

this way are called discounted present values. Once the estimated benefits and costs have been discounted, they can be combined to determine the overall value of net benefits.

OMB's basic guidance on the discount rate is provided in OMB Circular A-94. This Circular states that a real discount rate of 7 percent should be used as a base-case for regulatory analysis. The 7 percent rate is an estimate of the average before-tax rate of return to private capital in the U.S. economy. It is a broad measure that reflects the returns to real estate and small business capital as well as corporate capital. It approximates the opportunity cost of capital and is the appropriate discount rate whenever the main effect of a regulation is to displace or alter the use of capital in the private sector. OMB revised Circular A-94 in 1992 after extensive internal review and following public comment. The average rate of return to capital remains near the 7 percent rate estimated in 1992. Circular A-94 also recommends using other discount rates to show the sensitivity of the estimates to the discount rate assumption.

The effects of regulation do not always fall exclusively on the allocation of capital. When regulation primarily affects private consumption (e.g., through higher consumer prices for goods and services), a lower discount rate may be appropriate. The alternative most often used is called the "social rate of time preference." This simply means the rate at which "society" discounts future consumption flows to their present value. Economic distortions, including taxes on capital, create a divergence between this social rate and the private rate of return to capital. If we take the rate that the average saver uses to discount future consumption as our measure of the social rate of time preference, then the real rate of return on long-term government debt may provide a fair approximation. This rate has averaged around 3 percent since the mid-1950s.

For regulatory analysis, you should provide estimates of net benefits using both 7 percent and 3 percent. An example of this approach is EPA's analysis of its 1998 rule setting both effluent limits for wastewater discharges and air toxic emission limits for pulp and paper mills. In this analysis, EPA developed its present discounted value estimates using real discount rates of 3 and 7 percent applied to benefit and cost streams that extended forward for 30 years. (See EPA, Economic Analysis, October 1997, pages 10-3 and 10-4.) You should present a similar sensitivity analysis in your own work.

In some instances, if there is reason to expect that the regulation will cause resources to be reallocated away from private investment in the corporate sector, then the opportunity cost may be appreciably greater than the 3 to 7 percent discount rate. For example, Tresch suggests that rates in the range of 10 to 25 percent may be appropriate to reflect this opportunity cost, depending on the sector affected by the regulation. If you are uncertain about the nature of the opportunity cost, then you should present benefit and cost estimates using a higher discount rate as a sensitivity analysis as well as using 3 percent and 7 percent.

Circular A-94 points out that the analytically preferred method of handling

timing differences between benefits and costs would be to adjust all the benefits and costs to reflect their value in equivalent units of consumption.<sup>21</sup> Due to distortions in the economy such calculations require you to value the costs and benefits using shadow prices, especially for capital goods. If all costs and benefits are measured in terms of consumption equivalents, it is appropriate to discount them using the social rate of discount. Any agency that wishes to tackle this challenging analytical task should check with OMB before proceeding.

When future benefits or costs are health-related, some have questioned whether discounting is appropriate. Although some of the rationales for discounting money may not seem to be applicable to health (e.g., lives saved today cannot be invested in the bank to save more lives in the future, although the resources that would have been used to save those lives can often be saved with a higher pay-off in future lives saved). However, people do prefer health gains that occur immediately to identical health gains that occur only in the future, which would justify discounting the future gains. Also, if future health gains are not discounted while future costs are, then the following perverse result occurs: an attractive investment today in future health improvement can always be made more attractive by delaying the investment. For such reasons, there is a professional consensus that future health effects, including both benefits and costs, should be discounted at the same rate as generally used in both BCA and CEA.

A common challenge in health-related analyses is to quantify the time lag between when a rule takes effect and when the resulting physical improvements in health status will be observed in the target population. In such situations, you must carefully consider the timing of health benefits before present-value calculations are performed. It is not reasonable to assume that all of the benefits of reducing chronic diseases such as cancer and cardiovascular disease will occur immediately when the rule takes effect. For rules addressing traumatic injury, this lag period may be short while for chronic diseases it may take years or even decades for a rule to induce its full beneficial effects in the target population. When a time period between exposure to a toxin and increased probability of disease is likely (e.g., a so-called latency period), it is also likely that there will be a lag between exposure reduction and reduced probability of disease. This latter period has sometimes been referred to as a "cessation lag" and it may or may not be the same as the latency period. As a general matter, cessation lags will apply only to populations with at least some higher-level exposure (i.e., before the rule takes effect). For populations with no such prior exposure, such as those born after the rule takes effect, only the latency period will be relevant.

Ideally, your exposure-risk model would allow calculation of reduced risk for each

year following exposure cessation, perhaps incorporating total cumulative exposure and age at the time of exposure reduction into the calculation as well. The present value calculation of benefits could then reflect an appropriate discount factor for each year's risk reduction. Recent analyses of the cancer benefits of reducing public exposure to radon in drinking water have adopted this approach, supported by formal risk-assessment models that allow estimates of how the timing of lung cancer incidence and mortality are affected by different radon exposure levels. In many cases, you will not have the benefit of such detailed risk assessment modeling. You will need to use your professional judgement as to the average cessation lag for the chronic diseases affected by your rule. In situations where information exists on latency but not on cessation lags, it may be reasonable to use latency as a proxy for the cessation lag, unless there is reason to believe, based on data, modeling, or knowledge of the mechanism of action, that the two are different. When the average lag time between exposures and disease is unknown, a range of alternative yet plausible values for the time lag should be used in your analysis.

Special ethical considerations arise when comparing benefits and costs across generations. Although most people demonstrate in their own consumption behavior a preference for consumption now rather than in the future, it may not be appropriate for society to demonstrate a similar preference when deciding between the well-being of current and future generations. Future citizens who are affected by such choices cannot take part in making them, and today's society must act in their interest. One way to do this would be to follow the same discounting techniques described above, but to supplement the analysis with an explicit discussion of the intergenerational concerns and how they will be affected by the regulatory decision. Policymakers would be provided with additional information when the analysis covers many generations, but without changing the general approach to discounting.

Some have argued, however, that it is ethically impermissible to discount the utility of future generations. On this view, government should treat all generations equally. Even under this approach, it would still be correct to discount future costs and consumption benefits, although perhaps at a lower rate than for intragenerational analysis. There are two reasons for thinking that a nonzero discount rate is the appropriate assumption for intergenerational analysis, even when all generations are to be treated equally. First, future generations are likely to be wealthier than those currently living, so a marginal dollar of benefits or costs will be worth less to them than it would be to those alive today, at least on average. If that holds true, it is appropriate to discount future benefits and costs relative to currently consumed benefits and costs even if the welfare of future generations is not being discounted. Estimates of the discount rate

<sup>21</sup> A thorough discussion of this approach to discounting is provided in Robert C. Lind (ed.), *Discounting for Time and Risk in Energy Policy*, Baltimore: The Johns Hopkins University Press for Resources for the Future, 1982.