"Summary of article by Anil Markandya and David Pearce: Development, the Environment, and the Social Rate of Discount" in Frontier Issues in Economic Thought, Volume 1: A Survey of Ecological Economics. Island Press: Washington DC, 1995. pp. 266-271

Social Science Library: Frontier Thinking in Sustainable Development and Human Well-being

"Summary of article by Anil Markandya and David Pearce: Development, the Environment, and the Social Rate of Discount"

Many environmentalists have questioned the use of the discount rate in formulating economic policies related to natural resource use. This article examines and evaluates the use of the discount rate in environmental decision making. It argues that rather than trying to "do something" about the discount rate for environmental reasons, the problem might be addressed instead through developing the concept of sustainability as a policy instrument.

THE RATIONALE FOR DISCOUNTING AND THE CHOICE OF THE DISCOUNT RATE

Sixty-one cents invested today at a 5% compound interest rate will be worth $1 in 10 years; $0.61 is called the present value factor when the discount rate is 5%. The higher the discount rate or the longer the time horizon, the lower the present value factor. Discounting is used because less weight is attached to future benefits or costs than to those in the present. This is either because people are impatient, or because a dollar's worth of resources now will generate more than a dollar's worth of goods and services in the future, and an entrepreneur will therefore be willing to pay more than a dollar in the future to acquire a dollar's worth of those resources now.

The two main criteria used to determine the discount rate are the social rate of time preference and the opportunity cost of capital. Time preference rates tend to be lower than the opportunity cost of capital. The impact of costs and benefits on levels of consumption relative to savings are crucial in determining the discount rate. Both in theory and in practice, there is disagreement about the choice of discount rates.

DISCOUNTING AND THE ENVIRONMENT

There is no unique relation between high discount rates and environmental degradation. While high discount rates may shift the cost burden to future generations, they also reduce the level of investment, and lower investments reduce the use of natural resources. For example, high discount rates discourage development projects with large capital needs such as dams, and may therefore help preserve large areas in their existing state. We can consider five discounting methods and their implications for environmental problems:

Pure Individual Time Preference

There are three arguments as to why social discount rates should not be influenced by individual time preference rates. First, it is not necessarily true that an individual's welfare will be maximized if the individual acts on the impatience principle (which is the basis for the pure individual time preference rate). Second, individual wants carry no necessary implications for public policy. Finally, there are problems with the expression of the basic value judgment involved. Societies that seek to satisfy wants should be concerned with satisfying wants as they arise and so actually achieving tomorrow's satisfaction, rather than with today's assessment of tomorrow's satisfaction.

These objections are debatable. Overturning the fundamental value judgment of the liberal economic tradition - i.e., that individual preferences should count in social decisions - requires more compelling reasons. While the third objection is philosophically persuasive, the discount rate should be retained on pragmatic grounds to deal with serious environmental problems in developing countries.

Social Rate of Time Preference

The social rate of time preference measures the rate at which the utility of consumption decreases over time. The social rate of time preference can be expressed thus:

$$i = ng + z$$

where *i* is the social rate of time preference, *z* is the rate of pure time preference, *g* is the rate of growth of real consumption per capita, and *n* is the percentage decrease in marginal utility for each percentage point increase in consumption.

The first concern that environmentalists have with this formulation is the presumption that the growth of real consumption per capita, *g*, will always be positive. They argue that there are limits to growth based on natural resource and environmental sink constraints. For example, in low-income Sub-Saharan Africa, real per capita consumption fell by 1.9% between 1973 and 1983, yielding a negative *g*. While this might imply a negative *i* as well, these regions have individual time preference rates, *z*, as high as 10-15%, that may result in positive social rates of time preference. However, the high individual time preference rates themselves can be questioned. One argument for high individual time preference rates in situations of poverty is that the need for immediate food is more urgent than the need for assurance of food in the future, but this argument is problematic in the context of environmental degradation; high discount rates may lead to environmental degradation, which may result in further poverty. Thus a vicious cycle is operating in which poverty calls for high discount rates, which themselves cause poverty. As a result, a social time preference rate based on the above equation may not be useful when real consumption per capita is negative or falling, because the value of *z* may not be relevant. A better method for determining a social rate of time preference is needed.

Opportunity Cost of Capital

The opportunity cost of capital is the rate of return on the best alternative investment of similar risk that is foregone as a result of undertaking a particular project. Basing the discount rate on

the opportunity cost of capital is justified on the grounds that it is reasonable to expect a return on a project that is at least as high as the return on the best alternative use of funds. Environmentalists have objected to opportunity cost discounting on two grounds. The first objection is that opportunity cost discounting implies that the benefits of the investment will be reinvested at opportunity cost rates. If, however, the benefits of the investment are consumed rather than reinvested, then the consumption flows have no opportunity cost, and opportunity cost discounting becomes irrelevant. This problem has led to the development of weighted discount rate procedures, whereby the underlying discount rates are modified according to the levels of consumption and reinvestment.

Another problem with opportunity cost discounting relates to compensation across generations. If an investment today will cause x dollars worth of environmental damage T years from now, the damage will be valued today at much less than x dollars. The actual amount of the present value will depend on the discount rate and the length of time, T. The logic is that if this lower value is invested today, it will amount to x in T years, and could therefore be used to compensate for the environmental damage when it occurs. Environmentalists have argued that the lower discounted value for the environmental damage is legitimate only if the compensation will actually be paid, but this argument confuses potential and actual compensations. Efficiency only requires that a sum for compensation be generated, not that it be distributed.

Risk and Uncertainty

As the uncertainty of an occurrence increases, the value of associated benefits or costs should decrease. Three kinds of uncertainty are relevant to discounting. First, the risk-of-death argument (i.e., will an individual be alive or dead in the future) is used to justify consumption today rather than in the future. The objection to this argument is that while individuals are mortal, society is not. A second type is the uncertainty about individual preferences in the future. This uncertainty may be relevant for some goods, but the future preferences for goods such as food, shelter, water and energy are not uncertain. The third source is uncertainty about the size of benefits or costs in the future. It is often assumed that the further away in time benefits or costs will occur, the greater the uncertainty of their occurrence. However, there is no reason why this must be true. Economists accept this objection in theory, but use of risk-adjusted discount rates is still common in policy analysis. Rather than add risk premiums to discount rates, uncertainty can instead be dealt with by calculating certainty equivalents. However, these calculations are complex and the methodology is unclear.

Interests of Future Generations

A matter of debate and concern is whether the use of positive discount rates actually safeguards the interests of future generations. Models have been constructed in which the utility of the present generation depends on the utility of future generations, but these models reflect what the present generation thinks future generations will want, rather than what future generations actually want. Also, the results of these models depend on the extent and nature of the way present generations think about the future. There are a number of arguments suggesting that, for reasons relating to future generations' interests, social discount rates may be below market rates. However, there is no practical procedure to determine a social discount rate that accurately

reflects future generations' interests, so using discount rates to account for these interests is a complex and probably untenable approach.

DISCOUNT RATES AND SPECIFIC ENVIRONMENTAL ISSUES

Two specific environmental issues - irreversible damage and the management of natural resources - can be analyzed to see how they are affected by the discounting process.

Irreversible Damage

Krutilla and Fisher[1] (1975) developed a cost-benefit methodology for analyzing projects that have irreversible outcomes, such as the flooding of a valley or the loss of tropical forests. For this analysis, all of the costs and benefits need to be expressed in present value terms to determine whether or not the project should be undertaken. The lower the discount rate is, the larger will be the benefits of preservation and the lower the benefits of the project. In their analysis, Krutilla and Fisher do not adjust the discount rate. Instead they claim that the value of the wilderness will increase over time because the supply of such areas is shrinking and the demand for their services is increasing. The advantage of their approach is that it has the benefits of using a lower discount rate without the disadvantage of distorting resource allocations in the economy by using variable discount rates. They also argue that the value of the benefits from the project will decrease over time because better technologies will be available in the future. The basis for this argument is unclear, but it has the effect of lowering the discounted value of the benefits of development without altering the discount rates.

Management of Natural Resources

In general, the relationship between the discount rate and the pattern of exploitation of natural resources is complex, but the fundamental point is that higher discount rates lead to faster exploitation of resources. Discount rates also have important effects on the time profiles of costs and benefits. For example, in comparing two projects, one that would exhaust a resource in 10 years and another that would exhaust it in 25 years, a high discount rate will favor the shorter term project. Over-exploitation will also occur if the resource is held by the private sector and the private rate of discount is higher than the social rate of discount. High discount rates may exist due to anti-inflationary monetary policies or capital rationing, and they may be justified within these contexts, but at the same time they can have undesirable consequences with respect to natural resource management. However, while high discount rates can lead to over-exploitation of resources in several ways, over-exploitation can be more effectively controlled by the imposition of taxes than by trying to change discount rates, due both to the practical difficulties of controlling the rates, and to the need to use them as tools to control other problems within economies.

SUSTAINABILITY

Environmentalists' objections notwithstanding, the discount rate should not be tampered with. The paramount concern of environmentalists is to protect the interests of future generations. This can be accomplished without rejecting discounting by pursuing a policy that recognizes the constraints imposed by the need for sustainability. The central idea behind sustainability is the

protection of the natural resource base for future generations. While it would be absurd to require that no individual project harm the environment, it is possible to require that a portfolio of projects not cause harm, implying that some projects should improve the environment. Such a policy will permit the discount rate to function as a mechanism for resource allocation while protecting the environment.

Notes

1. John V. Krutilla and Anthony C. Fisher, *The Economics of Natural Environments* (Washington, D.C.: Resources for the Future, 1975).