

Basic economic concepts of Climate Change

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The mechanics of discounting

Net Present Value

- Benefits – Costs
- But the timing of costs and benefits matters, so you need to discount future costs and benefits

$$NPV = \sum_{t=0}^T \frac{(Benefits_t - Costs_t)}{(1+r)^t} =$$

$$= B_0 - C_0 + \frac{B_1 - C_1}{(1+r)} + \frac{B_2 - C_2}{(1+r)^2} + \frac{B_3 - C_3}{(1+r)^3} + \dots + \frac{B_T - C_T}{(1+r)^T}$$

- Use current or projected market prices for small impacts where available, not applicable to non-marginal impacts

Annualised cost

- Equivalent Annualised Cost: the cost per year of owning and operating an asset over its entire lifespan
- Used to compare investments with different lifetimes (useful in MAC curve calculation)

$$EAC = \frac{NPV}{\left(\frac{1 - \frac{1}{(1+r)^T}}{r} \right)}$$

- where $\left(\frac{1 - \frac{1}{(1+r)^T}}{r} \right)$ is the present value of the annuity factor

Why use discount rates?

Why use a discount rate?

- 1 € today is not the same as 1 € tomorrow
- If I have 1 € today I can put the money in the bank/invest it and it will be worth more than 1 € tomorrow (supply side)
- People also have a preference to receive money sooner rather than later (demand side)
- Discounting serves the purpose of making monetary values accruing in different times comparable by converting them to their 'present value'

Discounting private costs and benefits

- When companies make financial decisions discounting is used for comparing to best alternative investment
- Discount rate reflects the opportunity cost (i.e. return on the best alternative use of funding) of investment
- In the private sector the discount rate depends on risk – if risk is higher then higher returns are expected (Charlie's example and risk)
- Information on the return of the best alternative investment is available in the market \Rightarrow companies use market rates for discounting when making decisions on investments

Discounting social costs and benefits

General agreement that social CBA should not use a market rate, but a lower rate

If we use a similar approach to social CBA as for private CBA, then the question to ask is: what is the alternative to the investment?

- Return on alternative investments by the government
- Higher taxes crowding out investment or consumption or both (A. Harberger's approach and social cost of capital approach both based on these but use different weighting)
- Government borrowing rate/government bond interest rates
- Etc.

Different ways of calculating the discount rate depending on what is viewed as the alternative

Other approaches also exist (not based on what alternative investment is) e.g. optimal growth rate – reflects rate of growth that is optimises consumption over time, taking into account a pure time preference rate (in line with Ramsey growth model, these types of discount rates were used by the Stern Review)

In practice often there is no actual calculation, but a government mandated rate (e.g. 5%) or a rate for which no justification is given

The discount rate debate

Why does it matter?

discount rate	the present value of €100 which accrues...				
	today	in 10 years	in 20 years	in 50 years	in 100 years
0%	100	100	100	100	100
1%	100	90.53	81.95	60.80	22.48
2%	100	82.03	55.21	20.51	13.80
5%	100	61.39	37.69	8.72	0.76
10%	100	38.55	14.86	0.85	0.01

Compounded discounting implies division with an exponentially increasing factor \Rightarrow the present value of a given amount of money decreases very quickly over time
 High discount rates favour projects where benefits are front-loaded and/or costs occur in the distant future

Concerns of non-economists

- Environmental sustainability considerations, e.g. large future impacts of climate change would practically not matter...
- Related consideration of intergenerational equity/ethical implications, and the idea that the social discount rate should not reflect individual time preferences but moral obligations towards future generations
- Discounting implies no need for elements of nature whose value grows at a rate below the discount rate – however, nature a system where elements cannot be separated (example of Daly and Cobb of goose laying golden eggs)
- False assumptions? Will 1€ invested today really result in such large long run returns? Especially for social benefits related to e.g. environment where the long term trend is decreasing environmental asset value?

Existing practices

- Constant discount rate reflecting alternative use of government funds/source of funding
- Constant but lower discount rate
- Discount rate which diminishes over time
- Zero discount rate/negative discount rate?
- Sensitivity analysis using different discount rates
- Use positive discount rate but add environmental constraints to avoid unsustainable outcomes

Thank you for your attention!

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