FIFTH EDITION

COST–BENEFIT ANALYSIS

Concepts and Practice

Anthony E. Boardman
David H. Greenberg
Aidan R. Vining
David L. Weimer

C O S T – B E N E F I T A N A L Y S I S

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Fifth edition

Cost–Benefit Analysis provides accessible, comprehensive, authoritative, and practical treatments of the protocols for assessing the relative efficiency of public policies. Its review of essential concepts from microeconomics and its sophisticated treatment of important topics with minimal use of mathematics helps students from a variety of backgrounds to build solid conceptual foundations. It provides thorough treatments of time discounting; dealing with contingent uncertainty using expected surpluses and option prices; taking account of parameter uncertainties using Monte Carlo simulation and other types of sensitivity analyses; revealed preference approaches; stated preference methods including contingent valuation; and other related methods.

Updated to cover contemporary research, this edition is considerably reorganized to aid in student and practitioner understanding, and includes eight new cases to demonstrate the actual practice of cost–benefit analysis. Widely cited, it is recognized as an authoritative source on cost–benefit analysis. Illustrations, exhibits, chapter exercises, and case studies help students to master concepts and develop craft skills.

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Preface

Collaborative academic projects often take longer than originally anticipated, not just because of the normal delays of coordinating the efforts of busy people, but also because initially modest goals can become more ambitious as participants delve into their subject. We confess to both these sins with respect to preparing the first edition of this text. Our goal was to produce a book that would be conceptually sound, practically oriented, and easily accessible to both students and practitioners. Although our final product was far different in form and content than we initially planned, we believe that our first edition was such a book.

Our plans evolved for a number of reasons. Perhaps most importantly, through our teaching of undergraduate and graduate students in different countries, as well as our experiences training government employees in different jurisdictions, we realized that many topics demanded extended treatment if the essential basics were to be conveyed effectively and if solid foundations were to be laid for further learning of advanced topics. We also decided that integrating illustrations and examples with concepts and methods is useful in addition to presenting independent cases. The result is a series of chapters that develop conceptual foundations, methods of application, and extensions of cost–benefit analysis (CBA) through numerous practical examples and illustrations.

Our own use of the book in teaching, as well as comments from other teachers and students, have helped us identify several areas for incremental improvement in subsequent editions. With this current edition, however,

we decided to take a fresh look at both organization and content. With respect to organization, we interlace the chapters providing the theoretical foundations with those showing how to implement them. For example, the chapter introducing the basics of measuring social surplus changes in markets is followed immediately with the chapter on estimating demand schedules. With respect to content, we added a number of cases that show the application of concepts in policy analyses. For example, following the chapter on estimating demand schedules, we provide cases presenting the use, and misuse, of social surplus as a benefit measure in regulatory impact analyses. Other cases illustrate using evidence from multiple sources to arrive at net benefits, conducting Monte Carlo simulation to assess uncertainty in net benefits, estimating costs and benefits from social experiments, using contingent valuation methods to assess the benefits of non-market goods, developing a shadow price from multiple data sources, and weighting costs and benefits to incorporate distributional values.

In overview, this new fifth edition provides the following:

- Updated content and references
- Rearrangement of chapters to facilitate better integration of theory and craft
- Addition of six cases providing extended illustrations of CBA craft

As with the earlier editions, answers to chapter problems, including spreadsheets that can be provided to students, are available for instructors.

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We also thank Robert Dreesen and the editorial team at Cambridge University Press for encouraging us to take the time to do a substantial

revision. We hope that teachers and students find the new edition to be both authoritative and pedagogically effective.

List of Cases

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]

1.1 Individual Versus Social Costs and Benefits

Benjamin Franklin's advice about how to make decisions 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 the impacts in dollars (assigning weights), and then determining the *net benefit* of the proposal relative to the current policy (net benefit equal incremental benefits minus incremental costs).

When we as individuals talk of costs and benefits, we naturally tend to consider our *own* costs and benefits, generally choosing among alternative courses of action according to whichever has the largest net benefit from our perspective. 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 analysts 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 broad purpose of CBA is to help social decision-making and to increase social value or, more technically, to improve allocative efficiency.*

CBA analysts focus on social costs and social benefits, and conduct social cost–benefit analysis. However, it is tedious to keep including the word "social". We usually drop it and simply refer to costs, benefits, and cost–benefit analysis. Thus, *B* denotes the social benefits (the aggregate benefits to all members of society) of a policy, and *C* denotes the social costs (the aggregate costs to all members of society) of the policy. The aggregate value of a policy is measured by its *net social benefit*, sometimes simply referred to as the net benefit, and usually denoted *NSB*:

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

The term social is usually retained in the expression net social benefit to emphasize that CBA does concern the impacts on society as a whole.

Implicitly, the benefits, costs, and net social benefit of a policy are relative to some "benchmark." Usually, the "benchmark" is the status quo policy, that is, no change in the current policy. Generally, the benefits, costs, and net social benefit of a policy measure incremental changes relative to the status quo policy.

Stated at this level of abstraction, it is unlikely that many people would disagree with doing CBA from an ethical perspective. 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 people 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 value to them), and how to make trade-offs between the present and the future.

In this chapter we provide a non-technical 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.

1.2 Types of CBA Analyses

CBA may be conducted at different times in the project or policy life cycle. One type of CBA is called *ex ante* or prospective CBA. *Ex ante* literally means "before." Thus, *ex ante* CBA is conducted before the decision is made to undertake or implement a project or policy. The policy may or may not be under consideration by a government agency. If it is, then *ex ante* CBA informs the decision about whether resources should be allocated to that specific project or policy or not. Basically, *ex ante* CBA attempts to answer the question: *would* this policy or project be a good idea, that is, would it have a positive net social benefit?

Another type of CBA is called *ex post* or *retrospective CBA. Ex post* literally means "after." Thus, strictly speaking, *ex post* CBA is conducted after a policy or project is completed. It addresses the question: *was* this policy or project a good idea? Because *ex post* analysis is conducted at the end of the project, it is obviously too late to reverse resource allocation decisions with respect to that particular project. However, this type of analysis provides information not only about a specific intervention, but also about the "class" of similar interventions. In other words, it

contributes to learning by government managers, politicians, and academics about the costs and benefits of future projects and whether they are likely to be worthwhile. Such learning can be incorporated into future *ex ante* CBAs. The potential benefit, however, depends on the similarity between the future project and the project previously analyzed. For example, *ex post* CBAs of experiments involving the efficacy of new surgical procedures or new pharmaceutical products can usually be generalized to larger populations. However, if the proposed intervention is much bigger than the experiment, there may be unknown scale effects. Also, if the proposed program has a more extended time frame than the experiment, behavioral responses may affect costs or benefits unpredictably.

Most projects take many years to "complete." The impacts of a highway or subway system, for example, often continue for many decades (even centuries) after initial construction. In such cases, and, in fact, for any ongoing policy or project, prudent government analysts might well wish to conduct a CBA sometime after the policy or project has begun but before it is complete. To clarify that such an analysis applies to a still ongoing project, such studies are sometimes called *in medias res* CBAs (to maintain our fancy use of Latin). They attempt to answer the question: is continuation of this policy or project a good idea? An *in medias res* CBA can be conducted any time after the decision to undertake a project has been made (but before it is complete). Such studies are also called *post-decision analyses*.

An *in medias res* CBA might recommend the termination or modification of a particular policy or project. In practice, CBAs of infrastructure projects with large sunk costs are unlikely to recommend discontinuation of a project that is near to completion or even just after completion, but it does happen occasionally. Interestingly the Tennessee

Valley Authority decided to complete the Tellico Dam when it was 90 percent complete, even though the incremental social costs exceeded the incremental social benefits.[2] Also, a Canadian Environmental Assessment panel recommended decommissioning 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.[3]

Many businesses and critics of government complain about the burden of existing regulations and of too much "red tape." *In medias res* CBAs of some regulations might find that the critics are correct and they should be scrapped or changed for the benefit of society as a whole. In fact, *in medias res* CBAs conducted during 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.[4] These decisions were made both economically and politically easier by the reality that, unlike many physical infrastructure projects, regulatory projects usually have significant ongoing costs, rather than sunk, up-front costs. The same point also applies to ongoing social programs, such as government-funded training programs.

In practice, the term *in medias res* CBA is not used often: such CBAs are referred to as *ex post*, retrospective, hindsight, or post-decision analyses. It is particularly important if this is the case, therefore, to be clear when an *ex post* CBA is conducted: it might be any time after the decision to implement a new policy has been made.

There is also a fourth type of CBA – one that compares an *ex ante* CBA with an *ex post* CBA or an *in medias res* CBA *of the same project.*[5] Considerable research has found, for example, that the costs of large government infrastructure projects are often underestimated.[6] In contrast, another study that assessed the accuracy of US regulatory cost estimates

found that these costs tend to be overestimated.[7] This comparative type of CBA helps to identify past errors, understand the reasons for them, and avoid them in the future.

1.3 The Basic Steps of CBA: Coquihalla Highway Example

CBA may look quite intimidating and complex. To make the process of conducting a CBA more manageable, we break it down into 10 basic steps, which are listed in Table 1.1. We describe and illustrate these steps using a relatively straightforward example: the proposed 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.

Table 1.1 The Major Steps in CBA

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

Suppose that in 1986 a cost–benefit analyst, who worked for the Province of British Columbia, Canada, was asked to perform an *ex ante* CBA of a proposed four-lane highway between the town of Hope in the south-central part of the province and Merritt, which is north of Hope. This highway would pass through an area called the Coquihalla (an indigenous name) and would be called the Coquihalla Highway. A summary of the analyst's *ex ante* CBA is presented in Table 1.2. The original numbers were present values as of 1986, which have now been converted to 2016 dollars to make them easier to interpret. How did the analyst obtain these numbers? What were the difficulties? We go through each of the 10 steps in turn.

Table 1.2 Coquihalla Highway CBA (2016 $ Million)

	No tolls		**With tolls**	
	Global perspective (A)	**Provincial perspective (B)**	**Global perspective (C)**	**Provincial perspective (D)**
Social benefits:				
Time and operating cost savings	763.0	572.1	568.4	426.3
Safety benefits	70.5	52.8	49.3	37.0
New users	1.6	1.2	0.6	0.4
Alternate route benefits	28.6	21.3	18.4	13.9

Toll revenues	–	–	–	73.2
Terminal value of hwy.	104.3	104.3	104.3	104.3
Total social benefits	968.0	751.7	741.0	655.1
Social costs:				
Construction	661.8	661.8	661.8	661.8
Maintenance	14.9	14.9	14.9	14.9
Toll collection	–	–	16.4	16.4
Toll booth construction	–	–	0.6	0.6
Total social costs	676.6	676.7	693.7	693.7
Net social benefit	291.2	75.2	47.3	–38.6

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, 532–55, table 1, p. 537.

1.3.1 Explain the Purpose of the CBA

Step 1 requires the analyst to explain why she is conducting a CBA. She should answer the question: *what is the rationale for considering a change in policy*, in this case, building a new highway? Stated broadly, the goal of CBA is to improve social welfare. More specifically, CBA attempts to

maximize allocative efficiency, which we discuss in Chapter 3. That chapter argues that, where markets work well, individual self-interest leads to an efficient allocation of resources and, therefore, there should be no government intervention. *Prima facie* rationales for CBAs are *market failure* or *government failure*.[8] Where there is market failure, analysts use CBA to assess whether a particular intervention is more allocatively efficient than no intervention (or some other alternatives). Sometimes there is government failure: a government policy or project is currently in effect, but this policy appears to be less allocatively efficient than no intervention or some other alternative policy. In either of these situations CBA attempts to ascertain whether a new policy or program is more allocatively efficient than the existing policy. The analyst should explain the market failure or government failure that provides a purpose for the study.

In 1986, the existing routes to the interior of northern British Columbia were highly congested, dangerous (with many traffic accidents), and would not have the capacity to handle anticipated increases in traffic volumes. For political reasons, the government was unwilling to impose tolls on the existing routes. Widening the main road would have been prohibitively expensive because much of it was in a river canyon. The focus of the study was, therefore, on whether to build a new highway between Hope and Merritt in an alternative location, specifically in the Coquihalla Valley, which follows the Coldwater River.

1.3.2 Specify the Set of Alternative Projects

Step 2 requires the analyst to specify the set of alternative projects. In this example, there were only two feasible alternative highway projects: one built with tolls and one without. The provincial department of transportation decided that the toll, if applied, would be $78.3 for large

trucks and $15.7 for cars (in 2016 dollars). Thus, the analyst had a tractable set of only two alternatives to analyze.

In practice, there are often difficulties even at this stage because the number of potential alternatives is often quite large. Even restricting the analysis to a highway in the Coquihalla valley, it could vary on many dimensions including, for example, the road surface (either bitumen or concrete), routing (it could take somewhat different routes), size (it could have more or fewer lanes), toll level (could be higher or lower), wild animal friendliness (the highway could be built with or without "elk tunnels"), or timing (it could be delayed until a later date). Resource and cognitive constraints mean that analysts typically analyze only a few alternatives.[9]

CBA compares one or more potential projects with a project that would be displaced (i.e., not undertaken) if the project(s) under evaluation were to proceed. The displaced project is often called the *counterfactual.* Usually, the counterfactual is the status quo policy or no change in government policy. It does not mean "do nothing." It means that government continues to do what it has been doing: while there would be no new highway, the existing highway would continue to be maintained. Table 1.2 presents the social benefits, social costs, and net social benefit if the highway were built (with or without tolls) relative to what the social benefits, social costs, and net social benefit would be if the highway were not built (the status quo). Thus, one can interpret these social benefits, social costs, and net social benefit as *incremental* amounts. *In practice, as in this example, the term incremental is often omitted for convenience, but it is implicit.*

Sometimes the status quo policy is not a viable alternative. *If a project would displace a specific alternative, then it should be evaluated relative to the specific displaced alternative.* If, for example, the

government has committed resources to either (1) constructing a new highway project and maintaining the alternative routes) or (2) not constructing a new highway but expanding the capacity of the existing routes, and there is no possibility of maintaining the status quo, then the new highway project should be compared with the expansion of the capacity of existing routes, rather than with the status quo policy.

This CBA example pertains to a specific proposed highway. There is no attempt to compare this project to alternative highway projects in the rest of British Columbia, although one could do so. Rarely do analysts compare a project in one substantive arena of government, such as transportation, to projects in other arenas, such as health care or national defense. The limited nature of these kinds of 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, CBA evidence from different arenas can allow decision-makers to rank potential projects in terms of their net social benefit.

1.3.3 Decide Whose Benefits and Costs Count (Standing)

Next, the analyst must decide who has *standing*; that is, whose benefits and costs should be included and counted. In this example, the analyst conducted the CBA from the provincial perspective because taxpayers living there would pay for it, but thought that it was important to also take a global perspective. A CBA from the provincial perspective considers only the impacts (i.e., benefits and costs) that affect British Columbian residents, including costs and benefits borne by the British Columbian government. The global perspective considers the benefits and costs that affect anyone, irrespective of where they reside. Thus, it includes benefits and costs to Americans, Albertans, and even tourists using the highway from the United Kingdom or China. Including these two perspectives on

standing with the no-tolls and with-tolls alternatives gives the four columns in Table 1.2 labeled A through D and effectively means there are four distinct perspectives on costs and benefits.

The issue of standing is quite often contentious. While national governments usually take only national (i.e., domestic) costs and benefits into account, critics argue that issues that have significant negative impacts on residents of other countries 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 borne by residents of adjacent municipalities or higher levels of government. Our highway example deals with this issue by analyzing costs and benefits from both the subnational British Columbian perspective and the global perspective. Note that it does not adopt or measure the usual default perspective of the nation. Although these perspectives are not technically alternatives, they function as such in this example because they result in different estimates of costs, benefits, and net benefit.

1.3.4 Identify the Impact Categories, Catalogue Them, and Select Metrics

Step 4 requires the analyst to identify the impacts of the proposed alternative(s), catalogue them as benefits or costs, and specify the metric for each impact category. We use the term *impacts* broadly to include both inputs (resources employed) and outputs (predominantly benefits). A list of the relevant impact categories is referred to as an *impact inventory*. Preferably, analysts will construct an *impact matrix*, which describes or summarizes the impact of each policy alternative (or the impacts of one policy alternative on different groups) on each impact category.[10]

Sometimes the impacts are referred to as “ingredients” and steps 4 and 5 are labeled the “*ingredients method*,” although this terminology makes more intuitive sense for inputs than for outputs.

Different groups of residents will benefit from the highway. First, consider the users who currently travel on existing routes between Merritt and Hope, but will switch to the new highway. They will benefit from time saved (initially measured in hours), reduced vehicle operating costs (measured in dollars), and safety benefits due to a shorter, safer highway (initially measured in lives saved and the reduction in the number of accidents). Anticipation of these benefits is likely to attract some new users to travel this route (initially measured in number of vehicle trips). In the transportation literature, these new users are referred to as *generated traffic*. A third group consists of current users of the alternative routes who will continue to use these routes and will benefit from reduced congestion time on those routes (again initially measured in hours), because many other travelers will switch to the new highway. A fourth group is government, which may benefit from toll revenues (measured in dollars). A final benefit category for this project is the *terminal value* (sometimes called the *horizon value*) of the highway (measured in dollars). In practice, this highway will be in place for many years, but the analyst chose to predict and monetize the benefits and costs for only 20 years because no major refurbishment was expected to occur during that period. Sometimes we refer to such a period as the “life of the project.” The terminal value reflects the present value of the net social benefit of the highway for all subsequent years. The cost impact categories are construction costs, maintenance and snow removal, toll collection, and toll booth construction and maintenance (all measured in dollars).

Although this list of impacts appears comprehensive, critics might argue that some important impacts were omitted. These include several

externalities that spill beyond the use of the highway for transportation, including health impacts from reduced automobile emissions, environmental impacts on the elk population and other wildlife, and changes in scenic beauty. Also, the social cost of the land (the *opportunity cost*) should have been included.

It is important to try to include the full range of consequences of each project. However, from a practical perspective, analysts can consider only a manageable number of important impacts. Impacts associated with sunk costs should be ignored, although the analyst must be careful because recognizing economic sunkness is not simple. For example, when the Tellico Dam was being considered, the Tennessee Valley Authority argued incorrectly 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."[11] Who owns the land or has paid for it is often irrelevant. If, in fact, the land did have an alternative use, then there was an opportunity cost and land should have been included as an impact category.

Furthermore, as we discuss in Chapter 7, it is often incorrect to include secondary or "knock-on" effects. Such effects are often redistributional. For example, one might think that hotel businesses and gas stations in Hope, near the southern end of the highway, might suffer negative effects because the new highway would bypass the town. However, highway users would stay elsewhere and buy their gas elsewhere, in Merritt, for example. Thus, while business-owner residents of Hope might be worse off, other business-owner residents in the province would be better off. The effects cancel out, resulting in a net effect of zero. Therefore, they can be ignored in many circumstances.

From a CBA perspective, analysts are interested only in project impacts that affect the utility of individuals who have standing. (The caveat is that this applies only where human beings have the relevant knowledge and information to make rational decisions.) Impacts that do not have any positive or negative utility to human beings are not counted. Suppose, for example, the highway project would decimate the population of a particular avian species. Birds do not have standing. This impact should only be included if some humans regard it as a cost.

Politicians often state the benefits of some projects in very general terms. For example, they might say that a project will promote "community capacity building." Similarly, they tend to regard "growth" and "regional development" as beneficial impacts, possibly because it might lead to increased tax revenue for their jurisdictions. In contrast, CBA requires analysts to identify explicitly the ways in which the project would make some individuals in the province better off through, for example, improved skills, better education, or higher incomes.

Analysts should also be on the lookout for impacts that different groups of people view in opposing directions. Consider, for example, land that periodically floods but would not do so if a proposed project is implemented. Residents on the flood plain generally view these periodic 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 informative to have two impact categories – one for damaged homes, and another for recreation benefits.

In this example, the impact metrics are straightforward – hours of time saved, dollar value of operating and construction costs, for example. If environmental impacts had been included, however, the choice of metrics would not have been as straightforward. For example, if the

change in automobile emissions was included as an impact, the analyst might measure it by tons of various pollutants or the resultant health effects (e.g., changes in mortality or morbidity). The choice of metric often depends on data availability and the 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, she may have access to changes in arrest rates or changes in conviction rates and may be able to use one or both of these measures to estimate changes in crime.[12] 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.

1.3.5 Predict the Impacts Quantitatively Over the Life of the Project

The proposed highway project, like almost all public projects, has impacts that extend over time. The fifth task is to predict all of the impacts in each year during the discount period (the life of the project) for each alternative. More specifically, the analyst has to predict the *incremental impacts* of the highway relative to the current policy for the no-tolls and the with-tolls alternatives, and from the provincial and global perspectives. Obviously, there is considerable uncertainty in making these predictions. Analysts may determine the "most likely" impact in each time period or the expected impact in each period. In this initial case example, for simplicity, we ignore uncertainty in the predictions.

There were three different types of road user on the Coquihalla: truck drivers, drivers or passengers in cars on business, and drivers or passenger in cars on vacation. As we see in subsequent chapters, road users were partitioned in this way because their benefits vary quite a bit. For each of these three user groups, the analyst predicted for each alternative for each

year: the number of vehicle-trips on the new highway, the number of vehicle-trips on the old roads (alternative routes), and the proportion of travelers that reside in British Columbia. With these estimates, knowing that the highway is 195 kilometers long, and with other information, the analyst could estimate for each year the following incremental benefits: the total vehicle-kilometers saved, the number of accidents reduced, and the number of lives saved.

The analyst predicted that the new highway would save 6.5 lives each year. Lives would be saved for two reasons. First, the new highway would be shorter than the alternative routes. As a result, the analyst expected that travelers would avoid 130 million vehicle-kilometers (vkms) of driving each year, and evidence suggests that, on average, there are 0.027 deaths per million vkms. The shorter distance would, therefore, save 3.5 lives per year (130 vkms × 0.027 lives lost per vkm) on the basis of less distance driven. The new highway was also predicted to be safer per kilometer because it would be a divided highway. It was expected that 313 million vkms would 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 was expected to save 3.0 lives per year due to being safer (313 vkms × 0.027 lives lost per vkm × 0.33). Combining the two components suggests 6.5 lives would be saved each year.

In order to treat something as an impact, an analyst has to know there is a cause–effect relationship between some physical outcome of the project and the utility of human beings with standing. For some impacts the expected cause–effect relationships are reasonably well established, for instance, for the causal relationship between motor vehicle usage and motor vehicle accidents. For other impacts, however, the causal relationships are less obvious. What, if any, is the impact of exhaust fumes

from additional vehicle usage on residents' morbidity and mortality? Would this be offset by fewer airplane flights? Demonstrating and estimating such cause–effect relationships often requires an extensive review of scientific and social science research. Sometimes the evidence may be inconclusive. 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.[13] In practice, predicting impacts can be difficult and contentious.

In order to predict impacts over future time periods, analysts often assume a particular growth rate and apply it to all future time periods. However, some impacts might increase at an increasing or decreasing rate. For example, the number of statistical lives saved in a year might increase not only because of more drivers using the safer route but also because, without the new route, there would be significantly more congestion on the old routes, leading to proportionately more fatal accidents. Analogously, the cost of highway maintenance might be relatively constant for some years and then increase due to vintage (age) or more users.

Prediction is especially difficult where projects are unique, have long time horizons, or relationships among relevant variables are complex. Many of the realities associated with doing steps 4 and 5 are brilliantly summarized by Kenneth Boulding's poem on dam building, presented in Exhibit 1.1. Many of his points deal with the omission of impact categories due to misunderstanding or ignorance of cause-effect relationships and to the accuracy of estimations. He also makes points about the distributional impacts of costs and benefits, which we discuss later.

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

(Reprinted with the kind permission of Mrs. Boulding)

1.3.6 Monetize (Attach Dollar Values to) All Impacts

The analyst next has to monetize each and every impact. To *monetize* means to value in dollars. In this example, the analyst monetized the following categories of time saved: leisure time saved per vehicle (25 percent of the gross wage in the region times the average number of passengers) = $13.1 per vehicle-hour; business time saved per vehicle = $23.5 per vehicle-hour; and truck drivers' time saved per vehicle = $27.4 per vehicle-hour. One of the most important impacts to monetize in transportation and health CBAs is the value of a statistical life saved, the VSL. The term "statistical life" is used to imply that the reference is not to a specific person's life. In this *ex ante* study, conducted in 1986, the VSL used was $978,685 in 2016 dollars based on the literature at that time. A large body of recent research suggests that the VSL is much higher than that, as we discuss in Chapter 17.

Sometimes, the most intuitively important impacts are difficult to value in monetary terms. In CBA, the value of a benefit 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. For example, scholars have spent many person-years trying to determine the appropriate VSL. Valuing negative environmental impacts is especially contentious. In practice, most CBA analysts do not reinvent these wheels, but instead draw upon previous research: they use best-practice "plug-in" values whenever possible. Although catalogues of impact values are not comprehensive, considerable progress has been made in coming up with reasonable plug-ins as we show in Chapter 17.

If no person is willing to pay for some impact or to avoid it, 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 person with standing is willing to pay a positive amount to save that species, then the extermination of this fish would have zero cost 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*, *qualitative cost–benefit analysis* or *multigoal analysis*, which are described in Chapter 3.

1.3.7 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: they could earn a positive return elsewhere. 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 social benefits and social costs in year t, respectively. The present value of the social benefits, $PV(B)$, and the present value of the social 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 the Coquihalla 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 can be contentious and is, therefore, a good candidate for sensitivity analysis. For government analysts, the discount rate to be used is usually mandated by a government agency with authority (e.g., the Office of Management and Budget, or the General Accountability Office in the USA, or the Ministry of Finance or the Treasury Board in Canada). However, as we demonstrate in Chapter 10, those rates are generally too high. For projects that do not have impacts beyond 50 years (that is *intra-generational* projects), we recommend a real social discount rate of 3.5 percent. If the project is *inter-generational*, then we recommend time-declining discount rates.[14]

1.3.8 Compute the Net Present Value of Each Alternative

At the beginning of this chapter we stated that the net social benefit of a project equals the difference between the (incremental) social benefits and the (incremental) social costs, as in Equation (1.1). By definition, the *net present value* (*NPV*) of a policy alternative equals the difference between the *PV* of its (incremental) social benefits and the *PV* of its (incremental) social costs:

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

Thus, the *NPV* of a project or policy is identical to the *present value of the (incremental) net social benefit*:

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

The basic decision rule for a single alternative project (relative to the status quo policy) 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 (incremental) benefits exceed its (incremental) costs:

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

When there is more than one alternative to the status quo policy being analyzed and all the alternatives are mutually exclusive, then the rule is: *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 current policy, which should remain in place.

1.3.9 Perform Sensitivity Analysis

It should be clear that the PVs and NPVs discussed above are *predicted values*, based on certain assumptions. As the foregoing discussion

emphasizes, however, there will be uncertainty about the assumptions – both the predicted impacts and the appropriate monetary valuation of each unit of each 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. In order to get a handle on these uncertainties, the analyst might conduct sensitivity analysis which, with only one alternative, shows the values of a parameter that would change the recommendation from "go" to "no go," or vice versa. Also, analysts might examine different scenarios, with for example, "most likely," "optimistic," and "pessimistic" assumptions. Or analysts might construct decision trees or perform Monte Carlo analysis, as we discuss in Chapter 11. The purpose is to obtain a better understanding of the distribution of the estimated NPV.

1.3.10 Make a Recommendation

Suppose that one is only faced with two alternatives, A and B, one of which may or may not be the status quo policy. Alternative A has a higher expected NPV and lower risk (smaller variance) than alternative B. In this situation, the analyst would unambiguously recommend alternative A. Now suppose, however, that Alternative A has a higher expected NPV but has more risk than alternative B. In this situation, it is not so obvious what the analyst should recommend. One might think that the analyst should present the analysis, point out the trade-offs, and turn the decision-making over to the decision-maker. If so, a risk adverse decision-maker might choose alternative B. However, as we explain in Chapter 12, the *analyst can usually act as if society is risk-neutral and should therefore recommend the alternative with the largest expected NPV.*

In fact, there is some confusion about the appropriate decision rule. Both the *internal rate of return* and the *benefit–cost ratio* have also been proposed as alternative decision rules. This is one area where there is a right answer and wrong answers. The *appropriate criterion to use is the NPV rule.* As explained in Chapters 3 and 9, the other rules sometimes give incorrect answers; the *NPV* rule does not.

While the *NPV* criterion results in a *more efficient* allocation of resources, it does not necessarily recommend *the most efficient* allocation of resources because the most efficient alternative might not have been actually considered by the analyst or might not have been feasible because of budget constraints, political concerns, or other reasons. 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 benefit relative to the status quo policy, Q_0. As the scale increases, the net benefit increases up to the optimal scale, Q^*.[15] As the scale increases beyond Q^*, the net benefit decreases. The net benefit is positive as long as the benefit curve is above the cost curve, it is zero where the cost curve and benefit curve intersect, and it is negative for yet larger-scale projects.

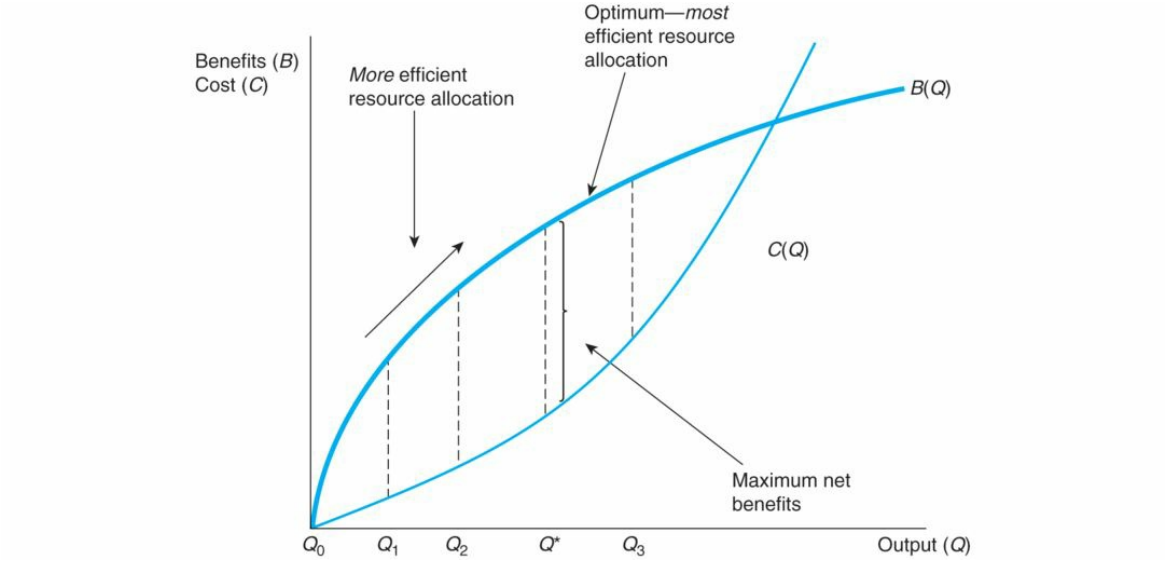

Figure 1.1 CBA seeks more efficient resource allocation.

Suppose that the analyst actually 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 output level, Q_0. The analyst would therefore recommend Q_2. However, as the figure shows, the net social benefit is maximized at output level Q^*. The analyst could not recommend this optimal output level because it was not among the set of alternatives evaluated. As this example illustrates, use of the NPV criterion leads to a more efficient outcome than the status quo, but not necessarily the most efficient outcome.

In the highway example, three of the four alternative projects had positive expected *NPV*s and one had a negative expected *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, both the no-tolls alternatives were 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 expected *NPV* of the tolled alternatives because they deter some people from using the highway, and so fewer people enjoy benefits; this reduces total benefits.[16]

Finally, as this discussion emphasizes, analysts almost always 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 where politicians or administrators may have goals that are not totally congruent with allocative efficiency. 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 drive choice between alternatives. Politicians are often not persuaded by economic efficiency arguments. Indeed, the Coquihalla highway was built with tolls, although they were removed in 2008, mainly for political reasons as far as we can determine.

1.4 Bureaucratic and Political "Lenses"[17]

CBA concerns how resources should be allocated. In practice, however, when bureaucrats or politicians conduct analysis, they have a tendency to *see* "costs" and "benefits" differently. Most of them have not taken formal courses in CBA. Although they may think they know what CBA is, they may be mistaken. 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*.[18] These labels are indicative of three different perspectives (lenses) bureaucrats bring to project evaluation. We assume the analysts' perspective is standard CBA, which we have just illustrated. Guardians and spenders have quite different perspectives.

This section describes both perspectives and shows how they differ from CBA. This helps clarify what CBA actually is, in contrast to what

some decision-makers or politicians may think it is. This section also identifies many of the common mistakes in CBA, which often vary systematically according to an individual's background and experiences. Even those trained in CBA may subconsciously 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, then you should make sure that you do not unconsciously drift into 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 about how to conduct CBA appropriately. It might also help guardians and spenders be better able to communicate with each other about the "biases" inherent in their perspectives. Finally, this section should help students understand better why project decisions are often not consistent with CBA – they are often made by guardians or spenders, not analysts.

These three lenses are only archetypes. In practice, an individual engaged in the analytic or decision-making process may not exhibit all of the attitudes associated with a particular lens. Some bureaucrats may be conflicted, sometimes adopting one cognitive perspective, sometimes another. Guardians in line agencies can be prone to cognitive dissonance because they have dual allegiances. They may veer between being guardians, spenders, or both. In practice, though, most bureaucrats recognize what their tendency is.

1.4.1 Guardians

Guardians are most often found in central budgetary agencies, such as the US Office of Management and Budget, or in controllership or accounting functions within line agencies. They naturally tend to have a bottom-line budgetary orientation. They often 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 *budget impact analysis*, also called *cash flow analysis* or *revenue-expenditure analysis*.[19] Guardians tend 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 is illustrated by the way they look at the costs and benefits of the Coquihalla Highway, as shown in Table 1.3. 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 1.2, respectively.

Table 1.3 Coquihalla Highway from a Provincial Guardian's Perspective (2016 $ Million)

	No tolls	**With tolls**
Revenues ("benefits"):		
Tolls from BC residents	0	219.4
Tolls from non-BC residents	0	73.2
Total "benefits"	0	292.6
Expenditures ("costs"):		
Construction	661.8	661.8
Maintenance	14.9	14.9
Toll collection		16.4
Toll booth construction		0.6
Total "costs"	676.6	693.7

Guardian's net "benefit"	–676.6	–401.1

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, 532–55, table 2, p. 539.

To guardians, all toll revenues are regarded as benefits, whether paid by the jurisdiction's residents (in this case, the province) or by non-residents. Construction costs are treated as a cost because they require a financial expenditure by the provincial government. 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 to generate larger revenues, irrespective of its effect on levels of use or its impact on social benefits.

How does the guardian's perspective differ from the CBA perspective? Most importantly, guardians ignore impacts valued by consumers and producers such as time and lives saved. In this example they ignore social benefits that amount to $751.8 million for the no-tolls alternative and $581.9 million for the with-tolls alternative, both from the provincial perspective. 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 non-governmental 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 a considerable difference between the two. For example, guardians treat the full cost of labor in a job-creation program as a cost, while CBA analysts consider only the opportunity cost

(such as the lost leisure time of newly employed workers). 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 (i.e., having no opportunity cost) because using them for a project does not entail additional budgetary outlay.

Similarly, guardians treat all toll revenues as a benefit and ignore the losses suffered by citizens from paying tolls. From the CBA analyst's perspective, these toll payments are a transfer from residents to the government: the offsetting costs and benefits result in zero net benefit. On the other hand, provincial guardians 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 social discount rate. They also know that using a high discount rate will make it more difficult to justify most infrastructure projects because costs occur earlier than benefits. Thus, they can limit spenders who, in their view, overestimate benefits, underestimate costs, and generally use money less efficiently than the private sector.

1.4.2 Spenders

Spenders are usually employed within service or line departments. Some service departments, such as transportation, are involved with physical

projects, while social service departments, such as those dealing with health, welfare, or education, make human capital investments. Other 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.

Spenders tend to deliver government-mandated services to particular groups in society. They see their purpose as helping these groups and other members of society. Therefore, we characterize them as primarily engaging in *constituency-support analysis.* Most importantly, spenders tend to regard government expenditures on constituents as benefits rather than as costs. Thus, they typically see expenditures on labor (jobs) as a benefit rather than a cost. The conceptual lens of "pure" provincial-based spenders can be illustrated by the way they would look at the costs and benefits of the Coquihalla Highway, which is shown in Table 1.4.

Table 1.4 Coquihalla Highway from a Provincial Spender's Perspective (2016 $ Million)

	No tolls	**With tolls**
Constituency "benefits":		
Project costs (from CBA)	676.6	693.7
Project benefits (from CBA)	751.8	655.1
Total constituency "benefits"	1,428.4	1,348.8
Constituency "costs":		
Tolls from BC residents	0	219.4
Total constituency "costs"	0	219.4
Spender's "net benefit"	1,428.4	1,129.4

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, 532–55, 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 residents of British Columbia are benefits. However, they also regard wages received by construction workers who build the highway as a benefit. Thus, spenders tend to think of both project benefits *and* project costs as being benefits. With this kind of accounting lens, each of the with-tolls and no-tolls highway alternatives generates net constituency benefits. In general, spenders tend to support *any* of the four alternatives rather than the status quo (no project). Also, because spenders tend to think of social costs as benefits, they are likely to want to finish partially completed projects, regardless of whether the incremental social costs exceed the incremental social benefits. Thus, the mistrust of spenders by guardians is perfectly understandable. Guardians and spenders almost always oppose one another in terms of alternative ranking of projects with fees or tolls.

Spenders view monetary outlays by British Columbia residents (i.e., constituents) as costs; so tolls paid by them are a cost. There is no other cost borne by spenders' constituents.

Table 1.4 illustrates that spenders favor the no-toll alternative primarily because a toll would impose a cost on their constituents. Indeed, spenders normally do not favor any user fees unless a large percentage of the payers are not constituents. If spenders could collect and keep the toll revenue within their own budget, then they would face a dilemma: tolls would reduce constituency benefits, but would increase the agency's ability to provide services to its constituents. Thus, they would face a

trade-off between constituency-support maximization and agency budget maximization.[20]

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.[21] Spenders have similar tendencies. 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. Because people almost always notice expenditures on themselves, such as construction jobs, such "benefits" are invariably weighted more heavily than are diffuse social benefits.[22]

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 hiring someone to work on a government project will reduce unemployment. 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 create jobs.

Spenders have much in common with proponents of *economic impact analysis*, which measures the impact of some project or policy on the economy as a whole. It is often used by politicians and others to justify expensive "events," such as hosting the Olympics, song contests, world fairs (e.g., Expos), or the like. It is important to recognize that such studies estimate economic activity, not social welfare. Economic impact analysis

draws on *input–output analysis*. These analyses often include multiplier effects, which reflect interdependencies among sectors. For example, a project might hire a construction worker to work on a stadium who then spends his money as he sees fit and then those paid by the construction worker spend the money they receive on something else, and so on. All of these expenditures increase economic activity. In the extreme, "super-spenders" have a "Midas touch" view of project evaluation: first declare the expenditures (which are really a social cost) to be a "benefit" and then power up these benefits by a multiplier. Inevitably, these spenders see any government project 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 a low discount rate 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]

1.5 The Origins and Demand for CBA

1.5.1 Origins

Some scholars trace the origin of CBA to Sir William Petty, author of *Political Arithmetick*, who argued that the British government should have paid to transport people out of London in 1665 to avoid the plague and thus save lives. He suggested that the value of a statistical life for a resident of England was £90 (at that time) and that, after taking account of transporting people out of London and caring for them, every pound spent would have yielded a return of £84. Petty, a doctor and founding member

of The Royal Society, further argued in 1676 that the state should intervene to provide better medicine.[24]

1.5.2 Government

The US Army Corps of Engineers, which designed and built canals, dams, harbors, and other water projects, was an early user and developer of CBA. The Flood Control Act of 1936 explicitly required the US Army Corps of Engineers to conduct CBA. Later, the Bureau of the Budget's Circular A-47 of 1952 and academic work by Otto Eckstein, John Krutilla, and others encouraged the use of CBA in other areas.[25] In the mid-1960s Barbara Castle, then Minister of Transport in the United Kingdom, promoted CBA for the evaluation of transportation projects. By the end of the 1960s CBA had spread around the world and was used in developed and developing countries for many different projects. Government agencies in many countries now require CBA of regulatory changes. Currently, the World Bank and other multilateral development banks require CBA or cost–effectiveness analysis for appraisal of all projects. Other actual or potential uses of CBA include the courts, various progressive interest groups, and private corporations.

In the United States, executive orders have expanded the use of CBA by federal agencies over time. Presidents Nixon, Ford, and Carter introduced requirements that improved agency project evaluation. Most importantly, in Executive Order 12291, issued in early 1981, President Reagan required the use of *regulatory impact analysis* (RIA) by executive branch agencies for every major regulatory initiative, specifically those that would have an annual effect on the economy of $100 million or more in terms of costs, benefits, or transfers. (A well-conducted RIA attempts to assess whether a regulation would improve social welfare through cost–benefit analysis, and would address all of the steps in Table 1.1.[26] In

practice, however, RIAs are often not well conducted and do not necessarily monetize all of the relevant impacts.[27]) Subsequently, President Clinton (Executive Order 12866 in 1993) more clearly specified the rules for conducting RIA and set up the Office of Information and Regulatory Affairs (OIRA) within the Office of Management and Budget (OMB). The OMB provides guidance to agencies and reviews individual regulations, including agencies' RIAs. Two orders introduced by President Obama (Executive Order 13563 in 2011 and Executive Order 13610 in 2012) are important for promoting "retrospective analyses" of existing rules, that is, *in medias res* CBAs.[28] In a recent attempt to reduce the regulatory burden on business, especially small businesses, President Trump (Executive Order 13771 in 2017) required each agency seeking to introduce a new regulation to identify two regulations for repeal with *compliance costs* (not social costs) that are at least as high as the new one it would like to introduce.

Government agencies in most major developed countries have produced comprehensive guides or guidelines for conducting CBA. Individual agencies have produced guides focused on specific policy areas, such as transportation, the environment, or waste management, or are about specific topics, such as the value of the social discount rate. International agencies, such as the European Commission (EC), the World Bank and the Inter-American Development Bank (IDB), also provide comprehensive guides or guides on specific topics. While some guides are up to date, others are not.[29]

1.5.3 The Courts

Courts of law use CBA and CBA methods in a variety of ways. Perhaps the most well-known example is the use of CBA in the assessment of damages in the *Exxon Valdez* disaster. Quantitative valuation of the costs

of the environmental impacts relied heavily on contingent valuation analysis, a CBA method discussed in detail in Chapter 16. Lawsuits continued many years after the disaster itself.

CBA is also used in antitrust cases. The Canadian Competition Act generally disallows proposed mergers if they result in a "significant lessening of competition." However, in a horizontal merger, production costs might fall due to economies of scale. In a classic article, Oliver Williamson argued that "a rational treatment of the merger" requires an analysis of the "trade-off" of the two effects.[30] Currently, 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 the merger is allocatively efficient (i.e., has positive net social benefit).

1.5.4 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 impacts), and are being more transparent about such impacts. For a longer time, 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 impacts on current members of society (broadly defined) and on future generations. In practice, however, there is no common measure of sustainability or CSR. Firms might measure and report their carbon footprint, their emissions of carbon and other gases, or their recycling efforts, or they might obtain a LEED (Leadership in Energy and Environmental Design) building rating. Different firms might measure different impacts. However, the basic goal

of sustainability and CSR is to improve the welfare of society as a whole, similar to CBA. This similarity has led some authors to argue that corporations should use CBA to measure their sustainability efforts or CSR.[31] Firms would likely analyze specific projects, rather than report measures on an annual basis, but it would require the application of a consistent set of principles, instead of the current ad hoc approach.

In practice, many environmentalists and other progressive groups prefer to make their arguments on emotional and ethical grounds and are reluctant to conduct CBAs. 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.[32]

1.6 The Cost of Doing CBA

There are literally thousands of RIAs conducted each year. Some RIAs are not particularly expensive. However, others are. For example, Thomas Hopkins reported in 1992 that a CBA of reducing lead in gasoline cost the Environmental Protection Agency (EPA) roughly $1 million.[33] On average, in the 1980s, the EPA spent approximately $700,000 for each CBA of projects with annual compliance costs in excess of $100 million.[34] Large-scale evaluations of welfare-to-work programs, of which CBA is one component, often run into millions of dollars. CBA of projects that are large, complex, and have unique features can be particularly expensive.

1.6.1 Readers of This Book

This book is primarily for those, whether student, consultant, or government analyst, who want to know how to do CBA. It is also 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 a specific CBA has been conducted well. Evidence suggests that, even with extensive budgets, US federal agencies have difficulty performing CBA well.[35] This is certainly true for other governments with less analytic capacity and smaller budgets. Also, 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.

1.7 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 is 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. Politicians, especially those feeling financially constrained, frequently want a budget impact analysis, rather than a CBA. CBA is a normative tool, not a description of how political and bureaucratic decision-makers actually make decisions. It is an input to decision-making. 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 benefit of the tariff is 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 the net benefit 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 the net benefit if it believes that domestic growers pay profit taxes at an average rate of 20 percent?

3. (Spreadsheet recommended) Your municipality is considering building a public swimming pool. Analysts have estimated the present values of the following effects over the expected useful life of the pool:

	PV **(million dollars)**
National government grant	2.2
Construction and maintenance costs	12.5
Personnel costs	8.2
Revenue from municipal residents	8.6
Revenue from non-residents	2.2
Use value benefit to municipal residents	16.6
Use value benefit to non-residents	3.1
Scrap value	0.8

The national government grant is only available for this purpose. Also, the construction and maintenance will have to be done by a non-municipal firm.

a. Assuming national-level standing, what is the net social benefit of the project?

b. Assuming municipal-level standing, what is the net social benefit of the project?

c. How would a guardian in the municipal budget office calculate the net benefit?

d. How would a spender in the municipal recreation department calculate the net benefit?

Notes

1. "Letter to Joseph Priestley", in *Benjamin Franklin: Representative Selections, with Introduction, Bibliography and Notes*, Frank Luther Mott and Chester E. Jorgenson (New York, NY: American Book Company, 1936), pp. 348–49.

2. R. K. Davis, "Lessons in Politics and Economics from the Snail Darter," in Vernon K. Smith, editor, *Environmental Resources and Applied Welfare Economics: Essays in Honor of John V. Krutilla* (Washington, DC: Resources for the Future, 1988), 211–36.

3. Federal Environmental Assessment Review Office, Oldman River Dam: Report of the Environmental Assessment Panel, Ottawa, Ontario, May 1992.

4. See Robert Hahn and John A. Hird, "The Costs and Benefits of Regulation: Review and Synthesis." *Yale Journal of Regulation*, **8**(1), 1991, 233–78.

5. 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.

6. Bent Flyvbjerg, "What You Should Know about Megaprojects and Why: An Overview." *Project Management Journal*, **45**(2), 2014, 6–19.

7. Winston Harrington, Richard D. Morgenstern, and Peter Nelson, "On the Accuracy of Regulatory Cost Estimates." *Journal of Policy Analysis and*

Management, **19**(2), 2000, 297–322. See also Henry J. Aaron, "Seeing Through the Fog: Policymaking with Uncertain Forecasts." *Journal of Policy Analysis and Management*, **19**(2), 2000, 193–206.

8. David L. Weimer and Aidan R. Vining, *Policy Analysis: Concepts and Practice*, 6th edn (New York, NY: Routledge, 2017).

9. In practice, individuals can only focus on approximately four to seven alternatives, at best. G. A. Miller, "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information." *Psychological Review*, **65**(1), 1956, 81–97.

10. See, for example, table 1 in David Long, Charles D. Mallar, and Craig V. Thornton, "Evaluating the Benefits and Costs of the Jobs Corps." *Journal of Policy Analysis and Management*, **1**(1), 1981, 55–76.

11. Robert D. Behn, "Policy Analysis and Policy Politics." *Policy Analysis*, **7**(2), 1981, 199–226, at 213, n. 27.

12. Remember that valuation of the impact at step 6 should be consistent with the chosen measurement indicator. For example, the valuation of an arrest should be lower than the valuation of a conviction so that the analyst would obtain similar estimates of the benefits of reduced crime from using either indicator.

13. These studies are discussed by Robert Williamson, "Pulp Cleanup May Be Waste of Money." *Toronto Globe and Mail*, December 23, 1992, pp. A1, A6.

14. These values are based on those laid out in Mark A. Moore, Anthony E. Boardman, Aidan R. Vining, David L. Weimer, and David H. Greenberg, "Just Give Me a Number! Practical Values for the Social Discount Rate." *Journal of Policy Analysis and Management*, **23**(4), 2004, 789–812.

15. Note that at the optimum output level, marginal benefits equal marginal costs: $\frac{dB}{dQ} = \frac{dC}{dQ}$. One can see that the slope of the benefit curve at Q^* equals the slope of the cost curve at Q^*.

16. In contrast, tolls on *congested* highways generally increase the net social benefit.

17. This section draws heavily 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, 532–55.

18. This terminology was introduced by Sanford Borins and David A. Good, "Spenders, Guardians and Policy Analysts: A Game of Budgeting Under the Policy and Expenditure Management System." Toronto, Case Program in Canadian Administration, Institute of Public Administration of Canada, 1987 (revised 1989).

19. Such analysis is very helpful for certain purposes, but a problem arises when an analyst does this type of analysis while thinking that he or she is performing CBA.

20. See, for example, William A. Niskanen, "Bureaucrats and Politicians." *Journal of Law and Economics*, **18**(3), 1975, 617–43; and André Blais and Stéphane Dion, editors, *The Budget-Maximizing Bureaucrat: Appraisals and Evidence* (Pittsburgh, PA: University of Pittsburgh Press, 1991). For various reasons, senior spenders may be more interested in the discretionary budget or "budget shaping" than in budget maximizing; see Patrick Dunleavy, *Democracy, Bureaucracy and Public Choice* (Englewood Cliffs, NJ: Prentice Hall, 1992). They may, therefore, be willing to support projects that involve considerable "contracting out" and other activities that may not be budget maximizing per se.

21. Robert H. Haveman, "Policy Analysis and the Congress: An Economist's View." *Policy Analysis*, **2**(2), 1976, 235–50.

22. Barry R. Weingast et al. refer to this phenomenon as the "Robert Moses effect" after the famous New Yorker who exploited it so effectively. See Barry R. Weingast, Kenneth A. Shepsle, and Christopher Johnsen, "The Political Economy of Benefits and Costs: A Neoclassical Approach to

Distributive Politics." *Journal of Political Economy*, **89**(4), 1981, 642–64, at 648.

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23. See, for example, Bent Flyvbjerg, Mette Skamris Holm, and Soren Buhl, "Underestimating Costs in Public Works Projects: Error or Lie?" *Journal of the American Planning Association*, **68**(3), 2002, 279–93; and Linda R. Cohen and Roger G. Noll, editors, *The Technology Pork Barrel* (Washington, DC: The Brookings Institution, 1991).

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24. Rashi Fein, "Petty's Cash Ledger," letter to *The Economist*, Jan. 11 2014, accessed from www.economist.com/news/letters/21593391-france-hotels-heathrow-iran-william-petty-films-our-country-year on April 1, 2017.

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25. For a very brief discussion of the origins of CBA, see D. W. Pearce, *Cost–Benefit Analysis* (London: MacMillan, 1971).

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26. Many countries have guidelines for conducting RIA. See www.oecd.org/gov/regulatory-policy/ria.htm, accessed April 3, 2017.

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27. See Robert W. Hahn, Jason K. Burnett, Yee-Ho I. Chin, Elizabeth A. Mader, and Petrea R. Moyle, "Assessing Regulatory Impact Analyses: The Failure of Agencies to Comply with Executive Order 12,866." *Harvard Journal of Law & Public Policy*, **23**(3), 2000, 859–85. This study found that, in a sample of 48 major RIAs conducted from mid-1960 to mid-199, only 29 percent quantified the net benefit.

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28. On retrospective regulatory review, see Randall Lutter, "Regulatory Policy: What Role for Retrospective Analysis and Review?" *Journal of Benefit–Cost Analysis*, **4**(1), 2013, 17–38.

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29. See, for example, Office of the Management and Budget (OMB), *Circular A-94: Guidelines and Discount Rates for BenefitCost Analysis of Federal Programs* (Washington, DC: OMB, 1992); Office of the Management and Budget (OMB) (Washington, DC: OMB, 2003); HM Treasury, *The Green Book: Appraisal and Evaluation in Central Government* (London: The Stationary Office, 2003 (updated 2011)); Treasury Board of Canada Secretariat (TBS), *Canadian Cost–Benefit*

Analysis Guide: Regulatory Proposals (interim) (Ottawa, Ontario: TBS, 2007); European Commission, *Guide to Cost–Benefit Analysis of Investment Projects* (Brussels: European Commission, 2015); Australian Government, *Guidance Note: Cost–Benefit Analysis* (Office of Best Practice Regulation, 2016).

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30. Oliver Williamson, "Economies as an Antitrust Defense: The Welfare Tradeoffs." *American Economic Review*, **58**(1), 1968, 18–36.

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31. Anthony E. Boardman, "Using Social Cost–Benefit Analysis to Measure Corporate Social Responsibility." *Infogas*, **5**(15), 2009, 6–13 (in Spanish).

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32. Richard Revesz and Michael Livermore, *Retaking Rationality: How Cost Benefit Analysis Can Better Protect the Environment and Our Health* (New York, NY: Oxford University Press, 2008).

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33. Thomas D. Hopkins, "Economic Analysis Requirements as a Tool of Regulatory Reform: Experience in the United States." Statement presented to the Sub-Committee on Regulations and Competitiveness Standing Committee on Finance, House of Commons, Ottawa, September 15, 1992, p. 10.

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34. US Environmental Protection Agency, EPA's Use of Benefit–Cost Analysis: 1981–1986, EPA-230–05-87–028, Office of Policy, Planning and Evaluation, August 1987, pp. 1–3.

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35. Robert W. Hahn and Patrick M. Dudley, "How Well Does the US Government Do Benefit–Cost Analysis?" *Review of Environmental Economics and Policy*, **1**(2), 2007, 192–211.

2

Conceptual Foundations of Cost–Benefit Analysis

It seems only natural to think about the alternative courses of action we face as individuals in terms of their costs and benefits. Is it appropriate to evaluate public policy alternatives in the same way? The CBA of the highway sketched in Chapter 1 identifies some of the practical difficulties analysts typically encounter in measuring costs and benefits. Yet, even if analysts can measure costs and benefits satisfactorily, evaluating alternatives solely in terms of their net benefits may not always be appropriate. An understanding of the conceptual foundations of CBA provides a basis for determining when CBA can be appropriately used as a decision rule, when it can usefully be part of a broader analysis, and when it should be avoided.

The goal of *allocative*, or *Pareto*, *efficiency* provides the conceptual basis for CBA. In this chapter, we provide a non-technical introduction to Pareto efficiency. We then explain its relationship to *potential Pareto efficiency*, which provides the practical basis for actually doing CBA. Our exploration of the roles of Pareto efficiency and potential Pareto efficiency in CBA provides a basis for distinguishing it from other analytical frameworks. It also provides a basis for understanding the various

philosophical objections commonly made against the use of CBA for decision-making.

2.1 CBA as a Framework for Assessing Efficiency

CBA can be thought of as providing a framework for assessing the relative efficiency of policy alternatives.[1] Although we develop a more formal definition of efficiency in the following section, it can be thought of as a situation in which resources, such as land, labor, and capital, are deployed in their highest-valued uses in terms of the goods and services they create. In situations in which decision-makers care only about efficiency, CBA provides a method for making direct comparisons among alternative policies. Even when goals other than efficiency are important, CBA serves as a yardstick that can be used to provide information about the relative efficiency of alternative policies. Indeed, analysts rarely encounter situations in which efficiency is not one of the relevant goals. Critical evaluation of these assertions requires a more precise definition of efficiency.

2.1.1 Pareto Efficiency

A simple and intuitively appealing definition of efficiency, referred to as *Pareto efficiency*, underlies modern welfare economics and CBA. *An allocation of goods is Pareto-efficient if no alternative allocation can make at least one person better off without making anyone else worse off.* An allocation of goods is inefficient, therefore, if an alternative allocation can be found that would make at least one person better off without making anyone else worse off. One would have to be malevolent not to

want to achieve Pareto efficiency – why forgo gains to persons that would not inflict losses on others?

Figure 2.1 illustrates the concept of Pareto efficiency in the simple allocation of a fixed amount of money between two persons. Imagine that the two persons will receive any total amount of money of up to $100 if they agree on how to split it between themselves. Assume that if they do not agree, then each person receives just $25. The vertical axis measures the amount of money received by person 1, and the horizontal axis measures the amount of money received by person 2. The point labeled $100 on the vertical axis represents the outcome in which person 1 receives the entire $100. Similarly, the point labeled $100 on the horizontal axis represents the outcome in which person 2 receives the entire $100. The line connecting these two extreme points, which we call the *potential Pareto frontier*, represents all the feasible splits between the two persons that allocate the entire $100. Splits involving less than $100 lie within the triangle formed by the potential Pareto frontier and the axes. The one labeled ($25, $25) is such a point. This point represents the status quo in the sense that it gives the amounts the two persons receive if they do not reach an agreement about splitting the $100. The segment of the potential Pareto frontier that gives each person at least as much as the status quo is called the *Pareto frontier*.

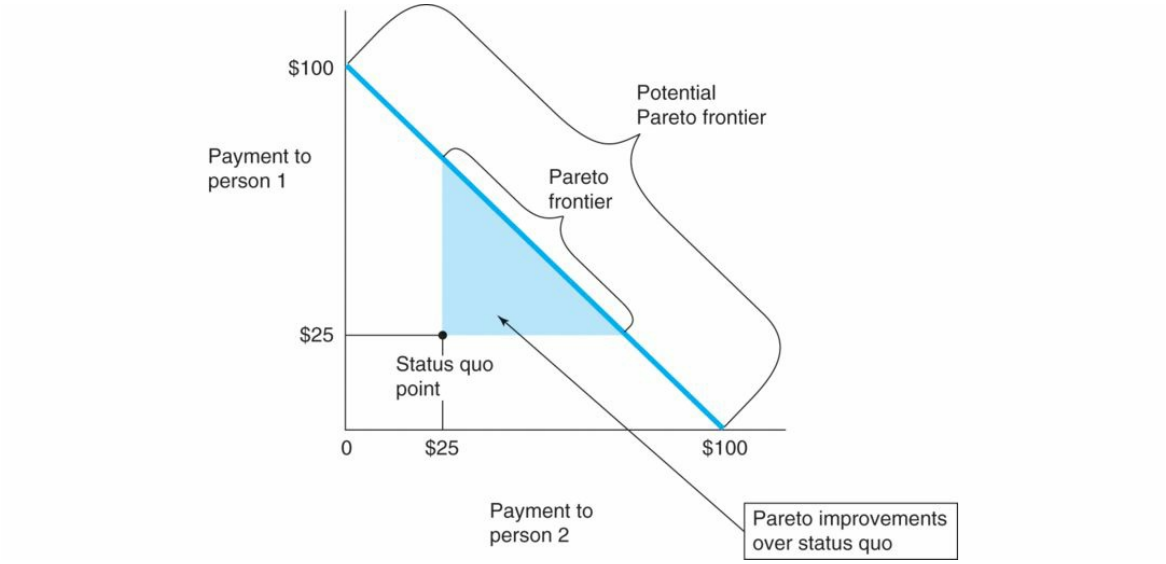

Figure 2.1 Pareto efficiency.

The shaded triangle formed by the lines through the status quo point and the Pareto frontier represents all the alternative allocations that would make at least one of the persons better off than the status quo without making the other worse off. The existence of these points, which are feasible alternatives to the status quo that make at least one person better off without making the other worse off, means that the status quo is not Pareto-efficient. Movement to any one of these points is called a *Pareto improvement.* Any Pareto improvement that does not lie on the potential Pareto frontier would leave open the possibility of further Pareto improvements and thus not provide a Pareto-efficient allocation. Only on the potential Pareto frontier is it impossible to make a feasible reallocation that makes one person better off without making the other person worse off.

It should be clear that the segment of the potential Pareto frontier that guarantees at least $25 to each person represents all the Pareto-efficient allocations relative to the status quo. Each of these points makes a Pareto improvement over the status quo and leaves no opportunity for further improvements. The segment of the potential Pareto frontier that represents actual Pareto improvements depends upon the status quo. In other words,

implicit in the concept of Pareto efficiency are the initial starting positions of the members of society. We return later to the significance of the difference between the potential and actual Pareto frontiers in our discussion of criticisms of CBA.

2.1.2 Net Benefits and Pareto Efficiency

The link between positive net social benefits (henceforth, net benefits) and Pareto efficiency is straightforward: *if a policy has positive net benefits, then it is possible to find a set of transfers, or side payments, that makes at least one person better off without making anyone else worse off.* A full understanding of this link requires some reflection on how one measures the benefits and costs of the incremental impacts of a policy alternative.

The overall guiding principle for valuation is willingness to pay (WTP), the amount that each person would be willing to pay to obtain the impacts of the policy taking account of all the changes in the person's consumption that would result. In practice, however, it is customary and convenient to divide impacts into the outcomes produced by the policy and the inputs required to implement it. As illustrated in Figure 2.2, assessing benefits and costs requires one to employ WTP as the method for valuing the outcomes of a policy and opportunity cost as the method for valuing the resources required to obtain those outcomes through implementation of the policy. Although we develop these important concepts more fully in Chapters 3, 5, 6, and 7 in the context of market exchange, the simple introductions that follow provide the basis for understanding the link between net benefits and Pareto efficiency.

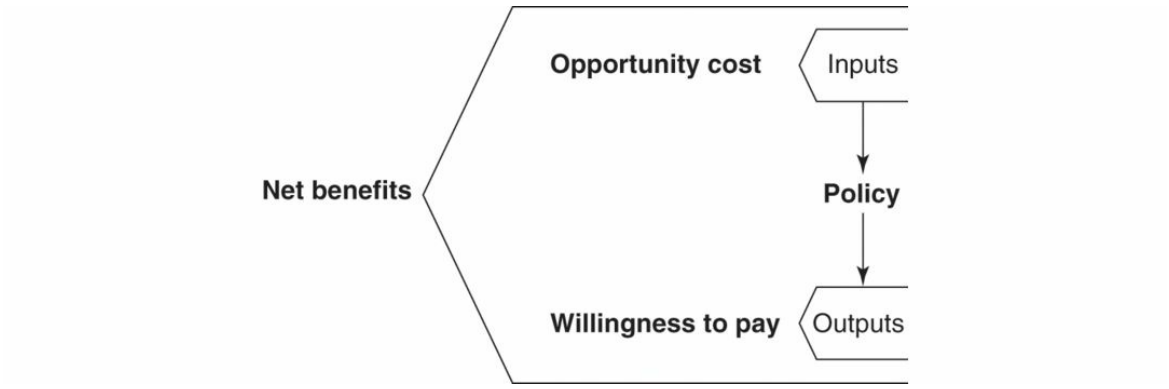

Figure 2.2 Categorization of net benefits of projects.

Willingness to Pay. Consider a proposed policy that would produce outputs of relevance to three people. Assume that these people make honest revelations of their assessments of the values of the outputs. Through a series of questions, we elicit the payments that each person would have to make or receive under the policy so that he or she would be indifferent between the status quo and the policy with the payments. So, for example, imagine that person 1 honestly reveals that she would be indifferent between the status quo and paying $100 to have the policy implemented. Similarly, person 2 might say that he is indifferent between the status quo and paying $200 to have the policy implemented. These values are the WTP of persons 1 and 2 for the policy. Unlike persons 1 and 2, assume that person 3 does not like the outcomes of the proposed policy and would have to receive a payment of $250 if the policy were implemented to feel just as well off as he did under the status quo; this $250 is the amount that would have to be given to the person in conjunction with the proposed policy so that he is indifferent between it and the status quo. The negative of this amount (−$250) would be the WTP of person 3 for the policy. As the policy in effect takes something away from person 3, the amount is called the person's *willingness to accept* (WTA).[2]

The algebraic sum of these WTP values is the appropriate measure of the net benefits of the outcomes of the policy. In this example, the WTP

amounts can be divided into $300 of benefits ($100 + $200) accruing to persons 1 and 2 and $250 of costs (−$250) accruing to person 3. The net benefits are thus positive and equal to $50. If these were the only three persons affected by the policy, and if the policy required no resources to implement, then the $50 would be the appropriate measure of net benefits from the perspective of CBA. Simple implementation of the policy would not be Pareto-efficient because person 3 would be made worse off with respect to the status quo policy. Yet, we can easily imagine altering the policy so that it would be Pareto-efficient. For example, imagine that person 3 receives $75 from person 1 and $175 from person 2 as part of the policy. Now person 1 is better off than the status quo ($100 of benefits minus $75 given to person 3), person 2 is better off ($200 of benefits minus $175 given to person 3), and person 3 is no worse off ($250 of costs from the policy minus $250 of benefits in the form of compensation from persons 1 and 2). The key point is that if, and only if, the aggregate net benefits of the policy as measured by the WTP of all affected individuals are positive, then there exist sets of contributions and payments that would make the policy a Pareto improvement over the status quo.

Opportunity Cost. The implementation of policies almost always requires the use of some inputs that could be used to produce other things of value. For example, implementing a policy to build a bridge across a river would require the use of labor, steel, concrete, construction machinery, and land that could be used to produce other things of value to people. The concept of opportunity cost is used in CBA to place a dollar value on the inputs required to implement policies. *The opportunity cost of using an input to implement a policy is its value in its best alternative use.* Opportunity cost measures the value of what society must forgo to use the input to implement the policy.

Return to the example of the three persons whose aggregate WTP for the policy was $50. Imagine that the policy requires inputs that have an opportunity cost of $75. That is, if the policy were implemented, then some other members of society would have to give up goods valued at $75. In this case, the policy does not generate enough net benefits to the three persons to allow them to compensate those who must forgo the $75 of goods – the net benefits to society as a whole are negative $25 ($50 of net benefits to the three persons minus $75 in opportunity costs to the rest of society). Thus, the policy could not be made Pareto-efficient because it does not produce enough benefits to permit all those who bear costs to be compensated fully. If the opportunity cost were only $20 instead of $75, then net benefits to society would be $30 and it would be possible to compensate all those who bear costs so that no one is made worse off, and some people are made better off, by the policy. In general, if the net benefits of a policy are positive, then it is potentially Pareto-improving.

2.2 Using CBA for Decision-Making

The connection between net benefits and Pareto efficiency should now be clear. *As long as analysts value all outcomes in terms of willingness to pay (or willingness to accept) and value all required inputs in terms of opportunity costs, then the sign of the net benefits indicates whether it would be possible to compensate those who bear costs sufficiently so that no one is made worse off and at least one person is better off.* Positive net benefits indicate the potential for compensation to make the policy Pareto-efficient; negative net benefits indicate the absence of this potential.

One could imagine the following decision rule for CBA: adopt only policies that are actually Pareto-efficient. In other words, only policies that yield positive benefits after providing full compensation to all those who

bear costs would be adopted so that there would be at least some winners and no losers. Although conceptually this is appealing, such a rule would be extremely difficult to apply in practice for a number of reasons. First, it would place great informational burdens on analysts not just to measure aggregate costs and benefits, which can often be inferred from observing prices and quantities in markets, but also to measure costs and benefits for each person, a task that would generally render CBA too costly to use. Second, once the distribution of costs and benefits at the individual level were known, the administrative costs of actually making specific transfers for each government policy would almost certainly be high. Third, it is difficult to operate a practical system of compensation payments that does not distort the investment and work behavior of households. Fourth, the requirement that everyone be fully compensated would create a strong incentive for people to find ways to overstate the costs and understate the benefits that they expect to receive from policies, complicating the already difficult task of inferring how much each person is willing to pay for the impacts produced by the policy. The "actual Pareto efficiency" principle in practice would thus result in society forgoing many policies that offer positive net benefits and the diversion of much effort toward the seeking of unjustified compensation.

2.2.1 Potential Pareto Efficiency

CBA utilizes an alternative decision rule with somewhat less conceptual appeal, but much greater feasibility, than the actual Pareto efficiency rule. It is based on what is known as the *Kaldor–Hicks criterion*: a policy should be adopted if and only if those who will gain could fully compensate those who will lose and still be better off.[3] The Kaldor–Hicks criterion provides the basis for the *potential Pareto efficiency rule*, or, more commonly, the *net benefits criterion: adopt only policies that have*

positive net benefits. As long as net benefits are positive, it is possible that losers could be compensated so that the policy potentially could be Pareto improving. In terms of Figure 2.1, any point on the potential Pareto frontier would pass the potential Pareto efficiency rule, while only those points on the potential Pareto frontier that guarantee at least $25 to each person (the labeled interior segment of the potential Pareto frontier) pass the actual Pareto efficiency rule.

In practice, the assessment of whether a particular policy would increase efficiency depends on whether it offers a *potential Pareto improvement.* That is, does the policy provide sufficient net gains so that all losers *could* be compensated? Potential Pareto efficiency is achieved only when all potential Pareto improvements have been exhausted.

Several justifications, aside from feasibility, are commonly offered in defense of the potential Pareto efficiency rule. First, by always choosing policies with positive net benefits, society maximizes aggregate wealth. This indirectly helps those who are worse off because richer societies have greater capability for helping their poorest members and, if redistribution is a normal good (that is, other things being equal, people want more of it as their wealth increases), members of society have a greater willingness to help.[4] Second, it is likely that different policies will have different sets of winners and losers. Thus, if the rule is consistently applied to government activity, then costs and benefits will tend to average out across people so that each person is likely to realize positive net benefits from the full collection of policies. Third, as we discuss later in this chapter, the rule stands in contrast to the incentives in representative political systems to give too much weight to costs and benefits that accrue to organized groups and too little weight to costs and benefits that accrue to unorganized interests. Its use in public discourse may thereby reduce the chances that Pareto-inefficient policies will be adopted. Fourth, if a more equal

distribution of wealth or income is an important goal, then it is possible to address it directly through transfers after a large number of efficiency-enhancing policies have been adopted. In other words, redistribution, at least in theory, can be done "wholesale" with a single redistribution program rather than "retail" in each particular program.

2.2.2 Application of the Decision Rule in Practice

Two polices can be thought of as independent if the adoption of one does not influence the costs and benefits of the other. When all relevant projects are independent, the CBA decision rule is simple: *adopt all policies that have positive net benefits.* A more general version of the rule applies in situations involving multiple policies that may enhance or interfere with each other: *choose the combination of policies that maximizes net benefits.* Physical, budgetary, and other constraints may limit the combinations of policies that are feasible.

Consider the list of projects in Table 2.1. Interpret the costs and benefits as being expressed in terms of present values, so that they can be directly compared with dollars of current consumption. Note that projects C and D are shown as synergistic. That is, the net benefits from adopting both together exceed the sum of the net benefits from adopting each one independently. Such might be the case if project C were a dam that created a reservoir that could be used for recreation as well as hydroelectric power and D were a road that increased access to the reservoir. Of course, projects can also interfere with each other; for instance, the dam might reduce the benefits of a downstream recreation project. The important point is that care must be taken to determine interactions among projects so that the combinations of projects providing the greatest net benefits in aggregate can be readily identified.

Table 2.1 Choosing Efficient Projects and the Use of Net Benefits versus Benefit–Cost Ratios

	Costs relative to no project (millions of dollars)	Benefits relative to no project (millions of dollars)	Net benefits (millions of dollars)	Benefits/costs
Project A	1	10	9	10
Project B	10	30	20	3
Project C	4	8	4	2
Project D	3	5	2	1.7
Projects C and D	7	21	14	3
Project E	10	8	−2	0.8

(1) No constraints: Choose A, B, and combination C and D (net benefits equal $43 million).

(2) All projects mutually exclusive: Choose B (net benefits equal $20 million).

(3) Total costs cannot exceed $10 million: Choose A and combination C and D (net benefits equal $23 million).

Source: Adapted from David L. Weimer and Aidan R. Vining, *Policy Analysis: Concepts and Practice*, 6th ed. (New York, NY: Routledge, 2017), figure 16.2.

Suppose we could choose any combination of projects; then we should simply choose all those with positive net benefits – namely, projects A, B, and combination C and D.

Suppose now the policies are mutually exclusive. For example, we cannot drain a swamp to create agricultural land and simultaneously preserve it as a wildlife refuge. When all the available policies are mutually exclusive, efficiency is maximized by choosing the one with the largest net positive benefits – project B, with net benefits of $20 million. Assume, however, that all projects are mutually exclusive, except C and D, which can be built together to obtain synergistic gains. By taking the combination of C and D to be a separate project, we can consider all the projects on the list to be mutually exclusive. Looking down the column labeled "Net benefits," we see that project B still offers the largest net benefits and therefore should be the one selected, but the combination of C and D offers the next highest net benefits.

Analysts often compare programs in terms of *benefit–cost ratios.* Note that project B, which offers the largest net benefits, does not have the largest ratio of benefits to costs. Project A has a benefit–cost ratio of 10, while project B has a benefit–cost ratio of only 3. Nevertheless, project B should be selected because it offers larger net benefits than project A. This comparison shows how the benefit–cost ratio can sometimes confuse the choice process when the projects under consideration are of different scale (that is, project B involves substantially higher costs than project A). Furthermore, the benefit–cost ratio is sensitive to whether negative WTP (willingness to accept) amounts are subtracted from benefits or added to costs. For example, imagine that the cost of $10 million for project B was opportunity costs and the benefits of $30 million consisted of $40 million for one group and −$10 million for another. Treating the negative WTP as a cost rather than as a negative benefit would leave the net benefits unchanged but lower the benefit–cost ratio from 3 to 2. Thus, benefit–cost ratios are subject to manipulation. For these reasons, *we recommend that*

analysts avoid using benefit–cost ratios to rank policies and rely instead on net benefits.

Return to Table 2.1 and interpret the listed costs as public expenditures exactly equal to opportunity costs and the listed benefits as the WTP values for all project effects. Now assume that, while none of the projects are mutually exclusive in a physical sense, total public expenditures (costs) cannot exceed $10 million because of a budget constraint that is binding for political reasons. If project B is selected, then the budget constraint is met, and net benefits of $20 million result. If project A and the combination of projects C and D are selected instead, then the budget constraint is also met, but net benefits of $23 million result. No other feasible combination offers larger net benefits. Thus, under the budget constraint, net benefits are maximized by choosing projects A and the combination of C and D.

2.3 Fundamental Issues Related to Willingness to Pay

Three sets of fundamental issues arise with respect to the interpretation of WTP as a measure of benefits in the assessment of the efficiency of policies. First, a theoretical limitation in the aggregation of willingness-to-pay amounts across individuals opens the possibility that the net benefits criterion will not lead to fully satisfactory rankings of policies. Second, normative issues arise because of the dependence of WTP on the distribution of wealth in society. Third, normative issues also arise with respect to the issue of *standing*, which concerns whose WTP counts in the aggregation of benefits.

2.3.1 Theoretical Limitation of WTP as the Basis for Social

Orderings

Although using net benefits as a basis for choosing efficient public policies is intuitively appealing, its implementation through the aggregation of the willingness-to-pay amounts of the members of society confronts a fundamental theoretical limitation: ranking policies in terms of net benefits does not guarantee a transitive social ordering of the policies.

A *transitive* ordering requires that if *X* is preferred to *Y*, and *Y* is preferred to *Z*, then *X* is preferred to *Z*. The logic of transitivity seems so clear that it is usually taken as an axiom of rationality in the preferences of individuals. We would certainly be skeptical about the mental state of someone who tells us she prefers apples to oranges, and she prefers oranges to peaches, but she prefers peaches to apples. This violation of transitivity implies a cyclical, and therefore ambiguous, ordering of the alternatives. Clearly, transitivity is a desirable property of any preference ordering.

If every member of a society has transitive preferences, then do reasonable procedures for aggregating their preferences always produce a transitive social ordering? An example makes clear that the answer is no. Consider a common aggregation procedure: majority rule voting over pairs of alternatives. Imagine that society consists of three voters who have preferences over three alternatives, *X*, *Y*, and *Z*, as displayed in Table 2.2. Specifically, voter 1 prefers *X* to *Y* to *Z*, voter 2 prefers *Z* to *X* to *Y*, and voter 3 prefers *Y* to *Z* to *X*. If the voters express their sincere preferences in each round of voting, then we would find that given the choice between *X* and *Y*, voters 1 and 2 (a majority) would vote for *X* because they each prefer it to *Y*. Similarly, given the choice between *Y* and *Z*, a majority would vote for *Y*. Yet in a choice between *X* and *Z*, a majority would vote for *Z*. Thus, the implied social ordering is intransitive because *X* is preferred to *Y*, *Y* is preferred to *Z*, but *Z* is preferred to *X*!

Table 2.2 Cyclical Social Preferences under Pairwise Majority Rule Voting

Preference ordering	**Voter 1**	**Voter 2**	**Voter 3**
First choice	*X*	*Z*	*Y*
Second choice	*Y*	*X*	*Z*
Third choice	*Z*	*Y*	*X*

(1) Pairwise voting outcomes: *X* versus *Y*, *X* wins; *Y* versus *Z*, *Y* wins; *X* versus *Z*, *Z* wins.

(2) Implied social ordering: *X* is preferred to *Y*, *Y* is preferred to *Z*, but *Z* is preferred to *X*!

Is the possibility of obtaining an intransitive social ordering peculiar to the use of pairwise majority rule voting to produce rankings of alternatives? Surprisingly, it can result from any rule for creating a social ordering that satisfies certain minimal requirements. We cannot expect any rule for creating a social ranking of policy alternatives to be fully satisfactory. As CBA is a social choice rule, it must either not satisfy one or more of the minimal requirements or risk producing an intransitive ordering of alternatives.

In 1951, Kenneth Arrow proved that any *social choice rule* that satisfies a basic set of fairness conditions can produce intransitive social orderings.[5] *Arrow's theorem* applies to any rule for ranking alternatives in which two or more persons must rank three or more alternatives. It requires any such scheme to satisfy at least the following conditions to be considered fair: First, each person is allowed to have any transitive preferences over the possible policy alternatives (*axiom of unrestricted domain*). Second, if one alternative is unanimously preferred to a second, then the rule for choice will not select the second (*axiom of Pareto choice*). Third, the ranking of any two alternatives should not depend on what other

alternatives are available (*axiom of independence*). Fourth, the rule must not allow any person dictatorial power to impose his or her preferences as the social ordering (*axiom of non-dictatorship*). Arrow's theorem states that any fair rule for choice (one that satisfies the four previous axioms) will not guarantee a transitive *social ordering* of policy alternatives. That is, it is possible that individual preferences are such that the social ordering will be intransitive and produce cyclical rankings, such as A is preferred to B and B is preferred to C but C is preferred to A! Thus, unless the net benefit rule, which is a social choice rule, violates one of the axioms, it cannot guarantee a transitive social ordering of policies.

In order to ensure that the use of WTP in the implementation of the net benefit rule will produce a transitive social ordering of policies, some restrictions, violating the axiom of unrestricted domain, must be placed on the preferences that individuals are allowed to hold.[6] Economic models commonly assume that individual preferences are represented by utility functions (numerical representations of preference orderings) that exhibit positive but declining marginal utility; that is, other things equal, incremental consumption of any good increases utility but not by as much as the previous incremental unit. Unfortunately, this relatively weak restriction of the domain of preferences (it rules out preferences that cannot be represented by such utility functions) is not enough to guarantee that the net benefit rule based on WTP will *always* produce a transitive social ordering. Two additional restrictions are required for such a guarantee: (1) the utility functions of individuals must be such that the individual demand curves that they imply can be aggregated into a market demand curve with the sum of individual incomes as an argument, and (2) all individuals must face the same set of prices.[7] The first restriction is quite strong in that it requires each individual's demand for each good to increase linearly with increasing income and to have the same rate of

increase for each individual. The second restriction, generally satisfied when all goods are traded in markets, may be violated when policies allocate quantities of goods to individuals who cannot resell them in markets.

The necessity of restricting the allowed preferences of individuals to guarantee a transitive social ordering from the use of WTP in the implementation of the net benefits criterion makes clear that it is an imperfect criterion for assessing the relative efficiency of alternative policies.[8] Of course, analysts can avoid this theoretical problem by assuming that the preferences of individual consumers conform to restrictive assumptions consistent with the existence of an appropriate aggregate demand function. Alternatively, analysts can avoid it by assuming that policies affect the price of only a single good. Indeed, as discussed in the next five chapters, analysts seeking to estimate WTP typically work with an aggregate, or market, demand schedule for a single good, implicitly assuming away price effects in the markets for other goods.

Despite its theoretical imperfection as a measure of efficiency, WTP is an intuitively appealing and practical concept for guiding the implementation of the net benefits criterion. As discussed next, however, its dependence on the distribution of wealth raises a serious normative concern about its use.

2.3.2 Dependence of WTP on the Distribution of Wealth

The willingness of a person to pay to obtain a desired policy impact will tend to be higher the greater the wealth that she or he has available. Consequently, the sum of the willingness of persons to pay, the benefit measure in CBA, depends on their levels of wealth. If the distribution of wealth in society were to be changed, then it would be likely that the sum

of individuals' willingness-to-pay amounts would change as well, perhaps altering the ranking of alternative policies in terms of their net benefits.

The dependence of net benefits on the distribution of wealth would not pose a conceptual problem if losers from adopted policies were *actually* compensated so that the adopted polices would produce actual, rather than potential, Pareto improvements. From a utilitarian perspective, Pareto improvement guarantees that the sum of utilities of individuals in society increases. In application of the potential Pareto principle, however, it is possible that an adopted policy could actually lower the sum of utilities if people with different levels of wealth had different *marginal utilities of money*.[9]

As an illustration, consider a policy that gives $10 of benefits to a person with high wealth and inflicts $9 of costs on a person with low wealth. If the low-wealth person's marginal utility of money is higher than that of the high-wealth person, then it is possible that the utility loss of the low-wealth person could outweigh the utility gain of the high-wealth person. Thus, while the Pareto principle allows us to avoid interpersonal utility comparisons by guaranteeing increases in aggregate utility for policies with positive net benefits, the potential Pareto principle does not do so.

The implication of the dependence of WTP on wealth is that the justification for the potential Pareto principle weakens for policies that concentrate costs and benefits on different wealth groups. Policies with positive net benefits that concentrate costs on low-wealth groups may not increase aggregate utility; moreover, policies with negative net benefits that concentrate benefits on low-wealth groups may not decrease aggregate utility. However, if the potential Pareto principle is consistently applied and adopted, then policies do not produce consistent losers or winners. Consequently, the overall effects of the policies taken together will tend to

make everyone better off. Hence, concerns about reductions in aggregate utility would be unfounded.

Critics of CBA sometimes question the validity of the concept of Pareto efficiency itself because it depends on the status quo distribution of wealth. In Figure 2.1, note that the location of the Pareto frontier would change if the location of the status quo point were changed. Some have advocated the formulation of a social welfare function that maps the utility, wealth, or consumption of all individuals in society into an index that ranks alternative distributions of goods.[10] In this broader framework incorporating distributional values, an efficient policy is one that maximizes the value of the social welfare function. But how does society determine the social welfare function? Unfortunately, Arrow's theorem, as well as practical difficulties in obtaining needed information, precludes the formulation of a social welfare function through any fair collective choice procedure.[11] In practice, it must therefore be provided subjectively by the analyst.[12] We believe that it is usually better to keep the subjective distributional values of analysts explicit by comparing policies both in terms of efficiency and the selected distributional criteria, as illustrated in the discussion of multigoal analysis and distributionally weighted CBA later in this chapter. As an alternative, analysts can report net benefits by wealth or income group, as well as for society as a whole.

2.3.3 Dependence of Net Benefits on Assumptions about Standing

The question of whose WTP should count in the aggregation of net benefits has come to be known as the issue of standing.[13] It has immediate practical importance in at least three contexts: the jurisdictional definition of society and its membership, the exclusion of socially unacceptable preferences, and the inclusion of the preferences of future generations.

Recognition of social constraints, rights, and duties often helps answer the question of standing.

Jurisdictional Definition of Society. The most inclusive definition of society encompasses all people, no matter where they live or to which government they owe allegiance. Analysts working for the United Nations or some other international organization might very well adopt such a universalistic, or global, perspective. Yet for purposes of CBA, most analysts define society at the national level. The basis for this restriction in jurisdiction is the notion that the citizens of a country share a common constitution, formal or informal, that sets out fundamental values and rules for making collective choices. In a sense, they consent to being a society and recognize that citizens of other countries have their own constitutions that make them distinct polities. Furthermore, these rules include fiscal and monetary policies that shape a national economy in which resources and goods are allocated.

The distinction between universal and national jurisdiction becomes relevant in the evaluation of policies whose impacts spill over national borders. For example, if US analysts adopt the national-level jurisdiction as defining society, then they would not attempt to measure the willingness of Canadian residents to pay to avoid pollution originating in the United States that exacerbates acid rain in Canada. Of course, the willingness of US citizens to pay to reduce acid rain in Canada should be included in the CBA, although in practice, it would be very difficult to measure.

As in the highway example discussed in Chapter 1, a similar issue arises with respect to subnational units of government. As an illustration, consider a city that is deciding whether to build a bike path. Assume that a CBA from the national perspective (giving standing to everyone in the country) predicts that the project will generate $1 million in benefits (which all accrue to city residents) and $2 million in costs (which are also

borne by city residents), thereby resulting in negative $1 million in net benefits (or $1 million in net costs). Also assume, however, that through an intergovernmental grants program the national government will repay the city's $2 million of costs resulting from this particular project. The grant appears to the city residents as a $2 million benefit offsetting $2 million in local costs. Thus, from the perspective of the city, the bike path generates $1 million in net benefits rather than $1 million in net costs.

One can make an argument that the city should treat its residents as the relevant society and, hence, should not give standing to non-residents. The city government has a charter to promote the welfare of its residents. The city by itself can do relatively little to affect national policy – even if it does not take advantage of all the opportunities offered by the national government, other cities probably will. Furthermore, analysts who do not adopt the city's perspective but instead employ only the broader national perspective risk losing influence, a possibility of special concern to analysts who earn their living by giving advice to the city.

Adopting the subnational perspective, however, makes CBA a less-valuable decision rule for public policy. We believe that *analysts should ideally conduct CBA from the national perspective.* They may, of course, also conduct a parallel CBA from the subnational perspective as a response to the narrower interests of their clients. If major impacts spill over national borders, then the CBA should be done from the global as well as the national perspective.

Jurisdictional Membership. Deciding the jurisdictional definition of society leaves open a number of questions about who should be counted as members of the jurisdiction. For example, almost all analysts agree that citizens of their country, whether living domestically or abroad, should have standing. With respect to non-citizens in their country, most analysts would probably give standing to those who were in the country legally. No

consensus exists with respect to the standing of other categories of people: Should illegal aliens have standing? What about the children of illegal aliens?

One source of guidance for answering these types of questions is the system of legally defined rights.[14] For example, a ruling by the courts that the children of illegal aliens are entitled to access publicly funded education suggests that analysts give these children standing in CBA. Reliance on legally defined rights to determine standing, however, is not always morally acceptable. It would not have been right to deny standing in CBA to slaves in the antebellum United States, non-whites in apartheid South Africa, or Jews in Nazi Germany simply because they lacked legal rights. Therefore, legal rights alone cannot fully resolve the issue of standing in CBA. They provide a presumption, but one that analysts may sometimes have an ethical responsibility to challenge. Democratic regimes usually provide mechanisms for challenging such presumptions, but often with personal cost to individual analysts.

One other issue of membership deserves brief mention. CBA is anthropocentric. *Only the WTP of people counts.* Neither flora nor fauna have standing. That is not to say that their "interests" have no representation. Many people are willing to pay to preserve a species, and some are even willing to pay to preserve individual animals or plants. As discussed in Chapter 13, it is conceptually correct within the CBA framework to take account of these WTP amounts, although doing so effectively is often beyond our analytical reach.

Exclusion of Socially Unacceptable Preferences. People sometimes hold preferences that society seeks to suppress through widely supported legal sanctions. For instance, although some people would be willing to pay for the opportunity to have sexual relations with children, most countries attempt to thwart the expression of such preferences through

strict criminal penalties. Should such socially unacceptable preferences be given standing in CBA? Common sense suggests that the answer should be no. One approach to answering this question conceptually adds duties and prohibitions to legal rights as sources of guidance about social values. Together they can be thought of as social constraints that should be taken into account in CBA just as the analyst takes into account physical and budgetary constraints.[15] Clear and widely accepted legal sanctions may help identify preferences that should not have standing.

An important application arises in estimating the net benefits of policies that are intended to reduce the amount of criminal behavior in society. In early applications, some analysts counted reductions in the monetary returns to crime as a cost borne by criminals, offsetting the benefits of reduced criminal activity enjoyed by their victims.[16] As the returns from crime are illegal and widely viewed as wrong, however, the social constraint perspective argues against treating them in this manner.

The issue of the standing of preferences can be especially difficult for analysts to resolve when they are dealing with foreign cultures. Consider, for instance, the CBA of a program to bring water to poor communities in Haiti.[17] Analysts found that husbands had negative WTP amounts for the time that their wives saved from easier access to water. By contemporary standards in most urban settings, people would generally regard these preferences as unworthy. Yet in the cultural context of rural Haiti at the time, they were consistent with prevailing norms. Should these preferences of husbands have standing? In practice, lack of data to estimate WTP amounts for this sort of impact usually spares analysts from having to answer such difficult questions.

Inclusion of the Preferences of Future Generations. Some policies adopted today, such as disposal of nuclear wastes or preservation of wetlands, may have impacts on people not yet born. Although we believe

that these people should have standing in CBA, there is no way to measure their WTP directly because they are not yet here to express it.[18] How serious a problem does this pose for CBA?

The absence of direct measures of the willingness of future generations to pay for policy impacts generally poses few problems for two reasons. First, because few policies involve impacts that appear only in the far future, the WTP of people alive today for the effects during their lifetimes can be used to some extent to predict how future generations will value them. Second, as most people alive today care about the well-being of their children, grandchildren, and great-grandchildren, whether born or yet to be born, they are likely to include the interests of these generations to some extent in their own valuations of impacts. Indeed, because people cannot predict with certainty the place that their future offspring will hold in society, they are likely to take a very broad view of future impacts.

In Chapters 10 and 13, we return to the question of the standing of future generations when we discuss the social discount rate and existence value, respectively.

2.4 Concerns about the Role of CBA in the Political Process

The most vocal critics of CBA fear that it subverts democratic values. Some see the monetizing of impacts as a profane attempt to place a price on everything. Others see CBA as undermining democracy. Although these fears are largely unfounded, they deserve explicit consideration by advocates of CBA.

2.4.1 Does CBA Debase the Terms of Public Discourse?

A number of objections have been raised to the effort made in CBA to value all policy impacts in terms of dollars: Pricing goods not normally traded in markets – for example, life itself – decreases their perceived value by implying that they can be compared to goods that are traded in markets; pricing such goods reduces their perceived value by weakening the claim that they should not be for sale in any circumstance; and pricing all goods undercuts the claim that some goods are "priceless."[19] The language and conceptual frameworks that people use almost certainly affect the nature of debate to some extent. It is not clear, however, how influential the technical concepts of economics are in actually shaping public discourse. In any event, the correct interpretation of how non-market goods are monetized largely undercuts the charge that CBA debases public discourse.

Consider the issue of the monetization of the value of life. On the surface it may appear that economists are implying that a price can be put on someone's life. A closer look, which we provide in Chapters 15 and 17, shows that the value of life estimated by economists is based on the implicit value people place on their own lives in making decisions that involve trade-offs between money or something else of value, and mortality risks. It is thus the value of a *statistical life*, the WTP to avoid risks that will result in one less death in a population. Although it may not be appropriate to place a dollar value on the life of any particular person, it is appropriate to use the value of a statistical life in assessing proposed policies that change the risks of death that people face.

Exhibit 2.1

Does wealth produce happiness? Surveys conducted within countries consistently find that rich people (say those in the top quarter of the income distribution) on average report being happier

than poorer people (say those in the bottom quarter of the income distribution). Yet, if one looks at either of these groups over time, one discovers that its absolute level of happiness is roughly constant despite the fact that economic growth has made them richer. Similarly, comparing the happiness of the rich (or poor) across countries generally shows similar levels of happiness despite substantial differences in the overall levels of wealth between the countries. What explains this puzzle? Richard Layard suggests two psychological effects that move up the norm to which people compare their own circumstances as societies become wealthier: habituation and rivalry. Habituation involves getting used to things we have – an initial feeling of happiness from acquisition tends to evaporate as we get used to having the goods. Rivalry involves comparing one's situation to those in a reference group – happiness depends on one's relative position.

These phenomena raise concerns about interpreting changes in income as changes in aggregate happiness. A policy that increased everyone's income would certainly pass the net benefits test. Yet extreme habituation might quickly return everyone to their initial levels of utility, or extreme rivalry would result in no utility gains at all because no one's relative position changes!

Source: Adapted from Richard Layard, "Happiness: Has Social Science a Clue?" Lionel Robbins Memorial Lectures, London School of Economics, Lecture 1: Income and Happiness: Rethinking Economic Policy, March 3, 4 and 5, 2003.

Every day, people voluntarily make trade-offs between changes in the risk of death and other values: driving faster to save time increases the risk of being involved in a fatal traffic accident; eating fatty foods is