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Regulatory Insight

The Discounting Dilemma

How to Use Two Discount Rates in a Regulatory Impact Analysis

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Abstract

OMB's guidance on regulatory analysis directs agencies to evaluate regulatory benefits and costs using two standard discount rates, 3 percent and 7 percent, but it gives little insight on how to use them other than to try both. The initial draft of OMB's first such guidance, published in 1988, did include specific instructions on how to use two rates simultaneously, but those instructions were deleted in the editing process. This Regulatory Insight recreates those original instructions, and explains how they help to resolve many misunderstandings about discounting that have developed since then.

The Unbearable Lightness of OMB Discounting Guidance

A Tale of Two Discount Rates

OMB's guidance on Regulatory Analysis, Circular A-4 (which incorporates by reference its more general guidance on discounting, Circular A-94) offers two discount rates for regulatory agency use.

> As a default position, OMB Circular A-94 states that a real discount rate of 7 percent should be used as a base-case for regulatory analysis. The 7 percent rate is an estimate of the average before-tax rate of return to private capital in the U.S. economy. . . It approximates the opportunity cost of capital, and it is the appropriate discount rate whenever the main effect of a regulation is to displace or alter the use of capital in the private sector. . .

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> The effects of regulation do not always fall exclusively or primarily on the allocation of capital. When regulation primarily and directly affects private consumption (e.g., through higher consumer prices for goods and services), a lower discount rate is appropriate. . . If we take the rate that the average saver uses to discount future consumption as our measure of the social rate of time preference, then the real rate of return on long-term government debt may provide a fair approximation. Over the last thirty years, this rate has averaged around 3 percent in real terms on a pre-tax basis.
>
> For regulatory analysis, you should provide estimates of net benefits using both 3 percent and 7 percent. [Circular A-4, pp. 33–34]

Both Circulars recognize that using 3 percent alone (the Social Rate of Time Preference, SRTP), or using 7 percent alone (the Rate of Return to Capital, RRC), are both analytically incorrect. Neither method is supported by economic theory, and displaying two wrong answers is not especially helpful. So OMB offers agencies another option, the shadow price of capital.

Or Maybe Just One Discount Rate, But with a Multiplier

The theoretically preferred method of discounting for regulatory analysis uses just the SRTP for discounting future values; and it accounts for the scarcity of capital, not by using a higher discount rate, but by applying a shadow price of capital.

This Shadow Price of Capital (SPC) approach originated in a conference held by Resources For the Future in 1977, which resulted in a conference volume edited by Robert Lind (hereinafter, "Lind-82").[1] As the Environmental Protection Agency (EPA) notes in its own *Guidelines for Preparing Economic Analysis*, "Lind (1982a) remains the seminal source for this approach in the social discounting literature." OMB agrees:

> Using the shadow price of capital to value benefits and costs is the analytically preferred means of capturing the effects of government projects on resource allocation in the private sector. To use this method accurately, the analyst must be able to compute how the benefits and costs of a program or project affect the allocation of private consumption and investment. OMB concurrence is required if this method is used in place of the base case discount rate. [Circular A-4, Section 8.b.(3)]

When using the SPC approach, all costs and benefits are discounted using the SRTP, but mandated capital costs are first multiplied by the SPC, which is equal to the RRC divided by the SRTP. (See

[1] Lind, R.C., ed. *Discounting for Time and Risk in Energy Policy*. Washington, DC: Resources for the Future, 1982.

Lind-82 for the explanation.) Using OMB's 7 percent and 3 percent the SPC = 7/3 or 2.33, but in 1982 the SPC worked out closer to a factor of three or four. Despite widespread dissatisfaction with OMB's policy of two alternative discount rates, and recognition that the SPC approach is more rigorous, agencies have not embraced it. Apart from having to ask OMB permission to use SPC, agencies may be wary of the "capital cliff" that it presents. That is, if a million-dollar cost is deemed to be a *capital* cost, it suddenly becomes three or four million dollars! This is such a sudden jump in regulatory costs that agencies are reluctant to include SPC in regulatory analysis. Instead, they continue to produce two incorrect calculations, using the two discount rates separately.

A Multitude of Myths About the Two Discount Rates

The long practice of using discounting methods that are officially approved, but known to be analytically incorrect, has caused a number of misunderstandings to develop among producers, as well as consumers, of regulatory impact analysis.

Myth 1. OMB's 3% and 7% are a range; the correct rate lies somewhere in between.

No, OMB's two discount rates represent empirically derived estimates of two different "prices," that apply to two different goods. It is not right to treat think of them as a range.

Myth 2. If we calculate an NPV at 3% and 7%, the true NPV will likely lie in between.

This is not quite right, either. EPA mistakenly embraces this view in its own *Guidelines*:

> In most cases the results of applying the more detailed "shadow price of capital" approach will lie somewhere between the NPV estimates ignoring the opportunity costs of capital displacements and discounting all costs and benefits using these two alternative discount rates. [EPA *Guidelines for Economic Analysis*, p. 6-19]

With a complex temporal pattern of benefits and costs, including capital costs, there is simply no reason to think that the math will work out this way. Although "ignoring" the opportunity costs of capital will result in an underestimate of total costs, using the 7 percent RRC to discount all costs and benefits could result in either an overstatement or an understatement of the correctly calculated NPV. In some cases the NPV of costs will appear too low; in other cases the NPV of benefits will be undervalued.

Myth 3. Consumption costs should be discounted at 3%, and capital costs at 7%.

Heck no! Remember that capital costs have a higher opportunity cost than pure consumption; discounting them at 7 percent would make them appear smaller relative to other costs!

Myth 4. Benefits that flow from a capital investment should be discounted at 7%.

This is a very common practice and is consistent with OMB guidance. It is directionally right (compared with Myth 3), but it is still analytically incorrect. Keep in mind that multiple alternative policies, with different costs and benefits, are being compared in an RIA. Suppose there are two effective options to eliminate a particular workplace hazard: one is a costly change in operating procedures, the other is a piece of capital equipment. If both options eliminate the hazard, the analysis should not pretend that the benefits are different. There will be extra costs associated with capital investments, but those should appear on the *cost* side of the ledger. The NPV of benefits alone should not be affected by how we choose to purchase them.

Myth 5. Use of the SPC approach requires a General Equilibrium (GE) analysis.

This is not true. *Explaining* why there are two different discount rates for different categories of cost required a general equilibrium analysis (See Lind-82), but agencies should not need a GE model to *apply* those prices in the microeconomic analysis of a particular rule – see the Mazur method below.

Myth 6. The SPC approach overstates capital costs because it assumes a dollar-for-dollar displacement of private capital, instead of a partial displacement.

This is not necessarily so. If we relax the dollar-for-dollar assumption, we cannot be sure that the correct answer would be a *partial* displacement; we might find a capital displacement well above 100 percent. Very often, regulatory requirements for capital investment are contingent requirements: *if* you have a widget factory, *then* you must also have a widget-wastewater treatment facility. Just as there is an excess burden of taxation, there can be an excess burden of regulation, so that each $1 of regulatory mandates for capital expenditures will displace substantially *more* than $1 of private capital investments. Indeed, it might even be true that noncapital costs imposed by regulation can reduce the incentives for private capital investment; or, in rare cases, increase them. These questions are worth exploring, but the answers are likely to be much more complicated than in the case of taxation, because tax authorities generally are trying to maximize net revenue and (equivalently) minimize excess burden. In non-tax regulatory programs there will be a variety of considerations that make it difficult to generalize about the magnitude of capital displacement or excess burden. Meanwhile, a dollar-for-dollar displacement seems like a reasonable default assumption. In any case, we should be careful to maintain the distinction between prices (the discount rate) and quantities (displacement of capital), rather than try to adjust one to compensate for assumed misestimates in the other.

Myth 7. The SPC approach should not apply to an open economy like the U.S., which can easily borrow overseas.

It is true that the Lind-82 treatment is based on a closed-economy model, in which the supply of capital is constrained and therefore carries a shadow price. We can think of this shadow price as capturing the "positive externalities" of scarce private investment, which mostly take the form of extra tax revenues to domestic governments. But when U.S. companies borrow overseas, some of those positive tax externalities are exported, rather than displaced. (Remember that foreign investors will be expecting real financial returns; they are not investing their funds simply to give the U.S. safer workplaces or cleaner waters.) From the point of view of a domestic BCA, those exported externalities still represent a loss; the shadow price (when our supply of capital is constrained) has simply been replaced by a real price (when we go out and buy more capital abroad). The full treatment of these effects would require a complex analysis of tax structures across the world and their interactions, as well as the varying rates of saving in different economies and cultures. This may be a good project for OMB, CEA, and Treasury to pursue, but it is not a project to undertake within the confines of an RIA. For RIA purposes, agencies should assume that the empirically derived OMB guidance on discount rates accurately captures the underlying costs to the U.S. economy.

Myth 8. This is too hard!.

No, no! Deriving the SRTP and the RRC is a complex undertaking, but using them correctly in a regulatory analysis is relatively simple. Read on.

The Mazur Method

OMB's original *Regulatory Impact Analysis Guidance* appeared as Appendix V in the *Regulatory Program of the U.S. Government* (April 1, 1988 – March 31, 1989). The first footnote read:

> This appendix was mainly written by Michael Mazur as one of his last projects before his untimely death last year. Those who knew Mike will appreciate his hard work and careful analysis that made this guidance possible.

This 1988 guidance introduced OMB's two discount rates, but it omitted critical instructions that Mike Mazur had drafted, shortly before his death in 1987, about how to use them properly.

Doing the Two-Step: First Amortize, then Discount.

Mazur gave a simple two-step procedure for using the two discount rates in proper relationship:

First, using the RRC, amortize any capital costs over the expected lifetime of the capital. This will produce a consumption-equivalent stream of future dollar values.

Second, using the SRTP, discount the amortized capital costs back to the present, along with all of the other consumption-equivalent costs and benefits.

The Mazur-87 method has several advantages. It is easy to do, and easy to understand what's going on. It does not require the use of a GE model. And it avoids the "capital cliff" that produces a sudden jump in costs when capital investment is mandated. For short term capital commitments, the NPV using the Mazur-87 method becomes indistinguishable from consumption. As the duration of the capital commitment gets longer, the additional opportunity costs grow larger.

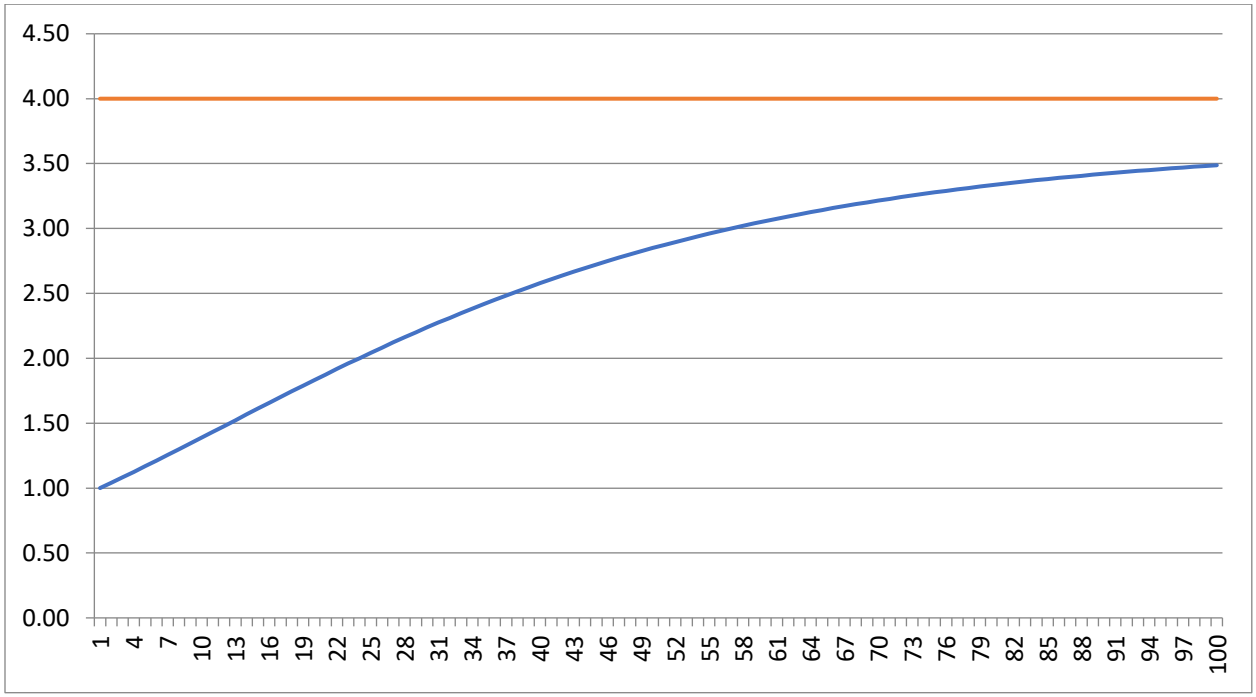
For *very* long-term capital investments the Mazur-87 approach is identical to the Lind-82 SPC approach. Indeed, Mazur's methodology makes it clear that the major weakness of the Lind-82 SPC was not that it assumed 100 percent displacement of private capital, but that it implicitly assumed *permanent* displacement. Lind-82 erred by ignoring the time dimension of capital commitments, which is the essential feature that distinguishes them from consumption.

Envisioning a Time-Dependent Shadow Price of Capital

The easiest way to envision the Mazur Method is to use it to calculate the NPV of one dollar of capital cost incurred today, amortized over *x* years. The result is effectively a time-dependent SPC.

The graph below uses an SRTP of 3 percent, and an RRC of 12 percent. The Lind-82 SPC would simply be 12/3 or a factor of four. That is represented by the horizontal orange line in the graph; it does not change its value as a function of *x*. The blue line is the Mazur-87 SPC; it varies as a function of x, the duration of the capital displacement.

Illustration of the Mazur-87 SPC: *y = The NPV at 3% of ($1, amortized at 12% over x years).*



Note that, with an SRTP of 3 percent and an RRC of 12 percent, the Lind-82 SPC is a factor of 4 – shown by the orange line in the graph above. That is, if $1 of cost is treated as a capital cost, its value goes up to $4. Capital costs are quadrupled, regardless of their duration. In contrast, Mazur-87 discounting generates a time-dependent SPC that gives us the same answer – but only if the capital commitment is infinitely long! Even after a century, the factor is only 3.5 rather than 4. For a more typical twenty-year capital investment, the Mazur-87 SPC (using these same discount rates) is a factor of less than 2. And for a one-year capital investment, the Mazur SPC is a factor of one – in other words, the capital cost is essentially consumption.

All this is exactly what we should expect. The time-dependent Mazur SPC is well behaved in all the ways that other methods are not. It makes it clear that the weakness of the Lind-82 SPC is not that it assumed 100 percent displacement, but that it effectively assumed *perpetual* displacement. By relaxing that assumption, Mazur made the SPC a much more realistic, as well as more usable, methodology.

This is not to say that it answers all questions about discounting. Indeed, it raises some new ones. Given this framework, are we confident we have the right two discount rates? Do they depend on whether the capital costs are imposed on households (e.g., in buying a new car) or on firms? How do we decide the applicable duration? Should we consider the lag (which may be very long) between the time the capital cost is incurred and the time the associated benefit is realized? These questions are not prohibitive, however. It's time to start doing discounting right.