the overflow as "waste water". Although the court made no distinction between waste and surplus water, it adopted a definition of waste water which could be construed to include both. Quoting Kinney on Irrigation and Water Rights (2nd ed.), section 322, the court adopted the following definition:

"Waste water may have three meanings, as follows: First, water that is actually wasted or not needed by the claimant thereto; second, water which, after it has served the purpose of the lawful claimant thereto, has been permitted to run to waste or to escape; and third, water which, from unavoidable causes, escapes from the ditches, canals or other works of the lawful claimants."^{92/}

The first meaning could include water before diversion ("not needed by claimant") and water which had been applied to a use ("actually wasted"). The second meaning refers to water which has been applied to the diverter's use. The third meaning applies to water which escapes during transportation. By the choice of meaning, the court could have classified the water as waste at any point from diversion to return to the stream. The court held that the water was waste water, apparently following the first meaning, that the water was not needed. The court noted that "...it is impossible for the city to impound the exact amount of water necessary for its use from day to day and unavoidably there is some overflow which is properly termed waste"^{93/} As an alternative, since the water was not needed, the court could have held that the water was not being beneficially used, and was therefore

available for appropriation. This holding would have required the city to release a measured amount of water which represented the reduction in the city's water right.

Barker v. Sonner^{94/}

After the Payette-Oregon Slope Irrigation District began operations, it was noticed that Shepard's Gulch, which had formerly been dry (excepting snow run-off), now contained a flow of 200 miners' inches during the summer. The gulch was located within the boundaries of the irrigation district, and the district passed a resolution declaring the gulch an extension of its ditches for conveying water. The irrigation district contracted with the defendant whereby all waters flowing through the gulch became property of the defendant in consideration of his release of the district from all claims for damages. The contract did not bind the district to supply any specific quantity of water. Downstream appropriators sued to restrain the defendant from diverting or using any waters from Shepard's Gulch on the ground that the water was available for appropriation by them.

The decision in this case hinged on the classification of the disputed water as either waste or unappropriated. By adopting the plaintiff's argument that the water flowing through Shepard's Gulch was unappropriated--on the basis that the district was not beneficially using the water or that it had already served its purpose and was not return flow--the court could have awarded the water to the plaintiffs. In holding in favor of the defendant, the court classified the water as waste, and applied the rule allowing recapture of waste water before it leaves the land of the original applicator.

Jones v. Warm Springs Irrigation District^{95/}

In 1917, the Warm Springs Irrigation District constructed a reservoir which provided so much water that by 1926, "50 to 75 percent of the lands in the district were waterlogged and unsatisfactory for cultivation". In that year, the district sold one-half of its rights to the reservoir and one-half of its rights to water stored there to the United States. As part of the compensation to the district, the United States constructed drainage ditches over much of the water-logged area in the district in order to reclaim those lands. The irrigation district claimed use of the water captured in the reclamation ditches, and downstream senior appropriators brought suit to enjoin the district's use of those waters.

The irrigation district argued that it was entitled to the use of the water on the theory that it had recaptured waste water. Even though this is authorized by ORS 537.800, the Court did not mention that statute. Instead, they took a position which seems to be directly in conflict with the court in Vaughn v. Kolb (supra). In that case, the court held that only the quantity of water actually released with no intention of recapture was abandoned. In the instant case, however, the Court held that since the district had not in the past eight years recaptured the return flow, they had abandoned the right to do so:

"The intent to recapture the water must be present at the time it is discharged from control...The intent to recapture is essential, and without it the water is abandoned and cannot be reclaimed..."^{96/}

This statement would be a helpful extension of the interpretation of water recapture, except that in application the Court fails to make the distinction between incremental releases of water and the total

volume of water released. Under Vaughn v. Kolb, the only water abandoned (or wasted) would be that released at any one time. In fact, by holding that the water was abandoned, the Court classified the water as unappropriated so that the waste water rules were inapplicable.

Cleaver v. Judd^{97/}

This case presents a factual situation quite similar to that of Jones v. Warm Springs (supra). An irrigation district constructed a ditch to recapture water seeping off of irrigated lands. Downstream appropriators filed suit to stop the district's water recapture. The result reached by the Court was the reverse of the decision in Warm Springs, however.

The Court framed the issues of the case as dealing with waste water. After finding that the disputed water at no time became part of a natural stream, and was thus "waste water", the conclusion that the irrigation district could recapture the water was unavoidable. The issues of abandonment and beneficial use were not discussed. The Court based their classification of the water as waste on the (disputed) fact that the water had not returned to a natural stream. The Court also uses this point to counter the downstream appropriators argument that Warm Springs should be controlling. In a footnote the Court says:

In the Warm Springs case, irrigation water was allowed to drain through the soil and return to the river without measurement. It was held that water which so returned to the stream was subject to appropriation by others. In the case at bar the waste and seepage water is recaptured before it reaches the stream.^{98/}

This line of reasoning is difficult to follow, since the decision in Warm Springs hinged on the evident intent to recapture, notwithstanding the use of a natural stream for conveyance. The authority the

Court in the case at bar relied on is a case which states that a natural channel may be used as a conduit and the water recaptured as long as it remains within the boundary of the appropriators lands^{99/}. The distinction between Warm Springs and the instant case which the Court makes is not supported by either law or fact.

Classification of Return Flow

The common element of all judicial definitions of waste is that the water in question has been diverted by a prior appropriator. This makes it clear that what is at issue is the classification of return flow. Where the return flow was characterized as unappropriated water the upstream diverter was forced to release a specific amount of water. If the water was described as waste, the upstream appropriator was allowed to recapture the water and could vary the amount of return flow at will.

The two classifications cannot be reconciled, since a strict application of the beneficial use rule would not allow for recognition of waste water. With only knowledge of the statutes, the probabilities of the Court choosing each rule are equal. The rule uncertainty created by the two classifications of water produces a system of rules which are not normative at the appellate level. In each case above, the Court was unconstrained as to whom they could award the disputed water. Oregon statutes and case law provide no guidance for the Court; there is no internal logical structure such as the analytical legal theorists proposed.

Hutchins similarly observed that beneficial use is an antonym of waste, but did not apply this argument^{100/}. Two kinds of disputes

where the definitions of waste and beneficial use may be applied with great effect are water rights transfers and water conservation.

Application of Rights Transfer Rules

Recall that the essence of Oregon's water rights transfer statutes is that an appropriator is allowed to change (1) the use, (2) the place of use, or (3) the point of diversion only if no other appropriator objects and alleges an injury to a valid water right. This rule seems clear enough, but let us consider it in the context of the beneficial use and waste water rules.

Assume that an appropriator proposes to change the use of his water to a consumptive use which, it is known, injures a downstream appropriation. Assume further that the policy of the Oregon Water Resources Department (WRD) is to deny such changes, based on ORS 540.510 et. seq., and that the person changing uses brings suit against the WRD to force them to approve the change. If the WRD policy allowed the use to change, the injured appropriator would have a cause of action. The dispute ends up in Court either way, assuming transaction costs are small compared with the possible gains or losses. In court, the WRD (or the downstream appropriator) would, as mentioned above, base their argument on the "no injury" rule in the transfer statutes. However, the person who wished to change uses might argue that the downstream appropriation is not valid on the grounds that the appropriator is not beneficially using the water, so that the beneficial use rule requires a reduction in the amount of water the downstream appropriator is entitled to divert, at least to the extent of the injury. There is nothing in the statutes which provides enough information to allow one to know which interpretation the court will choose.

The same arguments pitting the beneficial use rule against the waste rules discussed above apply in both the circumstances of change of place of use and change in point of diversion. If an appropriator changes either parameter of the water right, he can argue that prevention of waste requires the change, or that the injured appropriator was not entitled to the amount of water claimed. There are, of course, many additional arguments available to both parties to a water rights dispute which have not been considered here. The purpose of the discussion has been to show that a single instance of two logically conflicting sets of rules can strip the normative content from a part of a water rights system.

Water Conservation in Oregon

It is commonly argued that Oregon's statutes require that water conserved by an appropriator be deducted from the appropriation and is again available for appropriation by anyone. A new priority date will be assigned upon application to a beneficial use^{101/}. The Arizona case of Salt River Valley Water Users Association v. Kovacovich^{102/}, and the Oregon case of Tudor v. Jaca^{103/}, set out the reasoning underlying this view. The Arizona case is quite relevant to Oregon law, since that state adopted the Oregon water law code as its own^{104/}.

Salt River Valley Water Users Assn. v. Kovacovich

Defendants Kovacovich and Ward engaged in water saving practices which enabled them to enlarge the area under irrigated cultivation by 35 and 50 acres, respectively. Each defendant held a valid water right, and the two parcels were irrigated with water which had formerly been

applied to the lands to which the water rights were appurtenant. Other appropriators filed suit requesting Kovacovich and Ward be enjoined from diversion of the portion of water that was being applied to the newly irrigated lands. The Arizona Supreme Court reversed the lower court and ordered the lower court to issue the injunction.

The Court disposed of the issue by a simple application of the beneficial use rule. They concluded that since a water right is appurtenant, and the measure of the right is the amount beneficially used on that land to which the right is appurtenant, an appropriator is precluded from applying water gained by conservation practices to lands other than those to which the right was originally appurtenant.

Tudor v. Jaca

Under decree, a rancher was allowed to "use 100 inches of water as it saw fit on any of its lands". The Oregon Supreme Court interpreted this language as making 100 miners inches appurtenant to certain lands, but allowing a change in place of use. Originally, the water right was appurtenant to 119.0 acres. The Court refused to allow the appropriator to apply that 100 miners inches to 300 acres (which contained the original 119.9 acres). Using the beneficial use rule, the court held that only that water which was applied to the original 119.9 acres was included in the appropriation. The portion of the 100 miners inches applied to the remaining 180.1 acres was a new appropriation inferior to appropriations made in the intervening time since the original appropriation.

If...100 miners inches is a sufficient quantity of water to irrigate 300 acres of land, then the surplus over the amount reasonably necessary to irrigate the land for which it was originally appropriated (119.9 acres) was not within the original appropriation.

Alternative Strategies

A declaration that the conserved water was waste water, and so could be reclaimed by the appropriator is one simple device for allowing a conserver to retain the water saved. The definition of waste water adopted in Vaughn v. Kolb (supra) fits conserved water rather well, viz: "(1)...Water that is...not needed by the claimant..., (2) water which, from unavoidable causes, escapes from...works of the lawful claimants." Conserved water is no longer needed by the claimant for the land to which it is appurtenant, and it is water which in the past has escaped from the works of the claimant. It could be argued that if the claimant could conserve the water, escape was not unavoidable. However, judicial interpretation would no doubt compare the methods of the claimant with those of other appropriators in the area to determine what was "unavoidable", as in theory all losses could be avoided. In any case, once the water was classified as waste, the appropriator could recapture it.

Classification of conserved water as waste water, while perhaps encouraging conservation, would provide no recourse for other appropriators who were injured by the change in place of use or manner of application. A second alternative which would allow an appropriator to use the water conserved by him, yet require that affects on other appropriators be taken into account is to allow the transfer of fractional water rights. Following this strategy, the conserver would apply to the WRD for a transfer of a portion of his water equal to the amount conserved to be appurtenant to the land where the conserved water was used. This would allow the conserver to retain the same measure of his water right and use the conserved water elsewhere, and also require that the WRD

determine if any other rights would be injured, preventing the transfer if this were the case.

It could be argued that application of the beneficial use doctrine would prevent fractional transfers, based on the following reasoning: water is appurtenant to the land where it is used, the measure of the water right is the amount which may be beneficially used on that land. Thus, if part of a right was not be used on that land, the measure of the water right would be reduced by the amount not used. A counter to this argument is to suppose a person wanted to transfer a whole water right. Under the beneficial use doctrine, the whole water right would disappear. This result is clearly not what the legislature intended, as they specifically provided a means of making water rights transfers.

The position of the WRD on this issue may be inferred for the "Application for Transfer of Water Right" (the form issued by the WRD to initiate a water rights transfer). In the middle of page one appears the following:

"Note: If the entire right of record is not directly involved in the requested change, only that part of the right which is directly involved should be considered in answering the balance of the questions on this form."

It appears that the WRD would indeed allow the transfer of a partial water right.

It should be borne in mind that this chapter is not presented as proof that Oregon surface water statutes are not normative. It is an argument that these statutes are not normative. If it is true that all possible allocations can be achieved under statutes which are not normative, then the argument that Oregon's appropriation doctrine is not normative should provide a means of achieving all distributions of water within the state. The next chapter addresses this question.

V. APPLICATION OF ECONOMIC CRITERIA TO
OREGON SURFACE WATER STATUTES

S.V. Ciriacy-Wantrup (hereinafter cited as Wantrup) provides on of the earliest general discussions of the application of economic criteria to water rights^{105/}. His article is particularly relevant to this study because he takes care to set out the legal theory upon which his analysis is based. Wantrup adopts the legal theory of Pound:

"Economics cannot define social optima which the law--as "social engineering"--should aim to realize. What economics can do, however, is to explain why and how far certain conditions which are decisively influenced by the law, facilitate or impede an increase of national income. Economics can point out the essential features of conflict situations and the probable consequences of changes in statutory provisions, judicial^{106/} decisions, and administrative regulations."

Wantrup distinguishes economic criteria "in" water law from criteria "for" water law. Economic criteria "in" water law refers to language which can be interpreted to require economic concepts in their definition. For example, ORS 536.220 sets out Oregon's water resource policy, and calls for "increased economic and general welfare" and for a policy which secures the "maximum beneficial use" of water resources. The statute further "finds that it is in the interest of the public welfare (emphasis added) that a coordinated, integrated state water resources policy be formulated..." Other language appearing in Oregon statutes which lends itself to the application of economic concepts includes "highest and best use" (ORS 536.340(1)), "beneficial use" (ORS 537.160 (1)), "waste water" (ORS 537.800) and "injury to a right (ORS 540.530 (1)).

Wantrup focuses on two "functional relationships",

"First,...what are the economic implications--in the sense of logical and probable factual

consequences--if concepts used as criteria "for" and "in" water law are interpreted and applied in certain ways. Second, ...how far and why are these implications helpful or obstructive if certain economic objectives are sought.^{107/}

The concepts referred to by Wantrup are the dual criteria of security and flexibility. Security is defined as (1) protection against physical uncertainty (stochastic variation of supply resulting from natural causes) and (2) protection against tenure uncertainty (variation in water available resulting from lawful acts of others). It is the second sense of the concept security, tenure uncertainty, that is relevant to the analysis of normative content in statutes. Tenure uncertainty as defined by Wantrup is not exactly equivalent to rule uncertainty. Tenure uncertainty refers to "lawful acts". A lawful act is not defined, but it would probably not distort Wantrup's argument if lawful acts were defined as those acts which are neither contrary to nor forbidden by law^{108/}. Rule uncertainty refers to the circumstances where it is not certain which acts will be lawful. The distinction of "lawful" and "unlawful" is a direct result of Wantrup's assumption of a normative body of law.

The second criteria suggested by Wantrup for comparing water rights systems is "flexibility". He defines the flexibility of water rights as "those aspects of water rights which facilitate or obstruct changes over time in the allocation of water resources..."^{109/}. The criterion of flexibility is not necessarily equivalent to rule uncertainty either. A water rights system could have perfect rule certainty and yet be very flexible by allowing changes in water allocation. An analysis of this type of water rights system by the application of economic criteria to its statutes would yield positive results about the legal rules which

comprise those statutes. On the other hand, where there was a very high degree of rule uncertainty, a legal system whose statutes appeared to prevent changes in water allocation could in fact be very flexible. Statutes of that system which appeared to prevent transfers could be circumvented by the choice of different interpretations.

Wantrup does not use a formal analytical structure in his discussion. One can only make a relative comparison using the criteria of flexibility and security. For example, one type of water rights arrangement may be perceived as more or less flexible than an alternative. However, in Wantrup's study there is no discussion of the degree of flexibility and security one would prefer in a rights system, or how to evaluate alternative systems which present a trade-off between flexibility and security.

More recent economic analyses of water allocation use models which are based on mathematical optimization of economic variables, generally social revenue. This type of model allows the development of "efficiency" criteria "for" water law. The following section is a survey of the application of optimization criteria to water law.

A Return Flow Model

One of the principal problems of water allocation is the fact that some fraction of water which has been diverted and used will return to the stream, becoming available for re-use by downstream appropriators. Figure 1 is a schematic diagram of a simple basin system where the return flow from each diversion is available for downstream uses.

The usual approach of economists is to model a water system with the goal of ascertaining an allocation which maximizes some measure of social benefit, such as profit or revenue. On a stream where no return

flow from diversion existed, the allocation of water which maximized revenue would result in an efficiency condition which required the equation of the marginal value product (MVP) of all uses^{110/}. Hartman and Seastone argue (without formal derivation) that where return flows are present, the following necessary condition obtains because of downstream re-use of water:

$$\begin{aligned}
 (5.1) \quad & MVP_1 + r_1 MVP_2 + r_1 r_2 MVP_3 + \dots + (r_1 r_2 \dots r_{n-1}) MVP_n \\
 & = MVP_2 + r_2 MVP_3 + \dots + (r_1 r_2 \dots r_{n-1}) MVP_n \\
 & \quad \cdot \\
 & \quad \cdot \\
 & = MVP_n
 \end{aligned}$$

where r_k , the return flow coefficient, is the fraction of the water diverted by the k th diverter which is returned to the stream^{111/}.

In a more rigorous effort to analyze the surface water allocation problem, Calloway^{112/} uses a mathematical programming model to solve a constrained maximization problem where the objective function is

$$L = WTP_k = P_k Q_k (KLW) - h_1 K_k - h_2 L_k$$

and WTP_k = willingness to pay of the k th activity for surface water

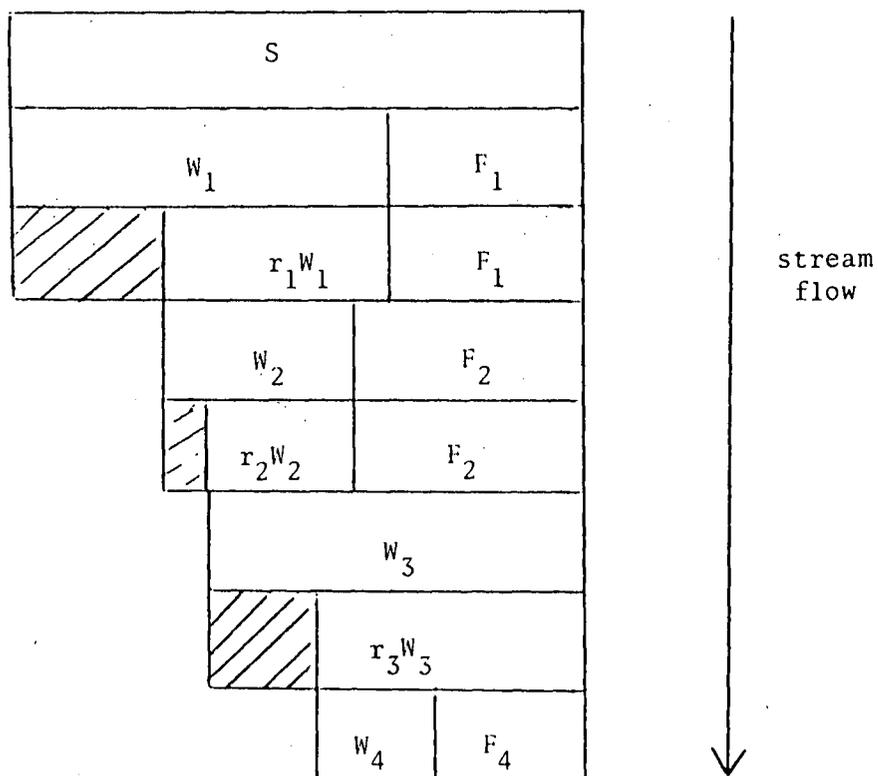
P_k = market price of output Q_k

K, L, W = quantities of capital, land and water used in production of Q_k

h_1, h_2 = input price of capital and labor, water assumed to be free.

To simplify the model, he makes the following assumptions:

- (1) there is a single mainstream fed from a single source,
- (2) there is no stochastic variation in stream flow,
- (3) there are no evaporation or seepage losses,
- (4) return flow is a constant fraction of the diversion W_k ,



S = total stream flow

W_k = amount of water diverted by the k th appropriator

r_k = fraction of diversion W_k returned to the stream

F_k = amount of water allowed to flow by the headgate of the k th appropriator

 = consumptive use

Figure 1. Configuration of a hypothetical river basin with four divisions.

(5) water quality is not affected by return flow.

The objective function is subject to the water constraints

$$(5.2) \quad W_1 + F_1 = S$$

$$(5.3) \quad W_k + F_k - r_{k-1}W_{k-1} - F_{k-1} = 0 \quad \text{for } k = 2, 3, \dots, n$$

where W_k is the amount of water diverted to the k th activity

F_k is the amount of water allowed to flow past the headgate
of the k th diverter

S is the total stream flow entering the system

n is the number of diversions

The Lagrangian function for the maximization problem is

$$(5.4) \quad L = \sum_{k=1}^n (P_k Q_k) + \lambda_1 (S - W_1 - F_1) + \sum_{k=2}^n \lambda_k (W_k + F_k - r_{k-1}W_{k-1} - F_{k-1})$$

where λ_k is the shadow price of water diverted to the k th activity

Holding capital and labor constant, the two Kuhn-Tucker conditions relevant to this discussion are

$$(5.5) \quad \frac{\partial L}{\partial W_k} = MVP_k - \lambda_k + r_k \lambda_{k+1} \leq 0$$

$$W_k \geq 0 \quad \text{and} \quad \frac{\partial L}{\partial W_k} \cdot W_k = 0 \quad \text{for all } k$$

$$(5.6) \quad \frac{\partial L}{\partial F_k} = -\lambda_k + \lambda_{k+1} \leq 0$$

$$F_k \geq 0 \quad \text{and} \quad \frac{\partial L}{\partial F_k} \cdot F_k = 0 \quad \text{for all } k$$

where $MVP_k = P_k \cdot \frac{\partial Q_k}{\partial W_k}$

From (5.5) and (5.6) it can be shown that

$$(5.8) \quad \lambda_1 = MVP_1 + r_1 MVP_2 + r_1 r_2 MVP_3 + \dots + (r_1 r_2 \dots r_{n-1}) MVP_n$$

$$\lambda_2 = MVP_2 + r_2 MVP_3 + r_2 r_3 MVP_4 + \dots + (r_2 r_3 \dots r_{n-1}) MVP_n$$

$$\vdots$$

$$\lambda_n = MVP_n$$

Thus, if the shadow prices λ_k are equal, Calloway obtains the same necessary condition for optimum allocation as do Hartman and Seastone^{113/}. However, from (5.6) Calloway argues that the shadow prices are equal only when some portion of the water available at the headgate of the k th diversion is allowed to flow past, where the n th diversion takes all the water remaining in the stream at that point. Stated another way, the shadow prices are equal when $F_k > 0$, $k \neq n$, and $F_n = 0$. Figure 1 shows a diagram of a stream with four diversions which may be used to illustrate how a different shadow price can exist in different places on the same stream. Note that the third diversion requires all the water remaining in the stream at that point. Assume that there is just enough water to allow three all the water that he can use. From (5.6) it can be seen that the shadow price of water for the basin would be zero everywhere. Now assume an exogenous shock which increases the MVP of two. A reallocation of water to two in order to meet the criterion of (5.6) will result in an increase in the shadow price at diversions one, two and three. The shadow price at diversion four will remain unchanged as long as the sum of the consumptive uses is less than $S - W_4$.

Proposed Alternatives to the Appropriation Doctrine

Hartman and Seastone argue from (5.1) that the appropriation doctrine will lead to a divergence between social and private water valuation. Given a market in water rights, a necessary condition for

an individual to maximize private revenue from water is to equate the MVP of his use with water price. The private marginal value of water would be lower than the social marginal value by $r_k^{MVP} r_{k+1} + r_k r_{k+1}^{MVP} + \dots + (r_k r_{k+1} r_{k+2} \dots r_{k+n-1})^{MVP} r_n$. Their solution is to redefine a water right to include a right to the return flow from a diversion as well as the right to divert water. An appropriator's right would be defined as $W_k + r_k W_k + r_k r_{k+1} W_k + \dots$. Downstream appropriators would be required to purchase the right to divert return flow from the k th diversion. Appropriators who changed return flow from their diversion would be able to sell an increase, but would be required to purchase the amount which the change reduced the amount of any downstream right. The result under this water rights regime would be an identification of private and social valuation of water. Therefore, a market in water rights would result in the optimum allocation specified by (5.1). Hartman and Seastone do not, however, discuss the institutional arrangements necessary to effect this type of water right.

Calloway suggests four different institutional arrangements which might be used to achieve the Kuhn-Tucker conditions (5.5) and (5.6): Allocation by quota, allocation by marginal value product, allocation by scarcity price and allocation by seasonal rental markets. All of these methods are based on the original ownership of all water by a central authority^{114/}.

Allocation by quota requires that the central authority solve the mathematical programming problem (5.4) and allocate water according to the resultant vector (W_1, W_2, \dots, W_n) .

Allocation by marginal value product similarly requires the solution of (5.4) by central authority. The authorities would then sell

water according to the equilibrium price condition (5.5). Assuming profit maximizing behavior by all diverters, the supply price to the k th diverter would be $\lambda_k = MVP_k + r_k \lambda_{k+1}$, where $r_k \lambda_{k+1}$ is the marginal external benefit of use k . When each activity equated marginal revenue with supply price, the optimum allocation specified by this model would be achieved.

Allocation by scarcity price would define a water right as Hartman and Seastone suggest, i.e., the diverter is permitted to sell the return flow from his use. The main feature of this allocation scheme is the initial sale by the authority of the amount of basin streamflow S at the shadow price of water at the head of the stream, λ_1 . Subsequently, diverters would buy and sell return flow on a competitive market. The result would be that the water pricing condition (5.5) would obtain throughout the basin.

Allocation by seasonal rental markets features an initial allocation by the quota system described above. The rights which are established by the quota system are defined in the same manner that Hartman and Seastone propose, i.e., the right to divert water also includes a right to the return flow. After the initial allocation the authority allows these rights to be traded, providing a mechanism for reallocation in response to changes in economic variables.

In each of the four water allocation arrangements suggested by Calloway, a central authority is assumed to know all the parameters of stream and return flow, plus the production functions of the activity at each diversion. Where a market of one form or another was proposed, it was assumed that each diverter also had that knowledge, and in all cases, information and transactions costs were zero.

In one of the most recent analyses of the appropriation doctrine, Burness and Quirk assert (without derivation) that the optimal allocation of water to maximize social revenue where return flows are present is $W_1 = S$ and $W_2 = rW_1$, $W_3 = r^2W_1$, $W_4 = r^3W_1$, ..., $W_n = r^{n-1}W_1$.^{115/} In other words, each user diverts the entire stream, and all except the first diverter receive only return flow from the next upstream use. It is assumed that all firms are identical. However, consider the optimization problem posed by this scheme. If a basin is constrained to this allocation, the Lagrangian which maximizes revenue is

$$(5.9) \quad L = \sum_{k=1}^n P_k Q_k + \lambda_1 (S - W_1) + \sum_{k=2}^n \lambda_k (r^{k-1}W_1 - W_k)$$

and first order conditions are

$$(5.10) \quad \frac{\partial L}{\partial W_1} = MVP_1 - \lambda_1 + \sum_{k=2}^n \lambda_k r^{k-1} = 0$$

$$(5.11) \quad \frac{\partial L}{\partial W_k} = MVP_k - \lambda_k = 0, \quad k = 2, 3, \dots, n.$$

By substitution of values of λ_k from (5.11) into (5.10) and from (5.11) alone, one obtains the shadow prices

$$(5.12) \quad \lambda_1 = MVP_1 + rMVP_2 + r^2MVP_3 + \dots + r^{n-1}MVP_n$$

$$\lambda_2 = MVP_2$$

.

$$\lambda_n = MVP_n$$

Comparison of (5.12) with (5.8) discloses that while the shadow prices are the same at the first diversion, the Burness-Quirk allocation undervalues subsequent diversions, except where return flow is zero or there is excess water. This allocation scheme apparently does not include the value of return flows from diversions downstream from the first one.

Regardless of the lack of generality of Burness' and Quirk's allocation scheme, their charge against the appropriation doctrine and the suggested remedy are familiar. They propose a water right which is defined by consumptive use and return flow. Optimum allocation is achieved by allowing the sale of return flow by a diverter, as suggested by Hartman and Seastone.

The recurrent theme through the criticism of the appropriation doctrine is that return flow is an externality which the doctrine cannot internalize. The solution is to re-define property rights in water to include return flow. Following Calloway, achievement of an "optimum" allocation under this type of rights system requires knowledge of all hydrological parameters and production functions in a basin. This knowledge would be required of either a central water allocation authority or all water users, or both. To be sure, the authors cited above considered only the most general description of the appropriation doctrine. The next issue is to analyze whether the allocation suggested by mathematical optimization models can be achieved under Oregon law using the same information required by these hypothetical allocation scheme.

Application of the Model to Oregon Surface Water Law

To simplify the analysis of Oregon water law, it will be assumed that the diversions within the hypothetical basin are all smaller than the amount of water which is in the stream at the headgate of that diversion, except for the last diversion, which may take all the stream flow. Under this assumption, there will be a shadow price which is the same everywhere in the basin, and the water constraints (5.2) and (5.3)

may be rewritten as a single constraint^{116/}

$$(5.13) \quad S = \sum_{k=1}^{n-1} (W_k - r_k W_k) + W_n + F_n.$$

That is, the stream flow equals the sum of the consumptive uses, the last diversion and the amount of water which flows past the headgate of the nth diversion. The constrained maximization problem is then

$$(5.14) \quad L = \sum_{k=1}^n P_k Q_k + \lambda [S - \sum_{k=1}^{n-1} (W_k - r_k W_k) - W_n - F_n]$$

and the relevant Kuhn-Tucker conditions are

$$(5.15) \quad \frac{\partial L}{\partial W_k} = P_k \frac{\partial Q_k}{\partial W_k} - \lambda(1 - r_k) \leq 0, \quad W_k \geq 0, \quad \frac{\partial L}{\partial W_k} \cdot W_k = 0, \quad \text{for } k > n.$$

$$(5.16) \quad \frac{\partial L}{\partial W_n} = P_n \frac{\partial Q_n}{\partial W_n} - \lambda \leq 0, \quad W_n \geq 0, \quad \frac{\partial L}{\partial W_n} \cdot W_n = 0$$

$$(5.17) \quad \frac{\partial L}{\partial F_n} = -\lambda \leq 0, \quad F_n \geq 0, \quad \frac{\partial L}{\partial F_n} \cdot F_n = 0$$

From (5.17) one sees that if the nth diverter allows any water to flow past his headgate when water is allocated to satisfy the conditions (5.15) through (5.17), the shadow price of water in the basin will be zero, reflecting the fact that there is no water scarcity in the basin. It can be shown from (5.15) and (5.16) that

$$(5.18) \quad \lambda = \frac{MVP_1}{(1-r_1)} = \frac{MVP_2}{(1-r_2)} = \dots = \frac{MVP_{n-1}}{(1-r_{n-1})} = MVP_n$$

where it is assumed that all diversions are for amounts of water greater than zero. Hartman and Seastone's efficiency condition (5.1) also follows from (5.15) and (5.16). The remainder of this chapter concerns the application of the criteria (5.15) and (5.16) to Oregon surface water law.

Abstract of Oregon Surface Water Law

Since the Oregon statutes dealing with surface and ground water run to several hundred pages, they must be simplified for analysis no less than the hydrology of a basin. There are three statutes in Oregon surface water law which specify the general scheme of surface water allocation under the appropriation doctrine in Oregon:

- (1) "Beneficial use shall be the ... measure and the limit of all rights..." (ORS 540.610)
- (2) Waste water may be appropriated, and it may be recaptured by the applicator. (ORS 537.800)
- (3) A change in use or change in place of use will be allowed only if the "change can be effected without injury to existing rights." (ORS 540.530)

For the initial application of the criteria (5.15) and (5.16) it is assumed that these three statutes represent the whole body of surface water law. The justification for this assumption is the argument in Chapter IV that these elements specify a non-normative property rights system. If this assumption is correct, these three statutes may be used to allocate water according to any allocation scheme.

Beneficial Use

"Beneficial use" may be defined as $\lambda = \frac{MVP_k}{(1-r_k)}$. Figure 2

illustrates how this interpretation might be used, assuming that each diverter operates where the marginal productivity of water is decreasing. The line MVP_k represents the private marginal valuation of water at diversion k , and the line $MVP_k/(1-r_k)$ is the social marginal value. Assume that initially in the basin the condition (5.18) is satisfied,

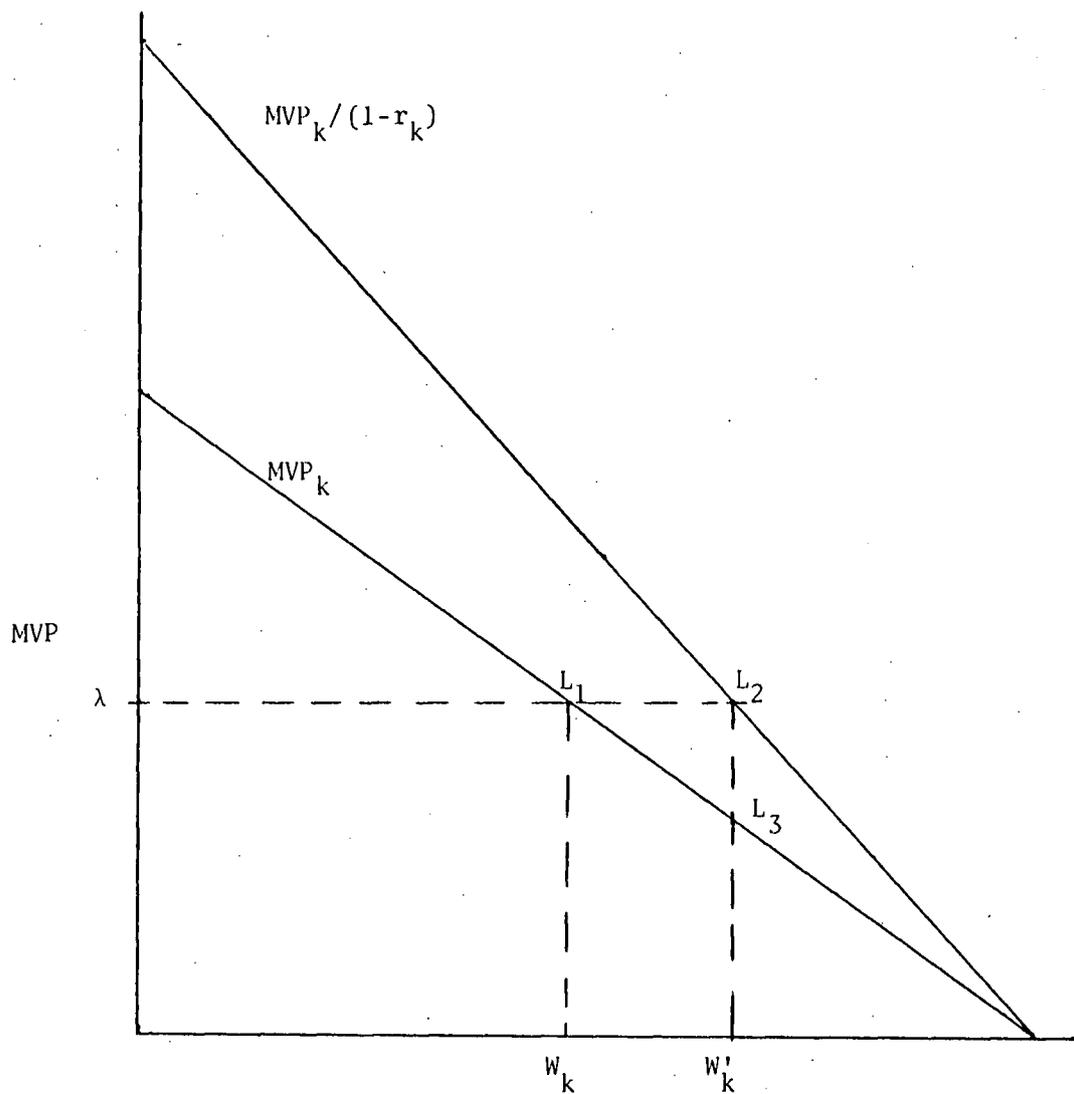


Figure 2. Allocation of water flowing the beneficial use rule.

and that λ is positive. The k th individual has an appropriation of W'_k units of water, and sees himself at L_3 . At the basin price for water of λ , the individual would wish to sell $W_k - W'_k$ units of water at that price to move to L_1 , where his MVP is equated with the input price (assuming profit maximizing behavior). Under the simplified legal regime used here, the definition of beneficial use could be used to prevent that individual from selling the water as follows: if the individual has more than W'_k units of water, the decision maker would rule that k was not beneficially using the water and reduce the allocation. Alternatively, if k has fewer than W'_k units, perhaps because of a change in use by an upstream appropriator, the decision maker, on the petition of k , would rule that the other appropriators had more than they could beneficially use ($MVP_1 < \lambda$, where $i \neq k$), reduce their allocations and allow k to increase his allocation until (5.18) was satisfied.

Water Rights Transfers

The Oregon water rights transfer statutes can be condensed to a single rule: a right may be transferred if no other right is injured as a result^{117/}. A transfer is defined as any change in use, place of use or point of diversion. The relevant parameter to the definition of injury is the amount of return flow.

To this point in the discussion, it has been assumed that the return flow coefficient r_k remained constant. We now turn to the analysis of a change in use, which may result in a change in MVP_k and r_k . It is still assumed that r_k is constant over the range of production after the change in use. A change in use may be to (1) a higher MVP and a higher r , resulting from a change from agricultural irrigation to a city

water supply for example, (2) a higher MVP and lower r , resulting perhaps from water conservation in irrigation, (3) lower MVP and increased r , or (4) lower MVP and decreased r . It is therefore the ratio $MVP/(1-r_k)$ in the old and new use which is of interest.

If $\frac{MVP_k}{(1-r_k)} > \frac{MVP'_k}{(1-r'_k)}$, the decision maker could prevent the change

on the grounds that it was a transfer which injured other rights (where MVP' and r' are parameters of the new use). As an alternative to that ruling, it could be held that k was no longer beneficially using the water and should have his allocation reduced if the change is made. This strategy might discourage an appropriator from making the change.

Where the social marginal value of the new use exceeded that of the old, the new use would be allowed as beneficial and the allocation increased to the limits set by the new solution to the optimization problem.

These interpretations allow a basin to be stabilized at any allocation a decision maker selects. The information required for "optimum" allocation is the same as that required for the allocation schemes discussed above, i.e., all production functions and hydrological parameters. However, the definition of beneficial use could also be "set" at $MVP_k/(1-r_k) \neq \lambda$. For example, beneficial use could be defined following some natural law standard of a "just" allocation. It could even be defined as a set of random numbers. One simply adopts the norms which specify the allocation as the definition of beneficial use. This simplified rights system does not determine the allocation of water within its jurisdiction. This result is analogous to the allocation possibilities inferred from the hypothetical non-normative property rights structure examined in Chapter II.

Because the three statutes may be used to adjust each appropriation individually, the analysis generalizes to every possible basin configuration. The allocation problems presented by branching streams and complex return flow patterns would all be adjudicated in the manner described above.

Accuracy of the Model Rights System

The question arises of whether the three statute water rights system posed here is an adequate representation of Oregon surface water statutes. Since any allocation may be achieved using the beneficial use rule and waste water definition, this representation of the Oregon statutes would not be accurate if the addition of other statutes prevented certain allocations of water. The argument above is that the "no injury" rule may not prevent transfers of water rights in adjustment to changed economic circumstances. There is a similar argument which would allow water conservation (where it increased basin revenue) in spite of the appurtenancy of water rights.

A water right is appurtenant to the place of use for which it was established (ORS 540.510), but waste water may be recaptured (ORS 537.800). The rule which allows recapture of waste water may be used to reach the efficient allocation of (5.18) by defining "waste water" as the quantity of water which would be re-allocated to k where $MVP_k / (1-r_k) < MVP'_k / (1-r'_k)$ and r'_k and MVP'_k describe the new use at the k th diversion. Where this relation held, water would have to be re-allocated from other users to k to attain the optimum allocation at a higher level of basin revenue. The decision maker might allow k to increase his diversion (or keep the same amount of water given a decrease in r_k) on the basis that k is recapturing waste water^{118/}. An

appropriator who objected to the transfer on the basis of the "no injury" rule would be denied. One who has appropriated waste water is entitled to it only at the discretion of the appropriator who releases it^{119/}. If $MVP/(1-r_k) > MVP'_k/(1-r'_k)$, the transfer would result in a decrease of basin revenue. The same definition of waste water prevents this change. Where the ratio of the new MVP at k to the fraction of the diversion not returned from the new use is less than of ratio of the same parameters for the old use, the transfer could be prevented on the grounds that the new use injured a downstream appropriator by reducing the amount of unappropriated water (from return flow) which was available.

As a result of the fact that "beneficial use" is the only measure of a water right in Oregon, transfers of water rights could be made which allocate water according to any given criteria. There may be statutory interpretations which would preclude an allocation, but the decision maker would have the choice to use the beneficial use rule and waste water definition to in fact allow that allocation. The addition of further statutory rules might allow more ways of achieving an allocation, but additional rules will not preclude any allocation which might be chosen.

Conclusions

Because beneficial use defines the amount of water an appropriator may divert, any allocation could be achieved by employing economic criteria to define "beneficial use". In this circumstance the allocation will always be optimal as defined by the criteria. The addition of other rules provide more complex ways of reaching the same

allocations, but do not proscribe any given allocation, since beneficial use is the only measure of an appropriative right. The use of economic criteria is not the only method which could be used to define beneficial use, waste water and other statutory rules. Therefore, any possible allocation could be achieved. This leads to the conclusion that Oregon surface water law is not normative at the appellate level to water allocation.

It may be argued that the statutes do indeed have normative content, since certain interpretations may be used as norms to achieve an efficient water allocation. However, the normative content is exogenous to the statutes themselves, in this model being supplied by economic theory. The statutes may be viewed as a mechanism which can be used to achieve different normative goals such as efficient allocation, but the norms are not part of the mechanism.

The general conclusion is that an economist who approaches Oregon surface water law must first ascertain just how water is allocated and what decision rules obtain. Those allocation rules cannot be ascertained from Oregon statutes and their appellate interpretations.

VI. SUMMARY AND SUGGESTIONS FOR FURTHER RESEARCH

The thesis argued here is that Oregon's statutes do not determine allocation of surface water within the state. This does not mean that those statutes are not used to effect water allocation. The thesis is predicated on the existence of rule uncertainty in the statutes which allows them to be used to achieve any allocation.

In Chapter II, an analysis of the Coase theorem in the long run provides a convenient way to examine the effect of rule uncertainty on allocation. The hypothetical property rights structure which forms the basis of the discussion consists of property and liability rules. A property rule provides an exclusivity of control which precludes the interference of any other party with a property right. A liability rule allows another party to injure or destroy the property right if that party is willing to pay the compensation required by an objective authority. The Coase theorem is that regardless of how property rights and liability are initially assigned, the same allocation will result. This allocation is commonly one which will optimize some economic variable such as utility, profit or revenue. The model which provides the framework for discussion assumes that in a single airshed, there are two industries, A and B, where B is a pollution emitter and A is a pollution recipient. The output of these industries is consumed by a single "person", and the objective function is constructed to maximize that person's utility, as a measure of social benefit.

In the long run, when industries are allowed free exit and entry, the model appears to show that the Coase theorem is valid for the use of property rules, but invalid for the use of only liability rules. The

difference in results occurs because of the nature of a liability rule. Under such a rule, any firm which contemplates entry is assured of compensation (or the duty to pay compensation) at no cost. A result is that too many pollution recipients enter production. The property rule, which requires that the right to pollute or to be free of pollution must be purchased, produces the optimal number of firms in both industries. Rule uncertainty is introduced by the introduction of conflicting property and liability rules. Under the hypothesized regime, a decision maker (in this case the single consumer) would have the choice of either a liability rule burdening the polluter or a property rule which protects the polluter. Through the use of these rules the level of production may be adjusted to any level the consumer chooses.

It is interesting that allocational neutrality may result from rule uncertainty in a hypothetical property rights system, but is that result relevant to actual legal regimes? This issue is addressed in Chapter III, where there is a short survey of the treatment of rule uncertainty by three major schools of legal thought. The teleological school includes the natural law scholars and is concerned with what the law ought to be. They argue that laws are normative in prescribing human behavior, and that they are based on universal or cultural norms. The analytical school attempts to analyze the law as a set of norms which possess a structure which guides the choice and application of legal rules. If accurately perceived, the normative structure of the law would guide a decision maker to the result without rule uncertainty. Scholars of the functional school choose to view the law as a tool which is used to achieve certain societal goals. There is no agreement

as to what goals are manifested by the law, but it is assumed that the law is normative to allow the causal connection between the law and control behavior. Within the functional school there is a "wing" or a "movement" which argues that the law provides only a posteriori rationalization of a decision which was made on other grounds. This group, the American realists, view rule uncertainty as the principle feature of statutes and statutory interpretations. It is this "realist" view which is adopted in the analysis of Oregon surface water law.

The antonyms "beneficial use" and "waste water" are the basis for an argument in Chapter IV that Oregon's surface water rights statutes are not normative at the appellate level. The measure of a water right in Oregon is the amount which is "beneficially used". In the sense of the purpose of a diversion, the Oregon courts have said that a beneficial use must be reasonable and economical.

The definition of waste is almost exclusively judicial. The common element of all uses of the term is that the water has been diverted. If the diverted water is classified as waste, the diverter may recapture it, or another appropriator may claim it, but only in the amount released at the discretion of the original diverter. An alternative is for the court to classify the water as unappropriated. The downstream appropriator of this water would be entitled to the release of that amount at all times where his priority date was eligible.

Given a transfer of a water right, the court might rule that an injured appropriator was not entitled to the water claimed under the beneficial use rule. The court could use the beneficial use rule to prevent a change in use by ruling that the change in use was not a beneficial use to the extent of the injury to the downstream

appropriators. The waste water rules could be used to allow the transfer by ruling that the transfer was to prevent waste or to recapture waste.

There are three classifications of water in Oregon: beneficially used water, waste water and unappropriated water. Chapter V uses a mathematical programming model to argue that these three classes of water (derived from the beneficial use rule and the definition of waste water) allow the allocation of water according to any scheme. The model is constructed of an objective function which represents basin revenue as a measure of social benefit, subject to a set of water constraints which are functions of the amount of diversion and return flows. Each diversion is constrained to the sum of the amount of water which has not been previously diverted and the return flows from upstream diversions. The Kuhn-Tucker conditions for the maximization of basin (social) revenue require that the marginal value of re-use of water returned from a diversion be included in the social marginal value. Therefore, there is a divergence between private and social marginal value. This discrepancy is the basis for much of the criticism of the appropriation doctrine.

Alternative property rights structures have been suggested which, it is asserted, would equate social and private valuation of water. A quota system would allocate water by solving the constrained maximization problem and allocating water accordingly. The most common suggestion is to re-define a water right to include the right to divert a certain amount and the right to all return flow. Each downstream appropriator then must purchase the right to divert return flow from the right holder. This arrangement assumes a market in which each

appropriator has full knowledge of the basin hydrology and production functions of all appropriations. The primary argument in support of the thesis is that with the same information, the appropriation doctrine in Oregon could be made to yield the "optimal" allocation specified by any model. This is accomplished by defining beneficial use at any diversion as the amount of water specified by the optimization process. Beneficial use is the only measure of a water right. Therefore, each appropriation could be adjusted to a calculated "optimum" allocation, or to any other allocation chosen.

Suggestions for Further Research

The primary problem raised by this research concerns the nature of the actual allocation of water in Oregon. Can the allocation be described by a model which optimizes some indicator variables? What are the variables? Even if the surface water statutes do not determine the allocation, they still may provide clues to the construction of an economic model of allocation.

The relaxation of the assumption that there are no transaction costs would be an area of research where the statutes might provide some insight. For example, during the permit process, a prospective appropriator is required to prove her ability to finance and construct the proposed works^{120/}. In addition, the appropriator may have to present evidence at a hearing that the proposed use would not "conflict with existing rights or be prejudicial to the public interest"^{121/}. Other appropriators and members of the public must bear the cost of informing themselves of a proposed use and of presenting supporting evidence of their view at any hearing.

The costs of a transfer may also include substantial transaction costs. A transfer will be allowed only if no other water right is injured^{122/}. However, a right transfer may be approved without a hearing if no person objects^{123/}. Thus, appropriators who would be injured by a transfer have the burden of learning of it. Although the party wishing a change would have the burden of proof at a hearing, those who face a reduction in available water are responsible for rebutting the evidence presented to show that no injury would occur.

A water management district is a public or quasi-public body which undertakes one or more water management functions. Irrigation districts and water control districts are of the most interest because both provide a centralized allocation authority for their members^{124/}. A comparison of water allocation within these districts among themselves and with similar areas outside of a district might yield information about the norms which determine allocation.

These are but a few examples of many statutes whose inclusion in the modeling process might reveal something of the way water is allocated in Oregon. More complicated mathematical programming models may include transaction costs, pollution, ground water substitution and recharge, storage and so on. No matter what type of model is attempted, the problem posed by this study is to describe the allocation of surface water in Oregon.

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- (10) Lewis v. McClure, 8 Or. 273 (1880).
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- (15) Or. Laws 1899, p. 172, Or. Laws 1905, ch. 228.
- (16) Or. Laws 1909, ch. 216.
- (17) C. Shannon, A Mathematical Theory of Communication (1949).
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- (19) Cf. R. Posner, Economic Analysis of Law (2nd ed., 1977).
- (20) For a discussion of the hierarchy of U.S. courts, see 1 Moore, Federal Practice sec. 4017, 4051 (1959).

Chapter 11

- (21) Alchian and Allen, Exchange and Production, Theory in Use, 151, 163 (1967).
- (22) Calabresi and Malamed, Property Rules, Liability Rules and Inalienability: One View of the Cathedral, 85 Harvard L. Rev. 1089 (1972).
- (23) Id. at 1090, Calabresi and Malamed discuss "entitlements" rather than property rights. An entitlement carries the expectation that the state will intervene in a conflict to favor the person holding the entitlement. This formulation is so similar to Alchian and Allen's definition of property rights that the term "property rights" has been substituted for "entitlement" to make it clear that these authors are addressing the same subject matter.
- (24) Id. at 1092.
- (25) Id.
- (26) In Re Hood River, 114 Or. 112, 181, 227 Pac. 1065 (1924).
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- (29) Op. cit. note 22 at 1093.
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- (38) Bass v. Gregory, 25 Q.B.P. 481 (1890).
- (39) Prosser, Torts, 571 (4th ed., 1971).

- (40) Op. cit. note 30 at 11.
- (41) Op. cit. note 34.
- (42) Id. 259, Frech assumes the following convexity relations hold:
- $$\begin{array}{ll} C_a^a > 0 & C_{bb}^a > 0 \\ C_a^a > 0 & C_{bb}^b > 0 \\ C_b^a > 0 & C_b^b > 0 \end{array}$$
- (43) Cf. Henderson and Quandt, Microeconomic Theory Chap. 3 (2nd ed., 1971).
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- (69) Caviness v. La Grande Irr. Co. 60 Or. 410, 119 Pac. 731 (1911).
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- (88) ORS 537.800
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APPENDICES

APPENDIX I

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APPENDIX II

OREGON STATUTES CITED

537.135

537.150

537.160

537.170

537.180

537.290

537.775

537.800

540.040

540.510

540.520

540.530

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540.720