

Cost-Benefit Analysis*

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When economics is normative—meaning that the objective is to make a policy recommendation—the evaluative criteria is economic efficiency. The basic idea is that scarce resources should be allocated to their most valued uses. Cost-benefit analysis (CBA) is the primary tool that economists employ to determine whether a particular policy, or policy proposal, promotes economic efficiency. At the most general and comprehensive level, CBA is an aggregator of all impacts, to all affected parties, at all points in time. The impacts, both positive and negative, are converted into a common monetary unit, and the cost-benefit criterion is simply a test of whether the benefits exceed the costs. If the net benefits are positive, the policy promotes economic efficiency.

CBA for the purpose of analyzing public policy is distinct from financial analysis in the private sector. CBA accounts for more than just financial costs and benefits in order to evaluate the net effect of a policy on overall social well-being. For this reason it is often referred to as “social cost-benefit analysis.” The broad scope of CBA, along with its inherent focus on monetization and efficiency, means that the technique is frequently controversial, especially when applied to environmental policy. Concerns about CBA tend to mirror more general critiques of economic efficiency as a normative criteria and the sway it should have on public decision-making, in addition to the technique’s sometimes controversial reliance on monetization of all costs and benefits. But the analytical rigor and bottom-line conclusion of CBA makes the approach highly influential—if not required by law—when it comes to decision-making in a variety of policy domains, ranging from transportation, health, crime, education, and the environment.

Some Fundamental Concepts

Every CBA is different regarding the appropriate methodologies and required assumptions. There are nevertheless some fundamental concepts that are common to most applications of CBA, and anyone interested in environmental management should be familiar with a few in particular.

A CBA of any policy must first determine which costs and benefits should count. Though sometimes a point of controversy, CBA has a utilitarian foundation, whereby costs and benefits are derived solely on the basis of whether impacts make members of society worse- or better-off. CBA is thus entirely anthropocentric, and the people who count depends on the particular policy in question. If a CBA is being conducted to evaluate a policy at the city, state, or national level, then people corresponding to the policy’s political jurisdiction define the relevant population. While impacts that spillover to other jurisdictions may be important, they are beyond the scope of a CBA.

A CBA must also specify the planning horizon over which costs and benefits count. Consider a policy that requires upfront costs with benefits that continue indefinitely or far into the future, as is

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likely the case with policies designed to mitigate the effects of climate change. Practical questions arise about how far into the future the benefits should count. While disagreement may exist about the most appropriate planning horizon—50 years, 100 years, 200 years, or more—CBA requires specification of some duration, and the assumption should be made explicit, as it can significantly affect study results.

Discounting is another feature of CBA that can significantly affect results. When costs and benefits occur at different points in time, discounting makes adjustments to facilitate intertemporal comparisons. The basic idea is that, after taking account of the time value of resources (i.e., money), future costs and benefits are worth less today. Discounting, in effect, is the opposite of compounding interest on an investment, and it converts all future costs and benefits into their present value. The cost-benefit criterion is then a question of whether the present value net benefits are positive.

Both the timing of impacts and the discount rate itself have an important effect on CBA. For instance, with a discount rate of five percent, a benefit (or cost) of one-hundred dollars in ten years has a present value of approximately sixty-one dollars, and if it occurs in fifty years, the present value drops to less than nine dollars. With a discount rate of eight percent, the two present values are even lower, at approximately forty-six dollars and two dollars, respectively. Even these simple examples demonstrate the significant effect that discounting can have on CBA of policies to address long-term climate change: benefits that occur far into the future count much less against costs that must be incurred earlier.

There is general consensus within the economics profession about the need to discount, but the question of what discount rate to use is often subject to debate. Many economists argue that discount rates should reflect market transactions in which people reveal how they actually make intertemporal tradeoffs. Others argue in favor of lower discount rates that reflect more normative judgments about how societies ought to place more weight on the future. Such debate about the most appropriate discount rate is particularly salient in the context of climate change, as discount rates have such a large influence on the CBA of long-range policies. In practice, discount rates between four and eight percent are most common in the literature, but recent well-known and controversial analyses have argued that discounting of climate impacts at a planetary scale over long periods of time should occur at a much lower rate.

A further challenge to the conduct of CBA is the fact that all costs and benefits are not readily translated into monetary values. The most common way for economists to measure an individual's value for something is through the intuitive concept of one's willingness to pay (WTP). But there are many things that people value, such as environmental quality, for which they pay nothing, at least not directly. In order to account for these values, CBA often requires the use of nonmarket valuation techniques, where the aim is to infer WTP (or sometimes willingness to accept) for things that are not directly traded in markets and for which there are no immediate prices.

In order to infer environmental and resource values, some nonmarket valuation techniques look to observed behavior in related markets. For example, the travel-cost method, is used to estimate the benefits of national parks and recreational fishing areas based on the expenditures that visitors make in traveling to such areas. Another technique, the hedonic-price method, is able to investigate how environmental quality affects the prices of other goods and services. Differences in housing prices, for example, can be used to isolate the value of things like a scenic view, local air quality, and proximity to a hazardous waste site. Other possibilities range from looking at insurance markets to value

the costs of more extreme weather events, and looking at agricultural land prices to value differences in climate. Researchers can also look at adaptation to climate change as an averting expenditure to estimate particular costs of a changing climate.

Some economic values, known as “nonuse values,” are different because they leave no trace in market behavior. Nonuse values arise in the absence of any use of an environmental or natural resource amenity and, therefore, are based on the satisfaction of simply knowing the amenity exists is a particular state. Many people, for example, have a WTP to ensure the continued existence of polar bears, even though they never plan to see one. Estimation of nonuse values requires the use of hypothetical markets, in which a method known as contingent valuation directly questions people through surveys about their economic value. While nonuse value estimates derived in this way are widely used in CBA and natural resource damage assessments, questions often arise about the legitimacy of the values themselves and the ability to reliably produce estimates.

When all the elements of a CBA come together, and an initial conclusion is reached about whether the present value net benefits are positive, sensitivity analysis is an important next step. Sensitivity analysis is a tool for testing the robustness of findings to inherent uncertainties and the need for assumptions. The idea is to simply replace unknown or uncertain parameters with alternative values drawn from a plausible distribution. Researchers might, for example, conduct sensitivity analysis over alternative specifications of the discount rate, dose-response relationships, omitted costs/benefits, or predictions about future impacts from global climate models. Conclusions of any CBA should be explicit about whether the qualitative results are sensitive to particular parameters, especially when they are associated with uncertainty, differences of option, or both.

Some Concerns with CBA

As mentioned previously, concerns about CBA mirror general critiques about the use of economic efficiency as a normative criteria and about the technique’s reliance on monetization. One source of controversy is the conceptual foundation of CBA as it relates to distributional equity. Consider a policy that makes some individuals better-off and no individuals worse-off. Such a policy is said to produce a “Pareto improvement,” and it would obviously pass the cost-benefit test. Most policies, however, are likely to produce winners and losers, and CBA requires only that the gains to the winners exceed the losses to the losers. While the winners could compensate the losers to create a Pareto improvement, the cost-benefit test implements only a “potential Pareto criterion,” meaning that compensation, while possible, need not take place—and in practice it rarely does. As a result, policies that make it through a CBA are frequently at odds with concerns about distributional equity.

Measuring costs and benefits with WTP is also objectionable to some because it depends so heavily on the distribution of income. People with lower incomes have a lower ability to pay and therefore have less influence on the outcome of a CBA. In principle, CBA can incorporate distributional weights to address concerns about inequity, but there is no clear guidance about how such weights should be assigned. Consequently, distributional weights are rarely used in practice. Related arguments are also made out of concern for future generations. Regarding climate change in particular, critics of the CBA approach argue that discounting poses problems for intergeneration equity because it down-weights the costs to future generations.

The fact that CBA is based on monetization of all costs and benefits is another source of criticism. Many things are difficult (or maybe impossible) to monetize, and there are those who feel that some

things are priceless, whereby placing an economic value on them is effectively devaluing. A rights-based environmentalist, for example, may believe that polar bears are priceless, and protecting the species is simply the right thing to do, regardless of the costs and benefits. The problem, of course, is that many people have different priorities and often disagree about the right thing to do, and we can only do them all under extremely rare circumstances. When tradeoffs are required, CBA provides a systematic way for evaluating the consequences of choosing a particular alternative. Though we should keep in mind that the systematic approach is based on economic efficiency, and other normative criteria (e.g., equity and ecological sustainability) may have an equal stake in the decision-making process.

Policy Relevance

No technique for analyzing public policy is immune to criticism, and CBA is no exception. Nevertheless, CBA is perhaps the most widely applied and influential method of policy analysis. Many countries have specific guidelines for the conduct of regulatory impact analysis, and CBA typically plays a prominent role. In the United States, for example, CBA has been required since 1981 of most new regulations that impose significant costs or economic impacts. The existing statutory requirement is not that policies necessarily pass the cost-benefit test, but that CBA be used as a general accounting framework to highlight the range of impacts of proposed policies. Since 1993, the specific provision has been that the “benefits justify costs.” In this capacity, CBA plays an important role in decision-making about environmental quality and public health at the U.S. Environmental Protection Agency, along with other regulatory agencies.

In the end, public policies in all areas of governance impose costs and benefits on members of society. Prudent decision-making requires a clear and systematic understanding of the different impacts, and CBA—appropriately applied as a *decision tool* rather than a *decision rule*—provides a useful framework to aid in the process. Other analytical techniques, among which CBA is a useful complement, include cost-effectiveness analysis, multi-criteria analysis, risk assessment, and environmental impact assessment.

References

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