Assessing Climate Policies with DICE

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The scenarios:

1. *No controls ("**baseline**")* *(No emissions controls for first 250 years)*
2. ***Optimal** policy:* Emissions and carbon prices set at optimal levels from second period in 2010–2019.
3. *Climatic constraints with **CO_2-concentration constraints**:* Similar to optimal case except that CO_2 concentrations are constrained to be less than a given upper limit:
   - A. CO_2 concentrations limited to 1.5preindustrial level (420 ppm)
   - B. CO_2 concentrations limited to 2preindustrial level (560 ppm)
   - C. CO_2 concentrations limited to 2.5preindustrial level (700 ppm)
4. *Climatic constraints with **temperature constraints**:* Similar to optimal case except that global temperature change is constrained to be less than a given increase from 1900.
   - A. limited to 1.5°C B. limited to 2°C
   - C. limited to 2.5°C D. limited to 3°C

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The scenarios continued:

5. ***Kyoto Protocol***. Different variants of the Kyoto Protocol.
   - A. *Original Protocol with the United States.*
     Constant emissions at level of 2008–2012 budget (all Annex I)
   - B. *Original Kyoto Protocol without the United States.*
     Above without the US
   - C. *Strengthened Kyoto Protocol.*
6. *Ambitious proposals*
   - A. *Spirit of the **Stern** Review:* Low discount rate.
   - B**. *Gore*** *emissions reductions:*
     Achieve global emissions reductions of 90 percent by 2050.
7. ***Low-cost backstop*** *technology:*
   Development of a technology or energy source that can replace all fossil fuels at current costs (which currently seems unrealistic).

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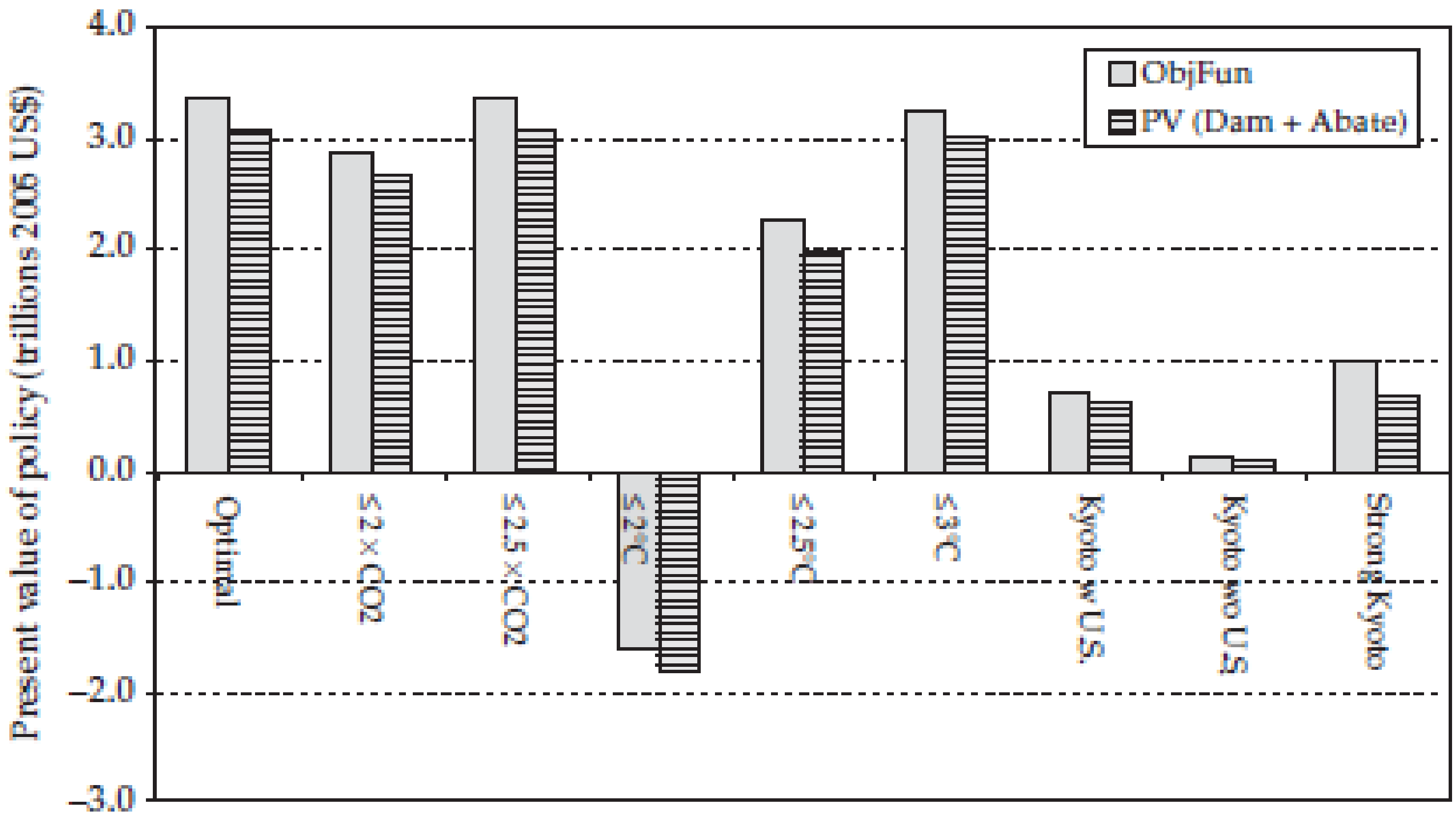
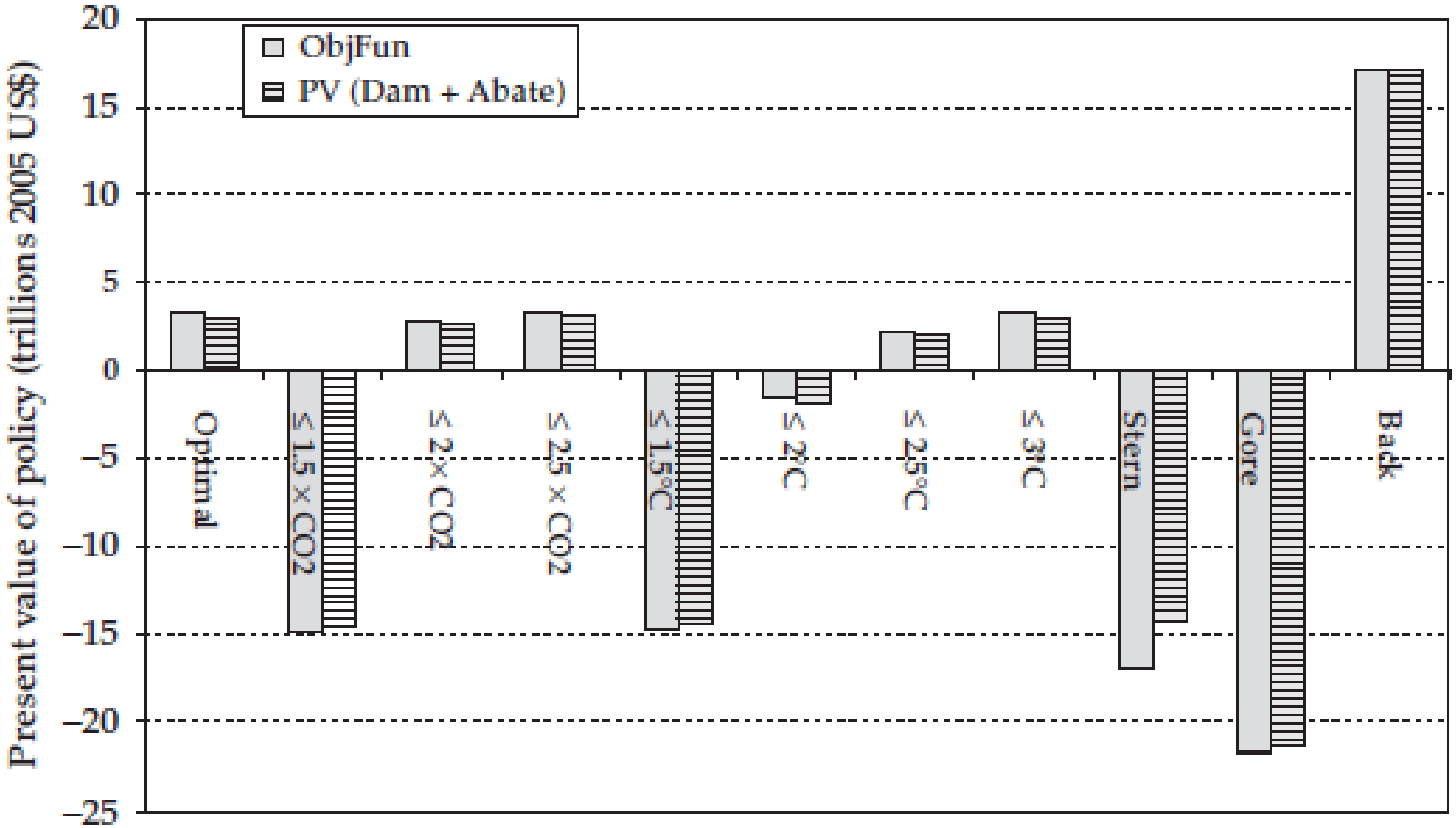


Source: Nordhaus (2007), Figure 5-2, p. 86, **Present value of alternative policies.**
Difference in the present value of a policy relative to the baseline under two measures.

Note: Optimal means (only) optimal with respect to Nordhaus specification!

Assessing Climate Policies with DICE



- Source: Nordhaus (2007), Figure 5-1. Present value of alternative policies. All scenarios.

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Table 5-2. Incremental Costs Imposed by Adding Climate Limits to Economic Optimum

	Incremental Effect Relative to Optimal Policy		
	Present-Value Climate Damages	Present-Value Abatement Costs	Net Present-Value Costs Plus Damages
Policy	(Trillions of 2005 U.S. Dollars)		
Limit to 1.5 × CO_2	−7.4	25.0	17.7
Limit to 2 × CO_2	−1.3	1.7	0.4
Limit to 2.5 × CO_2	0.0	0.0	0.0
Limit to 1.5°C	−7.4	24.9	17.5
Limit to 2°C	−4.2	9.1	4.9
Limit to 2.5°C	−2.0	3.1	1.1
Limit to 3°C	−0.6	0.7	0.0

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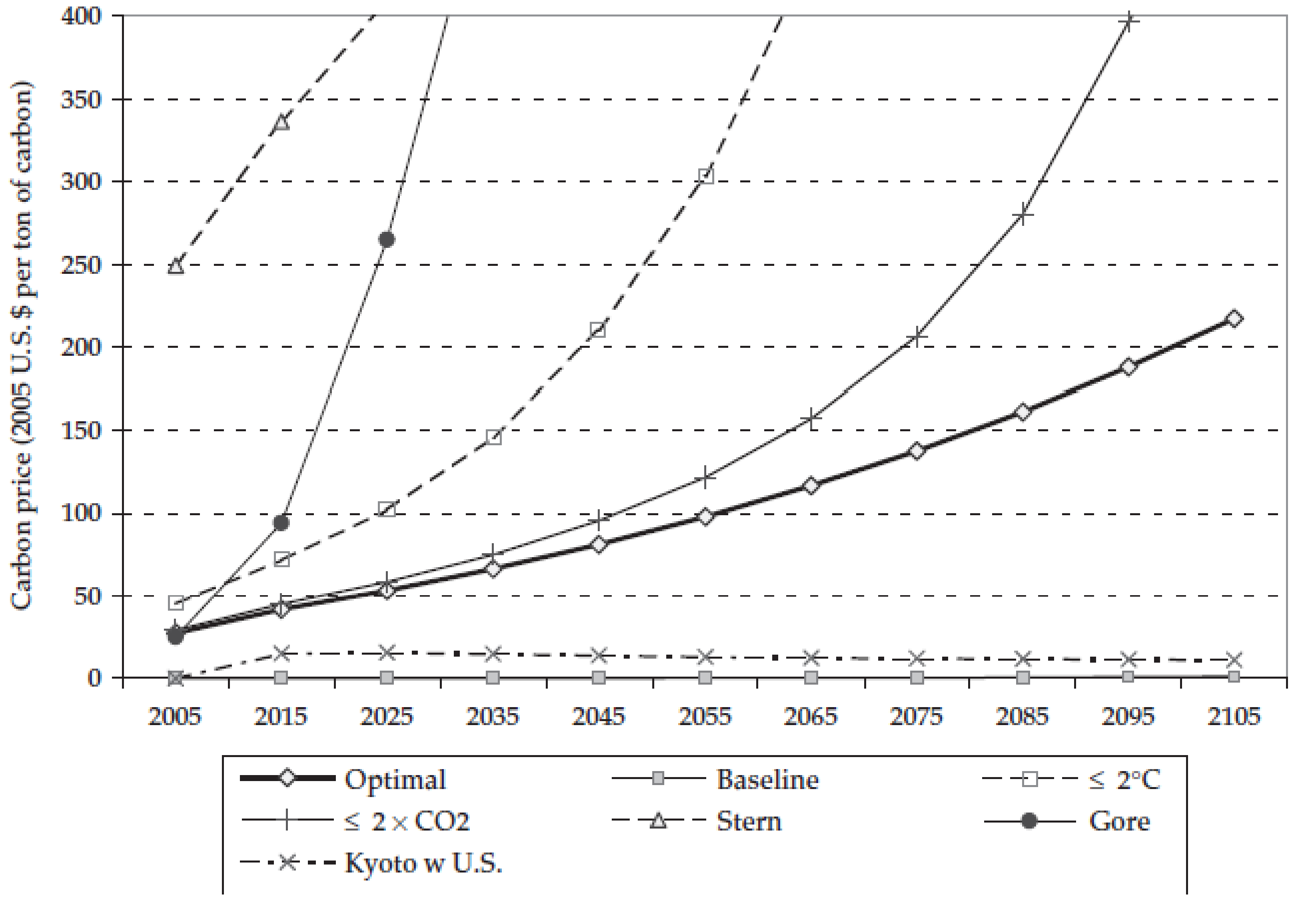

- Source: Nordhaus (2007), Figure 5-4, p.94. The (globally averaged) **carbon prices** under different policies. The prices are per ton of carbon, for prices per ton of CO_2, divide by 3.67.

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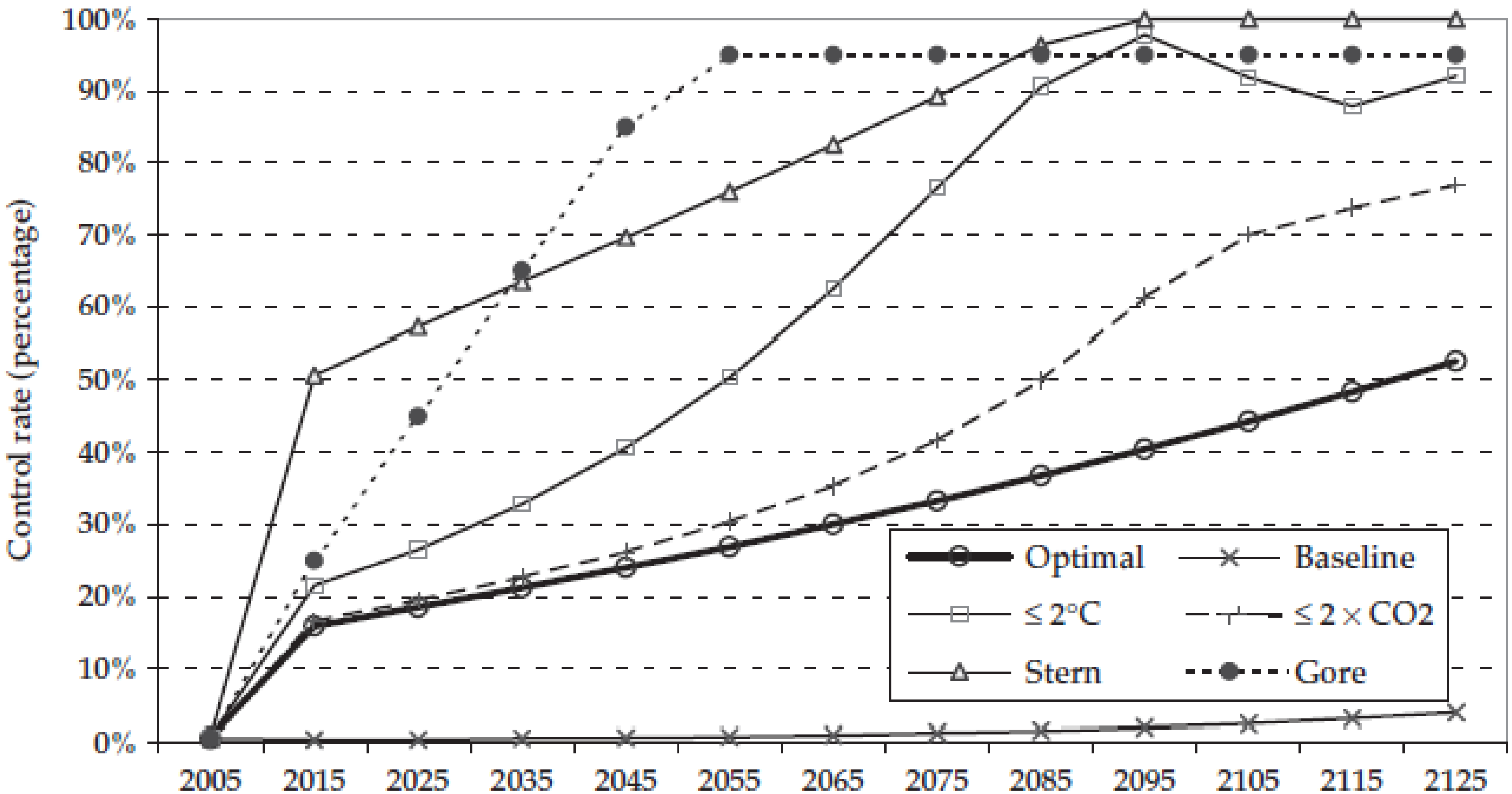

Source: Nordhaus (2007), Figure 5-5, p 98. The global for CO_2 **emissions-control rates** under different policies. Note the upward tilted ramp of the strategies.

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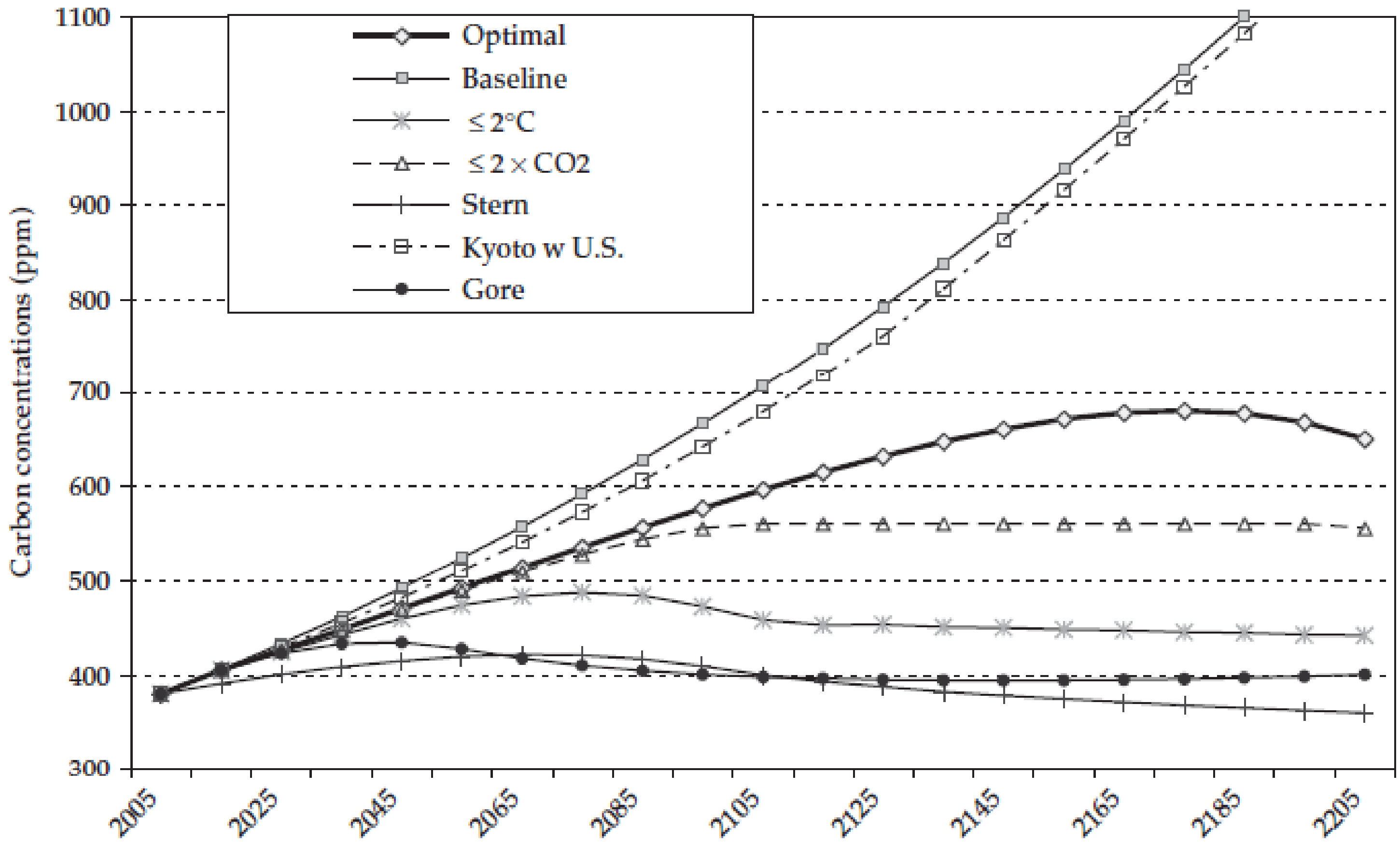

- Source: Nordhaus (2007), Figure 5-7, p.104. **The atmospheric concentrations** of CO2 under different policies.

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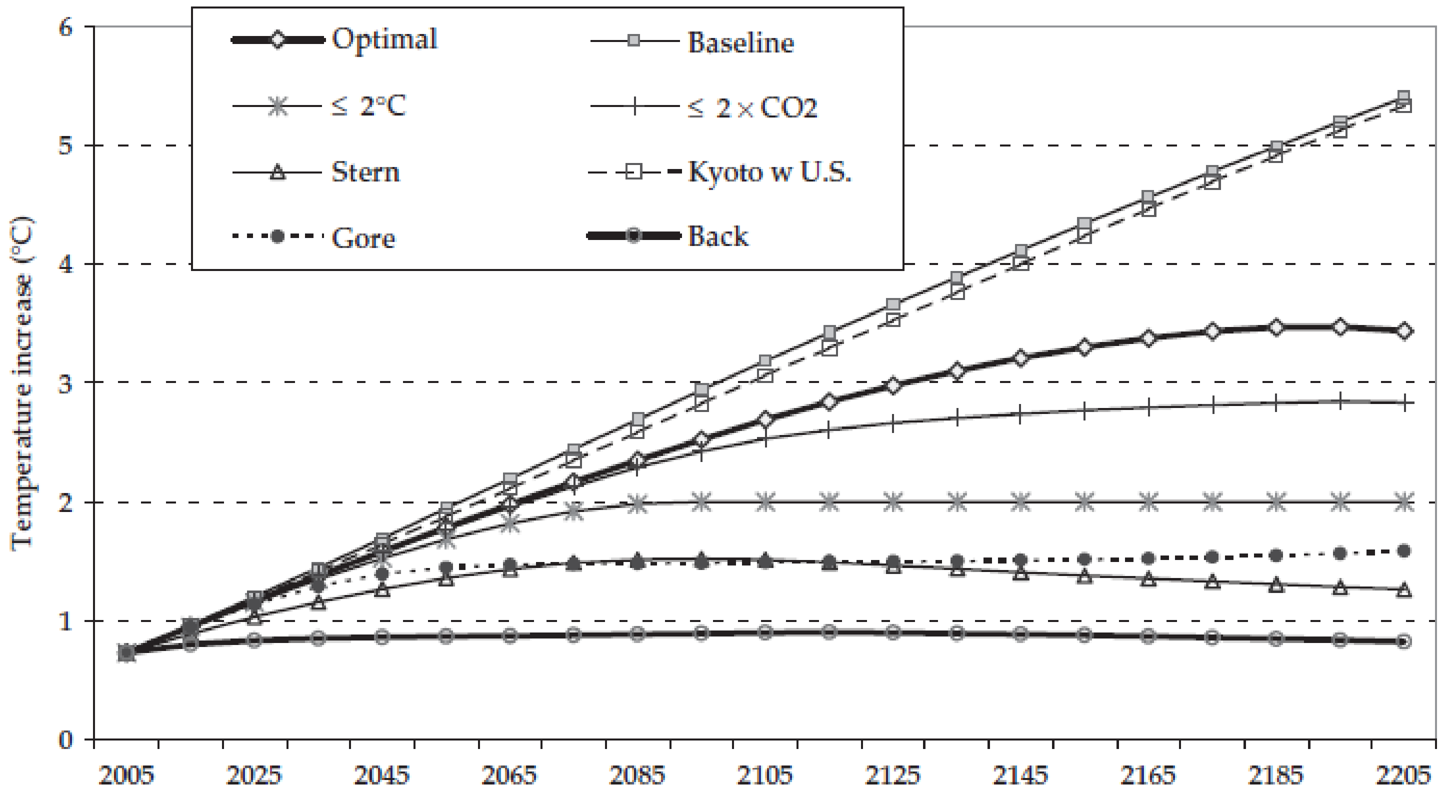


- Source: Nordhaus (2007), Figure 5-8, p.107. Projected global mean **temperature change** under different policies. Increases are relative to the 1900 average.

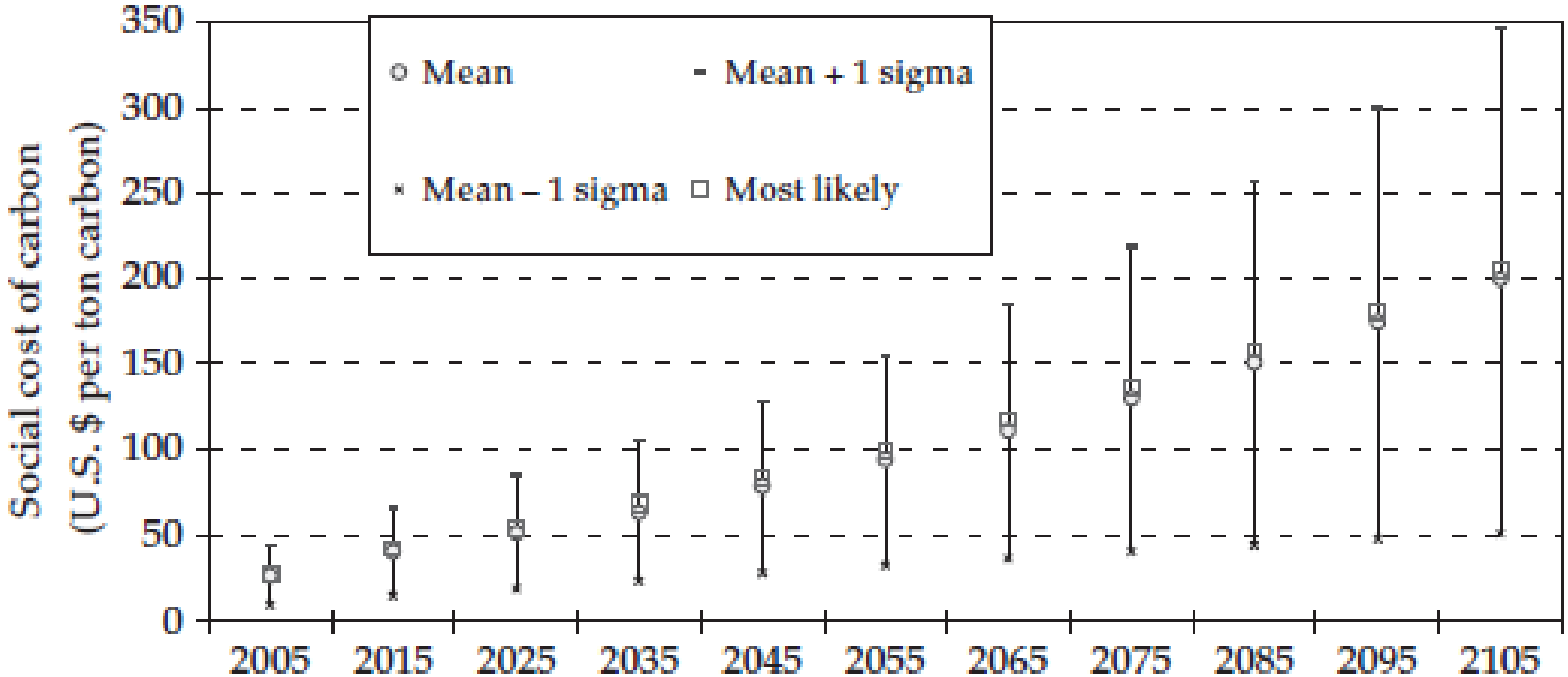
Uncertainty

To capture Uncertainty, Nordhaus runs DICE 2007 for different specifications of these parameters

Table 7-1. Major Assumptions about Uncertain Parameters in Uncertainty Runs

Variable	Definition	Units	Mean	Standard Deviation
g(TFP)	Rate of growth of total factor productivity	Per year	0.0092	0.0040
$g(CO_2/GDP)$	Rate of decarbonization	Per year	−0.007	0.002
$T2 \times CO_2$	Equilibrium temperature-sensitivity coefficient	°C per CO_2 doubling	3.00	1.11
DamCoeff	Damage parameter (intercept of damage equation)	Fraction of global output	0.0028	0.0013
P(back)	Price of backstop technology	$ per ton of carbon replaced	1,170	468
Pop	Asymptotic global population	Millions	8,600	1,892
CarCyc	Transfer coefficient in carbon cycle	Per decade	0.189	0.017
Fosslim	Total resources of fossil fuels	Billions of tons of carbon	6,000	1,200

Uncertainty over social cost of carbon = optimal carbon tax



- Source: Nordhaus (2007), Figure 7-3, p.135. Uncertainty bands for the social cost of carbon.