CHAPTER 1

Introduction to Cost-Benefit Analysis

In the Affair of so much Importance to you, wherein you ask my Advice, I cannot for want of sufficient Premises, advise you what to determine, but if you please I will tell you how. When those difficult Cases occur, they are difficult, chiefly because while we have them under Consideration, all the Reasons pro and con are not present to the Mind at the same time; but sometimes one Set present themselves, and at other times another, the first being out of Sight. Hence the various Purposes or Inclinations that alternately prevail, and the Uncertainty that perplexes us.

To get over this, my Way is, to divide half a Sheet of Paper by a Line into two Columns; writing over the one Pro, and over the other Con. Then during three or four Days Consideration, I put down under the different Heads short Hints of the different Motives, that at different Times occur to me, for or against the Measure. When I have thus got them all together in one View, I endeavor to estimate their respective Weights; and where I find two, one on each side, that seem equal, I strike them both out. If I find a Reason pro equal to some two Reasons con, I strike out the three. If I judge some two Reasons con, equal to some three Reasons pro, I strike out the five; and thus proceeding I find at length where the Balance lies; and if after a Day or two of farther consideration, nothing new that is of Importance occurs on either side, I come to a Determination accordingly. And, tho' the Weight of Reasons cannot be taken with the Precision of Algebraic Quantities, yet, when each is thus considered, separately and comparatively, and the whole lies before me, I think I can judge better, and am less liable to make a rash Step; and in fact I have found great Advantage from this kind of Equation, in what may be called Moral or Prudential Algebra.

—B. FRANKLIN, LONDON, SEPTEMBER 19, 1772[1]

INDIVIDUAL VERSUS SOCIAL COSTS AND BENEFITS

Benjamin Franklin's advice about how to make a decision illustrates many of the important features of cost-benefit analysis (CBA). These include a systematic cataloguing of impacts as benefits (pros) and costs (cons), valuing in dollars (assigning weights),

and then determining the *net benefits* of the proposal relative to the status quo (net benefits equal benefits minus costs).

When we as individuals talk of costs and benefits, we naturally tend to consider only our *own* costs and benefits, generally choosing among alternative courses of action according to whichever has the largest individual net benefits. Similarly, in evaluating various investment alternatives, a firm tends to consider only those costs (expenditures) and benefits (revenues) that accrue to it. In CBA we try to consider *all of the costs and benefits to society as a whole,* that is, the *social costs* and the *social benefits.* For this reason, some experts refer to CBA as *social* cost-benefit analysis.

CBA is a policy assessment method that quantifies in monetary terms the value of all consequences of a policy to all members of society. Throughout this book we use the terms *policy* and *project* interchangeably. More generally, CBA applies to policies, programs, projects, regulations, demonstrations, and other government interventions. The aggregate value of a policy is measured by its net social benefits, sometimes simply referred to as the net benefits. The *net social benefits, NSB,* equal the social benefits, *B,* minus the social costs, *C:*

$$NSB = B - C \tag{1.1}$$

Stated at this level of abstraction, it is unlikely that many people would disagree with doing CBA. In practice, however, there are two types of disagreements. First, social critics, including some political economists, philosophers, libertarians, and socialists, have disputed the fundamental utilitarian assumptions of CBA that the sum of individual utilities should be maximized and that it is possible to trade off utility gains for some against utility losses for others. These critics are not prepared to make trade-offs between one person's benefits and another person's costs. Second, participants in the public policy-making process (analysts, bureaucrats, and politicians) may disagree about such practical issues as what impacts will actually occur over time, how to monetize (attach a dollar value to them), and how to make trade-offs between the present and the future.

In this chapter we provide a nontechnical but reasonably comprehensive overview of CBA. Although we introduce a number of key concepts, we do so informally, returning to discuss them thoroughly in subsequent chapters. Therefore, this chapter is best read without great concern about definitions and technical details.

TYPES OF CBA ANALYSES AND THEIR PURPOSES

The broad purpose of CBA is to help social decision making and to make it more rational. More specifically, the objective is to have more efficient allocation of society's resources. As we show in Chapter 3, where markets work well, individual self-interest leads to an efficient allocation of resources. Consequently, government analysts and politicians bear the burden of providing a rationale for any governmental interference with private choice. Economists lump these rationales under the general heading of *market failures.* Where markets fail, there is a *prima facie* rationale for government intervention. However, and this is important to emphasize, it is no more

than that. One must be able to demonstrate the superior efficiency of a particular intervention relative to the alternatives, including the status quo. For this purpose, analysts use CBA.

There are two major types of cost-benefit analysis. *Ex ante* CBA, which is just standard CBA as the term is commonly used, is conducted while a project or policy is under consideration, before it is started or implemented. *Ex ante* CBA assists in the decision about whether resources should be allocated by government to a specific project or policy or not. Thus, its contribution to public policy decision making is direct, immediate, and bureau-specific. *Ex post* CBA is conducted at the end of a project. At this time, all of the costs are "sunk" in the sense that they have already been used up to do the project. The value of *ex post* analyses is broader but less immediate as they provide information not only about the particular intervention but also about the "class" of such interventions. In other words, they contribute to "learning" by government managers, politicians, and academics about whether particular classes of projects are worthwhile.

Some CBA studies are performed during the course of the life of a project, that is, *in medias res.* Like *ex ante* analyses, *in medias res* analyses have the potential of directly influencing a decision—whether or not to continue the project. They also provide information that can be used to predict costs and benefits in future *ex ante* analyses.

There is also a fourth type of CBA—one that compares an *ex ante* CBA with an *ex post* (or *in medias res*) CBA *of the same project.* This comparative type of CBA is most useful to policy makers for learning about the efficacy of CBA as a decision-making and evaluative tool. Unfortunately, there are only a few disinterested published examples of this type of CBA. The scarceness of this type of CBA is not as surprising as it may appear because there is relatively little demand for *ex post* or *in medias res* CBAs and, even if one of these studies is done, there may not be an *ex ante* CBA to compare it to.

It is useful to elaborate on the uses of these four types of CBAs. Table 1-1 summarizes the important ways that these four types of cost-benefit analyses aid government decision making.

Project-Specific Decision Making

Ex ante analysis is most useful for deciding whether resources should be allocated to a particular project or program that is under consideration. An *in medias res* analysis of an ongoing project can also be used for decision-making purposes where it is potentially feasible to shift resources to alternative uses. Although such an analysis may lead to discontinuation of service-orientated programs (e.g., government-funded training programs), it will rarely lead to termination of a physical investment project nearing completion, such as a dam or bridge, because a large share of the costs will likely have been incurred, and benefits subsequent to the analysis will usually exceed the remaining costs. However, it can happen. For example, a Canadian Environmental Assessment Panel recommended the decommissioning of a just-completed dam on the basis of an *in medias res* analysis which showed that, with use, future environmental costs would exceed future benefits.[2] Because *ex post* analysis is conducted at the end of the project,

TABLE 1-1 Value of Different Classes of CBA

	Class of Analysis			
Value	*Ex Ante*	*In Medias Res*	*Ex Post*	*Ex Ante/Ex Post or Ex Ante/ In Medias Res Comparison*
Resource allocation decision for this project.	Yes—helps to select best project or make "go" versus "no-go" decisions, if accurate.	If low sunk costs, can still shift resources. If high sunk costs, usually recommends continuation.	Too late—the project is over.	Same as *in medias res* or *ex post* analysis.
Learning about actual value of specific project.	Poor estimate—high uncertainty about future benefits and costs.	Better—reduced uncertainty.	Excellent—although some errors may remain. May have to wait long for study.	Same as *in medias res* or *ex post* analysis.
Contributing to learning about actual value of similar projects.	Unlikely to add much.	Good—contribution increases as performed later. Need to adjust for uniqueness.	Very useful—although may be some errors and need to adjust for uniqueness. May have to wait long for project completion.	Same as *in medias res* or *ex post* analysis.
Learning about omission, forecasting, measurement and evaluation errors in CBA.	No	No	No	Yes, provides information about these errors and about the accuracy of CBA for similar projects.

Source: Anthony E. Boardman, Wendy L. Mallery, and Aidan R. Vining, "Learning from *Ex Ante/Ex Post* Cost-Benefit Comparisons: The Coquihalla Highway Example," *Socio-Economic Planning Sciences,* 28(2), 1994, 69–84, Table 1, p. 71. Reprinted with kind permission from Elsevier Science Ltd., The Boulevard, Langford Lane, Kidlington OX5 1GB, UK.

it is obviously too late to reverse resource allocation decisions with respect to that particular project.

Learning about the Net Social Benefits of a Specific Project

In the early stages of a project there is considerable uncertainty about its actual impacts and, consequently, about the true net social benefits. As time goes by, more is known about the impacts, and CBA studies conducted later can estimate the net benefits of the

project more accurately. In general, *ex post* studies are more accurate than *in medias res* studies, which in turn are more accurate than *ex ante* studies.

Learning about the Potential Benefits of Similar Projects

Ex post analyses provide information not only about a particular policy intervention but, more importantly, about future similar interventions as well. *Ex post* analyses (and *in medias res* analyses) potentially contribute to learning by political and bureaucratic decision makers, as well as policy researchers, about whether particular kinds of projects are worthwhile. This potential depends crucially on the extent to which the particular project being assessed is being replicated or can serve as a generic model for other projects.[3] CBAs of experiments involving the efficacy of new surgical procedures or new pharmaceutical products usually can be generalized to larger populations. Lessons from other experiments, however, may not be as easily generalized. For example, if the proposed intervention is several orders of magnitude bigger than the experiment, there may be unknown nonlinear scale effects. Also, if the proposed program has a more extended time frame than the experiment, behavioral factors may affect costs or benefits unpredictably.

Learning about the Efficacy of CBA

Comparison of an *ex ante* study with either an *in medias res* or an *ex post* analysis is most useful for learning about the value of CBA itself. Most importantly, a comparison CBA provides information about the accuracy of the earlier *ex ante* CBA which, in turn, provides guidance about the accuracy of future *ex ante* analyses. One study has assessed the accuracy of U.S. regulatory cost estimates (although not of benefits) and found that total costs tend to be overestimated.[4] Information about the predictive ability of CBA is useful for decision-making purposes. Also, comparison studies help analysts understand the reasons for any divergence between predicted and actual benefits or costs. In Chapter 11, we discuss prediction (and valuation) in detail and review some important potential types of errors. Understanding the reasons for these errors helps to reduce them in the future.

THE BASIC STEPS OF CBA: COQUIHALLA HIGHWAY EXAMPLE

CBA may look intimidating and complex. To help make the process of conducting a CBA more manageable, we break it down into nine basic steps, which are listed in Table 1-2. We describe and illustrate these steps using a relatively straightforward example—the construction of a new highway. For each step, we also point out some practical difficulties. The conceptual and practical issues that we broach are the focus of the rest of this book. Do not worry if the concepts are unfamiliar to you; this is a dry run. Subsequent chapters fully explain them.

Imagine that in 1986 a cost-benefit analyst, who works for the Province of British Columbia, Canada, is asked to perform a CBA of a proposed highway between the town of Hope in the south-central part of the Province and Merritt, which is more or less due north of Hope. This highway would be called the Coquihalla Highway. The

TABLE 1-2 The Major Steps in CBA

1. Specify the set of alternative projects.
2. Decide whose benefits and costs count (standing).
3. Identify the impact categories, catalogue them, and select measurement indicators.
4. Predict the impacts quantitatively over the life of the project.
5. Monetize (attach dollar values to) all impacts.
6. Discount benefits and costs to obtain present values.
7. Compute the net present value of each alternative.
8. Perform sensitivity analysis.
9. Make a recommendation.

analyst's CBA is presented in Table 1-3.[5] How did the analyst get these results? What were the difficulties? We will go through each of the nine steps.

1. Specify the set of alternative projects. Step 1 requires the analyst to specify the set of alternative projects. In this example, the provincial government required the analyst to consider only two alternative four-lane highways, one with tolls and one without. The provincial department of transportation decided that the toll, if applied, would be $40 for large trucks and $8 for cars. Thus, the analyst has a tractable set of alternatives to analyze.

TABLE 1-3 Coquihalla Highway CBA (1986 $ Million)

	No Tolls		*With Tolls*	
	A ***Global Perspective***	***B*** ***Provincial Perspective***	***C*** ***Global Perspective***	***D*** ***Provincial Perspective***
Project Benefits:				
Time and Operating Cost Savings	389.8	292.3	290.4	217.8
Horizon Value of Highway	53.3	53.3	53.3	53.3
Safety Benefits (Lives)	36.0	27.0	25.2	18.9
Alternative Routes Benefits	14.6	10.9	9.4	7.1
Toll Revenues	—	—	—	37.4
New Users	0.8	0.6	0.3	0.2
Total Benefits	494.5	384.1	378.6	334.7
Project Costs:				
Construction	338.1	338.1	338.1	338.1
Maintenance	7.6	7.6	7.6	7.6
Toll Collection	—	—	8.4	8.4
Toll Booth Construction	—	—	0.3	0.3
Total Costs	345.7	345.7	354.4	354.4
Net Social Benefits	148.8	38.4	24.2	–19.7

Source: Adapted from Anthony Boardman, Aidan Vining, and W. G. Waters II, "Costs and Benefits through Bureaucratic Lenses: Example of a Highway Project," *Journal of Policy Analysis and Management,* 12(3) 1993, 532–555, Table 1, p. 537.

In practice, however, there are often difficulties even at this stage. For many projects, including this one, the number of potential alternatives is huge. This highway could vary on many dimensions including the following:

Road surface: It could be surfaced in bitumen or concrete.

Routing: It could take different routes.

Size: It could have two, three, four, or six lanes.

Tolls: The tolls could be higher or lower.

Wild animal friendliness: The highway could be built with or without "elk tunnels."

Timing: It could be delayed until a later date.

Changing the highway on just a few these dimensions would greatly increase the number of alternatives. For example, with four dimensions, each with three possible values, there would be 81 alternatives! Neither decision makers nor analysts can cognitively handle comparisons among such a large number of alternatives. Resource and cognitive constraints mean that analysts typically analyze only a few (less than six) alternatives.[6]

CBA compares the net social benefits of investing resources in one or more particular potential projects with the net social benefits of a project that would be displaced if the project(s) under evaluation were to proceed. The displaced project is often called the *counterfactual.* Usually, the counterfactual is the *status quo,* which means there is no change in government policy (i.e., in this case, no new highway). In Table 1-3 the analyst computes the benefits, costs, and net social benefits if the highway were built (with or without tolls) relative to the benefits, costs, and net social benefits if the highway is not built (the status quo). Thus, one can interpret these benefits, costs, and net benefits as *incremental* amounts.

Sometimes the status quo is not a viable alternative. *If a project would displace a specific alternative, then it should be evaluated relative to the specific displaced alternative.* Thus, if government has committed resources to either a highway project or a rail project, and there is no possibility of maintaining the status quo, then the highway project should be compared with the rail project, not the status quo.

This CBA example pertains to a specific proposed highway. There is no attempt to compare this highway project to alternative highway projects in British Columbia, although one could do so. Rarely does the analyst compare a highway project to completely different types of projects, such as health care, antipoverty, or national defense projects. As a practical matter, full optimization is impossible. The limited nature of the comparisons sometimes frustrates politicians and decision makers who imagine that CBA is a *deus ex machina* that will rank *all* policy alternatives. On the other hand, the weight of CBA evidence can and does help in making broad social choices across policy areas.

2. Decide whose benefits and costs count (standing). Next, the analyst must decide who has *standing*; that is, whose benefits and costs should be included. In this example, the analyst's superiors in the provincial government wanted the CBA to be done from the provincial perspective, but asked the analyst to also take a global perspective. The provincial perspective measures only the benefits and costs that affect British Columbian residents, including costs and benefits borne by the British Columbian government. The global perspective includes the benefits and costs that affect everyone,

irrespective of where they reside. Thus, it includes benefits and costs to Americans, Albertans, and even tourists from the United Kingdom. Combining these two perspectives on standing with the no-tolls and with-tolls alternatives gives the four columns in Table 1-3 labeled A through D.

The issue of standing is sometimes contentious. While federal governments usually take only national costs and benefits into account, critics argue that many issues should be analyzed from a global perspective. Environmental issues that fall into this category include ozone depletion, global climate change, and acid rain. At the other extreme, local governments typically want to consider only benefits and costs to local residents and to ignore costs and benefits that occur in adjacent municipalities or are borne by higher levels of government. Our highway example deals with this issue by analyzing costs and benefits from both the global and the British Columbian perspectives.

3. Identify the impact categories, catalogue them, and select measurement indicators. Step 3 requires the analyst to identify the physical impact categories of the proposed alternatives, catalogue them as benefits or costs, and specify the measurement indicator of each impact category. We use the term *impacts* broadly to include both inputs (required resources) and outputs. For this proposed highway, the anticipated benefit impact categories are time saved and reduced vehicle operating costs for travelers on the new highway ("Time and Operating Cost Savings" in Table 1-3); the value of the highway at the end of the discounting period of 20 years ("Horizon Value of Highway"); accidents avoided (including lives saved) due to drivers switching to a shorter, safer new highway ("Safety Benefits"); reduced congestion on alternative routes—the old road ("Alternative Routes Benefits"); revenues collected from tolls ("Toll Revenues"); and benefits accruing to new travelers ("New Users"). The cost impact categories are construction costs ("Construction"), additional maintenance and snow removal ("Maintenance"), toll collection ("Toll Collection"), and toll booth construction and maintenance ("Toll Booth Construction").

Although this list of impact categories appears comprehensive, current critics might argue that some relevant impacts were omitted. At the time of the analysis, health impacts from automobile emissions, impacts on the elk population and other wildlife, and changes in scenic beauty were not considered. Also, the cost of the land was excluded.

From a CBA perspective, analysts are interested only in project impacts that affect the utility of individuals with standing. Impacts that do not have any value to human beings are not counted. (The caveat is that this applies only where human beings have the relevant knowledge and information to make rational valuations.) Politicians often state the purported impacts of projects in very general terms. For example, they might say that a project will promote "community capacity building." Similarly, politicians have a strong tendency to regard "growth" and "regional development" as beneficial impacts. CBA requires analysts to identify explicitly the ways in which the project would make some individuals better off through, for example, improved skills, better education, or higher incomes. Of course, analysts should also include the negative environmental and congestion impacts of growth.

Put another way, in order to treat something as an impact, we have to know there is a cause-and-effect relationship between some physical outcome of the project and the utility of human beings with standing. For some impacts, this relationship is so obvious

that we do not think about it explicitly. For example, we do not question the existence of a causal relationship between motor vehicle usage and motor vehicle accidents. For other impacts, however, the causal relationships may not be so obvious. What, if any, is the impact of exhaust fumes from additional vehicle usage on residents' morbidity and mortality? How is this offset by fewer airplane flights? Demonstrating such cause-and-effect relationships often requires an extensive review of scientific and social science research. Sometimes the evidence may be ambiguous. For example, controversy surrounds the effect of chlorinated organic compounds in bleached pulp mill effluent on wildlife. Although a Swedish study found such a link, a later Canadian study found none.[7]

Analysts should be on the lookout for impacts that different groups of people view in opposite ways. Consider, for example, flooded land. Residents of a flood plain generally view floods as a cost because they damage homes, while duck hunters regard them as a benefit because they attract ducks. Even though opposing valuations of the same impact could be aggregated in one category, it is usually more useful to have two impact categories—one for damaged homes and another for recreation benefits.

Specification of impact measurement indicators usually occurs at the same time as specification of the impact categories. There are no particular difficulties in specifying measurement indicators of each impact in this illustration. For example, the number of lives saved per year, the number of person-hours of travel time saved, and the dollar value of gasoline saved are reasonably intuitive indicators. If environmental impacts had been included, then the choice of indicator would have not been so straightforward. For example, the analyst might have to decide whether to use tons of various pollutants or the resultant health effects (e.g., changes in mortality or morbidity).

The choice of measurement indicator depends on data availability and ease of monetization. For example, an analyst may wish to measure the number of crimes avoided due to a policy intervention but may not have any way to estimate this impact. However, the analyst may have access to changes in arrest rates or changes in conviction rates and may be able to use one or both of these surrogates to estimate changes in crime.[8] Bear in mind, however, that all surrogate indicators involve some loss of information. For example, the conviction rate might be increasing while there is no change in the actual crime rate.

4. Predict the impacts quantitatively over the life of the project. The proposed highway project, like almost all projects, has impacts that extend over time. The fourth task is to quantify all impacts in each time period. The analyst must make predictions for the no-tolls and with-tolls alternatives, for each year, and for each category of driver (trucks, passenger cars on business, passenger cars on vacation) about

- the number of vehicle-trips on the new highway,
- the number of vehicle-trips on the old roads, and
- the proportion of travelers from British Columbia.

With these estimates, knowing the highway is 195 kilometers long and with other information, the analyst can estimate

- the total vehicle operating costs that users save,
- the number of accidents avoided, and
- the number of lives saved.

For example, the analyst estimated the new highway would save 6.5 lives each year:

Shorter distance:	
130 vkm × 0.027 lives lost per vkm	= 3.5 lives/year
Safer (4-lane versus 2-lane):	
313 vkm × 0.027 lives lost per vkm × 0.33	= 3.0 lives/year
Total lives saved[9]	**= 6.5 lives/year**

Lives would be saved for two reasons. First, the new highway will be shorter than existing alternative routes. It is expected that travelers will avoid 130 million vehicle-kilometers (vkm) of driving each year, and evidence suggests that, on average, there are 0.027 deaths per million vehicle-kilometers. The shorter distance is expected, therefore, to save 3.5 lives per year on the basis of less distance driven. The new highway is also predicted to be safer per kilometer driven. It is expected that 313 million vehicle-kilometers will be driven each year on the new highway. Based on previous traffic engineering evidence, the analyst estimated that the new highway would lower the fatal accident rate by one-third. Consequently, the new highway is expected to save 3.0 lives per year due to being safer. Combining the two components suggests 6.5 lives will be saved each year.

In practice, predicting impacts is very important and very difficult! It is so important in CBA that Chapter 11 is devoted to it (and the related issue of valuation). Prediction is especially difficult where projects are unique, have long time horizons, or relationships among variables are complex. Many of the realities associated with doing steps 3 and 4 are brilliantly summarized by Kenneth Boulding's poem on dam building in the Third World, presented in Exhibit 1-1. Many of his points deal with the omission of impact categories due to misunderstanding or ignorance of cause-and-effect relationships and to prediction errors. He also makes points about the distribution of costs and benefits, which we discuss later.

5. Monetize (attach dollar values to) all impacts. The analyst next has to monetize each of the impacts. To *monetize* means to value in dollars. In the highway example, the analyst has to monetize each unit of time saved, lives saved, and accidents avoided. For this, the analyst needs the monetary value of an hour saved by each type of traveler, the value of a statistical life saved, and the value of an avoided accident. Ideally, these estimates should be specific to British Columbia in 1986. Some of the dollar values used in this CBA were

- leisure time saved per vehicle (25 percent of gross wage times the average number of passengers) = $6.68 per vehicle-hour,
- business time saved per vehicle = $12 per vehicle-hour,
- truck drivers' time saved per vehicle = $14 per vehicle-hour, and
- value of a life saved = $500,000 per life.

These estimates were based on studies conducted prior to 1986. Research over the last twenty years suggests the value of a statistical life saved is much higher, as we discuss in Chapter 16.

EXHIBIT 1-1

A BALLAD OF ECOLOGICAL AWARENESS

The cost of building dams is always underestimated,
There's erosion of the delta that the river has created,
There's fertile soil below the dam that's likely to be looted,
And the tangled mat of forest that has got to be uprooted.

There's the breaking up of cultures with old haunts' and habits' loss,
There's the education programme that just doesn't come across,
And the wasted fruits of progress that are seldom much enjoyed
By expelled subsistence farmers who are urban unemployed.

There's disappointing yield of fish, beyond the first explosion;
There's silting up, and drawing down, and watershed erosion.
Above the dam the water's lost by sheer evaporation;
Below, the river scours, and suffers dangerous alteration.

For engineers, however good, are likely to be guilty
Of quietly forgetting that a river can be silty,
While the irrigation people too are frequently forgetting
That water poured upon the land is likely to be wetting.

Then the water in the lake, and what the lake releases,
Is crawling with infected snails and water-borne diseases.
There's a hideous locust breeding ground when water level's low,
And a million ecologic facts we really do not know.

There are benefits, of course, which may be countable, but which
Have a tendency to fall into the pockets of the rich,
While the costs are apt to fall upon the shoulders of the poor.
So cost-benefit analysis is nearly always sure
To justify the building of a solid concrete fact,
While the Ecologic Truth is left behind in the Abstract.

—KENNETH E. BOULDING

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Sometimes, the most intuitively important impacts are difficult to value in monetary terms. Valuing environmental impacts is especially contentious. In CBA, the value of an output is typically measured in terms of "willingness-to-pay." As we discuss in Chapter 3, where markets exist and work well, willingness to pay can be determined from the appropriate market demand curve. Naturally, problems arise where markets do not exist or do not work well. Obtaining values for such impact categories can be a life's work. Scholars have spent many person-years trying to determine the appropriate value of a statistical life saved. In practice, most CBA analysts

do not reinvent these wheels but instead draw upon previous research: they use "plug in" values whenever possible. Although catalogues of impact values are not comprehensive, considerable progress has been made in this regard as we show in Chapter 16.

If no person is willing to pay for some impact, then that impact would have zero value in a CBA. For example, if construction of a dam would lead to the extermination of a species of small fish, but no one with standing is willing to pay a positive amount to save that species, then the extermination of this fish would have a value of zero in a CBA of the dam.

Some government agencies and critics of CBA are unwilling to attach a monetary value to life or to some other impact. This forces them to use an alternative method of analysis, such as *cost-effectiveness analysis* or *multigoal analysis,* which we discuss in Chapters 2 and 18.

6. Discount benefits and costs to obtain present values. For a project that has impacts that occur over years, we need a way to aggregate the benefits and costs that arise in different years. In CBA, future benefits and costs are *discounted* relative to present benefits and costs in order to obtain their *present values (PV).* The need to discount arises for two main reasons. First, there is an *opportunity cost* to the resources used in a project. Second, most people prefer to consume now rather than later. Discounting has nothing to do with inflation per se, although inflation must be taken into account.

A cost or benefit that occurs in year t is converted to its present value by dividing it by $(1 + s)^t$, where s is the social discount rate. Suppose a project has a life of n years and let B_t and C_t denote the benefits and costs in year t, respectively. The present value of the benefits, $PV(B)$, and the present value of the costs, $PV(C)$, of the project are, respectively:

$$PV(B) = \sum_{t=0}^{n} \frac{B_t}{(1 + s)^t} \tag{1.2}$$

$$PV(C) = \sum_{t=0}^{n} \frac{C_t}{(1 + s)^t} \tag{1.3}$$

In this highway example the analyst used a real (inflation-adjusted) social discount rate of 7.5 percent. As we discuss in Chapter 10, the choice of the appropriate social discount rate is contentious and is, therefore, a good candidate for sensitivity analysis. For government analysts, the discount rate is usually mandated by a government agency with authority (e.g., the Office of Management and Budget, or the General Accountability Office in the U.S., or the Ministry of Finance or the Treasury Board). However, as we argue in Chapter 10, these rates in other countries, especially in North America. In that chapter, we present the case for a range of rates depending on a few parameters. For most projects that do not have impacts beyond 50 years (it is *intragenerational*), we recommend a real social discount rate of 3.5 percent. If the project is *intergenerational,* then we recommend time-declining discount rates.[10]

7. Compute the net present value of each alternative. The *net present value (NPV)* of an alternative equals the difference between the *PV* of the benefits and the *PV* of the costs:

$$NPV = PV(B) - PV(C) \tag{1.4}$$

The basic decision rule for a single alternative project (relative to the status quo) is simple: *adopt the project if its NPV is positive.* In short, the analyst should recommend proceeding with the proposed project if its $NPV = PV(B) - PV(C) > 0$; that is, if its benefits exceed its costs:

$$PV(B) > PV(C)$$

When there is more than one alternative to the status quo and all the alternatives are mutually exclusive, then the rule is slightly more complicated: *select the project with the largest NPV.* This rule assumes implicitly that at least one *NPV* is positive. If no *NPV* is positive, then none of the specified alternatives are superior to the status quo, which should remain in place.

Earlier we emphasized the net social benefits of a project. We show in Chapter 6 that the *NPV* of a project or policy is identical to the present value of the net social benefits:

$$NPV = PV(NSB) \tag{1.5}$$

Thus, selecting the project with the largest *NPV* is equivalent to selecting the project with the largest *PV* of the net social benefits.

In the highway example, the no-tolls alternatives (columns A and B) have higher *NPV*s than the with-tolls alternatives (columns C and D). Thus, if the analyst were confident in these *NPV*s, she should recommend that the highway should be constructed without tolls. However, it is important to remember that these *NPV*s are estimates and that sensitivity analysis (step 8) should be conducted before making a final recommendation.

Before turning to sensitivity analysis, we discuss decision making in a bit more detail. In fact, there is some confusion about the appropriate decision rule. Both the *internal rate of return,* which is discussed in Chapter 6, and the *benefit-cost ratio,* which is discussed in Chapter 2, have also been proposed as decision rules. This is one area with more heat than light. The *appropriate criterion to use is the NPV rule.* Other rules sometimes give incorrect answers; the *NPV* rule does not.

An obvious caveat about the *NPV* criterion is that it applies only to the actual alternatives specified. Other alternatives might conceivably be better. While the *NPV* criterion results in a *more efficient* allocation of resources, it does not necessarily recommend *the most efficient* allocation of resources. This point is illustrated in Figure 1-1. Consider a set of proposed projects that vary according to the amount of output (Q), which in turn depends on the scale of the project. The benefits and costs associated with alternative scales are represented by the functions $B(Q)$ and $C(Q)$, respectively. The benefits increase as the scale increases, but at a decreasing rate. In contrast, costs increase at an increasing rate. A small-scale project (for example, Q_1) has positive net benefits relative to the status quo, Q_0. As the scale increases, the net benefits increase

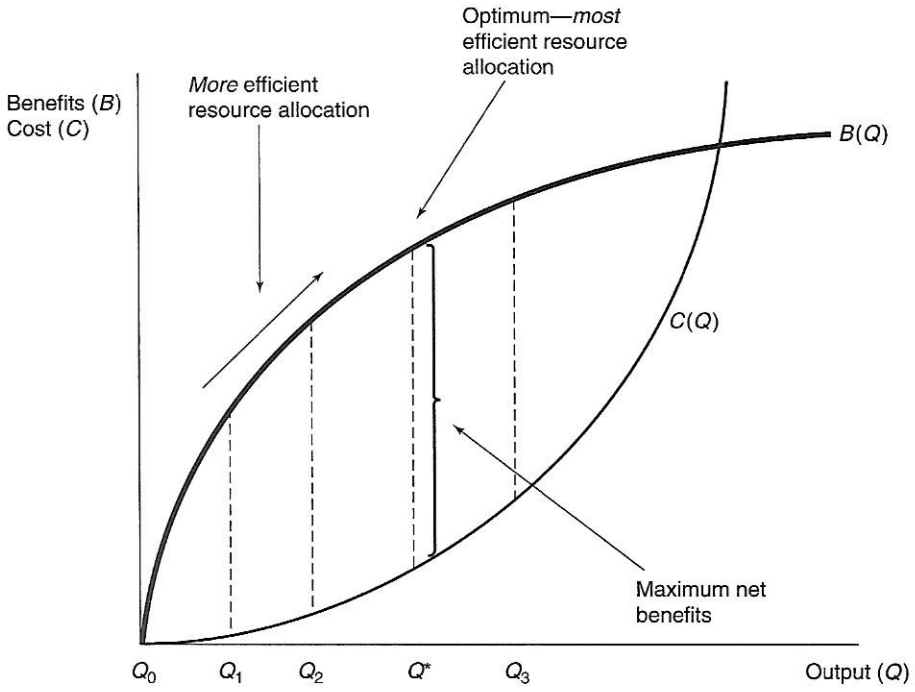

FIGURE 1-1 CBA Seeks More Efficient Resource Allocation

up to the optimal scale, Q^*.[11] As the scale increases beyond Q^*, the net benefits decrease. Net benefits are positive as long as the benefit curve is above the cost curve, they are zero where the cost curve and benefit curve intersect, and they are negative for larger-scale projects.

Suppose that the analyst evaluates only two alternative projects (those with output levels, Q_1 and Q_2). Clearly, output level Q_2 is preferred to output level Q_1, which, in turn, is preferred to the status quo, Q_0. The analyst would therefore recommend Q_2. However, as the figure shows, net social benefits are maximized at output level Q^*. This optimal output level was not recommended because it was not among the set evaluated. As this example illustrates, *use of the NPV criterion leads to a more efficient outcome than the status quo, not necessarily the most efficient outcome.*

The analyst may not have included the optimum output level in the set of alternatives for a number of reasons. The optimum output level may not have been known, even approximately, until after the analysis was performed. Cognitive capacity limitations, often summarized as *bounded rationality* problems, may have hindered the analyst from considering the optimal alternative.[12] Additionally, budgetary or political constraints may have limited the range of alternatives considered.

8. Perform sensitivity analysis. As the foregoing discussion emphasizes, there may be considerable uncertainty about both the predicted impacts and the appropriate monetary valuation of each unit of the impact. For example, the analyst may be uncertain about the predicted number of lives saved and about the appropriate dollar value to place on a statistical life saved. The analyst may also be uncertain about the appropriate social discount rate and about the appropriate level of standing. Sensitivity analysis, which we discuss in Chapter 7, attempts to deal with such uncertainties. As shown in Table 1-3, the analyst performed sensitivity analysis on the standing issue by computing the *NPV*s from both the global perspective and the provincial perspective.

There are practical limits to the amount of sensitivity analysis that is feasible. Potentially, every assumption in a CBA can be varied. In practice, one has to use judgment and focus on the most important assumptions. Although this can mean that CBA is vulnerable to the biases of the analyst, carefully thought-out scenarios are usually more informative than a mindless varying of assumptions.

9. Make a recommendation. Generally, the analyst should recommend adoption of the project with the largest *NPV*. In the highway example, three of the alternative projects had positive *NPV*s and one had a negative *NPV*. The latter indicates that from the British Columbian perspective it would be more efficient to maintain the status quo and not build the Coquihalla highway than to build it and charge tolls. As discussed earlier, the no-tolls alternatives are superior to the with-tolls alternatives. This result gives a flavor of the possibly counterintuitive recommendations that CBA can support. In this case, tolls lower the *NPV* because they deter people from using the highway, and so fewer people enjoy the benefits.[13]

As we have emphasized, however, the *NPV*s are estimated values. Sensitivity analysis, which we have not shown in detail, might suggest that the alternative with the largest expected *NPV* is not necessarily the best alternative in all circumstances.

Finally, it is important to note that analysts make recommendations, not decisions. CBA concerns how resources *should* be allocated; it is *normative.* It does not claim to be a *positive* (i.e., descriptive) theory of how resource allocation decisions are actually made. Such decisions are made in political and bureaucratic arenas. CBA is only one input to this political decision-making process—one that attempts to push it toward more efficient resource allocation. CBA does not always succeed. Politicians are often reluctant to be persuaded by economic arguments. Indeed, the highway was built with tolls, although they were removed in 2008.

BUREAUCRATIC AND POLITICAL "LENSES"[14]

Thus far, we have assumed that CBA is not influenced by bureaucratic or political processes. This approach is appropriate given that CBA concerns how resources should be allocated. In practice, however, CBA frequently gets distorted when bureaucrats or politicians become involved with it. Bureaucrats have a tendency to *see* "costs" and "benefits" differently depending on their position and their agency. Bureaucrats' roles have a strong influence on what they think CBA is, or should be, about. Specifically, their perceptions of what constitutes "benefits" and "costs" are based on whether they

are *analysts, spenders,* or *guardians.*[15] These labels are indicative of three different perspectives (lenses) bureaucrats bring to project evaluation in government. The analysts' perspective is standard CBA, which we have already illustrated in Table 1-3. Guardians and spenders have quite different perspectives.

Most government bureaucrats have not taken, and will not take, formal courses in cost-benefit analysis. They believe that what they think is CBA is, in fact, CBA, even if it is not. This section describes the perspectives of guardians and spenders, and shows how these perspectives differ from CBA. This helps clarify what CBA actually is, in contrast to what one may think it is. This section also identifies many of the common mistakes in CBA. These mistakes often vary systematically according to one's background and experiences. Even those trained in CBA may modify their orientation toward those of guardians or spenders as a consequence of the immediacy of their daily bureaucratic roles. If you are in a government job, you should make sure that you are not unconsciously adopting a guardian or spender perspective. We also hope that by understanding these different perspectives, analysts may be better able to communicate with guardians and spenders. Also, guardians and spenders may be better able to communicate with each other. Finally, this section helps students understand better why decisions are often not consistent with CBA—they are often made by guardians or spenders, not analysts.

These bureaucratic lenses are archetypes. In practice, a bureaucrat may not exhibit all of the characteristics associated with a particular lens. From time to time, bureaucrats exhibit schizophrenic tendencies, sometimes adopting one cognitive perspective, sometimes another. Guardians in line agencies are prone to cognitive dissonance because they have dual allegiances. They are likely to be unsure whether they are guardians, spenders, or both. In practice, though, most bureaucrats recognize that they have a tendency to adopt one perspective or another.

Guardians

Guardians are often found in central budgetary agencies, such as the U.S. Office of Management and Budget, and in controllership or accounting functions within line agencies. They tend to have a bottom-line budgetary orientation. Their natural tendency is to equate benefits with revenue inflows to their agency or other governmental coffers (at the same jurisdictional level) and to equate costs with revenue outflows from their agency or other governmental coffers (at the same level). Thus, they engage in *revenue-expenditure analysis.*[16] Guardians have a natural tendency to regard actual CBA as naive, impractical, and, worst of all in their eyes, a tool whereby spenders can justify whatever it is they want to do.

The conceptual lens of "pure" provincial-based guardians can be illustrated by the way they tend to look at the costs and benefits of the Coquihalla Highway, which is shown in Table 1-4. These evaluations of the no-tolls and with-tolls alternatives can be compared to the analyst's evaluations that appear in columns B and D of Table 1-3, respectively.

To guardians, all toll revenues are regarded as benefits, whether paid by the jurisdiction's residents (in this case, the province) or by nonresidents. Construction costs are a cost, because they require an outlay by the provincial government.

TABLE 1-4 Coquihalla Highway from a Provincial Guardian's Perspective (1986 $ Million)

	No Tolls	*With Tolls*
Revenues ("Benefits"):		
Toll revenues from British Columbia residents	0	112.1
Toll revenues from non–British Columbia residents	0	37.4
	0	149.5
Expenditures ("Costs"):		
Construction	338.1	338.1
Maintenance	7.6	7.6
Toll collection	—	8.4
Toll booth construction	—	0.3
	345.7	354.4
Net Revenue-Expenditure "Benefits"	345.7	204.9

Source: Adapted from Anthony Boardman, Aidan Vining, and W. G. Waters II, "Costs and Benefits through Bureaucratic Lenses: Example of a Highway Project," *Journal of Policy Analysis and Management* 12(3) 1993, 532–555, Table 2, p. 539.

Because guardians seek to minimize net budgetary expenditures, their preference, not surprisingly, is for the with-tolls alternative. Indeed, their gut reaction is to consider raising tolls, irrespective of its effect on levels of use or its impact on social benefits.

How does the guardian's perspective differ from CBA? Most importantly, guardians ignore nonfinancial social benefits, in this case $384.1 million for the no-tolls alternative and $297.3 million for the with-tolls alternative. In general, they ignore impacts valued by consumers and producers such as time saved and lives saved. When guardians are in control of a government service, it is easy to understand why one has to wait so long for the service. Neither your time nor anyone else's figures into their calculations! Similarly, guardians tend to ignore nonfinancial social costs, such as congestion and pollution.

In the Coquihalla Highway example, all social costs happen to represent governmental budgetary costs, and so there is no difference between the CBA cost figures and the guardians' cost figures. In other situations, however, there might be considerable differences between the correct social costs and guardians' costs. Consider, for example, the cost of labor in job-creation programs. Guardians would treat the full financial remuneration to labor as a cost, while CBA analysts would consider only the opportunity cost (such as lost leisure time). Another manifestation of the same mistake concerns the treatment of resources currently owned by the government, such as offices or land. Guardians tend to treat these resources as free because using them for a project does not entail additional budgetary outlay. They ignore the value of these resources in other uses.

Guardians ignore costs not borne by their government. Thus, they ignore the loss suffered by British Columbians from paying tolls and treat all toll revenues as a benefit. In CBA tolls are a transfer from travelers to the government: offsetting costs and benefits result in net benefits of zero. On the other hand, provincial guardians

automatically treat subsidies from the federal government as a benefit because they are revenue inflows to their level of government. However, if the federal government has earmarked a certain amount of money to transfer to British Columbia and if funds used for one purpose reduce the amount available for other purposes, then federal funds for this highway should not be treated as a benefit from the provincial perspective.

Finally, guardians generally want to use a high social discount rate. Because of their financial background or their agency's culture, they naturally prefer to use a financial market rate, which is generally higher than the appropriate social discount rate. They also know that using a high discount rate will make it more difficult to justify most projects because costs usually occur before benefits. Thus, they can limit spenders who, in their view, overestimate benefits, underestimate costs, and generally use money less efficiently than the private sector.

Spenders

Spenders are usually in service or line departments. Some service departments, such as transportation, are involved with physical projects, while social service departments, such as health, welfare, or education, make human capital investments. Some service departments, such as housing, make both types of expenditures. The views of spenders are somewhat more varied than those of guardians because the constituencies of particular agencies are more varied. Nevertheless, there are several commonalities.

Most importantly, spenders have a natural tendency to regard expenditures on constituents as benefits rather than as costs. For example, they typically see expenditures on labor as a benefit rather than a cost. Spenders regard themselves as builders or professional deliverers of government-mandated services. As spenders focus on providing projects or services to particular groups in society, we characterize them as engaging in *constituency-support analysis.* Table 1-5 summarizes how spenders in the provincial highway department view the no-tolls and with-tolls alternatives.

TABLE 1-5 Coquihalla Highway from a Provincial Spender's Perspective (1986 $ Million)

	No Tolls	*With Tolls*
Constituency "Benefits":		
Project Costs (from CBA)	345.7	354.4
Project Benefits (from CBA)	384.1	334.7
	729.8	689.1
Constituency "Costs":		
Toll Revenues from British Columbia Residents	—	112.1
Net Constituency "Benefits"	729.8	577.0

Source: Adapted from Anthony Boardman, Aidan Vining, and W. G. Waters II, "Costs and Benefits through Bureaucratic Lenses: Example of a Highway Project," *Journal of Policy Analysis and Management* 12(3) 1993, 532–555, Table 3, p. 542.

Spenders treat social benefits and monetary payments received by their constituents (residents of British Columbia in this example) as benefits. Thus, time saved, lives saved, and vehicle operating costs saved by British Columbians are benefits. However, they also treat wages received by construction workers who build the highway as a benefit. Thus, spenders think of both project benefits *and* project costs as benefits. With this method of accounting, both the with-tolls and no-tolls highway alternatives generate huge net constituency benefits. In general, spenders tend to support *any* alternative rather than the status quo (no project). Thus, the mistrust of spenders by guardians is perfectly understandable. Guardians and spenders almost always oppose one another in terms of project alternative ranking.

Spenders view monetary outlays by British Columbian highway users (also their constituents) as costs; for example, they treat tolls paid by British Columbians as costs. Table 1-5 shows that spenders favor the no-tolls alternative primarily because a toll is a cost for some of their constituents. Indeed, spenders normally do not favor user fees, unless their agency keeps the toll revenue within its own budget or the payers are not constituents. If spenders could collect and keep the tolls, then they would face a dilemma: tolls would reduce constituency benefits, but would increase the agency's budget. Thus, they would face a trade-off between constituency-support maximization and their budget maximization.[17]

In general, as Robert Haveman and others have pointed out, politicians prefer projects that concentrate benefits on particular interest groups and camouflage costs or diffuse them widely over the population.[18] Spenders have similar preferences. They tend to weight each impact category by the strength of the connection that constituents make between the impact and their agency. They focus on impacts for which their constituents will give them a lot of credit and ignore others. Because people almost always notice expenditures on themselves, such "benefits" are invariably weighted more heavily than social benefits.[19] Thus, for example, construction jobs are more heavily weighted than diffuse social benefits.

Spenders are also similar to politicians in their determination to finish partially completed projects. Congress, for example, decided to complete the Tellico Dam when it was 90 percent complete, even though the incremental costs exceeded the incremental benefits.[20] Presumably, the politicians believed that continuation of the project would bring ongoing political support. Even though sunk costs are, by definition, sunk and it may not be efficient to finish a partially completed project, spenders tend to believe that there are positive constituency-support benefits from completion of projects.

Spenders treat some inputs as neither benefits nor costs. Currently owned government assets may simply be ignored. In support of the Tellico Dam, for example, the Tennessee Valley Authority argued that "since the farm land behind the dam had already been purchased, the value of this land should be considered a sunk cost, even though the land has yet to be flooded and could be resold as farm land if the project was not completed."[21]

Spenders tend to favor large, irreversible, capital-intensive projects, such as urban rail systems, over reversible, less capital intensive projects, such as buses. There are immediate, significant construction job creation benefits. Also, once the infrastructure is in place, it cannot be easily redeployed to other uses, so the system will almost certainly remain in operation, and constituents are guaranteed to receive

some benefits. Furthermore, the normally lower operating costs for such projects allow for lower prices and relatively high usage levels, thereby further increasing constituency benefits.

The perspective of spenders concerning market efficiency has a bearing on the way they view many aspects of CBA. To spenders, markets are almost always inefficient. Spenders act as if unemployment is high in all labor markets. They believe that unemployment will be reduced by the number of people used on a government project. Even if some workers switch from other employment, these workers' vacated jobs will be filled by unemployed workers. Thus, even if the job created did not go directly to an unemployed worker, there would eventually be a job created somewhere in the economy for an unemployed worker. Spenders do not recognize that project resources are diverted from other potentially productive uses that might also involve the creation of jobs.

Furthermore, spenders believe there are indirect benefits of creating jobs and making other project expenditures, which are called multiplier effects.[22] In the extreme, spenders have a "Midas touch" view of project evaluation: first declare the expenditures (costs) to be a "benefit" and then increase these benefits by a multiplier. As a result, any government project would be seen as producing benefits greater than costs.

Spenders generally favor using a low (even zero) social discount rate. For some, this is because they are not familiar with the concept of discounting. For others, they know this tends to raise the project's *NPV* and, therefore, the probability of its adoption. Other ways spenders generate support for their projects is to choose a poorly performing counterfactual (a straw man), to lowball cost projections, or to overestimate project usage.[23]

THE DEMAND FOR CBA

CBA was initially used in the U.S. in the 1930s. The Flood Control Act of 1936 required the U.S. Army Corps of Engineers to conduct CBAs for flood control and harbor deepening projects. A big impetus to the use of CBA was given by the Bureau of Budget's Circular A-47 of 1952 and academic work by Otto Eckstein, John Krutilla, and others.[24] In the mid 1960s it was picked up and promoted by Barbara Castle when she was Minister of Transport in the UK. By the end of the 1960s it had spread around the world and was used in both developed and developing countries. Because of its importance in developing countries we devote Chapter 17 to that topic. Now, CBA is used in many different contexts for many different purposes. Many government agencies require CBA of regulatory changes. Other actual or potential uses of CBA include the courts, various progressive interest groups and private corporations.

Government

The U.S. federal government first mandated the general use of CBA in Executive Order 12291, issued by President Reagan in early 1981. This order requires a regulatory impact analysis (RIA) for every major regulatory initiative. (An RIA is essentially a

cost-benefit analysis that also takes into account distributional and fairness considerations.) President Clinton confirmed the federal government's commitment to CBA in Executive Order 12866 in 1994. Quite a few U.S. federal laws, such as the Unfunded Mandates Reform Act and the Government Performance and Results Act, specifically mandate some form of *ex ante* analysis.

Nearly all other Western industrialized countries have similar protocols covering broad ranges of programs or specific program areas. For example, Canada's Regulatory Policy requires a CBA of changes to any regulation.

The demand for *ex post* analysis is generally not so explicit; there are usually no mandatory requirements that it be done. However, on occasion, the U.S. Congress does explicitly mandate *ex post* CBA. The Clean Air Act Amendments (1990), for example, require the Environmental Protection Agency to assess the overall benefits and costs of the first 20 years of the Act. The Small Business Regulatory Enforcement Act (1996) also requires retrospective analysis.

Despite the little explicit demand for *ex post* analyses, resource allocation decisions often draw heavily on these analyses. For example, President Clinton's 1993 State of the Union Address emphasized the relationship between *ex post* analyses of specific Head Start programs (i.e., educational programs for low-income preschool children) and his intention to increase funding and expand the scope of such programs. The U.S. federal government has also explicitly induced a form of *ex post* learning by sponsoring and requiring evaluation of a variety of "pilot tests," "demonstration projects," and "social experiments" including, for example, various welfare reform demonstrations that were conducted by different states during the 1980s and 1990s.[25] On a number of occasions the weight of the evidence has led to a policy change.[26] For example, CBAs in the 1960s and 1970s of industry-specific economic regulations showed that the costs of regulation often exceeded the benefits, thereby paving the way for deregulation initiatives in the trucking, airline, and telecommunications industries.[27]

As public officials face citizen resistance to raising taxes or pressure to reduce taxes, they are increasingly forced to ensure that government works more efficiently and effectively. In practice, this provides an impetus toward the increased use of CBA and related methods. Such trends are contemporaneous with greater concern for the environment, which calls for the inclusion of environmental and other social impacts, in addition to government expenditures.

The Courts

Courts of law use CBA or CBA methods in a variety of ways. Perhaps the most notorious has been the use of CBA in the assessment of damages in the Exxon Valdez disaster. Quantitative valuation of the environmental impacts relied heavily on contingent valuation analysis, which we discuss in Chapter 15. The lawsuits continued into 2009, more than 20 years after the disaster itself.

CBA is also used in antitrust cases. Section 9b of the Canadian Competition Act explicitly prohibits the Competition Tribunal from intervening in a merger if the efficiency gains to the merging firms are greater than the potential anticompetitive effect. In effect, this requires determining whether or not the merger is allocatively efficient (i.e., has positive net social benefits).

Environmental and Other Progressive Groups

As mentioned above, the U.S. government and the courts have used CBA extensively to set environmental, health, and safety regulations. However, many environmentalists and other progressive groups prefer to make their arguments on emotional and ethical grounds and are reluctant to conduct CBAs. Recently, Richard Revesz and Michael Livermore argue that such groups will be more effective if they do not "give up on rationality" and perform CBAs. The authors argue that this is necessary if we truly want to protect our natural environment.[28]

CBA, Sustainability, Corporate Social Responsibility, and the Triple Bottom Line

Most private-sector corporations are now paying attention to *sustainability* or their "*triple bottom line*" (i.e., their "social, economic, and environmental" impact), and are being more transparent about such impacts. For a longer time, many companies have been concerned about *corporate social responsibility* (CSR). These terms are not well-defined but overlap considerably. Basically, they mean that firms consider their "social bottom line" and their impact on future generations. In practice, however, firms engage in idiosyncratic behavior and use all sorts of different criteria to measure their "social bottom line." They may measure their carbon footprint, their emissions of carbon and other gasses, or their recycling efforts. Other firms measure different impacts. There are a host of different ways of measuring CSR. However, the basic goal of CSR is to improve the welfare of society as a whole. Since the goal of CBA is to improve net social benefits, this has led some authors to argue that corporations should engage in CBA to measure their CSR.[29] They would likely be for specific projects, rather than on an annual basis, but it would mean the application of a consistent set of principles, instead of the current *ad hoc* approach.

THE COST OF DOING CBA

Although the demand for CBA is increasing, we should keep in mind that it takes many resources (time, skill, and money) to do CBA well, especially where projects are large, complex, and have unique features. The costs of conducting CBA can be very large. For example, Thomas Hopkins reported in 1992 that a CBA of reducing lead in gasoline cost the Environmental Protection Agency (EPA) roughly $1 million.[30] On average, the EPA spent approximately $700,000 for major CBA projects in the 1980s, that is, for the analysis of projects with compliance cost in excess of $100 million annually.[31] Large-scale evaluations of welfare-to-work programs, of which CBA is one component, often ran into millions of dollars.

READERS OF THIS BOOK

This book is primarily for people who want to know how to do CBA. Second, it is for people who want to know how to interpret CBA—in other words, for clients of CBA. Clients can be helped in two ways. In the narrow sense, clients should be well enough informed to judge whether or not a specific CBA has been conducted well. Evidence suggests that U.S. federal agencies, even with extensive budgets, have difficulty performing CBA well. This is certainly also true for other governments with less analytic capacity

and smaller budgets. Clients need to be well enough informed to avoid endorsing flawed analysis because there is a growing trend for oversight agencies and external critics to point out and publicize analytic errors.[32]

In the broad sense, clients may have to evaluate CBA studies well enough to have a sense of the weight of evidence in specific policy areas, such as employment training or environmental regulation. In order to do this well, one has to understand the basic principles of CBA.

Conclusion

This chapter provides a broad overview of many of the most important issues in CBA. We deal with these issues in detail in subsequent chapters. At this point, do not worry if you can only see CBA "through the glass, darkly." Do not worry if you cannot entirely follow the highway analysis. Our aim was to give you a taste of the practical realities. We think that it is important to provide readers with a sense of these realities before dealing with the technical issues.

CBA is often taught in a way that is completely divorced from political reality. We wish to avoid this mistake. CBA is a normative tool, not a description of how political and bureaucratic decision makers actually make decisions. Because CBA disregards the demands of politicians, spenders, guardians, and interest groups, it is not surprising that there are tremendous pressures to ignore it or, alternatively, to adapt it to the desires of various constituencies or interest groups. In practice, correct CBA is no more than a voice for rational decision making.

Exercises for Chapter 1

1. Imagine that you live in a city that currently does not require bicycle riders to wear helmets. Furthermore, imagine that you enjoy riding your bicycle without wearing a helmet.
   a. From your perspective, what are the major costs and benefits of a proposed city ordinance that would require all bicycle riders to wear helmets?
   b. What are the categories of costs and benefits from society's perspective?
2. The effects of a tariff on imported kumquats can be divided into the following categories: tariff revenues received by the treasury ($8 million), increased use of resources to produce more kumquats domestically ($6 million), the value of reduced consumption by domestic consumers ($13 million), and increased profits received by domestic kumquat growers ($4 million). A CBA from the national perspective would find costs of the tariff equal to $19 million—the sum of the costs of increased domestic production and forgone domestic consumption ($6 million + $13 million). The increased profits received by domestic kumquat growers and the tariff revenues received by the treasury simply reflect higher prices paid by domestic consumers on the kumquats that they continue to consume and, hence, count as neither benefits nor costs. Thus, the net benefits of the tariff are negative (−$19 million). Consequently, the CBA would recommend against adoption of the tariff.
   a. Assuming the Agriculture Department views kumquat growers as its primary constituency, how would it calculate net benefits if it behaves as if it is a spender?
   b. Assuming the Treasury Department behaves as if it is a guardian, how would it calculate net benefits if it believes that domestic growers pay profit taxes at an average rate of 20 percent?