# Circular A-4

## April 6, 2023

## TO THE HEADS OF EXECUTIVE AGENCIES AND ESTABLISHMENTS

**Subject:**          **Regulatory Analysis**

Circular A-4 provides the Office of Management and Budget's (OMB's) guidance to Federal agencies on the development of regulatory analysis as required under Section 6(a)(3)(C) of Executive Order 12866 of September 30, 1993 (Regulatory Planning and Review), as amended; the Regulatory Right-to-Know Act, Pub. L. 106–554, § 624, 114 Stat. 2763, 2763A–161 (2000) (codified as amended at 31 U.S.C. 1105 note); and a variety of related authorities. The Circular also provides guidance to agencies on the regulatory accounting statements that are required under the Regulatory Right-to-Know Act.

This proposed update to Circular A-4, when finalized, will supersede the previous version of OMB Circular No. A-4, issued on September 17, 2003. Until then, that version of OMB Circular No. A-4 remains in effect.

This proposed update to Circular A-4 was subject to interagency review and will go through a process of public comment and peer review. OMB is grateful for feedback from interagency reviewers, and looks forward to feedback from public commenters and peer reviewers. OMB itself is solely responsible for the content of this Circular.

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## 1. Introduction

This Circular is designed to assist analysts in the regulatory agencies by providing guidance on conducting high-quality and evidence-based regulatory analysis—referred to as either "regulatory analysis" or "analysis" in this Circular for brevity—and standardizing the way benefits and costs of Federal regulatory actions are measured and reported. Executive Order 12866 of September 30, 1993 (Regulatory Planning and Review)[1]—as amended by the Executive Order of April 6, 2023 (Modernizing Regulatory Review)—and Executive Order 13563 of January 18, 2011 (Improving Regulation and Regulatory Review)[2] require agencies to conduct a regulatory analysis for regulatory actions that are significant as defined by Section 3(f)(1) of Executive Order 12866, and more generally to assess the benefits and costs of other significant actions. These requirements apply to regulatory actions that rescind or modify existing regulations as well as to new regulatory actions. This Circular is intended to aid agencies in their analysis of the benefits and costs of regulations, both when such analysis is required under Executive Orders 12866 and 13563 and when agencies undertake analysis as a matter of discretion.

### a. *The Need for Analysis of Regulatory Actions*

Regulatory analysis is a tool that regulatory agencies use to anticipate and evaluate the likely consequences of their regulatory actions. It provides a formal way of organizing the evidence on the key effects of the various alternatives that should be considered in developing regulations. A high-quality regulatory analysis is designed to inform policymakers, other government stakeholders, and the public about the effects of alternative actions. Regulatory analysis can help agencies in developing regulations by clarifying the likely effects of a regulation under consideration, and it is meant to inform the public about the anticipated consequences of government action (and alternatives).

Benefit-cost analysis is the primary analytical tool used for regulatory analysis. As stated in Section 1(a) of Executive Order 12866, "The Regulatory Philosophy":

> Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.

Executive Order 12866 Section 1(b), "The Principles of Regulation," states that, to the extent permitted by law and where applicable, agencies "shall assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the

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[1] Exec. Order No. 12866, 58 Fed. Reg. 51,735 (Oct. 4, 1993).
[2] Exec. Order No. 13563, 76 Fed. Reg. 3821 (Jan. 21, 2011).

intended regulation justify its costs."

Benefit-cost analysis of a regulation and alternative regulatory approaches provides policymakers and the public with information about the important advantages and disadvantages of different courses of action. When all benefits and costs (including distributional impacts) can be quantified and expressed in monetary units, a regulation's monetized net benefits—the difference between the monetized benefits and the monetized costs—are an indication of the alternative, from the set of analyzed alternatives, that generates the largest welfare improvement to society. In practice, it is often difficult to quantify and express all of the important effects of a regulation in monetary units. When it is not possible to monetize all of the important benefits and costs, the alternative with the greatest monetized net benefits will not necessarily be the alternative that generates the greatest social welfare. So, while monetized net benefits are an important guide for agencies deciding what course of action to pursue, regulatory analyses should encompass additional relevant factors; in particular, analyses should include any important non-monetized and non-quantified effects. You should consider, as discussed below, how to be as specific as possible in presenting such non-monetized and non-quantified effects.

Regulatory analysis, as described in this Circular, does not supplant any analytic requirements or other requirements set out in the statutes that authorize or require agency action, though when appropriate, the regulatory analysis guided by this Circular may inform or be combined with other analytic requirements.

### b. Developing a Regulatory Analysis

In general, key steps in producing a regulatory analysis include:

- evaluating the need for the regulatory action;
- defining the baseline;
- identifying a range of regulatory alternatives;
- estimating the benefits, costs, and transfers of each regulatory alternative; and
- summarizing the regulatory analysis.

There are detailed descriptions of each of these steps in the subsequent sections of this Circular (see the Table of Contents above for a list of sections).

You will find that you cannot conduct a good regulatory analysis according to a formula. Conducting high-quality analysis requires competent professional judgment. Different regulations may call for different emphases in the analysis, depending on the nature and complexity of the regulatory issues and the sensitivity of the benefit, cost, and transfer estimates to the key modeling choices. A regulatory analysis should, all else equal, aim for specificity in identifying how the state of the world in the regulation's presence would differ from the state of the world in its absence. Where there are data or methodology challenges, less-specific inputs (*e.g.*, for monetization) are sometimes used; however, even where a relatively general approach was the best available in the past, it is appropriate to reconsider whether greater specificity could, given scientific advances, be practicable in the regulatory analysis currently being conducted. For example, it might be possible to quantify some effects that could not be quantified a decade

earlier, and it might be possible to monetize some effects that could not be monetized a decade earlier.

You should aim for transparency about the key methods, data and other analytical choices you make in your analysis.

As you design, execute, and write your regulatory analysis, you should, when feasible and appropriate, seek out the opinions of those who will be affected by the regulation as well as the views of those individuals and organizations who may not be affected but have special knowledge or insight into the regulatory issues.[3] Consultation can be useful in ensuring that your analysis addresses all of the relevant issues and that you have access to all pertinent data. Early consultation can be especially helpful. You should not limit consultation to the final stages of your analytical efforts.

## 2. Analytical Approaches

Both benefit-cost analysis (BCA) and cost-effectiveness analysis (CEA) provide a systematic framework for identifying and evaluating the likely outcomes of alternative regulatory choices. When a regulatory analysis is required by Executive Order 12866, a BCA is generally the more informative of the two types of analysis, because it is a better way of capturing the effects of regulations on social welfare. If some of the primary benefit categories cannot be expressed in monetary units, you may also choose to conduct a CEA. Specifically, you may choose to prepare a CEA for any regulation for which the primary benefits cannot be monetized and a valid effectiveness measure can be developed to represent benefits-relevant outcomes instead. In undertaking these CEAs and related analyses, it is important to keep in mind the advantages of analytical consistency in estimating benefits and costs across regulations and agencies, subject to statutory requirements, practical limitations, or other reasons for inconsistency, such as improvements on previous analytic approaches. Failure to maintain such consistency may prevent achievement of the greatest risk (or other harm) reduction for a given level of resource expenditure.

### a. Benefit-Cost Analysis

A distinctive feature of BCA is that both benefits and costs are expressed in monetary units to the extent feasible, which allows you to evaluate different regulatory options with a variety of attributes using a common measure. By measuring incremental benefits and costs of successively more stringent regulatory alternatives, you can identify the alternative that maximizes net benefits.

The size of net benefits is the absolute difference between the projected benefits and costs. The ratio of benefits to costs is not a meaningful indicator of net benefits and should not be used for that purpose. Considering such ratios alone can yield misleading results, as such ratios do not clarify which alternative yields the greatest net benefits, and are sensitive to whether negative willingness-to-pay (WTP) or willingness-to-accept (WTA) valuations are subtracted

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[3] Such consultations may be subject to the Paperwork Reduction Act, Pub. L. 104-13, 109 Stat. 163 (1995).

from benefits or added to costs.[4]

When a benefit or cost cannot be expressed in monetary units, it is often informative to measure it in terms of physical or other quantitative units that may indicate the direction of welfare change. If it is not possible to estimate quantitatively, you should describe the benefit or cost qualitatively using the best methods available. For guidance on describing qualitative information, see the section "*Developing Benefit and Cost Estimates*."

When important benefits and costs cannot be expressed in monetary units, relying on the monetized net benefits alone will be less useful, and can even be misleading, because the calculation of net benefits in such cases does not provide a full evaluation of all relevant benefits and costs. In other words, relying on a materially incomplete monetized BCA does not offer an adequate summary of evidence intended to inform determination of the most net beneficial alternative, and such reliance could even be misleading.

You should exercise professional judgment in identifying the importance of non-quantified factors and assess as best you can how they might change the ranking of alternatives based on estimated net benefits. This discussion should also include a clear explanation that supports your determination that these non-quantified factors are important. In this case, you may also consider conducting a threshold analysis to help decision makers and other users of the analysis to understand the potential significance of these factors to the overall analysis. For additional discussion, see the section "*Methods for Treating Non-Monetized Benefits, Costs, and Transfers*."

### b. *Cost-Effectiveness Analysis*[5]

Cost-effectiveness analysis can provide a rigorous way to identify options that achieve the most effective use of the resources available without requiring monetization of all of the relevant benefits or costs. Generally, cost-effectiveness analysis is designed to compare a set of regulatory actions with the same primary outcome or multiple outcomes that can be integrated into a single meaningful numerical index (*e.g.*, units of health improvement).

A cost-effectiveness ratio is calculated by dividing a numerator of cost by a denominator of units of some effectiveness measure to arrive as cost per unit of effectiveness. The value of CEA is enhanced when there is consistency in the analysis across a diverse set of possible regulatory actions. To achieve consistency, you need to carefully construct the two key components of any CEA: the cost, and the "effectiveness" or performance measures for the alternative policy options.

With regard to measuring costs, you should be sure to include all the relevant costs to

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[4] Anthony E. Boardman et al., *Cost-Benefit Analysis: Concepts and Practice*, 5th ed. (Cambridge University Press, 2018), 35.
[5] For a full discussion of CEA, *see* Marthe R. Gold et al., *Cost-Effectiveness in Health and Medicine* (New York: Oxford University Press, 1996).

society, whether public or private, when feasible.[6] Regulations may also yield cost savings (*e.g.*, energy savings associated with new technologies). The numerator in a cost-effectiveness ratio should reflect net costs, defined as the gross cost incurred to comply with the requirements (sometimes called "total" costs) minus any cost savings. You should be careful to avoid double-counting effects in both the numerator and the denominator of cost-effectiveness ratios. For example, it would be incorrect to reduce gross costs by an estimated monetary value on life extension if life-years are already used as the effectiveness measure in the denominator.

In constructing measures of "effectiveness," final outcomes, such as lives saved or life-years saved, are preferred to measures of intermediate outputs, such as tons of pollution reduced, crashes avoided, or cases of disease avoided. Where the quality of the measured unit varies (*e.g.*, acres of wetlands vary substantially in terms of their ecological benefits), it is important that the measure capture the variability in the value of the selected "outcome" measure (*e.g.*, an index value that weights the quality of each acre). You should provide an explanation of your choice of effectiveness measure.

Cost-effectiveness results based on averages need to be treated with great care. They suffer from the same drawbacks as benefit-cost ratios. The alternative that exhibits the smallest cost-effectiveness ratio may not be the best option, just as the alternative with the highest benefit-cost ratio is not always the one that maximizes net benefits. Incremental cost-effectiveness analysis (discussed later in this section) can help to avoid mistakes that can occur when policy choices are based on average cost-effectiveness.

CEA can also be misleading when the "effectiveness" measure does not appropriately weight the consequences of the alternatives. For example, if effectiveness were to be measured in tons of reduced pollutant emissions encompassing multiple types of pollutants, cost-effectiveness estimates will be misleading unless the reduced emissions of diverse pollutants result in the same health and environmental benefits. Such simplified effectiveness measures should be generally avoided.

When you have identified a range of alternatives (*e.g.*, different levels of stringency), you should determine the cost-effectiveness of each option compared with the baseline as well as its incremental cost-effectiveness compared with successively more stringent requirements. Ideally, your CEA would present an array of cost-effectiveness estimates that would allow comparison across different alternatives. However, analyzing all possible combinations is not practical when there are many options (including possible interaction effects). In these cases, you should use your judgment to choose reasonable alternatives for careful consideration.

When constructing and comparing incremental cost-effectiveness ratios, you should be careful to determine whether the various alternatives are mutually exclusive or whether they can

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[6] Gillian D. Sanders et al., "Recommendations for Conduct, Methodological Practices, and Reporting of Cost-Effectiveness Analyses: Second Panel on Cost-Effectiveness in Health and Medicine," *JAMA* 316, no. 10 (2016): 1093-1103 and David D. Kim et al., "Perspective and Costing in Cost-Effectiveness Analysis, 1974–2018," *PharmacoEconomics* 38, no. 10 (2020): 1135-1145 warn about numerous inconsistencies in the published health and medical cost-effectiveness literature. For a database of this literature, *see, e.g.*, Center for the Evaluation of Value and Risk in Health, "Cost-Effectiveness Analysis (CEA) Registry," *https://cevr.tuftsmedicalcenter.org/databases/cea-registry*.

be combined. If they can be combined, you should consider which alternatives might be favored under different regulatory budget constraints (implicit or explicit). You should also make sure that inferior alternatives identified by the principles of strong and weak dominance are eliminated from consideration.[7]

Where regulation may yield several different beneficial outcomes, a cost-effectiveness comparison becomes more difficult to interpret because there is more than one measure of effectiveness to incorporate in the analysis. To arrive at a single measure, you will need to weight the value of disparate benefit categories, but this computation raises some of the same difficulties you will encounter in BCA. If you can assign a reasonable monetary value to all of the regulation's different benefits, then you should do so. But in this case, you will be doing BCA, not CEA.

When you can estimate the monetary value of some, but not all, of the benefits of a regulation, but cannot assign a monetary value to the primary measure of effectiveness, the appropriate approach is to subtract the monetary value of the estimated benefits from the gross cost estimate to yield an estimated net cost. (This net cost estimate for the regulation may turn out to be negative: that is, the monetized benefits exceed the cost of the regulation.) If you are unable to estimate the value of some of the benefits, the cost-effectiveness ratio (the net costs per unit of the outcome variable) will be overstated, and this should be acknowledged in your analysis. CEA does not yield an unambiguous choice when there are benefits or costs that have not been incorporated in the net-cost estimates. You also may choose to use CEA to compare regulatory alternatives in cases where the statute specifies the level of benefits to be achieved.

### c. *Metrics for Health and Safety Outcomes*

[*Note: Material in this section remains largely unchanged from the version of this Circular issued in September 2003, with relatively minor edits, including updating language and clarifying the appropriate usage of quality-adjustment for non-fatal outcomes in footnote 8. For more discussion, see the accompanying preamble, "Preamble: Proposed OMB Circular No. A-4, 'Regulatory Analysis.'"*]

When BCA or CEA is conducted in a health or safety context, there can be relatively simple measures such as the number of lives saved, cases of cancer reduced, or cases of paraplegia prevented. Sometimes these measures account only for mortality information, such as the number of lives saved and the number of life-years saved. There are also more comprehensive, integrated measures; for example, the change in life-years could be summed with the change in "quality-adjusted life years" (QALYs) due to changes in non-fatal health or safety outcomes.[8]

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[7] Marthe R. Gold et al., *Cost-Effectiveness in Health and Medicine* (New York: Oxford University Press, 1996), 284-285. An option strongly dominates another option if it is more effective and less costly; an option weakly dominates another option if it is more effective and equally costly, or equally effective and less costly.

[8] Although many academic studies calculate QALYs associated with both fatal and non-fatal outcomes, we note that, for regulatory analysis purposes, quality adjustment (the QA of QALY) should be used only in the portion of the analysis that focuses on non-fatal injury or illness.

The main advantage of the integrated measures is that they more fully account for a regulation's impact on morbidity (nonfatal illness, injury, impairment and quality of life) as well as premature death. The inclusion of morbidity effects is important because (a) some illnesses (*e.g.*, asthma) cause more instances of pain and suffering than they do premature death, (b) some population groups are known to experience elevated rates of morbidity (*e.g.*, the elderly and low-income individuals) and thus impacts on these groups are more accurately reflected by measures including morbidity measurement,[9] and (c) some regulatory alternatives may be more effective at preventing morbidity than premature death (*e.g.*, some advanced airbag designs may diminish the nonfatal injuries caused by airbag inflation without changing the frequency of fatal injury prevented by airbags).

However, the main drawback of these integrated measures is that they must meet some restrictive assumptions to represent a valid measure of individual preferences.[10] For example, a QALY measure for an improvement in health-related quality of life implicitly assumes that the fraction of remaining lifespan an individual would give up for that improvement does not depend on the remaining lifespan; in other words, if an individual is willing to give up 10 years of life among 50 remaining years for a given health improvement, they would also be willing to give up 1 year of life among 5 remaining years. To the extent that individual preferences deviate from these assumptions, analytic results from BCA or CEA using QALYs could differ from analytic results based more exclusively on willingness-to-pay measures.[11] Though willingness-to-pay and willingness-to-accept are generally the preferred economic measures of value in benefits analysis, the CEA method, as applied in medicine and health, does not evaluate health changes using individual willingness to pay or accept.

When performing CEA of a regulation that has a meaningful impact on both mortality and morbidity, you should consider using at least one integrated measure of effectiveness. When CEA is performed in specific regulatory contexts, you should be prepared to make appropriate adjustments to ensure fair treatment of all segments of the population. Fairness is important in the choice and execution of effectiveness measures. For example, if QALYs are used to evaluate a lifesaving regulation aimed at a population that happens to experience a high rate of disability (*i.e.*, where the regulation is not designed to affect the disability), the number of life years saved should not be diminished simply because the regulation saves the lives of people with life-shortening disabilities. Both analytic simplicity and fairness suggest that the estimated number of life years saved for the disabled population should be based on average life expectancy information for the relevant age cohorts. More generally, when numeric adjustments are made for life expectancy or quality of life, analysts should prefer the use of population averages rather than information derived from subgroups dominated by a particular demographic or income group.

OMB does not require agencies to perform cost-effectiveness analysis, or to use any specific measure of effectiveness when doing so. In fact, OMB encourages agencies to report

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[9] Louise B. Russell and Jane E. Sisk, "Modeling Age Differences in Cost-Effectiveness Analysis," *International Journal of Technology Assessment in Health Care* 16, no. 4 (2000): 1158-1167.

[10] Joseph S. Pliskin, Donald S. Shepard, and Milton C. Weinstein, "Utility Functions for Life Years and Health Status," *Operations Research* 28, no. 1 (1980): 206-224.

[11] James K. Hammitt, "QALYs Versus WTP," *Risk Analysis* 22, no. 5 (2002): 985-1002.

results with multiple measures of effectiveness that offer different insights and perspectives. The regulatory analysis should explain which measures were selected and why, and how they were implemented.

The analytic discretion provided in choice of effectiveness measures will create some inconsistency in how agencies evaluate the same injuries and diseases, and it will be difficult for policymakers and the public to draw meaningful comparisons between regulations that employ different effectiveness measures. As a result (and consistent with analytic transparency goals), agencies should provide the public with the underlying data where feasible and consistent with law, including mortality and morbidity data, the age distribution of the affected populations, and the severity and duration of disease conditions and trauma.

### 3. Scope of Analysis

#### a. *Geographic Scope of Analysis*

In many circumstances, your primary analysis should focus on the effects of a regulation that are experienced by citizens and residents[12] of the United States (which will often be the primary effects of the regulation). When feasible and appropriate, all such important effects should be included, regardless of whether they result directly from a regulation's domestic applicability, or indirectly from a regulation's impact on foreign entities. Indirect effects may arise through markets (*e.g.*, changes in the costs imposed on foreign producers that affect U.S. consumers or investors) or outside of markets (*e.g.*, changes in foreign ecosystem services[13] that affect U.S. citizens and residents but are not reflected in market transactions). Relevant effects also include the effects of a regulation on U.S. strategic interests, including the potential for inducing strategic reciprocity or other policy changes from actors abroad or effects on U.S. government assets located abroad. Such effects are particularly likely to occur when your regulation bears on a global commons or a public good.[14] In addition, relevant effects include those that occur entirely outside the United States when they affect U.S. citizens and residents, such as effects experienced by citizens residing abroad. These examples of relevant effects experienced by U.S. citizens and residents are not exhaustive, and appropriate care should be taken to identify all such important effects in your regulatory analysis. To better inform policymakers and the public of the effects of your regulation, it may be appropriate to also analyze effects on noncitizens residing abroad[15] in a supplementary analysis when your primary analysis focuses on the effects on U.S. citizens and residents.

In certain contexts, it may be particularly appropriate to include effects experienced by noncitizens residing abroad in your primary analysis. Such contexts include, for example, when:

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[12] The term "citizen" in this Circular refers to a person who is a citizen or national of the United States. The term "residents" in this Circular includes all non-U.S. citizens who live in the United States.

[13] See the section "*Accounting for the Benefits and Costs from Environmental Services, Ecosystem Services, and Natural Capital*" regarding ecosystem services.

[14] See the section "*Externalities, Common Property Resources, and Public Goods*" for an explanation of these concepts.

[15] The term "noncitizen" in this Circular refers to a person who is not a citizen or national of the United States. The phrase "noncitizens residing abroad," therefore, refers to those residing in countries besides the United States who are not U.S. citizens or nationals.

- assessing effects on noncitizens residing abroad provides a useful proxy for effects on U.S. citizens and residents that are difficult to otherwise estimate;
- assessing effects on noncitizens residing abroad provides a useful proxy for effects on U.S. national interests that are not otherwise fully captured by effects experienced by particular U.S. citizens and residents (*e.g.*, national security interests, diplomatic interests, etc.);
- regulating an externality on the basis of its global effects supports a cooperative international approach to the regulation of the externality by potentially inducing other countries to follow suit or maintain existing efforts; or
- international or domestic legal obligations require or support a global calculation of regulatory effects.

When your primary analysis focuses on the global effects of the regulation, it is generally appropriate to produce a separate supplementary analysis of the effects experienced by U.S. citizens and residents, unless you determine that such effects cannot be separated in a practical and reasonably accurate manner, or that the separate presentation of such effects would likely be misleading or confusing in light of the factors detailed above.

You should be consistent in your treatment of noncitizens residing abroad in your benefit and cost estimates. If you include some effects experienced by such noncitizens in your primary analysis, consistency generally requires also including countervailing effects on similar noncitizens in your primary analysis. For example, if benefits that are experienced by noncitizens residing abroad are included in your analysis, compliance costs borne by noncitizens residing abroad should generally be included in your analysis as well, and vice versa. Whatever decisions you make regarding the inclusion and exclusion of effects in your analysis, the basis for those decisions should be transparent and clear, and should focus on capturing the significant effects of a regulation. Similarly, you should be transparent about any data limitations or other sources of uncertainty regarding who will experience regulatory impacts.

Consistent with Executive Order 13609,[16] agencies often engage in international regulatory cooperation (IRC), which can include information exchange, work sharing, scientific collaboration, pilot programs, and alignment of regulatory requirements. IRC activities may aim to address or prevent unnecessary differences between the regulatory approaches of U.S. agencies and those of their foreign counterparts that may unnecessarily impair economic growth, innovation, competitiveness, and job creation. In addition to the conditions above, inclusion of the foreign effects of a regulation in your primary analysis will often be appropriate when such analysis would help inform cooperative efforts with foreign regulators that aim to minimize unnecessary regulatory differences and meet shared challenges.[17] As noted below—see the

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[16] Exec. Order No. 13609, 77 Fed. Reg. 26,413 (May 4, 2012).

[17] Regulatory Working Group, *Regulatory Working Group Guidelines: Executive Order 13609 "Promoting International Regulatory Cooperation"* (June 26, 2015), *https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/inforeg/inforeg/eo_13609/eo13609-working-group-guidelines.pdf*; *see also* Administrative Conference of the United States, *Recommendation 2011-6: International Regulatory Cooperation* (2011) (recommending that agencies document cost savings and regulatory benefits from mutual regulatory arrangements with foreign authorities).

section "*Showing Whether Regulation at the Federal Level Is the Best Way to Solve the Problem*"—you should, when required or otherwise appropriate, evaluate a regulation's effects on international trade. Changes to import and export volumes may be useful metrics that form part of your analysis, but changes in such volumes are not themselves welfare measures.

You should recognize that regulatory effects on firms, nongovernmental organizations, or other similar entities ultimately accrue to those entities' individual consumers, owners of assets or liabilities, workers, program beneficiaries, and so forth, and those individuals may comprise a mix of U.S. citizens and residents and noncitizens residing abroad.[18] You should consider the principles above in determining how to appropriately include or exclude such effects. When it is too difficult in practice to separate such regulatory impacts—for example effects on the foreign versus U.S. owners, customers, or employees of regulated firms—you should be consistent and transparent in whether and how important impacts to noncitizens residing abroad are included in your analysis. As noted previously, if benefits that are experienced by such noncitizens are included in your analysis, consistency generally requires that the costs to similar noncitizens be included as well, and vice versa.

Finally, you should seek to ensure that you are providing informative analysis to policymakers and the public. For example, regulations may impose costs on international visitors entering the United States such as through pre-arrival out-of-pocket expenses (*e.g.*, fees for medical exams); screening or testing products or people prior to entry into the United States; or delay at the port of entry due to additional processing requirements. While the most directly affected individuals may include noncitizens residing abroad, you should still estimate and present the potential effects of the regulation on non-immigrant visa holders and report these effects in your primary regulatory analysis to ensure that the regulatory analysis is informative.

### b. *Temporal Scope of Analysis*

The time frame for your analysis should include a period before and after the date of compliance that is long enough to encompass all the important benefits and costs likely to result from the regulation.[19] See the section "*Discount Rates*" for more details on the appropriate time frame for an analysis. If benefits or costs become more uncertain or harder to quantify over time, that does not imply that you should exclude such effects by artificially shortening your analytic time frame; instead, consult—as appropriate—the discussion in the section "*Treatment of Uncertainty*."

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[18] Unless it can be demonstrated using appropriate empirical evidence that regulatory costs imposed on foreign manufacturers or other producers will not be passed through to U.S. citizens or residents, a reasonable estimate of the portion of the costs that are passed through should be included in a primary regulatory analysis that focuses exclusively on effects that are experienced by U.S. citizens and residents. You should transparently present the total costs imposed abroad to clarify your estimate of the share of those costs that are passed through. Similarly, such an analysis should not exclude benefits to U.S. persons merely because they flow through foreign channels, but rather provide a reasonable estimate of the benefits that are passed through.

[19] For example, when assessing the benefits of a regulation that could prevent a catastrophic event with some probability, it may be appropriate for you to consider not only the near-term effects of averting the catastrophic event on those who would be immediately affected, but also the long-run effects on others—including future generations—who would be affected by the catastrophic event.

### 4. Developing an Analytic Baseline

The benefits and costs of a regulation are generally measured against a no-action baseline: an analytically reasonable forecast of the way the world would look absent the regulatory action being assessed, including any expected changes to current conditions over time. Such a forecast focuses on the issues or phenomena relevant to the effects of the regulation—for example, the number of foodborne illnesses, the level of emissions, the number of automobile crashes, or the availability of wheelchair-accessible facilities—that would most likely exist or occur without the regulation. This forecast should, to the extent feasible, be grounded in sound theories and empirical evidence about current conditions and ongoing and anticipated future trends in the areas of interest.[20]

The choice of appropriate baseline may require consideration of a wide range of potential factors, including:

- evolution of the market;
- changes in external factors affecting expected benefits, costs, or transfers;
- changes in regulations promulgated by the agency or other government entities;
- the degree of compliance by regulated entities with other regulations; and
- any additional data that provide information on the scale and number of entities or individuals that will be subject to, or experience the benefits or costs of, the regulation.

In some cases, it may be reasonable to forecast that the world absent the regulation will resemble the present. In other cases, particular attention should be paid to ways in which conditions will change absent the regulation—*e.g.*, technological advances, demographic changes, changes in the economy, or alterations to the climate—that will significantly affect the estimated effects of the regulation. For example, if a harm addressed by a regulation is expected to become more severe over time, the baseline should reflect that trend. Thus, when calculating the effects of the regulation, your analysis would be measured relative to a baseline in which the harm is becoming more severe. Depending on the specific circumstances, the use of this baseline may result in greater benefits (because the harm being addressed by the regulation is becoming more severe), greater costs (because larger investments may be required to address the increasing severity of the harm), or both. On the other hand, if a harm is expected to become less severe over time, your baseline should reflect that assessment as well. In either case, the use of a reasonable baseline—meaning one in which the severity of the harm changes over time in a manner consistent with a reasonable assessment of the future—could potentially yield substantially different estimates of the net benefits (or other impacts) of a regulation than a baseline in which the harm is assumed to remain at current levels.

Your baseline should reflect, when appropriate and feasible, the future effect of current government programs and policies. More specifically, the baseline should attempt to reflect relevant final rules (especially if their requirements are being modified by the regulation under consideration) and proposed rules or other previously announced policy changes that the agency

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[20] The same data that are used to establish the analytic baseline are likely to be relevant to the regulatory analysis's discussion of the need(s) for Federal regulation; see the section "*Identifying the Need for Federal Regulatory Action*" for more details.

is reasonably certain will be finalized before the rule under consideration.[21] Agencies are encouraged to consider the likely path of future government programs and policies when relevant and appropriate, either reflecting them in the primary or in a supplemental baseline (in either approach, carefully describe the ways in which the future government programs or policies may affect your analysis). The regulations and policies reflected in a primary baseline and any supplementary baselines at the final rule stage for a given rule typically will align with those reflected at the proposed rule stage, but the baseline may need to be adjusted if, for example, the finalization of a separate (but related) proposed rule has been unexpectedly delayed. For guidance about incorporating the extent of compliance with earlier regulations in an analytic baseline, please see the section "*Accounting for Compliance*" for more details.[22]

Regulatory analysis should assist policymakers in choosing among policy options available to the regulating agency at the time decisions are made and inform the public about the likely effects of the policies adopted. In general, an agency's first regulatory action implementing a new statutory authority should be assessed in a manner that accounts for the effects of the statute itself—that is, assessed against a pre-statutory baseline.[23] However, in some cases, substantial portions of a regulation may simply restate statutory requirements that are self-implementing even in the absence of the regulatory action or over which an agency clearly has little (or no) regulatory discretion. In these cases, you may use a post-statutory baseline in your regulatory analysis, focusing on the discretionary elements of the action and potential alternatives. Such an analysis should be accompanied by a brief description of and citation to the relevant statute. If you plan to use a post-statutory baseline for a regulation, you should consult with OMB as early as possible in the process of developing your regulatory analysis, including about how to describe—in sufficient detail—the post-statutory baseline that is being used.

When choosing an appropriate analytic baseline, analysts should generally consider: transparency, the goal of informing policy decisions, data availability, a general emphasis on empirical evidence, and the timing of interrelated policies. Several important points and illustrative cases are discussed below:

- An agency's regulation should generally be assessed in a manner that compares against a state of the world that conforms to any relevant previously issued regulations. Attention should also be given to analysis that isolates meaningful changes relative to any sub-regulatory action (*e.g.*, agency guidance) in a supplementary analysis. This dual-baseline approach allows for assessment relative to both a previous regulation and any subsequent guidance. Relatedly, it acknowledges the range of possible future behavior patterns by affected entities, which may not match what is observed at the time the regulatory

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[21] The effects of regulatory and other policy changes induced by the regulation under consideration should generally be attributed to the future actions themselves. Please consult with OMB for more specific guidance in particular cases.

[22] Updating assessments of compliance illustrates how analytic approaches—including choice of baseline—that serve the purpose of informing policy options at the time decisions are made do not universally lend themselves to aggregation of estimates across regulations over time.

[23] The term "pre"-statutory is used for continuity with the text of OMB Circular No. A-4 as originally issued in 2003. However, as noted elsewhere, the baseline for a regulatory analysis is (and has been) the predicted *future* state of the world in the absence of the policy being assessed, so a more precise term—avoiding the potentially misleading temporal element of the prefix "pre-"—might be without-statute.

analysis is conducted.

- Subsequent finalization of an interim final rule (IFR) should generally be assessed with at least two baselines: in a manner that compares against a state of the world that (hypothetically) lacks the IFR *and* in a manner that isolates changes in the subsequent finalization of the IFR relative to the IFR (if any). In order to ensure the production of an informative analysis, the former should be your primary baseline.[24] When appropriate, analysis of a subsequent finalization of an IFR could refer back to the analysis in the IFR for the first baseline, while also providing a new analysis that isolates changes relative to the IFR.
- If a recently finalized regulation is clarified, delayed, or otherwise revised or reversed by a new agency action, the primary baseline of the new action would be a baseline where the recently finalized regulation is issued as originally stated. In these cases, estimates from the earlier regulation's regulatory analysis are presumably readily available and, especially if the previous regulation is very recent, can be used to characterize that primary baseline in assessment of the new action. However, analysts are encouraged to update this analysis with an assessment that reflects newly available data or meaningful updates or changes in circumstances that affect the baseline.
- If a previous policy has been clarified, delayed, or otherwise revised by a new regulatory or sub-regulatory action, then among the factors needing careful accounting are costs associated with past compliance activity that have already been incurred. The analysis should carefully document costs that have been incurred, and cannot be recovered, versus other types of costs.
- If a regulatory preamble states or implies that changes caused by a regulation will have large effects, but the regulatory analysis states that there will be minimal effects, it may be that the preamble and analysis are comparing the regulation to different baselines. If a given baseline is important enough to inform discussion in the preamble, then there should generally be consideration given to addressing it in the regulatory analysis as well.

The preceding discussion notes various circumstances in which multi-baseline analysis may be the most informative approach to assessing a policy's impacts. Even in multi-baseline analysis, benefits and costs must be compared to each other only when assessed relative to the same baseline.[25] Moreover, where an agency considers one category of impact (benefits, costs, or transfers) to be appropriately assessed relative to a particular baseline, the other types of impacts should also receive analytic attention relative to that same baseline. You may also consider exploring, in sensitivity analyses, the reasonableness of the baselines used. For each baseline you use, it is helpful to identify the key uncertainties in your forecast. Regardless of the number of baselines used in the analysis, presentation of effects without any baseline is generally not appropriate.

Uncertainty about outcomes in the baseline and uncertainty about outcomes in a regulatory alternative both contribute to uncertainty about the relative magnitude of benefits, costs, and transfers. See the section "*Treatment of Uncertainty*" for more information on accounting for uncertainty. Discussing uncertainty in the baseline is particularly important

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[24] Consistent with the next bullet, the primary baseline of the *rescission* of an IFR should be a baseline that includes changes relative to a state of the world in which the IFR remains in place.

[25] Assessment of policy alternatives should also be presented relative to a consistent baseline.

insofar as it informs uncertainty about a regulation's net benefits. There may be cases in which a source of uncertainty will affect outcomes in both the baseline and the regulatory alternatives equally, and thus have little effect on the difference between the two.

## 5. Identifying the Need for Federal Regulatory Action

Section 1(a) of Executive Order 12866, "The Regulatory Philosophy," states that "Federal agencies should promulgate only such regulations as are required by law, are necessary to interpret the law, or are made necessary by compelling need, such as material failures of private markets to protect or improve the health and safety of the public, the environment, or the well-being of the American people." Section 1(b), "The Principles of Regulation," further provides that each agency, as applicable and permitted by law: "shall identify the problem that it intends to address (including, where applicable, the failures of private markets or public institutions that warrant new agency action) as well as assess the significance of that problem."

Section 6(a)(3)(B)(i) of Executive Order 12866 requires agencies to provide OMB's Office of Information and Regulatory Affairs (OIRA) with "text of the draft regulatory action, together with a reasonably detailed description of the need for the regulatory action and an explanation of how the regulatory action will meet that need," in addition to the required assessments and analyses of benefits and costs. It is helpful for agencies to describe the need for action in their regulatory preambles. In addition, including a summary of the need in regulatory analyses may provide useful background and help ensure that the description of the need informs the scope of the analyses (and vice versa) to the extent relevant, appropriate, and consistent with the best available evidence and best practices for objective analysis.

Regardless of its nature, you should generally describe the need for a regulation qualitatively and (when applicable) quantitatively. It is important to analyze any potential need before determining that it is present and relevant in your particular regulatory context. Your analysis of the effects of the regulation should not presuppose that there is a need for the regulation, and your analysis of the need for the regulation should not presuppose the effectiveness of your regulation.

The need for a regulation may take different forms. Modeling underlying market, institutional, or behavioral distortions is a standard starting point for conducting benefit-cost analysis of a regulatory action or other government intervention,[26] but these concepts do not capture all the underlying circumstances that spur regulatory action. Common needs for regulation include, but are not limited to:

- correcting market failure, which may implicate externalities, common property resources, public goods, club goods, market power, and imperfect or asymmetric information
- addressing behavioral biases;

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[26] Richard E. Just, Darrell L. Hueth, and Andrew Schmitz, *The Welfare Analysis of Public Policy: A Practical Approach to Project and Policy Evaluation* (Cheltenham, UK: Edward Elgar, 2004).

- improving government operations and service delivery;
- promoting distributional fairness and advancing equity; and
- protecting civil rights and civil liberties or advancing democratic values.

A regulation can be needed for multiple interconnected reasons, for several distinct reasons, or for one primary reason. For example, regulations that promote distributional fairness may also address a market failure. Regardless of the particular needs for the regulation, regulations can benefit from evidence-based qualitative and (when applicable) quantitative analysis of the effects. Identifying the need or needs for regulation is not about "checking a box" to confirm there is at least one need; for example, if an agency identifies that a regulation is necessary to implement or interpret a statute, that does not end the inquiry with respect to identifying needs. Instead, analysts should conduct reasonable inquiries to identify any relevant needs for regulatory action—such as correcting a market failure— because identifying relevant needs may inform the analysis of important categories of benefits, costs, and transfers, or the analysis of distributional effects.

### a. *Certain Needs for Federal Regulatory Action*

#### i. *Externalities, Common Property Resources, and Public Goods*

An externality can occur when one party's actions impose uncompensated benefits or costs on another party.[27] Environmental problems are a classic case of externalities. For example, the emissions from a factory may adversely affect the health of local residents while soiling the property in nearby neighborhoods; an externality exists because the marginal cost of producing the goods at the factory does not account for these effects, enabling the factory to sell its goods at a lower price. In theory, if bargaining were costless and all property rights were well defined, fully informed people could eliminate externalities through bargaining without the need for government regulation.[28] From this perspective, externalities can arise from high transaction costs or poorly defined/costly to enforce property rights that prevent people from reaching efficient outcomes through market transactions.

Externalities are related to the concepts of common pool resources (resources that are rivalrous and non-excludable), club goods (which are non-rivalrous and excludable), and public goods (which are non-rivalrous and non-excludable). A good is non-rivalrous if there is no marginal cost to also providing it to another individual. A good is non-excludable if the provision of the good to some individuals cannot occur without providing the same amount of goods to other individuals, free of charge. Common pool resources, such as many fisheries or the broadcast spectrum, may become congested or overused. Public goods, such as defense or basic scientific research, by contrast, do not generally suffer from congestion problems, but may be underprovided because their benefits fall on a large number of people while their costs often fall

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[27] *See* Hal R. Varian, 9th ed., *Intermediate Microeconomics: A Modern Approach* (W. W. Norton & Company, 2014), 663-685.
[28] *See* Ronald H. Coase, "The Problem of Social Cost," *Journal of Law and Economics* 3 (1960): 1-44.

only on a few.[29] Network benefits can also result when a greater degree of adoption and standardization in the use of a good or service increases the value of a good or service for all users. For example, network benefits are generally realized when there is standardization of which side of the road cars drive on, of the gauge of railroad tracks, or of weights and measures used in commerce. Regulatory benefits and costs should reflect relevant positive and negative externalities and the extent to which they interact with the regulation being analyzed, regardless of the form those externalities take.

### ii. Market Power

A firm or group of firms has market power as a seller ("monopoly power" or "oligopoly power") when it can influence or determine the price at which it sells its goods and services; analogously, a firm or group of firms has market power as a purchaser ("monopsony power" or "oligopsony power") when it can influence or determine the wages or other prices paid for goods and services it buys. Firms may also have market power that manifests in non-price ways, such as the ability to decrease product quality, restrict the range of products available to consumers, worsen wage or non-wage attributes of employee positions, or disproportionately influence the terms of service available to consumers, workers, or other firms. Firms may be able to exercise greater market power on those who are in more disadvantaged and vulnerable communities or groups.[30] Firms may exercise market power collectively or unilaterally. Government action can be a source of market power, such as when regulatory actions exclude lower-cost imports. More generally, market power may arise from a variety of sources, including but not limited to barriers to entry for competitors, economies of scale, control of inherently scarce resources, intellectual property protections, privileged access to infrastructure, control over commercial platforms or networks, unlawful exclusionary conduct, and monopoly access to detailed consumer data.

There are limited circumstances in which government may choose to grant a monopoly in a market and regulate the monopolist. If a market can be served at lowest cost only when production is limited to a single producer—historically, local gas and electricity distribution services have been examples—a natural monopoly is said to exist. In such cases, the government may choose to grant a monopoly and regulate prices or production decisions. Nevertheless, you should keep in mind that technological advances often affect economies of scale. This can, in turn, transform what was once considered a natural monopoly into a market where competition can flourish. Alternatively, technological advances can transform what was once considered a competitive market into a monopolistic or monopsonistic one. Please see the section "*Benefits and Costs Arising from Regulations' Interactions with Market Power*" for further discussion of related analytic issues.

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[29] There may be instances where your regulation provides information that is a public good and addresses incomplete/imperfect or asymmetric information, which is discussed below. For example, regulations requiring public disclosure of information may both provide a public good and alter transactions that would have otherwise been characterized by asymmetric information. When discussing the need for your regulation in such cases, your discussion of market failures should be inclusive, addressing these different reasons for regulation together.

[30] *See, e.g.*, Caitlin Knowles Myers et al., "Retail Redlining: Are Gasoline Prices Higher in Poor and Minority Neighborhoods?," *Economic Inquiry* 49, no. 3 (2011): 795-809 and Jennifer L. Doleac and Luke C.D. Stein, "The Visible Hand: Race and Online Market Outcomes," *The Economic Journal* 123, no. 572 (2013): F469-F492.

### iii.  Asymmetric or Imperfect Information

Asymmetric information describes a market failure that exists because one party in a transaction has more information than the other. Asymmetric information provides an advantage to one side of a market over the other when negotiating a transaction. Imperfect information exists when buyers and sellers do not have all of the necessary information to make an informed decision about the transaction. Imperfect information leads to inefficient markets that may result in market failure. Asymmetric and imperfect information can be common features of markets. However, although the market may supply less than the full amount of information, the amount it does supply may be reasonably adequate in light of the marginal benefits and costs of producing more information, and therefore may not require government regulation. Sellers generally have an incentive to provide information through advertising that can increase sales by highlighting distinctive characteristics of their products. Buyers may also acquire reasonably adequate information about product characteristics through other channels, such as a seller offering a warranty or a third party providing information. Nonetheless, absent government regulation, imperfect or asymmetric information continues to substantially affect important sectors of the economy, such as the agricultural, insurance, consumer credit, healthcare, and real estate markets.[31] Imperfect information can be relevant to game-theoretic modeling of interactions between market participants,[32] and should be given consideration when performing such modeling as part of a regulatory analysis.

### iv.  Behavioral Biases

Behavioral biases can be categorized in two groups: limitations on information processing and decision-making biases.[33]

Because of limited capacity to process information, even when adequate information is available, people can make systematic mistakes; limited attention, focus, and time can lead to the use of heuristics (rules of thumb). These heuristics may or may not be reasonable at the level of individual decision-making, but they can produce serious errors. If, for example, people have a clear mental image of an event (which makes it cognitively "available," or vivid and salient), they might overstate the probability that such an event will occur (*e.g.*, the risk of airplane travel may be overestimated following an airplane crash due to intense media coverage). This is an example of the use of a well-known heuristic, the availability heuristic, which might lead to availability bias.[34] Such heuristics can lead to inefficient outcomes when they produce systematic errors.

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[31] *See, e.g.*, Liran Einav, Amy Finkelstein, and Paul Schrimpf, "Optimal Mandates and the Welfare Cost of Asymmetric Information: Evidence from the U.K. Annuity Market," *Econometrica* 78, no. 3 (2010): 1031-1092; Liran Einav, Mark Jenkins, and Jonathan Levin, "Contract Pricing in Consumer Credit Markets," *Econometrica* 80, no. 4 (July 2012): 1387-1432; Pablo Kurlat and Johannes Stroebel, "Testing for Information Asymmetries in Real Estate Markets," *Review of Financial Studies* 28, no. 8 (2015): 2429-2461.

[32] Robert Gibbons, *Game Theory for Applied Economists* (Princeton: Princeton University Press, 1992).

[33] *See* Richard H. Thaler, "Behavioral Economics: Past, Present, and Future," *American Economic Review* 106, no. 7 (2016): 1592-94 (distinguishing between "behavioral beliefs" and "behavioral preferences").

[34] Amos Tversky and Daniel Kahneman, "Availability: A Heuristic for Judging Frequency and Probability," *Cognitive Psychology* 5, no. 2 (1973): 207-232.

People also exhibit various decision-making biases, such as those stemming from framing effects, anchoring effects, loss aversion, present bias, unrealistic optimism, and a preference for the status quo.[35] Another sort of decision-making bias stems from challenges in decision-making, such as imperfect self-control. When individuals exhibit imperfect self-control, they make a decision that increases short-term well-being by less than it decreases future well-being (appropriately discounted; see the section "*Discount Rates*" for more information). Imperfect self-control is often associated with present bias. Unlike most of the types of market or public institution failure discussed above, accounting for behavioral biases—which may produce internalities (understood as harms that people impose on their future selves)[36]—requires a departure from an assumption that typically underlies regulatory analyses conducted in accordance with this Circular: that individuals optimize their own lifetime well-being subject to budget and other relevant constraints.[37] You should carefully consider the degree to which the evidence available to you indicates that behavior reflects rational preferences and the degree to which it indicates that such behavior is the product of a behavioral bias.[38] When you have gathered evidence that the latter is the case—for example, studies demonstrating private undervaluation or overvaluation of relevant consumer products—that evidence will likely provide a key input in your quantification of regulatory benefits.

### v. *Improving Government Operations and Service Delivery*

Regulations are necessary for the day-to-day functioning of government and can also help promote a government that operates smoothly, is more transparent, and delivers public services efficiently. For example, a regulation may further effective government operations by setting performance criteria that government must follow. Regulations can also help government deliver services to more individuals at lower cost, such as by reducing administrative burdens or by simplifying public-facing or internal processes.

### vi. *Promoting Distributional Fairness and Advancing Equity*

Regulations can play a key role in promoting distributional fairness and advancing equity. Such regulations are sometimes issued pursuant to statutes that reflect congressional determinations that advancing these goals serves a compelling public need. For example, some statutes create social welfare programs, such as Medicaid, Medicare, and the Supplemental Nutrition Assistance Program. Congress has enlisted agencies to implement these programs, including through agency regulations that help determine who is eligible for program benefits and what sorts of benefits they may receive under which circumstances.

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[35] Thomas Gilovich, Dale Griffin, and Daniel Kahneman, eds., *Heuristics and Biases: The Psychology of Intuitive Judgment* (Cambridge: Cambridge University Press, 2002).

[36] The concept of internalities was adapted from the canonical market failure of externalities, with a consumer's future self the third-party on whom direct parties to a transaction (including the consumer's current self) impose costs. David L. Weimer, *Behavioral Economics for Cost-Benefit Analysis: Benefit Validity when Sovereign Consumers Seem to Make Mistakes* (Cambridge: Cambridge University Press, 2017); Raj Chetty, "Behavioral Economics and Public Policy: A Pragmatic Perspective," *American Economic Review* 105, no. 5 (2015): 1-33.

[37] As discussed in the section "*The Key Concepts Needed to Estimate Benefits and Costs*," internalities can also affect the interpretation of willingness-to-pay and willingness-to-accept evidence.

[38] Lisa A. Robinson and James K. Hammitt, "Behavioral Economics and the Conduct of Benefit-Cost Analysis: Towards Principles and Standards," *Journal of Benefit-Cost Analysis* 2, no. 2 (2011).

> ### vii.   Protecting Civil Rights and Civil Liberties or Advancing Democratic Values

Government plays a key role in protecting civil rights and civil liberties and in safeguarding democratic institutions. Regulations can protect free exercise of religion, secure due process rights, and promote personal freedom and dignity. Regulations can prevent discrimination by public or private actors. Regulations can also protect privacy, by ensuring that government and private entities that lawfully collect, maintain, and use large amounts of personal information do so in a way that protects and promotes individual privacy.

> ### b.   *Integration of Assessments of Need for Federal Regulatory Action into the Regulatory Analysis*

Observing the mere possibility of market failure, failure of public institutions, or behavioral biases is only an initial step in your analysis; you should consider the likelihood of various explanations for why the phenomenon under consideration occurs, and tailor your regulatory analysis accordingly. Ideally, to the extent feasible, you should quantify the extent of any relevant market failure, failure of public institutions, or behavioral bias, with the resulting estimates integrated into your regulatory analysis. You could also integrate estimates of distributional effects into your analysis, as explored in the section "*Distributional Effects*" below. Quantitative (or qualitative) assessments of other potential needs for regulation can also be used as inputs to benefit-cost analysis or cost-effectiveness analysis.

As various portions of a regulatory analysis are developed, there should be a continual assessment of whether the analysis as a whole achieves internal consistency. For example, if a market failure, failure of public institutions, or behavioral bias cannot be identified, then an estimate of positive monetized net benefits may be the result of missing cost categories, inappropriate methods or data, or implausible assumptions.[39] If negative net benefits are estimated after accounting for all important monetized and non-monetized effects, then the size of the identified market failure, failure of public institutions, or behavioral biases or the degree to which the regulation addresses those phenomena may need to be qualified. More generally, if the analysis identifies categories of benefits or costs beyond those implicated by the need(s) for regulation as originally articulated, the relationship between those effects and another market failure, failure of public institutions, or behavioral bias that the regulation addresses is something that you should endeavor to describe.

> ### c.   *Showing Whether Regulation at the Federal Level Is the Best Way to Solve the Problem*

It can be informative to consider other means of addressing the need for regulatory action you have identified in addition to, or instead of, Federal regulation. Alternatives to Federal regulation that may be appropriate in certain contexts, or analytically informative even when not feasible as policy options, include antitrust enforcement, consumer-initiated litigation in the

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[39] This may not be the case if an agency that is interested in accounting for diminishing marginal utility weights benefits and costs by, for example, income; see the section "*Distributional Effects*" for more details.

product liability system, reframing programmatic context to induce behavior change, or administrative compensation systems. These other approaches will sometimes be a means of securing some of the benefits of regulation. In many contexts, however, these alternatives will not be available at all or, even if they are available, they will not be as efficient or as effective as Federal regulatory means of obtaining the relevant benefits. Either way, evidence related to these questions may have the potential to enrich analysis of a regulatory approach being pursued by a Federal agency.

In assessing whether Federal regulation is the best approach, it is also helpful to consider, when relevant, whether State, local, territorial, or Tribal governments are well-positioned to address the issue and whether they are acting to do so. In some cases, the relevant need for regulatory action may suggest the most appropriate governmental level of regulation. For example, problems that spill across State lines (such as acid rain whose precursors are transported widely in the atmosphere) are probably best addressed by Federal regulation. More localized problems, including those that are common to many areas, may be better addressed locally, provided State, local, territorial, or Tribal authorities are able to do so and are effectively acting to address the relevant problem. Importantly, the fact that State, local, territorial, or Tribal authorities are empowered to address an issue does not mean that they are likely to do so effectively, universally, or at all. If State, local, territorial, or Tribal governments are failing to appropriately address a problem, analysis may indicate that Federal action is the best approach. Preventing a "race to the bottom" across jurisdictions should be considered when assessing effects of a Federal regulation.

Generally, there are advantages and disadvantages to regulating at different levels of government. If preferences differ by region, those differences can be reflected in varying State, local, territorial, and Tribal regulatory policies. Moreover, States, localities, territories, and Tribal lands can serve as a testing ground for experimentation with alternative regulatory policies. One State can learn from another's experience while local jurisdictions may compete with each other to establish the best regulatory policies. As noted previously, the opposite is also possible, and is of particular concern when activities conducted in one State or locality impose externalities on the residents of other States or localities. Moreover, producers may experience lower costs in the presence of Federal regulation, as opposed to a patchwork of State regulations when firms operate or conduct commerce across multiple jurisdictions.

Though a diversity of regulations may generate gains for the public, duplicative regulations can also be costly. The local benefits of State regulation may not justify the national costs of a fragmented regulatory system. For example, the increased compliance costs for firms to meet different State, local, territorial, and Tribal regulations may exceed any advantages associated with the diversity of State, local, territorial, and Tribal regulation. Your analysis should consider the possibility of reducing as well as expanding State and local regulation.

The role of Federal regulation in facilitating U.S. participation in global markets and diplomatic agreements should also be considered. Many societal concerns cannot be addressed through the regulatory actions of one country. Differences between the U.S. regulatory approach and those of foreign governments, though sometimes necessary, might impair the ability of American businesses to export and compete internationally. Concerns that new U.S.

regulations could act as non-tariff barriers to imported goods should be evaluated carefully. Efforts to align or harmonize U.S. and international regulations may require a strong Federal regulatory role.

## 6. Alternative Regulatory Approaches

You should consider reasonable regulatory alternatives deserving careful analysis. In approaching the assessment of alternative regulatory approaches, you ordinarily will be able to eliminate some alternatives through a preliminary analysis, leaving a manageable number of alternatives to be evaluated according to the principles of Executive Orders 12866 and 13563.

The number and choice of alternatives selected for detailed analysis is a matter of judgment. There must be some balance between thoroughness and practical limits, such as the limits on your analytical capacity. With this qualification in mind, it is generally informative to explore modifications of some or all of a regulation's key individual attributes or provisions to identify appropriate alternatives. When feasible and appropriate, you should analyze at least three options for each key attribute or provision, including: the proposed or finalized option; at least one option that achieves additional benefits (and presumably costs more due to, for example, greater stringency) beyond those realized by the proposed or finalized option; and at least one option that costs less (and presumably generates fewer benefits due to, for example, less stringency) than the proposed or finalized option.[40] A key attribute or provision is an attribute or provision where the choice among alternatives has substantial implications for the welfare effects of the rule.

You generally should analyze the benefits and costs of alternatives to key individual provisions separately when a regulation includes a number of distinct provisions. If the existence of one provision affects the benefits or costs arising from another provision, the analysis becomes more complicated, but it is important to examine provisions separately to the extent feasible and appropriate. In such a case, you should evaluate each specific provision by determining the net benefits of the proposed regulation with and without it.

Analyzing all possible combinations of provisions is impractical if the number of provisions is large and interaction effects are widespread. You need to use judgment to select the most significant or relevant provisions for such analysis. Some alternative policy options may merit relatively formal assessment because they provide richer insights into evidence, models, or other analysis details than might be available from a sole focus on the regulatory approach being proposed or finalized. You are expected to document all of the alternatives that were assessed in a list or table and note which were selected for emphasis in the main analysis.

In some cases, you may decide to analyze a wide array of options. In 1998, the Department of Energy (DOE) analyzed a large number of options in setting new energy efficiency standards for refrigerators and freezers and produced a rich amount of information on their relative effects. This analysis—examining more than 20 alternative performance

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[40] The less-costly regulatory alternative should be a policy option other than agency inaction. The anticipated state of the world in the absence of agency action restates the analytic baseline and thus its inclusion in the alternatives assessment would not serve the goal of increasing the informational content of the overall regulatory analysis.

standards for one class of refrigerators with top-mounted freezers—enabled DOE to select an option that produced $200 more in estimated net benefits per refrigerator than the least attractive option.

Different alternatives may also have different distributional effects; some alternatives may change distributional effects even without significantly changing stringency. When the distributional effects of your regulation merit specific attention, it may be worthwhile to consider preliminarily analyzing regulatory alternatives that may have important differences in distributional effects. See the section "*Distributional Effects*" for details regarding identifying relevant groups and approaches to analyzing distributional effects.

The following is a list of alternative regulatory actions that you should consider analyzing, as feasible and appropriate.

### a. *Different Choices Defined by Statute*

When a statute establishes a specific regulatory requirement or requires an agency to periodically consider updating a regulation, it is generally helpful for the agency to also consider whether to add discretionary provisions (such as increasing stringency above the minimum set by statute or by existing regulations). In such cases, you should examine the benefits and costs of reasonable alternatives that reflect the range of the agency's statutory discretion, including the specific statutory requirement.

If legal or other constraints prevent the selection of a regulatory action that best satisfies the philosophy and principles of Executive Orders 12866 and 13563, you may consider identifying these constraints and estimating their opportunity cost (and effects more generally). Such information may be useful to Congress under the Regulatory Right-to-Know Act or in considering statutory reforms.

### b. *Different Compliance Dates and Other Timing Considerations*

The timing of a regulation may also have an important effect on its net benefits. Benefits may vary significantly with different compliance dates where a delay in implementation may result in a substantial loss in future benefits (*e.g.*, a delay in implementation could result in a significant reduction in spawning stock and jeopardize a fishery); that reduction in benefits should be assessed against any reduction in costs from the delay. Similarly, the cost of a regulation may vary substantially with different compliance dates for an industry that requires a year or more to plan its production runs. In this example, a regulation that provides sufficient lead time is likely to achieve its goals at a much lower overall cost than a regulation that is effective immediately; that reduction in cost should be assessed against any reduction in benefits from the delay.

If it is difficult to determine which of several policy options is the optimal choice, and if timing and other circumstances allow, you may consider analyzing the alternative of developing one or more pilot projects to test the measures under consideration. If there are significant uncertainties about benefits or costs, or if benefits or costs may change over time,

you may consider assessing alternatives that include plans for data collection and that include retrospective review. See "*Treatment of Uncertainty*" for more details on analyzing these approaches through the framework of real options.

### c. Different Enforcement Methods

Compliance alternatives for Federal, State, or local enforcement include on-site inspections, periodic reporting, and noncompliance penalties structured to provide the most appropriate incentives. When alternative monitoring and reporting methods vary in their benefits and costs, you should gather evidence relevant to the identification of the most appropriate enforcement framework. For example, in some circumstances random monitoring or periodic monitoring will be less expensive and nearly as effective as continuous monitoring. Continuous monitoring may be more appropriate where slight or frequent variation from the standard could have significant effects. Advances in monitoring technology should be considered in setting monitoring standards. Regarding analysis of differing levels of compliance, see the section "*Accounting for Compliance.*"

### d. Different Degrees of Stringency

In general, both the benefits and costs associated with a regulation will increase with the level of stringency (although marginal costs generally increase with stringency, whereas marginal benefits may decrease). It is informative to study alternative levels of stringency to understand more fully the relationship between stringency and the size and distribution of benefits and costs among different groups.

### e. Different Requirements for Different Sized Entities

You should consider assessing different requirements for large and small firms (or other entities), basing the requirements on estimated differences in the expected costs of compliance and in the expected benefits. The balance of benefits and costs can shift depending on the size of the firms being regulated. Small firms may find it more costly to comply with regulation, especially if there are large fixed costs required for regulatory compliance. This can potentially lead small firms to exit, resulting in reduced competition in some markets. On the other hand, it is not necessarily efficient to place a heavier burden on one segment of a regulated industry solely because it can better afford the higher cost. This has the potential to load costs on the most productive firms, costs that may be disproportionate to the marginal harms those firms' actions cause. Size-based requirements may also induce strategic responses in firms[41]; these responses should be carefully analyzed. You should also remember that a rule with a significant economic impact on a substantial number of small entities will trigger the requirements set forth in the Regulatory Flexibility Act (5 U.S.C. 603(c), 604). See the section "*Impact on Small Businesses and Other Small Entities*" for more details.

### f. Different Requirements for Different Geographic Regions

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[41] Louis Kaplow, "Optimal Regulation with Exemptions," *International Journal of Industrial Organization* 66 (2019): 1-39; Stacy Sneeringer and Nigel Key, "Effects of Size-Based Environmental Regulations: Evidence of Regulatory Avoidance," *American Journal of Agricultural Economics* 93, no. 4 (2011): 1189-1211.

Assuming that all regions of the country benefit uniformly from government regulation is a simplification (and possibly an oversimplification), as is assuming that costs will be uniformly distributed across the country. Where there are significant regional variations in benefits or costs, you should consider assessing the consequences of setting different requirements for the different regions.

### g. Performance Standards Rather than Design Standards

Performance standards express requirements in terms of outcomes rather than specifying the means to those ends. When outcomes are straightforward to measure, performance standards often are superior to engineering or design standards, because they give the regulated parties the flexibility to achieve regulatory objectives in the most cost-effective way.[42] As a result, performance standards often provide greater incentives for innovation that may ultimately result in greater net benefits than an otherwise similarly net-beneficial (in the near-term) design standard. In general, the analysis would take into account both the cost savings to the regulated parties of the greater flexibility and the costs of assuring compliance through monitoring or some other means.

### h. Market-Oriented Approaches Rather than Direct Controls

Market-oriented approaches that use economic incentives should be explored when permissible and appropriate. These alternatives include fees, penalties, subsidies, marketable permits or offsets, changes in liability or property rights (including policies that alter the incentives of insurers and insured parties), and required bonds, insurance, or warranties. One example of a market-oriented approach is a program that allows for averaging, banking, or trading (ABT) of credits for achieving additional emission reductions beyond the required air emission standards. ABT programs can be extremely valuable in reducing costs or achieving earlier or greater benefits, particularly when the costs of achieving compliance vary across production lines, facilities, or firms. ABT can be allowed on a plant-wide, firm-wide, region-wide, or nation-wide basis rather than source by source, but analysis may reveal that this produces distributional effects that are deemed unacceptable, for example, in local air quality outcomes (such as "hot spots" from local pollution concentration).

### i. Informational Approaches to Regulation and Nudges

If intervention is contemplated to address a market failure that arises from asymmetric or imperfect information, or certain behavioral biases, informational remedies or nudges (modifications of choice architecture that alter behavior) may be appropriate. Measures to improve the availability of information include government establishment of a standardized testing and rating system (the use of which could be mandatory or voluntary), mandatory disclosure requirements (*e.g.*, by advertising, labeling, or enclosures), and government provision of information (*e.g.*, by government publications, telephone hotlines, or public interest broadcast announcements). To be effective, measures to improve the availability of

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[42] While performance standards are generally less costly to regulated entities, they may be more burdensome for the regulating agency.

information should be clear, meaningful, timely, salient, and designed to be sensitive to how people process information and make choices based on that information. A measure to improve the availability of information, particularly about the concealed or non-transparent characteristics or prices of products, may provide consumers a greater choice than a mandatory product standard or ban. Measures that serve as "nudges"—such as changing the default or pre-selected options, or changing the manner in which information that is made available must be presented—can also improve consumer welfare without restricting choice.[43] Such nudges can include simplifying choices through sensible default rules (such as setting automatic enrollment with opt-out versus opt-in) and reducing complexity; increasing the salience of certain factors or variables; and promoting desirable social norms.

Careful analysis may help with the important task of matching underlying problems to the regulatory action that is best designed to address those problems. Informational remedies make most sense when an underlying market failure involves an informational issue, though even in such cases, informational remedies may not be either helpful or sufficient. Similarly, nudges make most sense when the market failure involves a behavioral bias, although even in such cases, nudges may not be either appropriate or sufficient. Analytic attention may be usefully directed to the question of whether it is possible or preferable to combine informational remedies and nudges with other regulatory approaches, rather than assessing them only as substitutes.

Specific informational measures or nudges, like other measures, should be evaluated in terms of their benefits and costs.[44] Some effects of informational measures are easily overlooked. The benefits of a mandatory disclosure requirement for a consumer product potentially include not only the benefits arising from consumers' ability to make more welfare-enhancing choices, but also the net benefits arising from any shifts in the composition of, and innovative additions to, products within the market. These other benefits also could include reductions in markups by increasing product comparability, or the development of products or services that meet new consumer demand resulting from the disclosure. The costs of a mandatory disclosure requirement for a consumer product will potentially include not only the cost of gathering and communicating the required information, but also the opportunity costs of the loss of any information displaced by the mandated information. The other costs also may include the effect of providing information that is ignored or misinterpreted (as when a truthful disclosure causes excessive or misplaced fear), and inefficiencies arising from the incentive that mandatory disclosure may give to overinvest in a particular characteristic of a product or service.

Where information on the benefits and costs of alternative informational measures or nudges is insufficient to provide a clear choice between them, you should consider the least intrusive alternative sufficient to accomplish the regulatory objective.

### j. A Note Regarding Certain Types of Economic Regulation

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[43] *See, e.g.*, Stefano DellaVigna and Elizabeth Linos, "RCTs to Scale: Comprehensive Evidence from Two Nudge Units," *Econometrica* 90, no. 1 (2022): 81-116.

[44] The section "*The Key Concepts Needed to Estimate Benefits and Costs*" discusses how willingness-to-pay and willingness-to-accept measures may need to be adjusted when analyzing informational measures or nudges that interact with behavioral biases.

In light of both economic theory and actual experience, it is particularly difficult to demonstrate positive net benefits for any of the following types of regulations:

- price controls in well-functioning competitive markets;
- production or sales quotas in well-functioning competitive markets;
- mandatory uniform quality standards for goods or services, if the potential problem can be adequately dealt with through voluntary standards or by disclosing information of the hazard to buyers or users; or
- controls on entry into employment or production, except (a) where needed to protect health and safety (*e.g.*, Federal Aviation Administration tests for commercial pilots) or (b) to manage the use of common property resources (*e.g.*, fisheries, airwaves, Federal lands, and offshore areas).

### k.  *Presenting Analysis of Alternatives*

It is usually not sufficiently informative to simply report a comparison of the agency's proposed or finalized option to the analytic baseline(s). Whenever you report the benefits and costs of alternative options, you should also consider presenting both total and incremental benefits and costs. If doing so, you should present incremental benefits and costs as differences from the corresponding estimates associated with the next less-stringent alternative.[45] It is important to emphasize that incremental effects are usually simply differences between successively more stringent alternatives. For alternatives that cannot be ordered by stringency, this type of comparison may not be possible.

## 7.  Developing Benefit and Cost Estimates

### a.  *Some General Considerations*

The regulatory analysis should discuss the expected benefits, costs, and transfers of the selected regulatory option and reasonable alternatives. How is the proposed action expected to cause the anticipated effects? What is the monetized value of the expected benefits and costs to society, or transfers within society? To present your results, you should:

- include separate schedules of the monetized benefits, costs, and transfers that show the type and timing of effects, and express the estimates in this table in constant (all indexed to inflation as of the same year), undiscounted dollars (for more on discounting see the section *"Discount Rates"* below);
- include schedule(s) of monetized net benefits for each analyzed subgroup (when subgroups are analyzed), and express the estimates in these table(s) in discounted dollars (for more on distributional analysis see the section "*Distributional Effects*" below);

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[45] For the least stringent alternative, you should estimate the incremental benefits and costs relative to the baseline. Thus, for this alternative, the incremental effects would be the same as the corresponding totals. For each alternative that is more stringent than the least stringent alternative, you should estimate the incremental benefits and costs relative to the closest less-stringent alternative.

- list the benefits, costs, and transfers that you can quantify, but cannot monetize, including their timing;
- describe benefits, costs, and transfers that you cannot quantify; and
- identify or cross-reference the data or studies on which you base the benefit, cost, or transfer estimates.

When benefit, cost, and transfer estimates are uncertain (for more on this see the section *"Treatment of Uncertainty"* below), you should report estimates of effects that reflect as full a probability distribution of potential consequences as is feasible and appropriate, recognizing that some categories of benefits and costs may be unquantified. If factors such as fundamental scientific disagreement or lack of knowledge prevent construction of a scientifically defensible probability distribution, you should describe benefits, costs, or transfers under plausible scenarios and characterize the evidence and assumptions underlying each of those scenarios.

Minor additional benefits, costs, or transfers (or ones that evidence indicates are highly speculative) may not be worth further formal analysis. At the same time, the fact that benefits, costs, and transfers often are uncertain, or difficult to monetize or quantify, does not necessarily make them either highly speculative or minor. Analytic priority should be given to those additional benefits, costs, and transfers that are important enough to potentially change the rank ordering of the main alternatives in the analysis.

### b. The Key Concepts Needed to Estimate Benefits and Costs

"Opportunity cost" is the appropriate concept for valuing benefits and costs. There are two primary frameworks for measuring opportunity cost: "willingness-to-pay" (WTP) and "willingness-to-accept" (WTA). Both assume voluntary transactions and measure an individual's willingness to forgo an opportunity. WTP captures the notion of opportunity cost by measuring what individuals are willing to pay to obtain a particular good or service (*i.e.*, as the buyer). WTA captures the notion of opportunity cost by measuring what individuals are willing to accept to forgo a particular good or service (*i.e.*, as the seller). In other words, WTP and WTA differ in who starts with the good or service. WTP and WTA will produce similar estimates of opportunity cost under certain circumstances.[46] These circumstances include when: prices change but quantities do not; the change being evaluated is small; there are reasonably close substitutes available; and the income/wealth effect is small.[47] However, empirical evidence from experimental economics and psychology shows that even when income/wealth effects are "small," the measured differences between WTP and WTA can be large, especially in cases with

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[46] In markets for fungible goods or services, observed prices often reflect both WTP and WTA simultaneously. John D. Graham, "Saving Lives Through Administrative Law and Economics," *University of Pennsylvania Law Review* 157 (2008): 427 (citing W. Michael Hanemann, "Willingness to Pay and Willingness to Accept: How Much Can They Differ?," *American Economic Review* 81, no. 3 (1991): 635). In many cases, however, there can be large differences between WTP and WTA measures. Thomas C. Brown and Robin Gregory, "Why the WTA-WTP Disparity Matters," *Ecological Economics* 28, no. 3 (1999): 323-335.

[47] *See* W. Michael Hanemann, "Willingness to Pay and Willingness to Accept: How Much Can They Differ?," *American Economic Review* 81, no. 3 (1991): 635-647 and Jinhua Zhao and Catherine L. Kling, "A New Explanation for the WTP/WTA Disparity," *Economics Letters* 73, no. 3 (2001): 293-300.

uncertainty, irreversibility, and limited opportunities to learn.[48]

In practice, the evidence available for your regulatory analysis may constrain your choice of WTP and WTA measures. As always, you should use your professional judgment to determine the most appropriate use of the available evidence. This may include using WTP or WTA data as a proxy for the other measure, in a situation in which the other measure might be preferable. When this is the case, you should be cognizant of—and discuss as appropriate—the potential directional errors that may result in your analysis, noting that generally the value of WTA will be greater than or equal to the value of WTP.

Market prices provide rich data for estimating benefits and costs based on WTP or WTA if the goods and services affected by the regulation are traded in well-functioning competitive markets. The opportunity cost of an alternative includes the value of the benefits forgone as a result of choosing that alternative. For instance, the opportunity cost of banning a product—for example, a consumer good, food additive, or hazardous chemical—is the forgone net benefit (including lost consumer and producer surplus[49]) of that product, taking into account the mitigating effects of potential substitutes.

The use of any resource has an opportunity cost regardless of whether the resource is already owned or has to be purchased. That opportunity cost is equal to the net benefit the resource would have provided in the next best use in the absence of the requirement. For example, if regulation of an industrial plant affects the use of additional land or buildings within the existing plant boundary, there is an opportunity cost of using the additional land or facilities. To the extent feasible, you should monetize any such forgone benefits and add them to the other costs of that alternative. You should also, to the extent feasible, monetize any cost savings as a result of an alternative and either add it to the benefits or subtract it from the costs of that alternative, in a manner reflecting the incidence of cost savings. Your approach should endeavor to be transparent and consistent, and to avoid double-counting. The avoided costs of not doing another regulatory alternative may not represent the benefits of a regulatory action where there is no direct, necessary relationship between the two.

Estimating benefits and costs is more difficult when markets are distorted (due to market failure, failure of public institutions, or behavioral biases), market prices are difficult to measure, or markets do not exist and allocation is via some other mechanism, such as household

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[48] *See* Daniel Kahneman, Jack L. Knetsch, and Richard H. Thaler, "Anomalies: The Endowment Effect, Loss Aversion, and Status Quo Bias," *Journal of Economic Perspectives* 5, no. 1 (1991): 193-206; Jason F. Shogren and Dermot J. Hayes, "Resolving Differences in Willingness to Pay and Willingness to Accept: Reply," *American Economic Review* 87, no. 1 (1997): 241-244; Catherine L Kling, John A. List, and Jinhua Zhao, "A Dynamic Explanation of the Willingness to Pay and Willingness to Accept Disparity," *Economic Inquiry* 51, no. 1 (2013): 909-921; Keith M. Marzilli Ericson and Andreas Fuster, "The Endowment Effect," *Annual Review of Economics* 6 (2014): 555-579; Carey M. Morewedge and Colleen E. Giblin, "Explanations of the Endowment Effect: An Integrative Review," *Trends in Cognitive Sciences* 19, no. 6 (2015): 339-348; Christina McGranaghan and Steven G. Otto, "Choice Uncertainty and the Endowment Effect," *Journal of Risk and Uncertainty* 65 (2022): 83-104.

[49] Consumer surplus is the difference between what a consumer pays for a unit of a good and the maximum amount the consumer would be willing to pay for that unit, holding income and the prices of other goods constant. It is measured by the area between the price paid and the demand curve for that unit. Producer surplus is the difference between the amount a producer is paid for a unit of a good and the minimum amount the producer would accept to supply that unit. It is measured by the area between the price and the supply curve for that unit.

production.[50] In these cases, estimating the value of the benefit or cost that you are interested in requires developing appropriate proxies.

Adoption of either WTP or WTA as the measure of value implies that individual preferences of the affected population should be a guiding principle in the regulatory analysis. However, in some cases adjustments to observed values or alternative methods of estimating values are required to obtain WTP or WTA estimates appropriate for benefit-cost analysis, because of the distortions caused by market failures.

An important class of cases in which the observed WTP or WTA may need to be adjusted to obtain estimates appropriate for benefit-cost analysis involves behavioral biases. A high observed WTP or WTA may reflect a truly high valuation for the underlying good or service or it may reflect a smaller WTP or WTA coupled with a bias that increases consumers' observed WTP or WTA. The same may be true of a low observed WTP or WTA. In these cases, you should endeavor to separate these two components, the true valuation and the bias, to accurately measure benefits and costs in your regulatory analysis. For example, where there is evidence that manipulative, rather than informational, aspects of advertising influence individuals' WTP or WTA, the observed or measured WTP or WTA should accordingly be adjusted.[51] Another class of cases involves situations in which the relevant population's preferences may not be appropriately measured using traditional techniques, and alternative approaches to valuation are necessary. See the section "*Benefits, Costs, and Transfers that Are Difficult to Quantify or Monetize*" below for more details.

Estimates of WTP or WTA based on revealed preference methods can be useful (see the section "*Appropriate Use of Revealed Preference Methods*" below for more discussion). As one example, analysts sometimes use "hedonic price equations" based on regression analysis of market behavior to identify the implicit prices for the attribute of interest.[52] The hedonic technique allows analysts to develop an estimate of the implicit price for specific attributes associated with a product. For instance, a house is a product characterized by a variety of attributes, including the number of rooms, total floor area, type of heating and cooling, and access to environmental amenities. If there are enough data on transactions in the housing market, it is possible to develop an estimate of the implicit price for specific attributes, such as the implicit price of an additional bathroom or for central air conditioning. This technique can be

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[50] When markets are distorted, the extent of such distortions should provide a key input in your quantification of regulatory net benefits; please see the section "*Partial and General Equilibrium Analysis*" below; the section "*Transfers, Incentives, and Modeling*"; and the section "*Detailing Market Failure, Failure of Public Institutions, and Behavioral Biases*" for related discussion.

[51] Relatedly, if a regulation affecting a product causes measured WTP for the product to rise, it could mean that the regulation rendered the product more valuable to consumers by reducing the source of a behavioral bias associated with that product, yielding a regulatory benefit (or vice versa, yielding a regulatory cost). Conversely, if a regulation causes measured WTP for a product to fall, it could be because consumers are now accounting for what was formerly an internality, also a regulatory benefit (or, again, vice versa, thus indicating a cost). You are encouraged— especially in such cases—to augment direct WTP or WTA studies with other behavior-change evidence before monetizing quantitative estimates. (In general, quantifying regulatory effects is contingent upon estimation of behavior change. Such estimation should be conducted holistically with consideration of WTP and WTA evidence.)

[52] *See, e.g.*, Kelly C. Bishop et al., "Best Practices for Using Hedonic Property Value Models to Measure Willingness to Pay for Environmental Quality," *Review of Environmental Economics and Policy* 14, no. 2 (2020): 260-281.

extended, as well, to develop an estimate for the implicit price of public goods that property provides access to, or other goods or services that are not directly traded in markets. An analyst can develop such implicit price estimates for goods or services like air quality, access to public parks, and public-school quality by assessing the effects of these goods on the housing market.

You should try to account for the shares of the same benefits and costs captured by different estimates as you refine your analysis. In other words, you need to guard against double-counting, since some benefits or costs are embedded in other broader measures. To balance this goal with concerns about under-counting meaningful effects by excluding potentially overlapping benefits or costs, it may be helpful to include a range—with the lower-bound estimate prioritizing the avoidance of double-counting and the upper-bound estimate prioritizing avoidance of omitted categories of impacts. A primary estimate, however, should generally not be derived by averaging these bounds; see the section "*Treatment of Uncertainty*" for more details.

To illustrate potential overlaps and gaps, consider a policy that reduces air pollutants in a community. If you measure the public health benefits of the regulation exclusively using the change in the net present value of expected lifetime wage income of those in the community, then you will have excluded benefits that accrue to those who do not earn wage incomes, health benefits reflected incompletely (or not at all) in lifetime wages, aesthetic value, etc. Even if you develop a complete measure of the public health benefits of the regulation, note that the air pollutant regulation may also improve the quality of the environment in a community, and the value of real estate in the community will generally rise to reflect the greater attractiveness of living in a better environment. However, simply adding the increase in property values to the estimated value of improved public health would be double counting if the increase in property values fully or partly reflects the improvement in public health. To avoid this problem, you should try to separate the embedded effects on the value of property arising from improved public health. At the same time, an analysis that fails to incorporate the change in value caused by any land use changes when accounting for costs will not capture the full effects of regulation.

### c.  *Appropriate Use of Revealed Preference Methods*

Revealed preference methods develop estimates of the value of goods or services—or attributes of those goods or services—based on observable tradeoffs that people actually make.[53] These methods are well grounded in economic theory. When designing or evaluating a revealed preference study, the following principles should be considered:

- consistency of the results with up-to-date economic theory and the best available economic science;
- validity of the research design and framework for analysis;
- if the market is not efficient, identification of the relevant market failure, failure of public institutions, or behavioral bias (and, as feasible, adjustments such that the

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[53] *See* Catherine L. Kling, ed. "Symposium: Best Practices for Using Revealed Preference Methods for Nonmarket Valuation," special issue, *Review of Environmental Economics and Policy* 14, no. 2 (Summer 2020): 240-323.

resulting estimates reflect the social value of the benefits and costs)[54];

- the representativeness of the specific market participants being studied given the target populations that will likely be affected by the regulation under consideration; and

- the appropriateness of the theoretical, statistical, and econometric models employed, the potential for explicit identification of key parameters, and the robustness of the resulting estimates in response to plausible changes in model specification and estimation technique.[55]

You should try to determine whether there are multiple revealed-preference studies of the same good or service and whether anything can be learned by comparing the methods, data, and findings from different studies or by synthesizing them in a meta-analysis. Professional judgment is required to determine the appropriate use of each available study. You should analyze the available evidence and related literature to determine the quality of studies in your analysis and the weight you give them in your analysis, if any, and discuss any relevant limitations of such studies.

### i. *Direct Uses of Market Data*

Economists ordinarily consider market prices as the most accurate measure of the marginal value of goods and services to society. This is most likely to be the case for goods and services exchanged in competitive markets with no externalities or other market failure. When goods or services are not exchanged in well-functioning markets or there are spillover benefits or costs, then market prices generally do not reflect the marginal social value of goods and services. Goods whose market prices may not reflect their social value include those whose production or consumption results in substantial positive or negative external effects, transfer payments, etc. For example, the observed consumer price of gasoline does not necessarily reflect the marginal social value of a gallon of gasoline because of taxes, other government interventions, and negative externalities (*e.g.*, the impacts of pollution on the local environment and global climate change).

If a regulation involves a market where the price does not reflect the value to society, you should try to identify and estimate the additional benefits and costs external to the market that result from changes in the quantity of goods and services in the market in your analysis. For example, suppose damage to pollinator habitat reduces crop yields. One of the benefits of controlling the loss of pollinator habitat is the value of the crop yield maintained or increased as a result of the controls. That value is typically measured by the price of the crop. However, if a government program has distorted the agricultural market and increased the crop's price above what it would otherwise be, then the change in crops valued at the prevailing price may overstate the value of the additional yield that results from controlling habitat loss. In this case, some adjustment of the value implied by the market data on price alone may more appropriately reflect the net social effects of the increased crop yield and, hence, the associated value of protecting

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[54] If relevant types of distortions are not accounted for in the source study, you should attempt to make adjustments that account for the relevant types of distortions when incorporating the study into your regulatory analysis.

[55] Emily Oster, "Unobservable Selection and Coefficient Stability: Theory and Evidence," *Journal of Business & Economic Statistics* 37, no. 2 (2019): 187-204 and Ethan T. Addicott et al., "Toward an Improved Understanding of Causation in the Ecological Sciences," *Frontiers in Ecology and the Environment* 20, no. 8 (2022): 474-480.

against the loss of pollinator habitat.

### ii. Indirect Uses of Market Data

Many goods or attributes of goods that are affected by regulation—such as preserving environmental or cultural amenities—are not traded directly in markets. The value for these goods or attributes arises from use and non-use. When feasible, these values should be included in your estimates of benefits and costs. Estimation of these values is challenging relative to observing prices in markets, though techniques for estimating implicit prices that are not observed in markets are well developed. Overlooking or ignoring benefits or costs that result from changes in indirect market or non-market transactions in your regulatory analysis may significantly understate or overstate the benefits or costs of regulatory action.

"Use values" arise where an individual derives satisfaction from using a resource irrespective of whether the resource is consumed or degraded in the process. Some use values are exclusionary and directly alter ownership of a good, such as mineral extraction and sale. In other cases, the marginal use is less excludable, and each additional user may reduce the value of the resource to each other user as crowding occurs (use is rivalrous), as is the case for fisheries. At times, exclusive and non-exclusive uses are incompatible. Importantly, non-exclusionary use values can be passive (*i.e.*, non-consumptive). One example of such use values is storage of future opportunities—*e.g.*, holding minerals in the ground to hedge against price risk or holding fossil fuels in the ground to avoid the need for additional expenditures on greenhouse gas abatement—and another is risk management—*e.g.*, forgoing development of forests, wetlands, and dunes to reduce the risk of flooding. Holding the opportunity or option—the possibility, but not the obligation—to use the resource in the future is a type of use value (often called option value). One way to account for passive use values is to think of them as valuable "real options" (see "*Treatment of Uncertainty*" below for more details on real options). Another example is storm protection generated by natural infrastructure. Sand dunes, mangrove forests, or coastal wetlands can provide protection to homes without the homeowners acting. In such cases, a minimum value (though not the total value) of these ecosystem services is revealed by homeowners' choice not to interfere with existing natural infrastructure or nature-based solutions.[56] Indeed, in many relevant economic cases, doing nothing can be the "action" that generates the greatest welfare.[57]

"Non-use values" arise where an individual places value on a resource, good, or service even though the individual will not use the resource, now or in the future. Non-use value includes bequest and existence values. You should endeavor to give due weight to the tradeoffs people make and preferences people have with respect to such non-use values.[58] Techniques consistent with the best available economic science enabling estimates of these non-use values

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[56] *See generally* White House Council on Environmental Quality, White House Office of Science and Technology Policy, and White House Domestic Climate Policy Office, "Opportunities for Accelerating Nature-Based Solutions: A Roadmap for Climate Progress, Thriving Nature, Equity, and Prosperity," Report to the National Climate Task Force (2022).

[57] Nancy L. Stokey, *The Economics of Inaction: Stochastic Control Models with Fixed Costs* (Princeton University Press, 2008); Yukiko Hashida and Eli P. Fenichel, "Valuing Natural Capital when Management Is Dominated by Periods of Inaction," *American Journal of Agricultural Economics* 104, no. 2 (2022): 791-811.

[58] *See, e.g.*, John V. Krutilla, "Conservation Reconsidered," *American Economic Review* 57, no. 4 (1967): 777-786.

should be employed when appropriate and feasible.[59]

Altruism for the health and welfare of others is a closely related concept but may not be strictly considered a "non-use" value.[60] A pure concern for the welfare of all others, as measured by others' willingness-to-pay for or willingness-to-accept regulatory effects, supplements both benefits and costs (when appropriately weighted) proportionally, and therefore does not have an effect on rank ordering of the net benefits of different policy alternatives; in such cases, it is not necessary to measure the amount of such general altruism in regulatory analysis. If altruism instead varies with the benefit or cost (*e.g.*, is greater for health benefits or costs than for other benefits or costs) or depends on the individuals affected (*e.g.*, is greater for lower-income individuals than for higher-income individuals), then it can affect the rank ordering of the net benefits of different policy alternatives.[61]

Some goods and services are indirectly valued in markets, which means that their value is reflected in the prices of related goods and services that are directly traded in markets. Their use values are typically estimated through revealed preference methods. Examples include estimates of the values of environmental amenities derived from travel-cost studies[62] and hedonic price models that measure differences or changes in the value of real estate. It is important that you use revealed preference models that are consistent with up-to-date economic theory and the best available economic science when it is feasible to do so. Also, you should take particular care when developing a revealed preference model that you are designing protocols for reliably estimating the values of these attributes.

### d. *Appropriate Use of Stated Preference Methods*

Stated preference methods (SPM) have been developed and used in the peer-reviewed literature to estimate use and non-use values of goods and services in many contexts. They also have been widely used in regulatory analyses by Federal agencies, in part because these methods can be creatively employed to address a wide variety of goods and services that are not easy to study through revealed preference methods.

The distinguishing feature of these methods is that hypothetical questions about use or non-use values are posed to survey respondents in order to obtain WTP or WTA estimates relevant to benefit or cost estimation. Some examples of SPM include contingent valuation, attribute-based methods (sometimes called choice experiments), and risk-tradeoff analysis. The surveys used to obtain the health-utility values used in cost-effectiveness analysis are similar to stated-preference surveys but do not entail monetary measurement of value. The principles governing quality stated-preference research, with some obvious exceptions involving monetization, are also relevant in designing quality health-utility research.

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[59] Richard C. Bishop et al., 2017. "Putting a Value on Injuries to Natural Assets: The BP Oil Spill," *Science* 356, no. 6335 (2017): 253-254. More generally, see the section "*Appropriate Use of Stated Preference Methods*" below.

[60] *See* Kevin E. McConnell, "Does Altruism Undermine Existence Value?," *Journal of Environmental Economics and Management* 32, no. 1 (1997): 22-37.

[61] *See* Lisa A. Robinson and James K. Hammitt, "Behavioral Economics and the Conduct of Benefit-Cost Analysis: Towards Principles and Standards," *Journal of Benefit-Cost Analysis* 2, no. 2 (2011): 25-28; Theodore C. Bergstrom, "Benefit-Cost in a Benevolent Society," *American Economic Review* 96, no. 1 (2006): 339.

[62] Estimates of such costs can also potentially be relevant to your analysis of other regulatory benefits and costs.

When you are evaluating a stated-preference study, the following principles should be considered, including whether the study[63]:

- Explained the good or service being evaluated to the respondent in a clear, complete, and objective fashion, with a clear baseline or status quo scenario.
- Provided evidence that respondents understand, accept, and view as credible in the scenarios presented.
- Developed the survey instrument based on formative work, including focus groups and pre-testing, and documented such formative work.
- Designed WTP or WTA questions to relate to how respondents see the good, focusing them on the reality of budgetary limitations, and alerting them to the availability of substitute goods and alternative expenditure options.
- Had experimental designs that yield efficient and unbiased estimates of preference parameters. Ideally, designs should allow for interactions among attributes.
- Ensured questions are incentive compatible, randomized question order across respondents, and used a decision rule and payment vehicle that is realistic and binding. For public goods, referendum formats should be considered, but are not always the right choice. It is important that analysts attempt to account for any strong preferences that respondents may have concerning the payment vehicle itself (*e.g.*, a tax payment vehicle).
- Designed the survey instrument to probe beyond general attitudes (*e.g.*, a "warm glow" effect for a particular use or non-use value) and focus on the magnitude of the respondent's economic valuation.
- Included auxiliary questions to enhance validity.
- Ensured that the analytic results are consistent with economic theory using "internal" (within respondent) and "external" (among respondents) scope tests, such that the willingness to pay is larger (or smaller) when more (or less) of a good is provided.
- Selected/sampled the subjects being interviewed in a statistically appropriate manner, had a sample frame adequately covering the target population, and had a sample drawn using probability methods from a known sampling frame in order to generalize the results to the target population.
- Had response rates that are as high as reasonably possible, that is, followed best survey practices to achieve high response rates. Low response rates increase the potential for statistical bias and raise concerns about the generalizability of the results. If response rates are not adequate, you should consider conducting an analysis of non-response bias or further studies. Caution should be used in assessing the representativeness of the sample based solely on demographic profiles. Statistical adjustments to reduce non-response bias should be undertaken whenever feasible and appropriate.
- Had a mode of administration of surveys (in-person, phone, mail, internet, or multiple modes) that was appropriate in light of the nature of the questions being posed to respondents and the length and complexity of the instrument.
- Provided documentation about the target population, the sampling frame used and its

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[63] Robert J. Johnston et al., "Contemporary Guidance for Stated Preference Studies," *Journal of the Association of Environmental and Resource Economists* 4, no. 2 (2017): 319-405.

coverage of the target population, respondent recruitment method, the design of the sample (including any stratification or clustering), the cumulative response rate (including response rate at each stage of selection if applicable), the item non-response rate for critical questions, the exact wording and sequence of questions and other information provided to respondents, and the training of interviewers and techniques they employed (as appropriate).

- Used statistical and econometric methods to analyze the collected data that are transparent, well suited for the analysis, based on peer-reviewed methods, and applied with rigor and care.
- Addressed observed and unobserved preference heterogeneity.
- Used methods of computing WTP or WTA that are transparent, consistent with theory, and provide an estimated central tendency and dispersion.
- Included an internal validity assessment in stated preference and stated behavior assessments, with formally constructed validity tests and assessment of content validity.

Professional judgment is necessary to apply these criteria to one or more studies, and thus there is no mechanical formula that can be used to determine the appropriate use of any given study in regulatory analysis. You should analyze the available evidence and related literature to determine the quality of studies in your analysis as well as the weight you give them in your analysis. You should also discuss any relevant limitations of such studies.

Since SPM generate data from respondents in a hypothetical setting, sometimes on complex and unfamiliar goods, special care is needed in the design and execution of surveys, analysis of the results, and characterization of the uncertainties. Examples exist that illustrate these challenges being overcome.[64] A stated-preference study may be the only way to obtain quantitative information about non-use values, though—as is the case more generally—a number based on a poor-quality study is not necessarily superior to a qualitative analysis of the non-use value. Non-use values that are not quantified should be discussed qualitatively.

A single study can use a mix of revealed and stated preference information. Augmenting revealed preference data with stated preference data can help reduce biases that stem from unobservable features of the respondents, extend estimates beyond range of observed variability, or offer greater confidence in stated preference information.

In some cases, either revealed-preference or stated-preference studies will not be directly applicable to the regulatory analysis; for example, certain revealed-preference studies may not capture non-use values relevant to a regulatory analysis. If both revealed-preference and stated-preference studies that are directly applicable to regulatory analysis are available, you should consider both kinds of evidence and compare the findings when feasible. If the results diverge significantly, you should, when feasible, compare the overall quality of the two bodies of evidence. Other things equal, revealed preference data is preferable to stated preference data because revealed preference data are based on actual decisions, where market participants enjoy or suffer the consequences of their decisions. This is not generally the case for respondents in

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[64] *See, e.g.*, Richard C. Bishop et al., 2017. "Putting a Value on Injuries to Natural Assets: The BP Oil Spill," *Science* 356, no. 6335 (2017): 253-254.

stated preference surveys, where respondents may not have similar incentives to offer thoughtful responses that are consistent with their preferences or may be likely to bias their responses. However, it is generally appropriate to—all else equal—give less credence to a lower-quality revealed preference study than a higher-quality stated-preference study (*e.g.*, when a stated preference study is better targeted at valuing the particular good being analyzed than a revealed preference study). Consultation with OMB is advisable, prior to initiating a regulatory analysis, for further guidance on selecting between or combining revealed preference and stated preference studies.

### e. *Benefit-Transfer Methods*

It is often helpful to collect timely, case-specific data on revealed preference or stated preference to support regulatory analysis. Yet conducting an original study may not be feasible due to the time and expense involved, or such a study may not be able to produce evidence that yields sufficient additional insight. One alternative to conducting an original study is the use of "benefit transfer" methods. (The transfer may involve cost determinations as well.) The practice of "benefit transfer" began with transferring existing estimates or functions obtained from indirect market, other revealed preference, and stated preference studies to new contexts (*i.e.*, the context posed by the regulation). The principles that guide transferring estimates from indirect market, other revealed preference, and stated preference studies should apply to direct market studies as well.

Benefit-transfer can provide a lower-cost, readily implementable approach for obtaining desired monetary values for regulatory analysis. However, transferring estimates or functions from one context to another requires attending to external validity, and may create additional uncertainties of unknown magnitude. Nonetheless, benefit-transfer methods are appropriate when more direct and specific valuations are unavailable or inferior, or when time, resources, or other constraints do not permit conducting studies specific to the regulatory context.

In conducting benefit transfer, the first step is to describe the policy case and identify potential sources of information for the regulatory analysis. You should identify the relevant measure of the policy change at this initial stage. For instance, you can derive the relevant willingness-to-pay measure by specifying an indirect utility function. This identification allows you to "zero in" on key aspects of the benefit transfer.[65]

The next step is to identify appropriate studies to conduct benefit transfer. In selecting transfer studies for either value transfers or function transfers, you should consider the following

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[65] Sapna Kaul et al., "What Can We Learn from Benefit Transfer Errors? Evidence from 20 Years of Research on Convergent Validity," *Journal of Environmental Economics and Management* 66, no. 1 (2013): 90-104; Kevin J. Boyle, "The Benefit-Transfer Challenges," *Annual Review of Resource Economics* 2, no. 1 (2010): 161-182; Randall S. Rosenberger and John B. Loomis, "Benefit Transfer," in *A Primer on Nonmarket Valuation*, ed. Patricia A. Champ, Kevin J. Boyle, and Thomas C. Brown (New York: Springer Science & Business Media, 2003), 445-482; Robert J. Johnston, John Rolfe, and Randall S. Rosenberger, eds., *Benefit Transfer of Environmental and Resource Values: A Guide for Researchers and Practitioners* (Springer Dordrecht, 2015), 14; and Robert J. Johnston et al., "Guidance to Enhance the Validity and Credibility of Environmental Benefit Transfers," *Environmental and Resource Economics* 79, no. 3 (2021): 575-624.

criteria, as feasible and appropriate[66]:

- The selected studies are based on adequate data, and on sound and defensible empirical methods and techniques.
- The selected studies document parameter estimates of the valuation function.
- The study context and policy context have similar populations (*e.g.*, demographic characteristics). The market size (*e.g.*, target population) between the study site and the policy site are similar. For example, a study valuing water quality improvement in one locality may not necessarily be a suitable proxy for valuing a policy that will affect water quality throughout the United States if the affected populations are different in relevant ways.
- The good or service, and the magnitude of change in that good or service, are similar in the study and policy contexts.
- The relevant characteristics of the study and the policy contexts are similar. For example, the effects examined in the original study should be "reversible" or "irreversible" to a degree that is similar to the regulatory actions under consideration.
- The distribution of property rights is similar so that the analysis uses the same welfare measure. If the property rights in the study context support the use of WTA measures while the rights in the regulatory context support the use of WTP measures, use of that study when conducting benefit transfer may not be appropriate.
- The availability of substitutes across study and policy contexts are similar.

If you can choose between transferring a function or a point estimate, transferring the entire function (referred to as benefit function transfer) is generally preferable to adopting a single point estimate (referred to as benefit point transfer).[67] At times, it may be appropriate to transfer some parameters that are inputs to a transfer function, while estimating other parameters for the specific case.[68]

Finally, it is generally advisable not to use a study to conduct benefit transfer in estimating benefits or costs when doing so would lack external validity, as may be the case in the following circumstances:

- The study involves small, marginal changes, while the policy context involves much larger changes, or vice-versa.

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[66] Stephen Newbold et al., "Benefit Transfer Challenges: Perspectives from U.S. Practitioners," *Environmental and Resource Economics* 69, no. 3 (2018): 467-481.

[67] *See* John B. Loomis, "The Evolution of a More Rigorous Approach to Benefit Transfer: Benefit Function Transfer," *Water Resources Research* 28, no. 3 (1992): 701-705 and Stephanie Kirchoff, Bonnie G. Colby, and Jeffrey T. LaFrance, "Evaluating the Performance of Benefit Transfer: An Empirical Inquiry," *Journal of Environmental Economics and Management* 33, no. 1 (1997): 75-93. Transfer of point estimates may be acceptable when the study and policy sites are very similar. Robert J. Johnston et al., "Guidance to Enhance the Validity and Credibility of Environmental Benefit Transfers," *Environmental and Resource Economics* 79, no. 3 (2021): 575-624.

[68] When a large number of potential study sites are available, a meta-analysis could be constructed for the purpose of benefit transfer. Jon P. Nelson, "Meta-Analysis: Statistical Methods," in *Benefit Transfer of Environmental and Resource Values: A Guide for Researchers and Practitioners*, eds. Robert J. Johnston et al. (Springer: Dordrecht, 2015), 329-356.

- There are significant problems with applying an "*ex ante*" valuation estimate to an "*ex post*" policy context. If a policy yields a significant change in the attributes of the good, it is usually inappropriate to use the study estimates to value the change using a benefit transfer approach.
- Differences in context prevent the study from illuminating the context at hand. This may be especially relevant for studies or regulations that concern natural resources with unique attributes. For example, if a study values visibility improvements at the Grand Canyon, these results should not be used to value visibility improvements in urban areas, and vice versa.

You should attempt to satisfy as many of these criteria as possible when choosing studies from the existing economic literature. Professional judgment is required in determining whether a particular transfer is too speculative to use in regulatory analysis.

### f.  Valuation for Use in Multiple Analyses

When the same outcome is caused by many regulations, monetary valuations can sometimes be developed once and used across regulatory analyses. Various estimates of benefits per ton of emissions reductions or costs of labeling changes are examples of such valuations that are used across many regulations. Developing a valuation in this manner promotes consistency across regulatory contexts and reduces costs—as developing valuations can be an expensive and time-consuming endeavor—and can be beneficial when appropriate. However, you should consider the degree of similarity of outcomes and whether the use of common valuation is useful in your particular context. If you intend to develop a valuation that would be relevant for regulatory analyses conducted by multiple agencies, you should consult with OMB prior to beginning the work, to learn whether other agencies have data, tools, or estimates relevant to the valuation, or are interested in collaboration.

### g.  Additional Benefits, Costs, and Transfers

Your analysis should look beyond the obvious benefits and costs of your regulation and consider any important additional benefits, costs, or transfers, when feasible. An additional benefit is a favorable impact (financial, health, safety, environmental, or other consequence) of the regulation that is typically unrelated to the main purpose of the regulation (*e.g.*, reduced refinery emissions due to more stringent fuel economy standards for light trucks), while an additional cost is an adverse impact (financial, health, safety, environmental, or other consequence) that occurs due to a regulation and is not already accounted for in the direct cost of the regulation. These sorts of effects sometimes are referred to by other names: for example, indirect or ancillary benefits and costs, co-benefits, or countervailing risks.

It is often helpful to begin by listing the possible additional benefits, costs, and transfers. In exactly the same manner as is the case for direct benefits, costs, and transfers, additional effects that are important enough to potentially change the rank ordering of the main alternatives in the analysis should be given analytic priority.[69] In some cases, directing attention to these effects may help in the generation of a superior regulatory alternative with greater additional

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[69] See the section "*Some General Considerations*" above.

benefits and reduced additional costs.[70]

Like other benefits, costs, and transfers, an effort should be made to quantify and monetize additional effects when feasible and appropriate. If monetization is not feasible, quantification should be attempted through use of informative physical (or other quantitative) units. If monetization and quantification are not feasible, then these issues should be presented as non-quantified benefits, costs, and transfers. The same standards of information and analysis quality that apply to direct benefits, costs, and transfers should be applied to additional benefits, costs, and transfers.

### h. Partial and General Equilibrium Analysis

#### i. Partial and General Equilibrium Modeling Methods Generally

Partial equilibrium economic analysis considers a single market or markets in isolation from the rest of the economy. For example, a partial equilibrium analysis of a regulation regarding a particular crop subsidy may look only at the market for that crop or related markets (*e.g.*, markets for fertilizer, complimentary and substitute goods). General equilibrium economic analysis considers all markets jointly. A general equilibrium analysis of the same crop subsidy might look at how the subsidy affects the economy at large, including the market for the subsidized crop, the markets for other related crops, the markets for relevant agricultural inputs, and interactions with all other relevant markets in the economy and pre-existing policies. In practice, benefit-cost analyses may combine elements of a partial equilibrium analysis and elements of a general equilibrium analysis.[71]

Partial equilibrium analysis is most useful when the effects of a regulation are likely to occur mostly within a narrow segment of the economy and are unlikely to interact with pre-existing distortions in other markets. An implicit assumption of this approach is that effects that occur in other markets are not material for the analysis because they are either fully captured in the analysis of the directly affected markets or are small. For example, if a regulation affecting a particular crop causes farmers to reduce the acreage devoted to that crop and increase the acreage devoted to another, but there are no price effects in the market for the alternative crop, a partial equilibrium analysis examining the decline in the acreage devoted to the affected crop may fully capture the relevant effects. Similarly, if the regulation reduces acreage devoted to the affected crop but does not cause any changes in other production decisions, a partial equilibrium analysis may be sufficient.[72]

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[70] Exploring the data and methods associated with an effect that seems ancillary may reveal an evidence base that is at least as extensive, or chains of cause and effect at least as integrated with outcomes attributable to the regulation, as what is associated with impacts that originally appeared to be more direct.

[71] A commonality across equilibrium concepts is that they are often associated with a time span that is sufficient for a new steady state to be reached in the market(s) affected by the regulatory intervention being assessed. Such considerations are likely to be important when selecting a time horizon for your regulatory analysis.

[72] When using partial equilibrium analysis, it is important to identify potential offsetting effects that could occur outside of the market or geographic area covered by the analysis. For example, an analysis may indicate that there are net benefits within a particular region, but if those net benefits result, in part, because costs would be borne in another region, the preliminary analysis could be misleading. Refinement might take the form of expanding to multi-market analysis or revising the single-market analysis to define the market to encompass wider geographic range.

General equilibrium analysis is most useful when a regulation affects many markets simultaneously or the effects in one market have important spillovers into many other markets, interact with pre-existing distortions or policies, or behavioral shifts related to non-market allocation mechanisms. For example, if a safety regulation increases the cost of a good and causes buyers to substitute other goods and, in addition, the increased demand for those other goods leads to higher prices for those goods that further affect purchasing decisions, a general equilibrium analysis may be necessary to capture the full range of effects. In determining the appropriate analytic approach, the nature and extent of relationships between the effects in different markets is more important than the size of the markets, though regulations affecting a larger market may also be more likely to have important effects in other markets.

There are many circumstances in which general equilibrium analysis, or partial equilibrium analysis extending beyond direct impacts to secondarily affected markets, may be particularly useful. As suggested in the examples above, one such circumstance is when a regulation causes material price changes in markets other than the directly affected market or material reallocation of time or services not allocated through markets. However, the appropriate mode of analysis in a specific regulatory context is necessarily a question that requires professional judgment. When the differences in estimates of benefits and costs between a partial equilibrium analysis and a general equilibrium analysis are unlikely to be material, it will often be the case that improving and refining a partial equilibrium analysis will make your estimates of benefits and costs more accurate than adding a general equilibrium analysis would.

Both partial equilibrium and general equilibrium analytic approaches can be appropriate in a regulatory analysis.[73] The choice between the two may depend on the nature of the regulation under consideration, the anticipated effects of the regulation, the available data and evidence for use in the analysis, and the feasibility of the different approaches. You may also combine aspects of the two approaches, such as by conducting a partial equilibrium analysis of several markets or conducting a quantitative partial equilibrium analysis supplemented by a qualitative general equilibrium analysis.[74]

### ii.   Considerations When Conducting General Equilibrium Analysis

As with the use of any other methodological approach, analysts conducting a general equilibrium analysis will need to make a variety of assumptions. Consistent with the general

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[73] However, input-output models, such as the Bureau of Economic Analysis's RIMS II model, are not generally appropriate as the primary basis for assessing the benefits and costs of regulatory actions. Input-output models quantitatively assess the interdependencies between different sectors in an economy. Input-output models generally do not account for any feedback effects, including general equilibrium macroeconomic feedback effects that depend on the current state of the business cycle, and often produce measures such as changes in output or wages which should not be conflated with estimates of benefits. See the section "*Accounting for Business Cycle Dynamics in the Estimation of Benefits and Costs*" for more details. Input-output models may still be a useful part of an analysis (*e.g.*, establishing baseline conditions), even when not appropriate as a primary basis for assessing the benefits and costs of regulatory actions.

[74] For an example of qualitative general equilibrium analysis being used in a policy-relevant fashion, *see* J. Peter Neary, "Intersectoral Capital Mobility, Wage Stickiness, and the Case for Adjustment Assistance," in *Import Competition and Response*, ed. Jagdish N. Bhagwati (Chicago: University of Chicago Press, 1982).

guidance of this Circular, analysts should take care to detail and explain the assumptions they make when conducting a general equilibrium analysis. Two general equilibrium-specific situations requiring guidance are discussed next; however, other assumptions may also need to be addressed.

First, general equilibrium modeling often imposes budget constraints on each household, firm, or government in the model. A household budget constraint may, for example, limit household spending to the sum of income and borrowing. However, the development of an appropriate Federal government budget constraint for use in regulatory analysis is challenging because typical implementations of such constraints assume Federal policy changes that are not part of the regulation under consideration. For example, a regulation that has the effect of discouraging production may reduce the quantity of labor supplied and reduce income tax revenues. A general equilibrium model may assume that the reduction in income tax revenues is offset by a reduction in transfer payments, but such a reduction in transfer payments is not part of the regulation. Assumptions about the policies the government will use to balance the budget in these models are sometimes known as fiscal closure rules. You should take care to ensure that such rules do not inappropriately affect the results of your analysis.

In estimating the net benefits of a regulation, it is generally important to account for relevant government transfer effects. For example, an analysis of a regulation that increases payments to recipients of a public benefits program needs to reflect the budgetary cost of those payments to ensure that net benefit estimates are not overstated. All else being equal, a $1 increase in benefit payments would be offset by a $1 cost to the Federal government and have no net benefits.[75] Fiscal closure rules are a common means of accounting for these transfer effects in general equilibrium modeling, but fiscal closure rules are hypothetical because they assume policy changes that are not part of the regulation. Application of fiscal closure rules can thus make the results of a regulatory analysis sensitive to these assumptions about hypothetical policy. Special attention should be paid to the development and presentation of your estimates to appropriately reflect this sensitivity.

In general, you may choose to use adjustments in lump-sum transfers from households to balance net government transfers. This approach is straightforward to implement and highly tractable. However, when behavioral responses to a private-sector mandate or other similar regulation cause material increases or decreases in Federal deficits you should present results that isolate the role of these behavioral effects on Federal deficits, and you should present estimates of the net benefits including and excluding these effects. This range illustrates the sensitivity of the results to assumptions about the fiscal closure rule and can be used in place of an analysis using alternative fiscal closure rules.

More generally, you should take care to ensure that your results are minimally affected by any policy changes that are not part of the regulation of interest and you should not include in

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[75] All else is not always equal; for example, in a recession, such government outlays may have benefits that exceed the size of the outlay. These are often referred to as "multiplier effects." See the section "*Accounting for Business Cycle Dynamics in the Estimation of Benefits and Costs*" for more discussion. As noted in the section "*Transfers, Incentives, and Modeling,*" transfers may also have important effects on incentives and behavior that should be captured in your analysis.

your primary estimates effects that depend on future Federal legislation or regulation. For example, if you use lump-sum transfers to close a fiscal shortfall in your general equilibrium analysis, the corresponding distributional analysis should report the effects on people excluding the effect of these lump-sum transfers, accompanied by an estimate of the net effect on the Federal budget absent the lump-sum transfer. This approach allows for presentation of the direct distributional consequences of the regulation.

Second, in all modeling the analyst must choose what parameters are chosen outside the model and what parameters are determined within the model. Many parameters chosen outside the model in partial equilibrium analysis may be determined within the model in general equilibrium analysis. This is often viewed as a strength of general equilibrium analysis. Therefore, it may be appropriate to use a general equilibrium model that would imply parameter values different from those recommended elsewhere in this Circular. One example of this issue is the case of a general equilibrium model in which the model specification—resulting from analysis-specific considerations—implies a discount rate schedule differing from the default values recommended in this Circular. See the section "*Discount Rates*" for more discussion. In these cases, you should take care in how you combine elements of your analysis that rely on different implicit assumptions. You should take similar care when elements of general equilibrium analyses are combined with partial equilibrium analyses. There may also be other endogenously determined parameters in general equilibrium analyses. The discount rate is merely an example, and similar principles apply to other such cases.

### i. *Methods for Treating Non-Monetized Benefits, Costs, and Transfers*

Sound quantitative estimates of benefits, costs, and transfers, where feasible, are preferable to qualitative descriptions of benefits, costs, and transfers, because quantitative estimates succinctly summarize the magnitudes of the effects of alternative actions. As a general matter, you should use sound and defensible values or procedures to quantify and monetize benefits, costs, and transfers, and ensure that key analytical assumptions are defensible. However, some important benefits, costs, and transfers may be either difficult to quantify or difficult to monetize. When you determine that it is not possible or appropriate, given the state of the evidence, to quantify or monetize certain effects, you should carry out a careful identification and assessment of non-monetized and non-quantified benefits, costs, and transfers.

When it is not possible to quantify or monetize all of the important benefits and costs of a regulation, the most advantageous policy will not necessarily be the one with the largest quantified and monetized net-benefit estimate. In such cases, you should exercise professional judgment in determining how important the non-quantified benefits or costs may be in the context of the overall analysis. This section discusses how such benefits and costs can be considered.

### i. *Benefits, Costs, and Transfers that Are Difficult to Quantify or Monetize*

Possible reasons that a benefit, cost, or transfer may be difficult to quantify or monetize include, but are not limited to:

- The monetized value of a benefit or cost cannot be measured or cannot be appropriately measured through individual choice.[76] For example:
  - It would not be appropriate to attempt to fully measure the value of human dignity, civil rights and liberties, or indigenous cultures through individual choice as measured by WTP or WTA. While it is possible to conceptualize a WTP or WTA for certain such impacts, those measures will not capture all of the impacts of regulations that implicate human dignity, civil rights and liberties, or indigenous culture.
  - In some instances, traditional WTP or WTA measures are predicated on assumptions about behavior, decision-making, or appropriate valuation that do not apply. For a regulation that impacts the safety of young children, for example, it is possible to use market transactions or survey evidence to estimate the WTP or WTA of others (such as parents) but generally not of the children themselves; for that reason, traditional WTP or WTA measures may yield incomplete estimates.
- The approach to measurement is conceptually clear, but difficulty in collecting the relevant data or conducting the relevant experiment prevents measurement. For example, science might not have progressed to the point where it is possible to quantify the harm done by some pollutant, or technical analysis might not enable an agency to quantify the benefits of some measure designed to reduce safety risks on the highways, or of some measure designed to reduce the importation of contraband. Alternatively, directly measuring the valuation of the avoidance of some harm may be inconsistent with research ethics and a relevant quasi- or natural experiment may not be apparent.
- The data exists and the proper method of measurement is clear, but expenditure of the time or resources needed to measure the benefit or cost in the specific regulatory context would be unreasonable.

These reasons why benefits, costs, or transfers may be difficult to quantify or monetize are merely examples and are by no means exhaustive.

When you are unable to quantify or monetize important benefits or costs due to difficulty in collecting data or time and resource constraints, it is helpful to outline the data collection or analysis that would enable quantification or monetization, even if doing such data collection or analysis would be infeasible during your current regulatory process. Doing so may encourage research that would allow for such effects to be monetized in future regulations.

Benefits, costs, and transfers that are difficult to quantify or monetize differ from those that are uncertain (although an effect of a regulation can be both difficult to quantify or monetize and also uncertain). Uncertain effects are those that may or may not come to pass or that have uncertain magnitudes, but where some aspects of the underlying probability of occurring or of potential outcomes are known. It is important that your analysis, to the extent feasible, account for both effects that are difficult to quantify or monetize (whether or not they are especially uncertain) and those that are uncertain (whether or not they are difficult to quantify or monetize). See the section "*Quantitative Analysis of Uncertainty*" for details on how to quantify or monetize uncertain effects, where doing so is possible.

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[76] See related discussion in Daniel Acland, "What's in, What's out? Towards a Rigorous Definition of the Boundaries of Benefit-Cost Analysis," *Economics & Philosophy* 38, no. 1 (2022): 34-50.

### ii. Accounting for Benefits, Costs, and Transfers that Are Difficult to Quantify or Monetize

If you are not able to quantify certain effects of a regulation, you should present any relevant quantitative or qualitative information that would inform an understanding of those effects (including their magnitude and probability) along with a description of the unquantified effects, such as (in the context of assessing a regulation that affects the environment) ecological gains or ecosystem services, improvements in quality of life, viewshed improvement, and indigenous culture preservation. You should generally discuss the strengths and limitations of the qualitative information. The discussion should include the reason(s) why the relevant benefits, costs, and transfers are not quantified.

Even when it is possible to quantify certain effects of a regulation, it might not be possible or sensible to express those effects in monetized terms. In such cases, you should generally explain why this is the case and present all available quantitative information. For example, if you can quantify but cannot monetize improvements in water quality and fish populations resulting from water quality regulation, you can describe recreation benefits in terms of changes in visitation to recreational fishing areas or changes in recreational fish landings. You should endeavor to describe the timing and probability of such effects and avoid double-counting of benefits when estimates of monetized and non-monetized effects are mixed in the same analysis. Similarly, it is important to endeavor to avoid double-counting costs. You should, where feasible and appropriate, accompany this quantitative information with qualitative categorization and discussion of the likely welfare effects (benefits, costs, or transfers) of the quantified changes.

For cases in which the unquantified or non-monetized benefits, costs, or transfers could be meaningful in informing a policy choice, it is important, when feasible, to provide detailed information on the nature, timing, probability, location, and distribution of the unquantified or non-monetized benefits, costs, or transfers.[77] Also, you should include a summary table that lists all the unquantified or non-monetized benefits, costs, and transfers, and when feasible and appropriate highlight (*e.g.*, with categories or rank ordering) those that you believe are most important (*e.g.*, by highlighting factors such as the degree of certainty, expected magnitude such as the number of individuals affected, and reversibility of effects).

While the focus is often placed on benefits of regulatory action that are difficult to quantify or monetize, costs can be difficult to quantify or monetize as well.[78] Certain permitting

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[77] *See, e.g.*, Daniel A. Farber, "Breaking Bad? The Uneasy Case for Regulatory Breakeven Analysis," *California Law Review* 102, no. 6 (2014): 1469-1493; Rachel Bayefsky, Note, "Dignity as a Value in Agency Cost-Benefit Analysis," *Yale Law Journal* 123, no. 6 (2014): 1732-1782.

[78] Opportunity costs (or cost savings) of a regulation might not be reflected in budgets, which can create challenges in quantification. As an example of this phenomenon, an agency might not immediately devote fewer resources to processing applications when it issues a new regulation that shortens an application form, but the labor and other resources previously used for processing the longer form would, in the presence of the regulation, be freed for some other valuable purpose, such as achieving greater speed in the processing of the applications. Hence, there would be a cost savings attributable to the regulation. By the same reasoning, there is a cost attributable to a regulation if an agency will be performing enforcement activities or otherwise using resources in connection with that regulation, even if the agency's budget is not increasing.

requirements may restrict the decisions of production facilities to shift to new products and adopt innovative methods of production. While costs to innovation may be substantial, it is difficult to quantify and monetize these effects. Where important costs cannot be analyzed quantitatively, they should be analyzed qualitatively, specifying who is affected and how.

For benefits or costs that are difficult to quantify or monetize, it may be helpful to solicit the views of outside experts or members of the public. Additional discussion of methods for doing so are included in the section on "*Quantitative Analysis of Uncertainty.*"

### iii.   Threshold, Break-Even, Screening, and Order-of-Magnitude Comparisons

If the non-monetized benefits and costs are likely to be important, a "threshold" or "break-even" analysis may be considered for inclusion in a regulatory analysis. Threshold or break-even analysis asks what magnitude non-monetized benefits and costs would need to have for the regulation at issue to yield positive net benefits or to change which regulatory alternative is most net beneficial. Put differently, the method answers the question, "How small could the value of the non-monetized benefits be (or how large would the value of the non-monetized costs need to be) before the regulation would yield zero net benefits (or before the most net beneficial regulatory alternative changes)?"

Break-even comparisons have strengths and limitations that you should be conscious of when employing them. It may be useful to focus a break-even analysis on whether the action under consideration will change the probability of events occurring or the potential magnitude of those events. For example, there may be instances where you have estimates of the expected outcome of a type of catastrophic event, but assessing the change in the probability of such an event may be difficult. Your break-even analysis could demonstrate how much a regulatory alternative would need to reduce the probability of a catastrophic event occurring in order to yield positive net benefits or change which regulatory alternative is most net beneficial. Regardless, you should avoid giving the impression that whether net benefits will be positive or negative, or which regulatory alternative is most net beneficial, is known with certainty in cases where such certainty is not possible.[79]

Break-even presentations may reflect situations in which multiple inputs are available (A,B) and other inputs are missing (X,Y). The analysis would demonstrate how A and B combine to quantify what is known about the scope and timing of the potential benefits (or costs), and how X and Y would need to combine for a regulatory provision to break even; a diagonal dividing line—which can be thought of as a break-even curve, as it represents all of the combinations of points that causes the analysis to break even[80]—could divide a diagram with X and Y axes, or a table with X and Y rows and columns, into regions with positive and negative net benefits. In other words, a range of outcomes that represents the break-even state may be

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[79] For more on break-even analysis, *see, e.g.*, Cass R. Sunstein, "The Limits of Quantification," 102 *California Law Review* 102, no. 6 (2014): 1369-1421; Clark Nardinelli, "Some Pitfalls of Practical Benefit-Cost Analysis," *Journal of Benefit-Cost Analysis* 9, no. 3 (2018): 519-530.
[80] This concept is similar to the indifference (iso-utility) curves and iso-profit curves used extensively in microeconomics. *See, e.g.*, Hal R. Varian, 9th ed., *Intermediate Microeconomics: A Modern Approach* (W. W. Norton & Company, 2014).

constructed of a set of combinations of outcomes and probabilities such that the levels of unknown benefits or costs allow the equality between them to hold.[81]

Similarly, agencies may deploy "screening" or "order-of-magnitude" analysis when the quantitative information they have may not be of sufficient quantity or quality to produce precise estimates, but may be suited to produce information about the potential magnitude of the effects. For example, suppose there are three facilities emitting by-products of their production process through their air vents, and suppose there is insufficient information to model air transport, which would be necessary to estimate who might be exposed. If the agency knows the population of the nearby towns, by invoking reasonable assumptions about the transport distance of the air emissions, the agency would likely be able to present screening or order-of-magnitude analysis encompassing various scenarios.

### j. *Monetizing Health and Safety Benefits and Costs*

[*Note: Material in this section remains largely unchanged from the version of this Circular issued in September 2003, with relatively minor edits, including updating language, providing a missing citation to an already-referenced source, and updating to reflect current agency estimates of value of statistical life (VSL). For more discussion, see the accompanying preamble, "Preamble: Proposed OMB Circular No. A-4, 'Regulatory Analysis.'"*]

We expect you to provide a benefit-cost analysis of health and safety regulations that are significant under Section 3(f)(1) of Executive Order 12866, as amended by the Executive Order of April 6, 2023 (Modernizing Regulatory Review). The BCA provides insight because it provides some indication of what the public is willing to pay for improvements in health and safety.

In monetizing health benefits, a WTP or WTA measure is the conceptually appropriate measure as compared to other alternatives (*e.g.*, cost of illness or lifetime earnings), in part

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[81] Adapting an example from Richard L. Revesz, "Quantifying Regulatory Benefits," *California Law Review* 102, no. 6 (2014): 1423-1456, suppose a regulation's costs are estimated to be $5 billion per year and mortality-related benefits are estimated to be $4 billion per year. Suppose further that baseline evidence indicates 100,000 individuals experience non-fatal health harms—perhaps such that they stay home from work or school—on an average of two days per year, due to the activity (*e.g.*, pollution emission) that would be subject to the regulation. Two challenging areas for estimating morbidity-related regulatory benefits might be quantification of the regulation's effectiveness at reducing health harm and monetization per day in which adverse health outcomes are avoided as a result of the regulation. Points along the locus of break-even thresholds would include 100% effectiveness and $5,000 per day, 50% effectiveness and $10,000 per day, and 10% effectiveness and $50,000 per day.

| Regulatory Effectiveness / Daily Value | 10% | 25% | 50% | 75% | 100% |
|---|---|---|---|---|---|
| $50,000 | 0 | + | + | + | + |
| $20,000 | - | 0 | + | + | + |
| $10,000 | - | - | 0 | + | + |
| $6,667 | - | - | - | 0 | + |
| $5,000 | - | - | - | - | 0 |

Regulatory effectiveness (at preventing missed days of work or school) and the monetized value of daily absenteeism combine to yield negative net benefits (-), positive net benefits (+), or break-even status (0) for the hypothetical regulation described above.

because it attempts to capture pain and suffering and other quality-of-life effects. Using a WTP or WTA measure for health and safety allows you to directly compare your results to the other benefits and costs in your analysis, which will typically be based on WTP or WTA.

If well-conducted revealed-preference studies of relevant health and safety risks are available, you should consider using them in developing your monetary estimates. If appropriate revealed-preference data are not available, you should use valid and relevant data from stated-preference studies. You will need to use your professional judgment when you are faced with limited information on revealed preference studies and substantial information based on stated preference studies.

A key advantage of stated-preference and health-utility methods compared to revealed preference methods is that they can be tailored to address the ranges of probabilities, types of health risks and specific populations affected by your rule. In many rulemakings there will be no relevant information from revealed-preference studies. In this situation you should consider commissioning a stated-preference study or using values from published stated-preference studies. For the reasons discussed previously, you should be cautious about using values from stated-preference studies and describe in the analysis the drawbacks of this approach.

### i. *Nonfatal Health and Safety Risks*

With regard to nonfatal health and safety risks, there is enormous diversity in the nature and severity of impaired health states. A traumatic injury that can be treated effectively in the emergency room without hospitalization or long-term care is different from a traumatic injury resulting in paraplegia. Severity differences are also important in evaluation of chronic diseases. A severe bout of bronchitis, though perhaps less frequent, is far more painful and debilitating than the more frequent bouts of mild bronchitis. The duration of an impaired health state, which can range from a day or two to several years or even a lifetime, need to be considered carefully. Information on both the severity and duration of an impaired health state is necessary before the task of monetization can be performed.

When monetizing nonfatal health effects, it is important to consider two components: (1) the private demand for prevention of the nonfatal health effect, to be represented by the preferences of the target population at risk, and (2) the net financial externalities associated with poor health such as net changes in public medical costs and any net changes in economic production that are not experienced by the target population. Revealed-preference or stated-preference studies are necessary to estimate the private demand; health economics data from published sources can typically be used to estimate the financial externalities caused by changes in health status. If you use literature values to monetize nonfatal health and safety risks, it is important to make sure that the values you have selected are appropriate for the severity and duration of health effects to be addressed by your regulation.

If data are not available to support monetization, you might consider an alternative approach that makes use of health-utility studies. Although the economics literature on the monetary valuation of impaired health states is growing, there is a much larger clinical literature on how patients, providers, and community residents value diverse health states. This

literature typically measures health utilities based on the standard gamble, the time tradeoff or the rating scale methods. This health utility information may be combined with known monetary values for well-defined health states to estimate monetary values for a wide range of health states of different severity and duration. If you use this approach, you should be careful to acknowledge your assumptions and the limitations of your estimates.

### ii. Fatality Risks

Since agencies often design health and safety regulations to reduce risks to life, evaluation of these benefits can be the key part of the analysis. A good analysis must present these benefits clearly and show their importance. Agencies may choose to monetize these benefits. The willingness-to-pay approach is the best methodology to use if reductions in fatality risk are monetized.

Some describe the monetized value of small changes in fatality risk as the "value of statistical life" (VSL) or, less precisely, the "value of a life." The latter phrase can be misleading because it suggests erroneously that the monetization exercise tries to place a "value" on individual lives. You should make clear that these terms refer to the measurement of willingness to pay for reductions in only small risks of premature death. They have no application to an identifiable individual or to very large reductions in individual risks. They do not suggest that any individual's life can be expressed in monetary terms. Their sole purpose is to help describe better the likely benefits of a regulatory action.

Confusion about the term "statistical life" is also widespread. This term refers to the sum of risk reductions expected in a population. For example, if the annual risk of death is reduced by one in a million for each of two million people, that is said to represent two "statistical lives" extended per year (2 million people x 1/1,000,000 = 2). If the annual risk of death is reduced by one in 10 million for each of 20 million people, that also represents two statistical lives extended.

The adoption of a value for the projected reduction in the risk of premature mortality is the subject of continuing discussion within the economic and public policy analysis community. A considerable body of academic literature is available on this subject. This literature involves either explicit or implicit valuation of fatality risks, and generally involves the use of estimates of VSL from studies on wage compensation for occupational hazards (which generally are in the range of $10^{-4}$ annually), on consumer product purchase and use decisions, or from an emerging literature using stated preference approaches. Agencies have engaged in a consistent practice, over the course of several decades, of relying on this literature to estimate VSL. Based on this consistent practice, agencies utilize central estimates of VSL between $10 million to $12 million as of 2022, and regularly update these values to reflect inflation and real income growth.[82]

There is a continuing debate within the economic and public policy analysis community

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[82] *See* Environmental Protection Agency, *Guidelines for Preparing Economic Analyses* (2016); Department of Health and Human Services, *Guidelines for Regulatory Impact Analysis* (2016); Department of Transportation, *Treatment of the Value of Preventing Fatalities and Injuries in Preparing Economic Analyses* (2021).

on the merits of using a single VSL for all situations versus adjusting the VSL estimates to reflect the specific regulatory context. A variety of factors have been identified, including whether the mortality risk involves sudden death, the fear of cancer, and the extent to which the risk is voluntarily incurred.[83] The consensus of EPA's 2000 Science Advisory Board (SAB) review of this issue was that the available literature does not support adjustments of VSL for most of these factors. The panel did conclude that it was appropriate to adjust VSL to reflect changes in income and any time lag in the occurrence of adverse health effects.[84]

The age of the affected population has also been identified as an important factor in the theoretical literature. However, the empirical evidence on age and VSL is mixed. In light of the continuing questions over the effect of age on VSL estimates, you should not use an age-adjustment factor in an analysis using VSL estimates.[85]

Another way that has been used to express reductions in fatality risks is to use the life expectancy method, the "value of statistical life-years (VSLY) extended." If a regulation protects individuals whose average remaining life expectancy is 40 years, a risk reduction of one fatality is expressed as "40 life-years extended." Those who favor this alternative approach emphasize that the value of a statistical life is not a single number relevant for all situations. In particular, when there are significant differences between the effect on life expectancy for the population affected by a particular health risk and the populations studied in the labor market studies, they prefer to adopt a VSLY approach to reflect those differences. You should consider providing estimates of both VSL and VSLY, while recognizing the developing state of knowledge in this area.

Longevity may be only one of a number of relevant considerations pertaining to the regulation. You should keep in mind that regulations with greater numbers of life-years extended are not necessarily better than regulations with fewer numbers of life-years extended. In any event, when you present estimates based on the VSLY method, you should adopt a larger VSLY estimate for senior citizens because senior citizens face larger overall health risks from all causes and they may have accumulated savings to spend on their health and safety.[86]

The valuation of fatality risk reduction is an evolving area in both results and methodology. Hence, you should utilize valuation methods that you consider appropriate for the regulatory circumstances. Since the literature-based VSL estimates may not be entirely appropriate for the risk being evaluated (*e.g.*, the use of occupational risk premia to value reductions in risks from environmental hazards), you should explain your selection of estimates

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[83] Distinctions between "voluntary" and "involuntary" should be treated with care. Risks are best considered to fall within a continuum from "voluntary" to "involuntary" with very few risks at either end of this range. These terms are also related to differences in the cost of avoiding risks.

[84] "With regard to population characteristics, the Committee believes that it is appropriate to adjust the value of projected statistical lives saved in future years to reflect higher incomes in those years, but not for cross-sectional differences in income." U.S. Environmental Protection Agency, *An SAB Report on EPA's White Paper Valuing the Benefits of Fatal Cancer Risk Reduction* (2000), 5, *https://nepis.epa.gov/Exe/ZyPDF.cgi/P100JOK2.PDF?Dockey=P100JOK2.PDF*.

[85] John D. Graham, Memorandum to the President's Management Council, "Benefit-Cost Methods and Lifesaving Rules" (May 30, 2003), *https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/assets/regulatory_matters_pdf/pmc_benefit_cost_memo.pdf*.

[86] Ibid.

and any adjustments of the estimates to reflect the nature of the risk being evaluated. You should present estimates based on alternative approaches, and if you monetize mortality risk reduction, you should do so on a consistent basis to the extent feasible. You should clearly indicate the methodology used and document your choice of a particular methodology. You should explain any significant deviations from the prevailing state of knowledge. If you use different methodologies in different regulations, you should clearly disclose the fact and explain your choices.

### iii.   Valuation of Reductions in Health and Safety Risks to Children

The valuation of health outcomes for children and infants poses special challenges. It is rarely feasible to measure a child's willingness to pay for health improvement, and adults' concern for their own health is not necessarily relevant to valuation of child health. For example, the wage premiums demanded by workers to accept hazardous jobs are not readily transferred to regulations that accomplish health gains for children.

There are a few studies that examine parental willingness to pay to invest in health and safety for their children. Some of these studies suggest that parents may value children's health more strongly than their own health. Although this parental perspective is a promising research strategy, it may need to be expanded to include a societal interest in child health and safety.

Where the primary objective of a regulation is to reduce the risk of injury, disease or mortality among children, you should conduct a cost-effectiveness analysis of the regulation. You may also develop a benefit-cost analysis to the extent that valid monetary values can be assigned to the primary expected health outcomes. For regulations where health gains are expected among both children and adults and you decide to perform a benefit-cost analysis, the monetary values for children should be at least as large as the values for adults (for the same probabilities and outcomes) unless there is specific and compelling evidence to suggest otherwise.[87]

### k.  *Accounting for the Benefits and Costs from Environmental Services, Ecosystem Services, and Natural Capital*

In order to provide policymakers with relevant information, an analysis should account for effects on environmental or ecosystem services, or changes in the value of natural assets, if relevant and feasible, in your benefit-cost analysis. The phrase "ecosystem services" refers to the welfare contributions from biotic and abiotic elements of nature that are enjoyed, consumed, or used in a manner that affects human well-being; the phrase "environmental services" refers to the abiotic portion of ecosystem services.[88] Natural assets, or natural capital, are physical biotic or abiotic natural resources capable of providing—or contributing to—future welfare, potentially through environmental or ecosystem services. Natural capital is distinguished from ecosystem services in that natural capital is a stock (measure of quantity)

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[87] For more information, *see* Chris Dockins et al., "Valuation of Childhood Risk Reduction: The Importance of Age, Risk Preferences, and Perspective," *Risk Analysis* 22, no. 2 (2002): 335-346.

[88] James Boyd and Spencer Banzhaf, "What Are Ecosystem Services? The Need for Standardized Environmental Accounting Units," *Ecological Economics* 63, no. 2-3 (2007): 616-626.

whereas ecosystem services are a flow (measure of change in quantity over time). The two are connected, and the choice of which to value often depends on available analytic tools.

Many regulations will influence environmental or ecosystem services that directly impact the welfare of relevant populations. For example, a housing regulation may interact with air quality or open space influencing health outcomes, leisure opportunities, or both. It is helpful to identify relevant ecosystem services potentially impacted by the regulation under consideration. Where you identify relevant ecosystem services, you should seek to monetize their impacts when feasible, quantify impacts when monetization is not feasible, and describe qualitatively impacts that are not monetized or quantified. See the section "*Methods for Treating Non-Monetized Benefits, Costs, and Transfers*" and forthcoming OMB guidance on ecosystem services for additional information and guidance. As with other benefits and costs, your analysis should be designed to account for each effect of a regulation exactly once.

## 8. Other Key Considerations

### a. Other Benefit and Cost Considerations

You should generally, if feasible, include these effects in your analysis and provide estimates of their monetary values when they are substantial:

- private-sector compliance costs and savings;
- government administrative costs and savings;
- gains or losses in consumers' or producers' surpluses;
- discomfort or inconvenience costs and benefits; and
- gains or losses of time in work, leisure or commuting/travel settings.

A possible mistake in regulatory analysis is failing to carefully forecast potential changes in technology and other economic or social conditions over time, and the implications of those changes for estimated benefits and costs. Technological, economic, social, and other conditions may evolve due to forces outside the regulatory framework under consideration. A baseline constitutes an analytically reasonable assessment of the way the world would look absent the regulatory action being assessed (see the section "*Developing an Analytic Baseline*" above), so these potential changes should be carefully considered in constructing one or more appropriate baselines for your analysis. That includes considering the likely technological changes that would have occurred in the absence of the regulatory action. If you assume that technology will remain unchanged in the absence of regulation when technological changes are likely, then your analysis may misstate both the benefits and costs attributable to the regulation.

Technological, economic, social, and other conditions also may evolve due to the design of the regulation under consideration. Regulations may provide incentives to increase technology innovation or impede such progress.[89] You should, when appropriate and feasible, consider cost-saving innovations that may result from a shift to regulatory performance standards and incentive-based policies. In addition, costs may result from a slowing in the rate

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[89] *See* Knut Blind, "The Influence of Regulations on Innovation: A Quantitative Assessment for OECD Countries," *Research Policy* 41, no. 2 (2012): 391-400.

of innovation or slowing of adoption of new technology due to delays introduced or exacerbated by the regulatory approval process or the setting of more stringent standards for new facilities than for existing ones. You should carefully consider the incentive effects of your regulation.

In some cases, agencies are limited under statute to set regulatory standards based only on technologies that have been demonstrated to meet a legal standard of feasibility. In these situations, it is nevertheless appropriate to estimate benefits and costs in a manner that accounts for a wider range of technical possibilities in order to provide information to the public or policymakers.

There are other phenomena that may affect benefits and costs over time unrelated to the development of novel technologies. For example, retrospective studies have provided some evidence that learning reduces the costs of a regulation in future years because the variable costs of deploying new technologies, or existing technologies in new applications, decrease.[90] The examination of variable cost reduction due to learning has an extensive history in the economics and engineering literatures. In your regulatory analysis, you may wish to consider any relevant studies of past rates of cost reductions resulting from such effects as learning, with due regard for the studies' timeliness and applicability to the regulation under consideration.

You should also consider quality, applicability, and possible bias based on the source of the studies. For example, data provided by the regulated industry may overestimate costs, while data provided by an industry that competes with the regulated industry may underestimate costs.

### b. *Accounting for Compliance and Take-up*

You should endeavor to clearly present any key assumptions about compliance with a regulation. Assuming full compliance may be inappropriate when available evidence suggests imperfect compliance is likely. Both under-compliance and over-compliance may occur. Under-compliance occurs when regulated entities do not fulfill all of their obligations under a regulation. This often occurs when compliance costs exceed the expected penalty (*i.e.*, the probability of being penalized for failure to comply multiplied by the cost of being penalized for failure to comply). Over-compliance occurs when regulated entities surpass the requirements set forth in a regulation. This is usually driven by uncertainty regarding compliance, the "lumpiness" of compliance technologies, risk aversion, or market factors such as consumer or shareholder preferences. When compliance issues are material to the analysis of a regulation, to the extent that doing so is feasible, your analysis should reflect available evidence about compliance, in terms of the percentage of regulated entities at full compliance or the level of compliance across various entities. In the absence of evidence indicating that under-compliance or over-compliance with your regulation is likely, or when compliance issues are not material to the outcome of your analysis, assuming full compliance is often a reasonable default. It is generally helpful to specifically address the manner and method of enforcement, and how enforcement decisions will

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[90] *See* Arthur G. Fraas, Elizabeth Kopits, and Ann Wolverton, "A Retrospective Review of Retrospective Cost Analyses" (Working Paper No. 21-29, Resources for the Future, September 2021), *https://media.rff.org/documents/WP_21-29.pdf* for a meta-analysis of retrospective reviews.

affect compliance and enforcement costs. There is a rich economic literature in this area to build on.[91]

Consideration of compliance issues is especially important when analyzing regulatory actions intended to address compliance problems associated with prior regulations. In these cases, assuming a full-compliance baseline could lead to inaccurate conclusions about the effects of the new regulatory action. Suppose, for example, that an existing regulation was assessed at the time of its issuance assuming full eventual compliance, but this assumption turns out to have been overly optimistic, motivating the issuance of a new policy designed to improve compliance with the existing regulation. In this case, hewing to the assumption of full compliance with the original regulation would attribute zero benefits and zero (or otherwise-underestimated) costs to the new regulation, undermining the ability of a new regulatory analysis to inform decisions about the compliance-improvement policy. Instead, it would be most informative for the analytic baseline for the new regulation to reflect the best available evidence regarding the incomplete compliance with the earlier regulation. Estimates of incomplete compliance are most useful when noncompliance is identified with as much specificity as possible. For example, if noncompliance is driven by high compliance costs, estimating the costs of compliance separately for compliant and noncompliant facilities (that do not incur those costs) would likely be more accurate than simply scaling costs by the percentage of noncompliant facilities. More generally, a description of imperfect compliance in the baseline—consistent with the best available evidence—is generally the optimal starting point for analyzing the effects of policies meant to increase compliance.[92]

Sometimes entities anticipate more stringent regulations in the future and undertake actions to preemptively comply with or exempt themselves from such regulations, and it may be helpful for your analysis to examine data on relevant trends, the shape of cost curves for regulated entities, and other such considerations. When analyzing anticipatory compliance, you should capture the effects of regulatory anticipation consistently across both benefits and costs, such that both benefits and costs of compliance are attributed to the forthcoming regulation or both reflected in the baseline. If you estimate that entities will anticipatorily comply, you should generally provide the evidence supporting that estimate. Consistency is similarly important when analyzing firms undertaking additional compliance measures to meet consumer demand, compliance with overlapping legal requirements, and other analytic considerations. For example,

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[91] *See* A. Mitchell Polinsky and Steven Shavell, "The Economic Theory of Public Enforcement of Law," *Journal of Economic Literature* 38, no. 1 (2000): 45-76 for a review of literature in this area or Anthony Heyes, "Implementing Environmental Regulation: Enforcement and Compliance," *Journal of Regulatory Economics* 17, no. 2 (2000): 107-129; Wayne B. Gray and Jay P. Shimshack, "The Effectiveness of Environmental Monitoring and Enforcement: A Review of the Empirical Evidence," *Review of Environmental Economics and Policy* 5, no. 1 (2011): 3-24; Jay P. Shimshack, "The Economics of Environmental Monitoring and Enforcement," *Annual Review of Resource Economics* 6, no. 1 (2014): 339-360 for an analysis of enforcement of environmental regulations.

[92] If systematic data about past compliance is not yet available (perhaps due to the relevant regulation's recency), a multi-baseline analysis may be an especially informative approach. For example, if a delay of a previous regulation is announced—via rulemaking or a statement of enforcement discretion—between the issuance of a regulation and its impending compliance date, one set of estimates of the delay's effect should be calculated relative to a baseline of full compliance, even if this quantification is accompanied by an acknowledgement that the full-compliance baseline is overly simplistic. Information on the magnitude of penalties potentially imposed by enforcement bodies would be a possible key input to a useful second baseline analysis, in which the incentives created by such penalties lead to other compliance patterns.

if you estimate that removing regulatory requirements will not have significant costs (forgone benefits) because regulated entities will continue to comply with the previous regulatory requirements either voluntarily or because of overlapping legal requirements (such as State or local laws), the same assumption should be applied to the estimation of benefits (cost-savings).

Similar issues can arise with respect to imperfect take-up of government program benefits. Fewer individuals or entities may claim a benefit than are eligible to do so, potentially because of the costs of claiming the benefit, informational barriers, or cognitive biases.[93] Just as with compliance, when take-up questions are material to the analysis, your analysis should reflect available evidence about take-up to the extent that doing so is feasible and appropriate. It may be particularly relevant to consider whether take-up rates may systematically vary across groups identified in any distributional analysis, as this could alter the expected distribution of benefits.

### c. *Accounting for Business Cycle Dynamics in the Estimation of Benefits and Costs*

Benefit-cost analysis often excludes consideration of business-cycle fluctuations in economic activity, which is a reasonable and tractable approach to conducting the analysis in most cases. However, in certain regulatory contexts—such as those relating to automatic stabilizers—an examination of how the frequency or severity of recessions interacts with the benefits and costs of a regulation can be useful. Whether such an analysis is useful will require both an assessment of the regulation's anticipated effects and the materiality of any interactions with business cycle dynamics.

If you determine that a regulation is likely to have substantially different effects over the course of recessions and recoveries, you should consider how to account for the benefits and costs attributable to these effects in your estimate of transfers and net benefits. Since the timing of business cycles is uncertain, these effects will also be uncertain. As a result, they should be presented and calculated in a manner that reflects their uncertainty. See the section "*Treatment of Uncertainty*" for additional discussion. Approaches you may consider range in formality from qualitative discussion of the issues to quantification of the expected benefits, costs, and transfers (if applicable) in a calibrated economic model. It is helpful, in such an analysis, to carefully distinguish between the underlying causes of business cycles and the economic response to them generated by the regulation in question.

In any such analysis, you should focus on the benefits, costs, and transfers attributable to a regulation's interactions with the business cycle. These results should be presented in whichever way most clearly conveys your findings while appropriately describing relevant underlying uncertainties. While impacts on macroeconomic aggregates such as consumption,

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[93] *See* Wonsik Ko and Robert A. Moffitt, "Take-up of Social Benefits" (National Bureau of Economic Research Working Paper No. 30148, 2022), *https://www.nber.org/papers/w30148*; Marianne Bertrand, Sendhil Mullainathan, and Eldar Shafir, "Behavioral Economics and Marketing in Aid of Decision Making among the Poor," *Journal of Public Policy & Marketing* 25, no. 1 (2006): 8-23.

employment,[94] or gross domestic product may be useful ingredients in estimating these benefits and costs, they are not themselves measures of benefits or costs. See the section "*Developing Benefit and Cost Estimates*" for a more detailed discussion of how to estimate such benefits and costs using the information available to you.

### d. Benefits and Costs Arising from Regulations' Interactions with Market Power

The presence of market power may affect your benefit and cost estimates. You generally should account for the presence of market power—and changes in market power induced by your regulation—when it is material to the effects of the regulation under consideration. Regulations may affect market power in many ways. Examples include, but are not limited to, creating or lowering barriers to entry for new firms, increasing or decreasing the costs to consumers of switching among suppliers of a good, strengthening or limiting labor market competition in ways that impact workers, or limiting or enhancing monopoly power stemming from procurement decisions. Regulatory analysis should keep in mind the effects of government regulation in markets that are both "upstream" and "downstream" from the market that is directly affected. For a regulation that leads to a material increase or decrease in market power, for example, your analysis generally should examine the benefits and costs arising from these effects, which could arise from changes in the price and quantity of goods sold in that industry, quality of goods and services produced, or incentives to innovate, among other possibilities.

You should also be attentive to the possibility that regulations directly addressing issues other than market power may have meaningful indirect effects on market structure and competition, and it is informative to discuss and, if feasible, to quantify the benefits and costs arising from such effects in your analysis. For example, licensing or permitting requirements intended to increase safety may act as a barrier to entry, allowing incumbent firms to charge higher-than-competitive prices. In such cases, you should consider whether the regulation's safety benefits (along with the regulation's other benefits) outweigh any losses in consumer surplus caused by higher prices (along with the regulation's other costs), and whether there are alternatives that are less anticompetitive and would therefore have greater net benefits.

### e. Benefits and Costs Arising from Imperfect or Asymmetric Information

Generally, for policies that materially reduce the burden of gathering and interpreting information, it will be informative to explain how that reduction in burden would impact market participants; when possible and appropriate, you should quantify such cost reductions for market participants. When relevant to your analysis of the presence of imperfect or asymmetric information, you should consider how information proliferation and access to information may fail to remedy information burden by resulting in information overload, producing a degree of confusion, or raising the cost of interpreting the information.[95] Simpler presentation of

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[94] *See* Office of Mgmt. & Budget, *2015 Report to Congress on the Benefits and Costs of Federal Regulations and Agency Compliance with the Unfunded Mandates Reform Act* (2015), 42 (noting potential pitfalls in assessing employment effects of individual regulations, including the need to consider the timing of the business cycle and long-run market adjustments).

[95] *See* Oren Bar-Gill, David Schkade, and Cass R. Sunstein, "Drawing False Inferences from Mandated Disclosures," *Behavioural Public Policy* 3, no. 2 (2018): 209-227.

information might have higher benefits. On one hand, search technologies may have improved information access for many consumers and other market participants even as, on the other hand, label proliferation and other forms of information overload can lead to information-processing issues (and associated behavioral biases).

Some policies may make information available in a way that reduces information asymmetries, reducing or eliminating problems of adverse selection or moral hazard. For example, when product quality cannot be observed by consumers but is known by firms, requiring producers to disclose information about product quality may increase efficiency by addressing adverse selection. To use another example, when limited liability creates an incentive for those shielded by it to take excessive risks, this moral hazard problem can be addressed by regulations that limit excessive risk-taking.

Policies that alter the availability of information can also impact producers directly. In some cases, increasing or decreasing the availability of information may have market power effects, for example by increasing or decreasing the ability of producers or employers to collude. In other cases, increasing the availability of information may increase producer efficiency, and therefore lead to benefits for the relevant firms' consumers, workers, or owners.[96]

## 9. Transfers

A transfer payment, in its simplest form, is a shift in money from one party to another. More generally, when a regulation generates a gain for one group and an equal-dollar-value loss for another group, the regulation is said to cause a transfer from the latter group to the former. The term transfer is perhaps most commonly used in situations where a single effect of a regulation causes linked, exactly offsetting impacts on different groups. However, this linkage is not necessarily a defining feature of transfers, and different approaches to thinking about these effects are discussed below.

### a. Consistent Treatment of Transfers in Your Estimates of Regulatory Impacts

There are two approaches to accounting for transfers, either of which you may apply in your regulatory analysis[97]:

### i. Accounting for Transfers Separately from Benefits and Costs

This accounting approach excludes both sides of a transfer from your estimates of benefits and costs and provides a separate accounting of transfers. As a general matter, this is the default approach to analyzing transfers. If you adopt this approach, you must, for consistency,

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[96] Sang-Hyun Kim and Serguei Netessine, "Collaborative Cost Reduction and Component Procurement under Information Asymmetry," *Management Science* 59, no. 1 (2013): 189-206; Xavier Vives, "Information Sharing: Economics and Antitrust," in *The Pros and Cons of Information Sharing* (Stockholm: Swedish Competition Authority, 2006), 83-100; Carl Shapiro, "Exchange of Cost Information in Oligopoly," *Review of Economic Studies* 53, no. 3 (1986): 433-446; Alison J. Kirby, "Trade Associations as Information Exchange Mechanisms," *RAND Journal of Economics* 19, no. 1 (1988): 138-146.

[97] It is generally helpful to use the same accounting approach across analyses of related regulations. OMB is available if case-by-case consultations would be helpful.

exclude both sides of the transfer from your estimates of benefits and costs. (If you classify one side of a transfer as a benefit and the other as a transfer, or one side as a cost and the other side as a transfer, your estimate of net benefits will be incorrect.) It is generally informative to also include a clear statement of the parties from whom and to whom the transfer is occurring (insofar as such entities can be identified). Under this approach, distinguishing between benefits or costs and transfer payments can sometimes be difficult, and OMB is available as a resource if you are unsure of how to categorize particular effects.

When taking this accounting approach, it is informative to distinguish between analysis of transfers and assessment of who experiences regulatory benefits and costs. For instance, if a regulation implements a statute that calls for costly compliance activities and also expends Federal funds to reimburse entities performing such activities, the regulation's impact is appropriately categorized as a cost borne by the Federal government; separate presentation of costs to regulated entities and transfers from the Federal government to those entities is more likely to be appropriate if the Federal funding is not contingent on the compliance activities, if the reimbursement does not cover the entire cost of the compliance activities, or if there are data or methodological differences in how the cost and transfer amounts are estimated.

It will generally be appropriate to categorize an effect as a transfer if its effects on one group are exactly offset by its effects on another group or if there is a similarly direct link between the effect on one group and the effect on another group. Examples of *transfers* potentially include the following:

- Fees to government agencies for goods or services.[98]
- Tax payments from individuals or businesses to the government (monetary transfers from taxpayers to the government) and tax refunds from the government to individuals or businesses (monetary transfers from the government to taxpayers).[99]
- Payments by the government for goods or services provided by the private sector (that is, monetary transfers by the government to service providers, such as reimbursements by the Medicare program).
- Reductions in sales of a good or service by one business that are matched by increases in sales of the same good or service by another (that is, transfers in economic activity from one business to another).
- Reductions in resources for some consumers that are matched by increases for others (that is, transfers of resources among consumers).

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[98] In some cases, user fees (or user fee changes) may provide a reasonable approximation of the incremental societal opportunity cost of a service that the government would not provide to the same extent, or at all, in the absence of the regulatory action. But when a fee is not a good proxy for the underlying cost to the government of providing the service, the cost to the government should be separately reported from the fee (with the fee categorized as a transfer). Regardless of whether that is the case, your presentation of transfers should complement other portions of your analysis—portions that may be accounting for the value of the goods or services to the feepayer as a benefit or the expense (to the government) of providing those goods or services as a cost.

[99] As a first-order approximation, tax payments are categorized as transfers. Tax payments may also have important negative or positive impacts on net benefits, for example through incentive effects or by funding socially valuable expenditure. Tax payments are only pure transfers when the marginal benefit of a dollar collected is equal to the marginal cost of a dollar collected.

Separately, under this approach, examples of *benefits or costs*—as opposed to transfers—potentially include:

- Changes in use of goods and services to comply with relevant regulatory requirements.
- Changes in consumer and producer well-being resulting from regulation-induced price or quantity changes.
- Changes in premature death, illness, or disability.

Additionally, agency analysts should consider asking the following questions, which are likely to be helpful in the task of categorizing regulatory impacts:

- *Are effects naturally dollar-denominated?* If not, the impacts in question are unlikely to be transfers. For example, time spent on a compliance activity must be transformed into a monetary value using a wage or fee estimate—in other words, it is not naturally dollar-denominated—and thus is typically a cost.
- *Do estimates depend on behavior change?* If so, the impact for which the estimates have been developed is less likely to *purely* be a transfer.[100]

If you take this accounting approach, it is helpful to distinguish transfers caused by Federal budget actions, such as those stemming from a regulation affecting public benefits payments, from those that involve transfers between non-governmental parties, such as regulations that effectuate transfers between employers and employees or regulations that confer monopoly rents on a private party.[101] You can use as many categories of transfers as necessary to describe the major effects of a regulatory action.

### ii. Accounting for Transfers as Offsetting Benefits and Costs

An alternative approach that you may choose to adopt is to include one side of a transfer as a benefit and the other side of a transfer as a cost, such that the transfer is treated symmetrically in your estimate of net benefits. Under this approach, a larger transfer will result in larger benefits and larger costs and a smaller transfer will result in smaller benefits and smaller costs. If you adopt this approach, it is important that you ensure that you include both sides of a transfer in your accounting. For example, a grant paid by the government to an individual should be included in your analysis as both a benefit to the individual and a cost to the government.[102]

One advantage of this second approach is that it can provide greater clarity in documenting the impacts on different parties. When you conduct a distributional analysis, and in particular when you compute an income-weighted estimate of the net benefits of a regulation in accordance with the section "*Weights and Benefit-Cost Analysis*," adopting this approach is necessary to ensure that all the significant effects on different groups are accounted for. This approach can also be useful if it is difficult to categorize whether or not various effects are transfers, but straightforward to account for them as benefits and costs. Under this second

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[100] See the section "*Transfers, Incentives, and Modeling*" for more detail on this point.

[101] See the section "*Accounting Statement*" for a suggested format for doing so.

[102] There may be some exceptions to this general statement—for example, if following it would generate double-counting when considered in combination with other portions of your analysis.

approach, you would not need to present a separate category of benefits and costs that are transfers unless you believe that the presentation of this information is valuable.

### b. *Transfers, Incentives, and Modeling*

Transfers can induce important behavioral changes. For example, consider a regulation that increases payments to recipients of a public benefits program available only to retired individuals by five percent. The most straightforward impact of this regulation is a transfer to these recipients. In addition, this regulation might have important implications for retirement decisions for individuals eligible for the public benefits program. This, in turn, could have broad impacts across the labor market, with potentially large implications for the benefits and costs of the regulation. A full analysis of this regulation would incorporate estimates of relevant and significant behavioral effects, if feasible.

As a further illustration, consider a regulation that implements a new Federal spending program in a market characterized by some distortion, such as a positive externality. The payment amount may be most readily categorized as a transfer. This effect would be accompanied by external benefits, that is, benefits experienced by individuals not directly receiving payments.

### c. *The Marginal Cost of Public Funds*

Regulations that affect net transfers from the government will lead to changes in the Federal debt, taxes or other revenues, or government spending. As governmental transfers make up a larger share of a regulation's total effects, partial estimation of that regulation's net benefits—*i.e.*, estimates that do not account for resulting changes to the Federal debt, taxes, or government spending—becomes increasingly less informative. Relatedly, net benefits comparisons across regulatory alternatives are likely to be more informative if the alternatives have similar effects on governmental transfers.

One approach to estimating welfare effects associated with transfers from the government to other entities is to apply a factor known as the marginal cost of public funds. This factor is an estimate of the distortionary cost of taxation. For example, people take actions to avoid paying tax, such as choosing to work fewer hours, sheltering more income from tax using available deductions, or hiring a tax lawyer to set up trusts to minimize tax liabilities. Whether or not to apply this factor in an analysis can be particularly consequential for regulations that cause a material increase or decrease in Federal outlays, such as a regulation that modifies the eligibility criteria for an existing policy or program.[103] As noted in more detail below, however, agencies generally should not make this adjustment to regulations associated with spending programs.

This longstanding approach of not making such adjustments in analysis of individual regulations is due to several reasons, but is primarily because such regulations typically do not make offsetting changes to tax policy. For example, if a regulation would increase Medicare spending by some amount but would not directly affect the tax system, applying a marginal cost

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[103] *See* Office of Mgmt. & Budget, Circular A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs* 13 (Oct. 29, 1992).

of public funds in the primary analysis may inappropriately express false certainty about the attribution to the Medicare regulation of effects of an assumed change in tax rates. In practice, these two policies (*i.e.*, changes to Medicare, and changes to tax rates) may not be correlated at all. Additionally, any such analysis could be further complicated by the nature of how the tax system is designed. The benefits and costs of behavioral responses to taxation will vary with the form of taxation enacted; for example, taxation of a negative externality may produce behavioral responses with substantial net social benefits.[104] Another challenge in using a marginal cost of public funds is that estimates of the distortionary costs of taxation often ignore distributional considerations.[105]

## 10. Distributional Effects

The benefits and costs of a regulation are ultimately experienced by people. For some regulations, different groups of people may be impacted differently. Distributional analysis, whether quantitative or qualitative, can help illustrate these effects. This section provides agencies undertaking distributional analysis of a regulation with information to assist them in doing so.

### a. *General Issues*

The term "distributional effect" refers to the impact of a regulatory action across the population and economy, divided up in various ways (*e.g.*, income groups, race or ethnicity, sex, gender, sexual orientation, disability, occupation, or geography; or relevant categories for firms, including firm size and industrial sector). The benefits and costs of a regulation may also be distributed unevenly over time, resulting in regulatory benefits and costs falling on different individuals or different groups of individuals; for example, lead remediation will have costs concentrated at the time of remediation, but benefits that persist over many decades. A regulation may deliver net benefits to one group while imposing net costs on other groups. A regulation may also deliver relatively more net benefits to one group than to another: for example, because of differences in cumulative exposures and underlying health risk factors, reducing the emissions of harmful pollution may benefit certain exposed populations more than others.

A "distributional analysis" is performed to estimate the likely effects of the regulation on those in the groups being analyzed. This analysis involves estimation of the benefits, costs, and net benefits expected for each of these groups, if such data are available. You should not assume that aggregated data is applicable to particular groups, or that data for only one population group is applicable to other groups, without justification. If the relevant disaggregated quantitative data is not available, you may still be able to provide a qualitative distributional analysis.

In evaluating the distributional effects of a regulation, contextual considerations can be critical; for example, what appears to be a policy with an inequitable distribution of net benefits when analyzed in isolation may in fact be remedying inequitable conditions that exist in the

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[104] Amy Finkelstein and Nathaniel Hendren, "Welfare Analysis Meets Causal Inference," *Journal of Economic Perspectives* 34, no. 4 (2020): 155-156.
[105] Bas Jacobs, "The Marginal Cost of Public Funds Is One at the Optimal Tax System," *International Tax and Public Finance* 25 (2018): 883-912.

baseline. For that reason, it is often important to assess and present the distribution of conditions in the baseline, in addition to the distribution of regulatory effects. It may be useful for agencies to produce agency-specific guidance regarding the analysis of distributional effects, identifying particular groups likely to be affected by that agency's regulations or any methodological issues that are particularly relevant for that agency.

### b.   *When to Perform Distributional Analysis*

Reasonably available methodologies and data, as well as input from experts and the public, can inform an agency's determination as to whether production of a distributional analysis is practical, appropriate, permitted by law, and will produce relevant and useful information in a specific context. Distributional effects may merit specific attention when disaggregated analysis is required by the statute(s) under which the regulation is issued, warranted by the need for regulatory action identified in your regulatory analysis, or called for by an Executive Order.

Distributional effects exist whether or not a distributional analysis is produced. But by producing a distributional analysis, you may be able to better identify alternative regulatory options or impacts that can be mitigated through other regulatory or non-regulatory decisions, whether by your agency or others. Production of a distributional analysis therefore may, in some circumstances, allow for more effective consideration of regulatory alternatives. Accordingly, when you decide to conduct a distributional analysis of a regulation, you should also conduct distributional analyses for each of the regulatory alternatives presented in the regulatory analysis, consistent with the availability of resources, appropriate methods, and data. Such analysis can be particularly useful when the distributional effects are likely to be material to your decision to move forward with the regulation or to adopt one regulatory approach over other alternatives.

### c.   *Group Identification for Distributional Analysis*

If you conduct a distributional analysis, you will need to identify the groups across which estimates of the benefits, costs, and net benefits of a regulation are to be disaggregated. The groups that are relevant to the analysis will vary depending on the regulatory context. In general, it is most informative to focus analytic efforts on the groups for which the variation of regulatory effects is likely to be important in the context of your regulatory action. To the extent possible given available evidence, it is advisable for agencies to maintain consistency when identifying groups of interest across their regulations—particularly for regulations addressing similar concerns—or else explain their rationale for not doing so. Relatedly, if an agency identifies different groups of interest when analyzing regulations because of differences in the relevant statutory provisions underlying those regulations, the agency should state so explicitly.

It will sometimes be informative to consider whether a regulation's effects will differ by income group. A distributional analysis that focuses on income groups should be tailored to the context of the regulation under consideration. Frequently, an analysis by income classes or percentiles (*e.g.*, quintiles or deciles of the income distribution, if such data is available to you) will be most tractable and appropriate. However, other approaches may be more appropriate in certain circumstances. For statutory frameworks that operate by reference to the Federal poverty

thresholds or the Federal poverty guidelines, for example, an analysis by reference to those thresholds or guidelines may be most informative.

When choosing the unit of analysis, you should consider whether the unit of analysis could obscure the relevant distributional effects. For example, if a regulation affects only individuals in the lowest decile of income, summarizing by quartile will make the average size of such effects appear smaller. This concern is magnified if there are both positive and negative effects for subgroups within the constructed group. You will also need to consider whether to analyze income per individual, per family, or per household, and how to account for differences in household or family size when measuring income by group.

Other economic and demographic categories such as those based on race and ethnicity, sex, gender, geography, wealth, disability, sexual orientation, religion, national origin, age or birth cohort, family composition, or veteran status—among others—may be relevant to a particular regulation.[106] When this is the case, and when permitted by law, it may be useful to analyze the incidence of regulatory effects on each group of interest, or combinations of those groups, if relevant data are available. If identifying groups for distributional analysis by race and ethnicity, you should follow OMB's guidance on the topic.[107] Similarly, distributional analysis by gender should define gender categories according to OMB guidance.[108]

### d. *Producing a Distributional Analysis*

The guidance provided in this section is particularly relevant to quantitative distributional analyses, but may also be helpful in designing some qualitative analyses. Both types of analysis may be useful approaches for agencies looking to explore distributional effects.

If you determine that a distributional analysis that analyzes a regulation's effects on particular groups is appropriate, one consideration is whether you will need to take particular dynamics into account in establishing the baseline for the groups you are analyzing. For example, if a regulation is expected to affect a specific geographical region, you could consider the demographics of that region and whether those demographics are likely to change over time in the absence of the regulation.[109] For more discussion on this point, see the section "*Developing an Analytic Baseline*."

Next, you should estimate the regulation's effects on relevant groups, relative to the baseline, as well as the effects of regulatory alternatives under consideration. In some cases, members of different groups may exhibit systematically different responses to the same

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[106] Certain groups that are defined by Federal agencies, such as food-insecure or energy-insecure, may also provide context-relevant categories.

[107] As of the writing of this Circular, the most recent guidance on race and ethnicity categories is available in Revisions to the Standards for the Classification of Federal Data on Race and Ethnicity, 62 Fed. Reg. 58,782 (Oct. 30, 1997).

[108] As of the writing of this Circular, the most recent guidance on gender categories is available in *Interagency Technical Working Group on Sexual Orientation and Gender Identity Items in the Household Pulse Survey: Report and Recommendations* (April 2021), *https://omb.report/icr/202106-0607-003/doc/112605500*.

[109] Consistent with the following paragraph, you could also compare demographic changes in the baseline (if any) to how demographics are likely to change under each regulatory alternative under consideration.

regulation, which could be relevant to estimating the regulation's effects on each group. For each group, you should add benefits and transfers expected to be received by members of the group as a result of the regulation, and subtract costs and transfers expected to be paid by members.[110] It is important to include key categories of benefits, costs, and transfers in your analysis of each alternative, including both monetized and unmonetized effects, as feasible and appropriate. It may be difficult to determine who will ultimately bear the benefits and costs of any newly imposed regulation. For example, if a regulation is expected to raise a manufacturer's costs of production, that manufacturer may be able to pass on a portion of those costs to its customers in the form of higher prices. The portion of the cost burden that remains with the manufacturer may be split between owners of the manufacturer and its workers. Estimating where the incidence of such costs will fall may involve uncertainty. Your analysis should account for any important sources of uncertainty in your estimates.

In a distributional analysis, sound monetized estimates are preferred to non-monetized estimates where their production is feasible and appropriate. In some cases, where data limitations make monetization difficult, evidence related to distributional effects could be presented quantitatively–or if not quantitatively, then qualitatively—to the extent practicable. Agencies may consider planning to collect additional data if they expect to issue regulations that could be informed by such information in the future. In other cases, the distribution of regulatory effects may be clear from the available evidence, but the nature of the regulatory effect itself renders it difficult to monetize. Whenever distributional effects cannot be monetized or quantified in a distributional analysis, they can be described qualitatively. See the section "*Methods for Treating Non-Monetized Benefits, Costs, and Transfers*" for more detail on how to incorporate non-monetized effects into regulatory analysis.

Finally, when distributional effects are relevant to the agency's decision, you should summarize your results and describe your analysis in a manner that supports transparency and comprehensibility for policymakers and the public. For example, if your regulation is likely to have geographically differentiated effects, maps may help to clarify where the benefits or costs will be felt. Graphs or maps may be illustrative, though care should be taken to ensure that the format of such figures is accessible. It is generally not sufficient for your analysis to merely state that the chosen alternative does not make relevant groups worse off; it is important to analyze and describe the benefits and costs of different regulatory alternatives for relevant groups. Further, in such cases, agencies should endeavor to be specific, in a regulatory preamble or in the brief background section that introduces a regulatory analysis, about the nature of the distributional interests the agency is considering, in order to allow policymakers and the public to better understand the connection between the distributional interest being pursued and the analysis of the regulation. This interest may lead an agency to select a regulatory alternative with lower monetized net benefits over another with higher monetized net benefits because of the difference in how those net benefits are distributed in each alternative. See Section 1 of

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[110] When estimating the effects of a regulation on different groups, it is appropriate to take into account how the regulation will impact government tax collection where it is feasible to do so. For example, if a regulation increases wages of a given income group by $100, but that group's wage tax rate is 20%, only $80 of income should be attributed to the group, and the other $20 should be counted as increasing government revenues. *See* Amy Finkelstein and Nathaniel Hendren, "Welfare Analysis Meets Causal Inference," *Journal of Economic Perspectives* 34, no. 4 (2020): 146-167.

Executive Order 12866.

### e.  Weights and Benefit-Cost Analysis

In traditional benefit-cost analysis, the sum of the net benefits across society equals the aggregate net benefits of the regulation. Any approach to estimating aggregate net benefits uses distributional weights. An analysis that sums dollar-denominated net benefits across all individuals to measure aggregate net benefits—as the traditional approach generally does—adopts weights such that a dollar is equal in value for each person, regardless of income (or other economic status).[111]

Agencies may choose to conduct a benefit-cost analysis that applies weights to the benefits and costs accruing to different groups in order to account for the diminishing marginal utility of goods when aggregating those benefits and costs. Diminishing marginal utility means that an additional unit of a good is more valuable to a person if they have less of it than if they have more of it. Weights of this type are most commonly applied in the context of variation in net benefits by income, consumption, or other measures of economic status. If you decide to produce an estimate of net benefits utilizing such weights, you may treat it as your primary estimate of net benefits, or as a supplemental estimate. The same weights should be applied to benefits and costs consistently in each analysis, and the weights that you used in each analysis should be communicated clearly. As noted in the section "*Some General Considerations*" you should also present traditionally-weighted estimates (sometimes, albeit inaccurately, referred to as "unweighted" estimates) when conducting an analysis using weights that account for diminishing marginal utility.

One practical approach to implementing weights that account for diminishing marginal utility uses a constant-elasticity specification to determine the weights for subgroups defined by annual income.[112] To compute an estimate of the net benefits of a regulation using this approach, you first compute the traditional net benefits for each subgroup. You can then compute a weighted sum of the subgroup-specific net benefits: the weight for each subgroup is the median income[113] for that subgroup divided by the U.S. median income, raised to the power of the elasticity of marginal utility times negative one.[114] OMB has determined that 1.4 is a reasonable

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[111] Takashi Negishi, "Welfare Economics and Existence of an Equilibrium for a Competitive Economy," *Metroeconomica* 12, nos. 2-3 (1960): 92-97.

[112] Subgroups can also be defined by lifetime income, consumption, or other measures of economic status when data is available and doing so is appropriate and relevant in the regulatory context.

[113] There may be circumstances where specifying weights as a function of the mean, rather than median, income for each subgroup is appropriate for your analysis, such as when it increases consistency between the calculated weight and the incidence of benefits and costs within the subgroup. For example, if the incidence of net benefits is proportional to income, mean income may be the more appropriate measure of income, whereas if the incidence of net benefits is per capita, median may be the more appropriate measure.

[114] In other words, you can compute a weighted sum of the subgroup-specific net benefits where the weight for subgroup $i$, denoted $w_i$, is

$$w_i = \left(\frac{\bar{y}_i}{y_{\text{med}}}\right)^{-\varepsilon}$$

estimate of the income elasticity of marginal utility for use in regulatory analyses.[115] This determination is based on a survey of empirical evidence that can provide insight into the shape of the utility function assuming an underlying utility specification with a constant elasticity. For more discussion, see the section "Weights and Benefit-Cost Analysis" in the accompanying preamble, "Preamble: Proposed OMB Circular No. A-4, 'Regulatory Analysis.'"

If you are using population averages for benefits or costs, you should consider that such values may be implicitly weighted already, and strive to weight all benefits and costs consistently. For example, it is appropriate to use a value for mortality risk reductions (sometimes referred to as the value of a statistical life, or VSL) that does not depend on the income of the sub-population to which the mortality risk reduction benefits accrue, consistent with the guidance provided elsewhere in this Circular.[116] This amounts to weighting mortality risks by the income elasticity of marginal utility (given that it is also the income elasticity of individuals' valuations of a marginal mortality risk). In practice, therefore, you should not apply income weights to such values of mortality risk reductions; they have already been weighted by income.

## 11. Treatment of Uncertainty

The precise consequences (benefits, costs, and transfers) of regulatory options are not generally known for certain, as there may be uncertainty regarding the incidence and magnitudes of such consequences and the probability of their occurrence. However, reasonable estimates of such uncertain consequences can often be developed. An effect of a regulation should not be excluded from a regulatory analysis simply because its estimation is highly uncertain. There may be other reasons to exclude effects (*e.g.*, because the size of the effect is negligible). But even for highly uncertain effects, it is often possible to use available evidence to produce estimates of those effects for inclusion in a regulatory analysis that are more accurate than assuming uncertain effects do not occur or have no benefits or costs. Moreover, inclusion of uncertain effects is necessary for the robustness of a regulatory analysis when those uncertain effects are an important contributor to the benefits, costs, and transfers of a regulation. However, you should be particularly careful when interpreting effects that are highly speculative.

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In this formula, $\bar{y}_i$ is the median income for subgroup $i$, $y_{\text{med}}$ is U.S. median income, and $\varepsilon$ is the elasticity of marginal utility. As noted previously, you will need to consider how to account for differences in household or family size when measuring income by group.

    More generally, calculating the income weighted sum of subgroup-specific net benefits is most useful when net transfers to government—if the analysis does not account for what such governments do with such transfers—are small relative to other effects, and thus the estimate of income weighted net benefits is relatively insensitive to the weighting applied to such transfers. Note that an appropriate weighting for effects on government budgets depends on the use or source of funds, which will often be indeterminate in regulatory contexts. Also note that altering this approach would be necessary when analyzing regulations with an international scope. See the section "*Scope of Analysis*" for more discussion of such regulations.

[115] As the economic literature estimating the income elasticity of marginal utility continues to improve, OMB's best estimate of this value may be refined in future revisions of this Circular.

[116] Agencies' standard practice, which this Circular has implicitly endorsed since 2003, has been to apply VSLs in regulatory analysis that do not vary by income for all U.S. citizens and residents at a given point in time. This can be viewed as a way in which income weighting has long been integrated into the traditional approach to regulatory analysis.

It will often be helpful to begin your analysis of uncertainty at the earliest possible stage in developing your analysis. It may be informative to consider both the statistical variability[117] of key elements underlying the estimates of benefits, costs, and transfers (for example, the expected change in the distribution of automobile accident deaths that might result from a change in automobile safety standards) and the incomplete knowledge about these key elements or relationships among key elements (for example, the uncertain knowledge of how driver behavior might affect automobile accident outcomes).[118] Assessing important sources of uncertainty and the way in which benefit and cost estimates may be affected under plausible assumptions often provides useful information to decision makers and the public about the effects and the uncertainties of alternative regulatory actions. Both qualitative and quantitative assessments of uncertainty can provide useful information. It is generally helpful to distinguish between the uncertainties regarding accuracy of estimates and the precision of estimates.[119]

The treatment of uncertainty should be guided by the same principles of full disclosure and transparency that apply to other elements of your regulatory analysis. Your analysis should be credible, objective, realistic, and scientifically balanced.[120] You should generally discuss the sources of the available data used and any particularly significant aspects of its quality. Inferences and assumptions used in your analysis should be identified, and your analytical choices should be adequately justified. If the analytic results are sensitive to a given assumption or data source, alternative modeling assumptions or data sources can be used to demonstrate the sensitivity of the results. Alternative data and models that you use to analyze uncertainty should be described in detail or with references to ensure the public can find such information. In your presentation, it is informative to delineate the strengths of your analysis along with important uncertainties about its conclusions. Your presentation should also generally explain, when relevant, how your analytical choices have significantly affected your results.

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[117] In some contexts, the word "variability" is used as a synonym for statistical variation that can be described by a theoretically valid distribution function, whereas "uncertainty" refers to a more fundamental lack of knowledge. Throughout this discussion, we use the term "uncertainty" to refer to both concepts.

[118] In addition to distinguishing between the underlying probabilistic nature of an element (aleatory uncertainty) and incomplete knowledge about elements (epistemic uncertainty) noted previously, it may be useful to distinguish between two types of epistemic uncertainty: measurement uncertainty and model (or process) uncertainty. Measurement uncertainty exists because of the challenges in accurately and precisely measuring various properties in the world. This sort of uncertainty can usually be described statistically; when considering measurement uncertainty, you may wish to describe the robustness of estimates to alternative measurement techniques and assumptions. Model uncertainty refers to uncertainty about which model—*i.e.*, description of the causal relationship among elements—best describes the underlying relationships. While modeling choices should be grounded in the best available science, there is often more than one model that is consistent with the available evidence. Model uncertainty is more difficult to describe statistically than measurement uncertainty, often because of conceptual challenges or a lack of variability in data that would enable the model uncertainty to be reduced to measurement uncertainty. Still, when feasible, you could consider multiple models to establish robustness and reduce model uncertainty.

[119] Accuracy refers to how close an estimate is to the true value in question. Precision refers to the resolution of that estimate (*e.g.*, the number of significant figures for a numerical estimate). See the section "*Precision of Estimates*" for more details.

[120] When disseminating information, agencies should follow their own information quality guidelines, issued in conformance with the OMB government-wide guidelines. *See* Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies; Republication, 67 Fed. Reg. 8452 (Feb. 22, 2002).

In some cases, the level of scientific uncertainty—including economic uncertainty—may be so large that you can only present discrete alternative scenarios without assessing the relative likelihood of each scenario quantitatively. In such cases, you might choose to present results from a range of plausible scenarios, together with any available information that might help in qualitatively determining which scenario is most likely to occur and the likelihood relative to other scenarios.

In some situations, particularly where irreversibility is material to your analysis, such as when you are regulating an exhaustible resource or an endangered species, or when the timing of economic developments is central to your regulation's benefits and costs, it may be useful to analyze a regulation with uncertain effects as an option (referred to in the academic literature as "real options" analysis).[121] The assessment of real options allows you to monetize the benefits and costs of changing the timing of regulatory effects in light of the value of information about potential states of the world that can be learned over time. The costs of shifting the timing of regulatory effects further into the future may be especially high when regulating to protect against irreversible harms. For example, a regulation that preserves a natural resource today may preserve option value associated with future uses of that resource that are unknown today. Over the duration of time that regulatory effects are deferred, you may learn additional information that reduces uncertainty about some of those regulatory effects. When uncertainty about the regulation's effects stems from a lack of data sources, you may want to collect appropriate data as part of regulatory action. Formal tools for assessing the value of additional information are well developed in the applied decision sciences and can be used when appropriate.[122] You may wish to consider doing original research, if feasible and appropriate to your regulation. Decision trees may be helpful visual devices in analyzing real option value.

### a. Quantitative Analysis of Uncertainty

Uncertainty can often be subject to quantitative analysis, broadly defined. Examples would include quantitative estimates of the probabilities of environmental damage (for example, to soil or water, the possible loss of habitat, or endangered species), probabilities of harm to human health and safety, etc. There are also uncertainties associated with monetizing estimates of economic benefits and costs, such as improved consumer health associated with a regulation that increases safety (a regulatory benefit) or the additional costs of implementing these safety improvements (a regulatory cost). Thus, your analysis may benefit from including multiple components of uncertainty, reflective of the number of inputs used to generate an impact estimate; for example, a quantitative analysis characterizing the probabilities of the relevant outcomes (that are not already valued in monetary terms) and an assignment of economic value

[121] *See* Avinash K. Dixit and Robert S. Pindyck, *Investment under Uncertainty* (Princeton: Princeton University Press, 1994); Anthony E. Boardman et al., "Risk, Option Price, and Option Value," in *Cost-Benefit Analysis: Concepts and Practice*, 5th ed. (Cambridge: Cambridge University Press, 2018); Nancy L. Stokey, *The Economics of Inaction: Stochastic Control Models with Fixed Costs* (Princeton: Princeton University Press, 2008); Joe Vladeck, Note, "Valuing Regulatory Flexibility: A Real Options Approach to Cost-Benefit Analysis," *Georgetown Law Journal* 103 (2015): 797-824.

[122] *See, e.g.*, Warren B. Powell and Illya O. Ryzhov, *Optimal Learning*, (John Wiley & Sons, 2012); Adam M. Finkel & John S. Evans, "Evaluating the Benefits of Uncertainty Reduction in Environmental Health Risk Management," *Journal of the Air & Waste Management Association* 37, no. 10 (1987): 1164-1171.

to the projected outcomes.  It is essential that both parts be conceptually consistent.  In particular, the quantitative analysis should be conducted in a way that permits it to be applied within a more general analytical framework, such as benefit-cost analysis. For example, you should address explicitly the implications for benefits, costs, and transfers of any probability distributions developed in your analysis.

As with other elements of regulatory analysis, you will need to balance thoroughness with the practical limits on your analytical capabilities and the opportunity cost of more thorough analysis of uncertainty. Your analysis does not have to be exhaustive, nor is it necessary to evaluate each alternative at every step. Your analysis should target the inputs, approaches, and assumptions that have particularly significant effects on the analytic results, and that are subject to significant uncertainty. The overall goal is for the inputs, approaches, and assumptions in your analysis to be clearly identified and consistent with the relevant science. Your analysis should provide sufficient information for decision makers to grasp the degree of scientific uncertainty and the robustness of estimated probabilities, benefits, and costs to changes in key assumptions.

Your estimates cannot usually be more precise than their most uncertain component.[123] Thus, your analysis should, when feasible and appropriate, report estimates in a way that reflects the degree of uncertainty and does not create a false sense of precision (see the section "*Precision of Estimates*" for more details), including using appropriate significant figures. Worst-case or bounding analyses do not adequately convey the complete probability distribution of outcomes, and are therefore of limited use in the context of conducting uncertainty analysis. Whenever it is feasible to quantitatively characterize the probability distributions, you should provide some estimates of central tendency (*e.g.*, mean or median) in addition to ranges, variances, specified low-end and high-end percentile estimates, and other characteristics of the distribution. Expert elicitation, discussed in more detail below, can be helpful in bridging the gap between existing evidence and the information required to produce such estimates. Even when probability distributions are unknown, an assumption about the distribution may be implied in your analysis. When this is the case, you should try to make these assumptions explicit.[124]

When feasible, you should use appropriate statistical techniques to determine a probability distribution of the relevant outcomes. For regulations with projected annual economic effects of $1 billion or more, you should, when feasible and appropriate, present a formal quantitative analysis of the relevant uncertainties about benefits, costs, and transfers, *i.e.*, provide an estimate of the probability distribution of regulatory effects.

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[123] The exception is distributions where component variables have negative covariance, as this could produce estimates with more precision than the most uncertain component.

[124] In many health and safety regulations, analysts rely on formal risk assessments that address a variety of risk management questions, such as the baseline risk for the affected population, the safe level of exposure, or the amount of risk that would be reduced by various interventions. Because the answers to some of these questions are directly used in benefits analyses, the risk assessment methodology must allow for the determination of expected benefits in order to be comparable to expected costs. This means that bounding exercises unaccompanied by central estimates are likely to result in benefit estimates that exceed the appropriate certainty-equivalent (see the section "*Economic Values of Uncertain Outcomes*") or expected value measure.

For regulations with projected gross annual benefits, costs, or transfers of $200 million[125] to $1 billion, you should seek to use more rigorous approaches to accounting for uncertainty when analyzing such higher consequence regulations. This is especially helpful when net benefits are projected to be close to zero and uncertainty is substantial. More rigorous uncertainty analysis may not be valuable for regulations in this category if simpler techniques are sufficient to show robustness, *i.e.*, that net benefits are relatively unaffected by changes in uncertain parameters or models. You may find it helpful to consider the following analytical approaches that entail increasing levels of complexity:

- Discuss qualitatively the main uncertainties in each important input to the calculation of benefits, costs, and transfers. These disclosures would address the uncertainties in the data as well as in the analytical results. However, as previously mentioned, regulations above the $1 billion annual threshold should receive a formal treatment when feasible and appropriate.
- Use a numerical sensitivity analysis to examine how the results of your analysis vary with plausible changes in assumptions, choices of input data, and alternative analytical approaches. Sensitivity analysis is especially valuable when the information is lacking to carry out a formal probabilistic simulation. Sensitivity analysis can be used to find "switch points," critical parameter values at which estimated net benefits change sign or the alternative with the most net benefits switches. Sensitivity analysis usually proceeds by changing one variable or assumption at a time, but it can also be done by varying a combination of variables simultaneously to learn more about the robustness of your results to widespread changes.
- Apply a formal probabilistic analysis of the relevant uncertainties, possibly using simulation models or expert judgment as revealed, for example, through Delphi methods.[126] Expert judgment is often elicited through a survey process which eliminates certain interactions between experts, and may be a useful way to fill key gaps in your ability to assess uncertainty.[127] These expert elicitations, along with other sources of data, can be combined in Monte Carlo simulations to derive a probability distribution of benefits and costs. Such a formal analytical approach is often appropriate for complex regulations where there are large, multiple uncertainties whose analysis raises technical challenges, or where the effects cascade.
  - For example, in the analysis of regulations addressing air pollution, there is uncertainty on the benefits side about the effects of the regulation on future emissions, about how the change in emissions will affect air quality, about how changes in air quality will affect health, and about the economic and social value of the change in health outcomes. Importantly, there is also uncertainty on the cost side, such as uncertainty about the pace of innovation in—and

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[125] As updated under the Executive Order of April 6, 2023 (Modernizing Regulatory Review).

[126] The purpose of Delphi methods is to generate suitable information for decision making by eliciting expect judgment. *See* M. Granger Morgan and Max Henrion, *Uncertainty: A Guide to Dealing with Uncertainty in Quantitative Risk and Policy Analysis* (Cambridge: Cambridge University Press, 1990).

[127] *See* Anthony O'Hagan et al., *Uncertain Judgements: Eliciting Experts' Probabilities* (John Wiley & Sons, 2006); Robert T. Clemen, *Making Hard Decisions: An Introduction to Decision Analysis*, 2nd ed. (Duxbury, 1996); Committee on Assessing Approaches to Updating the Social Cost of Carbon, National Academies of Sciences, Engineering, and Medicine, "Appendix C," in *Valuing Climate Changes: Updating Estimation of the Social Cost of Carbon Dioxide* (2017), 221-228.

diffusion of—emission-reducing technologies both in the absence of regulations and in response to regulations, about the costs of such technologies, and about other components of compliance costs. There is also uncertainty about distributional incidence of regulatory effects.

New methods of analyzing uncertainty may become available in the future. This Circular is not intended to discourage or inhibit their use (or the use of other available and appropriate methods), but rather to encourage and stimulate their adoption as appropriate.

### b. *Economic Values of Uncertain Outcomes*

In developing benefit, cost, and transfer estimates, you may develop probability distributions of values for each outcome.  When this is the case, you will need to combine these probability distributions to provide estimates of total benefits, costs, or transfers. Where there is a distribution of outcomes, you may often find it useful to emphasize summary statistics or figures that can be readily understood and compared to achieve the broadest public understanding of your findings.

In measuring the value of uncertain outcomes, you will need to determine how to account for risk preferences, including risk aversion. It is important to note that this guidance is not intended to preclude the use of any reasonable and appropriate assumptions about risk preferences suitable to your regulatory context. People are risk averse when they prefer more certain outcomes to less certain outcomes with the same expected value. Risk aversion is widespread, and the underlying motivation for insurance in many economic models. For example, people often purchase life insurance because they value the financial protection for their beneficiaries in the case of their premature death more than the insurance premiums that they must pay. However, you should be mindful that not all relevant parties are risk averse, and therefore risk aversion may not be an appropriate assumption in all parts of your analysis. For example, firms are often not risk averse[128]; in such cases, if your regulation is, for instance, intended to encourage investments in undemonstrated technology to reduce harmful emissions, modeling firms as risk averse would often result in incorrect adoption or diffusion rate estimates.[129] To the extent practicable and when appropriate, you should develop an analysis that takes risk aversion into account. The below paragraphs provide some guidance on how this may be accomplished.

You should attempt to determine the risk preferences of the population impacted by your regulation when it is material to your analysis. As noted previously, risk aversion is widespread, and is consistent with common models of rational preferences.[130] Nevertheless, there are a variety of circumstances in which risk aversion may not be material to your analysis and you could appropriately assume risk neutrality. First, and perhaps most commonly, when a regulation

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[128] But there are various reasons why even risk-neutral firms may behave as if they are risk averse. *See* Louis Eeckhoudt, Christian Gollier, and Harris Schlesinger, "The No-Loss Offset Provision and the Attitude Towards Risk of a Risk-Neutral Firm," *Journal of Public Economics* 65, no. 2 (1997): 207-217.

[129] Firms may be slow to adopt undemonstrated technologies for reasons other than risk aversion, such as first-mover disadvantages, loss aversion, etc.

[130] Charles A. Holt and Susan K. Laury, "Chapter 4 - Assessment and Estimation of Risk Preferences," in *Handbook of the Economics of Risk and Uncertainty*, eds. Mark J. Machina and W. Kip Viscusi (2014), 135-201.

has modest effects on each person or group that is affected, or when a regulation's net benefits are almost identical in different states of the world, it will often be reasonable to ignore risk preferences in your analysis because the consequences of incorporating them would be negligible.[131] Second, when people are already fully insured against a risk or could choose to be so, regulations affecting that risk may not offer any additional insurance benefits to the affected population.[132] As a result, when a regulation only addresses such risks, consideration of risk aversion may not be material to estimating the benefits and costs of the regulation. However— due to incomplete markets, the existence of uninsurable risks, and other distortions—full insurance may not be obtainable, and it is generally not appropriate to presume the existence of full insurance unless there is evidence that it is present. In these circumstances, if your analysis takes a risk-neutral approach, you should explain why. Finally, as noted previously, while risk aversion is widespread, there may be contexts in which some people are risk-neutral or risk-seeking. If there is evidence that this is the case in a context that is relevant to your regulation, you should alter your analysis accordingly.[133] These three cases are not intended to be exhaustive.

When considering risk, it is critical to consider how uncertainty about a regulation's effects relates to the uncertainty about the baseline (or uncertainty that people are exposed to in the baseline). All else held equal, a regulation that has more beneficial effects when outcomes in the baseline are better, and less beneficial effects when outcomes in the baseline are worse, is worth relatively less than a regulation that has more beneficial effects when outcomes in the baseline are worse, and less beneficial effects when outcomes in the baseline are better. That is, due to diminishing marginal utility, a regulation with benefits that are positively correlated with baseline outcomes has a lower value than an otherwise identical regulation with benefits that are negatively correlated with baseline outcomes.

Certainty-equivalent valuations provide a useful tool for comparing different possible outcomes. For an uncertain benefit, the certainty-equivalent is the number of certain dollars that the uncertain benefit is worth to its recipient. A certainty-equivalent valuation can be thought of as the expected value of a benefit or cost less a premium that reflects risk aversion. For example, suppose that a particular regulation reduces the probability of fire in a particular type of facility. As part of a benefit-cost analysis for this regulation, the dollar value of the expected reduction in fire losses might be calculated.[134] The owners of the protected facilities may place a higher dollar

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[131] If two or more related regulations are issued in sequence, it may be the case that these regulations interact in consequential ways. Your assessment of risk, as with other aspects of the regulatory analysis, should strive to count all effects of these regulations exactly once across these analyses. This can be achieved through a variety of approaches; the approach that is most likely to be appropriate is for a second regulation to account for the effects of the first regulation in its baseline.

[132] This result may not hold if the transaction costs of becoming fully insured are substantial.

[133] You should be cautious before adopting an assumption that evidence supports risk-seeking behavior. For example, people who gamble—despite zero expected gains or even expected losses—may be both risk-averse and put a positive value the social or competitive aspect of their particular game. John Conlisk, "The Utility of Gambling," *Journal of Risk and Uncertainty* 6, no. 3 (1993): 255-275. Alternatively, those individuals may instead erroneously overrate their skill, or be addicted to gambling; see the section "*Behavioral Internalities*" on accounting for such benefits and costs.

[134] Market conditions—especially availability of insurance, as noted above—would affect the relevance of the expected value of fire losses to a benefit-cost-transfer analysis, but for simplicity of explanation, such considerations are set aside in this illustrative example.

value on the lessening of risk of a fire than the expected dollar value of the loss. If so, it would be demonstrated by a willingness-to-pay for fire insurance in excess of the expected value of claims. Therefore, the owners' relative net cost (the percentage difference between insurance premiums and expected value of insurance company claims payments) for fire insurance can be used to increase the expected dollar values of the reduction in fire loss to its certainty-equivalent value.

One way to incorporate risk aversion into a regulatory analysis is to directly determine individuals' certainty-equivalent valuations for relevant benefits or costs through their willingness to pay for (or willingness to accept) specific outcomes related to a regulation. In some cases, it may be possible to infer this valuation via revealed preference, using individuals' behaviors in markets (or other situations involving trade-offs), as discussed previously. Individuals' willingness to pay for insurance, for example, may be indicative of their valuation of the protection from a risk that may be achieved by regulatory intervention (in a related context for which insurance is not available). Where revealed preference methods do not yield an estimate, you may be able to rely on stated preferences. Both of these methods of eliciting certainty-equivalent valuations can be flawed, however, as individuals often display both decision-making and judgment biases when considering decisions that would generate small changes in the probabilities of low-probability events in the baseline that have large costs when they occur.[135] For similar reasons, there are challenges in eliciting the willingness to pay to avoid risks that are unprecedented, or that primarily accrue to other people (*e.g.*, future generations).

Another approach is to translate the valuation of uncertain outcomes into certainty-equivalent valuations by modeling individual preferences, for example, using an assumed utility function. Under this approach, you would first estimate the distribution of possible outcomes, and then convert these estimates of outcomes into ex-ante certainty-equivalent values using an appropriate utility function. One simple approach uses a constant elasticity utility function.[136] Other methods of incorporating risk aversion are also available. To allow for a distinction between risk aversion and the intertemporal elasticity of substitution, economists frequently employ Epstein-Zin preferences.[137] Similarly, you may determine that the assumption of constant relative risk aversion, implicit in the constant elasticity approach, is inappropriate in your context. As with other aspects of your regulatory analysis, you should balance thoroughness with practical constraints, including when deciding whether to calculate certainty equivalents or use other methods to assess uncertainty.

### c. *Alternative Inputs, Approaches, and Assumptions*

If benefit or cost estimates depend heavily on particular inputs, approaches, or

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[135] Colin F. Camerer and Howard Kunreuther, "Decision Processes for Low Probability Events: Policy Implications," *Journal of Policy Analysis and Management* 8, no. 4 (1989): 565-592.

[136] OMB provides a default estimate of the elasticity of marginal utility of 1.4 for use in income weighted benefit-cost analysis. (See the section "*Distributional Effects*" for more discussion of income weighted benefit-cost analysis.) The constant elasticity utility function uses the same parameter to value the aversion to uncertain outcomes and aversion to inequality across a population, but empirical estimates of risk aversion vary, and different values may be appropriate in different regulatory contexts.

[137] *See* Larry G. Epstein and Stanley E. Zin, "Substitution, Risk Aversion, and the Temporal Behavior of Consumption and Asset Returns: An Empirical Analysis," *Journal of Political Economy* 99, no. 2 (1991): 263-286.

assumptions, it is often informative to make those details explicit and carry out sensitivity analyses using plausible alternatives. If the value of net benefits changes from positive to negative (or vice versa) or if the relative ranking of regulatory options changes with alternative plausible inputs, approaches, or assumptions, you should generally consider conducting further analysis to inform the determination of which of the alternatives is more appropriate. Because different estimation methods may embed different assumptions, you may find it helpful to analyze estimation methods carefully to make any hidden assumptions explicit.

## 12. Discount Rates

Benefits and costs often take place in different time periods. When this occurs, simply adding all of the expected benefits or costs without regard for when they actually occur fails to account for differences in those values that result from the differences in timing. If benefits or costs are delayed or otherwise separated in time from each other, the difference in timing should be reflected in your analysis through appropriate discounting.

As a first step, you should present the undiscounted annual time stream of benefits, costs, and transfers expected to result from a regulation, clearly identifying when they are expected to occur. A logical beginning point for your stream of estimates would be the year in which the regulation will begin to have effects, even if that is expected to be some time in the future.[138] The ending point for analysis of each regulatory alternative should be far enough in the future to encompass, to the extent feasible, all the important discounted benefits, costs, and transfers likely to result from all regulatory alternatives under consideration. You generally should not, for example, select an ending point after which the relative size of benefits or costs is likely to change in a way that could change the sign of the estimated net benefits, change the relative ranking of regulatory alternatives, or otherwise have effects relevant to the public or policymakers. Though estimates of some effects may become more uncertain over time, the applicable guidance on dealing with uncertainty (see the section "*Treatment of Uncertainty*") provides methods for assessing uncertain effects that will provide more robust analysis than artificially shortening your time horizon.

To avoid the misleading effects of inflation in your estimates, it is important to measure the stream of effects in constant dollars. If the benefits and costs are initially measured in prices reflecting expected future inflation, you can convert them to constant dollars by using an appropriate inflation index that corresponds to the affected markets.[139]

### a. *The Rationale for Discounting*

All future effects, regardless of what form they take (*e.g.*, changes to consumption, health, environmental amenities, etc.), should be discounted to reflect changes in valuation of impacts across time. The present value of an impact depends on the timing of the impact and the appropriate discount rate. Benefits or costs that occur sooner are generally understood to be more valuable, all else equal. The main rationales for the discounting of future impacts are:

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[138] You may also choose to use a different starting date if you have compelling reasons to do so.

[139] Please note any conversion into constant dollars is a separate calculation from discounting future effects to present value, as described below.

(a) If consumption continues to increase over time—as it has for most of U.S. history—an increment of consumption will be less valuable in the future than it would be today (all else equal); as total consumption increases, the value of a marginal unit of consumption declines.
(b) People may exhibit "pure time preference," meaning that even in the absence of future changes in consumption, people prefer consumption now rather than later.
(c) In addition, regulations that displace or induce capital investments at a point in time can affect future consumption differently than regulations that increase or decrease consumption at a point in time, because capital investments are normally expected to yield a positive return.

It is helpful to carefully consider the analytic time length of benefit and cost streams in the context of your analysis when discounting. Somewhat different considerations apply in the context of discounting long-term effects, as explored further in the section "*Long-Term Discounting*" below. Several reasonable approaches to discounting are presented in this section.

### b. *Discounting in General*

A discount factor is used to adjust the estimated benefits, costs, and transfers of a regulation for differences in timing. The further in the future the effects are expected to occur, the more they are discounted. If the discount rate is constant, the discount factor for a particular year can be calculated as $1/(1+ \text{the discount rate})^t$ where "t" measures the number of years[140] in the future that the benefits, costs, or transfers are expected to occur. Effects that have been adjusted in this way are called "discounted present values" or simply "present values." Only when the estimated benefits and costs have been discounted can effects occurring across different time periods be added together to determine the overall present value of net benefits.

In your analysis, it is advisable to carefully consider the types of effects that need to be discounted. Depending on the effects that you are analyzing, you may be discounting using rates reflecting either society's perspective or a private entity's perspective. The social rate of time preference corresponds to the rate at which society is willing to trade current consumption for future consumption. However, you may be estimating underlying private behavioral changes that inform estimates of the effects of your regulation. Modeling private behaviors requires the use of appropriate private discount rates faced by the relevant populations. When estimating private discount rates, ideally the appropriate distribution of rates faced by affected populations should be considered. In addition, you should consider if readily available market rates are appropriate approximations of private discount rates. Once necessary private behaviors are modeled, then the social discount rate can be applied to ascertain the social welfare effects (benefits and costs) of a regulation. The guidance below generally pertains to society's perspective rather than private entities' perspective.

#### i. *A Default Approach to the Social Rate of Time Preference*

One approach assumes that the real (inflation-adjusted) rate of return on long-term U.S.

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[140] For simplicity, units of whole years are typically used.

government debt provides a fair approximation of the social rate of time preference. It is the rate available on riskless personal savings and is therefore a rate at which individuals may increase future consumption at the expense of current consumption. It is also the rate at which society as a whole can trade current consumption for future consumption.[141]

Over the last thirty years,[142] this rate has averaged around 1.7 percent in real terms on a pre-tax basis. OMB arrives at this figure by considering the 30-year average of the yield on 10-year Treasury notes minus the average annual rate of change in the consumer price index (CPI) over the period within that 30 years that 10-year Treasury Inflation Protected Securities are not available (currently, 1993 to 2002), and the yield of 10-year Treasury Inflation Protected Securities over the period they are available (currently, 2003 to 2022).[143] This produces a real 10-year rate of 1.7 percent,[144] and corresponds to a social rate of time preference of 1.7 percent.

For simplicity, transparency, and tractability, OMB is setting one default rate for social rate of time preference for all effects from the present through 30 years into the future, rather than a more elaborate discount rate schedule.[145] For the longer term, see the section "*Long-Term Discounting*" below.

### ii. Alternative Approaches

There are other appropriate approaches to discounting.[146] For example, you may also analyze the welfare effects of your regulation in an economic model in which the evolution of the discount rates is endogenous. One common approach to discounting along these lines that you may choose to adopt is the Ramsey approach, which is based on the Ramsey model.[147] The key tradeoff in the Ramsey model is the timing of consumption versus savings, with preferences based on a constant elasticity of marginal utility of consumption. The agent accumulates productive capital, which earns a rate of return, in order to generate future

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[141] Depending on assumptions about the mechanisms by which, for example, the government shifts the timing of consumption.

[142] As of the time of this Circular's writing, these thirty years cover 1993 through 2022.

[143] The 2003 version of this Circular similarly estimated the social rate of time preference using a 30-year average of 10-year Treasury notes less the average annual rate of change in the CPI. OMB believes that 10-year Treasury Inflation Protected Securities, which were not an available measure in 2003, provide a more accurate measure of the real (inflation-adjusted) return of 10-year Treasury notes.

[144] The pre-tax return is appropriate for these purposes because the marginal tax rate on interest is modest for much of the population, and borrowers cannot deduct personal interest.

[145] Thirty years matches the term of the longest-duration Treasury bond, and therefore the limit on directly observed interest rates on long-term U.S. government debt. Beyond this point, it becomes more important to allow for dynamic rates, as the effect of "[u]ncertainty about future interest rates … does not 'kick in' until we are out of the range of a near-future period within which we can feel confident projecting forward today's relevant interest rates." Martin L. Weitzman, "Just Keep Discounting, but…" in *Discounting and Intergenerational Equity*, eds. Paul R. Portney and John P. Weyant (New York: Resources for the Future, 1999), 23-29.

[146] They may be particularly appropriate when regulations have general equilibrium effects that affect the appropriate discount rate. See the section "*Partial and General Equilibrium Analysis*" for more details.

[147] Frank P. Ramsey, "A Mathematical Theory of Saving," *Economic Journal* 38, no. 152 (1928): 543-559. The Ramsey model was developed as a model of a single, representative, infinitely-lived agent who can consume or save with one type of capital and who faces no uncertainty; it has also been interpreted as having many types of capital, all of which are all perfectly substitutable, or many agents whose aggregate behavior matches that of the representative agent.

consumption. In the Ramsey model, the social rate of time preference reflects the representative agent's preferences for utility in one period relative to utility in a later period, and the value of additional consumption as income changes. These factors are combined in the equation

$$r_t = \rho + \eta g_t$$

where $r_t$ is the social rate of time preference in year $t$, $\rho$ is the pure rate of time preference, $\eta$ is the elasticity of the marginal utility of consumption, and $g_t$ is the representative agent's consumption growth rate in year $t$. There are a variety of established methods of calibrating Ramsey parameters. For example, the model can be calibrated so the social rate of time preference matches market data on real interest rates[148] or to allow the social rate of time preference to be a function of empirical estimates of the pure rate of time preference, the elasticity of the marginal utility of consumption, and per capita consumption growth.[149]

Undertaking the Ramsey approach[150] may appear to be more complicated than estimating the social rate of time preference using interest rates on long-term U.S. government debt, as outlined earlier, but explicit modeling of discount rates has a firm grounding in the underlying economics of welfare analysis, when the model is designed to well-approximate relevant preferences and behaviors. If you take a Ramsey approach to discounting, a number of assumptions need to be made in order to inform the selection of parameter values. Consequently, any agency that wishes to use this or other alternative approaches to discounting should confer with OMB before proceeding.

Agencies may also choose to consider, as appropriate, the rich and developing economics literature that, for example, extends the Ramsey framework to multiple sources of capital that are not perfect substitutes, introduces risk, allows the elasticity of marginal consumption to be a function of consumption level (or be time-varying), and adds overlapping generations of agents. In addition, as noted previously, the Ramsey formula is derived from a utility function that uses a single elasticity parameter to reflect numerous and often distinct preferences: various studies have derived more complex versions of the Ramsey formula using preference specifications with additional parameters.[151]

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[148] *See, e.g.*, Ben Groom et al., "The Future, Now: A Review of Social Discounting," *Annual Review of Resource Economics* 14, no. 1 (2022): 467-491.

[149] Note that when calibrating the Ramsey formula approach so that the discount rate matches market data on real interest rates, certain estimates of near-term consumption growth and of the elasticity of marginal utility (see the discussion of such estimates in the section "*Weights and Benefit-Cost Analysis*") would be most consistent with an estimated negative rate of time preference. Such a result may indicate that a more complicated model of the economy could increase descriptive precision relative to the Ramsey approach. *See, e.g.*, Gauti B. Eggertsson, Neil R. Mehrotra, and Jacob A. Robbins, "A Model of Secular Stagnation: Theory and Quantitative Evaluation," *American Economic Journal: Macroeconomics* 11, no. 1 (2019): 1-48.

[150] Note that this approach can be supplemented along many dimensions (*e.g.*, with uncertainty, Epstein-Zin preferences, etc.).

[151] A survey of economists found that when those surveyed responded to questions about discounting, their responses implied the use of modified versions of the Ramsey formula, suggesting that exploring augmented versions of the Ramsey formula could capture additional nuance. *See* Moritz A. Drupp et al., "Discounting Disentangled," *American Economic Journal: Economic Policy* 10, no. 4 (2018): 109-134. Some studies augment the elasticity parameter by using recursive (Epstein-Zin) preferences that separate aversion to risk from aversion to

The discounting considerations reviewed in this section are not exhaustive. To the extent other considerations are relevant to discounting in a specific regulatory context, you may choose to incorporate them as appropriate and feasible either as a primary or supplemental analysis.[152]

### c. Accounting for Effects on Capital

Regulations that displace or induce capital investments at a point in time may affect present and future consumption differently than regulations that increase or decrease consumption at a point in time. This arises because the return on capital need not equal the social rate of time preference, as taxes on capital, other economic distortions, and missing markets can create a sustained divergence between these rates of return and among rates of return to different capital.[153] Such distortions may include, for example, returns to capital investments stemming from unpriced social externalities, risk premia, and market power.[154] This divergence can persist despite the tendency for capital to flow to where it can earn the highest rate of return.

The analytically preferred method of handling temporal differences between benefits and costs is to adjust all the benefits and costs to reflect their value in equivalent units of consumption before discounting them.[155] This approach to discounting is sometimes called the "shadow price" approach, because doing such calculations requires you to value benefits and costs using shadow prices, especially for capital goods, to correct for market distortions.[156] Shadow prices are notional, unobserved prices that reflect the social opportunity cost of an

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intertemporal fluctuations. For an example of a revised Ramsey formula derived using recursive preferences, *see* Ton S. van den Bremer and Frederick van der Ploeg, "The Risk-Adjusted Carbon Price," *American Economic Review* 111, no. 9, (2021): 2782-2810. Others allow for alternative forms of capital, correlation structures, and other higher order terms to emerge in more complicated versions of a Ramsey-like formula.

[152] For example, some have proposed adjusting discount rates to account for differential valuations (stemming from, for example, changes in scarcity or substitutability over time) of certain non-market goods and services relative to market goods when the differential valuations are not directly accounted for in the analysis (which may allow for more precision). For more detail on this issue, *see* HM Treasury, *Environmental Discount Rate Review: Conclusion* (London: HM Treasury, September 2021); Partha Dasgupta, *The Economics of Biodiversity: The Dasgupta Review* (London: HM Treasury, 2021).

[153] In the Ramsey model, if there are no market distortions, the social rate of time preference equals the return on capital net of depreciation; in that case, it provides a measure of how displacement of current investment affects future consumption.

[154] While such considerations may or may not be relevant to private preferences for trading off present versus future consumption (sometimes called private discount rates), they are generally not relevant to social discount rates. *See* Council of Economic Advisers, *Discounting for Public Policy: Theory and Recent Evidence on the Merits of Updating the Discount Rate* (January 2017), 4 ("Market rates also reflect risks faced in the private sector, which may not be relevant for public sector evaluation. In addition, private returns that involve unpriced externalities or monopoly rents will likely be higher than the true social return.").

[155] Such an approach more accurately accounts for the potential effects of a regulation that fall on capital than discounting at the rate of return to capital would. *See* Qingran Li and William A. Pizer, "Use of the Consumption Discount Rate for Public Policy over the Distant Future," *Journal of Environmental Economics and Management* 107 (2021): 102428.

[156] OMB has consistently noted that the "shadow price" approach is "analytically preferred" since 1992. *See* Office of Mgmt. & Budget Circular A-94, at 9; Office of Mgmt. & Budget, *Economic Analysis of Federal Regulations under Executive Order 12866* (Jan. 11, 1996), https://georgewbush-whitehouse.archives.gov/omb/inforeg/riaguide.html; Office of Mgmt. & Budget, Circular A-4, *Regulatory Analysis* 33 (Sept. 17, 2003).

activity.

Analyzing a regulation using a shadow price of capital approach—converting benefits and costs into consumption-equivalent values before discounting—is generally preferred if a shadow price appropriate for the regulatory context can be approximated and the incidence of regulatory effects on capital can be estimated.[157] However, this often may not be feasible: a shadow price specific to the regulatory context may not be well established, or the distribution of impacts from the regulation on capital and consumption may not be readily quantifiable. In such cases, you may wish to consider an appropriate range of shadow prices.

Where substantial incidence on capital is anticipated, as a default, OMB recommends consideration of a lower value of 1.0, reflecting an open economy estimate with perfect capital mobility (which, when applied to your analysis, will result in no change to your estimates of benefits and costs and is functionally equivalent to assuming that foreign capital flows offset any displacement or inducement of capital that would otherwise occur),[158] and a high value of 1.2, reflecting a closed economy estimate with no foreign capital flows.[159] If the incidence of benefits and costs falling on capital are not directly estimated, one approach is to test your analysis's sensitivity to assumptions about the incidence of regulatory effects on capital by analyzing two outer-bound cases: one assuming all benefits and no costs fall on capital, and another assuming all costs and no benefits fall on capital, as lower- and upper-bound estimates of the effect of capital on your estimate of net benefits. An example of such sensitivity analyses is presented in

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[157] In some particular cases, it may be appropriate to assume a shadow price of approximately one or that regulatory effects are not likely to significantly displace or induce investment. When you have reason to make such an assumption, conversion of benefits and costs to consumption-equivalent values may be unnecessary, as the benefits and costs can be discounted with the social rate of time preference. Factors contributing to such a situation may include the substantial availability of foreign funds, and the contribution of risk and economic rents (such as those accruing to market power) to the spread between the risk-free rate and the average private return to capital. Conversely, accounting for the incidence of effects on capital may be especially important when there is reason to believe that the appropriate shadow price of capital is not one, and the time horizon of regulatory analysis is short or the uncertainty about the incidence of the regulation's effects on natural, human, or physical capital is large.

[158] Robert C. Lind, "Reassessing the Government's Discount Rate Policy in Light of New Theory and Data in a World Economy with a High Degree of Capital Mobility," *Journal of Environmental Economics and Management* 18, no. 2 (1990): S–8-S-28; Jonathan A. Lesser and Richard O. Zerbe, "Discounting Procedures for Environmental (and Other) Projects: A Comment on Kolb and Scheraga," *Journal of Policy Analysis and Management* 13, no. 1 (1994): 140-156 (building on Robert C. Lind, "Reassessing the Government's Discount Rate Policy in Light of New Theory and Data in a World Economy with a High Degree of Capital Mobility," *Journal of Environmental Economics and Management* 18, no. 2 (1990): S–8-S-28, and concluding: "Private capital in an open economy comes primarily at the expense of consumption, not from crowding out other private capital. Thus, even where private funds are involved, the SPC [shadow price of capital] approach would use the consumer's rate of time preference in an open economy.").

[159] Richard G. Newell, William A. Pizer, and Brian C. Prest, "The Shadow Price of Capital: Accounting for Capital Displacement in Benefit-Cost Analysis," (Resources for the Future, 2022) (citing Qingran Li and William A. Pizer, "Use of the Consumption Discount Rate for Public Policy over the Distant Future," *Journal of Environmental Economics and Management* 107 (2021): 102428). *See also* Jonathan A. Lesser and Richard O. Zerbe, "Discounting Procedures for Environmental (and Other) Projects: A Comment on Kolb and Scheraga," *Journal of Policy Analysis and Management* 13, no. 1 (1994): 140-156; Mark A. Moore et al., ""Just Give Me a Number!" Practical Values for the Social Discount Rate," *Journal of Policy Analysis and Management* 23, no. 4 (2004): 789-812.

the footnote below.[160] This approach can be useful to regulatory analysis, but does not suggest that agencies should consider the ratio of benefits to costs—as opposed to net benefits—when analyzing regulatory alternatives, as noted in the section "*Benefit-Cost Analysis.*" Rather, this approach suggests circumstances in which agencies may consider additional steps, such as more detailed discussions or, to the extent feasible, estimation of an appropriate shadow price of capital or of the likely incidence of regulatory effects on capital in a particular regulatory context. Alternatively, as noted previously, accounting for shadow prices can also be done endogenously in a well-calibrated general equilibrium model.

In certain cases, it may be clear that that your regulation likely has little or no incidence on capital,[161] or the magnitudes of costs and benefits falling on capital are the same in every period.[162] In such cases, you can simply discount at the social rate of time preference.

### d. Long-Term Discounting

Special ethical considerations arise when comparing benefits and costs across generations. Although most people demonstrate time preference in their own consumption behavior, which may vary by the good or service at hand, it may not be appropriate for society to demonstrate a similar preference when deciding between the well-being of current and future generations. Future citizens and residents who are affected by such choices cannot take part in making them, and today's society must act with some consideration of their interest.

Some believe that it is ethically impermissible to discount the utility of future

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[160] For example, if a regulation has $100 million in costs in the first year, and $50 million in benefits for five years, the analysis with a shadow price equal to 1.0 is unchanged (values discounted at 1.7% in parentheses):

|  | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|
| **Benefits** | $50 ($49.2) | $50 ($48.3) | $50 ($47.5) | $50 ($46.7) | $50 ($46.0) |
| **Costs** | $100 ($98.3) | $0 ($0) | $0 ($0) | $0 ($0) | $0 ($0) |

Assuming a shadow price of 1.0, discounted net benefits would be about $139.4. You could then consider a case where 100% of benefits fall on capital and 0% of costs fall on capital, and the shadow price is 1.2 (values discounted at 1.7% in parentheses):

|  | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|
| **Benefits** | $60 ($59.0) | $60($58.0) | $60 ($57.0) | $60 ($56.1) | $60 ($55.2) |
| **Costs** | $100 ($98.3) | $0 ($0) | $0 ($0) | $0 ($0) | $0 ($0) |

In this outer-bound case, discounted net benefits would be about $187.0. And, conversely, you could consider a case where 0% of benefits fall on capital and 100% of costs fall on capital, and the shadow price is 1.2 (values discounted at 1.7% in parentheses):

|  | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|
| **Benefits** | $50 ($49.2) | $50 ($48.3) | $50 ($47.5) | $50 ($46.7) | $50 ($46.0) |
| **Costs** | $120 ($118.0) | $0 ($0) | $0 ($0) | $0 ($0) | $0 ($0) |

In this outer-bound case, discounted net benefits would be about $119.7. More precise estimates of the incidence of effects on capital and consumption are preferable to these outer-bounds analyses, if available.
[161] This happens if a regulation is unlikely to significantly impact private investment rather than consumption, such as when regulatory costs will predominantly be passed through to consumers and do not affect investment decisions.
[162] Mark A. Moore et al., ""Just Give Me a Number!" Practical Values for the Social Discount Rate," *Journal of Policy Analysis and Management* 23, no. 4 (2004): 792 (citing Jonathan A. Lesser and Richard O. Zerbe, "Discounting Procedures for Environmental (and Other) Projects: A Comment on Kolb and Scheraga," *Journal of Policy Analysis and Management* 13, no. 1 (1994): 140-156).

generations.[163] That is, government should treat all generations equally. Even under an approach that does not discount the utility of future generations, it is often appropriate to discount long-term consumption benefits and costs—although at a lower rate than the near-term effects more likely to fall on a single generation—if there is an expectation that future generations will be wealthier and thus will value a marginal dollar of benefits or costs by less than those alive today, or a non-zero probability of sufficiently catastrophic risks. To account for these special ethical considerations, an extensive literature uses a "prescriptive" approach to long-term discounting, determining the appropriate degree of weight that society should place on the welfare of future generations.[164]

A distinct reason for discounting the benefits and costs accruing to future generations at a lower rate is uncertainty about the appropriate value of the discount rate.[165] Private market rates provide a reasonably reliable reference for determining the rate at which society is willing to trade consumption over time within a few decades, but for extremely long time periods no comparable private rates exist.[166] Because future changes in the social rate of time preference are uncertain but correlated over time, the certainty-equivalent discount rate will have a declining schedule.[167] The appropriate discount rate declines because it is the average of the cumulative discount factors, not an average of the discount rates, that matters.[168]

There are various reasonable approaches to long-term discounting that account for uncertainty and other relevant factors, and therefore lead to dynamic discount rates over time. One approach uses data from historical interest rates in financial markets to project uncertainty in

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[163] *See, e.g.*, Derek Parfit, *Reasons and Persons* (Oxford: Oxford University Press, 1984); Frank P. Ramsey, "A Mathematical Theory of Saving," *Economic Journal* 38, no. 152 (1928): 543-559.

[164] Antony Millner and Geoffrey Heal, "Choosing the Future: Markets, Ethics, and Rapprochement in Social Discounting," *Journal of Economic Literature* (forthcoming); J. Paul Kelleher and Gernot Wagner, "Prescriptivism, Risk Aversion, and Intertemporal Substitution in Climate Economics," *Annals of Economics and Statistics* 132 (2018): 129-149; Partha Dasgupta, "Discounting Climate Change," *Journal of Risk and Uncertainty* 37 (2008): 141-169; Kenneth J. Arrow et al., "Intertemporal Equity, Discounting and Economic Efficiency," in *Climate Change 1995: Economic and Social Dimensions of Climate Change, Contribution of Working Group III to the Second Assessment Report of the Intergovernmental Panel on Climate Change*, eds. James P. Bruce, Hoesung Lee, and Erik F. Haites (Cambridge University Press, 1996).

[165] *See* Kenneth J. Arrow et al., "Should Governments Use a Declining Discount Rate in Project Analysis?," *Review of Environmental Economics and Policy* 8, no. 2 (2014): 145-163. Note that in a Ramsey model approach, discussed previously, incorporation of uncertainty about shocks to *g* leads to an extended Ramsey formula that also exhibits a declining discount rate.

[166] Property is one of the few assets that may be held over very long time horizons, and there is evidence of a downward-sloping term structure of discount rates for real estate. *See* Stefano Giglio et al., "Climate Change and Long-Run Discount Rates: Evidence from Real Estate," *Review of Financial Studies* 34, no. 8 (2021): 3527-3571 (parameterizing a real risk-free rate of about 1% over near-term time horizons, and finding declining rates for risky real estate over longer time horizons). Inter-vivos wealth transfers to subsequent generations and stated-preference studies on people's attitudes about discount rates over long time horizons also suggest that market data that end at shorter horizons may not capture societal preferences that are relevant to long-term discount rates. *See* Richard L. Revesz & Matthew R. Shahabian, "Climate Change and Future Generations," *Southern California Law Review* 84, no. 5 (2011): 1097-1163.

[167] Uncertainty about long-term growth rates can also be understood as causing a precautionary response to save more for the future, and increased rates of savings correspond to a lower discount rate. *See* Maureen L. Cropper et al., "Declining Discount Rates," *American Economic Review* 104, no. 5 (2014): 538-543.

[168] Martin L. Weitzman, "Why the Far-Distant Future Should Be Discounted at Its Lowest Possible Rate," *Journal of Environmental Economics and Management* 36, no. 3 (1998): 201-208.

the future path of such rates.[169] This approach is a way of extending the use of financial market data to determine the discount rate in the long-term. Another approach is to explicitly use an economic model for welfare analysis, for example the Ramsey model discussed earlier, to generate a discount rate schedule tailored to the regulatory context. As noted previously, when taking a descriptive approach to generating a discount rate schedule, the parameters of the Ramsey formula can be calibrated to observed market data on real interest rates[170] or to allow the discount rate to be a function of empirical estimates of the pure rate of time preference, the elasticity of the marginal utility of consumption, and per capita consumption growth. When taking this alternative approach, agencies should report information on their discount rate schedule in order to provide useful information to the public.

### e. *The Relationship between Discounting and Risk*

As discussed in the section "*Economic Values of Uncertain Outcomes*," you should endeavor to estimate certainty equivalents[171] when risk is material to your analysis. This approach is generally favored over the use of higher discount rates as a means of accounting for risk due to its potential for greater accuracy. Simple examples illustrate the point: using a higher discount rate to account for risk would be inappropriate when evaluating regulations that reduce risk (meaning that they have higher net benefits when other outcomes are worse, and vice versa); accounting for this risk reduction would be akin to using a lower, not higher, discount rate. Investments in pandemic preparedness could fall in this category. Conversely, for a regulation that increases risk (meaning that it has lower net benefits when outcomes are worse, and vice versa), accounting for risk through certainty equivalents could be mathematically equivalent to the use of a higher discount rate. For an example of when the two could be mathematically equivalent, the use of a stock market-based (or stock and bond market-based) discount rate could be equivalent to the use of certainty-equivalent valuations for regulations relating to pension funding, or when a regulation induces investment that closely mimics the risk profile of private sector investment (such as programs that provide debt financing to businesses). However, as a general matter, using discount rates to account for risk requires rigid assumptions about the form that risks take over time, and therefore creates the potential for increased inaccuracy relative to the certainty equivalents approach.[172]

In cases where risk is material to the regulation, you should generally account for relevant risk in your regulatory analysis explicitly. While use of certainty equivalents is the default method of accounting for risk, if you are unable to estimate appropriate certainty

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[169] *See* Michael D. Bauer and Glenn D. Rudebusch, "The Rising Cost of Climate Change: Evidence from the Bond Market," *Review of Economics and Statistics* (2021): 1-45; Richard G. Newell and William A. Pizer, "Discounting the Distant Future: How Much Do Uncertain Rates Increase Valuations?," *Journal of Environmental Economics and Management* 46, no. 1 (2003): 52-71; and Martin L. Weitzman, "Gamma Discounting," *American Economic Review* 91, no. 1 (2001): 260-271.

[170] Richard G. Newell, William A. Pizer, and Brian C. Prest, "A Discounting Rule for the Social Cost of Carbon," *Journal of the Association of Environmental and Resource Economists* 9, no. 5 (2022): 1017-1046 and Keven Rennert et al., "The Social Cost of Carbon: Advances in Long-Term Probabilistic Projections of Population, GDP, Emissions, and Discount Rates," *Brookings Papers on Economic Activity* (Fall 2021).

[171] Other methods to incorporate risks into your analysis may also be useful.

[172] Anthony E. Boardman et al., *Cost-Benefit Analysis: Concepts and Practice*, 5th ed. (Cambridge University Press, 2018), 263.

equivalents and risk is material to your analysis, you may choose to instead use alternative discount rates, appropriate to the specific regulatory context, as a sensitivity analysis.[173] Any agency that wishes to account for risk using alternative discount rates in primary or sensitivity analysis should confer with OMB before proceeding.

### f. Time Preference for Non-Monetized Benefits and Costs

Differences in timing should be considered even for benefits and costs that are not expressed in monetary units, including health benefits.

Alternatively, it may be possible in some cases to avoid discounting non-monetized benefits. If the expected flow of benefits begins as soon as the cost is incurred and is expected to be constant over time, then annualizing the cost stream is sufficient, and further discounting of benefits is unnecessary as annualized benefits and annual benefits are the same.

## 13. Quality, Objectivity, Transparency, and Reproducibility of Results

Pursuant to the Information Quality Act (Public Law 106-554),[174] OMB has issued *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by Federal Agencies* ("Guidelines").[175] The Guidelines describe expectations for pre-dissemination review[176] of the quality of information disseminated by Federal agencies (as is relevant here, your regulatory analysis, including the underlying data). During your pre-dissemination review of your regulatory analysis, you should ensure objective presentation of the analysis and consider the appropriate level of information quality for your specific regulatory analysis based on the likely use of that information. The Guidelines explain that quality encompasses utility, integrity, and objectivity. Objectivity refers to whether the disseminated information is accurate, reliable, and unbiased as a matter of presentation and substance. The focus on the information's usefulness is critical; the Guidelines recognize that some government information may need to meet higher or more specific quality standards than those that would apply to other types of government information, due to the information's

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[173] A general approach to selecting discount rates that can account for certain forms of risk is to estimate an economy-wide systematic risk premium and the regulation-specific correlation of regulatory benefits and costs with that systematic risk, combining the two to obtain a regulation-specific discount rate. However, the parameters necessary to pursue such an approach are difficult to estimate, the approach inherently offers limited flexibility in modeling changes to risk over time (*e.g.*, it is only valid if uncertainty grows exponentially over time), and this type of risk is not always the most material type of risk in regulatory analysis. Note that for many regulations, an appropriate risk premium adjustment to the discount rate would be negligible (or negative), as many regulations provide their largest value to society when mitigating the harms of a number of risks or market inefficiencies in bad states of the world. (By contrast, the benefits of many Federal investments are positively correlated with future economic outcomes.) Accordingly, this Circular does not recommend this approach broadly at this time. Nonetheless, you may find this conceptual framework useful in specific regulatory contexts.

[174] Treasury and General Government Appropriations Act, 2001, Pub. L. No. 106-554, § 515(a) (2000) (codified at 44 U.S.C. 3516, note).

[175] Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies; Republication, 67 Fed. Reg. 8451 (Feb. 22, 2002).

[176] Pre-dissemination review, as it applies to regulatory analyses, refers to the process used by agencies to evaluate whether information quality is consistent with the planned use for it, prior to making the information public or using it as a basis for a policy decision.

expected use. For this reason, the Guidelines characterize a subset of agency information as "influential," which is subject to certain requirements.

Under the Guidelines, information is influential if "the agency can reasonably determine" that it "will have or does have a clear and substantial impact on important public policies or important private sector decisions." In the context of a policy decision, a specific piece or body of information is "influential" when it is a principal basis for a decision by a Federal policymaker—that is, if the same decision would be difficult to reach in the information's absence or if the decision would lose its fundamental scientific, financial, or statistical underpinnings absent the information. Even if a decision is very important, a particular piece of information supporting it may or may not be "influential," depending on whether the decision could be reached in the information's absence. Because of its potentially influential nature and special role in the rulemaking process, it is appropriate to set minimum quality standards for regulatory analysis. Each agency is authorized to define whether its regulatory analyses, or the information contained within such analyses, is likely to be "influential" given the nature of the issues for which the agency is responsible and the particular analysis in question. The Guidelines include a "reproducibility standard" for influential information such that, absent compelling interests,[177] agencies should generally disseminate their influential analyses with sufficient descriptions of data and methods to allow them to be reproduced by qualified third parties who may want to test the sensitivity of agency analyses.

When the regulatory analysis is driven by scientific information, that scientific information may be influential itself, and thus OMB's *Final Information Quality Bulletin for Peer Review* (Bulletin) would apply. The Bulletin includes guidance on the selection of reviewers and the transparency of the review plans, as well as guidance about selecting the appropriate mechanism for peer review, the importance of providing explicit instructions to reviewers (*i.e.*, a peer review charge), and expectations regarding the resolution and dissemination of peer reviewer comments.

A good analysis is transparent in its methods, data sources, and analytic choices. Not only is a good analysis designed to transparently inform policymakers, other government stakeholders, and the public about the effects of alternative actions, but transparency is also integral to the concept of reproducibility of regulatory analysis. Consistent with the expectations in the academic literature, a qualified third party reading the analysis should be able to understand your analysis, underlying assumptions, and the way in which you developed your estimates. There may be situation-specific challenges related to conveying some types of information, but best effort should be made within the scope of the analysis. Regulatory analyses subject to this Circular should provide documentation that the analysis reflects the highest quality evidence (including scientific, technical, economic, and indigenous knowledge[178]) and

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[177] In this Circular, consistent with the Guidelines, the term "compelling interests" includes, but is not limited to, policies related to protecting the privacy of persons, confidentiality of data, intellectual property, national or homeland security, scientific integrity, and cost to the government.

[178] Many types of original information exist. For example, local or affected communities may possess important original scientific, technical, or economic information—including, but not limited to, indigenous knowledge—that is relevant to your analysis. *See* Office of Science and Technology Policy and Council on Environmental Quality, *Guidance for Federal Departments and Agencies on Indigenous Knowledge* (2022) for information on how to foster

analytical methods, as feasible and appropriate, and consistent with Federal policies for evidence building and information quality.

Since the Guidelines were originally published in 2002, Federal data access policies have been promulgated to both increase taxpayer return on Federal investment and to spur private sector innovation.[179] These Federal data access policies, in conjunction with responsibilities under the Guidelines mean that reproducibility requires more than simply documenting sources used. For example:

- The underlying data that are pivotal to the conclusions of the regulatory analysis should be made available to the public absent compelling interests.[180]
- When results are generated by, for instance, a statistical model or machine-augmented learning, reproducibility generally requires, at minimum, transparency about the specific methods, design parameters, equations or algorithms, parameters, and assumptions used.
- When an agency has performed an analysis using a specialized set of computer code, the computer code used to process it should be made available to the public for further analysis, if consistent with applicable law and policy. When appropriate and feasible, this code should be written in a programming language that does not require a commercial license.

Agencies should refer to the most recent best practices[181] regarding how and where to provide electronic access to your analysis, including all the supporting documents, so the public can easily access this material. Because one purpose of a regulatory analysis is to inform the public regarding the potential impacts of a proposed or final rule, it is critical that such documentation be made available promptly and reliably for public review and comment during

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collaboration with Tribal Nations and knowledge holders so that indigenous knowledge can inform evidence-based Federal government decision-making, where appropriate.

[179] *See, e.g.*, the Open, Public, Electronic, and Necessary (OPEN) Government Data Act, Pub. L. No. 115-435, 132 Stat. 5534 (2019) (Title II of the Foundations for Evidence-Based Policymaking Act of 2018). Office of Mgmt. & Budget, Circular No. A-130, *Managing Information as a Strategic Resource* (July 28, 2016), requires agencies to collect and create information in a way that supports public transparency as well as downstream, secondary information dissemination and processing by third parties, thereby making government information accessible, discoverable, and usable.

[180] *See* footnote 177 above for examples of compelling interests. Cutting-edge technologies reduce the risk of re-identification and therefore may mitigate certain privacy risks associated with providing access to the data underlying regulatory analysis. Risk reduction techniques include creating multiple versions of a single dataset with varying levels of specificity and protection (sometimes referred to a "tiered access"). Public access data sets are the lowest tier, while access to the most restricted versions is limited to authorized researchers. To maintain confidentiality, less restricted "middle tier" versions of datasets typically reduce specificity or granularity in exchange for easier access that allows users to replicate statistical analyses and explore sensitivity of conclusions to alternative assumptions without having access to the original data file that includes personally identifiable information. *See, e.g.*, Advisory Committee on Data for Evidence Building, *Advisory Committee on Data for Evidence Building: Year 2 Report* (October 14, 2012).

[181] For instance, Section 2 of Executive Order 13563 directs agencies (to the extent feasible and permitted by law) to give the public timely online access to the rulemaking docket on Regulations.gov, including relevant scientific and technical findings. For proposed rules, agencies are required to include an opportunity for public comment on the rulemaking docket, including comment on relevant scientific and technical findings. Examples of supporting materials include notices, significant guidance, environmental impact statements, regulatory impact analyses, and information collections. *See* Exec. Order No. 13563, 76 Fed. Reg. 3821 (Jan. 21, 2011).

the proposed or interim final phase of the rulemaking process and for public review when the rule is final.[182] Where other compelling interests prevent the public release of data or key elements of the analysis, certain generally-recommended practices (*e.g.*, robustness checks and sensitivity analyses and their documentation) should be performed in an especially rigorous manner.

Agencies should, whenever feasible and appropriate, disclose the use of outside consultants and the nature of their contributions.

## 14. Specialized Analytical Requirements

In preparing analysis of your regulation, you should be aware that there are a number of analytic requirements imposed by law. When developing a regulatory analysis consistent with the requirements of Executive Order 12866, as reaffirmed and amended by Executive Order 13563 and the Executive Order of April 6, 2023 (Modernizing Regulatory Review), you should also consider whether your regulation will need specialized analysis.

The differences across the various analyses listed below can create practical challenges but also offer opportunities for enhanced understanding of the available evidence and how it can be quantitatively compiled. For instance, if small entities experience the most direct effects of a regulation, an Initial Regulatory Flexibility Analysis may be an intuitive starting point for generating the suite of required assessments. Then, when you broaden the analytic perspective to be society-wide, in order to conduct a regulatory analysis consistent with Executive Order 12866, you may find that some benefits or costs experienced by small entities are accompanied by offsetting benefits or costs experienced by other entities and thus are often transfers of value within society (that is, they do not affect aggregate societal benefits or costs).[183] For example, grant funding received by small business, small non-profit, or small government entities from the Federal government would often be a transfer of value within society.[184]

Specialized analytic requirements are sometimes prescribed by statute. Some examples include:

### a. *Impact on Small Businesses and Other Small Entities*

Under the Regulatory Flexibility Act (5 U.S.C. chapter 6), agencies must prepare an

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[182] For example, disseminating regulatory analyses and other supporting documents simultaneously with disseminating a proposed or final rule—for example, on the agency's website—prior to sending the rule to the Federal Register. Because weblinks can become broken over time, regulatory analyses and associated materials should be made available in regulatory dockets, even when also published on agency websites.

[183] Further related discussion appears in the "*Scope of Analysis*" and "*Transfers*" sections above. Moreover, distributional effects may be relevant in such an analysis; see the section "*Distributional Effects*" for more details on how to account for such effects.

[184] As another example of the interaction between various analyses, estimating the effects of a new regulation may bring to light data that would also be relevant to updating past estimates of the effects of related earlier actions. Performing such updates would serve the goal of keeping a running tally of paperwork burden, in accordance with the Paperwork Reduction Act; however, for analysis as set forth in Executive Order 12866 (among numerous others listed below), the focus should be on effects attributable to the new regulation.

initial and final "regulatory flexibility analysis" (RFA) if the rulemaking could "have a significant economic impact on a substantial number of small entities." In this case, "significant" is context dependent, and is not necessarily the same standard as used to determine "significant" for Executive Order 12866 review. You should post your RFA on the internet so the public can review your findings.

Your agency should have guidelines on how to prepare an RFA and you are encouraged to consult with the Chief Counsel for Advocacy of the Small Business Administration on expectations concerning what is an adequate RFA. Under the Small Business Regulatory Enforcement Fairness Act of 1996, as amended, the Environmental Protection Agency, Occupational Safety and Health Administration, and Consumer Financial Protection Bureau are required to consult with small entities prior to developing a proposed rule that would have a significant effect on a substantial number of such entities.

### b. *Analysis of Unfunded Mandates*

Under the Unfunded Mandates Reform Act of 1995 (2 U.S.C. 1532), you must prepare a written statement about benefits and costs prior to issuing a proposed or final rule (for which your agency published a proposed rule) that may result in aggregate expenditure by State, local, and Tribal governments, or by the private sector, of $100,000,000 or more in any one year (adjusted annually for inflation since enactment). Analytic concepts under Executive Order 12866 are generally similar to the "written statement" analytic concepts under the Unfunded Mandates Reform Act, and thus an analysis produced pursuant to Executive Order 12866 will usually satisfy the analytic requirements for a written statement under the Unfunded Mandates Reform Act. For intergovernmental mandates, the assessment should also include an analysis of "the extent to which there are available Federal resources to carry out the intergovernmental mandate."

### c. *Information Collection, Paperwork, and Recordkeeping Burdens*

Under the Paperwork Reduction Act (44 U.S.C. chapter 35), you will need to consider whether your regulatory action will create any additional information collection, paperwork or recordkeeping burdens. These burdens are permissible only if you can justify the practical utility of the information for the implementation of your regulatory action. OMB approval will be required of any new requirements for a collection of information imposed on 10 or more persons[185] and a valid OMB control number must be obtained for any covered paperwork. Your agency's Chief Information Officer (CIO) should be able to assist you in complying with the Paperwork Reduction Act.

### d. *Information Quality Guidelines*

Under the Information Quality Act, agency guidelines, in conformance with the OMB

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[185] "Persons" under the Paperwork Reduction Act refers to any members of the public, including non-U.S. citizens, residences, and businesses. The 10-person maximum may be lowered if the entities represent the majority or all of a sector or industry. *See* U.S. General Services Administration and Office of Management and Budget, "Do I Need Clearance?," *https://pra.digital.gov/do-i-need-clearance/* for additional guidance.

government-wide guidelines, have established basic quality performance goals for all information disseminated by agencies, including information disseminated in support of proposed and final rules. The data and analysis that you use to support your regulation must meet these agency and OMB quality standards; see the section "*Quality, Objectivity, Transparency, and Reproducibility of Results*" for more information. Your agency's CIO should be able to assist you in assessing information quality. The Statistical and Science Policy Branch of OMB's Office of Information and Regulatory Affairs can provide you with assistance. This Circular defines OMB's minimum quality standards for regulatory analysis.

### e. Environmental Impact Statements

The National Environmental Policy Act (42 U.S.C. 4321-4347) and related statutes and executive orders require agencies to consider the environmental impacts of certain agency decisions, including regulations. An environmental impact statement must be prepared for "major Federal actions significantly affecting the quality of the human environment." Unless a rulemaking is otherwise exempt from NEPA, you must complete NEPA documentation before issuing a final rule. The White House Council on Environmental Quality has issued regulations (40 C.F.R. 1500 et seq.) and associated guidance for implementation of NEPA.

Specialized analytic requirements are also sometimes prescribed by Executive Order. Some examples include:

### f. Health and Environmental Impacts on Minority and Low-Income Populations

Under Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," to "the extent practical and appropriate, Federal agencies" must "determine whether their programs, policies, and activities have disproportionately high and adverse human health or environmental effects on minority populations and low-income populations." Agencies are also tasked with, "[t]o the greatest extent practicable and permitted by law, … addressing, as appropriate, disproportionately high and adverse human health or environmental effects of [their] programs, policies, and activities on minority populations and low-income populations."

### g. Environmental Health or Safety Impacts on Children

Under Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks," each agency must, with respect to its rules, "to the extent permitted by law and appropriate, and consistent with the agency's mission," "address disproportionate risks to children that result from environmental health risks or safety risks." For any substantive rulemaking action that "is likely to result in" a rule that may be significant under Section 3(f)(1) of Executive Order 12866, as amended by the Executive Order of April 6, 2023 (Modernizing Regulatory Review), and that may concern "an environmental health risk or safety risk that an agency has reason to believe may disproportionately affect children," the agency must provide OIRA "an evaluation of the environmental health or safety effects of the planned regulation on children," as well as "an explanation of why the planned regulation is preferable to other potentially and reasonably feasible alternatives considered by the agency," unless prohibited by

law.

### h. Energy Impacts

Under Executive Order 13211, agencies are required to prepare and submit to OMB a Statement of Energy Effects for significant energy actions, to the extent permitted by law. This Statement is to include a detailed statement of "any adverse effects on energy supply, distribution, or use (including a shortfall in supply, price increases, and increased use of foreign supplies) should the proposal be implemented" for the action and reasonable alternatives and their effects. You need to publish the Statement or a summary in the related notice of proposed rulemaking and final rule. For further information, see OMB guidance on implementing Executive Order 13211.

## 15. Accounting Statement

For each regulation that is significant under Section 3(f)(1) of Executive Order 12866, as amended by the Executive Order of April 6, 2023 (Modernizing Regulatory Review), an analysis should include an accounting statement with tables reporting benefit and cost estimates. You should use the guidance outlined above to report these estimates.  We have included a suggested format for your consideration.

### a. Categories of Benefits, Costs, and Transfers

To the extent feasible, you should quantify all potential incremental benefits and costs. You should report benefit and cost estimates within the following three categories: monetized; quantified, but not monetized; and unquantified.

These categories are mutually exclusive and exhaustive. Throughout the process of listing estimates of benefits and costs, agencies should avoid double-counting. This problem may arise if more than one way exists to express the same change in social welfare.

As noted in the section "*Accounting for Benefits, Costs, and Transfers that Are Difficult to Quantify or Monetize*," you should consider, if feasible given the state of the evidence, categorizing or ranking non-monetized or unquantified effects in terms of their importance. You should distinguish the effects that evidence indicates are likely to be significant enough to warrant serious consideration by decision makers from those that are likely to be minor.

### b. Treatment of Benefits, Costs, and Transfers over Time

You should present undiscounted streams of benefit, cost, and transfer estimates for each year of the analytic time horizon. You should generally present annualized[186] benefits,

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[186] Computing annualized costs and benefits from present values attempts to spread the costs and benefits equally over each period, taking account of the discount rate. The annualized value equals the present value divided by the sum of discount factors. If you are using Excel, an easy way to compute this amount is to use the PMT function,

costs, and transfers in accordance with guidance provided in the section "*Discount Rates*." The streams of annualized estimates should begin in the year in which the regulation will begin to have impacts, even if the regulation is not legally effective immediately. Please report all monetized effects in constant (*e.g.*, 2022) dollars. You should convert dollars expressed in different years using the most appropriate and reliable inflation index (*e.g.*, the Bureau of Economic Analysis's GDP price deflator or personal consumption expenditures price index) for your analysis.

### c. Treatment of Risk and Uncertainty

You should provide central estimates as well as distributions about those estimates, where such information exists. When you provide only upper and lower bounds (in addition to best estimates), you should, if possible and appropriate, use the 95 and 5 percent confidence bounds. Although we encourage you to develop estimates that capture the distribution of plausible outcomes for a particular alternative, detailed reporting of such distributions in the accounting statement is not necessary.

### d. Precision of Estimates

Reported estimates should reflect, to the extent feasible, the precision in the analysis. For example, an estimate of $220 million implies rounding to the nearest $10 million and thus a precision of +/-$5 million; similarly, an estimate of $222 million implies rounding to the nearest $1 million and thus, a precision of +/-$0.5 million.

### e. Effects on State, Local, and Tribal Governments, Small Business, Wages and Economic Growth

You may need to identify in your analysis the portions of benefits, costs, and transfers received or otherwise experienced by State, local, and Tribal governments.[187] To the extent feasible, you also should identify the effects of the regulation or program on small businesses, wages, and economic growth.[188]

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which calculates the annualized amount needed over a number of years to equal a given present value at a particular discount rate. The formula returns a negative number, so the result should be multiplied by -1 to obtain the annualized cost.

[187] This identification may be required by, for example, the Unfunded Mandates Reform Act of 1995, 2 U.S.C. 1532(a)(2).

[188] Regulatory Flexibility Act, 5 U.S.C. 603(c), 604.

**OMB #:**          **Agency/Program Office:**
**Rule Title:**
**RIN#:**          **Date:**

| Category | Primary Estimate | Low (e.g., 5th Percentile) Estimate | High (e.g., 95th Percentile) Estimate | Dollar Year | Discount Rate | Time Horizon | Notes (e.g., Risk Assumptions; Source Citations; Whether Inclusion of Capital Effects Differs Across Low, Primary, High Estimates; etc.) |
|---|---|---|---|---|---|---|---|
| *BENEFITS* | | | | | | | |
| Annualized monetized benefits | | | | | | | |
| Annualized quantified, but non-monetized, benefits | | | | | | | |
| Unquantified benefits | | | | | | | |
| *COSTS* | | | | | | | |
| Annualized monetized costs | | | | | | | |
| Annualized quantified, but non-monetized, costs | | | | | | | |
| Unquantified costs | | | | | | | |
| *TRANSFERS* | | | | | | | |
| Annualized monetized "on budget" transfers | | | | | | | |
| From whom to whom? | | | | | | | |
| Annualized monetized "off-budget" transfers | | | | | | | |
| From whom to whom? | | | | | | | |

| Category | Effects | Notes |
|---|---|---|
| Effects on State, local, or Tribal governments | | |
| Effects on small businesses | | |
| Effects on wages | | |
| Effects on growth | | |