



By Robert N. Stavins

## Does Econ Analysis Shortchange Future?

**D**ecisions made today usually have impacts both now and in the future. In the environmental realm, many of the future impacts are benefits, and such future benefits — as well as costs — are typically discounted by economists in their analyses. Why do economists do this, and does it give insufficient weight to future benefits and thus to the well-being of future generations?

This is a question my colleague Lawrence Goulder, a professor of economics at Stanford University, and I addressed in an article in *Nature*. We noted that as economists, we often encounter skepticism about discounting, especially from non-economists. Some of the skepticism seems quite valid, yet some reflects misconceptions about the nature and purposes of discounting. In this column, I hope to clarify the concept and the practice.

It helps to begin with the use of discounting in private investments, where the rationale stems from the fact that capital is productive — money earns interest. Consider a company trying to decide whether to invest \$1 million in the purchase of a copper mine, and suppose that the most profitable strategy involves extracting the available copper 3 years from now, yielding revenues (net of extraction costs) of \$1,150,000. Would investing in this mine make sense? Assume the company has the alternative of putting the \$1 million in the bank at 5 percent annual interest. Then, on a purely financial basis, the company would do better by putting the money in the bank, as it will have \$1,000,000

$\times (1.05)^3$ , or \$1,157,625, that is, \$7,625 more than it would earn from the copper mine investment.

I compared the alternatives by compounding to the future the up-front cost of the project. It is mathematically equivalent to compare the options by discounting to the present the future revenues or benefits from the copper mine. The discounted revenue is \$1,150,000 divided by  $(1.05)^3$ , or \$993,413, which is less than the cost of the investment (\$1 million).

Discounting translates future dollars into equivalent current dollars; it undoes the effects of compound interest. It is not aimed at accounting for inflation, as even if there were no inflation, it would still be necessary to discount future revenues to account for the fact that a dollar today translates (via compound interest) into more dollars in the future.

Can this same kind of thinking be applied to investments made by the public sector? Since my purpose is to clarify a few key issues in the starkest terms, I will use a highly stylized example that abstracts from many of the subtleties. Suppose that a policy, if introduced today and maintained, would avoid significant damage to the environment and human welfare 100 years from now. The “return on investment” is avoided future damages to the environment and people’s well-being. Suppose that this policy costs \$4 billion to implement, and that this cost is completely borne today. It is anticipated that the benefits — avoided damages to the environment — will be worth \$800 billion to people alive 100 years from now. Should the policy be implemented?

If we adopt the economic efficiency criterion I have described in previous columns, the question becomes whether the future benefits are large enough so that the winners could potentially compensate the losers and still be no worse off? Here discounting is helpful. If, over the next 100 years, the average rate of interest on ordinary investments is 5 percent, the gains of \$800 billion to people 100 years from now are equivalent to \$6.08 billion today. Equivalently, \$6.08 billion today, compounded at an annual interest rate of 5 percent, will become

\$800 billion in 100 years. The project satisfies the principle of efficiency if it costs current generations less than \$6.08 billion, otherwise not.

Since the \$4 billion of up-front costs is less than \$6.08 billion, the benefits to future generations are more than enough to offset the costs to current generations. Discounting serves the purpose of converting costs and benefits from various periods into equivalent dollars of some given period. Applying a discount rate is not giving less weight to future generations’ welfare. Rather, it is simply converting the (full) impacts that occur at different points of time into common units.

Much skepticism about discounting and, more broadly, the use of benefit-cost analysis, is connected to uncertainties in estimating future impacts. Consider the difficulties of ascertaining, for example, the benefits that future generations would enjoy from a regulation that protects certain endangered species. Some of the gain to future generations might come in the form of pharmaceutical products derived from the protected species. Such benefits are impossible to predict. Benefits also depend on the values future generations would attach to the protected species — the enjoyment of observing them in the wild or just knowing of their existence. But how can we predict future generations’ values? Economists and other social scientists try to infer them through surveys and by inferring preferences from individuals’ behavior. But these approaches are far from perfect, and at best they indicate only the values or tastes of people alive today.

The uncertainties are substantial and unavoidable, but they do not invalidate the use of discounting (or benefit-cost analysis). They do oblige analysts, however, to assess and acknowledge those uncertainties in their policy assessments, a topic I discussed in my last column, and one to which I will return in future columns.

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