A ROLE OF COVENANTS IN MARKETS FOR NATURAL RESOURCES

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Abstract

The balanced use of resources in a market-based economy is a difficult issue when the uses of some resources can be readily priced and others cannot. As the population of the world increases the value placed on a number of resources such as land for collection of clean water and forests is likely to increase considerably. This implies greater competition between interest groups for the use of these resources. Consideration is given in the paper to the role of covenants on the use of resources in the setting up of markets related to resources which have public good characteristics.

Keywords: covenants, land use, public goods, resource use

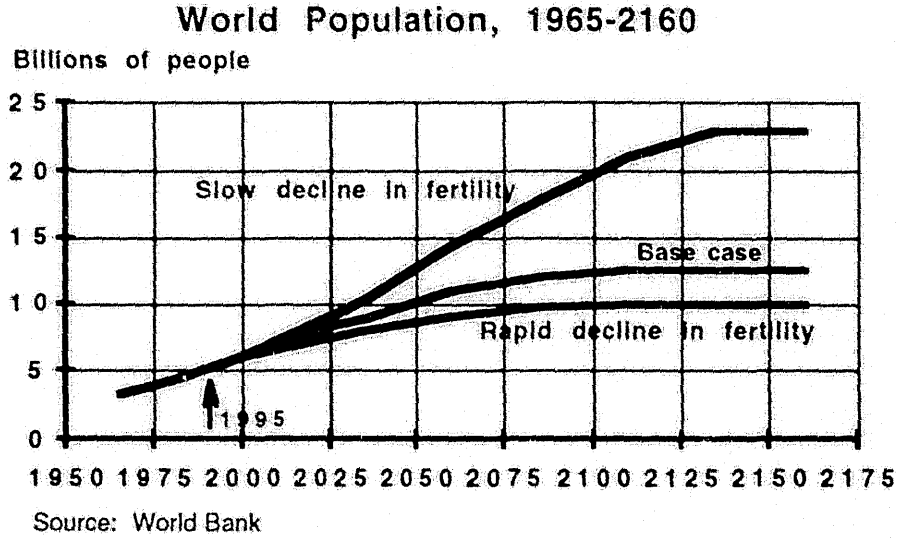
This paper is about opening up a discussion and testing an idea that may hopefully have some policy relevance. It may hopefully also lead to further research into the issue. However, the proposal at this stage is somewhat ill-developed and an idea requiring further investigation. Clearly the use of covenants is an idea that is connected with actions that are currently being taken in many places around the world on the use of resources which have public good characteristics. The focus of the paper will be on the use of land and the definition of use rights.

In economics, it is assumed that a utility function can represent the preferences of individuals. There is then a physical, economic and social system within which these preferences are expressed and which acts as a set of constraints. In the rest of this paper some of the economic questions relating to a dramatic growth in population in the context of a limited land area for agriculture will be explored using a reasonably simple comparative static model. Consideration will be given to the problem of the competition for the use of land between agriculture and uses for which a market in land is well established and also the uses of land for which there is no market such as the need for space, the preservation of species, the provision of clean water and other uses which provide goods and services which have the characteristics of public goods. These will be referred to as amenities. Behind these questions is the question of the nature of the institutional structures that might be used to allow for an improved allocation in the use of land as populations around the world increase. Randall (1994) supported the idea of a safe minimum standard as a means of dealing with the issue of sustainability. The notion of safe minimum standards is extended to the use of legally binding covenants as a means of restriction on the use of resources when there are externality issues involved.

World Population Growth

By the year 2100 or even earlier, world population is projected by the World Bank (1992) to double (Figure 1). There are obviously many uncertainties about such projections but it is clear that there will be very significant increases in population in the lifetime of the next generation. At the same time the available land area in many countries around the world on which agriculture may be expanded would seem to be quite limited. World-wide, the average annual

growth rate over the period 1965 to 1989 in the land in agriculture and permanent pasture was 0.3 per cent (World Bank 1992, p. 201 and Table 1 below). Thus, within the lifetime of children at school today the world faces a phenomenon it has never faced in the period of existence of the species of man. That is, the very rapid growth of the total population requiring food but with little scope to increase the land area devoted to food production. Biologists and scientists have studied population dynamics for biological species but there is an additional set of dimensions to the issues of biological population dynamics when economic questions must be added to the basic biological problem. The human species seems to be able to respond to both economic, social and political signals. These, of course, must be clear and effective signals. One of the major factors reducing population growth rates is rising incomes while a major factor in increasing population growth has been the impact of medical science on death rates.



Source: World Bank

TABLE 1

Shares of Total World Land Area by Use and Annual Average Growth Rates

Country group	Agricultural	Permanent pasture	Forests and woodlands	Other
	Shares of total land in 1989 (percent)			
Low income	13	27	25	36
Middle income	10	29	33	29
High income	12	25	30	33
World	11	25	31	32
	Average annual growth rate, 1965-89 (per cent)			
Low income	0.2	0.0	-0.4	0.3
Middle income	0.7	0.1	-0.4	0.2
High income	0.2	-0.1	-0.1	0.1
World	0.3	0.0	-0.2	0.1

World Bank (1992), pp. 200-201.

As the population of the countries around the world rise there has been and likely to continue to be increased demands for fresh water, recreational areas, preservation of species, forests as transformers of greenhouse gases, and all the myriad of other functions and uses modern societies have for land. (The oceans are not considered so as to keep the discussion reasonably focussed.) At the same time there will be increasing demand for food and fibre. Since under current technology food and fibre production is heavily dependent on land there is likely to be an increasing demand for land to use in food production unless the rate of growth in yield exceeds the rate of growth in demand. The rate of growth in yield clearly depends on the investment that countries make in research directed at increasing yields and the more efficient use and management of the land resource.

Public Goods

In this broad and generalised description of the nature of the population and land use problem, food and fibre consumption can be considered as a general private good and the amenities and services produced from land in the public domain as a public good. Randall (1987, p. 176) notes the possible confusion with the definition of a public good and distinguishes between rival and nonrival and exclusive and nonexclusive goods (there are four possible combinations of these two characteristics). In the case of nonexclusive goods and resources the solution to the problem is the specification of exclusive and non-attenuated property rights which can be effectively enforced. In some cases the costs of specifying and enforcing the rights may be such as to make it uneconomic to do so. However, investment in research and new technologies can lead to the possibility of reducing these costs. In such cases where the costs are too high direct government regulation of various kinds is frequently used.

In the case of rival goods the use by one individual precludes the use by another individual. When nonrivalry is present then the use by one individual has no effect on the use by another person. Also, the total amount of the nonrival good may be enjoyed by each individual. The amenities and services produced from land in the public domain may be both nonexclusive and nonrival.

Randall (1987, pp. 169-171) has outlined the basic economics of an efficient product mix in the case of a rival and nonrival goods. In this case the production possibility frontier applies as in standard production economics theory. However, consumption must be treated differently. In this case the rival good is allocated between the two consumers while the total amount of the nonrival good is consumed by both consumers. The allocation is adjusted until the sum of the rates of commodity substitution between the rival good and the nonrival good (RCS) for the two individuals is equal to the rate of product transformation (RPT) on the production possibility frontier (Figure 2).

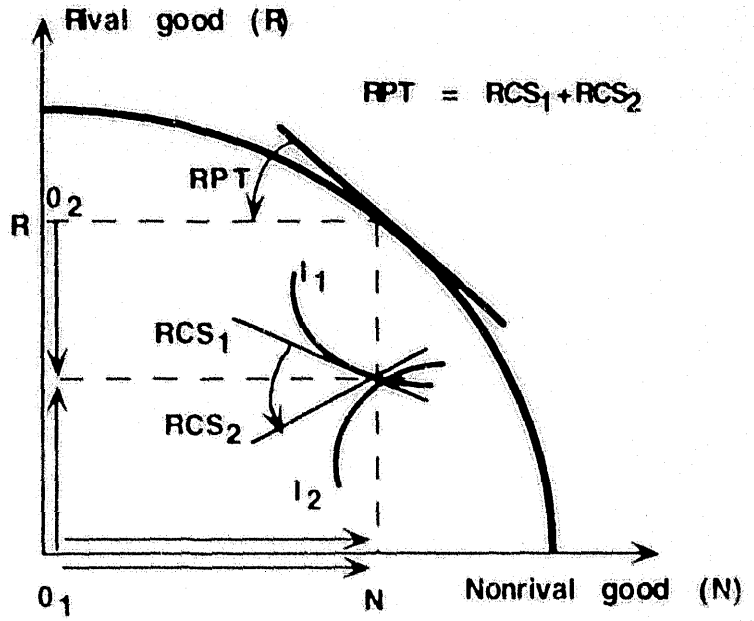


Figure 2 Efficient production and consumption of rival and nonrival goods

This problem can be formulated as a maximisation problem (Henderson and Quandt 1980, p.299) where the utility of one consumer of private good q_1 and a public good Q is maximised subject to the constraints that the level of utility of the second consumer is constant at U_2^0, the producion frontier F, and a quantity total. A slightly modified version of the problem is:

Maximise $U_1(q_1,Q)$
subject to

$$U_2(q_2,Q) = U_2^0$$

$$F(q,Q) = 0$$

$$q = q_1 + q_2$$

Deriving the first order conditions for the problem and rearranging it can be shown that:

$$\partial F/\partial Q \,/\, \partial F/\partial q = \partial U_1/\partial Q \,/\, \partial U_1/\partial q_1 + \partial U_2/\partial Q \,/\, \partial U_2/\partial q_2$$

that is

$$MRT_{Q,q} = MRS_{Q,q_1} + MRS_{Q,q_2}$$

This model can readily be generalised to many goods and many consumers. Implicit within it is the notion of a Nash-Cournot equilibrium as described in Cornes and Sandler (1986).

The Role of Technological Change

Smith (1974) has written in detail on the implications of technological change when there are manufactured goods and environmental amenity goods. This work points to the idea that with irreversibilities in production and limited substitution between manufactured and amenity goods that asymmetric technical change (in the sense that it will affect manufactured goods more than amenities) increases the community's ability to provide manufactured goods but leaves amenities largely unaffected and likely to become more scarce Smith (1974, p, 105). He also

points out (Smith 1972) that the ' ... effect of continued undervaluation of environmental services has been to induce a pattern of technical change which is biased in the direction of excess residual production and away from increased efficiency in the supply of resource amenities'. Cornes and Sandler (1986, p. 87) also consider the issue of technical change in both private and public goods production. They conclude that an increase in the efficiency of production of the public good will lead to an expansion in the use and production of the public good. An increase in the efficiency of the production of the private good will lead to a substitution away from the public good into the private good but with the possibility that welfare is reduced as a result. The outcome hinges on the level of consumption of the private good and also the elasticity of substitution between the public good and the private good.

Thus it is likely to be important in the future, as population rises along with incomes, that the relative valuation that society places on the various uses of land be effectively expressed and that appropriate relative valuations be determined.

Induced Technological Change

The theory of induced technological change, originally proposed by Hicks (1932), implies that changes in the relative prices of the factors used in production will change the investment in research effort and thus relieve the relative scarcity implied by a relative rise in the price of a factor of production (Hayami and Ruttan 1971). It thus clear that receiving appropriate market signals in terms of prices for land used in food and fibre production versus that used for the production of environmental amenities is important. To do so the analysis of the nature of public goods suggests that it may be possible to define a set of property rights to deal with the problem of nonexclusivity in the use of land for the production and consumption of amenities. Thus the suggestion is made for a system of tradeable covenants on the use of land.

The Nature of Covenants

A covenant can be considered as a legally binding restriction on the use of a resource, in particular, a restriction on the use of land. A covenant thus usually restricts one or more uses from among a number of possible uses of a resource. Consider a parcel of land which could be used to produce public amenities, could be farmed or could be used for construction of buildings. By zoning or the use of covenants it is possible to prevent any one of the uses by legislative or legal authority. From an economic point of view there will be a shadow value on any restrictions on the use of a resource if the restriction is effective. It is also apparent that there is a cost involved in the setting up of the covenant and in policing it. There may also be some costs involved in maintaining the resource in the covenanted use that would not be present if the covenant were removed (for example, weed and pest control on land used for public space). If land is zoned into collective uses only, such as national parks and other sets of uses such as water collection, preservation of species and so on, then it seems reasonable to treat such land as a zoned or covenanted public good.

A problem that is then faced by public administrators is how to determine the amount of land, or for that matter other resources, to be restricted in use. This is a significant problem when the alternative uses for land are in the production of marketable goods such as food, fibre and forest products. It is also a problem when powerful lobby groups are set up expressly to lobby for the 'preservation' or specific use of a resource. Sometimes this is a resource for which expectations about future production of marketable commodities have already been formalised such as in the case of native forests.

Anderson and Hill (1980, p.5) point out that the ownership of an input or output will be exchanged only if the marginal value of the ownership given up is less than the value of ownership obtained. They also note that voluntary trade involves the expectation of a positive-sum game and that trades will only be assured of being positive-sum games if there are no externalities involved. This condition also then ensures that society, as well as the individual,

gains from trade. Responsibility and accountability is argued by Anderson and Hill to also be important in ensuring that voluntary decisions are positive sum for society. They then note, that to ensure that voluntary actions of individuals are productive rather than non-productive transfer activities, the ownership must be exclusive. That is (Anderson and Hill 1980, p.5), '... property rights cannot be attenuated without incurring a social cost.'

Anderson and Hill (1980, p. 9) suggest that a case can be made for transfers of resources by use of the coercive power of government on the grounds of legitimacy of use of the resources (the resources may have been stolen) and for public goods reasons. They note the difficulty of controlling the extent of the use of that power. Once the mechanisms have been established there is little to hinder every individual and group from approaching government and arguing for the use of the power in their favour and potentially against the interests of some other group. Thus incentives are put in place for non-productive transfer activities.

From the work by Anderson and Hill it is apparent that transferability in covenants or land-use rights is likely to be preferable to non-transferability and also to direct regulatory mechanisms. However, they also point to the need to be able to specify and enforce the property rights involved. This, can also be argued on the basis of analogy to much of the work on the transferability of quota rights in industries such as agriculture, fishing (Lal, Holland and Power 1992; Baulch and Pascoe 1992) and even for atmospheric pollution (Hinchy, Thorpe and Fisher 1993).

Implications of Population Growth on the Use of Land

To begin, consider a very simple model. The primary concern is: How will individuals choose to use land when there are public unpriced uses and the production of food as a private good is one use for land. There is also assumed to be a limited area of land but a fixed production of food per unit of area. It is assumed the individual consumes an aggregate good, y, which could be represented by food which is produced from the land, a_1, and to also gain satisfaction from the use of the land as 'space', a_2. Individuals are assumed to be concerned only about the aggregate amount of land in use as space, A_2, rather than an allocation per person, a_2. This implies that the services from the land used for space to be of the nature of a public good. Thus the term $A_2 = N^*a_2$ enters the utility function where N is the total population. The total area of land is represented as $\bar{A}$. It is assumed for simplicity that the two types of land uses are mutually exclusive. The second type of land may have many diverse uses but the key feature of it is assumed to be that it does not have an explicit market price and that it is not used in the production of y. To begin with, this issue will be downplayed other than that the land enters into the individual's utility function. The constraints under which the consumer/producer operates are assumed to be that y is produced in fixed proportion to the land a_1, and that the total land is divided between the two uses on a per capita basis. Thus the simple model is as follows:

(1) $U = U(y, A_2)$

(2) $y = \beta a_1$

(3) $A = N a_1 + A_2$

It is also assumed that there is diminishing marginal utility for additional food and also for additional 'space'. A truly naive production system is assumed on the basis that the input-output coefficient, β, will be some complex function of relative prices (some form of the induced technological change hypothesis might be used). Finally the total land area must add up. It should be noted that the utility function bears some resemblance to that in the set of models referred to as 'club' models except that the population does not appear in the utility function. This is not included since it is implicitly assumed that the individual consumer/producer is not concerned with changes in membership of a club as all members of

society are assumed to have access to the 'space' represented by A_2 (Cornes and Sandler 1986, p. 165). This assumption could be relaxed.

By forming a Lagrangian function the first-order conditions for an optimum may be obtained.

(4) $L = U(y, A_2) + \lambda_1(y - \beta a_1) + \lambda_2(A - N a_1 - A_2)$

The first-order conditions are:

(5) $\partial L/\partial y = \partial U/\partial y + \lambda_1 = 0$

(6) $\partial L/\partial A_2 = \partial U/\partial A_2 - \lambda_2 = 0$

(7) $\partial L/\partial a_1 = -\beta \lambda_1 - \lambda_2 N = 0$

(8) $\partial L/\partial \lambda_1 = y - \beta a_1 = 0$

(9) $\partial L/\partial \lambda_2 = A - N a_1 - A_2 = 0$

By totally differentiating these first-order conditions with respect to population, N, solving, and making assumptions about the signs of the partial derivatives, it is possible to assess the likely impacts of an increase in the population on the relative land use (the Mathematica computer package was used for this purpose).

If it is assumed that there is diminishing marginal utility to consumption of both y and A_2 and that the cross-utility effects are zero then a marginal increase in the population will lead to a negative effect on the land per person used for food production, a negative effect on food consumed per person but an ambiguous effect on the public good, A_2.

If change in the yield of food is considered, that is totally differentiating with respect to b, then the reverse result is obtained of an ambiguous effect on the level of food consumption, y, dependent on the balancing of the declining marginal utility from the use of additional land allocated to food production and the positive effect of increased yields.

Illustration of Market-Based Solutions

Within the literature and as practical illustrations a list of examples of the use of defined property rights to control the use of land and water is provided. These are often voluntary in character. The examples illustrate the diversity of the approaches used and that the idea of a set of tradeable covenants in some ways generalises the types of definitions of property rights that have been used. Anderson (1991) gives information on the following:

Privatising instream flows
Private ownership of streams
Rights to fishing streams in the United Kingdom
Private rights for migratory fish and wildlife (eg breeding of salmon in hatcheries)
Hunting and fishing clubs supporting fish and animal species
Land holders providing hunting leases
The Nature Conservancy in the United States—purchase of land for conservation (tax exempt) and conservation contracts

Other examples have been outlined by Bennett (1995):

Earth Sanctuaries Pty Ltd based in South Australia uses funds from tourism to protect endangered species in sanctuaries

Australian Bush Heritage Fund raises funds to purchase areas of Tasmanian forests

New Zealand Native Forests Restoration Trust uses a title covenanting arrangement and publicly raises funds and has tax-free status

Royal Forests and Bird Protection Society of New Zealand owns land reserves

A variety of clubs and societies which may focus on lobbying of governments or the purchase of land.

Bennett (1995) also points to the case of the Queen Elizabeth II Trust in New Zealand which was established by Act of Parliament in 1977 and aims to help landowners protect land by arranging covenants over the land's title. The trust assists in the covenanting process through the provision of surveying expenses, legal services and fencing. Incentives are given to land owners through reductions in rates paid to local governments. Within Australia the Victorian Conservation Trust has a similar covenanting role in Victoria and in New South Wales the National Parks and Wildlife Service provides similar facilitation for conservation agreements (personal communication, R. Gillespie, Environmental Policy Division, National Parks and Wildlife Service, NSW, February 1996 and Conservation Agreements brochure). In the case of the Victorian Conservation Trust and the New South Wales National Parks and Wildlife Service there are objectives to set up 'revolving' funds which can then be used to fund the purchase of environmentally sensitive areas and then sell the land with a conservation covenant. This implies that the government pays for the covenant and thereby bears the cost of any reduction in the value of the land because of the imposition of the covenant. The mechanism provides a means of extending limited conservation budgets over a much larger area of land.

Finally, in all the examples illustrated, there are no cases of freely traded covenants. Using the analogy of tradeable quota rights for fishing it seems possible that if the transactions costs are not excessive that a market or markets in covenants would be feasible. In this case the resource to which the covenant was attached would be tradeable under the restrictions of the covenant attached at the time. In essence, all privately owned land has a range of covenant restrictions implicitly or explicitly attached to it. These restrictions may be general in nature or quite specific.

For a market in covenants to operate the original supply and nature of the covenants would need to be determined and allocated. The nature of covenants might, in principle, match the types of values people place on resources. Randall (1987, pp.252-3) describes these as 'use' values, 'option' values and 'existence' values. Within these categories a wide range of different covenants might be developed. These could include visiting rights only, settling rights, various harvesting rights, agricultural rights, scientific investigation rights, planting rights, hunting rights, mining rights, etc. It is possible to conceive of a 'null' covenant in which access and use of any kind is not permitted. Such a covenant would reflect existence values. The owner of the resource, such as land, would own the land purely for the potential capital gain that might be made in trading on the rising value the community may place on existence value. Clearly some locations and sites may have higher existence values than other sites so that for the owner wishing to convert an area of land from another type of use it would be possible to sell the existing covenant and purchase a 'null' covenant. In a freely operating market for covenants and land the value of the land would change by the value of the additional restrictions on use and the price of the covenant would reflect the supply and demand for covenants. The demand for covenants would reflect the desire of the community for land with a given level of restriction and the supply of covenants would have been determined, at least initially by the structure of the existing land use. Government could clearly enter into the market for covenants and buy covenants to reduce the supply or auction additional covenants of various types.

The issue of the equity of the distribution of such covenants would require detailed research. In principle the initial distribution would be designed to allow existing types of uses of land resources to continue. Such a system also raises the possibility of private ownership of a very large part of the nation's publicly owned land estate. Sale by auction of large tracts of crown

land would be possible under 'null' or near null covenants. In doing so governments would have an extended base for capital gains taxation and also through careful specification of covenants may have a means of collecting taxes for the maintenance and conservation of areas based on community valuations of those areas rather than the use of general taxes.

Finally, by setting up a market in covenants which is parallel to the market for land, the rights to use or non use of land are partly separated from the land itself. In this way the relative value of land in terms of a wide range of different uses can be established. This should greatly clarify the nature of the research and development investments that should be made to develop increased productivity in the production of not only food but also the use of resources in the production of amenities.

Concluding Comment

When the costs of implementing and the costs of policing are not so high as to prevent the structuring of covenants it would seem possible to set up what can be termed a 'market in covenants'. This involves the clear definition of detailed bundles of property rights which go beyond those that currently seem to be available. Such an approach focuses on the problem of property rights and also the issue of transactions costs.

What has been described is a broad picture of the population, food and resource use problem facing the world and then an attempt is made to connect this problem to the need for institutional change and development. The basic argument hinges on the notion that in a market driven world the relative valuations of both private goods and goods with public goods characteristics need to be expressed as clearly as possible if the appropriate investments are to be made in research and development and in the adoption of technologies. It is apparent that there is no perfect solution because of the transactions costs that are frequently involved. However, helping to more clearly express the valuations by individuals on the resources they use appears to be a worthwhile objective. It is also apparent that investment in yield improving technology for food and fibre production is likely to be one way to at least partly alleviate some of the problems of environmental conservation.

Finally, the paper is an expression of a more general view that approaches to the management of externalities is one of the very important issues facing applied economists today. Much has been written at a theoretical level but much more needs to be done in finding practical ways of internalising externalities.

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