Public Policy, Q1. What discount rate should be applied to long-run environmental policies? Why?

Decision-makers at federal regulatory agencies, members of Congress and other policymakers have wide latitude (subject to political realities) in choosing where and how to focus. For example, policymakers routinely evaluate different environmental policies, different versions of the same environmental policies and policies in other domains (such as healthcare, education or infrastructure). All policies involve costs and benefits, but no policies involve the same costs and benefits at the same times. To give structure and consistency to their analyses, policymakers subtract the present value (PV) of future costs of a policy from the (PV) of future benefits of a policy to determine the policy's net present value (NPV). If the NPV of the policy is positive, the policy is worth pursuing, and vice versa; among competing proposals, policies with higher NPVs are preferable.

NPV analysis rests on three primary assumptions: the size of costs and benefits; the timing of them; and the discount rate, i.e., the rate used to convert future dollars into present dollars. Among these assumptions, the discount rate has received particular attention from economists and others, for at least two reasons.

First, the discount rate powerfully affects the outcome of NPV analysis. As economist Martin Weitzman noted in "Gamma Discounting," his seminal essay on discount rates, "expected net present discounted values for long-term projects are notoriously hypersensitive to the interest rate being used to make the evaluation."[1] Higher discount rates yield lower present value dollars. For example, assume that a policy requiring the installation of scrubbers at coal-fired power plants will cost $5 billion today and generate $10 billion of benefit (i.e., avoided harm) in 20 years. At a 3% discount rate, the PV of the future benefit is $5.5 billion.[2] Since the PV exceeds the current cost, the policy is worth pursuing. However, at a 7% discount rate, the PV of the future benefit falls to $2.6 billion[3] – about half of the current cost, rendering the policy uneconomical.

Second, despite the veneer of mathematical precision and scientific rigor, selecting the appropriate discount rate is steeped in ethical and philosophical considerations. As such, the discount rate serves as a proxy for political persuasions; the discount rate is salient precisely because it is subjective. Again citing Weitzman: "The social discount rate here seems not so much to be a thing that economists *observe*, even in principle, but it appears rather more to represent a subjective *judgment* which they *believe in* to varying degrees."[4] Those subjective judgments on discount rates can be grouped into two broad worldviews among economists – the financial and the moral.

The financial view of discount rates is best explained in the work of Nobel Prize-winning economist William Nordhaus, who argued that long-run environmental policies should be discounted at a rate between 4% and 6%. According to Nordhaus, the long-term real return on capital is between 4% and 6%. Therefore, any environmental policy that earns less than 4% undermines economic value. Also, market interest rates indicate how market participants actually value the future, which (in Nordhaus' view) is more authoritative than philosophical judgments on how we should value the future. Finally, discounting environmental policies at a lower rate than the market rate used to discount health, education, infrastructure and other policies would arbitrarily privilege environmental versus health and other policy areas.[5]

The moral view of discount rates is best explained in the work economist Sir Nichoals Stern, who in his 2006 Stern Review on the Economics of Climate Change demonstrated through rigorous empirical analysis that the choice of discount rate is not an empirical question. Rather, the choice of discount rate is based on an ethical question: Do people born in the future matter less than people born in the present (justifying a higher discount rate), or do people born in the future have equal moral standing to people born in the present (justifying a zero or low discount rate)? Stern came down squarely in favor of the

latter view, characterizing as "ethically indefensible" the idea that future generations matter less.[6] Accordingly, Stern suggested a discount rate of 1.4%, with almost all of that rate (1.3%) comprised of anticipated consumption growth and just 0.1% based on a time preference for the present.

Yet another view of discount rates exists in the economics literature – one that can be read as superseding or reconciling the moral-financial binary. In a compelling 2001 paper, the aforementioned Martin Weitzman offered what he called "a radically different approach to the issue of what interest rate to use for discounting the future, starting with the recognition that the discount-rate problem is rooted in fundamental differences of opinion, which are unlikely to go away soon." Weitzman did not purport to determine *a priori* whether the financial or moral view of discount rates had more philosophical legitimacy. Instead, he surveyed 2,160 Ph.D.-level economists on their views of "the appropriate real discount rate to be used for evaluation environmental projects over a long time horizon." When plotted graphically, the responses fell into a "gamma distribution," in which a series of constant discount rates effectively declined over time. That is, Weitzman found that, according to his fellow economists, longer-dated costs or benefits merited lower discount rates, as follows:

Timing of cost or benefit (years from present)	**Discount rate (%)**
1-5	4
6-25	3
26-75	2
76-300	1
300+	0

Weitzman noted that "[i]f we were forced here to choose a single constant-equivalent discount rate . . . then it would be less than 2 percent per annum."[7]

To recap, some economists think discount rates applied to long-run environmental policies should be as high as 6% (the financial view); some think as low as 1.4% (the moral view); and the consensus thinks around 2% (the Weitzman survey result). Interestingly, real-world regulatory practice tracks the economics debate almost verbatim, and for similar reasons (namely, different ethical and philosophical views of different presidential administrations). The operative regulatory document is Circular A-4, promulgated by the Office of Management and Budget (OMB), which is an executive agency that reports directly to the President. Circular A-4 is often called "the most important document that most people have never heard of" because it provides, among other things, the discount rates that independent agencies (like the Environmental Protection Agency) must use in performing cost-benefit analyses.[8]

In 2003, under President George W. Bush, the original Circular A-4 established two discount rates: a 7% rate, reflecting the "opportunity cost of capital" and close to the upper end of the Nordhaus rate range described above, and 3% rate, reflecting the "social rate of time preference" and close to the Weitzman consensus rate described above. Circular A-4 required agencies to discount the costs and benefits of proposed policies using both rates. Twenty years later, President Biden's OMB revised Circular A-4 to replace both rates with a single 2% discount rate – close to the Stern rate described above, and roughly equal to the Weitzman consensus rate. The financial basis for the Biden OMB's rate reduction was that the real return on long-term government debt had (since 2003) averaged less than 2% per year on a pre-tax basis.[9] The moral basis for the rate reduction was that "[f]uture citizens and residents who are affected by [current consumption] choices cannot take part in making them, and today's society must act with some consideration of their interest."[10] On February 12, 2025, the Trump OMB issued Memorandum M-25-15, revoking the 2023 (Biden) version of Circular A-4 and reinstating the 2003 (George W. Bush) version of Circular A-4, thereby restoring the 7% and 3% discount rates.[11] The cited purpose of this discount rate increase was "to significantly reduce the private expenditures required to

comply with Federal regulations to secure America's economic prosperity and national security and the highest possible quality of life for each citizen."[12]

For determining the discount rate that should be applied to long-run environmental policies, Weitzman's "Gamma Discounting" framework – including a 2% discount rate for costs and benefits between 26 and 75 years – offers the best combination analytical rigor, empirical data support and inherent logic. Moreover, it accords with the Biden OMB's revisions to Circular A-4, which were based on real fixed income returns and sound moral reasoning. That said, Weitzman's framework predated the Paris Agreement by 14 years and landmark research on climate tipping points by 7 years.[13] In other words, while Weitzman's discounting framework remains relevant and persuasive, climate science has evolved since publication of his paper.

Accordingly, three refinements may better incorporate contemporary climate science into Weitzman's framework:

First, for every tenth of a degree by which global annual temperatures exceed 1.5°C above the pre-industrial baseline identified in the Paris Agreement in any year, the discount rates in Weitzman's "Gamma Discounting" chart should be permanently reduced by a tenth of a percent. For example, if global annual temperatures were 1.6°C above pre-industrial levels in 2027, the discount rate applicable to costs or benefits occurring between 26 and 75 later (from 2053 through 2102) would be 1.9%.

Second, to acknowledge the reality and the irrevocability of climate tipping points, any harm avoided by any climate policy should receive a 1.1x multiplier before being discounted. For example, taking the example above, the $10 billion of future harm avoided by installation of scrubbers would be worth $11 billion ($10 billion x 1.1) before discounting.

Third, and consistent with the 2023 version of Circular A-4, co-benefits of any policy should be explicitly included in any cost-benefit analysis (then discounted in accordance with the "Modified Gamma Discounting" schedule described above). Co-benefits may include job creation, acceleration of the technology learning curve, biodiversity and forest preservation, enhanced national security (via reduced climate-driven conflict and migration pressure), improved water access and management and better functioning insurance and financial markets. As the Inflation Reduction Act demonstrated, good environmental policy is also good industrial policy; even in the near term, well-designed environmental policies should generate jobs and other "spillover" benefits that offset public and private capital expenditure and compliance.[14]

Implicit in the foregoing – lower discount rates with higher warming; a multiplier on climate harms; explicit acknowledgment of co-benefits – is a moral imperative. As Al Gore said at the end of his 2017 documentary, *An Inconvenience Sequel*: "This movement to solve the climate crisis is in the tradition of every great moral movement that has advanced the cause of humankind. It is right to save the future for humanity; it is right to give hope to future generations." While the concepts in this essay are not limited to climate change – they apply with equal force to geological nuclear waste storage, species extinction and ocean acidification, for example – their fullest and most consequential application relates to climate. Taken together, the research and recommendations in this essay would advance the likelihood of adoption of well-designed, long-run environmental policies – which is morally right and economically defensible.

It should also be noted that there are other routes – routes beyond the corridors and contours of economics and public policy – to a similar conclusion. The Haudenosaunee Confederacy was a historic alliance of six Indigenous nations in what is now the United States – the Mohawk, Oneida, Onondaga, Cayuga, Seneca and Tuscarora. Their Great Law, written somewhere between 1442 and 1500, espoused the "Seventh Generation Principle": "Look and listen for the welfare of the whole people and have always in

view not only the present but also the coming generations, even those whose faces are yet beneath the surface of the ground – the unborn of the future Nation."[15]

Endnotes

[1] Martin L. Weitzman, "Gamma Discounting," American Economic Review 91, no. 1, March 2001, 260–271.
[2] PV = FV/$(1 + r)^n$, where: PF = present value; FV = future value; r = discount rate per period; n = number of periods (in years). So, here: PV = \$10 billion/$(1 + 3\%)^{20}$ = \$10 billion/1.8 = \$5.5 billion.
[3] PV = \$10 billion/$(1 + 7\%)^{20}$ = \$10 billion/3.9 = \$2.6 billion.
[4] Weitzman, "Gamma Discounting" (italics in original).
[5] See William Nordhaus, *A Question of Balance*, 2008.
[6] "The Stern Review on the Economics of Climate Change," Journal of Economic Literature, 2007.
[7] Weitzman, "Gamma Discounting."
[8] Sidley Austin LLP, "New Circular A-4: A Revolution in Cost-Benefit Analysis," Sidley, November 2023, https://www.sidley.com/en/insights/newsupdates/2023/11/new-circular-a4-a-revolution-in-cost-benefit-analysis.
[9] Office of Management and Budget, Circular A-4, November 2023, page 76, https://bidenwhitehouse.archives.gov/wp-content/uploads/2023/11/CircularA-4.pdf ("Over the last thirty years, this rate [the real, inflation-adjusted rate of return on long-term U.S. government debt] has averaged around 2.0 percent per year in real terms on a pre-tax basis. OMB arrives at this figure by considering the 30-year average of the yield on 10-year Treasury marketable securities.").
[10] Office of Management and Budget, Circular A-4, page 80.
[11] Office of Management and Budget, "Rescission and Reinstatement of Circular A-4," M-25-15, March 2025, https://www.whitehouse.gov/wp-content/uploads/2025/03/M-25-15-Recission-and-Reinstatement-of-Circular-A-4.pdf.
[12] The White House, "Unleashing Prosperity Through Deregulation," January 2025, https://www.whitehouse.gov/presidential-actions/2025/01/unleashing-prosperity-through-deregulation/.
[13] Lenton, T. M., H. Held, E. Kriegler, J. W. Hall, W. Lucht, S. Rahmstorf, and H. J. Schellnhuber, "Tipping Elements in the Earth's Climate System," Proceedings of the National Academy of Sciences 105, no. 6 (2008): 1786–93.
[14] John E.T. Bistline, Neil R. Mehrotra, and Catherine Wolfram, "Economic Implications of the Climate Provisions of the Inflation Reduction Act," Brookings Papers on Economic Activity, Spring 2023, 77–182, https://doi.org/10.3386/w31267.
[15] Haudenosaunee Confederacy, "Values," https://www.haudenosauneeconfederacy.com/values/.