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OPTIMALITY, SUB-OPTIMALITY, NIRVANA, AND TRANSACTION COST: FORAGING ON THE COMMONS*

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Introduction

Much of the literature on the management of common-property resources is focused directly or indirectly on enhancing the evidential basis for the formulation of policy. Therefore the assessment of the effects of a variety of factors, including institutional arrangements, on outcomes associated with the exploitation of common-property resources is a common theme.

But how do we measure outcomes? How do we know how well we are doing? A number of relevant categories of outcome measures have been proposed or used in literature. Prominent among these are measures of economic efficiency, equity, and sustainability (see for instance Berkes, Feeny, McCay, and Acheson 1989; Feeny, Berkes, McCay, and Acheson 1990; Feeny 1992; Norgaard 1992; Oakerson 1992; Ostrom 1992; Ostrom, Gardner, and Walker 1994; Rothenberg). Each of these categories includes a diversity of measures and indicators.

A large number of challenging issues arise in selecting outcome measures including the choice of viewpoint from which to assess outcomes, time horizon, choice of normative system, measurement properties of the indicators selected (including reliability, reproducibility, validity, and responsiveness), and practical implementability of the indicators. For the most part, I will ignore these difficult issues.

To simplify the analysis, without implying any lack of legitimacy to alternative viewpoints (or special legitimacy to the viewpoint selected), I am going to assume an anthropocentric viewpoint. An outcome that matters is human welfare. I am assuming that a fundamental objective in managing common-property resources is to enhance the welfare of human beings [[florin]] both current and future generations.

Again without implying any lack of legitimacy for equity and sustainability as measures of outcome, I will focus my attention on the use of economic efficiency as an indicator of outcome.

Concepts of Economic Efficiency

I will begin with textbook style definitions. For the outcome to be efficient a number of conditions have

to be met. For instance with respect to the level of production, efficiency occurs at the level at which marginal social benefit equal marginal social cost. Similarly with respect to the use of inputs, production efficiency occurs when marginal factor cost equals marginal factor revenue. Thus in the context of common- property resource management, where by definition there is a negative externality (Oakerson 1992; Berkes, Feeny, McCay, and Acheson, 1989; Feeny, Berkes, McCay, and Acheson 1990), the efficient level of utilization of the common-property resource occurs when the cost to the user and the cost the user imposes on all others are just balanced by the benefit derived by the user. A related criterion used in economics is Pareto optimality. A particular allocation is Pareto optimal (taking the existing income distribution and distribution of rights as given) if there is no change that would make someone better off while making no one worse off.

These concepts are powerful, in particular as normative standards against which to compare outcomes derived in abstract economic models. The operational content of these criteria is, however, often quite limited. Just as "assuming there are frictionless" pulleys is useful to understand the principles of physics, MSB = MSC is a useful standard against which to compare various equilibrium outcomes derived within models. Nonetheless it is useful to examine, in a cursory fashion, some selected evidence on the efficiency of common-property resource management.

Evidence on Optimality

Without claiming generalizability and representativeness, I will briefly examine evidence on optimality in three contexts: abstract bargaining models, controlled laboratory experiments, and natural field settings. A few "case studies" from these categories of inquiry will be examined.

Bargaining Model

Imagine the following extended thought experiment. The "three amigos," three potential users of a common-property resource, discover a commons [[florin]] a meadow suitable for grazing sheep. Each person is endowed with a technology for exploiting the commons and a reservation value, the return they can obtain in some alternative use of their time and thus the minimum they require to make it worthwhile for them to remain and exploit the commons. The production technology is such that for each herdsmen output increases with the activity level of the herdsmen but at a diminishing rate. In addition, each user imposes a cost on all users and that cost increases at an increasing rate. Production generates a negative externality.

What will the outcome be? Rodgers (1994) examines outcomes in a number of institutional settings. If the three amigos are able to exclude other potential users of the meadows but impose no restrictions on the activities of mutual owners, the resulting uncoordinated activity levels are not efficient. If instead the three amigos also bargain among themselves what will the equilibrium look like? Will the bargaining solution be efficient [[florin]] will it match the socially optimal level of utilization of the commons? Rodgers (1994) shows that a variety of solutions to the bargaining problem are possible. Rodgers also shows that it is unlikely that the three users will bargain to the socially optimal plan. In the bargained solution the users are likely to do better than if they ignored the negative externality and acted in a totally uncoordinated and atomistic fashion. They are also unlikely to reach the best possible outcome. Part of the intuition behind this result is that each user guards his self interest and even though he is aware that total returns from exploiting the commons could be higher, he has little personal incentive to curtail his grazing effort further. Rodgers (1994) also shows that in a number of circumstances, efficiency can be improved if one user, the manager, unilaterally sets access prices for use of the meadow. On the other hand, access prices set by bargaining are unlikely to lead to efficient levels of activity. Furthermore, if the

resource is privatized, it is likely that efficient activity levels will be achieved. In general, bargaining solutions are unlikely to be efficient unless there is an allowance for side payments.

Even in the abstract world of a bargaining model, it is not easy to achieve optimality. Bargaining and coordination have considerable potential to do better than a total lack of coordination but are unlikely to achieve the normative ideal. Thus the three amigos are successful in that they avoid the "tragedy of the commons" and in that they are able to devise a solution that will permit them to continue to use the commons without degrading the resource. The three amigos are also successful in that the solution provides each of them with a higher level of welfare than their reservation utility. But the solution is unlikely to be a first best optimum.

Controlled Laboratory Experiment

Do participants in controlled laboratory experiments that capture a key characteristic of common-property situations, rivalry or subtractability, achieve the most efficient outcome? The experimental literature indicates that certain characteristics of the environment, for instance the provision for communication, monitoring, or sanctioning, often enhance the efficiency of the outcomes (Feeny 1992; Ostrom, Gardner, and Walker 1994; Hackett, Schlager, and Walker 1994). In most experimental environments the costs of establishing and maintaining the rules of the game [[florin]] the costs of operating the institutional framework in which the experiment takes place [[florin]] are borne by the experimenters. Even in such environments, subjects often, but not universally, fail to achieve the optimum allocation of resources (Ostrom, Gardner, and Walker 1994, p 196). Although it is often the case that subjects avoid the "tragedy of the commons" outcome and do achieve considerable levels of cooperation, full optimality is not a routine outcome.

Field Settings

It is not difficult to find case studies that conform to the predictions of the "tragedy of the commons" paradigm. It is also not difficult to find "success" cases. In these cases users are able to exclude outsiders. Users are also able to create and maintain institutional arrangements that provide for sufficient coordination and enforcement and achieve outcomes that avoid the serious degradation of the resource (see for instance National Research Council 1986; Berkes 1989; Bromley et al 1992; Feeny, Berkes, McCay, and Acheson 1990; Ostrom 1990; Ostrom, Gardner, and Walker 1994). But are these outcomes optimal? Given the difficulties of operationalizing criterion such as Pareto optimality it is difficult to know. Nonetheless an examination of a few "success" cases tends to indicate that while users of the commons are able to fashion workable solutions to their problems, they are probably not achieving first best outcomes

For instance take the successful South Asian village irrigation and grazing systems described by Wade (1988, 1992). Villagers are able to cooperate in a limited number of activities. Villagers in fact achieve a great deal through cooperation. For instance, collusion with respect to bidding for the monopoly on the local sale of alcohol generates important revenues for village schools. Fees for post-harvest grazing rights also generate sizeable revenues. Collective action enables the villagers to divert additional water into the village-managed irrigation system and successfully maintain that system. Is the outcome optimal? Probably not. Although the rules governing the allocation of water are consistent with the maintenance of a stable coalition of water users and appear to be viewed as equitable, the resulting allocations are unlikely to be efficient. The cost of providing water to "tailenders" [[florin]] plots located distant from the point of water intake for the system [[florin]] is higher than the cost of providing water to the "headenders". The rule adopted by the users in allocating water rights is that everyone's plot must be

adequately wetted. Thus the distribution of water is unlikely to be efficient because it allocates "too much" water to high-cost of delivery users (tailenders) and too little to low- delivery cost users, headenders. Furthermore, the village council exerts little or no influence over crop mix. The village council does not attempt to influence decisions about how much land is planted in water-hungry paddy or, more generally, on how much land will be used in a given season and thus make demands on the irrigation system. It is likely that coordination among farmers could obtain a cropping pattern and schedule that would generate higher net yields, given the available water, than the pattern that emerges when each farmer is free to choose on his own (Wade 1988, p 217, 224). Similarly while the village council does regulate grazing on common lands, it does not regulate the number of head of livestock to be grazed (Wade 1988, p 213, 217, 224). Again the accomplishments of the villagers are formidable; they are quite successful in avoiding the "tragedy of the commons". Nonetheless in theory they could do even better.

Nirvana on the Commons

Is this apparent sub-optimality cause for concern? Or is it result of comparing reality to an abstract first-best solution? The answer to both questions is yes. Two key elements of the naturally occurring ("real") world that are absent in our simplified first-best abstract model help account for these divergences. First, given the voluntary nature of these arrangements to manage the commons and given the frequent lack of institutional arrangements to compel cooperation, each participant can, to some extent, hold the collective agreement "hostage" to satisfying their requirements. Thus the nature of the collective arrangements observed is often somewhat minimal [[florin]] enough cooperation to ensure that virtually everyone in the group is better off but without exhausting the gains from cooperation. To exploit these additional gains would require much more elaborate forms of cooperation, often necessitating an array of side-payments to ensure that virtually everyone still found the new arrangements beneficial. In the field, we seldom observe such elaborate and complex systems. Instead we observe simple systems that rely on simple rules.

Simple rules provide for a low level of transaction cost [[florin]] the second (and overlapping) missing element in our first-best abstract model. Simple rules are readily and widely understood. Simple rules are more readily enforced. The "minimal" cooperative solutions observed in field studies economize on transaction cost in negotiating and specifying agreements and in enforcement by relying on simple rules (Ostrom 1992).

Higher levels of cooperation can be achieved if the institutional arrangements facilitate limited forms of coercion. For instance Meiji Japan facilitated local-level investments in small-scale irrigation systems by passing the 1889 Arable Land Replotment Law that stated that if two-thirds of the landowners in a given area voted for a project it was binding on all landowners in the area affected (Feeny 1988, p 188). Such an institutional arrangement provides a mechanism to overcome hold outs and reduces significantly the ability of potential participants to hold collective projects "hostage". Such arrangements by reducing the costs of coercion are, of course, also open to abuse.

Thus the first-best solution Pareto optimality criterion is useful as a normative standard but provides attenuated practical guidance as a measure of success [[florin]] even from the narrow point of view of anthropocentric economic efficiency. Nirvana is not in the choice set. So how do we know how well we are doing? To what should be we compare existing institutional arrangements? We should compare existing arrangements not only to an ideal norm, the first-best solution, but also to other existing or potentially implementable practical arrangements. In making these comparisons we need not only to examine the outcomes (the benefits associated with the use of the arrangements) but also the cost of

creating and maintaining such arrangements [[florin]] the transaction cost.

The Need to Measure Transaction Cost

One part of the "solution" to this problem is to gather information, both qualitatively and quantitatively on the transaction cost associated with the institutional arrangements we study. Descriptions of these transaction cost are not, of course, absent from the accounts we have. We are told about meetings, encounters with magistrates, appearances in court, elections, field guards, and much more.

The case study literature also indicates that in some cases these meetings have a variety of purposes and consequences. Thus while the fishermen in the coffeehouse in Alanya are allocating seasonal rights to fishing sites they are also ingesting tea and exchanging gossip (Berkes 1992, p 170).

Should we charge all of the time spent in such encounters to the transaction cost of managing the fishery? Probably not. Meetings in the coffee house are valuable as forums for conducting the business of the community, for instance the allocation of fishing rights. Such meetings are also, in part, a final consumption good, the sharing of fellowship.

Of course, arguments that transaction cost are important are not new in the literature on the management of common- property resources. Wiggins and Libecap 1985 point to the importance of contracting costs in inhibiting unitization of oil pools. Johnson and Libecap 1982 and Karpoff 1987 stress the importance of contracting costs in affecting the management of fisheries. These authors also highlight the distributional consequences of various management options, again indicating the limited scope of voluntary agreements.

Wallis and North provide evidence on the sizeable quantitative magnitude of transaction cost in the context of the coordinating function of markets. Although the context is not identical to the context of common-property resource management, the conclusion that transaction costs are quantitatively important probably does generalize.

The key point is, however, that we need to go further in obtaining a comprehensive description of time and effort spent in creating and maintaining collective arrangements. When it is possible to meaningfully quantify some components of transaction cost (for instance time spent in formal meetings and fees and fines paid), we need to do so. We also need order of magnitude qualitative data on the level of transaction cost associated with various institutional arrangements for managing the commons.

Because enforcement also depends on the underlying normative behavioral codes or cultural endowments (Feder and Feeny 1991, 1993; Feeny 1988; Hayami and Ruttan 1985; North 1990b, 1994; Ruttan and Hayami 1984), we also need descriptions about the nature of the society in which these arrangements are found. What is it like to live in that setting? How much autonomy do individuals and households have? To what extent, in which domains, and under what conditions does the will of the community override the interests of the individual? We also need to know about the characteristics of the community in which the resource management takes place. Does everyone know everyone's business?

How to Develop Quantitative Measures of Transaction Cost

One approach to measuring transaction cost is to borrow from the frameworks of economic evaluation and economic accounting. Methods developed for cost-benefit analysis and the construction of estimates of national income provide guidance. A simple approach is to split the measurement process into steps. The first step is the quantification of the amount of resource or time used in operating the institutional

arrangements. The second step is the valuation of that time or resource utilization. Participant observer and ethnographic investigations provide an opportunity for obtaining reliable and valid estimates of the quantities. The choice of basis upon which to value the quantities will often be less straightforward. For purposes of illustration, assume that human time is the chief input involved in operating the institutional arrangements [[florin]] the chief component of transaction cost. Thus we can record person-hours. To return to our earlier example of the coffeehouse in Alanya, what do we do with time devoted to "producing" more than one "outcome"? Arbitrary decisions will have to be made; the key is to develop widely agreed upon conventions for allocating time spent simultaneously on more than one production process. Sensitivity tests can be used to assess the quantitative impact of whatever arbitrary rules of thumb that are selected.

A related issue is the valuation of the time or resources used to operate the institutional arrangements. At what rate should be value the time? In well-developed market systems, time could be valued at the going wage rate for such a person. Even this choice is, however, not quite so obvious. Should we use the marginal after-tax wage rate? In the absence of a well- developed labor market, more sophisticated methods for imputing the value of time may be indicated. Although the answers one obtains can obviously be affected by the choice of technique, similar problems have been handled successfully in a number of literatures. Situations involving the management of common-property resource management while perhaps a bit more challenging, should be amenable to these, and other approaches.

Conclusions

As we accumulate evidence of the level of transaction cost we can come to more informed evaluations of the transaction cost of collective arrangements and benefits derived from those arrangements. Such evidence is crucial in developing an empirically grounded collection of practical operational measures of success on the commons.

We have made intellectual progress on our studies of the commons. We have gone beyond the simple [[florin]] but powerfùl [[florin]] deterministic models of the tragedy of the commons paradigm that were interpreted as saying that if it is held in common it will be degraded (Gordon 1954; Scott 1955; Hardin 1968). We have perhaps flirted a bit too much with the argument that "communal" is better. Nonetheless we have documented that communal arrangements can and often do enhance human welfare. We now need to take a more thorough, comprehensive, and refined look at the cost of operating the institutional arrangements used to govern common-property resource management, in whatever property-rights regime the resource is held.