CHOOSING A DISCOUNT RATE

Overview

Discounting is the process of calculating the present value (in today's dollars) of a cost or benefit anticipated to be incurred in the future. Analysts apply the discount rate to benefits and costs over a project's time horizon or project options.

A dollar is worth more today than in the future because (1) it has a greater capacity to earn interest, (2) inflation devalues the purchasing power of a dollar over time, and (3) the future is uncertain. Because of this, future values are discounted to determine how much they are worth today.

Discounting the future dollar values for both benefits and costs into present-day dollars allows a comparison of benefits and costs across projects in dollar values that are comparable. This is an important aspect of accurately assessing the benefits and costs of a natural infrastructure project, since a large share of costs is often incurred at the beginning of a project, whereas benefits tend to accrue over time. Thus, failure to discount future costs or benefits (values) would result in benefits being overestimated relative to costs. Here is an example of how to calculate the present value (PV).

> To discount future values, and generate the present value (PV), each value is deflated by a certain percent for each year in the future.
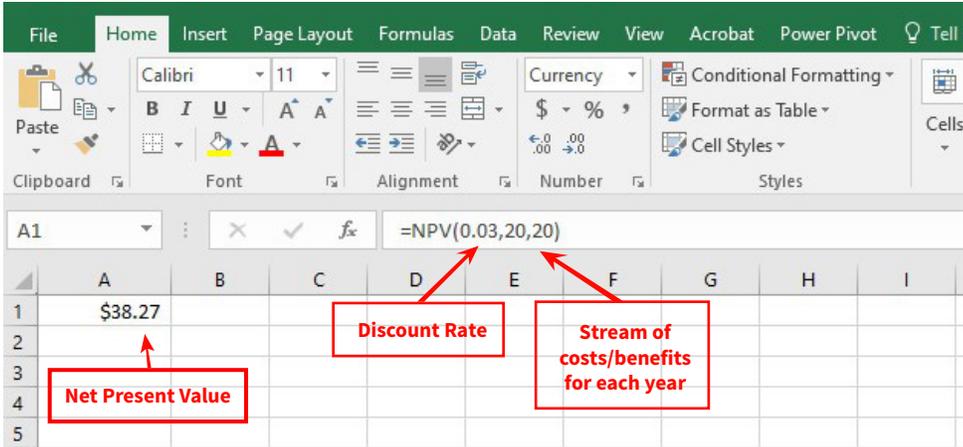>
> For example, using a discount rate of 3%, a benefit of $20 occurring each in Years 1 and 2 would be valued at $38.27 today.
>
> $$PV = \sum_{t=0}^{T} \left(\frac{X_i}{(1+i)^t} \right)$$
>
> Where **t** = year, **i** = discount rate, and **X** is the value
>
> $$\$38.27 = \frac{\$20}{(1+0.03)^1} + \frac{\$20}{(1+0.03)^2}$$
>
> In excel, the PV can be calculated using the formula NPV (net present value). Using the example, in an empty cell you would type "=NPV(0.03,20,20)" and press enter.

Example

Assume you invest $100 and that it yields $10 a year, with a payback of $120 at the end of year 5.

Discount Rate	Investment	Year 1	Year 2	Year 3	Year 4	Year 5	Present Value (PV)	Net Present Value (NPV)
Undiscounted	($100)	$10.00	$10.00	$10.00	$10.00	$130.00	$170.00	$70.00
5%	($100)	$9.52	$9.07	$8.64	$8.23	$101.86	$137.32	$37.32
10%	($100)	$9.09	$8.26	$7.51	$6.83	$80.72	$112.42	$12.42
15%	($100)	$8.70	$7.56	$6.58	$5.72	$64.63	$93.18	($6.82)

The federal government's U.S. Office of Management and Budget, Office of Information and Regulatory Affairs, mandates different discount rates for federal projects depending on the agency, program, or project purpose under its Circular A-94. [1,2] Here are some examples from the Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers.

- The Office of Management and Budget mandates that FEMA use real discount rates of 7% for projects that are for regulatory impact analyses (RIAs).
- The current discount rate for the Corps is 2.75% for fiscal year 2020 for evaluating projects and benefit-cost analysis.[3] This discount rate is updated annually.

What discount rate should you use? Very often, grant application guidelines will specify the required discount rate. An economist may also provide some insight when a discount rate is not specified. In the absence of being able to seek their advice, it may be worth implementing the analysis using multiple discount rates (e.g., 0%, 0.25%, 3%, 5%, and 7%) to understand the impact on the analysis if interest rates and discount rates vary.

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[1] Circular A-4, "Regulatory Impact Analysis: A Primer"; Circular A-94: "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs."

[2] FEMA Benefit-Cost Analysis

[3] Water Resources Council Rules and Regulations (33 F.R. 19170) section 704.39(a):

https://www.treasurydirect.gov/govt/rates/tcir/tcir_fy2020_opdirannual.htm#table4