

Critiques of the DICE model

Uncertainty in DICE 2007

The ‘uncertain’ run of DICE takes 100 random draws of the uncertain parameters and runs the (once parameters are drawn deterministic) model for each drawn parameter combination

-> Only captures current uncertainty over parameters

- No uncertainty other than over parameters (like economic shocks)
- No learning
- No Knightian Uncertainty

Recall

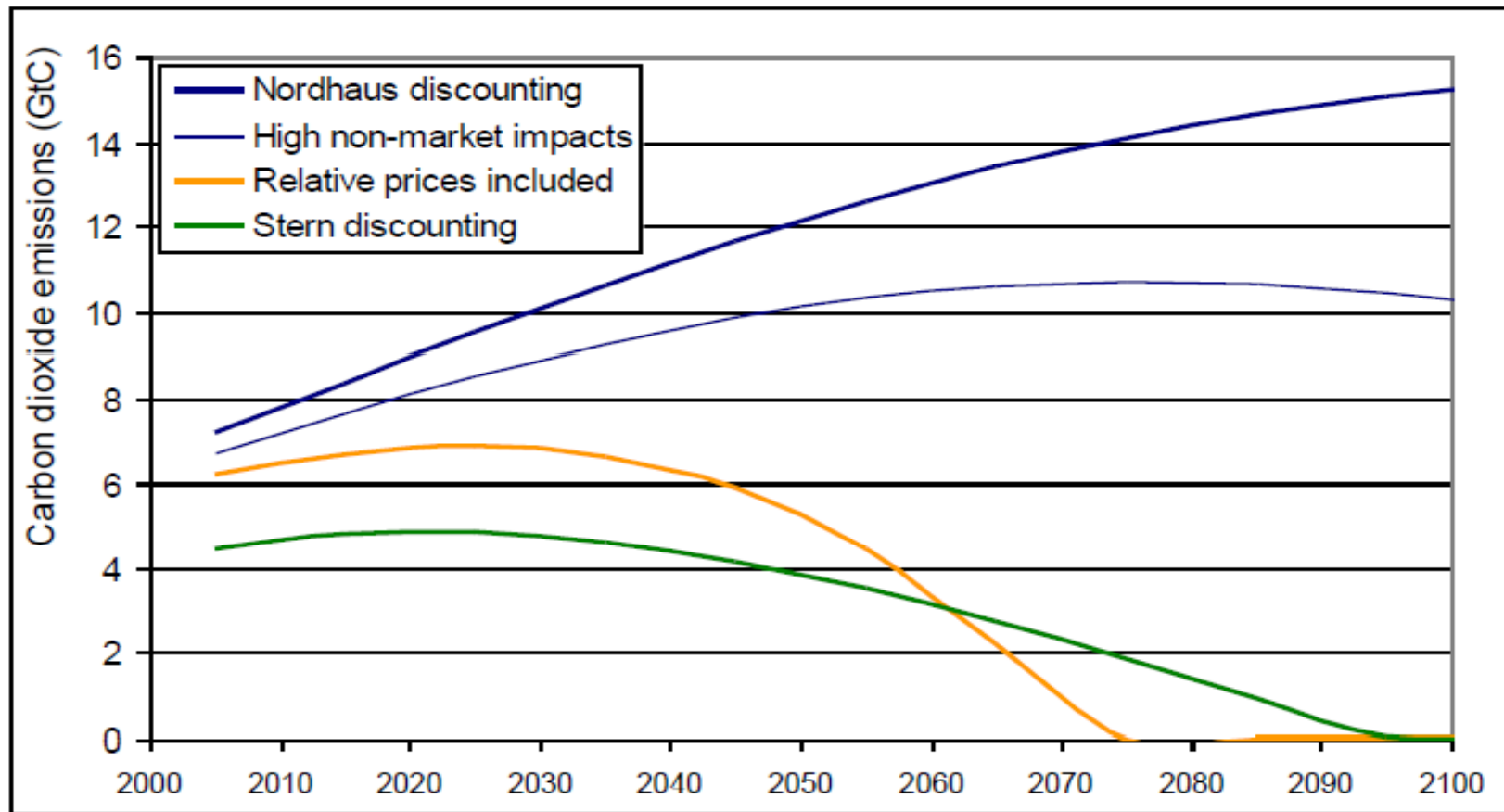
In our section on Discounting and Sustainability we discussed:

- Instead of modeling one aggregate consumption good, model
 - environmental goods \mathbf{x}^E AND produced goods \mathbf{x}^P AND
 - the fact that both goods are not perfect substitutes and environmental quality directly impacts welfare:

$$W = U(x_1^E, x_1^P) + \frac{1}{1+\rho} U(x_2^E, x_2^P) = \frac{[(x_0^E)^{.5} (x_0^P)^{.5}]^{1-\theta}}{1-\theta} + \frac{1}{1+\rho} \frac{[(x_1^E)^{.5} (x_1^P)^{.5}]^{1-\theta}}{1-\theta}$$

- And we learned that instead of a common discount rate we could derive
 - $r^E = \rho + \theta (.5 g^E + .5 g^P) - (.5 g^P - .5 g^E)$
 - $r^P = \rho + \theta (.5 g^E + .5 g^P) + (.5 g^P - .5 g^E)$

Separating Environmental and Produced Goods



- Source: Sterner & Persson (2008), An even Sterner Review: Introducing Relative Prices into the Discounting Debate.

Critique of Damages in DICE

Hanemann (2008) discusses the DICE 99 estimates for the US (for the 2.5°C, qualitatively similar to DICE 2007, though 07 slightly higher)

Aggregation:

- Average global temperatures (DICE) vs. statewise/local temperatures
- Year-Average (DICE) vs. winter and summer

Cites a climate model that delivers following increases:

- 2°C globally, 3.3°C California, 5°C Central Valley
- Californian winter 2.3 °C, but summer 4.6 °C

No risk aversion in damage evaluation except for catastrophic impacts

Damages in DICE: Agriculture

Agriculture:

- DICE neglects nonlinear effect of temperatures on crop yields: A degree more can sharply reduce crop yield
- Oversimplification in comparing cropland, precipitation and temperatures:
 - Some of richest farmlands in US in California and Arizona
 - These are also driest and hottest areas
 - Thus appears that dry and hot is good for crops

However, these regions are irrigated with water from elsewhere

- Evapotranspiration of plants increases water demand at higher temperatures

Damages in DICE: Water

Climate change not only changes precipitation level, but also:

- Water storage in form of snow
- Ground cover in the watershed:
 - E.g. wildfires can reduce forest cover accelerating runoff
 - Water consumption by ground cover in watershed
- Likely to face less frequent but more intense rainfall
 - Drier soil, faster runoff
 - Can have more floods in winter and drier summers

Sea-level rise:

- Neglects that more US population living close to coast increases
- Neglects that increasingly valuable assets at risk at coast

Damages in DICE: Energy and Health

Energy:

- DICE nets out reduced use in winter with increased use in summer
- However: Demand increases much steeper with high temperatures than it falls with low temperatures
- Also: Summer high temperature demand (AC) generally in peak hours

Health:

- DICE assumes that reduction in cold spell deaths in winter cancels with heat wave deaths in summer
- More recent epidemiologic studies show that heat wave deaths far larger

Damages, Alternative Value Suggestions for US and 2.5°C Billions of (1990-) USD

	DICE 99	Hanemann (suggestions)
Agriculture	4	15
Energy	0	5
Water	0	10
Sea Level	6	35
<i>Market Subtotal</i>	<i>11</i>	<i>60</i>
Health	2	10
Amenities	-17	-5
Settlement, Ecosystems	6	11
Extreme and catastrophic events	25	25
<i>Nonmarket Subtotal</i>	<i>17</i>	<i>41</i>
<i>Total</i>	<i>28</i>	<i>113</i>