Chapter 1

Introduction

The *Guidelines for Preparing Economic Analyses* are part of the U.S. Environmental Protection Agency's (EPA's) commitment to improve the preparation and use of sound science in economic analysis to inform decision making. Written primarily for the economic analyst, the main purpose of this document is to define and describe best practices for economic analysis grounded in the economics literature. It also describes Executive Orders (EOs) and other documents that impose analytic requirements and provides detailed information on selected important topics for economic analyses.

1.1 Background

Thorough and careful economic analysis is an important component for informing and developing sound environmental policies. High-quality economic analyses can greatly enhance the effectiveness of environmental policy decisions by providing policy makers and the public with data-driven information needed to systematically assess the consequences of various actions or options.[1] An economic analysis of a rulemaking is a positive exercise, as opposed to a normative one, that provides information on the potential economic efficiency of policy alternatives and assesses the magnitude and distribution of an array of impacts through careful investigation. Economic analysis also serves as a mechanism for organizing information carefully, identifying the kinds of impacts associated with stated policy alternatives and projecting who will be affected. Ultimately, economic analysis based on sound science should lead to better-informed regulatory and policy decisions.

The *Guidelines for Preparing Economic Analyses*, hereafter *Guidelines*, focus on the conduct of economic analysis to inform policy decisions and to meet requirements described by related statutes, Executive Orders (EOs) and associated implementing guidance of those EOs.[2] Based on the state of science and economics at the time of its writing, this document is intended to ensure high-quality analyses and consistency in how these economic analyses are prepared, performed and reported. In so doing, the *Guidelines* elevate the quality of information shaping environmental policy decisions and EPA-issued guidance. The *Guidelines* also describe an interactive policy analysis development process between analysts and decision makers; reviews and summarizes environmental economics theory and the practice of benefit-cost analysis; and emphasizes issues in practical applications.

1 It is important to note that economic analysis is but one component in the decision-making process. Depending on the statutory context, all or certain components of the economic analysis may not be used by or required for the legal rationale for the regulation. Other factors that may influence decision makers include statutory requirements, health risks, distributional considerations, enforceability, technical feasibility, policy priorities and ethics.

2 Chapter 2 describes many of these statues, EOs and the analytic and/or procedural requirements they impose, as well as associated guidance materials.

1.2 The Scope of the *Guidelines*

The *Guidelines* apply to economic analyses conducted for environmental policies using both regulatory and non-regulatory management strategies (e.g., support for voluntary programs) as well as Agency-issued guidance. Separate EPA guidance documents exist for related analyses, such as risk assessments, which can be inputs to economic analyses. No attempt is made here to summarize such guidance materials. Instead, their existence and content are noted in the appropriate sections.

The *Guidelines* assume the reader has some background in microeconomics as applied to environmental and natural resource policies. To fully understand and apply the approaches and recommendations presented in the *Guidelines*, readers should be familiar with basic applied microeconomic analysis, the concepts and measurement of consumer and producer surplus, and the economic foundations of benefit-cost analysis. Appendix A provides a brief review of economic foundations and the Glossary defines selected key terms.

The *Guidelines* are designed to assist staff with the preparation of economic analyses but are not a rigid blueprint nor a detailed set of step-by-step directions for all economic analyses. The most productive and illuminating technical approaches for an analysis will depend on case-specific factors and will require professional judgment. The *Guidelines* are a summary of analytical methodologies, empirical techniques, best practices and data sources that can assist in identifying and implementing those approaches.

Finally, it is important to note that while the *Guidelines* apply to all types of economic analysis, the focus is on benefit-cost analysis and economic impact analysis — two mainstays of the EPA's economic analyses. Typically, these economic analyses are not independent from other analyses. Assessing the effects of environmental policy is an inherently complex process in which results from various disciplines are integrated and inform one another. Taken together, they are used to predict environmental and behavioral outcomes and their economic consequences.

1.3 Economic Framework for Analysis

Conceptually, the ideal economic framework for assessing the effects of policy actions is one of general equilibrium that defines the allocation of resources and interrelationships for an entire economy with all its diverse components (e.g., households, firms, government). Potential regulatory alternatives are then modeled as economic changes that move the economy from a state of equilibrium absent the regulation (the baseline), to a new state of equilibrium with the regulation in effect. The differences between the old and new states are measured as changes in prices, quantities of goods, services and factors produced and consumed, including environmental quality, as well as wealth, income and other economic metrics. These measurements may then be used to characterize the net welfare change for each affected group to inform questions of efficiency and distribution, based on individuals' expected changes in their own welfare.

Questions about efficiency focus on aggregate changes in welfare. Economists generally define benefits as positive changes in welfare and costs as the opportunities foregone, or reductions in welfare. To assess efficiency under this scenario, we add these changes in welfare measured in monetary terms across all affected individuals. In the ideal, general equilibrium framework, we can estimate and sum all benefits and costs; so, a policy is a movement toward efficiency if the sum is positive and a movement away from efficiency if the sum is negative. The policy that maximizes this sum, i.e., net benefits, is considered economically efficient.[3]

3 Appendix A provides a conceptual overview of the economic theory of welfare changes and benefit-cost analysis.

Questions about the distribution of benefits and costs examine how specific groups of households and industries are affected by the policy. The ideal framework would answer questions framed in terms of welfare changes for groups of individuals (e.g., is the policy welfare-improving for a specific group?) or in terms of specific economic factors (e.g., how much will prices change for some goods?). These assessments of distributional outcomes are often important, apart from analysis of benefits and costs (i.e., economic efficiency).

In practice, of course, capturing this idealized framework empirically can be difficult, if not impossible, due to data availability; in most cases it is not possible to monetize all benefits and costs. No single modeling tool allows us to answer all policy-relevant questions about efficiency and distribution.[4] As a practical matter, most economic analyses assemble a set of models to address these issues separately, but, even then, not all effects can be monetized. If limitations are appropriately described, however, it is still informative to present comparisons of benefits and costs that can be monetized and qualitatively characterized, as well as evaluations of effects on specific groups.

As detailed more fully in Chapter 2, economic analysis of benefits, costs and distributional impacts are required by EO 12866 for economically significant rules. Although EO 12291 in 1981 was the first to require an economic assessment of significant regulatory actions in a regulatory impact analysis (RIA), these analyses were not as extensive as the economic analyses required now by EO 12866. A complete economic analysis today, though it may still at times be labeled as an RIA, consists of a benefit-cost analysis and any related cost-effectiveness analyses and assessments of economic and distributional impacts. The Office of Management and Budget (OMB) has a useful checklist (shown in Text Box 1.1) for all components of an economic analysis conducted under EO 12866 (OMB 2010).[5]

1.3.1 Assessing Economic Efficiency with Benefit-Cost Analysis (BCA)

Benefit-cost analyses assess economic efficiency using the Potential Pareto criterion: is it theoretically possible for those who gain from the policy to fully compensate those who lose, and remain better off? When the answer to this question is "yes," then net benefits (benefits minus costs) are positive and the policy is a movement toward economic efficiency.[6]

While conceptually identical, benefits and costs are often evaluated separately due to practical considerations. The benefits of reduced pollution are often attributable to changes in outcomes not exchanged in markets, such as improvements in public health. In contrast, the costs generally are measured through changes in outcomes that are exchanged in markets, such as pollution control equipment. As a result, different techniques are often used to estimate benefits and costs.[7]

Social benefits analyses evaluate the total expected welfare gains individuals experience resulting from the regulation or policy action. From the perspective of an action that reduces pollution or environmental contaminants, many of these benefits come from improvements in environmental quality. Once the

4 As discussed in Chapter 8, computable general equilibrium (CGE) models capture most, or all, modeled market benefits and costs, but may not include non-market benefits. In practice, CGE models may be unable to analyze relatively small sectors of the economy. See Chapter 8, Section 4.6.

5 The questions in Text Box 1.1 are exactly those from the OMB checklist sans the extensive footnotes. These footnotes and other details about the checklist can be found at https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/inforeg/inforeg/regpol/RIA_Checklist.pdf.

6 Appendix A describes the underlying economic theory in greater detail.

7 These *Guidelines* are organized from the perspective of an action that is designed to achieve health and environmental protection benefits, albeit at some cost. Chapter 7 (Estimating Benefits) therefore focuses primarily on how to evaluate improvements in health and environmental quality, while Chapter 8 (Social Costs) focuses on evaluating the costs associated with actions to achieve those benefits. However, the methods described in these chapters are equally applicable to evaluating decrements in health or environmental quality, and for cost savings if that is appropriate for the policy being evaluated (e.g., for deregulatory actions).

Text Box 1.1 - Agency Checklist for Regulatory Impact Analysis

Does the RIA include a reasonably detailed description of the need for regulatory action?

Does the RIA include an explanation of how the regulatory action will meet that need?

Does the RIA use an appropriate baseline (i.e., best assessment of how the world would look in the absence of the proposed action)?

Is the information in the RIA based on the best reasonably obtainable scientific, technical and economic information and is it presented in an accurate, clear, complete and unbiased manner?

Are the data, sources and methods used in the RIA provided to the public on the internet so that a qualified person can reproduce the analysis?

To the extent feasible, does the RIA quantify and monetize the anticipated benefits from the regulatory action?

To the extent feasible, does the RIA quantify and monetize the anticipated costs?

Does the RIA explain and support a reasoned determination that the benefits of the intended regulation justify its costs (recognizing that some benefits and costs are difficult to quantify)?

Does the RIA assess the potentially effective and reasonably feasible alternatives? Does the RIA assess different regulatory provisions separately if included in the rule?

Does the RIA assess at least one alternative that is less stringent and at least one alternative that is more stringent?

Does the RIA consider setting different requirements for large and small firms?

Does the preferred option have the highest net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a stature requires a different approach?

Does the RIA include an explanation of why the planned regulatory action is preferable to the identified potential alternatives?

Does the RIA use appropriate discount rates for benefits and costs that are expected to occur in the future?

Does the RIA include, if and where relevant, an appropriate uncertainty analysis?

Does the RIA include, if and where relevant, a separate description of distributive impacts and equity?

Does the RIA provide a description/accounting of transfer payments?

Does the RIA analyze relevant effects on disadvantaged or vulnerable populations (e.g., persons with disabilities and low-income groups)?

Does the analysis include a clear, plain language executive summary, including an accounting statement that summarizes the benefit and cost estimates for the regulatory action under consideration, including qualitative and non-monetized benefits and costs?

Does the analysis include a clear and transparent table presenting (to the extent feasible) anticipated benefits and costs (quantitative and qualitative)?

Reproduced from OMB's Agency Checklist: Regulatory Impact Analysis (2010).

changes in pollution levels or other environmental effects resulting from a policy are predicted, these changes are translated into health outcomes or other outcomes of interest using information provided by risk assessment and other disciplines. Benefits analyses then apply a variety of economic methodologies to estimate the value of these anticipated health improvements and other types of environmental benefits, but it is important to note that even those benefits that cannot be quantified or put into dollar terms should be described in a benefits analysis. Chapter 7 provides details on methods for estimating social benefits. Within a benefits assessment, pollution exposure may increase for some, e.g., emissions of a pollutant other than the one being regulated may increase, or when the policy is deregulatory. Such costs may be presented as negative benefits and may be described as disbenefits or foregone benefits provided that the analysis is internally consistent.

Social cost analyses evaluate the total expected welfare losses experienced by individuals resulting from the regulation or policy action. In most instances, these costs are measured by higher prices for goods and services for consumers and lower earnings for producers and factors of production. Sometimes one modeling effort can be used to estimate both social costs and inputs for benefits analyses, such as predicted changes in pollution from regulated sources. Chapter 8 provides detailed information on methods for estimating social costs. As with benefits, costs that cannot be quantified or put into dollar terms should be described. Also, some costs may decrease due to the regulation. For example, profits may increase for certain related entities or when the action is deregulatory. These outcomes may be presented as negative costs and may be described as avoided costs, again, provided that the analysis is internally consistent. Ultimately, from the perspective of economic theory, the treatment of disbenefits and avoided costs in the analysis is primarily a communications issue and should not affect efficiency analysis and whether net benefits are positive or negative.

1.3.2 Assessing Economic and Distributional Impacts

The assumptions and modeling framework developed for the BCA often do not include or allow for detailed examination of impacts on specific groups. Understanding the nature and magnitude of policy impacts and who will gain or lose from a regulation can be important to policy evaluation, and this requires analyses to supplement BCA.

The EPA addresses economic and distributional impacts of environmental policy through two sets of analyses:

- *Economic Impact Analyses* (EIAs) provide insight into how compliance costs, transfers and other policy outcomes are distributed across groups. EIAs describe and often quantify outcomes such as changes in employment, plant closures or local government tax revenues that provide insight into the economic consequences of regulation. Economic impacts may fall on groups such as industry sectors, small businesses, state governments, consumers or workers that may benefit or be harmed by a policy. Chapter 9 provides information on analyzing economic impacts.
- Other analyses evaluate the distribution of changes in environmental risks or health outcomes due to regulation from environmental justice (i.e., on minority, low-income or Indigenous populations), life stage (i.e., on children, the elderly) and intergenerational perspectives. Consideration of costs may also be relevant in such analyses. Chapter 10 provides information on how to analyze impacts from these perspectives.

1.4 Principles for Conducting Economic Analysis

While many specific aspects of an economic analysis will vary depending on the purpose, area of focus, available data and needed level of detail for the analysis, there are core principles that apply to all analyses. These principles draw in part from, and are consistent with, those described in OMB Circular A-4 (OMB 2003).

- **Economic analyses should be based on sound economics and science.** Economic analyses should be grounded in well-established economic methods, theory and principles. The effects considered in BCA, for example, should follow from economic principles and are independent of what is considered in legal or policy analyses, or what may be defined by science policy in other disciplines. Economic analysis should also be flexible enough to incorporate new information and advances in theory and the practice of economics. Economic analyses often rely upon or draw from the tools and results of other scientific analyses. These analyses should also be grounded in the principles, theories and methods appropriate to their discipline.
- **Economic analyses should be objective and avoid bias.** The goal of the economic analysis is to provide objective information about the consequences of policy decisions. Professional judgments and assumptions are generally required for economic analyses, but these judgments and assumptions should not be based on the preferences of the analyst or policy maker. Economic analyses should seek to capture the expected behavioral responses of households, firms and governments to incentives and options created by the actual requirements of the regulation or other context being analyzed as accurately as possible. Analyses should be unbiased and should not be framed or performed in a manner to obtain predetermined results or to defend a particular policy decision. In addition, judgments or assumptions should not be made to favor one conclusion over another. For instance, sensitivity analysis can be used to explore a range of possible outcomes but should examine both higher and lower values rather than only one or the other.
- **Economic analyses should be transparent and replicable.** Economic analysis requires choices about data sources, methods, models and assumptions. The reasons for these choices should be presented explicitly and clearly, along with appropriate justification. Economic analysis should also explicitly acknowledge and characterize important uncertainties in the analysis, state the judgments and decisions associated with these uncertainties and should identify the implications of these choices. Specific references should be made to all data sources and models, and publicly available data and models should be used to the maximum extent possible. The analysis should provide enough information for readers to see clearly how final empirical estimates and conclusions were reached.

Key best practices covered in the *Guidelines*

Key best practices that apply to all or most economic analyses are also covered in these *Guidelines*. These are listed below along with the chapter in which they are covered:

- Economic analyses produced by the EPA should be responsive to directives from applicable statutes and executive orders (Chapter 2).
- Analyses should describe the economic basis for the policy action and evaluate multiple options to arrive at the most desirable decision (Chapter 3).
- Economics and economic analysis can also inform the consequences of different regulatory designs under consideration, identifying those that are likely to be most cost-effective (Chapter 4).

- The economic impact and consequences of policy must be evaluated relative to some alternative setting, generally one without the policy action. This alternative setting is called the analytic baseline. Specifying baseline can sometimes be challenging, but it is essential for sound and informative economic analysis. The scope of the analysis should also be clearly defined, and uncertainties in the analysis should be evaluated and characterized (Chapter 5).
- The economic effects of policies usually take place over time periods of several years, and consistent application of discounting is necessary to make these effects comparable (Chapter 6).
- Analysis of benefits and costs should be grounded in sound, well-established economic principles and approaches, should capture all relevant outcomes to the extent possible and should incorporate advances in the field where warranted (Chapter 7 and Chapter 8).
- Analysis of the distribution of impacts associated with policy decisions should adhere to the same high standards of an economic analysis, should start with the same baselines as the economic analysis and should provide a balanced accounting of who gains and who loses as a result the policy action (Chapter 9 and 10).
- Finally, an economic analysis must be clearly and effectively communicated for it to be valuable for decision-making (Chapter 11).