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RESOURCE POLICIES, PROPERTY RIGHTS AND CONFLICTS OF INTEREST*

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Chicagoan theories of and policies for unpriced natural resources have gathered momentum over the past twenty years and have reached a fair degree of acceptability among some agricultural economists and some governments. The critical evaluation of the logic, explanatory and predictive power of these theories, which is undertaken in this paper, shows that this acceptability is not well founded. It is demonstrated that these theories embody substantial logical shortcomings and rely on hypotheses which may be falsified. These limitations have important implications for Chicagoan resource policies. Game theory is used to show that Pareto optimality cannot be reached when Chicagoan policies are implemented by a government, contrary to the contention of Chicagoan economists.

Real world decisions about natural resources are rarely made solely on economic grounds. The role played by the policy recommendations of resource economists in these decisions is thus not well defined. With this qualification in mind, one can nevertheless observe that two economic schools of thought have had a substantial influence on resource policies in industrialised countries.

The older school, which originated with Pigou and Marshall, is an offshoot of welfare economics. It has generated resource policies which necessitate complex forms of government intervention. Concepts belonging to this paradigm have been used in the formulation of policies in most industrialised countries since the 1950s (for example, use of fishing permits or mesh-size regulations in fishery policies). However, such policies are often difficult to implement. For example, since 1976, US law has required that fisheries be managed according to their maximum sustainable yield, computed from an economic, a social and a biological viewpoint (*Fishery Conservation and Management Act 1976*). Because of the problems involved in obtaining the data necessary for such computations, the Act has not, as yet, been implemented.

The younger school, often called the Chicagoan or property rights school, was originated by Coase (1960). It was created to provide an alternative to the Pigouvian paradigm which was judged by many Chicagoans to rely too heavily on 'non-optimal' government intervention. In most natural resource cases, property right economists advocate the privatisation of publicly owned resources as a means to achieve an optimal resource use. Policies based on this paradigm have recently been implemented by some governments. In 1983-84, for

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example, the US government sold federally owned wilderness areas to private interests to enable the private sector to 'better manage' these lands (Runge 1984). It is not yet possible to assess the success of these policies because their implementation is too recent. However, Chicagoan policies are, by comparison with Pigouvian policies, relatively easy to implement. This characteristic may contribute further to their political acceptability and to their utilisation as resource policies in the future, even though the real world consequences of their use will not be known for some time.

The objectives in this paper are twofold. The first objective is to evaluate critically the theoretical foundation of the Chicagoan policies which were developed after the publication of Coase's seminal paper and which are currently used to justify some resource policies. Up to now, critics have focused almost solely on Coase's writings (for example, Mishan 1967). The following evaluation will thus broaden the scope of the ongoing controversy. In addition, it is in the spirit of the critical intellectual tradition which, according to Hardaker (1985), greatly needs to be revived among Australian agricultural economists, even at the risk of treading on hallowed grounds. The second objective is to use this evaluation to predict the likely consequences of a utilisation of the Chicagoan property right paradigm in real world policy making.

Since different economists can interpret a given paradigm differently, the first section of the paper summarises my interpretation of the Chicagoan paradigm. This serves to establish clearly the basis of the following discussion. The explanatory power, the logic and the predictive power of the paradigm are evaluated in the second section. The paper is concluded with a discussion of the specific resource allocations which can be expected if a government adopts a Chicagoan policy.

Summary of Chicagoan Natural Resource Theories and Policies

As mentioned above, Coase established the foundations of Chicagoan resource theories in 1960.¹ The highlight of his argument was that when an externality involves two parties, transaction costs are nil and perfect competition prevails in the economy, then private bargaining between these parties will automatically result in optimality through the internalisation of the externality.² If transaction costs are positive, then

¹ The terms 'resource theories', 'natural resource theories' and 'unpriced resource theories' are used interchangeably in this paper to refer to the analysis of the externality, common property resource and public good misallocation problems created by the use of natural resources.

² This last point has been empirically investigated by Cheung (1973) who contends that there exist Pareto contractual arrangements for a typical externality case, namely nectar and pollination services. Cheung bases his contention on data which he acknowledges to be 'inadequate' for proving the Pareto optimality of the transactions taking place between apple growers and honey producers in Washington state. He nevertheless concludes that his data 'roughly implies' that Pareto optimality is reached in these private transactions (Cheung 1973, p. 32). Even if Cheung's computations are taken on face value, all that can be inferred from his computations is that the ratio of the prices of honey to apples is equal to the ratio of the marginal costs of honey to apples. This equality reflects only part of the necessary and sufficient conditions for a Pareto optimum. Cheung does not demonstrate that the necessary condition that the marginal rate of substitution of apples for honey be equal to the ratio of the prices of honey to apples holds. His conclusion that Pareto optimality is 'roughly' implied is thus unwarranted.

changes in property rights (necessary for internalising the externality) will occur only if the benefits of changing are greater than the costs (Coase 1960, p. 13). Coase (1960, p. 35) stressed that there is a strong presumption that when an externality exists, it is because 'it would cost too much to put the matter right'. It follows that 'the best policy is no policy' (d'Arge and Wilen 1974, p. 355).

The Coasian approach to externalities has served as the basis for the more recent property right approach to natural resource problems. The leader of the property right stream of thought, Demsetz, defines market exchange as exchange of property rights bundles (Demsetz 1967). Property rights, in turn, are defined as specifying 'how persons may be benefited or harmed, and therefore who must pay whom to modify the actions taken by persons' (Demsetz 1967, p. 347). It follows from these two definitions that an externality exists whenever property rights are non-existent or inadequate (Demsetz 1967; Cheung 1970; Pejovich 1972; Heller and Starrett 1976). ('Inadequate' or 'faulty' rights are impossible to exchange (Demsetz 1967).) This is another way of stating that externalities are non-market phenomena.

Property right economists contend that the absence of property rights (or the existence of faulty rights) is the cause for the existence of externalities (for example, Coase 1960; Demsetz 1967; Cheung 1970). And the reason for this absence of property rights is that:

What converts a harmful or beneficial effect into an externality is that the cost of bringing the effect to bear on the decisions of one or more of the interacting persons is too high to make it worthwhile. . . . One condition is necessary to make costs and benefits externalities. The cost of the transaction in the rights between the parties [internationalisation] must exceed the gains from internalization (Demsetz 1967, p. 348).

Or more briefly:

Thus externality is not an immutable natural or institutional characteristic of a good, but depends on the cost of making transactions and enforcing contracts relative to the benefit to be obtained (Gould 1983, p. 59).

It follows, for property right theorists, that changes in property rights over time reflect changes in the benefits and costs of contracting.

Externalities are thus defined by these writers as phenomena which do not differ in any way from market phenomena, except for one thing: the costs of delineating and trading property rights for externalities are greater than the benefits the operation would yield. The reasons for the existence of these high costs are not clearly developed. Demsetz (1967) mentions two causes of these costs: (a) 'natural difficulties' in trading associated with externalities (but does not develop this theme further, nor does he explain it); and (b) the prevailing legislation. He holds this legislation to be influenced by changes in the costs and benefits of delineating and trading property rights and contends that these changes arise when changes in technology and relative prices occur (Demsetz 1967, p. 360). Thus, to Demsetz (1967, p. 350) 'emergence of new property rights takes place in response to the desires of the interacting persons for adjustment to new benefit-cost possibilities'.

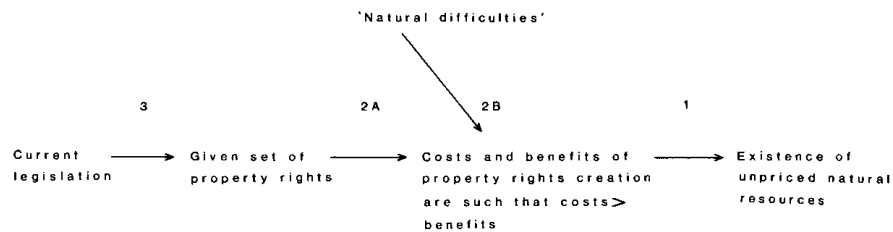
Cheung (1970), the other principal contributor to the property right approach, explains the existence of high establishment costs of property rights for externalities by briefly stating:

What was not worthwhile to enforce as private yesterday may be so today: changes in supply and demand conditions, technological innovations and improved methods of organisation may lower the transaction costs (Cheung 1970, p. 68).

The policy implications of this theory are that the establishment of property rights over all resources should bring about a Pareto optimum by internalising all externalities when property rights can be created at a low cost. ('Low' and 'high' costs clearly refer to the net costs or benefits of property right creation; this relative concept is represented in Figure 1.) Demsetz (1967, p. 357) assumes that this cost will be 'rather low' in most cases. He thus argues that the establishment of private property rights will either automatically internalise externalities (that is, the owner of a right to pollute will have to buy the right) or bring about private transactions (Coase's private bargaining) between affected parties, and thus the internalisation of the externality, at a minimum cost (Demsetz 1967, pp. 354-9).

However, other property right theorists consider that it may be costly for a community to establish property rights for externalities. As Heller and Starrett (1976, p. 21) note: 'Then the issue is not so clear' and the policy recommendations made by these authors become rather vague. Cheung (1970, p. 67) writes: 'The general issue is thus whether contractual arrangements or government regulations are economically desirable . . .' without defining what 'economically desirable' means to him. Heller and Starrett (1976, p. 21) state: 'Indeed, once this point [high cost of property right creation] is recognized, it is clear that rule of thumb procedures may in fact be optimal'.

Natural resources which are public goods (for example, national parks) are analysed by Chicagoans in substantially the same fashion as externalities (for example, Demsetz 1964; Coase 1974). The creation of private property rights over these resources is advocated on the grounds



Each arrow represents a causal link. The numeration of each of these links reflects the order in which Demsetz (1967) develops his argument

FIGURE 1—Static Private Property Right Theory Explanation of Unpriced Natural Resources.

that such exclusive rights will allow these resources to be allocated by the free play of the market. The spirit of the Chicagoan analysis of public goods is reflected in the following:

Our present purpose is merely to emphasize that there is nothing special and qualitatively different about any of these effects [externalities], including the effects which stem from what we ineptly call public goods, and that any special treatment accorded to them cannot be justified merely by observing their presence (Demsetz 1964, p. 26).

Common property resources (for example, oceans and air) are analysed likewise. The delineation of private property rights is seen as a solution to common property resource problems, for the same reasons as it is deemed to be a solution to externality problems. However, no pragmatic solution to the problem of delineating private property rights over resources such as oceans or wild animals is proposed by Chicagoan authors. Demsetz (1966, p. 64) acknowledges: 'I am unable at present to specify the procedure that should be followed for the assignment of property rights [over oceans] . . .' It must be noted that his argument focuses (implicitly) on open access or unregulated common property resources. He does not consider the case of successfully managed, commonly owned resources in his analysis (on this topic, see for example, Ciriacy-Wantrup and Bishop 1975).

The five causal propositions or links which constitute the explanation, model and predictions of Chicagoan theories of unpriced natural resources (Figures 1 and 2) are critically assessed in the following section.

Critique of Chicagoan Theories of Unpriced Natural Resources

Causal link 1

In link 1 (Figure 1), the existence of resource problems is related to the 'fact' that the costs of establishing property rights over these resources are greater than the corresponding benefits. These costs and benefits are not defined. However, Chicagoan economists consider that social costs and benefits (externalities) are ubiquitous in market economies. As Demsetz (1967, p. 348) notes: 'Every cost and benefit associated with social interdependence (e.g., market exchange) is a potential externality'.

This implies that costs and benefits of property right creation for natural resources must be defined as monetary and social costs and benefits. This amounts to explaining a phenomenon in terms of itself. In a valid scientific explanation, the existence of the generative mechanism is anterior to the existence of the generated phenomenon (Harre 1970, p. 125). Clearly, it is impossible that social costs and benefits exist previously to themselves. It follows that link 1 is a circular statement with no explanatory content.

Causal links 2A, 2B and 3

In links 2A, 2B and 3, property right theorists argue that high costs of property right creation over unpriced natural resources are caused by either: (a) 'natural difficulties' in trading associated with such resources

(link 2B); or (b) a given set of property rights (link 2A) which is the outcome of the current legislation (link 3) (see Figure 1).

'Natural difficulties' in trading are not defined. Demsetz (1967) briefly gives as an example of such difficulties the high number of parties involved in the trading of property rights related to air pollution. Cheung (1970, p. 67) states:

These costs [of property right creation over unpriced resources] vary, among other things, according to the physical attributes of the resource in question. In our example of marine fisheries, the difficulty of assessing, quantifying, identifying and policing private fishing rights is evident.

In spite of the absence of a definition of 'natural difficulties', it seems reasonable to surmise from these examples that these difficulties are intrinsic to natural resource problems (as indicated by the adjective 'natural' and the expression 'physical attributes of the resources') and do not exist for market goods. This, however, directly contradicts the view held by property right theorists that unpriced resources are similar in kind to market goods.

Even though simple observation shows that a given set of property rights may result in high costs of property right creation over unpriced resources, link 2A is a *non sequitur*. It does not logically follow that from any given set of property rights high costs of property right establishment over unpriced resources should emerge. Link 2A thus leaves unanswered the basic question of why some resources remain unpriced in a market economy.

That the current legislation in a society determines the set of property rights within that society (link 3) is evident under certain conditions. (For example, the power to enforce laws must be superior to the power of law offenders.) However, such a fact is not specific to unpriced resources; it also holds for market goods. Link 3 in Figure 1 is thus a valid causal link, under specific conditions, and even though it is not restricted to unpriced resources. However, it still does not explain why the prevailing laws in a market economy can result in the existence of unpriced resources.

Causal link 4

In Figure 2, changes in technology and relative prices are contended to generate changes in the ratio of costs and benefits of right creation, that is, benefits have become superior to costs (link 4). Instances of the kinds of changes in technology and relative prices which Chicagoans deem relevant can be found in the historical examples they present to validate their theories (see below). It appears from these examples that they simply include in their theory any technological or price change which modifies (for reasons which are not identified) the costs and benefits of property right creation for unpriced resources. Link 4 is thus logically sound, even though the causal relationship it establishes is rather trivial because of its lack of specificity.

Causal link 5

Link 5 asserts that 'the emergence of property rights takes place in response to the desires of interacting persons for adjustment to new

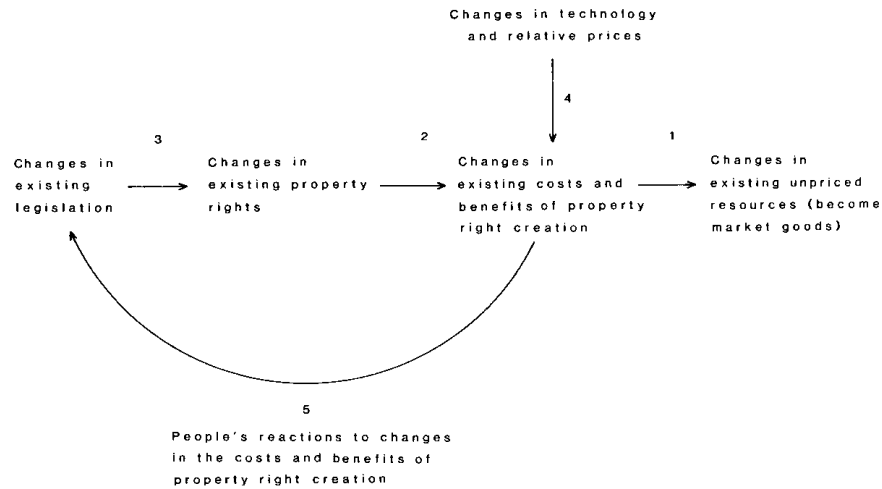


FIGURE 2—Dynamic Property Right Theory Explanation of Unpriced Natural Resources.

benefit–cost possibilities’ (Demsetz 1967, p. 350). Furthermore, Chicagoans consider that their paradigm explains how efficiency in the allocation of natural resources can be reached (Demsetz 1967, p. 350; Cheung 1970, p. 66–7).³ They do not specify if this concerns *ex post* or *ex ante* efficiency. A controversy exists regarding which of these two concepts is relevant to the analysis of collective choices made under uncertainty (see, for example, Harris and Olewiler 1979; Hammond 1983). Therefore, in what follows, the validity of link 5 is examined with respect to both concepts of efficiency.

If *ex ante* efficiency is the criterion used by Chicagoans (that is, efficiency of an expected state of nature, before realisation of this state of nature), then link 5 implicitly assumes that ‘interacting persons’ have an equal bargaining or lobbying power in regard to legislators. If lobbying power is unequal, then changes in legislation and the emergence of new rights can result from changes in the balance of power among parties (while costs and benefits of rights creation remain constant) as well as changes in these costs and benefits. The former will trigger inefficient legislative changes which do not reflect actual costs and benefits.

If *ex post* efficiency is the criterion used by Chicagoans (that is, efficiency in a realised state of nature), then link 5 not only assumes equal bargaining power but also perfect knowledge of the benefits and costs of property right creation. If these costs and benefits are not perfectly known, then the new set of rights which will emerge will be based on inaccurate costs and benefits, and will be inefficient.

The following empirical evidence shows that the two assumptions of perfect knowledge and equality of bargaining power cannot be assumed to be verified in the real world.

³ An important shortcoming of the Chicagoan paradigm, discussed in the literature in terms of Coase’s theory, is that it is tautological. As pointed out by Mishan (1967), for example, Chicagoans argue that optimality results from a given set of property rights. These property rights, in turn, are alleged to be the outcome of self-adjusting mechanisms leading to the fulfilment of the necessary and sufficient conditions for optimality. (The circularity of this argument is made visible by Figures 1 and 2.)

The changes which have taken place in US pollution laws since 1900 have been examined by Laitos (1975). His study shows that legislators from 1900 onwards have always been aware of their lack of knowledge of the costs and benefits of property right creation associated with air, water and noise pollution. He also shows that the strong bargaining power of polluting firms and the comparatively weak bargaining power of the individuals affected by pollution have consistently been correlated, in the United States, with legislation favouring the strongest bargaining parties in terms of the attribution of property rights.

A recent survey of US congressmen and members of committees dealing with natural resource problems shows that these officials — with very few exceptions — do not have a specific knowledge of the costs and benefits of property right creation for the resource policies on which they are working (Kelman 1983).

The enclosure movement in Great Britain also provides some interesting evidence. From the beginnings of the movement in the fifteenth century until the present, laws were passed by English monarchs to prohibit the enclosure of most commons because enclosure was judged to be too 'costly' for the peasants (see Tate 1967, chapters 5 to 8 and 13). These laws were ignored by some lords who kept appropriating commons for themselves. Tate, a British authority on the enclosure movement, examined in detail various instances of such unlawful appropriations:

It is clear that the legislation on the subject [of the enclosure movement] had been evaded, often because its administration was put into the hands of the magistrates, belonging of course to the very class which had most offended (Tate 1967, p. 67).

The unsuccessful riots organised by peasants to protest against such unlawful appropriations are a further indication that the new set of property rights created at the instigation of some of the lords was the result of an unequal balance of power.

Another instance of inequality of bargaining power between 'interested' parties can be found in the system of derogations to zoning laws in the Paris region (and elsewhere). To preserve existing green spaces, zoning laws prohibit building in designated areas in the region. However, a few developers with political connections have obtained derogations which allow them to build in these designated areas (Izac 1973).

Examples of cases in which changes in technology and relative prices led to changes in property rights which fulfilled some of the conditions for optimality can probably be found. However, the above evidence shows that the two hypotheses on which link 5 is based can be falsified. It follows that link 5 is not a valid generalisation, and therefore not a valid causal relationship.

Predictive power

Chicagoan theories predict that, provided a government abstains from intervening: (a) the resource remains unpriced if the costs of establishing property rights over an unpriced resource are higher than the benefits of the action; and (b) the resource becomes a market good,

that is, property rights are created over the resource if the benefits of property right creation are higher than the costs. It follows that whatever occurs, in terms of unpriced resources, is optimal; otherwise it would automatically change.

Property right economists use anthropological examples to support their second prediction (Demsetz 1967; Cheung 1970; Pejovich 1972; Coase 1974; Umbeck 1981). All these examples deal with a shift away from communal land ownership toward private land ownership. In his seminal article, Demsetz (1967) uses examples which are representative of the instances produced by the other authors. He cites the case of two Canadian Indian tribes which have evolved a private property right system, and of a third tribe which has preserved the communal ownership of its land. He argues that the two private property right systems are the outcome of a change in technology and relative prices which took the form of the appearance of fur trade. The fur trade 'made it worthwhile' for the two tribes to establish private property rights over previously communally owned land because the externalities associated with hunting beavers on communally owned land became 'too important' (Demsetz 1967, p. 352). Communal land ownership survived in the third tribe because 'the externality [associated with hunting plain animals on common property land] was just not worth taking into account' (Demsetz 1967, p. 353). To him, private property right creation was economically rational in the first two cases and not in the third one because beavers (hunted for fur by the first two tribes) have relatively small territories whereas plain animals (hunted by the third tribe) have large territories (Demsetz 1967, p. 353).

Demsetz fails to mention that his interpretation of change (or the absence thereof) in a social system is only one of the three main interpretations of social change which exist in anthropology, the field from which he draws his examples. Indeed a controversy exists among the anthropologists who explain social change from an economic-utilitarian perspective (as he does), those who advocate a cultural perspective, and those who subscribe to an ecological perspective. Empirical evidence has been presented in support of these different interpretations.

In pre-colonial India, for example, changes in property rights were determined by changes in the caste system (instead of technological changes) and were unrelated to changes in the costs and benefits of property right creation over unpriced resources (Neale 1957, pp. 226-7; Hopkins 1957, p. 301).

The Cherokees (an American Indian tribe) had established a balance with their environment before European contact. All natural resources were communally owned but common ownership externalities were maintained at a very low level by religious and cultural rules operating as an effective system of resource management (Goodwin 1977). The technological changes brought about by European contact through the skin trade and the use of European agricultural tools did not generate the adoption of a private property right system but resulted in overcutting of forests, soil depletion and overhunting (Goodwin 1977). Common ownership externalities reached a high level but were not internalised by the creation of private rights, as property right theories predict. Anthropologists concur that non-economic factors (such as the religious

and cultural values of the Cherokees) constituted the major obstacle to the creation of private property rights (Goodwin 1977).

These various examples are presented here to stress the relativity of Demsetz's interpretation of anthropological data, and to exemplify the impossibility of empirically testing the predictions of Chicagoan resource theories. This impossibility arises from the historical concomitance of the multitude of factors (for example, economic, social, political, historical, cultural and ecological) which can cause changes in social institutions such as property rights. Adelman and Morris (1978), for example, have provided empirical evidence of the historical concomitance of 35 socio-economic and political variables explaining social and institutional changes in 24 countries, from the middle of the nineteenth century until World War I. It is consequently impossible to prove, on the basis of *ex post* historical (or contemporary) data, that one of the variables concomitant with many others is the determinant cause of a given social change.

The two corollary predictions of Chicagoan economists are that: (a) the privatisation of communally owned resources brings about optimality in resource use through private bargaining; and (b) whatever property rights exist for a resource, the situation is 'optimal' otherwise it would change. Here again, the evidence does not seem to confirm the first corollary prediction. To use an anthropological example once more, the creation of private property rights consequent to the introduction of the fur trade to eastern Canadian Indian tribes does not appear to have led to optimality. In spite of these rights, beavers and caribous were overhunted and became extinct in most areas (Martin 1978, pp. 27-8 and 102-5). The resultant famines can hardly be considered to have been an 'optimal' situation for the Canadian Indians.⁴

However, both predictions are, in fact, untestable. Their testing would involve the empirical measurement of the theoretical concept 'optimal'. Such a measurement is impossible since the necessary condition for optimality, that marginal rates of substitution be equal to relevant price ratios, cannot be empirically demonstrated to hold because individual marginal rates of substitution are unknown quantities (see footnote 2).

It has been shown so far that link 1 (Figure 1) is a circular statement with no explanatory power. Link 2B (Figure 1) is logically inconsistent with the definition of unpriced resources that Chicagoan economists use. Link 2A is a *non sequitur*. Link 3 is a valid causal link. Link 4 (Figure 2) is a logically sound but trivial causal relationship. Link 5 was empirically falsified.

Chicagoan predictions cannot be empirically tested because of the historical concomitance of the numerous variables which can explain the creation of property rights. The corollary predictions are also untestable because such testing necessitates the empirical measurement of a theoretical concept which, by definition, is impossible.

⁴ Martin (1978, p. 3) stresses that this overhunting did not result from a lack of information. The long-term consequences of overhunting were acknowledged by most Indians; overhunting continued because of the pressures which missionaries and fur company agents exerted on some members of these tribes.

Because of these shortcomings, the use of the Chicagoan resource paradigm in policy making has specific consequences which are discussed in the following section.

Consequences of the Use of the Chicagoan Paradigm in Policy Making

If a government abides by the Chicagoan policy recommendations and lets its natural resources policy be shaped by the demands of 'interested parties', then game theory can be used to predict the resulting outcome. Pigouvian economists analyse resource problems in terms of the basic conflict of interests which arises between social welfare maximisation (when each individual uses a resource until marginal cost equals marginal revenue) and individual utility maximisation (when each individual uses a resource until average cost equals average revenue). Evidence shows that, in addition, the various users of a resource are likely to want to use the resource in different and mutually exclusive ways. An analysis of 3000 natural resource cases in 40 countries demonstrates that in each one of these cases the interests of various groups of users of the resource conflicted (Gladwin 1980).

Gladwin's (1980) study and the examples used in this paper show that conflicts over the use of an unpriced resource in which the government restricts its role to that of creating property rights can be characterised as three-person games in which the players are: player *A* — the government as legislator; player *B* — the lobbyists who perceive the resource as unique and want to preserve it in its 'natural' state; and player *C* — the lobbyists who perceive the resource as non-unique and want to use it in a consumptive fashion which alters its natural characteristics. A government following a Chicagoan policy does not attempt to identify social welfare (or the expected utility of society as a whole) but simply creates property rights. 'Society' is thus not a player in Chicagoan resource games.

These games are co-operative since some information is circulated between players, coalitions can be formed, and agreements between players are relatively binding. Players *B* and *C* must, to a certain extent, follow the rules set by player *A*. Further, player *A* cannot achieve, by itself, a positive payoff (expected utility of a given outcome) without some co-operation from one of the other players (unless this government is a dictatorship). This is because the enforcement costs of a resource policy which is not endorsed by at least one group of users are likely to be prohibitive. Enforcement and policing costs of resource policies are already substantial when co-operation exists (see Squires 1983 for evidence).

Gladwin's (1980) study shows that the outcomes of such conflicts can be classified as follows: (a) outcomes favourable to conservationists; (b) outcomes favourable to developers; and (c) outcomes which are compromises between the two. These outcomes will be Pareto optimal if these games have a core. The core of a game is defined as the set of conflict outcomes such that each player does not have both the desire and the power to change the outcome of the game. The core thus consists of all the Pareto optimal outcomes (see Shubik 1975 for a rigorous demonstration). However, by theorem, the core of three-person games

is empty if these games are constant sum and are essential (Vorob'ev 1977).

It is easy to check (by writing the characteristic function of Chicagoan natural resource games) that such games are constant sum and essential. Therefore, they have no core. It follows that if a government adopts a Chicagoan resource policy, the resulting allocation of resources cannot be Pareto optimal, contrary to what Chicagoan economists contend. The absence of a core means that this allocation will reflect only the relative political bargaining power of the coalitions present, and will not be stable. A change in the balance of power will bring about a different outcome. Consequently, a government which follows a Chicagoan policy will use the interests or desires of those who have the strongest bargaining power in the development of a resource allocation criterion.

Each conflicting party will have considered only a subset of all the relevant economic, social and environmental costs and benefits of the resource allocation they advocate. This subset is that which is consistent with their own perspectives and interests. Further, each party is also likely to have a rate of time preference which reflects their own perception of the 'best' use of a resource, and which may, therefore, differ from society's rate of time preference. In this context, using the desires of the winning coalition as an allocative criterion can lead to three principal kinds of problems. First, the resulting resource allocation may not be the one which society would choose if all the relevant costs and benefits were taken into account. This allocation is thus unlikely to be rational from an economic viewpoint. Second, if the resource use advocated by the winning coalition is not reversible, and if the coalition's and society's rate of time preference differ, the welfare of future generations may be negatively affected. Third, the equity or fairness of the resulting allocation may be questioned on the basis that it does not conform to democratic ideals — which Chicagoans themselves generally endorse.

Clearly, these issues form a whole host of complex and inter-dependent economic, environmental and distributional problems. This necessarily brief and schematic description serves to stress that the use of the Chicagoan allocative criterion will result in resource allocations which are non-optimal and may not be rational from economic, environmental and distributional viewpoints.

Concluding Remarks

The foregoing critique shows that out of the five propositions which constitute the core of property right resource theories, three are logically or empirically invalid and one is a trivial statement. Furthermore, the predictions yielded by these theories are untestable. This conclusion should not detract from the real contribution of the Chicago School to the understanding of the role of property rights in natural resource problems.

Game theory was used to show that the implementation of Chicagoan resource policies will lead to resource allocations which are not Pareto optimal and which are determined by the relative political power of the parties in conflict. This results from some of the major flaws of the

Chicagoan paradigm. For example, the paradigm is centred around the concept of optimality and fails to account for differences in political bargaining power. It is thus not surprising that since optimality does not exist for natural resource problems in which the government has only a legislative role, the use of Chicagoan policies will bring about resource allocations determined, precisely, by the relative power of the parties involved. Such allocations are likely to be unacceptable to most economists for economic, environmental and distributional reasons.

Perhaps it is ironical that Chicagoans, who are concerned about the inefficiency of government intervention (and evidence of this inefficiency is easy to find in the 'real world'), would advocate a resource policy which must ultimately rest on government intervention — through property right delineation. Because this delineation mainly results from the political manoeuvres of a few conflicting groups, it leads to resource allocations which have many of the drawbacks of Pigouvian government interventionist policies. This is in spite of the fact that this property right delineation is congruent with the Chicagoan theory of the state. Chicagoans generally identify political and economic freedom with individualism, the dominance of private property in society and a very restricted role for the government. In this role, the government administers the constitution (or common law) and must refrain from creating new laws of its own accord.

If 'the government', which is conceived as an enforcing agent for individual rights, itself captures powers to change the legal structure, individuals are deprived of rights and their existence becomes equivalent to that described in Hobbesian anarchy (Buchanan 1975, p. 84).

The above argument possibly has helped to show that natural resource policies cannot be classified into 'market' and 'government interventionist' policies. In fact, such an oversimplified classification is very misleading. Real world conditions do not conform to ideal economic models and ideal market solutions to resource problems are no more feasible than ideal governmental solutions. Natural resource and environmental problems are just as ubiquitous in the USSR as they are in western industrialised countries; in spite of this, Soviet economists generally contend that such problems cannot exist in a system which, by definition, ensures that social welfare is maximised. Their argument is not too far removed from the argument of Chicagoans who hold that unpriced resources cannot be misallocated by a free market system which, by definition, will reach optimality.

The argument presented in this paper indicates that further research is needed concerning decision criteria for the allocation of natural resources. In view of the conflicts of interest which normally exist among users of natural resources, maximisation of social welfare is not an attainable policy objective. A feasible decision rule would thus simply aim at increasing an objective function which accounts for all the relevant costs and benefits of a resource policy to all the different groups of users of that resource. The aggregation rule used for this function could be, for example, an explicit weighting of these costs and benefits. The explicit weights would reflect the political judgment of a given government. Such a decision rule would include all relevant economic

variables and would also make explicit governmental trade-offs between the interests of different groups of users. It would, of course, lead to a specific distribution of property rights over natural resources, but this distribution would be congruent with some openly stated policy objectives instead of being determined by the winning coalition. (For a more detailed discussion of one such decision rule, see Izac 1985.) This would have the advantage (to those outside of government) to make decision makers more accountable for their natural resource decisions.

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