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The growing impact of regulations on the economy has led both Congress and the Administration to search for new ways of reforming the regulatory process. Many of these initiatives call for greater reliance on the use of economic analysis in the development and evaluation of regulations. One specific approach being advocated is benefit-cost analysis, an economic tool for comparing the desirable and undesirable impacts of proposed policies.

For environmental, health, and safety regulation, benefits are typically defined in terms of the value of having a cleaner environment or a safer workplace. Ideally, costs should be measured in the same terms: the losses implied by the increased prices that result from the costs of meeting a regulatory objective. In practice, the costs tend to be measured on the basis of direct compliance costs, with secondary consideration given to indirect costs, such as the value of time spent waiting in a motor vehicle inspection line.

The direct costs of federal environmental, health, and safety regulation appear to be on the order of \$200 billion annually, or about the size of all domestic nondefense discretionary spending (1). The benefits of the regulations are less certain, but evidence suggests that some but not all recent regulations would pass a benefit-cost test (2). Moreover, a reallocation of expenditures on environmental, health, and safety

regulations has the potential to save significant numbers of lives while using fewer resources (3). The estimated cost per statistical life saved has varied across regulations by a factor of more than \$10 million (4), ranging from an estimated cost of \$200,000 per statistical life saved with the Environmental Protection Agency's (EPA's) 1979 trihalomethane drinking water standard to more than \$6.3 trillion with EPA's 1990 hazardous waste listing for wood-preserving chemicals (3, 5). Thus, a reallocation of priorities among these same regulations could save many more lives at the given cost, or alternatively, save the same number of lives at a much lower cost (6).

Most economists would argue that economic efficiency, measured as the difference between benefits and costs, ought to be one of the fundamental criteria for evaluating proposed environmental, health, and safety regulations. Because society has limited resources to spend on regulation, benefit-cost analysis can help illuminate the trade-offs involved in making different kinds of social investments. In this regard, it seems almost irresponsible to not conduct such analyses, because they can inform decisions about how scarce resources can be put to the greatest social good. Benefit-cost analysis can also help answer the question of how much regulation is enough. From an efficiency standpoint, the answer to this question is simple: regulate until the incremental benefits from regulation are just offset by the incremental costs. In practice, however, the problem is much more difficult, in large part because of inherent problems in measuring marginal benefits and costs. In addition, concerns about fairness and process may be important noneconomic factors that merit consideration. Regulatory policies inevitably involve winners and losers, even when aggregate benefits exceed aggregate costs (7).

Over the years, policy-makers have sent mixed signals regarding the use of benefit-cost analysis in policy evaluation. Congress has passed several statutes to protect health, safety, and the environment that effectively

preclude the consideration of benefits and costs in the development of certain regulations, even though other statutes actually require the use of benefit-cost analysis (8). Meanwhile, former presidents Carter, Reagan, and Bush and President Clinton have all introduced formal processes for reviewing economic implications of major environmental, health, and safety regulations. Apparently the Executive Branch, charged with designing and implementing regulations, has seen a need to develop a yardstick against which the efficiency of regulatory proposals can be assessed. Benefit-cost analysis has been the yardstick of choice (9).

We suggest that benefit-cost analysis has a potentially important role to play in helping inform regulatory decision-making, although it should not be the sole basis for such decision-making. We offer the following eight principles on the appropriate use of benefit-cost analysis (10).

1) *Benefit-cost analysis is useful for comparing the favorable and unfavorable effects of policies.* Benefit-cost analysis can help decision-makers better understand the implications of decisions by identifying and, where appropriate, quantifying the favorable and unfavorable consequences of a proposed policy change, even when information on benefits and costs, is highly uncertain. In some cases, however, benefit-cost analysis cannot be used to conclude that the economic benefits of a decision will exceed or fall short of its costs, because there is simply too much uncertainty.

2) *Decision-makers should not be precluded from considering the economic costs and benefits of different policies in the development of regulations.* Agencies should be allowed to use economic analysis to help set regulatory priorities. Removing statutory prohibitions on the balancing of benefits and costs can help promote more efficient and effective regulation. Congress could further promote more effective use of resources by explicitly asking agencies to consider benefits and costs in formulating their regulatory priorities.

3) *Benefit-cost analysis should be required for all major regulatory decisions.* Although the precise definition of "major" requires judgment (11), this general requirement should be applied to all government agencies. The scale of a benefit-cost analysis should depend on both the stakes involved and the likelihood that the resulting information will affect the ultimate decision. For example, benefit-cost analyses of policies intended to retard or halt depletion of stratospheric ozone were worthwhile because of the large stakes involved and the potential for influencing public policy.

4) *Although agencies should be required to conduct benefit-cost analyses for major decisions and to explain why they have selected actions for which reliable evidence indicates*

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that expected benefits are significantly less than expected costs, those agencies should not be bound by strict benefit-cost tests. Factors other than aggregate economic benefits and costs, such as equity within and across generations, may be important in some decisions.

5) *Benefits and costs of proposed policies should be quantified wherever possible. Best estimates should be presented along with a description of the uncertainties.* In most instances, it should be possible to describe the effects of proposed policy changes in quantitative terms; however, not all impacts can be quantified, let alone be given a monetary value. Therefore, care should be taken to assure that quantitative factors do not dominate important qualitative factors in decision-making. If an agency wishes to introduce a "margin of safety" into a decision, it should do so explicitly (12).

Whenever possible, values used to quantify benefits and costs in monetary terms should be based on trade-offs that individuals would make, either directly or, as is often the case, indirectly in labor, housing, or other markets (13). Benefit-cost analysis is premised on the notion that the values to be assigned to program effects—favorable or unfavorable—should be those of the affected individuals, not the values held by economists, moral philosophers, environmentalists, or others.

6) *The more external review that regulatory analyses receive, the better they are likely to be.* Historically, the U.S. Office of Management and Budget has played a key role in reviewing selected major regulations, particularly those aimed at protecting the environment, health, and safety. Peer review of economic analyses should be used for regulations with potentially large economic impacts (14). Retrospective assessments of selected regulatory impact analyses should be carried out periodically.

7) *A core set of economic assumptions should be used in calculating benefits and costs. Key variables include the social discount rate, the value of reducing risks of premature death and accidents, and the values associated with other improvements in health.* It is important to be able to compare results across analyses, and a common set of economic assumptions increases the feasibility of such comparisons. In addition, a common set of appropriate economic assumptions can improve the quality of individual analyses. A single agency should establish a set of default values for typical benefits and costs and should develop a standard format for presenting results.

Both economic efficiency and intergenerational equity require that benefits and costs experienced in future years be given less weight in decision-making than those experienced today. The rate at which future benefits and costs should be discounted to present values will generally not equal the rate of return on private investment. The discount rate should instead be based on how individuals trade off current for future consumption. Given uncertainties in identifying the correct discount rate, it is appropriate to use a range of rates. Ideally, the same range of discount rates should be used in all regulatory analyses.

8) *Although benefit-cost analysis should focus primarily on the overall relation between benefits and costs, a good analysis will also identify important distributional consequences.* Available data often permit reliable estimation of major policy impacts on important subgroups of the population (15). On the other hand, environmental, health, and safety regulations are neither effective nor efficient tools for achieving redistributive goals.

*Conclusion.* Benefit-cost analysis can play an important role in legislative and regulatory policy debates on protecting and improving health, safety, and the natural environment. Although formal benefit-cost analysis should not be viewed as either necessary or sufficient for designing sensible public policy, it can provide an exceptionally useful framework for consistently organizing disparate information, and in this way, it can greatly improve the process and, hence, the outcome of policy analysis. If properly done, benefit-cost analysis can be of great help to agencies participating in the development of environmental, health, and safety regulations, and it can likewise be useful in evaluating agency decision-making and in shaping statutes.

## REFERENCES AND NOTES

1. T. D. Hopkins, "Cost of Regulation: Filling in the Gaps" (report prepared for the Regulatory Information Service Center, Rochester, NY, 1992); Office of Management and Budget, *Budget of the United States Government, Fiscal Year 1996* (Government Printing Office, Washington, DC, 1995).
2. R. W. Hahn, in *Risks, Costs, and Lives Saved: Getting Better Results from Regulation*, R. W. Hahn, Ed. (Oxford Univ. Press, Oxford, and AEI Press, Washington, DC, in press).
3. J. F. Morrall, *Regulation* 10, 25 (November-December 1986).
4. These figures represent the incremental direct cost of part or all of proposed regulations relative to specified baselines. For examinations of issues associated with estimating the full costs of environmental protection, see (16).
5. Office of Management and Budget, *Regulatory Program of the United States Government: April 1, 1992-March 31, 1993* (Government Printing Office, Washington, DC, 1993).
6. If the goals of a program or the level of a particular standard have been specified, economic analysis can still play an important role in evaluating the costs of various approaches for achieving these goals. Too frequently, regulation has used a one-size-fits-all or command-and-control approach to achieve specified goals. Cost-effectiveness analysis, which identifies the minimum-cost means to achieve a given goal, can aid in designing more flexible approaches, such as using markets and performance standards that reward results.
7. L. Lave, in (2).
8. Several statutes have been interpreted to restrict the ability of regulators to consider benefits and costs. Examples include the Federal Food, Drug, and Cosmetic Act (Delaney Clause); health standards under the Occupational Safety and Health Act; safety regulations from the National Highway and Transportation Safety Agency; the Clean Air Act; the Clean Water Act; the Resource Conservation and Recovery Act; the Safe Drinking Water Act; and the Comprehensive Environmental Response, Compensation, and Liability Act. On the other hand, the Consumer Product Safety Act, the Toxic Substances Control Act, and the Federal Insecticide, Fungicide, and Rodenticide Act explicitly allow regulators to consider benefits and costs.
9. In particular cases, such as the phasing out of lead in gasoline and the banning of certain asbestos products, benefit-cost analysis has played an important role in decision-making (17).
10. For a more extended discussion, see (18).
11. In this context, "major" has traditionally been defined in terms of annual economic impacts on the cost side.
12. For example, potentially irreversible consequences are not outside the scope of benefit-cost analysis. The combination of irreversibilities and uncertainty can have significant effects on valuation.
13. For a conceptual overview of methods of estimating the benefits of environmental regulation and a brief survey of empirical estimates, see (19). For examinations of regulatory costs, see (16).
14. For a description of problems that arise when benefit-cost analysis is used in the absence of standardized peer review, see (20).
15. G. B. Christiansen and T. H. Tietenberg, in *Handbook of Natural Resource and Energy Economics*, A. V. Kneese and J. L. Sweeney, Eds. (North-Holland, Amsterdam, 1985), vol. 1, pp. 345-393.
16. R. Schmalensee, in *Balancing Economic Growth and Environmental Goals*, M. B. Kotowski, Ed. (American Council for Capital Formation, Center for Policy Research, Washington, DC, 1994), pp. 55-75; A. B. Jaffe, S. R. Peterson, P. R. Portney, R. N. Stavins, *J. Econ. Lit.* 33, 132 (1995).
17. A. Fraas, *Law Contemp. Probl.* 54, 113 (1991).
18. K. J. Arrow et al., *Benefit-Cost Analysis in Environmental, Health, and Safety Regulation* (AEI Press, Washington, DC, 1996).
19. M. L. Cropper and W. E. Oates, *J. Econ. Lit.* 30, 675 (1992); A. M. Freeman, *The Measurement of Environmental and Resource Values* (Resources for the Future, Washington, DC, 1993).
20. W. N. Grubb, D. Whittington, M. Humphries, in *Environmental Policy Under Reagan's Executive Order: The Role of Benefit-Cost Analysis*, V. K. Smith, Ed. (Univ. of North Carolina Press, Chapel Hill, 1984), pp. 121-164.
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