Preamble: Proposed OMB Circular No. A-4, "Regulatory Analysis"

Assessing benefits and costs of alternative regulatory options through analysis helps agency policymakers arrive at sound regulatory decisions. It also helps the public, Congress, and the courts understand the effects of those decisions. Careful analysis can facilitate the development of well-designed regulations and thereby increase net benefits for society as a whole. To help support the development of better analysis, the Office of Management and Budget (OMB) has provided guidance to agencies since the 1980s on how to conduct regulatory analysis. The current OMB guidelines were issued in 2003 as OMB Circular No. A-4.[1]

In order to encourage continued improvements in the quality of the regulatory analyses prepared by agencies, and pursuant to the Executive Order of April 6, 2023 (Modernizing Regulatory Review) and the Presidential Memorandum of January 20, 2021 (Modernizing Regulatory Review), OMB's Office of Information and Regulatory Affairs (OIRA) is initiating a process to revise these guidelines. Through revised guidelines, we seek to ensure that analytic guidance reflects new developments in economic and other scientific understanding. OMB, in consultation with the Council of Economic Advisers as well as relevant agencies and Executive Office of the President components, has drafted and proposed revised guidelines which are available at https://www.whitehouse.gov/wp-content/uploads/2023/04/DraftCircularA-4.pdf. OMB now invites public comment on the revised guidelines and is initiating a peer review process with respect to them.

OMB believes that the benefits of revising Circular A-4, following public comment and peer review, are likely to be substantial. Improvements to guidance on the analytical assessment of regulatory benefits and costs will facilitate better decision-making in the policymaking process. OMB expects that improved analysis will lead to better policy that improves societal well-being. More narrowly, clarifying guidance in the Circular is likely to also reduce confusion and allow for the more effective use of agency and OIRA resources. While there are costs associated with the drafting of, and transition to, new guidance, OMB believes that the aggregate benefits of these proposed revisions are likely to well exceed those costs.

Some of the motivations for the more important proposed revisions, and some considerations that OMB would like to highlight given the request for public comment, are elaborated below. Not all sections of Circular A-4 are addressed in the explanatory material below—which focuses on proposed revisions that may be especially relevant to public commentators—but OMB generally requests comments on all the proposed revisions to Circular A-4, including sections not referenced below. OMB also specifically requests comment on whether it would be helpful to provide fewer or more examples throughout Circular A-4 (including examples that feature technical tools such as diagrams and tables), if it would be helpful to provide updated examples or move existing examples to call-out boxes, appendices, or a supplementary guidance separate from Circular A-4, as well as—more generally—the appropriate balance between detail and brevity in Circular A-4. OMB further requests comment on the Circular's organization, including whether reordering content might better establish links between related concepts.

[1] OMB, Circular A-4, *Regulatory Analysis* (Sept. 17, 2003), https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/circulars/A4/a-4.pdf (Circular A-4).

Scope of Analysis

The proposed revisions to Circular A-4 in the "*Scope of Analysis*" section would make several changes that respond to issues raised regarding the 2003 Circular, elaborated upon in the discussion below. The revised "*Scope of Analysis*" section notes that primary analyses of regulations can often continue to focus on effects experienced by citizens and residents of the United States. But it also notes that U.S. citizens and residents are frequently affected by a regulation indirectly, through that regulation's effects on noncitizens residing abroad, and clarifies that such effects may be important for analysts to estimate. The section also clarifies situations in which including effects experienced by noncitizens residing abroad in a primary analysis may be particularly appropriate. It emphasizes the importance of consistency in the scope of analysis used to analyze benefits and costs. It also provides additional guidance about analysis in the context of regulations that implicate international regulatory cooperation and adds discussion of Executive Order 13609 of May 1, 2012 (Promoting International Regulatory Cooperation) (E.O. 13609). And while most of the section focuses on the *geographic* scope of analyses, it also clarifies that the *temporal* scope of analyses should be long enough to encompass all of the important effects that are likely to result from the regulation.[2]

The material in Circular A-4 on the appropriate scope of analysis merits potential revisions for several reasons. First, Circular A-4's language in the section "*Scope of Analysis*" is potentially unclear. For example, it contrasts "benefits and costs that accrue to citizens and residents" with "effects beyond the borders of the United States," even though at any given point in time some citizens and residents of the United States are not within the borders of the United States, and effects occurring beyond the border of the United States can result in benefits or costs that accrue to U.S. citizens (whether or not they reside abroad) and residents. Second, there has long been a practice of accounting for certain benefits and costs accruing to noncitizens residing abroad in regulatory analyses without accounting for other benefits or costs accruing to noncitizens residing abroad.[3] The result has been analyses that often have inconsistent scope with respect to different categories of benefits or costs, without adequate explanation of why the scope of analysis was varying across these categories. Third, both the reality of—and, in some cases, agencies' knowledge of—the ways that the global economy, ecosystems, and other important vectors of regulatory impacts are intertwined and interconnected have greatly expanded over the last two decades. This has led to new ways of thinking about the appropriate way to focus the scope of regulatory analyses.[4] Fourth, the importance of international regulatory cooperation has grown since Circular A-4 was originally issued, and E.O. 13609 had not yet been issued when the Circular was written.

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[2] For example, if the regulation has its largest effects more than 30 years in the future, then an analysis would be insufficient if it omits effects occurring after 30 years.

[3] *See, e.g.*, Office of Management and Budget and the Secretariat General of the European Commission, *Review of the Application of EU and US Regulatory Impact Assessment Guidelines on the Analysis of Impacts on International Trade and Investment: Final Report and Conclusions* (2008).

[4] However, there is some academic disagreement about the most appropriate scope for policymakers to focus on when using analyses to inform their decisions. Compare, for instance, Ted Gayer and W. Kip Viscusi, "Determining the Proper Scope of Climate Change Policy Benefits in U.S. Regulatory Analyses: Domestic versus Global Approaches," *Review of Environmental Economics and Policy* 10, no. 2 (2016): 245-63, with Peter Howard and Jason Schwartz, "Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon," *Columbia Journal of Environmental Law* 42, no. S (2017): 203-94.

We solicit comment on all aspects of the proposed revisions to this section, including:

- Should a revised Circular include suggestions for useful data sets, and if so, which data sets should be listed?
- Given the data-intensive nature of estimating the portion of regulatory effects ultimately experienced by U.S. citizens and residents indirectly through foreign noncitizens, are there rules of thumb that agency analysts should follow, toward the goal of not omitting such effects?
- Does the revised Circular provide sufficient guidance on cases when it may be especially relevant to assess benefits or costs that may accrue to noncitizens residing abroad, for example in the context of non-tariff barriers to trade?
- Are there any interactions between this section and other sections of the Circular, for example between the sections "*Scope of Analysis*" and "*Distributional Effects*," that should be further accounted for in the revisions to the Circular?

Developing an Analytic Baseline

Despite Circular A-4's use of future-implying words, such as "forecast," a common area of confusion in the development of regulatory impact analyses has been the nature of an analytic baseline as a projection of the future in the absence of the regulation being assessed. Proposed revisions to the "*Developing an Analytic Baseline*" section of the Circular include adding more thorough discussion regarding the differences between the present and the absence-of-regulation future that may be important in characterizing a baseline; narrowing the specific circumstances in which use of a pre-statute baseline is called for; and including more robust discussion of instances in which comparisons of regulatory effects against multiple baselines may be appropriate. Each of these changes are discussed in more detail below.

Proposed revisions to Circular A-4 would clarify that an appropriate standard (i.e., no-action) baseline is not a description of the status quo; it is a *forecast* of the way the world would look absent the regulatory action being assessed. That means that it should account for expected changes to current conditions over time. Circular A-4 notes that "[i]t may be reasonable to forecast that the world absent the regulation will resemble the present."[5] However, the circumstances in which this is a reasonable assumption may be somewhat narrow, and this comment therefore merits augmentation so as to provide useful guidance to agencies. The proposed revisions to Circular A-4 in this section would emphasize that baselines should be grounded in sound theoretical and empirical evidence about not only current conditions, but also ongoing and anticipated future trends in the areas of interest.

The proposed revisions in this section would also narrow the circumstances in which use of a pre-statute baseline for the primary analysis of the effects of the first regulation that implements a statutory requirement is called for. Currently, pre-statute baselines are used for all

[5] Circular A-4, at 15.

such analyses.[6] This issue has received occasional attention in response to past issuance of OMB reports.[7] Discussion has also touched on the question of baseline choice in specific policy areas.[8] The proposed revision to Circular A-4 relates to this discussion, stating that, "[i]n general, an agency's first regulatory action implementing a new statutory authority should be . . . assessed against a pre-statutory baseline"; but if "substantial portions of a regulation . . . 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," agencies "may use a post-statutory baseline in" their analysis, in order to focus analytic efforts "on the discretionary elements of the action and potential alternatives."

Further proposed revisions would include more robust discussion of instances in which comparisons of regulatory effects against multiple baselines may be appropriate. Circular A-4 illustrates this practice with a reference to a 1998 analysis, recent at the time of Circular A-4's issuance in 2003, conducted by the Environmental Protection Agency. We request comment on whether revisions reinstating this type of real-world illustration would be helpful, if a fictional example would offer less risk of becoming quickly dated, or if we might usefully blend real and hypothetical elements in an example. For instance, a blended illustration could look like the following:

> To illustrate how multiple baselines might be presented in a regulatory impact analysis, consider a rule taking effect in 2024 that would incentivize, but not mandate, the adoption of a new technology. Evidence indicates that past adoption of similar technology has followed an S-shape across time, and the issuing agency expects the draft rule would accelerate adoption over a similar pattern. Table __, below, illustrates multiple estimated future adoption patterns in the absence of the rule being assessed (i.e., in the analytic baseline) and the multiple resulting estimates of rule-induced costs.[9]

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[6] *See id.* at 15-16 ("In some cases, substantial portions of a rule may simply restate statutory requirements that would be self-implementing, even in the absence of the regulatory action. In these cases, you should use a pre-statute baseline. If you are able to separate out those areas where the agency has discretion, you may also use a post-statute baseline to evaluate the discretionary elements of the action.").

[7] For instance, Aldy, Fraas, and Lutter (2012) state that "a key strength of the baseline embraced by A-4 [as issued in 2003] is its support for accountability and transparency. Use of such a baseline in regulatory analysis provides information to the public and to Congress about the effects of statutes . . . ." Joe Aldy, Art Fraas, and Randall Lutter, *Public Interest Comment on The Office of Management and Budget's Draft 2012 Report to Congress on the Benefits and Costs of Federal Regulations* 5 (2012), *https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/2012_cb/comments/joe-aldy-art-fraas-randall-lutter-comments.pdf*.

[8] *See, e.g.*, Greg Leiserson and Adam Looney, "A Framework for Economic Analysis of Tax Regulations" (Brookings Institution and Washington Center for Equitable Growth, 2018), *https://www.brookings.edu/wp-content/uploads/2018/12/ES_20181220_Looney-OIRA-Tax-Regs.pdf*, which supports a post-statutory baseline in the tax context, and Jerry Ellig, "Regulatory Impact Analysis for Financial Regulations" (George Washington Regulatory Studies Center, 2020), *https://regulatorystudies.columbian.gwu.edu/regulatory-impact-analysis-financial-regulations*, which supports a pre-statutory baseline in the context of financial regulations.

[9] Although this example is hypothetical, it draws heavily on an assessment of a 2004 Food and Drug Administration (FDA) bar code rule: Aaron Kearsley, Nellie Lew, and Clark Nardinelli, "A Retrospective and Commentary on FDA's Bar Code Rule," *Journal of Benefit-Cost Analysis* 9, no. 3 (2018): 496-518. A key theme of the paper is the challenge of establishing an appropriate analytic baseline, even retrospectively.

Table __. Illustrating Baseline Cost Estimates and Incremental Regulatory Cost Estimates Relative to Multiple Baselines ($ millions)

	(a)	(b)	(c)	(d)	(e)
	Costs of Technology Adoption: Baseline 1	Costs of Technology Adoption: Baseline 2	Costs of Technology Adoption: With Rule	Incremental Regulatory Costs Relative to Baseline 1	Incremental Regulatory Costs Relative to Baseline 2 *
2024	70	144	145	75	1
2025	72	293	294	222	1
2026	76	434	435	359	1
2027	90	639	640	550	1
2028	130	839	839	709	< 1
2029	222	957	957	735	< 1
2030	404	1,161	1,161	757	< 1
2031	709	1,645	1,645	936	< 1
2032	1,145	2,183	2,183	1,038	< 1
2033	1,673	2,696	2,696	1,023	< 1
2034	2,219	3,034	3,034	815	< 1
2035	2,699	3,243	3,243	544	< 1
2036	3,058	3,250	3,250	192	< 1

* The differentials in this column are roughly consistent with Tam's (1996) Model 8 elasticity estimates, as applied to the incentive magnitudes estimated for FDA's 2004 bar code rule. Kar Yan Tam, "Dynamic Price Elasticity and the Diffusion of Mainframe Computing," *Journal of Management Information Systems* 13, no. 2 (1996): 163-183.

Furthermore, we request comment on potentially helpful clarifications where there is overlap or interaction between the "*Developing an Analytic Baseline*" section and content that appears or could be added elsewhere in revisions to the Circular. For example, we solicit comment on whether discussion of practices related to the President's Budget (PB) baseline—e.g., the PB baseline potentially including some or all of a proposed rule's estimated effects, even before finalization—would be a useful addition to the Circular, and if so, whether such discussion would be most helpfully placed in the "*Developing an Analytic Baseline*" section (providing guidance on when the PB baseline might be informative as an regulatory impact analysis's secondary baseline) or in the "*Specialized Analytical Requirements*" section, where there is an outline of analyses that sometimes partially overlap with analyses conducted in accordance with Executive Order 12866 of September 30, 1993 (Regulatory Planning and Review) (E.O. 12866). In addition, we note that the proposed revisions to the Circular contain cross-references between, for example, the "*Developing an Analytic Baseline*" section and the compliance discussion in the "*Other Key Considerations*" section, and we request comment on useful ways to further draw out any such relevant connections.

Identifying the Need for Federal Regulatory Action

Proposed revisions to Circular A-4 (2003)'s material in the section previously titled "*The Need for Federal Regulatory Action*" primarily fall within two categories.

First, the proposed revisions would amend discussion in Circular A-4 to clarify that analysis of a regulation's anticipated effects can reveal that what was previously assumed to be a need for regulation is not present, or identify additional needs for regulation not previously

considered. Proposed revisions would clarify that consideration of the need for federal regulatory action and development of the regulatory analysis is an iterative process. Further, proposed revisions would emphasize that statements about a need for federal regulatory action should generally be supported by evidence in the regulatory analysis. Proposed revisions would also clarify that even when a regulation is implementing or interpreting a statutory requirement, an agency should conduct reasonable inquiries to identify other needs for federal regulatory action.

Second, proposed revisions to this section would elaborate and expand upon the existing discussions of market failures and other distortions. As noted in the proposed revisions to Circular A-4, modeling such distortions is often a standard starting point for conducting analyses of regulatory interventions. Proposed revisions would add additional material on the connection between the concept of externalities and common pool resources, club goods, and public goods, as well as the concept of network benefits. Proposed revisions would expand the material on market power to provide further information regarding the sources and effects of market power. Proposed revisions would clarify material in Circular A-4 focusing on asymmetric and imperfect information and distinguish it from behavioral biases; proposed revisions would break out material on behavioral biases into its own section and discuss it separately. And proposed revisions would emphasize improving government operations and service delivery, promoting distributional fairness and equity, and protecting civil rights and civil liberties or advancing democratic values as potential needs for federal regulation by breaking each out into a separate section as well. Proposed revisions to this section would more generally aim to emphasize the critical relationship between identifying market failure—or other distortions—and producing a rigorous regulatory analysis.

Market failure is a critical concept in welfare economics. The first fundamental welfare theorem[10] states that competitive equilibrium generates Pareto efficient outcomes under certain conditions. When an equilibrium is Pareto efficient, variations on equilibrium outcomes cannot improve outcomes for one party without worsening outcomes for at least one other party. Violations of these required conditions are often called distortions or market failures. Regulatory action is often motivated by distortions that violate the conditions under which the first fundamental welfare theorem is relevant—whether from market failure, suboptimal service delivery by or operation of public institutions (sometimes referred to in the academic literature as government failure), or behavioral biases—but there are many other legitimate motivations for regulatory action.[11]

We seek feedback on our proposed reorganization of, and revisions to, the section with the proposed title "*Identifying the Need for Federal Regulatory Action*." We recognize that societal problems motivating regulatory action may be challenging to analyze using a benefit-cost analysis framework (as set forth in the Circular as issued in 2003), so we solicit comment related to problems that pose this type of challenge, including analyzing associated regulatory effects using quantitative and qualitative methods. We ask for comment on whether more

[10] *See, e.g.*, Andreu Mas-Colell, Michael D. Whinston, and Jerry R. Green, *Microeconomic Theory* (New York: Oxford University Press, 1995).

[11] In cases where distortions cannot be fully eliminated or offset, the theory of the second best often underlies regulatory action. R. G. Lipsey and Kelvin Lancaster, "The General Theory of Second Best," *The Review of Economic Studies* 24, no. 1 (1956): 11-32.

explication would be helpful about any particular or additional types of market failures, behavioral biases, or other important examples of a need for regulatory action associated with E.O. 12866 Section 1(a), 1(b) or 6(a)(3)(B)(i), as well as if or how the approach to regulatory analysis should be adjusted if a distortion or market failure is not identified.

Developing Benefit and Cost Estimates

Many updates are proposed to the material in the "*Developing Benefit and Cost Estimates*" section, including regarding revealed preference methods, stated preference methods, benefit-transfer methods, general equilibrium analysis, and how to account for non-monetized effects. These proposed revisions largely elaborate on material that was previously present in Circular A-4, with reference to more recent methods and findings in the academic literature, and make other incremental improvements. In addition, a terminological change from discussion of "ancillary benefits and countervailing risks" to "additional benefits and costs" has been proposed to clarify that categories of effects such as "ancillary" or "indirect" are not meaningfully different for analytical purposes from categories of effects that are "primary" or "direct." We solicit comment and feedback on all of these proposed revisions, including on how to ensure that unquantified and non-monetized effects are given appropriate attention in the analysis, such as through summary tables with categories or rank ordering.

One part of this section that was largely left unchanged in the proposed revisions is the material on monetizing health and safety benefits and costs (including the subsections on non-fatal risks, fatality risks, and risks to children). As the proposed revised version of the Circular notes, that material is essentially unchanged, with the exception of relatively minor edits, including correcting outdated language, providing a missing citation to an already-referenced source, and updating to reflect current agency estimates of value of statistical life (VSL).

Although the Circular's discussion of health and safety metrics appears in another section—"*Analytical Approaches*"—it is worth mentioning here because health and safety metrics are often analyzed in conjunction with monetization methods such as VSL. The proposed revisions to the "*Analytical Approaches*" section would also leave it largely unchanged, with relatively minor edits, including correcting outdated language and clarifying the appropriate usage of quality-adjustment for non-fatal outcomes in footnote 8.

While recognizing that potential modifications to material on monetizing health and safety benefits and costs and health and safety metrics could be advantageous, OMB believes that continued reliance on this material is generally appropriate at this time.[12] While you may submit comments on potential revisions to this material, OMB does not intend to substantially revise this material at this time.

Some guidance offered in the proposed revisions to the "*Developing Benefit and Cost Estimates*" section would be relevant for the assessment of any category of regulatory effects (e.g., content about performing general or partial equilibrium analysis would be associated with estimation of both benefits and costs, and possibly also transfers), whereas some of its sub-

[12] We invite comment on whether there are any areas where well-supported and longstanding agency practice is not reflected in this section of the Circular.

sections relate mostly to the types of impacts typically categorized as benefits. A peer review of OMB's 2013 *Report to Congress on the Benefits and Costs of Federal Regulations* notes that Circular A-4 "provides very little guidance on estimating costs."[13] We welcome feedback related to this observation—and the related need to provide additional guidance on estimating benefits—including, but not limited to, potential revisions of the Circular to include or address any of the following:

- The use of wage data to estimate cost of time spent responding to a regulation is addressed in a section of 2011's Circular A-4 Frequently Asked Questions titled "How do I value time?"[14] (Note that time *savings* can also be a regulatory benefit.) Should this content, or a revised version of it, be incorporated into the Circular itself? Are there other metrics for estimating the cost of time that can be used where wage data are not readily available, such as for volunteers, retirees, or the self-employed? How should fringe benefits and overhead also be accounted for in estimating the cost of time?
- Is there general guidance that can be provided regarding how regulatory benefits or costs differ depending on the length of time allowed for compliance (that is, the length of time between issuance of a regulation and the date(s) when regulated entities must comply with its provisions)? For example, are there rules of thumb related to "rush" charges that would be broadly applicable?
- For many regulations, the most direct costs are associated with activity that does not itself yield benefits, but instead may prompt intermediate actions that connect the direct effects with ultimate beneficial outcomes. For instance, a regulation may require collection and dissemination of information related to safety practices; the information itself does not make anyone safer, but its greater availability may prompt more widespread use of effective safety practices.[15] Is there guidance that can be provided toward the goal of avoiding the inappropriate omission of costs of activities that accrual of benefits is contingent upon (such as the more widespread safety practices in the example above)?
- In some cases, empirical evidence, including cost-related data, will be available only from entities or individuals who have voluntarily performed (or refrained from) some activity. All else equal, a regulatory requirement will impose higher costs than what is observed from voluntary actions or inaction—if not in terms of direct spending, then in some other aspect of the broader phenomenon of opportunity cost. (Note, however,

[13] Lisa A. Robinson, *Review of OMB's Draft 2013 Report to Congress* (2013), *https://obamawhitehouse.archives.gov/sites/default/files/omb/inforeg/2013_cb/comments/robinson-omb-2013-comments.pdf*.

[14] Office of Information and Regulatory Affairs, *Regulatory Impact Analysis: Frequently Asked Questions (FAQs)* (2011), *https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/assets/OMB/circulars/a004/a-4_FAQ.pdf*.

[15] As a further example, a new rulemaking may clarify existing regulatory requirements. Clarification may increase performance of the same type of costly activities associated with the earlier regulation being clarified (as well as beneficial activities associated with those activities). Proposed revisions to the "*Estimating Compliance*" section make some progress toward providing guidance relevant to such issues, and we welcome further relevant suggestions. Also, evidence may indicate positive willingness-to-pay or willingness-to-accept associated with information even when it does not change targeted behavior: informed people may feel more confident in their decisions, may find other applications for the information, or may value the information for other reasons.

that market failures, behavioral biases, and other distortions can cause divergences between the observed costs and benefits of voluntary actions and the amounts that would appropriately be included in benefit-cost analysis conducted from a society-wide perspective.) Are there potential revisions to the Circular that would inform extrapolation from empirical evidence in such cases?

As noted previously, proposed revisions to this section expand on methods for accounting for non-monetized effects. Scholarly research features a wide variety of contexts—only some of which are related to regulation or other public policy—in which break-even concepts are relevant to theoretical modeling or numerical results.[16] We request comment on whether and how this wide-ranging quantitative literature can be synthesized into practical guidance related to the presentation of break-even comparisons in the regulatory context.

Although the revised Circular as proposed provides some discussion in individual sections related to econometrics and other applied statistics (e.g., in the discussion of stated preference studies), we request comment on generalizing guidance on these topics and collecting the relevant content in one section. What reference materials—for example, Athey and Imbens (2017),[17] Wing et al. (2018),[18] Manski (2008),[19] or others—could be cited (if any) that would be broadly relevant across regulatory contexts and useful for analysts with a range of technical training and experience? How could guidance be crafted to effectively address both agencies' own conducting of statistical studies for the purpose of providing inputs into regulatory analyses and their incorporation of external research into such analyses? In order to establish conceptual connections with related content already in the Circular (for example, in the "*Quality, Objectivity, Transparency, and Reproducibility of Results*" or "*Treatment of Uncertainty*" sections) while minimizing unnecessary duplication of text, what location should be considered for placement of a potential econometrics and applied statistics section or sub-section?

Transfers

Circular A-4 gives limited attention to transfers, a category of regulatory effects that can be differentiated from societal benefits or costs. In 2011, OIRA issued "Regulatory Impact Analysis: A Primer"[20] and an accompanying set of "Frequently Asked Questions (FAQs),"[21] which provided further guidance on the topic. The proposed revisions to the Circular draw on examples listed in the Primer and the FAQ. In addition, the proposed revisions would clarify that agencies can alternatively eschew the use of the category of transfers, and treat transfers instead

[16] A survey of recent papers published in the *Journal of Policy Analysis and Management* and the *Journal of Benefit-Cost Analysis* since 1983 reveals at least sixty papers that include break-even calculations or related discussion.
[17] Susan Athey and Guido W. Imbens, "The State of Applied Econometrics: Causality and Policy Evaluation," *Journal of Economic Perspectives* 31, no. 2 (2017): 3-32.
[18] Coady Wing, Kosali Simon, and Ricardo A. Bello-Gomez, "Designing Difference in Difference Studies: Best Practices for Public Health Policy Research," *Annual Review of Public Health* 39 (2018): 453-69.
[19] Charles F. Manski, *Identification for Prediction and Decision* (Cambridge, Massachusetts: Harvard University Press, 2008).
[20] OIRA, *Regulatory Impact Analysis: A Primer* (Aug. 15, 2011), *https://www.reginfo.gov/public/jsp/Utilities/circular-a-4_regulatory-impact-analysis-a-primer.pdf*.
[21] OIRA, *Regulatory Impact Analysis: Frequently Asked Questions (FAQs)* (Feb. 7, 2011), *https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/assets/OMB/circulars/a004/a-4_FAQ.pdf*.

as offsetting benefits and costs (which leaves estimates of net benefits unchanged). This approach may be of particular use when producing a distributional analysis. The proposed revisions would also include discussion of why agencies should not use the marginal cost of public funds (MCPF) when analyzing changes in government revenues and expenditures caused by regulations, as discussed below.

Two transfers-related accounting approaches appear in the proposed revisions. Importantly, net benefits (societal benefits minus societal costs) would be the same regardless of accounting approach. OMB requests comments on presenting these two transfer-related accounting approaches in revisions to Circular A-4, and any recommendations regarding improvements to the revised material in this section, as proposed.

We request comment on whether there is terminology-related guidance that we should include in revisions that would enhance clarity in categorizing regulatory impacts. For instance, use of the phrase "in-kind benefits" or "cash benefits" illustrates a common challenge in regulatory assessment when using the concepts of benefits, costs, and transfers: the imperfect overlap between phenomena ordinarily described using the words "benefits," "costs," or "transfers" and those three categories as they would be used for analysis conducted in accordance with the Circular. We request comment and recommendations for overcoming this challenge.

The marginal cost of public funds (which is closely related to the marginal excess tax burden (METB)) is not discussed in specific terms in Circular A-4. OMB Circular No. A-94—OMB's guidance on benefit-cost analysis of federal programs, as published in 1992—directs that analysis of certain public investments should include a supplementary analysis with METB.[22] However, there are noteworthy practical and theoretical challenges with performing sufficiently thorough regulatory assessments to apply the METB or MCPF in an analysis, as discussed in the proposed revisions to Circular A-4. In addition, the METB and MCPF have not been applied in regulatory impact analyses conducted under E.O. 12866 previously. Considering the relevant theoretical and practical challenges of such approaches,[23] we request comment on the proposed revisions' guidance that agencies should avoid attributing future changes in the tax system to regulations that affect federal revenues or expenditures. In addition to welcoming comments on any relevant scholarly literature or practitioner experience, we request updates that have become available since OMB last sought feedback on this conceptual area in late 2019 and early 2020, via an METB-related docket,[24] that are relevant to the proposed revisions to the Circular.

Distributional Effects

Review of Agencies' Analyses of Distributional Effects

[22] OMB, Circular A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs* 13 (Oct. 29, 1992), https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/circulars/A94/a094.pdf.
[23] *See, e.g.*, Bas Jacobs, "The Marginal Cost of Public Funds is One at the Optimal Tax System," *International Tax and Public Finance* 25 (2018): 883-912; Amy Finkelstein and Nathaniel Hendren, "Welfare Analysis Meets Causal Inference," *Journal of Economic Perspectives* 34, no. 4 (2020): 146-67.
[24] This docket's URL is *https://www.regulations.gov/document/OMB-2017-0002-0055*.

Circular A-4 directs agencies to include an analysis of the expected distributional effects of their regulatory actions:

> Your regulatory analysis should provide a separate description of distributional effects . . . so that decision makers can properly consider them along with the effects on economic efficiency. . . . Where distributive effects are thought to be important, the effects of various regulatory alternatives should be described quantitatively to the extent possible, including the magnitude, likelihood, and severity of impacts on particular groups.

E.O. 12866, similarly, requires agencies to consider distributive impacts when deciding among alternatives. However, recent studies of agencies' regulatory impact analyses have found that most contain little analysis of regulations' effects on particular groups, aside from analysis of effects on small businesses included to comply with the requirements of the Regulatory Flexibility Act. One study looked at 24 economically significant rules and found that a few contained some information about the health risk reductions expected from the rule for specific groups, often children, but none provided a distributional analysis of net benefits.[25] The expanded guidance on distributional analysis in the proposed revisions to Circular A-4, described in more detail below, is intended to assist agencies in expanding estimation of disparate effects of rules on individual groups.

Rationale for Distributional Analysis

While a regulation may have positive net benefits for society as a whole, it may make some individuals, firms, or other entities better off and some individuals, firms, or other entities worse off. If it were possible to redistribute income from the winners to the losers using a costless, non-distortionary tax and transfer scheme, everyone could potentially be made better off (or no worse off) by a regulation for which there is a positive total net willingness to pay. However, this theoretical possibility is not likely to be realized or even approximated. As such, analyzing the full welfare effects of regulations requires analyzing the incidence, or distribution, of their effects. In addition, policymakers may be concerned about the effects of regulations on particular groups—such as the incidence of benefits and costs of regulations on lower income groups and other underserved communities—for a variety of reasons. As a result, it can be important for policymakers to have estimates of the distributional effects of regulatory alternatives (along with estimates of the aggregate net benefits of these alternatives).

Considerations in Distributional Analysis

In developing proposed revisions to Circular A-4, we considered whether the Circular should call for agencies to generally produce distributional analyses in regulatory impact analyses for certain types of rules. After consideration, we have proposed revisions that do not adopt this approach. Regardless of the type of rule, not all rules of a given type will necessarily

[25] Lisa A. Robinson, James K. Hammitt, and Richard J. Zeckhauser, "Attention to Distribution in U.S. Regulatory Analyses," *Review of Environmental Economics and Policy* 10, no. 2 (2016): 308-28; *see also* Richard L. Revesz and Samantha P. Yi, "Distributional Consequences and Regulatory Analysis," *Environmental Law* 52, no. 1 (2022): 53-98 (summarizing the literature and surveying several environmental regulations).

have important distributional effects, distributional analysis can be a complex undertaking (especially when the expected incidence of benefits and costs is fully analyzed), and agencies' resources for conducting economic analyses of regulatory actions are scarce. For this reason, we have proposed revisions that emphasize agency discretion to perform preliminary screening of rules to determine which are most likely to have significant differentiated effects on particular demographic groups and to analyze important distributional effects in those cases.

In developing proposed revisions, we also considered whether Circular A-4 should specify which demographic or other groups should be analyzed when agencies conduct distributional analysis. Such a specification would ensure greater uniformity in agencies' analysis and allow comparisons across rules. However, Circular A-4 applies across a large number of different agencies that analyze rules addressing a wide variety of issues and the important distributional effects and concerns are likely to differ across rules. Therefore, the proposed revisions would include a list of possible groups to examine, but would not strictly call for the analysis of particular groups across all rules, nor is the list exhaustive of groups that may be affected by rules. That said, to the extent possible given available evidence, we tentatively conclude that it is nevertheless generally 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. OMB solicits comment on this approach.

Weights and Benefit-Cost Analysis

A standard assumption in economics, informed by empirical evidence (as discussed below), is that an additional $100 given to a low-income individual increases the welfare of that individual more than an additional $100 given to a wealthy individual. Traditional benefit-cost analysis, which applies unitary weights to measures of willingness to pay, does not usually take into account how distributional effects may affect aggregate welfare because of differences in individuals' marginal utility of income. Related to the topic of distributional analysis is the question of whether agencies should be permitted or encouraged to develop estimates of net benefits using weights that take account of these differences.[26] The proposed revisions to Circular A-4 suggest that agencies may wish to consider weights for each income group affected by a regulation that equal the median income of the group divided by median U.S. income, raised to the power of the elasticity of marginal utility times negative one.

A crucial component of this approach is the value of the elasticity of marginal utility. OMB has preliminarily determined that 1.4 is a reasonable default estimate of a constant elasticity of marginal utility for use in computing distributional weights. This preliminary determination is based on a survey of the empirical evidence discussed below.[27] There are a

[26] As noted in the "*Distributional Effects*" section of the proposed revisions to the Circular, agencies can take distributional concerns into account as non-monetized effects of a regulation.

[27] Agencies have previously examined these lines of evidence for various purposes distinct from calculating an income-weighted benefit-cost analysis. In calibrating the elasticity of marginal utility with respect to consumption for the purpose of discounting, Environmental Protection Agency, *EPA External Review Draft of Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances* (2022), *https://www.epa.gov/system/files/documents/2022-11/epa_scghg_report_draft_0.pdf*, uses values of 1.02, 1.24, and

variety of different approaches and methodologies in the literature, but many assume an underlying utility function with constant elasticity. Acland and Greenberg (2022) include a recent survey of many of these approaches.[28]

Evidence on risk aversion can be used to estimate the elasticity of marginal utility. In a constant-elasticity utility specification, the coefficient of relative risk aversion is the elasticity of marginal utility. There are numerous different estimates of the coefficient of relative risk aversion (CRRA), using data from a variety of different markets, including labor supply markets,[29] the stock market,[30] and insurance markets.[31] Relevant estimates vary widely, though assumed values of the CRRA between 1 and 2 are common.[32]

1.42 to match evidence on market interest rates, following Kevin 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 2022): 223-75. And in calibrating the elasticity of intertemporal substitution in its SAGE model, Alex Marten, Andrew Schreiber, and Ann Wolverton, *SAGE Model Documentation (Version 2.0.1)* (Environmental Protection Agency, 2021), *https://www.epa.gov/sites/default/files/2020-12/documents/sage-model-documentation-version-2.0.0_0.pdf*, uses a value of 1.66, citing to Tomas Havranek et al., "Cross-Country Heterogeneity in Intertemporal Substitution," *Journal of International Economics* 96, no. 1 (2015): 100-18. This estimate reflects the generally higher empirical estimates found in studies of the elasticity of intertemporal substitution. Agencies have also examined VSL elasticity evidence for the purpose of projecting VSL given expected economic growth. For example, the Department of Transportation, *Treatment of the Value of Preventing Fatalities and Injuries in Preparing Economic Analyses* (2021), *https://www.transportation.gov/sites/dot.gov/files/2021-03/DOT%20VSL%20Guidance%20-%202021%20Update.pdf*, after surveying VSL evidence, adopted the use of an elasticity of 1.0 for such purposes, stating that "this guidance adopts this more moderate figure, pending more comprehensive documentation." Department of Health and Human Services, *Guidelines for Regulatory Impact Analysis* (2016), *https://aspe.hhs.gov/sites/default/files/migrated_legacy_files//171981/HHS_RIAGuidance.pdf* also uses 1.0 for this value, while noting uncertainty. And Environmental Protection Agency, *EPA External Review Draft of Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances* (2022), *https://www.epa.gov/system/files/documents/2022-11/epa_scghg_report_draft_0.pdf* also uses 1.0 for VSL income elasticity. These estimates reflect the generally lower empirical estimates found in studies of the income elasticity of VSL. Because of the links between different approaches to estimating this elasticity given an underlying utility function with constant elasticity, and the differing empirical findings across different lines of evidence, we follow Ben Groom and David Maddison Pr., "New Estimates of the Elasticity of Marginal Utility for the UK," *Environmental and Resource Economics* 72 (2019): 1155-82 and Daniel Acland and David H. Greenberg, "Principles and Practices for Distributional Weighting: A New Approach" (Goldman School of Public Policy Working Paper, 2022), *https://gspp.berkeley.edu/faculty-and-impact/working-papers/principles-and-practices-for-distributional-weighting-a-new-approach* by considering a range of evidence rather than focusing on a single line of evidence.

[28] Daniel Acland and David H. Greenberg, "Principles and Practices for Distributional Weighting: A New Approach" (Goldman School of Public Policy Working Paper, 2022), *https://gspp.berkeley.edu/faculty-and-impact/working-papers/principles-and-practices-for-distributional-weighting-a-new-approach*.

[29] Using estimates of labor supply elasticities, Raj Chetty, "A New Method of Estimating Risk Aversion," *The American Economic Review* 96, no. 5 (2006): 1821-34 derives an estimate of 0.71 for the CRRA.

[30] Robert S. Pindyck, "Risk Aversion and Determinants of Stock Market Behavior," *The Review of Economics and Statistics* 70, no. 2 (1988): 183-90 uses stock market data and estimates the CRRA to be "in the range of 3 to 4."

[31] George G. Szpiro, "Measuring Risk Aversion: An Alternative Approach," *The Review of Economics and Statistics* 68, no. 1 (1986): 156-59 found an estimate of 1.2 to 1.8 using data from property/liability insurance in the U.S.

[32] Levon Barseghyan et al., "Estimating Risk Preferences in the Field," *Journal of Economic Literature* 56, no. 2 (2018): 501-64 provides a review of research estimating risk aversion using data, from various markets.

One approach to estimating how utility changes with changes in income is to look at how individuals' self-reporting of happiness varies with income.[33] Layard, Nickell, and Mayraz (2008) use the results of six surveys of individuals, including one U.S.-only survey, on their level of satisfaction or happiness, as well as income and other demographic data, to estimate the elasticity of marginal utility of income.[34] Using data from the single U.S.-only survey they estimate an elasticity of 1.20 and based on data from the full six surveys they estimate an elasticity of 1.26. The U.K. government cites this work to justify its use of an elasticity of 1.3 in weights for benefit-cost analysis. Using a similar methodology and data from the Gallup World Poll, Gandelman, and Hernández-Murillo (2015) estimate an elasticity of 1.39 for the U.S.[35]

The elasticity of intertemporal substitution (EIS) measures peoples' willingness to shift consumption over time, such as from one year to the next. Under the assumption of constant elasticity, this parameter is the inverse of the elasticity of marginal utility, though in more complex models it need not be.[36] Havranek et al. (2015) provide a meta-analysis of such estimates, investigating heterogeneity across methodology and context.[37] They find a mean estimate of the EIS for the United States of 0.594, consistent with an elasticity for purposes of computing weights of 1.7.

Another approach relies on the income elasticity of the value of a statistical life (VSL). The income elasticity of the VSL is linked to the elasticity of marginal utility in models with constant elasticity.[38] A number of meta-analyses and reviews of the empirical evidence on the VSL have reached mixed conclusions. A meta-analysis by Viscusi and Aldy (2003) indicates an income elasticity of the VSL of about 0.5 to 0.6.[39] Viscusi and Masterman (2017) obtain an estimate of 0.5 to 0.7 for the U.S, after correcting for publication bias.[40] Using panel data on

[33] See Andrew J. Oswald, "On the Curvature of the Reporting Function from Objective Reality to Subjective Feelings," *Economics Letters* 100, no. 3 (2008): 369-72 and Timothy N. Bond and Kevin Lang, "The Sad Truth about Happiness Scales," *Journal of Political Economy* 127, no. 4 (2019): 1629-40 for, respectively, a critique of the assumption that these measures can be interpreted as measures of utility and an evaluation of the limitations of collecting happiness data in discrete categories (*e.g.*, very happy, pretty happy).

[34] Richard Layard, Guy Mayraz, and Stephen Nickell, "The Marginal Utility of Income," *Journal of Public Economics* 92, no. 8-9 (2008): 1846-57.

[35] Néstor Gandelman and Rubén Hernández-Murillo, "Risk Aversion at the Country Level," *Federal Reserve Bank of St. Louis Review* 97, no. 1 (2015): 53-66.

[36] Using micro data on expenditures in the U.K., Thomas F. Crossley and Hamish W. Low, "Is the Elasticity of Intertemporal Substitution Constant?," *Journal of the European Economic Association* 9, no. 1 (2011): 87-105, reject the assumption of a constant EIS.

[37] Tomas Havranek et al., "Cross-Country Heterogeneity in Intertemporal Substitution," *Journal of International Economics* 96, no. 1 (2015): 100-18.

[38] See Louis R. Eeckhoudt and James K. Hammitt, "Background Risks and the Value of a Statistical Life," *Journal of Risk and Uncertainty* 23, (2001): 261-79, Louis Kaplow, "The Value of a Statistical Life and the Coefficient of Relative Risk Aversion," *Journal of Risk and Uncertainty* 31, no. 1 (2005): 23-34, and Mary F. Evans and V. Kerry Smith, "Measuring How Risk Tradeoffs Adjust with Income," *Journal of Risk and Uncertainty* 40, no. 1 (2010): 33-55 for discussion of these relationships.

[39] W. Kip Viscusi and Joseph E. Aldy, "The Value of a Statistical Life: A Critical Review of Market Estimates throughout the World," *Journal of Risk and Uncertainty* 27 (2003): 5-76.

[40] W. Kip Viscusi and Clayton J. Masterman, "Income Elasticities and Global Values of a Statistical Life," *Journal of Benefit-Cost Analysis* 8, no. 2 (2017): 226-50.

workers' wages, Knieser et al. (2010) found a somewhat higher estimate of 1.44 across all income quartiles examined.[41]

Table I below presents a selection of estimates of the elasticity of marginal utility drawn from each of these literatures. The simple average of estimates across these studies is 1.4. When a range of estimates is shown for a single paper, the midpoint of that range is used in computing the average. The average is sensitive to the choice of studies included or excluded from the computation, and a different average would be obtained if a different selection of papers and methodology were chosen. An important source of uncertainty in selecting an appropriate elasticity is the relative weight to place on each source.

Table I
Evidence on the Elasticity of Marginal Utility

	Elasticity of Marginal Utility
Studies of risk aversion	
Chetty (2006)	0.7
Pindyck (1988)	3-4
Szpiro (1986)	1.2-1.8
Studies of subjective well-being	
Gandelman and Hernández-Murillo (2015)	1.39
Layard, Nickell, and Mayraz (2008)	1.20
Studies of intertemporal substitution	
Havranek et al. (2015)	1.7
Studies of the income elasticity of the VSL	
Kniesner et al. (2010)	1.44
Viscusi and Masterman (2017)	0.5-0.7
Viscusi and Aldy (2003)	0.5-0.6

The preliminary recommended value of 1.4 for the elasticity of marginal utility is close to the mean value of 1.35 found by Drupp et al. (2018)[42] in a survey of 200 experts conducted in the context of discounting. Acland and Greenberg (2022)[43] recommend a value of 1.5 for the United States, with sensitivity testing at 1.3 and 1.7.

[41] Thomas J. Kniesner, W. Kip Viscusi, and James P. Ziliak, "Policy Relevant Heterogeneity in the Value of Statistical Life: New Evidence from Panel Data Quantile Regressions," Journal of Risk and Uncertainty 40, no. 1 (2010): 15-31.
[42] Moritz A. Drupp et al., "Discounting Disentangled," *American Economic Journal: Economic Policy* 10, no. 4 (2018): 109-34.
[43] Daniel Acland and David H. Greenberg, "Principles and Practices for Distributional Weighting: A New Approach" (Goldman School of Public Policy Working Paper, 2022), *https://gspp.berkeley.edu/faculty-and-impact/working-papers/principles-and-practices-for-distributional-weighting-a-new-approach*.

We solicit comment on the expanded guidance on distributional analysis in the draft Circular A-4, as well as the following specific questions:

1. How can OMB refine the list of groups identified for consideration in distributional analysis?
2. Are there available data sources that OMB should identify as being potentially useful for agencies that would like to perform a distributional analysis, particularly focusing on underserved populations?
3. Should OMB provide additional guidance on when, and using what methods, it would be most appropriate for agencies to undertake benefit-cost analysis weighted by income (or other measures of economic status)?
4. How can OMB refine its preliminary default estimate of elasticity of marginal utility? What additional studies should be considered? What other methods should be considered to derive a default estimate?

Treatment of Uncertainty

The treatment of uncertainty in Circular A-4 warrants revisiting as the literature and the tools to assess uncertainty have evolved significantly since guidance was issued in 2003. Two important changes in the proposed revisions to this section of Circular A-4 include no longer stating that an assumption of risk-neutrality is generally appropriate, and providing more guidance on how to calculate risk-adjusted benefit or cost values when willingness-to-pay or willingness-to-accept values do not already reflect individuals' risk preferences. We solicit comment on all aspects of these proposed revisions, and we note that many of these topics are interrelated. Please provide information including peer-reviewed journal articles, data, and other relevant information that would be helpful.

Expected Utility Framework and Non-Expected Utility Framework

We note that Circular A-4 implicitly directs agencies to use expected utility frameworks in their quantitative assessment of uncertainty.[44] While expected utility frameworks still possess usefulness in benefit-cost analysis, the economics literature, through various behavioral observations and experiments, highlights the potential for alternatives to expected utility frameworks—referred to as non-expected utility frameworks—to be deployed in benefit-cost analysis.[45] We seek comment on whether and how to incorporate non-expected utility frameworks in revisions to the Circular.

Objective and Subjective Probability

Circular A-4 states: "[w]henever possible, you should use appropriate statistical techniques to determine a probability distribution of the relevant outcomes."[46] While there are various statistical techniques to determine probability distributions, we note that both objective

[44] Circular A-4, at 42.
[45] Chris Starmer, "Developments in Non-Expected Utility Theory: The Hunt for a Descriptive Theory of Choice under Risk," *Journal of Economic Literature* 38, no. 2 (2000): 332-82.
[46] Circular A-4, at 41.

and subjective probability distributions have garnered much academic attention[47] and have relevance to benefit-cost analysis of regulations. Generally, Federal benefit-cost analysis deploys extrapolation of historical information to derive future probability distributions in assessing expected benefits and costs. But depending on the quality of historical information and the different use of such information (e.g., extrapolation far into the future), subjective probability may be more informative for regulatory analysis. We seek comment on whether and how to incorporate subjective probability in revisions to the Circular.

Risk Preferences

Circular A-4 directs agencies to assume "risk neutrality" generally. However, there is a growing literature in measuring risk preferences that may be relevant in regulatory analysis. In particular, there is a growing literature showing that individuals exhibit substantial risk aversion across various contexts.[48] To capture these findings, there are at least two measures of risk preferences that could receive attention: measures of risk preferences that adjust probabilities associated with different goods or assets, and measures of risk preferences that adjust prices as reflected in certainty-equivalent values.[49] We seek comment on how to incorporate risk preferences in revisions to the Circular, and whether the proposed guidance regarding incorporation of risk preferences is sufficiently clear in the "*Economic Values of Uncertain Outcomes*" section.

Treatment of Low-Probability, High-Consequence Events

Circular A-4 does not explicitly give guidance on the analysis of low-probability, high-consequence events. Improvements in analyzing these types of events are important as policymakers and the public need information to accurately assess the efficacy of various policies to avoid such disasters as major oil spills or airline crashes. Past Federal benefit-cost analyses have used break-even comparisons or probabilistic risk assessment to analyze low-probability, high-consequence events. We seek comment on improvements in methods that may improve discussion of analysis of low-probability, high-consequence events in revisions to the Circular.

Discount Rates

Discounting Generally

[47] *See* Edi Karni, "Chapter 1—Axiomatic Foundations of Expected Utility and Subjective Probability," in *Handbook of the Economics of Risk and Uncertainty*, eds. Mark J. Machina and W. Kip Viscusi (Oxford: North Holland, 2014), 1-39.

[48] *See, e.g.*, Matilde Bombardini and Francesco Trebbi, "Risk Aversion and Expected Utility Theory: An Experiment with Large and Small Stakes," *Journal of the European Economic Association* 10, no. 6 (2012): 1348-99; Alma Cohen and Liran Einav, "Estimating Risk Preferences from Deductible Choice," *The American Economic Review* 97, no. 3 (2007): 745-88; Glenn W. Harrison, John A. List, and Charles Towe, "Naturally Occurring Preferences and Exogenous Laboratory Experiments: A Case Study of Risk Aversion," *Econometrica* 75, no. 2 (2007): 433-58; Raj Chetty, "A New Method of Estimating Risk Aversion," *The American Economic Review* 96, no. 5 (2006): 1821-34.

[49] 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 (Oxford: North Holland, 2014), 135-201.

As a general rule, the proposed revisions to Circular A-4 follow the same basic discount rate principles as in Circular A-4; however, the discount rate guidance warrants updating, as the academic literature and financial markets have evolved significantly since the 2003 guidance. There are two trends that are worth noting in particular. First, there has been a persistent decline in real interest rates over the last 40 years; real interest rates on Treasury bonds[50] had already fallen below 3% by 2003, and have remained lower than that level since then even as nominal rates have recently increased. Second, over the last 20 years, the literature on the treatment of the long-term discount rate has evolved substantially. Circular A-4 provides general guidance on how to address discounting over long time periods, and we believe that this guidance should be updated to incorporate advances in the economics literature.

We solicit comment on all aspects of this proposed revision, including the specific rates, parameters, and approaches discussed. Please provide any information—including peer-reviewed journal articles, data, and other relevant information—that you believe would be helpful. We specifically solicit comment on the frequency of subsequent updates to the proposed recommended rates or guidance, as well as the form of updates such as through separate notices, appendices to Circular A-4, or other suitable vehicles.

A discount rate, as noted in the proposed revision of Circular A-4, is a way to "reflect changes in the valuation of impacts across time." Specifically, between the present and any given point in the future, the discount rate is the amount by which the future valuation must be adjusted to be expressed in present value terms (after accounting for inflation). Thus, if the annual discount rate is a fixed 5%, $100 a year from now is valued equivalently to about $95.24 today ($100/(1 + 0.05)).

There are two primary approaches to determining the social discount rate for regulatory analysis. One is a "normative" or "prescriptive" approach that makes an ethical determination regarding the appropriate weight to place on the welfare of future and current generations.[51] Another approach is "descriptive," or "positive." With this approach, "the discount rate is inferred from rates of return that reflect consumers' actual choices," such as choices about saving and borrowing.[52] The primary argument for the use of a descriptive approach in the context of benefit-cost analysis is that it enables policymakers "to base resource allocation on the tradeoffs that society actually makes."[53] For this reason, Circular A-4 recommends—and the proposed revisions would continue to recommend—a descriptive approach to discounting in many circumstances; the remainder of this discussion will focus on descriptive approaches, while recognizing it reflects just one strand of the discounting literature.

Estimating an Appropriate Social Rate of Time Preference

[50] As measured by the annual average of the 10-year Treasury Inflation Protected Security.
[51] National Academies of Sciences, Engineering, and Medicine, *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide* (Washington, DC: The National Academies Press, 2017): 162; *see also* Giles Atkinson et al., *Cost Benefit Analysis and the Environment: Further Developments and Policy Use* (Paris: OECD Publishing, 2018): 198.
[52] National Academies of Sciences, Engineering, and Medicine, *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide* (Washington, DC: The National Academies Press, 2017): 162.
[53] *Id.*

The social rate of time preference is a term that refers to the discount rate (or schedule of discount rates) that can be used to convert consumption effects across different time periods into a present value.[54] As Circular A-4 notes, "the real rate of return on long-term government debt may provide a fair approximation" of society's rate of time preference in the near-term.[55] This approximation continues to be commonly advised: the "typical source of information for the risk-free rate would be government bonds."[56] As the proposed revision to Circular A-4 notes, this rate "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," and "also the rate at which society as a whole can trade current consumption for future consumption."[57] That is, use of financial market rates are primarily justified because they are a real price at which many individuals, and society as a whole, can trade off consumption over time. In addition, the use of an observable rate helps to establish an objective evidentiary basis for the specific parameters the government uses when developing the analytical basis for policymaking.[58]

In Circular A-4, the social rate of time preference rate was estimated using a 30-year average of the rate of return on 10-year Treasury notes less the annual average change in consumer price index (CPI) inflation.[59] Since Circular A-4 was published in 2003, the interest rate on 10-year Treasury notes has declined significantly and persistently, and remains low. This has also occurred in other advanced economies. Some suggest this is due to the policy response to the Great Recession (which started in 2007), but the decline began 20 years prior to the Great Recession.[60]

The proposed revision to Circular A-4 would retain the existing method for calculating the social rate of time preference and updating the 30-year average using data from 1993 to 2022, except that the 10-year Treasury Inflation-Protected Securities (TIPS) yield would be used for the years it is available (2003-2022), for the reasons discussed below. Using this method, the proposed revisions would update the estimate of the social rate of time preference to 1.7%.

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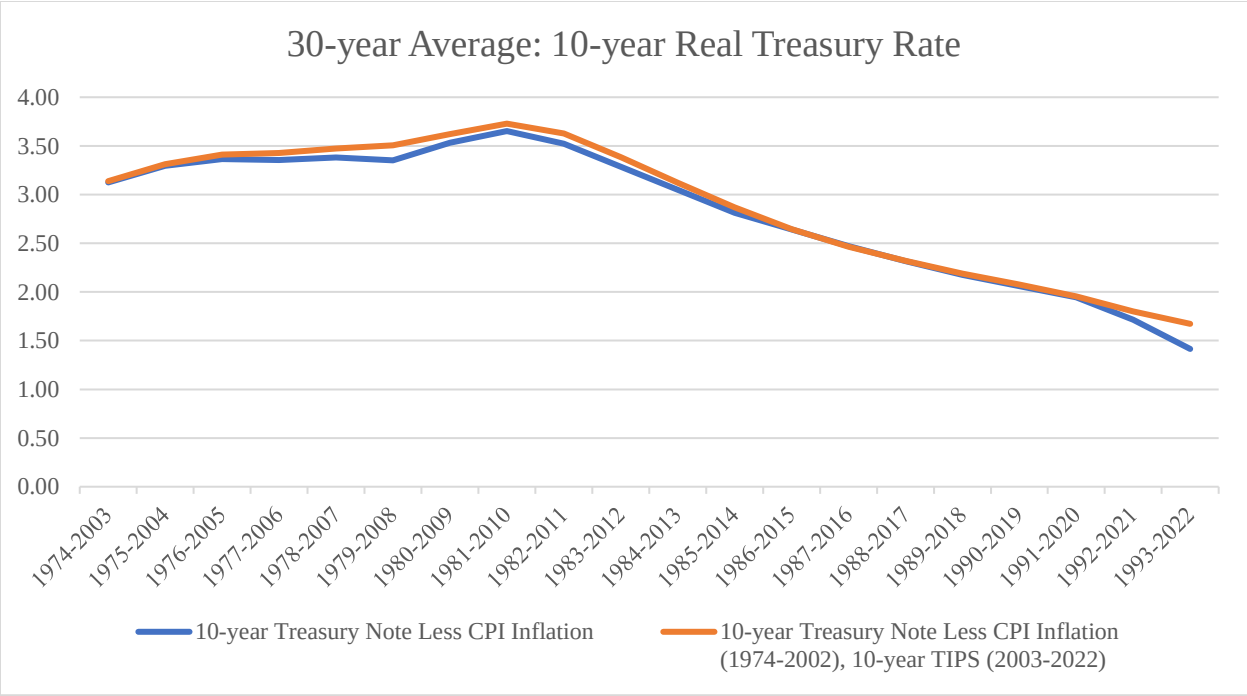
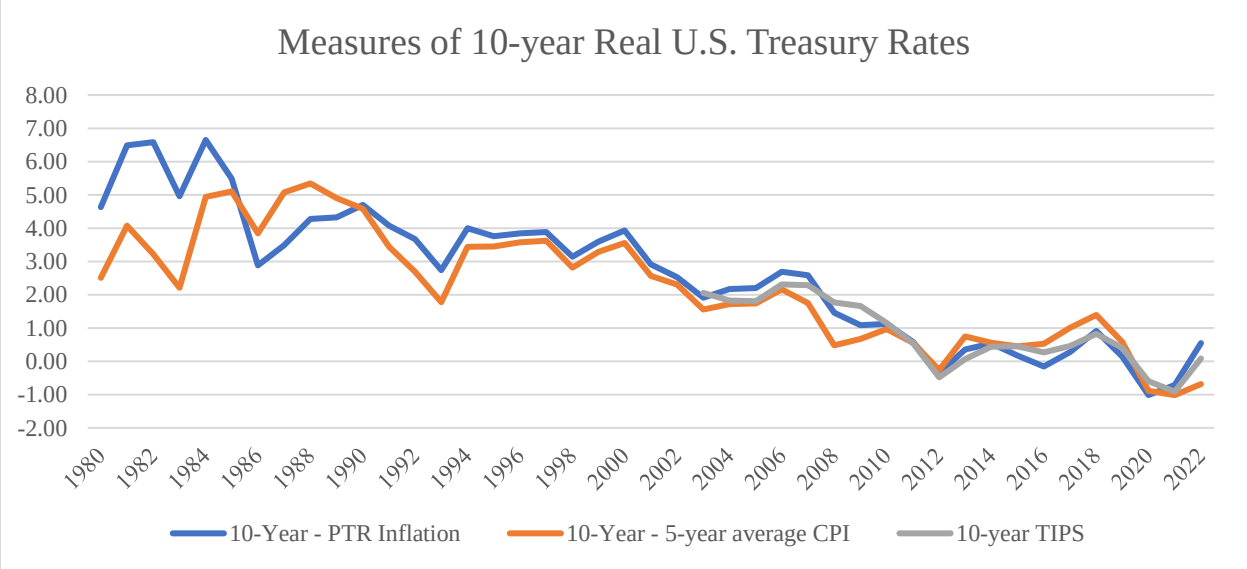
[54] Note that this approach can be expanded to account for uncertainty, and analysts can explicitly take uncertainty into account through various methods, including certainty equivalence.
[55] Circular A-4, at 33.
[56] Giles Atkinson et al., *Cost Benefit Analysis and the Environment: Further Developments and Policy Use* (Paris: OECD Publishing, 2018): 217.
[57] However, particular methods of moving consumption between time periods (e.g., changing the timing of government borrowing, taxation, and disbursement decisions) may entail other effects (discuss in more detail below) that could cause tradeoffs to no longer be well-described by this discount rate, and require other adjustments.
[58] In the descriptive approach, one looks for an "appropriate rate of return – a risk-free rate in this case – in the market place." Giles Atkinson et al., *Cost Benefit Analysis and the Environment: Further Developments and Policy Use* (Paris: OECD Publishing, 2018): 202.
[59] Circular A-4, at 33-34.
[60] *See* Council of Economic Advisers, *Discounting for Public Policy: Theory and Recent Evidence on the Merits of Updating the Discount Rate* (2017). Some potential explanations for this persistent decline can be found in 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 and Łukasz Rachel and Lawrence H. Summers, "On Secular Stagnation in the Industrialized World," *Brookings Papers on Economic Activity* (Spring 2019): 1-54.

As the first graph below demonstrates, had Circular A-4's estimate of the social rate of time preference been updated every year since 2003 using the original methodology, the rate would have been gradually declining for more than the last decade, particularly once the unusually high rates from the early 1980s fall out of the 30-year window.





We note that Circular A-4's approach combines an ex-ante measure of return (10-year Treasury notes) with an ex-post measure of inflation (CPI). This inconsistency is partially resolved in OMB's proposed new estimate by incorporating Treasury Inflation-Protected Securities return data for the years available. Introduced in 2003, TIPS offers protection against inflation risk by indexing the bond's principal to CPI inflation. Had OMB retained the original

approach from Circular A-4 (2003) for all years 1993-2022 (in other words, continuing to use 10-year Treasury rates and CPI even in the years when TIPS data is available), the estimated social rate of time preference would have instead been 1.4%. If OMB used the Federal Reserve perceived (inflation) target rate (PTR)—the median 10-year personal consumption expenditures (PCE) inflation expectation of the Survey of Professional Forecasters, shown in the second graph above—to address this conceptual inconsistency (which also means switching from using CPI inflation to PCE inflation), then the estimated social rate of time preference would be 1.7%. We believe that this conceptual inconsistency of using ex-ante yield data and ex-post inflation data can best be resolved by using both ex-ante yield data and ex-ante inflation expectation data to the extent available, as through the use of the TIPS yield measure. However, we request comment on whether this is the case, and if so, which data series are most appropriate to use for estimating the social rate of time preference.

The efficient markets hypothesis implies that a retrospective average of rates cannot outperform the current forward-looking market rate as the best estimate of the risk-free rate over the relevant time horizon.[61] However, we note that in times of economic turbulence, this may not hold, and that estimates of real returns using measures of expected inflation can deviate substantially from estimates of real returns using ex-post data on inflation. We solicit comment on how to address both the advantages and disadvantages of longer or shorter retrospective averages in light of both the strengths and limitations of the efficient markets hypothesis, as well as such averages' interaction with the discrepancy between expected inflation versus realized inflation.

Additionally, yields from longer-dated assets may provide an estimate that may be more appropriate for a regulation with a longer horizon. For example, 30-year Treasury bonds can be used to obtain a longer-horizon estimate of the social rate of time preference instead of the 10-year Treasury notes. This switch from a 10-year asset to a 30-year asset may provide more insight for regulations with longer time horizons, but those insights may come at the expense of greater distortions from term premia (which will generally bias longer rates upwards relative to shorter rates), and data is available for fewer years historically.[62] Because of data scarcity, only a few works attempt to estimate discount rates using returns on long-lived assets. However, some studies estimate a discount rate using leases that last hundreds of years.[63]

If we extend the data set of 10-year Treasury note yields and annual CPI inflation to include information from 1968 (when the Federal Reserve PTR data series begins) through 2022, the estimated social rate of time preference increases to 2.0% when using annual CPI, to 2.15% when TIPS are incorporated from 2003, and to 2.75% when Federal Reserve PTR is used. This is

[61] *See, e.g.*, Eugene F. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work," *The Journal of Finance* 25, no. 2 (1970): 383-417.
[62] Michael D. Bauer and Glenn D. Rudebusch, "The Rising Cost of Climate Change: Evidence from the Bond Market," *The Review of Economics and Statistics* (2021).
[63] Stefano Giglio, Matteo Maggiori, and Johannes Stroebel, "Very Long-Run Discount Rates," *The Quarterly Journal of Economics* 130, no. 1 (2015): 1-53; Stefano Giglio et al., "Climate Change and Long-Run Discount Rates: Evidence from Real Estate," *The Review of Financial Studies* 34, no. 8 (2021): 3527-71; Eric Fesselmeyer, Haoming Liu, and Alberto Salvo, "Declining Discount Rates in Singapore's Market for Privately Developed Apartments," *Journal of Applied Econometrics* 37, no. 2 (2022): 330-50; Òscar Jordà et al., "The Rate of Return on Everything, 1870–2015," *The Quarterly Journal of Economics* 134, no. 3 (2019): 1225-98.

because much higher real interest rates prevailed in the 1980s. More recently, as of the end of February 2023, 10-year TIPS yield was 1.49% and 30-year TIPS yield was 1.57%. Going back further in the 20th century, "Dimson et al. (2017) have collated historical interest rate data and find that over the period 1900-2016 the global average real interest rate for relatively risk-free assets was approximately 0.8%."[64]

We solicit comment on whether OMB should retain the current method used to estimate the social rate of time preference in Circular A-4, or revise the method by using ex-ante measures for both the returns and inflation. Please provide justification for adopting one approach over another, including merits on conceptual framework, ease of implementation, and other considerations. We also solicit comment on the relative merits of two ex-ante measures of real rates: using TIPS data (as in the current proposal) or using 10-year Treasury yield data coupled with Federal Reserve PTR data. We further solicit comment on the most appropriate inflation index to use in such estimation methods, and how to adjust interest rate or inflation data sources that use CPI or PCE inflation values (e.g., TIPS, Federal Reserve PTR, etc.) if a different inflation index is more appropriate. We also solicit comment on whether OMB should retain or modify the 30-year retrospective average time horizon, and whether OMB should consider using yields for longer-lived assets than 10-year Treasury notes for estimating the social rate of time preference. Finally, while our initial conclusion, based on this review, is that the longer-term fundamental conditions that have led to a lower risk-free rate have not changed, we welcome comment on whether the currently evolving economic environment would warrant consideration of a different approach to using data from financial markets to estimate risk-free rates.

Another approach is to calibrate or estimate the standard Ramsey formula's underlying parameter values in order to determine the social rate of time preference.[65] In the Ramsey model, the social discount rate r is written as:

$$r = \rho + \eta * g$$

where ρ is the pure time preference rate, which measures society's preference for utility now as opposed to later; η is the change in the welfare (or utility) from additional consumption as society grows wealthier (the absolute value of the 'elasticity of marginal utility of consumption'); and g is the growth rate of per capita consumption.[66] This Ramsey model approach assumes that the elasticity of marginal utility of consumption is invariant to the level of consumption and unchanging over time for a representative agent that accumulates capital in order to generate future consumption.[67] The social discount rate reflects society's valuation of consumption in one period relative to its valuation in a later period, and the marginal value of additional consumption as income changes.

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[64] Giles Atkinson et al., *Cost Benefit Analysis and the Environment: Further Developments and Policy Use* (Paris: OECD Publishing, 2018): 217.
[65] Frank P. Ramsey, "A Mathematical Theory of Saving," *The Economic Journal* 38, no. 152 (1928): 543-59.
[66] National Academies of Sciences, Engineering, and Medicine, *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide* (Washington, DC: The National Academies Press, 2017): 162-63; Giles Atkinson et al., *Cost Benefit Analysis and the Environment: Further Developments and Policy Use* (Paris: OECD Publishing, 2018): 202-03.
[67] Note that, under alternative model specifications, this basic Ramsey formula may no longer hold.

These parameter values can be relevant in other types of economic policy evaluation. For example, the elasticity of marginal utility of consumption η is estimated or calibrated in a wide variety of contexts, as discussed in the revised Circular A-4's section on Distributional Effects. The pure time preference rate ρ can be determined in a multitude of ways, including based on aggregate investment behavior.[68] The growth rate of consumption g can be determined using aggregate data or based on forecasts. Taken together, the rate of return on productive capital is equal to the rate of social time preference.[69] This lends itself to two equivalent approaches to deriving the discount rate. However, "[o]nly when markets are perfectly competitive and function perfectly both within and between time periods and for all inputs and outputs, will the decentralised economy of utility maximising agents and profit maximising firms equate the rate of return to capital," and the Ramsey rule.[70] "When this assumption fails, which is most of the time, due to externalities and distortionary taxes for instance, then a decision must be made concerning which of these discount rates should be employed for [cost-benefit analysis] and [cost-effectiveness analysis] of public projects."[71]

There is a rich 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 sophisticated versions of the Ramsey formula using preference specifications with additional parameters.[72]

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[68] *See, e.g.*, Thomas F. Cooley and Edward C. Prescott, "Economic Growth and Business Cycles," in *Frontiers of Business Cycle Research*, ed. Thomas F. Cooley (Princeton: Princeton University Press, 1995), 1-38. Note that other important parameter values must be jointly determined in this process.

[69] One difficulty with this descriptive approach to parameterizing the Ramsey formula is that one "implication of the Ramsey equation is that the discount rate is inherently linked to the growth rate of the economy." National Academies of Sciences, Engineering, and Medicine, *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide* (Washington, DC: The National Academies Press, 2017): 163. However, observed risk-free rates in financial markets do not appear to be correlated with the growth rate of the economy. Olivier Blanchard, *Fiscal Policy Under Low Interest Rates* (forthcoming, MIT Press 2023); James D. Hamilton et al., "The Equilibrium Real Funds Rate: Past, Present, and Future," *IMF Economic Review* 64, no. 4 (2016): 660-707. Another difficulty emerges if calibrating the Ramsey equation to market rates, as reasonable estimates of near-term growth projections and of the elasticity of marginal utility may be most consistent, in the Ramsey formula approach, with an estimated negative rate of time preference, which is not plausible. Both of these difficulties likely reflect that the simplicity of the basic Ramsey approach omits (descriptively) important variables that partially determine the risk-free rate.

[70] Giles Atkinson et al., *Cost Benefit Analysis and the Environment: Further Developments and Policy Use* (Paris: OECD Publishing, 2018): 204.

[71] *Id.* at 205.

[72] A survey of discounting experts found that most experts do not apply the assumptions embedded in the Ramsey formula when advising on social discount rates, suggesting factors beyond the basic Ramsey formula are important. *See* Moritz A. Drupp et al., "Discounting Disentangled," *American Economic Journal: Economic Policy* 10, no. 4 (2018): 109-34. Some studies augment the elasticity parameter by using recursive (Epstein-Zin) preferences that separate aversion to risk from aversion to 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," *The American Economic Review* 111, no. 9 (2021): 2782-810. Others allow for alternative forms or capital, correlations structures, and other higher order terms to emerge in more complicated versions of a Ramsey-like formula.

We solicit comment on this approach to estimating the social rate of time preference, on whether there is an academic consensus on appropriate calibration or estimation procedures to determine these underlying parameters, and on alternative economic models that could be used.

A different approach to estimating the social rate of time preference looks to other sources of data about individual behavior, or surveys regarding intertemporal preferences.[73] However, such results have been called into question on a number of grounds.[74] Accordingly, we solicit comment on whether such studies are relevant in estimating the social rate of time preference. First, we are concerned that the results from the above studies may not be appropriate to generalize to the populations affected by relevant regulations. Second, we are concerned that analysis of such data sources may suffer from omission bias, in that factors contributing to these individual behaviors may not have been adequately captured in the estimation process. Finally, we solicit comment on whether other empirical studies exist that are relevant in estimating the social rate of time preference.

Accounting for Capital

Circular A-4 advises agencies to look not only at the social rate of time preference as measured by the risk-free rate in the marketplace, but also "the average before-tax rate of return to private capital in the U.S. economy" which "approximates the opportunity cost of capital."[75] This led to Circular A-4's recommendation to use a second default discount rate, an opportunity cost of capital rate of 7%.[76] Circular A-4 states that such an approach is recommended because in certain circumstances, the costs "of a regulation . . . displace or alter the use of capital in the private sector," whereas the benefits largely do not affect capital in those certain circumstances.[77]

However, what proportion of future consumption or capital investment gets displaced due to regulatory actions may remain unclear. For example, if a regulation directs electric utilities to reduce emissions of sulfur dioxide to reduce acid rain, depending on the specific circumstances and investment plans of utilities, the regulation may or may not result in productive capital being displaced by emission-reducing capital. The effect of such regulations on displacement of capital

[73] *See, e.g.*, John T. Warner and Saul Pleeter, "The Personal Discount Rate: Evidence from Military Downsizing Programs," *The American Economic Review* 91, no. 1 (2001): 33-53; Jerry A. Hausman, "Individual Discount Rates and the Purchase and Utilization of Energy-Using Durables," *The Bell Journal of Economics* 10, no. 1 (1979): 33-54; Maribeth Coller and Melonie B. Williams, "Eliciting Individual Discount Rates," *Experimental Economics* 2 (1999): 107-27; Neil Bhutta, Jacob Goldin, and Tatiana Homonoff, "Consumer Borrowing after Payday Loan Bans," *The Journal of Law and Economics* 59, no. 1 (2016): 225-59.

[74] *See, e.g.*, Susan Payne Carter et al., "Time to Repay or Time to Delay? The Effect of Having More Time before a Payday Loan is Due," *American Economic Journal: Applied Economics* 14, no. 4 (2022): 91-126; National Academies of Sciences, Engineering, and Medicine, *Review of Methods Used by the U.S. Department of Energy in Setting Appliance and Equipment Standards* (Washington, DC: The National Academies Press, 2021); Annamaria Lusardi and Olivia S. Mitchell, "The Economic Importance of Financial Literacy: Theory and Evidence," *Journal of Economic Literature* 52, no. 1 (2014): 5-44; Johannes Haushofer and Ernst Fehr, "On the Psychology of Poverty," *Science* 344, no. 6186 (2014): 862-67.

[75] Circular A-4, at 33.

[76] See Council of Economic Advisers, *Discounting for Public Policy: Theory and Recent Evidence on the Merits of Updating the Discount Rate* (2017) for a discussion of issues with estimating this rate.

[77] Circular A-4, at 33; 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.

versus consumption depends on the utilities' ability to pass on the compliance costs to consumers, on the extent to which costs passed on to consumers affect investment decisions, on the extent to which reductions in acid rain reduce capital depreciation and thereby leads to increased capital investment, etc. To determine this displacement of capital, agencies could undertake general equilibrium analysis or other methods to trace out the incidence of regulatory effects. There are many other regulations where the initial compliance costs are not so capital intensive, or where over time the benefits may affect capital more than costs do. In any case, as previously explained in Circular A-4, the recommended use of two discount rates was motivated due, in part, to this uncertainty,[78] and our preliminary conclusion is that this uncertainty with respect to the effects of regulation on capital flows continues to exist, but can be accounted for more accurately through the use of the shadow price of capital approach, as discussed below.[79] In addition, as also discussed below, the social rate of time preference estimate in the revised guidance is meant to apply to a risk-free (or, e.g., certainty-equivalent) stream of regulatory benefits and costs, whereas the 7% rate used to estimate the opportunity cost of capital represents a pre-tax rate of return that is not risk-free.[80] We solicit comment on when and how agencies should conduct incidence analysis to ascertain to what extent regulatory benefits or costs displace consumption versus capital.

Finally, the guidance in Circular A-4 is an attempt to approximate the concepts that we are proposing to elaborate on in these revisions. Consistent with Circular A-4, we continue to believe that the analytically preferred method when capital effects are relevant but the proportion of capital versus consumption displacement is uncertain is to use the "shadow price" approach.[81] The proposed revisions explain in more detail our proposed approach to this issue (which is also discussed more in this preamble, below); in essence, all benefits and costs can be converted into consumption-equivalent values—including the regulatory effect of capital impacts, by multiplying such impacts by the shadow price of capital—and then discounted using the social rate of time preference. We believe that this is a more accurate approach to capturing the effects on capital than the previous approach of using a discount rate that reflected the rate of return on capital,[82] and our proposed revisions would replace that approach. We solicit comment on this change in approach.

Generally, an estimate of the shadow price of capital appropriate for regulatory analysis may be empirically uncertain. Various estimates of a shadow price of capital (the value of one unit of capital in consumption units) in a closed economy are above one.[83] "The key question . . .

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[78] Circular A-4, at 33-34.

[79] 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.

[80] Council of Economic Advisers, *Discounting for Public Policy: Theory and Recent Evidence on the Merits of Updating the Discount Rate* (2017). Note also that the 7% rate derived from market data likely reflects returns to market power, uninternalized externalities, and other market distortions.

[81] Circular A-4, at 33.

[82] Which—as measured by market returns—does not represent the social return on capital, due to distortions such as risk, market power, and uninternalized externalities, as noted previously.

[83] Ben Groom et al., "Declining Discount Rates: The Long and the Short of It," *Environmental and Resource Economics* 32, no. 4 (2005): 445-93; 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; Mark A. Moore, Anthony E. Boardman, and Aidan R. Vining, "More Appropriate Discounting: The Rate of Social Time Preference

is whether or not capital is sufficiently mobile worldwide to largely eliminate the crowding out associated with" regulatory impacts on capital.[84] In 1990, Lind concluded that it is "inappropriate to assume that there will be much crowding out of private investment through higher interest rates" and that "[t]he crowding out that has been the focus of most of the closed economy models does not appear to be very important to the analysis of the social discount rate."[85] In 1994, Lesser and Zerbe concluded that "the supply of capital is highly elastic" given capital market openness, and that "[p]rivate capital in an open economy comes primarily at the expense of consumption, not from crowding out of private capital"; accordingly, a shadow price of capital approach would use a value of one and discount at "the consumer's rate of time preference in an open economy."[86] Since the 1990s, U.S. capital markets have generally become more open.[87]

Where substantial incidence on capital is anticipated, the proposed revisions to the Circular encourage agencies to test their analysis's sensitivity to capital effects through consideration of shadow prices of 1.0 (no change, reflecting an open economy estimate with perfect capital mobility) and 1.2, reflecting a closed economy estimate with no foreign capital flows. In cases where an agency has not directly estimated the incidence of regulatory benefits and costs falling on capital, the proposed revisions to the Circular encourage agencies to analyze two outer-bounds cases using the high shadow price of capital (1.2) estimate: one assuming all benefits and no costs fall on capital, and another assuming all costs and no benefits fall on capital.[88] This approach can help agencies identify circumstances in which they may consider

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and the Value of the Social Discount Rate," *Journal of Benefit-Cost Analysis* 4, no. 1 (2013): 1-16; 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.

[84] 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-13 to S-14.

[85] *Id.* at S-15 to S-16.

[86] 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): 150; *see also id.* at 152 ("As long as the fraction of project costs coming from private capital is not large, and as long as the ratio between this fraction and the fraction of benefits returning to private capital is within a broad range, ordinary benefits and costs may simply be discounted by the [social rate of time preference] with a sensitivity test . . . . The high degree of elasticity in capital markets means that . . . it will be sufficient to discount ordinary benefits and costs by the [social rate of time preference]. Even if there were some crowding out of private investment, a procedure that discounted ordinary benefits and costs by the [social rate of time preference] and then performed a sensitive test would be all that was required.").

[87] Menzie D. Chinn and Hiro Ito, "What Matters for Financial Development? Capital Controls, Institutions, and Interactions," *Journal of Development Economics* 81, no. 1 (2006): 163-92 (data through 2020 available at *http://web.pdx.edu/~ito/Chinn-Ito_website.htm*); International Monetary Fund, *Annual Report on Exchange Arrangements and Exchange Restrictions 2021* (2022).

[88] *See* 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 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): 152 ("even in the absence of an open economy where the savings rate represents the contribution of private capital to projects, and where there were almost no returns of benefits to private capital, a sensitivity adjustment of 10 percent applied to costs would almost certainly cover the range of results that would be produced by a full [shadow price of capital] calculation"); 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): 805

taking 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.

As noted previously, the proposed revisions to Circular A-4 relies on the work of Li and Pizer (2021), and related literature, in order to arrive at estimates of the shadow price of capital. We also seek comment on an alternative approach that is similar to Li and Pizer (2021) and based on the neoclassical growth model.

First, in this alternative approach using a simple version of the neoclassical growth model, we could derive a shadow price using macroeconomic data. This derivation informs the discussion of implementation of the shadow price of capital in the proposed revisions to Circular A-4. The neoclassical growth model is populated by a representative agent with isoelastic utility and a constant pure rate of time preference who faces tradeoffs between consumption and investment in each period. Assuming that the economy moves along a "balanced growth path" with constant consumption growth and capital depreciation, the shadow price of capital is the ratio of the gross rate of return on capital over the consumption discount rate plus the capital depreciation rate. Using Li and Pizer (2021) and equilibrium conditions of the neoclassical growth model under balanced growth, a shadow price for each model can be derived. Both models could be parameterized using the social rate of time preference, observed returns on capital, observed depreciation of capital, and the savings rate over the last 30 years.

The key difference between these models can be described as follows. The Li and Pizer (2021) model assumes investment effects result in subsequent reinvestment, and includes valuation of that subsequent reinvestment in its shadow price value. The alternative model does not assume subsequent reinvestment. It follows that the Li and Pizer (2021) model results in a higher value of the shadow price of capital than the alternative model. More generally, shadow price of capital values in the literature, including literature cited in the proposed revisions to Circular A-4, depend on the degree to which an economy is closed or open and how economic distortions[89] are accounted for. For example, estimates of the closed economy shadow price ranges from 1.1 to 2.2 across the cited literature, while open economy assumptions described in the proposed revisions to Circular A-4 yield a value of 1. Other values can be derived using more recent data and/or methods. We seek comment on the merits of various conceptual frameworks and parameterizations of the shadow price, such as those presented here and in the proposed revisions to Circular A-4.

Second, this alternative approach to accounting for capital could address effects that directly alter resources available to households, businesses, or the government and are most likely to result in investment effects. These could be referred to as "resource effects." Resource effects in this approach would be contrasted with "utility effects," which primarily address direct impacts to consumer utility flows, such as improvements in health and safety. We seek comment on whether the distinction between "resource effects" and "utility effects" is sound and useful in assessing regulatory capital effects.

(recommending a shadow price of capital of 1.1 "as a best estimate" and use of shadow prices of 1.0 and 1.3 "in sensitivity analysis").

[89] *See supra* note 82.

Third, we seek comment on what would constitute a reasonable value for the incidence of resource effects on investment in this alternative approach. One option is to use the marginal propensity to consume (MPC) to determine the incidence of "resource effects" on investment. However, a review of the literature[90] found that "most estimates of the aggregate MPC range between 0.2 and 0.6," a relatively wide range. There is also uncertainty regarding whether specific regulatory effects are large enough to generate marginal effects on consumption and investment for affected parties. An alternative is to rely on the average savings rate, which is approximately 20%. Taking these factors into account, we seek comment on values for the incidence rate of resource effects on investment in this alternative approach, such as 20% (based on the savings rate), 60% (based on the 0.4 midpoint of the MPC range above), and their average of 40%.

We solicit comment on the most appropriate estimate of the shadow price of capital, and how such estimates could be adjusted to account for open economy effects and relevant distortions. We also solicit comment on the conditions under which regulations will have effects purely on consumption (i.e., when a shadow price of one should be used).

Discount Rates over the Long Term

Circular A-4 states, and OMB continues to believe, that:

> special ethical considerations arise when comparing benefits and costs across generations. Although most people demonstrate time preference in their own consumption behavior, 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 who are affected by such choices cannot take part in making them, and today's society must act with some consideration of their interest.[91]

As noted in the draft revision of the Circular, some believe that it is ethically impermissible to discount the welfare of future generations. One study surveyed economists regarding their judgment on what social discount rate should be used for long-lived projects.[92] The lower-bound estimates ranged as low as -3% and the upper-bound estimates ranged as low as 0%, indicating that ethical considerations play a role in economists' selection of social discount rate when the welfare of future generations is at stake.[93] Even under an approach in which the welfare of future generations is not discounted, it may often still be appropriate to discount future costs and consumption benefits—at a lower rate than for analysis of near-term effects more likely to fall on a single generation—if there is an expectation that future generations may be wealthier and thus will value a marginal dollar of benefits or costs by less

[90] Christopher Carroll et al., "The Distribution of Wealth and the Marginal Propensity to Consume," *Quantitative Economics* 8, no. 3 (2017): 977-1020.
[91] Circular A-4, at 26.
[92] Moritz A. Drupp et al., "Discounting Disentangled," *American Economic Journal: Economic Policy* 10, no. 4 (2018): 109-34.
[93] *Id.* at 118.

than those alive today.[94] An extensive literature uses a prescriptive approach to long-term discounting, grounded in the "special ethical considerations" mentioned above. While acknowledging that literature, the proposed revisions to Circular A-4 primarily discusses a descriptive approach to discounting, including for long term benefits and costs.

Circular A-4 also notes that, descriptively, lower rates may be appropriate for discounting benefits and costs far into the future for the independent reason that uncertainty about what specific rates should be used increases over time.[95] Because uncertainty about the discount rate increases over time, "there exists a rigorous generic argument that the future should be discounted at a declining rate that approaches asymptotically its lowest possible value."[96]

Various approaches can be used to incorporate the effects of uncertainty on the discount rate in longer-horizon analyses. Recent research using alternative approaches and specifications consistently produces schedules with rates declining by about 1 to 2 percentage points over a several-hundred-year time horizon, with larger declines associated with higher starting rates.[97] To facilitate agencies' implementation of appropriate discount rates for time ranges beyond 30 years, OMB is considering including a default schedule of rates in revisions to Circular A-4, while continuing to emphasize that an alternative approach that agencies may choose to take—for both short-term and long-term discounting—is analyzing their regulation in an economic model in which the evolution of the discount rates is endogenous. Agencies may prefer to do so in projecting long-term discount rates, in part, in order to provide consistency with their preferred approach to discounting in the shorter term.

The proposed schedule of rates below was generated by OMB, adapting the model from Bauer and Rudebusch (2021) with the starting interest rate initialized at 1.7% (the proposed value of the social rate of time preference for use in near-term analyses). Bauer and Rudebusch (2021) model the interest rate in each year as the sum of a slow-moving trend component and a cyclical component. The slow-moving trend component is a random walk. OMB simulates

[94] There are situations where the assumption of wealthier future generations may not hold, e.g., in the face of unchecked climate change. Also, even if future generations are wealthier in monetary terms, their utility could be lower if they lack non-substitutable non-market goods that do not grow over time in line with wealth.

[95] Circular A-4 states that "[p]rivate market rates provide a reliable reference for determining how society values time within a generation, but for extremely long time periods no comparable private rates exist." Circular A-4, at 36. There are some recent econometric papers that estimate discount rates using information from real estate contracts of significant lengths, such as a 999-year lease, although such rates are likely upwardly biased by risk premia. Stefano Giglio et al., "Climate Change and Long-Run Discount Rates: Evidence from Real Estate," *Review of Financial Studies* 34, no. 8 (2021): 3527-71. Regardless, some physical phenomena are thousands of years in length, such as radiation decay from nuclear waste. We are not aware of private contracts of such lengths.

[96] Christian Gollier and Martin L. Weitzman, "How Should the Distant Future be Discounted when Discount Rates are Uncertain?," *Economic Letters* 107 (2010): 351; *see also* Giles Atkinson et al., *Cost Benefit Analysis and the Environment: Further Developments and Policy Use* (Paris: OECD Publishing, 2018): 211-14; National Academies of Sciences, Engineering, and Medicine, *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide* (Washington, DC: The National Academies Press, 2017): 164-67.

[97] Michael D. Bauer and Glenn D. Rudebusch, "The Rising Cost of Climate Change: Evidence from the Bond Market," *The Review of Economics and Statistics* (2021); Environmental Protection Agency, *EPA External Review Draft of Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances* (2022), *https://www.epa.gov/system/files/documents/2022-11/epa_scghg_report_draft_0.pdf*.

100,000 paths for the interest rate, calculates the expected discount factor across these paths, and computes the forward rates consistent with this path of expected discount factors.[98]

Years	Discount Rate
2024 – 2089	1.7%
2090 – 2104	1.6%
2105 – 2116	1.5%
2117 – 2127	1.4%
2128 – 2138	1.3%
2139 – 2148	1.2%
2149 – 2161	1.1%
2162 – 2172	1.0%

The rates presented in this table are forward rates, meaning the rate provided for a given year is the rate appropriate to discount effects in that year to the previous year. To illustrate the application of these rates, consider a regulation that has only one effect: a benefit of $100 billion dollars in 2150. To calculate the present value of that benefit in 2022, you multiply the benefit by a modified version of the discounting formula for discounting, $1/(1 + \text{the discount rate})^t$:

$$\text{PV} = \frac{\$100 \text{ billion}}{(1.017)^{66} * (1.016)^{15} * (1.015)^{12} * (1.014)^{11} * (1.013)^{11} * (1.012)^{10} * (1.011)^{2}}$$

The exponents in the denominator (66, 15, 12, etc.) match the range of years that the particular discount rate covers (1.7% from the year 2023 to 2088, 1.6% from the year 2023 to 2088, etc.). The $100 billion dollar effect is first discounted from 2150 back to 2148 at a 1.1% rate, and then back to 2138 at a 1.2% rate, and so forth back to 2023. In this case, the benefit has a present value of roughly $14 billion. OMB could make year-specific cumulative discount factors available for ease of analysis.

[98] More concretely, the rates in this table approximate certainty-equivalent rates for a model in which interest rates are fixed at the near-term estimated value of the social rate of time preference for 30 years and subsequently follow an unobserved components specification with trend and cyclical components, as in Bauer and Rudebusch (2021). OMB assumes innovations in the random walk are normally distributed with mean of zero and variance of 0.04; the cyclical component is an AR(1) process, with the AR parameter set to 0.7, and innovations normally distributed with mean of zero and variance of 0.9. The variance of the innovations in the random walk is chosen to be conservative (0.04); larger variance leads to more volatile estimates of the equilibrium real interest rate and causes the discount rate to decline more rapidly (though as discussed below, the model also imposes a non-negativity constraint, which ultimately limits the decline). The estimation is less sensitive to choices regarding the specifications of the other parameters.

Interest rates are constrained to be non-negative in each year. The specification of the non-negativity constraint is influential in determining the results. As demonstrated by Newell and Pizer (2003), if negative interest rates are allowed, the resulting discount rate can become negative. Different modeling exercises adopt different approaches to specifying the non-negativity constraint; if a laxer constraint were imposed (e.g., only requiring that there be no cumulatively negative discount rates), the discount rate would fall more sharply. See Michael D. Bauer and Glenn D. Rudebusch, "The Rising Cost of Climate Change: Evidence from the Bond Market," *The Review of Economics and Statistics* (2021); 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," *The American Economic Review* 91, no. 1 (2001): 260-71 for related analyses.

OMB proposes to provide this schedule over a 150-year horizon to provide one approach that could be taken in analysis of regulations that may have important effects occurring over long time horizons (with rates extending beyond this time period available from OMB upon agency request). While much of the literature on long-term discounting is in the context of climate change—which may benefit from distinct analytic approaches for many reasons—many categories of regulations may have important benefits and costs far into the future, including those with impacts on children's lifetime earnings, those affecting long-term health outcomes, or those implicating the efficacy of highly durable infrastructure. However, for most regulations, the appropriate time horizon for analysis will be considerably shorter, and may fall entirely within the first range of years in the schedule above. To reiterate, the schedule of rates in the above table reflects only the effect of uncertainty on the appropriate discount rate, which will be relevant in a variety of regulatory contexts.

The model presented above follows one established and tractable approach to dynamic discounting, using data from "historical interest rates" in financial markets to project uncertainty in the path of future rates.[99] Instead of focusing on uncertainty in the underlying growth rate or other parameters, this approach focuses on long-term uncertainty over interest rates.

Another established approach to dynamic discounting uses the Ramsey formula, discussed above, where the expected underlying growth rate, other parameters, and their uncertainty can be calibrated on a descriptive basis.[100] This approach is often applied in the context of regulations that affect greenhouse gas emissions, as it allows for integrated consideration of potentially important effects of greenhouse gas emissions on determinants of the social discount rate. That is, such regulations may raise additional special considerations due to the important interactions between the damages caused by climate change and other assumptions that influence the social discount rate, including:

- *Economic growth.* Economic activity causes greenhouse gas emissions and thus climate damages, which in turn can reduce economic growth.[101] Assumptions

[99] Giles Atkinson et al., *Cost Benefit Analysis and the Environment: Further Developments and Policy Use* (Paris: OECD Publishing, 2018): 219 (citing 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; Ben Groom et al., "Discounting the Distant Future: How Much Does Model Selection Affect the Certainty Equivalent Rate?," *Journal of Applied Econometrics* 22, no. 3 (2007): 641-56; Cameron Hepburn et al., "Social Discounting under Uncertainty: A Cross-Country Comparison," *Journal of Environmental Economics and Management* 57, no. 2 (2009): 140-50; Mark C. Freeman and Ben Groom, "Positively Gamma Discounting: Combining the Opinions of Experts on the Social Discount Rate," *The Economic Journal* 125, no. 585 (2015): 1015-24); Michael D. Bauer and Glenn D. Rudebusch, "The Rising Cost of Climate Change: Evidence from the Bond Market," *The Review of Economics and Statistics* (2021).

[100] *See* 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): 1017-46; Kevin 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 2022): 223-75.

[101] *See, e.g.*, Melissa Dell, Benjamin F. Jones, and Benjamin A. Olken, "Temperature Shocks and Economic Growth: Evidence from the Last Half Century," *American Economic Journal: Macroeconomics* 4, no. 3 (2012): 66-95; Marshall Burke, Solomon M. Hsiang, and Edward Miguel, "Global Non-Linear Effect of Temperature on

about the growth of the economy, inclusive of climate damages, can influence discount rates by changing the marginal value of future benefits and costs.[102]

- *Intragenerational equity.* Climate change (like certain other long-lasting phenomena) disproportionately affects people who cannot afford to prepare for or cope with its costs.[103] The draft revisions to Circular A-4 in the "*Distributional Effects*" section describes how differences in marginal utilities of income across people can be reflected in an analysis.[104]

Other studies have highlighted additional important interactions between climate change and the social discount rate, including large and uninsurable climate risks[105] and the effects on the relative scarcity of non-market goods.[106] (In both cases, estimating consumption equivalents in each period is an alternative to adjusting the social discount rate.)

We solicit comment on the various approaches to discounting over the long term. Please provide explanations and evidence on the strengths and weaknesses of the above approaches, including the conceptual framework, availability of data, and ease of implementation. We solicit comment on the default schedule of discount rates presented, including whether such a default schedule is useful, OMB should consider a shorter or longer time frame, and whether OMB should use an alternative approach to derive the default schedule (including parameterizing the Ramsey formula-based projection approach). Please provide peer-reviewed journal articles, reports, and data to support your viewpoints.

Accounting for Risk

Economic Production," *Nature* 527 (2015): 235-39; Tatyana Deryugina and Soloman Hsiang, "The Marginal Product of Climate" (Working Paper No. 24072, NBER, 2017), *https://www.nber.org/papers/w24072*; Marshall Burke and Vincent Tanutama, "Climatic Constraints on Aggregate Economic Output" (Working Paper No. 25779, NBER, 2019), *https://www.nber.org/papers/w25779*; Riccardo Colacito, Bridget Hoddman, and Toan Phan, "Temperature and Growth: A Panel Analysis of the United States," *Journal of Money, Credit and Banking* 51, no. 2-3 (2019): 313-68; Martin Henseler and Ingmar Schumacher, "The Impact of Weather on Economic Growth and its Production Factors," *Climatic Change* 154 (2019): 417-33; Matthew E. Kahn et al., "Long-Term Macroeconomic Effects of Climate Change: A Cross-Country Analysis," *Energy Economics* 104 (2021): 105624; Surender Kumar and Madhu Khanna, "Temperature and Production Efficiency Growth: Empirical Evidence," *Climatic Change* 156 (2019): 209-29.

[102] National Academies of Sciences, Engineering, and Medicine, *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide* (Washington, DC: The National Academies Press, 2017).

[103] U.S. Global Climate Change Research Program, *Fourth National Climate Assessment* (2018).

[104] For example, Geoffrey Heal, "The Economics of Climate Change: A Post-Stern Perspective," *Climatic Change* 96 (2009): 275-97; Partha Dasgupta, "Discounting Climate Change," *Journal of Risk and Uncertainty* 37 (2008): 141-69; Marc Fleurbaey and Stéphane Zuber, "Discounting, Beyond Utilitarianism," *Economics* 9, no. 2015-12 (2015): 1-52; David Anthoff, Cameron Hepburn, and Richard S.J. Tol, "Equity Weighting and the Marginal Damage Costs of Climate Change," *Ecological Economics* 68, no. 3 (2009): 836-49.

[105] For example, Martin L. Weitzman, "Tail-Hedge Discounting and the Social Cost of Carbon," *Journal of Economic Literature* 51, no. 3 (2013): 873-82.

[106] For example, Moritz A. Drupp and Martin C. Hänsel, "Relative Prices and Climate Policy: How the Scarcity of Nonmarket Goods Drives Policy Evaluation," *American Economic Journal: Economic Policy* 13, no. 1 (2021): 168-201; Thomas Sterner and U. Martin Persson, "An Even Sterner Review: Introducing Relative Prices into the Discounting Debate," *Review of Environmental Economics and Policy* 2, no. 1 (2008): 61-76.

When risk is material to the analysis, using certainty-equivalent valuations or other measures of risks enables measurements of benefits and costs to reflect important risks. We solicit comment on whether risks should be modeled as certainty-equivalent valuations or whether some other guidance on modeling risk should be provided and, if so, what form it should take. We also solicit comment on the usefulness of modeling or estimating risks and the relevant time horizons.[107] Please comment on the conceptual strength of an approach, data availability, and ease of implementation.

Some have argued that uncertainty can alternatively be reflected in adjusted discount rates.[108] In principle, a general approach to selecting discount rates can account for certain forms of risk by estimating 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. We solicit comment on if and when analysis should explicitly use higher discount rates to account for systemic risk.

Time Preference for Health-Related Benefits and Costs

A common challenge in health-related analysis is to quantify the time lag between when a rule takes effect and when the resulting physical improvements in health status will be observed in the target population. In such situations, agencies must carefully consider the timing of health benefits before performing present-value calculations. It is usually not reasonable to assume that all of the benefits of reducing chronic diseases, such as cancer and cardiovascular disease, will occur immediately when the rule takes effect. For rules addressing traumatic injury, this lag period may be short. For chronic diseases, it may take years or even decades for a rule to induce its full beneficial effects in the target population, although other related beneficial effects may occur in the meantime (e.g., reduction of dread). In the benchmark Ramsey framework discussed above, higher consumption growth raises discount rates because the higher future consumption reduces the marginal utility of consumption, and therefore reduces marginal willingness to pay for future consumption. In symmetric but opposite fashion, improvements in health could be understood to reduce the discount rate. For instance, if a regulation reduces mortality rates from heart disease 20 years from now, it will increase willingness to pay for subsequent consumption, resulting in a lower discount rate over relevant time periods, all else equal. Note that careful attention must be paid to ensure that the monetization approach used in association with mortality effects does not double count effects accounted for elsewhere. We solicit comment on how to draft revisions to Circular A-4 to improve current practice regarding discounting health-related effects, both monetized and non-monetized.

Private Discount Rates vs. Social Discount Rates

[107] See Mark C. Freeman and Ben Groom, "How Certain are we about the Certainty-Equivalent Long Term Social Discount Rate?," *Journal of Environmental Economics and Management* 79 (2016): 152-68 for more discussion.
[108] *See, e.g.*, Christian Gollier, "The Welfare Cost of Ignoring the Beta" (Discussion Paper DP16007, CEPR, 2021), *https://cepr.org/publications/dp16007*.

Proposed revisions to Circular A-4 would clarify that analysis modeling private behavior requires the use of appropriate private discount rates faced by the relevant population. Once necessary private discount rates are modeled, then the social discount rate can be applied to ascertain the social benefits and costs of a regulation.

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The proposed revisions to Circular A-4 are being released for a 60-day public comment period as well as peer review. We will continue to use our current guidance, OMB Circular No. A-4 as issued in 2003, until we complete this review process and publish revised guidelines.