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The earth belongs in usufruct to the living.
-- Thomas Jefferson

There is a long tradition in economics of separating analyses of equity and efficiency. In this view, benefit-cost analysis should be used to evaluate alternative policy actions, with discounting being used to compare costs and benefits across time periods. Then equity considerations should be assessed independently. This can be called the *separated approach* to decision-making. This article proposes an alternative, *integrated approach*, in which equity and efficiency are interrelated, and the principle of intergenerational equity provides the basis for sustainability.

Potential Conflicts Between Equity and Efficiency

A distribution system may be efficient but inequitable, for example if 100 pounds of flour is divided between two people, with one receiving 95 pounds and the other 5. Or it may be equitable but inefficient, as when 20 pounds of flour is spilled during the distribution, and the recipients then get 40 pounds each. It may be both efficient and equitable (50 pounds each) or inefficient and inequitable (20 pounds spilled, one recipient gets 75, the other 5). However, it may be difficult to say what is equitable. An even division may not be equitable if one person has worked harder than the other to produce the flour. We must also consider incentive effects -- the prospect of a larger share may induce someone to work harder, thereby producing a larger total amount to the benefit of both.

Efficiency considerations must thus be balanced against equity issues, in sometimes complex ways. When we consider the long time horizons associated with many environmental decisions, the problem of conflict between principles of equity and efficiency becomes especially important.

Problems with the Separated Approach for Intergenerational Allocation

The use of intergenerational discounting for policy purposes has several well-known problems:

• **Extreme sensitivity to the discount rate.** $1 million of costs 100 years from now, evaluated at a 10% discount rate, yields a present value of future harm of only $72. At a 3% discount rate, the present value would be $52,033 -- a more than 70-fold difference. For long-run decision making, the choice of the discount rate typically has a larger impact than any other element of the analysis.

• **Hypothetical markets as the standard of value.** Benefit-cost analysis is intended to mimic market valuation. Market decisions, however, depend on the distribution of wealth and income, which implicitly treats the existing distribution as a normatively acceptable basis for the calculation. Yet this basis is not considered acceptable for many social decisions; typically many decisions are made politically ("one person, one vote") or through a judicial process (the rule of law).

• **Intergenerational asymmetry of decision power.** As a practical reality, there is a "dictatorship of the present". Even if current actors take an interest in the well-being of future generations, it is still the present generation that controls decisions on resource use. However, there are large differences in the way various institutional processes work with regard to preserving resources for future generations. The use of market power may be significantly more present-oriented than the use of legislative, judicial, or other mechanisms for deciding resource allocation.

• **Choice of the discount rate.** Even if we accept the use of a market logic, we must still choose a specific discount rate to weigh present versus future. The marginal productivity of capital, often suggested by economists, may not correspond to individual or social time preference. The preferences of future generations cannot easily be included. Also, empirical evidence indicates that people choose a lower discount rate when considering a longer time horizon -- something which is not taken into account in benefit-cost analyses.

Intergenerational Equity as Sustainability

Economists sometimes dismiss "sustainability" as a vague and ill-defined concept. Yet many key concepts in economics are equally imprecise. How exactly can we define "money", "capital", or "utility"? The economic definition of "income" put forward by Hicks[1] implies that income must be sustainable, thus introducing the need to define sustainability itself. The concept of sustainability suggested here, based on an integrated approach to equity and efficiency, is no more vague that these key economic terms.

Thomas Jefferson's statement that "the earth belongs in usufruct to the living" is a good working definition of sustainability as intergenerational equity. "Usufruct" has a precise legal definition which specifies a right to use something which belongs to another, provided that the thing itself is not altered or damaged. This can be applied to the earth's resource base taken as a whole. This resource base can be viewed as a commons over generational time. Just as a commons can be destroyed by overuse by many individuals, so the earth's resource base can be destroyed through intensive exploitation by successive generations. But just as there can be successful management principles for the commons, so there can be equitable rules for sharing the earth's productivity between generations.

Identifying these rules depends on assumptions about substitutability, technological progress, and human adaptive capability. If we believe these to be unlimited, then the problem of sustainability becomes trivial. On the other hand, if we believe them to be extremely limited, then sustainability is impossible. It is the middle ground which is the most likely case -- there is enough flexibility in productive systems and institutions to make sustainability possible, but only if proper principles for intergenerational justice are established. Further, the problem of intergenerational equity becomes more difficult, and more important, as population and economic output grow relative to the resource base.

An Analogy to Constitutional Law

In jurisprudence, certain principles are established as fundamental or constitutional; within these principles laws are made and implemented based on current social preferences and empirical evidence. Laws and their application are continually changing, based on legislative action and judicial decisions. In contrast, the fundamental constitutional principles can be altered only based on super-majorities or special procedures, something which generally occurs only rarely. Just as the stable basis of constitutional law provides the "environment" for day-to-day decisions and activities, so the stable basis for all economic activity is provided by the natural environment. This suggests that rules for use of the natural resource base should be established based on fundamental principles of intergenerational equity.

To implement this approach, the following steps are necessary:

- Identify key components of the resource base which are essential to sustainability.
- Identify the most effective instruments and decision processes for maintaining the resource base intact.
- Once these instruments are in place, allow ordinary decision-making to take place based on economic criteria, within an intergenerationally equitable decision environment.

Conclusion

This integrated two-tier approach differs from the separated approach used for much current decision-making. Unlike the separated approach, it is not sensitive to discount rates or current market preferences and income allocations, nor is it intergenerationally asymmetric. It goes some way towards resolving potential conflicts between equity and efficiency by allowing economically efficient mechanisms to operate subject to basic principles of equity. However, it poses the problem of distinguishing between fundamental principles and ordinary, day-to-day decision-making. This must be done on a case-by-case basis. For example, the Safe Drinking Water Act employs a precautionary principle to safeguard public health, rather than using cost-benefit analysis or discounting.

The use of this two-tier decision system should become more widespread, both nationally and internationally. It will need to be developed in practice by such institutions as Congress, regulatory agencies, the World Bank and the International Monetary Fund, just as case law and constitutional law have been fine-tuned over the years by court decisions. While this legal

process has been operating for two hundred years in the United States, we can hope that "it will take less time to clarify the issues of intergenerational efficiency and equity in environmental management." (596)

Notes

1. See Costanza and Daly (Part I, this volume), note 2.