Uncertainty and the Social Cost of Carbon

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Introduction

- Most climate policy analyses pull a target out of thin air and then spend a lot of effort in meeting that target in some clever way
- Many analysts would hide behind a policy maker, who does not know what target to select either
- The few targets around were picked by people bold enough to stick their neck out, not smart or wise enough to pick a target, and typically without an electoral mandate

Introduction -2

- In von Neumann-Morgenstern terms, one can justify cost-effectiveness if variance of the benefits is infinite, and one should then select at least that target that renders the impact of climate change finite again
- Note that this still does not justify parroting Hartmut Grassl that 2°C is dangerous
- So, is the variance of the crucial variable, the social cost of carbon, finite?

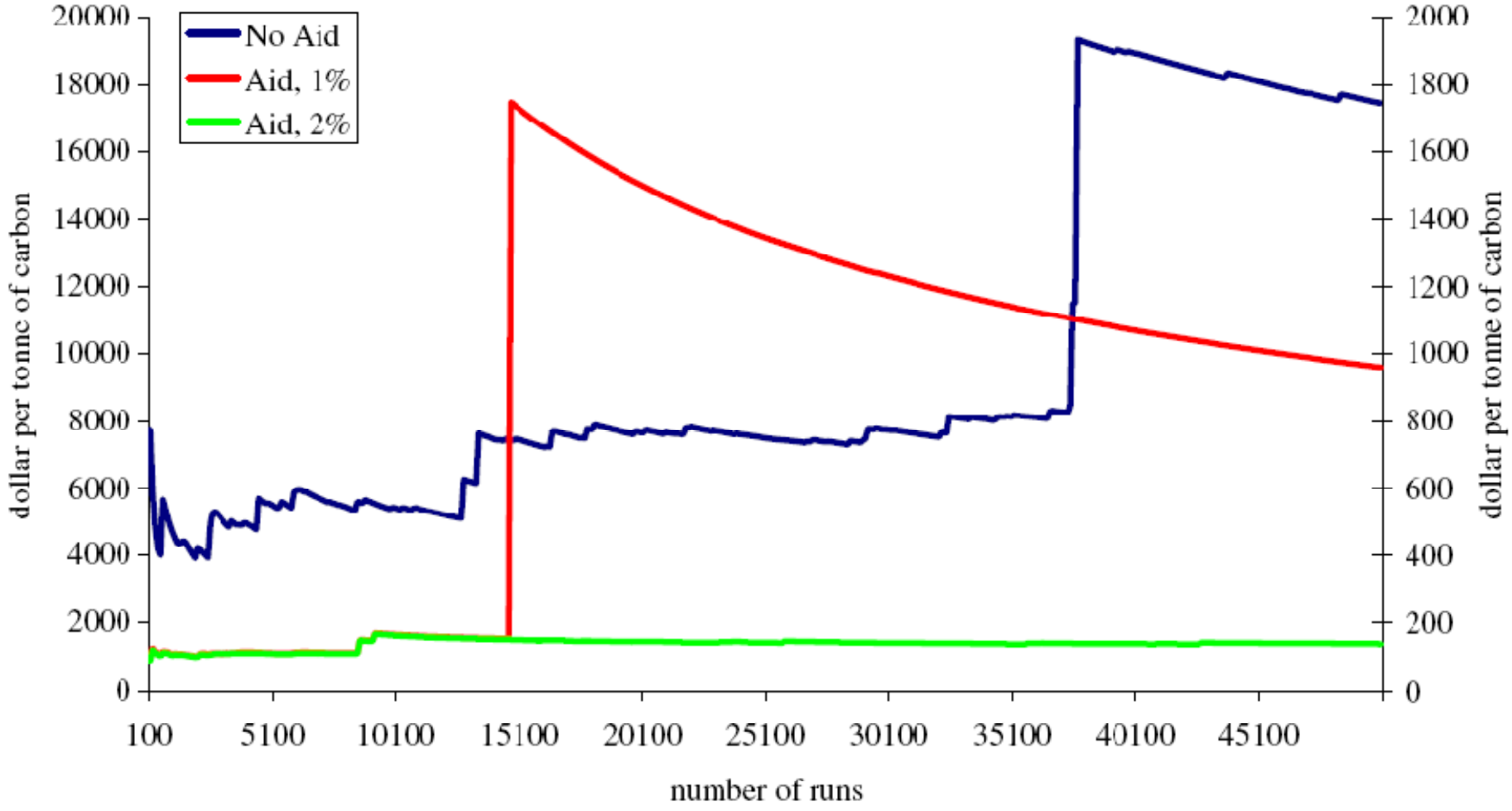


Fig. 1 The standard deviation of the marginal damage costs of carbon dioxide emissions with and without aid as a function of the number of Monte Carlo runs for a 1% pure rate of time preference; impacts are equity-weighted; annual aid is limited to 1 or 2% of OECD GDP. The "No Aid" estimates are measured against the *left-hand vertical axis*; the 1 and 2% Aid cases are calibrated by the *right-hand vertical axis*

Tol & Yohe, 2007, Climatic Change

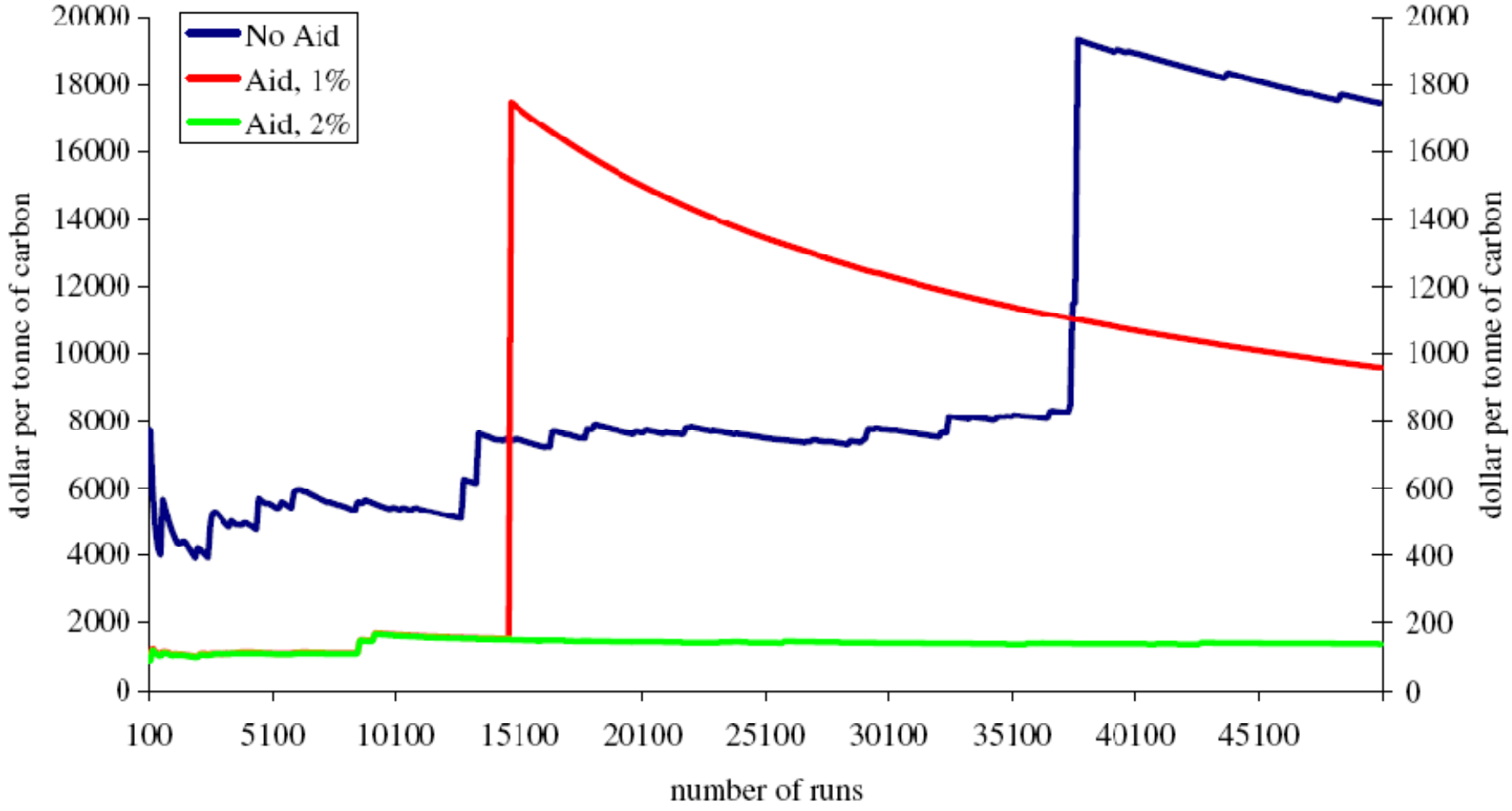
Infinite impacts?

- Net present value of a constant stream of impacts
- Now suppose that impacts grow with income
- Or impacts reduce economic growth
- Convergence is no longer guaranteed, and a small chance is enough

$$V^* = \sum_{t=0}^{\infty} \frac{V}{(1+\rho+\eta g)^t}$$

$$V^* = \sum_{t=0}^{\infty} \frac{V(1+\varepsilon g)^t}{(1+\rho+\eta g)^t}$$

$$V^* = \sum_{t=0}^{\infty} \frac{V}{(1+\rho+\eta(g-\delta))^t}$$



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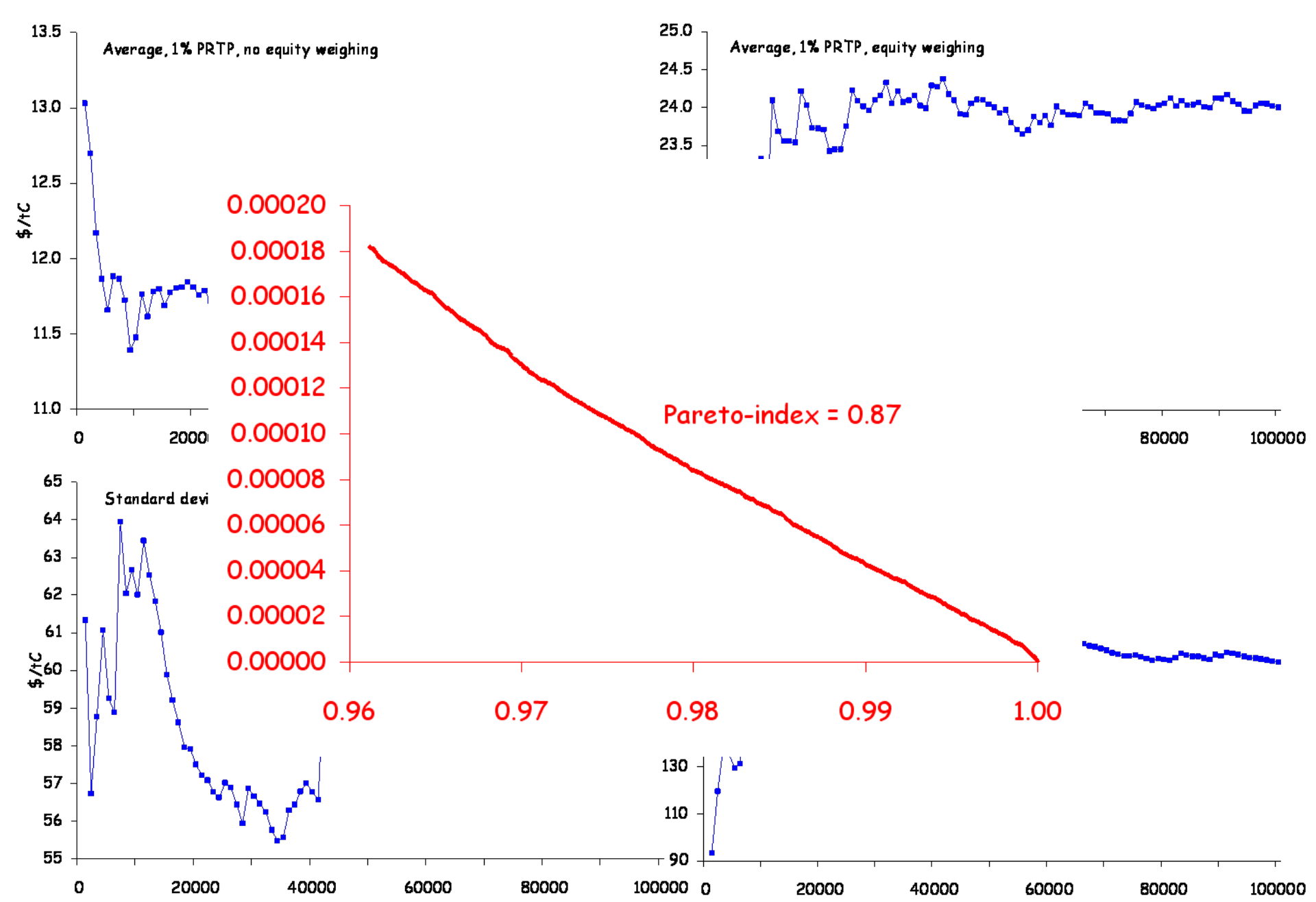
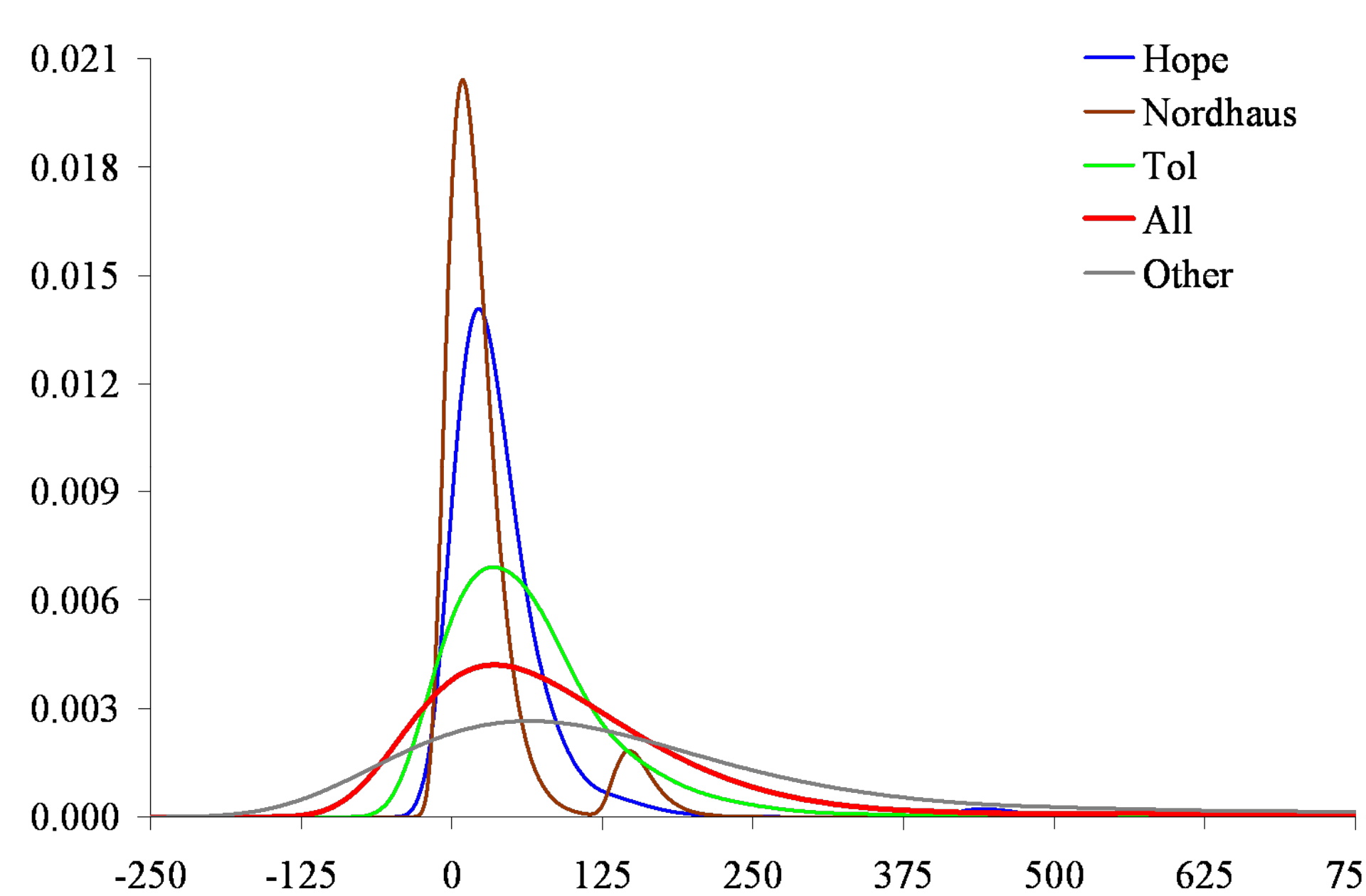


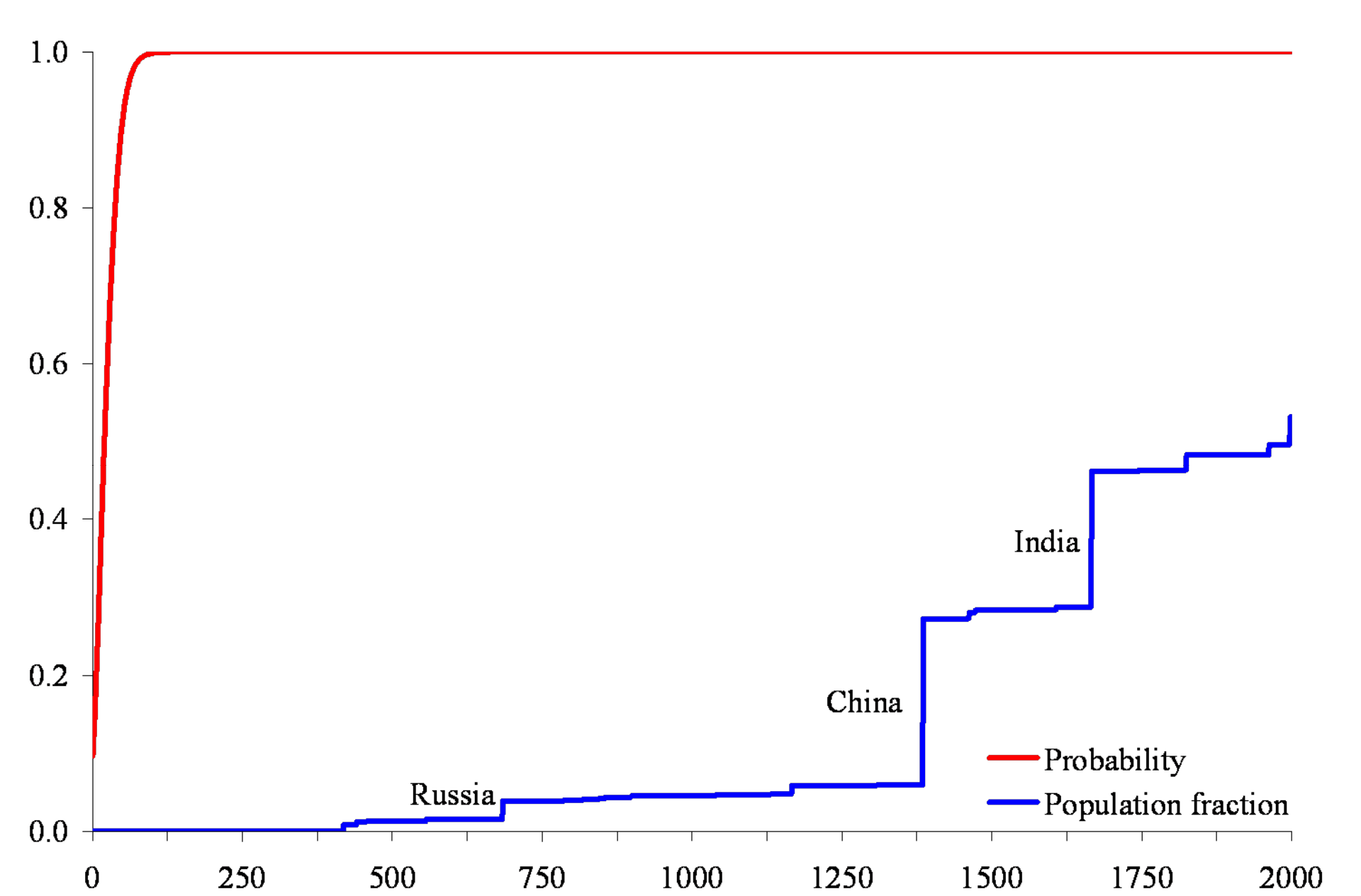
Source: FUND2.9

Infinite uncertainty?

- In the latest version of FUND, uncertainty is perhaps bounded but definitely large with a fat tail
- Fat tail is confirmed by meta-analysis



Tol, 2008, *economics ejournal*



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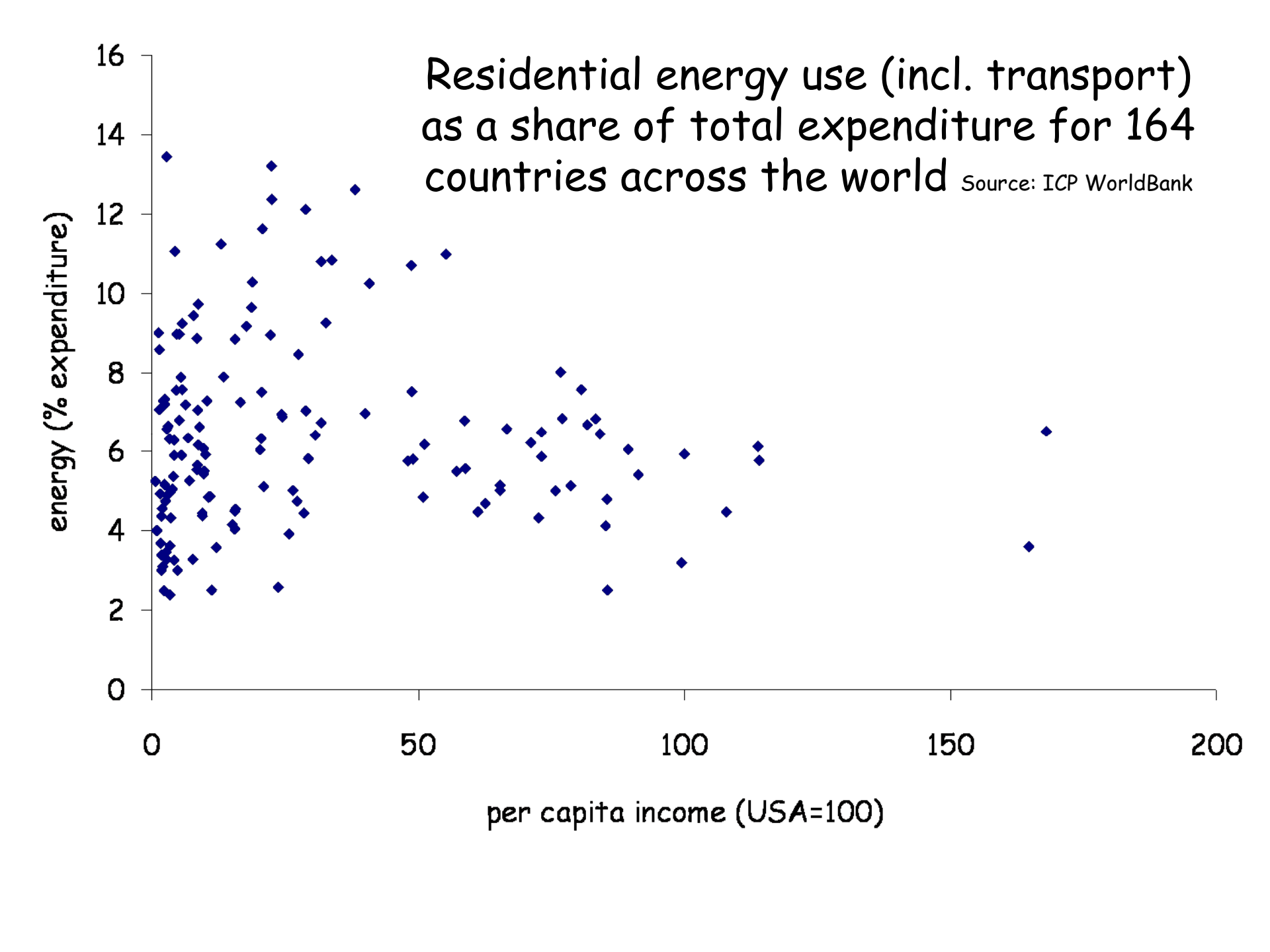
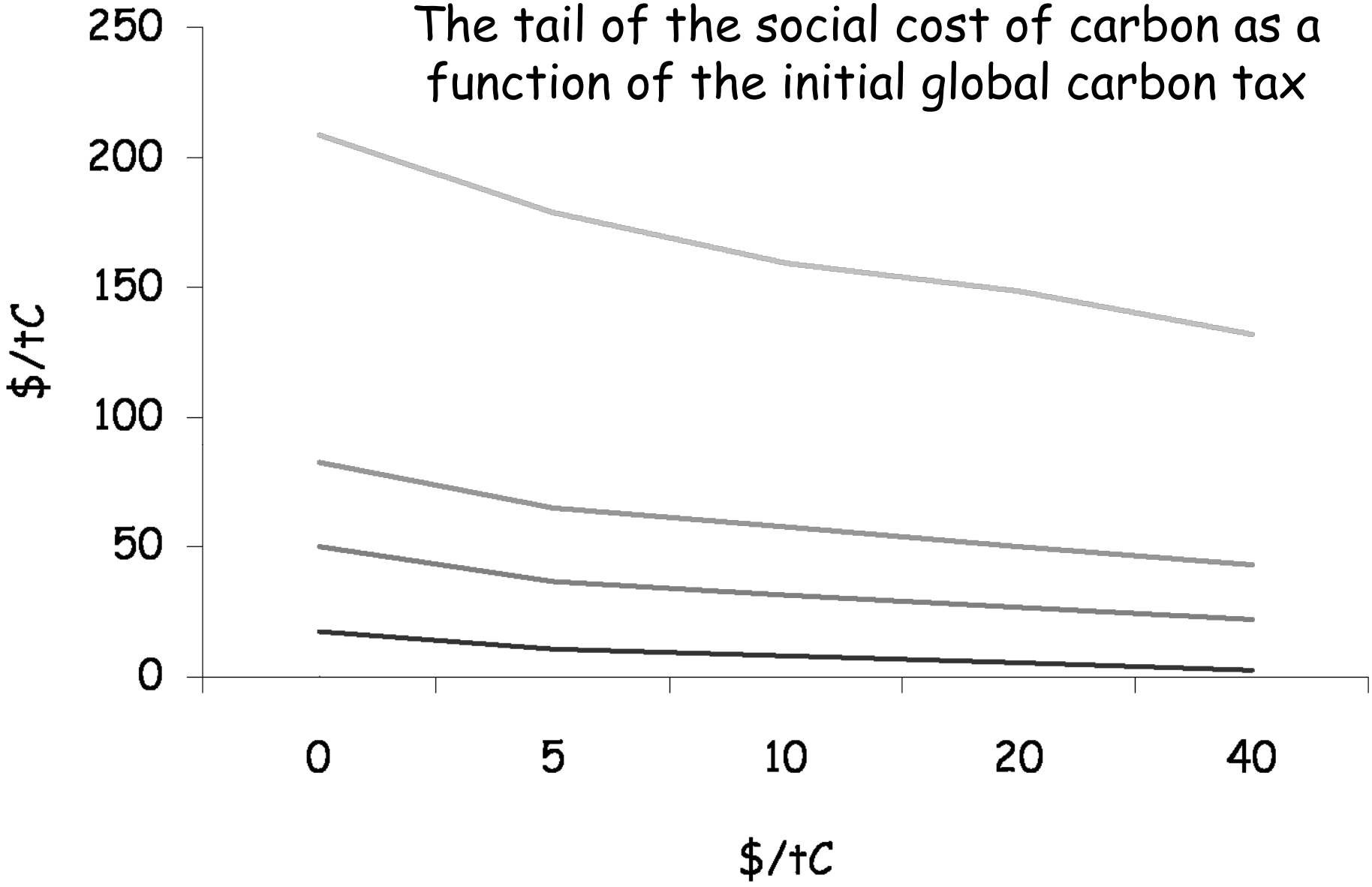

Residential energy use (incl. transport) as a share of total expenditure for 164 countries across the world
Source: ICP WorldBank
energy (% expenditure)
16
14
12
10
8
6
4
2
0
0
50
100
150
200
per capita income (USA=100)

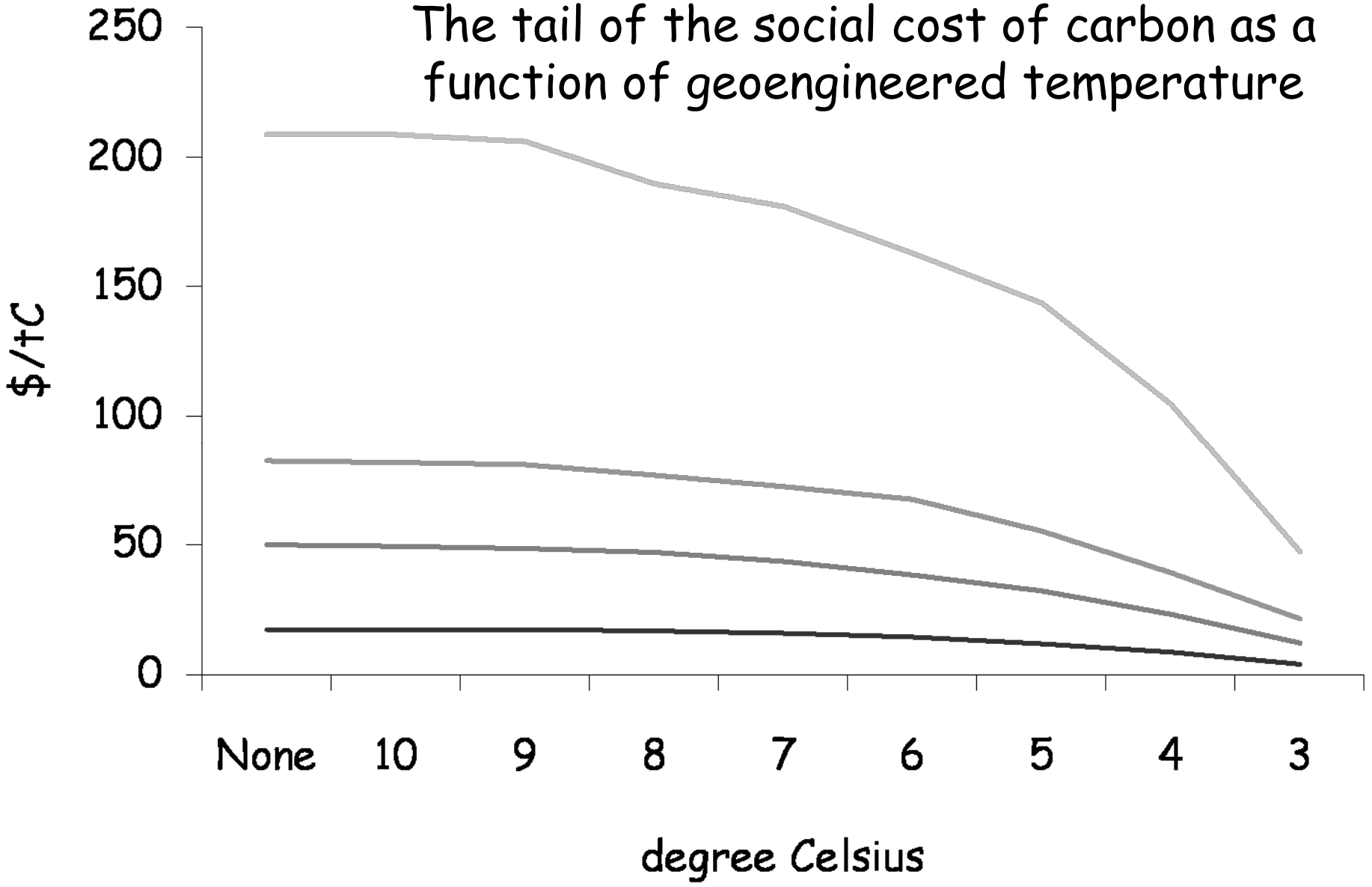
What to do?

- Uncertainty is large with a fat tail and may not be bounded
- Policy should thus focus on reducing the uncertainty

The tail of the social cost of carbon as a function of the initial global carbon tax



Source: FUND2.9



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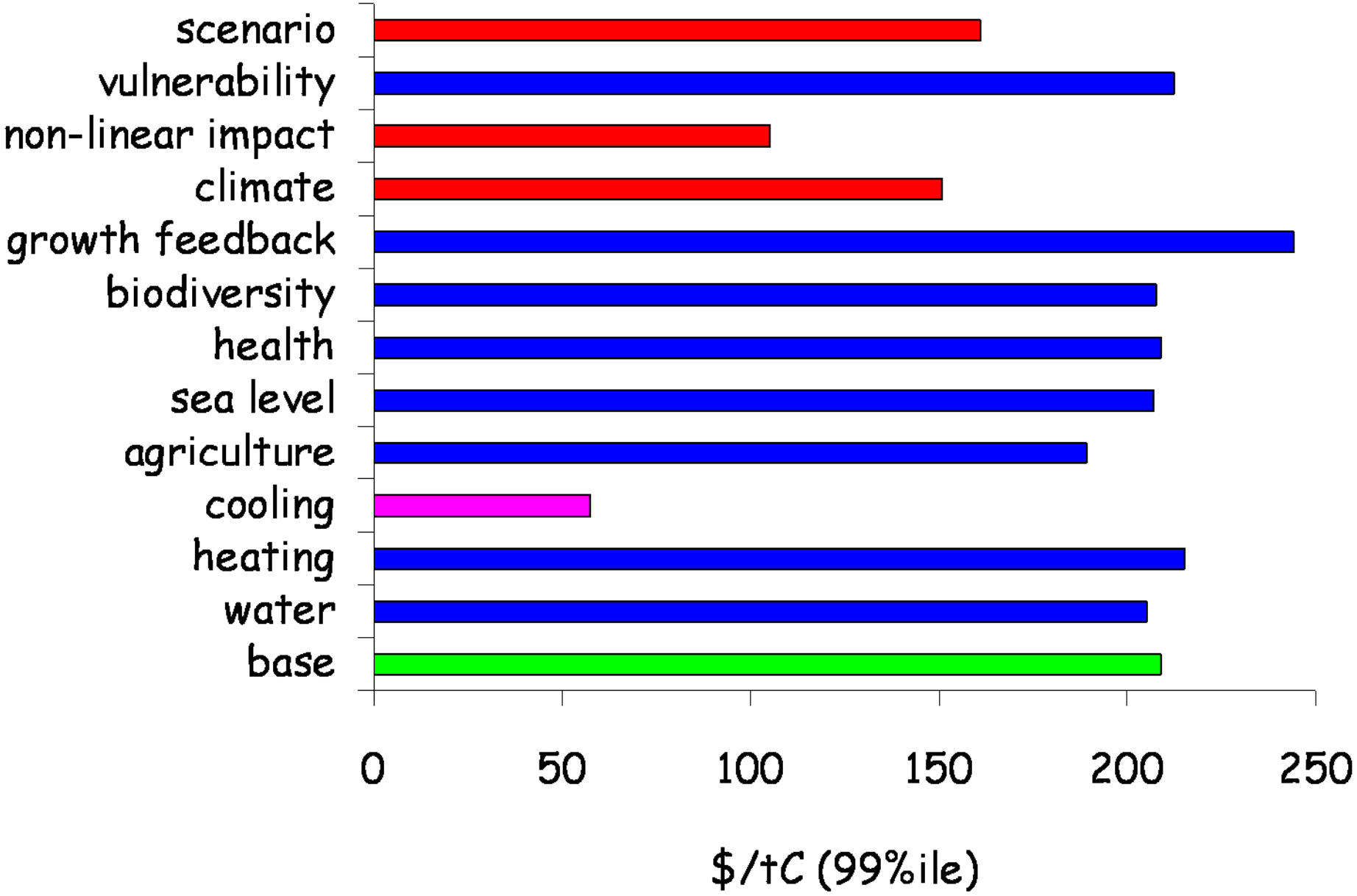

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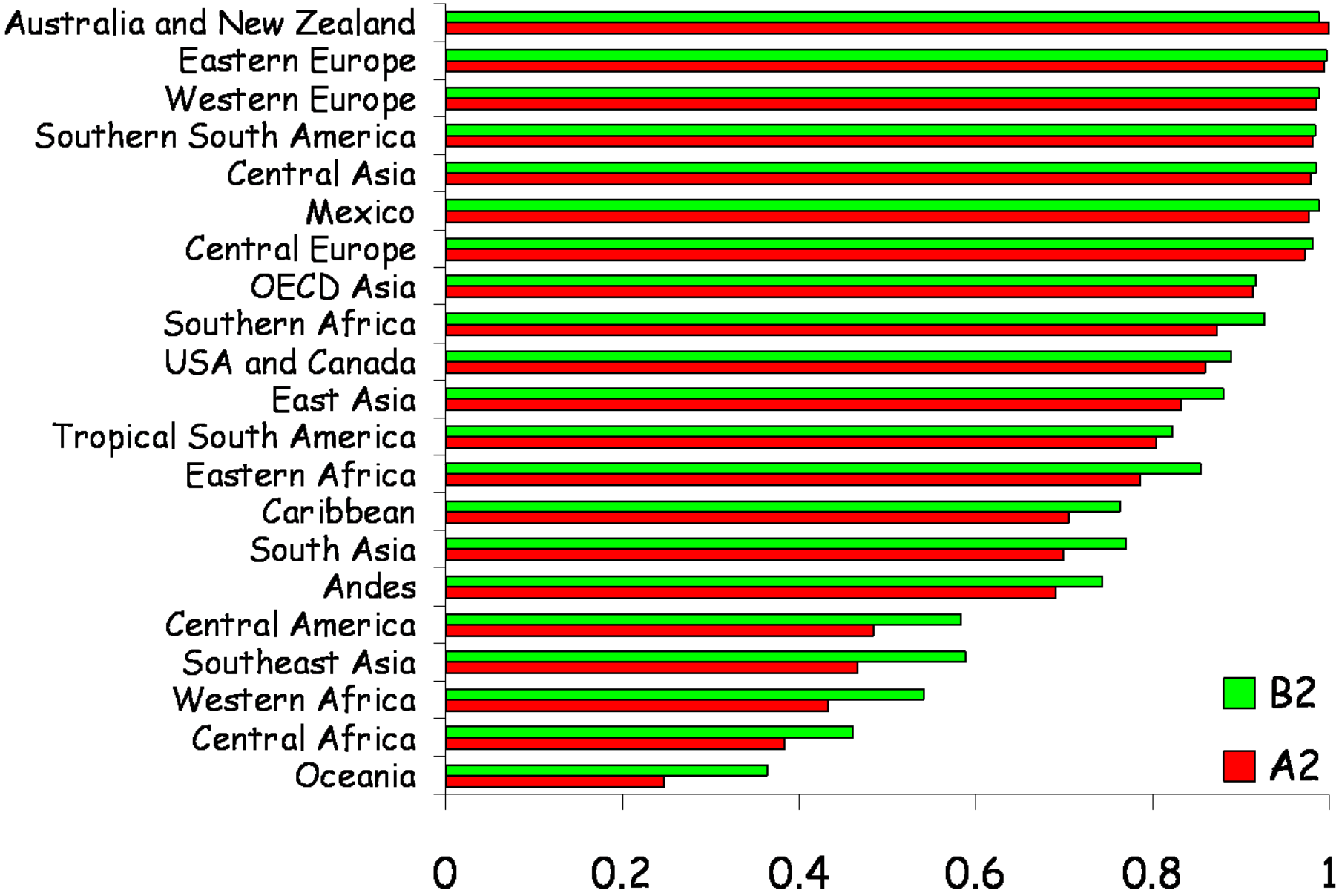

Kjellstrom, Kovats et al., in prep.

Conclusions

- Uncertainty about the impact of climate change is very large indeed
- While research may help and emission reduction does help, a large share of the uncertainty is irreducible in the medium term
- This suggests that emission reduction should be driven as hard as palatable, while adaptive capacity should be improved as much as possible too