The Unsettled Matter of Discounting the Future

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ABSTRACT

This paper reviews complications associated with the two most popular discounting frameworks for benefit-cost analysis, and presents an alternative approach based on a social discount rate of zero. The first method, known as the social opportunity cost of capital approach, is problematic in that it assumes all benefits are just like cash, thereby giving too much weight to consumption relative to investment. The second method, the social rate of time preference approach, applies distributive weights to benefits and costs in a manner inconsistent with economic efficiency, and it assumes a social welfare function that is unlikely to correspond with society's actual preferences. This paper suggests modifying the social rate of time preference approach so that it relies on a social welfare function consistent with efficiency. This would seem to be equitable as well as wealth maximizing. But even if the approach recommended here is not preferred by economists, a reexamination of the standard approaches is long overdue.

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In 2001, Martin Weitzman expressed a widespread sentiment among policy analysts that "the choice of an appropriate discount rate is one of the most critical problems in all of economics."[1] Yet, today, we do not appear any closer to forging consensus about the correct discount rate for policy analysis. To the contrary, we may have drifted further away from general agreement.

This lack of consensus reflects not just differences about what number is the correct social discount rate (SDR) for use in policy analysis, but also differing judgments about what that analysis is supposed to measure. The two most common approaches to discounting in benefit-cost analysis (BCA) are so different from one another, in fact, that they do not agree on the measure of human welfare that BCA is evaluating. If a welfare measure is not agreed upon, disagreements about the SDR may prove irreconcilable.

This short paper reviews complications associated with the two most popular discounting approaches. As will be shown, both methods have serious shortcomings, such that a wholesale reexamination of the SDR concept is almost certainly necessary. This paper also proposes one possible alternative path forward, a potential middle ground between these two approaches, based on an SDR of zero.

THE SOC METHOD

There exist two main methods for discounting in policy analysis. The first is called the social opportunity cost of capital (SOC) approach. The SOC approach intends for BCA to measure economic efficiency, which relates to maximizing a broad conception of society's overall wealth. Specifically, SOC advocates want BCA to assess "Kaldor-Hicks efficiency"; that is, to determine if the gains from

1. Martin Weitzman, "Gamma Discounting," *American Economic Review* 91, no. 1 (2001): 260–71.

a policy are greater than the losses, such that the winners could compensate the losers, making everyone at least as well off or better off than they were before the change. If the answer is yes, then a project increases efficiency. This result holds true regardless of how costs and benefits are distributed and regardless of whether compensation actually takes place; the theoretical possibility of compensation is sufficient for a project to increase efficiency.

Under the SOC view, the discount rate compares a project to a counterfactual state of the world in which the project was never undertaken. The counterfactual describes how resources would most likely have been used absent the project going forward, and the discount rate is this alternative state's rate of return.

The Office of Management and Budget (OMB), which sets guidelines for US government regulatory analysis, recommends that agencies use two SDRs in their analysis—3 percent and 7 percent.[2] They represent a "consumption rate of interest" and an "investment rate of interest," respectively. The consumption rate of interest is the marginal rate at which "society" would trade a unit of present consumption for a unit of future consumption. It represents a "marginal social rate of time preference." The alternative and higher investment rate of interest reflects the marginal rate of return to private capital in the economy. It can be thought of as something like the pretax rate of return available on stocks.

With the SOC method, the SDR is a weighted average of these two rates, weighted based on the proportion of project funding coming from consumption versus investment. Consider a hypothetical example of the SOC approach in practice. A project is under consideration that costs $1 billion today and is expected to prevent 100 deaths in 30 years. In addition to these saved lives, the project also generates $2 billion in cash in 30 years, which is an indirect financial benefit of extending people's lives. Think of this benefit as deriving from new businesses created that would not have existed had these people perished (or perhaps from economic activity of their children, who might not have been born otherwise).

If the government undertakes this project and, say, half of the resources to finance the project come from displacing consumption and half from displacing investment, then using the OMB's recommended rates, the appropriate SOC discount rate would be 0.5(0.07) + 0.5(0.03) = 5 percent.

A standard practice in BCA is to put a dollar value on a life,[3] which allows benefits to be measured in monetary terms so that they can be compared to the

2. OMB (Office of Management and Budget), *Circular A-4: Regulatory Analysis*, September 17, 2003.
3. This most common way is using a measure called the "value of a statistical life."

cost of a project. Assume one life in 30 years is deemed to be worth $20 million. The future value of the saved lives, then, is 100 × $20 million = $2 billion.

Under the SOC method, the lives should be discounted at the 5 percent SDR, so their present value is $463 million. Meanwhile, the present value of the $2 billion in cash is also $463 million. This project fails a benefit-cost test because the present value of the benefits is a combined $926 million while the costs are $1 billion.

The SOC method has a problem, however. Both the health benefits (the lives saved) and the financial benefits (the cash) in this example have the same future value—$2 billion each. When both benefits are discounted at the same rate, they also have the same present value. But the cash has a clear advantage in that it can be reinvested, meaning if the cash were held in an interest-bearing account until some date further in the future, it would allow for the purchase of even more than $2 billion of health benefits. Health, because it cannot be invested in an account and earn interest like cash, has a lower opportunity cost than an equivalent dollar value of cash, yet the SOC method treats these different benefits as if they are the same.

Advocates of the SOC approach try to get around this problem by assuming that all benefits are just like cash. But this assumption is clearly false for any benefit, like health, that cannot be reinvested. Martin Feldstein notes that the opportunity cost of capital in BCA must be addressed using a "shadow price," not a discount rate.[4] In other words, the value of capital must be multiplied by a conversion factor to account for capital having a higher opportunity cost than consumption. A discount rate is too blunt a tool to account for the opportunity cost of capital in BCA.

THE STP METHOD

The second major discounting approach is called the social rate of time preference (STP) approach. In contrast to the SOC method, STP advocates usually want BCA to measure well-being, not efficiency. Their approach to estimating the rate of social time preference involves using a social welfare function that comes from the Ramsey neoclassical growth model. This social-welfare-function approach helps the analyst determine the effect of a policy on *aggregate utility*.

The STP approach works in a two-step fashion. First, this method converts all capital goods to their "consumption equivalent." This overcomes the problem

4. Martin S. Feldstein, "The Inadequacy of Weighted Discount Rates," in *Cost-Benefit Analysis: Selected Readings*, ed. Richard E. Layard (Baltimore: Penguin, 1972), 311–32.

identified by Feldstein—namely, that it is improper to discount consumption and capital using a single discount rate. After ensuring that all costs and benefits are expressed as consumption equivalents, the STP method then discounts these consumption streams at the consumption rate of interest (which corresponds to the social rate of time preference).

The conversion to consumption equivalents is done using what economists call the shadow price of capital (SPC). In the simple case where all the returns to capital are consumed each period, such that no returns are reinvested, the SPC is equal to the ratio ROI/ρ, where ROI is an annual rate of return to capital net of depreciation, and ρ is the social rate of time preference. A simple way to think about the SPC formula is that it is describing the present value of a perpetual stream of consumption.

Now let us return to our hypothetical project to evaluate it with the STP method. If we assume ROI is 7 percent, in line with OMB guidelines, and our societal time preference is 3.5 percent—as derived from the Ramsey model—then the shadow price of capital is $\frac{0.07}{0.035} = 2$. The 100 lives saved are already expressed in consumption form, so no conversion is needed. They still have a future value of $2 billion. However, the $1 billion in upfront costs can be divided into two forms: recall that half is financed by displacing investment and the other half by displacing consumption. The upfront costs therefore have a consumption equivalent value of 2 × $500 million + $500 million = $1.5 billion. Similarly, let us assume half the $2 billion in cash in 30 years will be invested and half will go toward consumption. Then the cash has a consumption equivalent value of 2 × $1 billion + $1 billion = $3 billion. The benefits of the project, including the $2 billion in monetized lives saved, are $5 billion in total—which, when discounted at 3.5 percent, have a present value of $1.8 billion. Compared to $1.5 billion in costs, the project now passes a benefit-cost test.

Although the STP method has some advantages over the SOC method, it also has its own disadvantages. First, the STP approach applies distributive weights to consumption streams across time, giving lower weight to benefits and costs in the future based on the idea that future individuals will be richer than present-day individuals owing to economic growth, and because the utility of future citizens is deemed to be less valuable than the utility of present citizens. Weighting benefits and costs depending on who receives them has traditionally been controversial within a single time period. Therefore, it is odd to apply such weights across time.

Another serious drawback of the STP method is that it assumes a social welfare function can describe the aggregated preferences of all individuals in

society, an idea that has been rejected by many economists.[5] This strategy also forces the analyst to make interpersonal comparisons of utility, something that economists try to avoid because utility rankings of two individuals cannot be compared precisely. As an example, we do not know whether a rich person or a poor person values an additional dollar more, despite the rich person being endowed with more dollars (think of a dollar going to Ebenezer Scrooge versus a Buddhist monk). Absent a cardinal measure of utility, comparing one person's set of utility rankings to another's does not provide much useful information.

SETTING THE SOCIAL DISCOUNT RATE TO ZERO

The SOC method tries to avoid making interpersonal comparisons of utility through the potential compensation test of Kaldor and Hicks. If the losers of policy could be compensated by the winners, the losers could be returned to their initial levels of utility, guaranteeing an increase in aggregate utility. The potential compensation test offers a way around the problem of comparing utilities across individuals.

However, the distributive problems that plague the STP method actually extend to the SOC method. That is because these problems arise with any non-zero consumption rate of interest—a rate that is employed by both methods. A consumption rate of interest represents a scheme of unequal weights applied to benefit and cost streams based on who receives them. When benefits and costs are weighted in this manner, the net benefits calculation does not answer the question of whether the winners of a policy have enough to compensate the losers with their gains.

Those who endorse the STP method are not bothered by this; they are not satisfied with the concept of economic efficiency, as is evident from their abandonment of the Kaldor-Hicks principle in favor of this social-welfare-function approach. At least in principle, however, SOC advocates say they want to evaluate economic efficiency. But, in effect, they are not measuring efficiency either because they too are placing unequal distributive weights on benefits and costs.[6]

This leads to a question: Is it possible to identify a discount rate that conforms with a normative social welfare function that is consistent with our basic

5. The work of Kenneth Arrow is influential here. See Kenneth J. Arrow, *Social Choice and Individual Values*, 3rd ed. (New Haven, CT: Yale University Press, 2012 [1951]).
6. In addition to applying weights based on the timing of consumption, the SOC method also implicitly applies weights to consumption as it is valued relative to capital, a point raised above.

moral intuitions, but that also conforms with economists' traditional notion of economic efficiency? I submit that there is, based on an SDR of zero.

The social welfare function I seek to maximize is $SW = \sum_{t=0}^{\infty} U(C_t)$, where U(C) = C. This can be viewed as a special case of the Ramsey social welfare function. Here, to maximize aggregate utility, we must maximize aggregate consumption over an infinite time horizon.[7]

Because this is a social-welfare-function approach, the selection of this particular function is normative, just as with the standard Ramsey method. However, this social welfare function has properties that may make it superior to the usual Ramsey approach.[8] Its greatest advantage is that it conforms with common notions of equity and fairness in that the analyst does not give less weight to the well-being of future people. In fact, the consumption of every individual in the analysis receives equal weight, regardless of who they are or when they live.[9]

There is an economic rationale for this approach as well. When consumption is weighed equally across time, the calculation of net benefits evaluates whether the Kaldor-Hicks potential compensation criterion is satisfied. Therefore, if this social welfare function is accepted, then the same project that improves Kaldor-Hicks efficiency increases aggregate social utility. In other words, the social welfare function recommended here is one that corresponds with both economic efficiency and social welfare. Welfare and wealth maximization need not be divergent goals.

How would such an approach work in practice? We start with the same two-step process as is followed with the STP method. Recall that the simple formula for the SPC assumes no reinvestment, an assumption that is unlikely to hold in the real world. More realistically, some of capital's returns will be reinvested.[10] With a social rate of time preference of zero, the value of the consumption stream that capital generates grows without bound. This creates an obvious complication, but it also has an intuitive meaning. It reflects that continually reinvesting

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7. This is similar to the Golden Rule rate of economic growth from growth theory.

8. For a moral, economic, and philosophical defense of a zero social discount rate, see Tyler Cowen, *Stubborn Attachments: A Vision for a Society of Free, Prosperous, and Responsible Individuals* (San Francisco: Stripe Press, 2018).

9. Hence, this is a form of analytical egalitarianism. See Sandra Peart and David Levy, *The "Vanity of the Philosopher": From Equality to Hierarchy in Post-Classical Economics* (Ann Arbor, MI: University of Michigan Press, 2005).

10. When returns are partially reinvested, the equation for the SPC is $\sum_{t=0}^{\infty} (1-f)ROI \times \frac{(1+fROI)^t}{(1+\rho)^t}$ where f represents the fraction of returns reinvested each year, $fROI$ is the annual growth rate of the consumption stream, and t_0 is the year in which the capital benefit or cost is delivered. One can think of this equation as being similar to the price of a stock with a growing dividend, except in place of a growing dividend stream is a growing stream of consumption.

project returns leads to a stream of consumption that grows ever greater in value each year—toward infinity in the limit.

Returning to the example above, if the SPC is infinity, then the consumption equivalent value of $1 billion in upfront expenditures is infinity, so long as any capital is displaced by the project. The consumption equivalent of $2 billion in future cash is similarly infinity, so long as any fraction of this cash will be invested in capital. The 100 lives saved are already expressed in consumption terms, so no conversion is necessary.

To assess the efficiency of a project with infinite benefits and costs, one can resort to a comparison of their growth rates.[11] Although both the benefits and costs of this project are approaching infinity in the limit, one may be growing *at a faster rate* than the other.

Over an infinite time horizon, all that will matter are the growth rates of the streams of consumption flowing from capital, as every other benefit and cost will eventually be surpassed in value. In that case, if the expected annual rate of return on the capital underlying the $2 billion in cash exceeds the annual growth rate from the SPC formula (which is denoted *fROI*, found in footnote 10), then the benefits of this project should be growing faster than the costs, such that the project passes a benefit-cost test. Thus, the growth rate from the SPC formula is a hurdle rate that a project's benefits' rate of return must exceed.[12]

I submit that 4 percent may be a reasonable hurdle rate, though there is significant uncertainty surrounding this number. First, there is no consensus about the degree to which investment is displaced by marginal government projects nor about the degree to which returns are reinvested. This is an area of considerable disagreement between advocates of the SOC method and those of the STP method, for example. However, OMB's 7 percent rate of return to capital seems, if anything, too low given recent estimates.[13] Most likely the hurdle rate will vary somewhat by project, but arguably an even higher rate than 4 percent may be justified to account for factors such as uncertainty and the general irreversibility of government projects. Accounting for these factors might yield a rate along the lines of the 7 percent rate recommended by OMB.

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11. Tyler Cowen, "Caring about the Distant Future: Why It Matters and What It Means," *University of Chicago Law Review* 74, no. 1 (2007): 5–40.

12. The time horizon becomes important here. If the principal amounts differ substantially, the time it takes for the value of benefits to overtake the costs may seem excessive, even if benefits are growing faster than costs.

13. For example, Arnold Harberger and Glenn Jenkins estimate the rate of return to private capital in advanced countries could be as high as 11 percent annually. See Arnold C. Harberger and Glenn P. Jenkins, "Musings on the Social Discount Rate," *Journal of Benefit-Cost Analysis* 6, no. 1 (2015): 6–32.

Furthermore, it may be reasonable to assume that there is something like an underlying natural rate of growth in the economy and that all capital has essentially the same opportunity cost (i.e., the consumption stream that capital generates always grows in value at the same rate in the long run). If we also assume the proportion of cash flows that represents investment on the benefits side of the ledger is the same proportion that represents displaced investment on the cost side, then we could simply discount the value of future cash flows at a rate of *fROI*. If the present value of these streams, net of the financial costs, is positive, then the project passes a benefit-cost test.[14]

Returning to our example, if *fROI* is 4 percent, then the discounted present value of the $2 billion in cash is $617 million. This is less than the financial costs of $1 billion, so the project fails a benefit-cost test. The discount rate used in this final example is not a social discount rate. It is a financial discount rate, in that it is only applied to money.

CONCLUDING THOUGHTS

The two standard approaches to discounting both have serious conceptual problems, such that an alternative approach is needed. The SOC method fails to adequately account for how consumption and capital-related benefits have different opportunity costs. The STP method relies on social welfare function that is unlikely to correspond with society's actual preferences. Both methods add a layer of distributive weighting on top of the arithmetic of benefits and costs, such that it is unclear what measure of welfare BCA is even evaluating.

This paper has offered reasons to consider a zero discount rate, which would seem to be equitable as well as wealth maximizing. This approach draws on those aspects of the SOC and STP methods that make sense while discarding those aspects that are problematic. But even if the approach recommended here is not preferred by economists, a reexamination of the standard approaches is long overdue.

14. The project that maximizes net benefits will be identified when discounting in this manner, because multiplying all cash flows by the same nonzero constant preserves the relative sizes of the discounted cash flows compared to the unadjusted discounted cash flows. As a result, it will not matter how much investment is displaced or encouraged by social projects, so long as it is not zero. Discounting cash flows will produce the same recommendations as in the case where the analyst knows exactly the proportion of cash that represents real investment.

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James Broughel is a senior research fellow at the Mercatus Center at George Mason University and an adjunct professor in the economics department and Antonin Scalia Law School at George Mason. He specializes in state and federal regulatory procedures, cost-benefit analysis, and economic growth. Broughel has authored numerous policy briefs and reports on regulatory issues. His work has appeared in outlets such as the *Washington Post*, the *Baltimore Sun*, *U.S. News & World Report, Real Clear Policy, The Hill*, and *Yahoo Finance*. He has been published in scholarly journals, including the *Harvard Journal of Law & Public Policy: Federalist Edition* and the *European Journal of Risk Regulation*. Broughel received his PhD in economics from George Mason University in 2017 and his BA and MA in economics from Hunter College of the City University of New York, from which he graduated *summa cum laude*.

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