



Grantham Research Institute on  
Climate Change and  
the Environment

# Uncertainty in climate economics... ...and what to do about it.

**Antony Millner**

**London School of Economics and Political Science**



Munich RE



Global  
Green Growth  
Institute



UNIVERSITY OF LEEDS



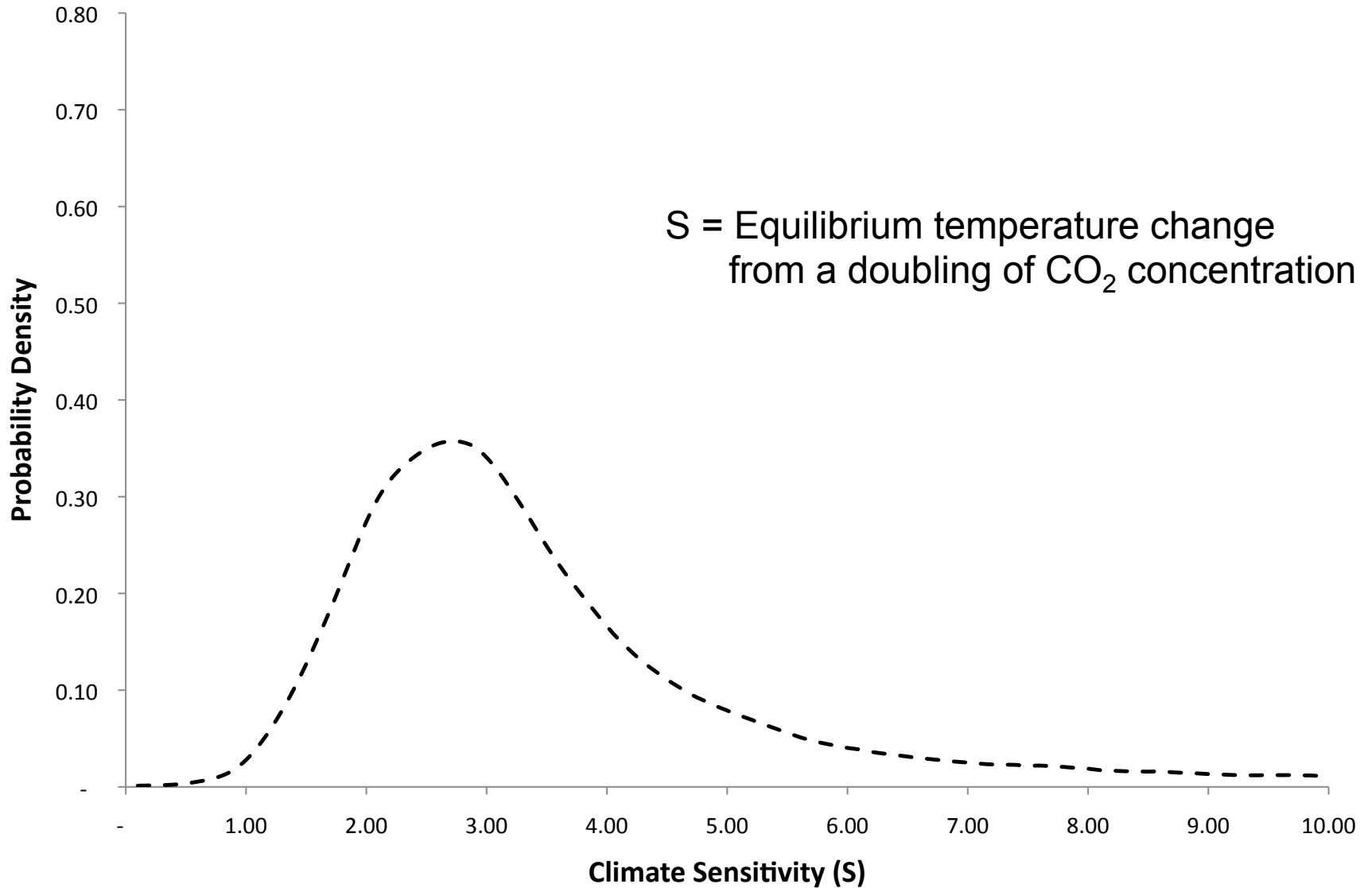
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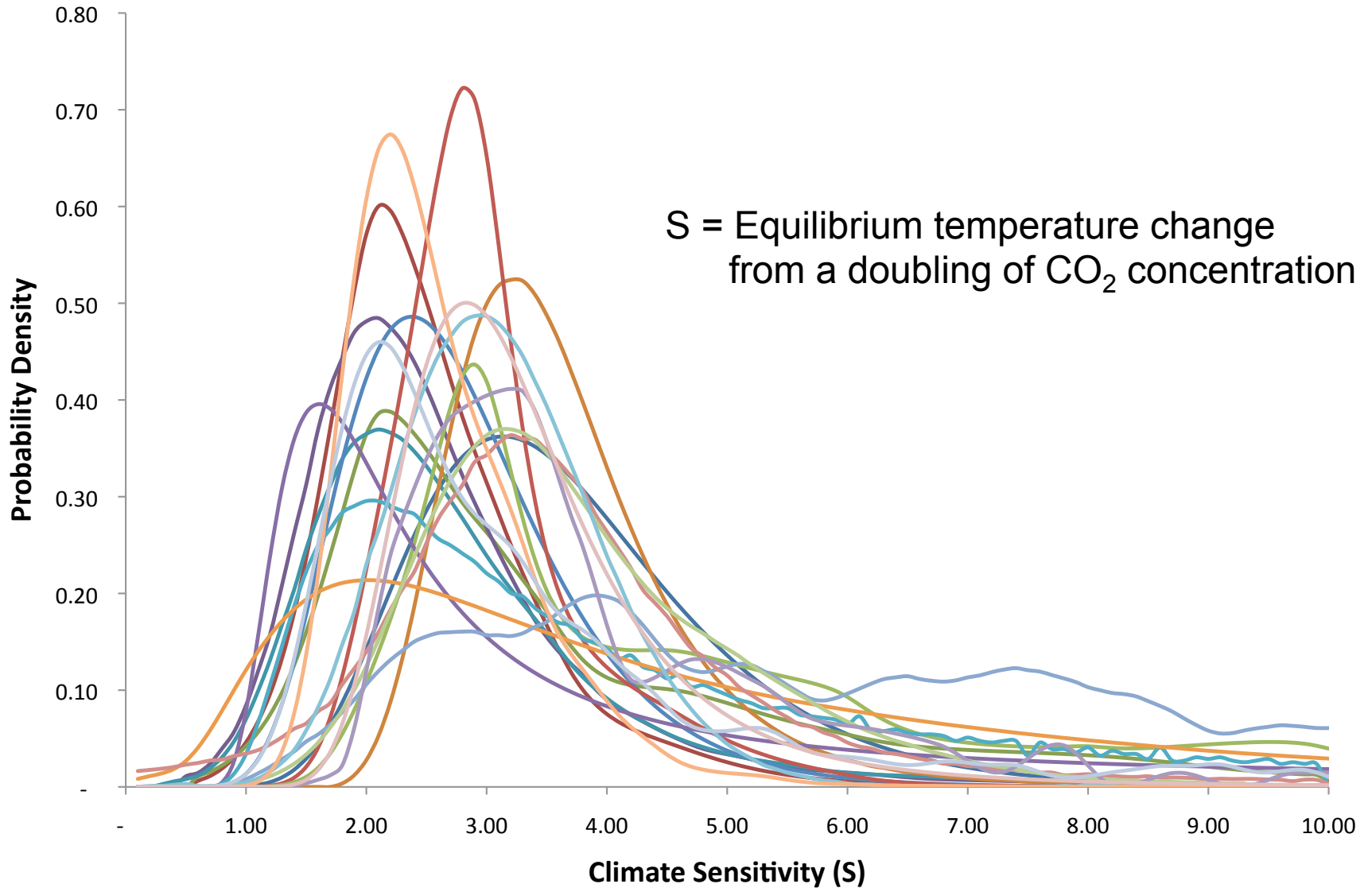
## Economic models: problematic necessities

- ***“Without a profound simplification the world around us would be an infinite, undefined tangle that would defy our ability to orient ourselves and decide upon our actions.... We are compelled to reduce the knowable to a schema.”***  
-- Primo Levi, *The Drowned and the Saved*.
- ***“Mathematics has brought rigor to economics. Unfortunately, it also brought mortis.”***  
-- Kenneth Boulding



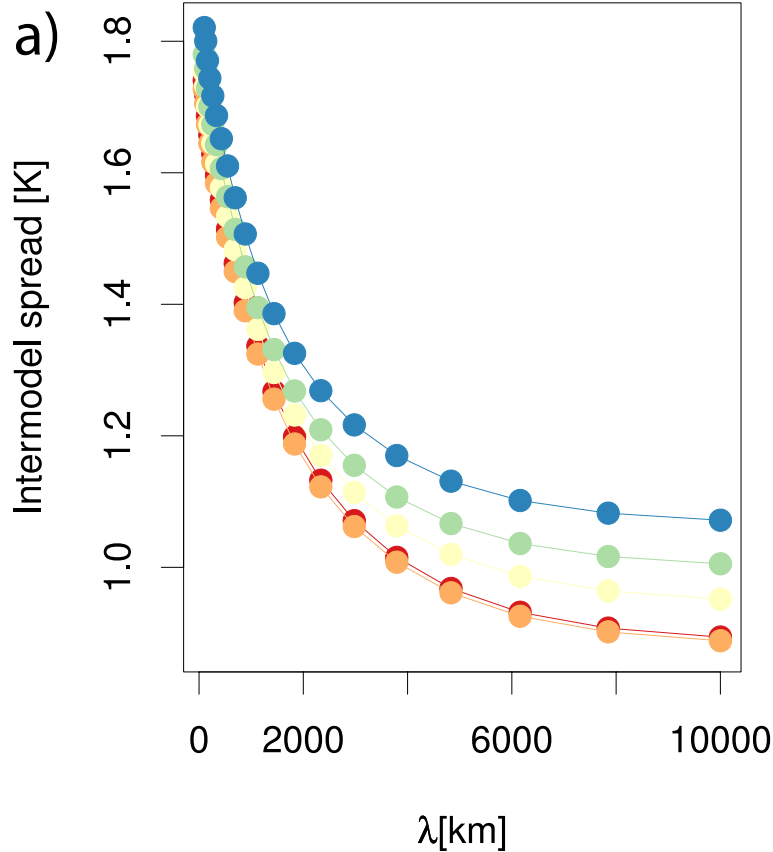
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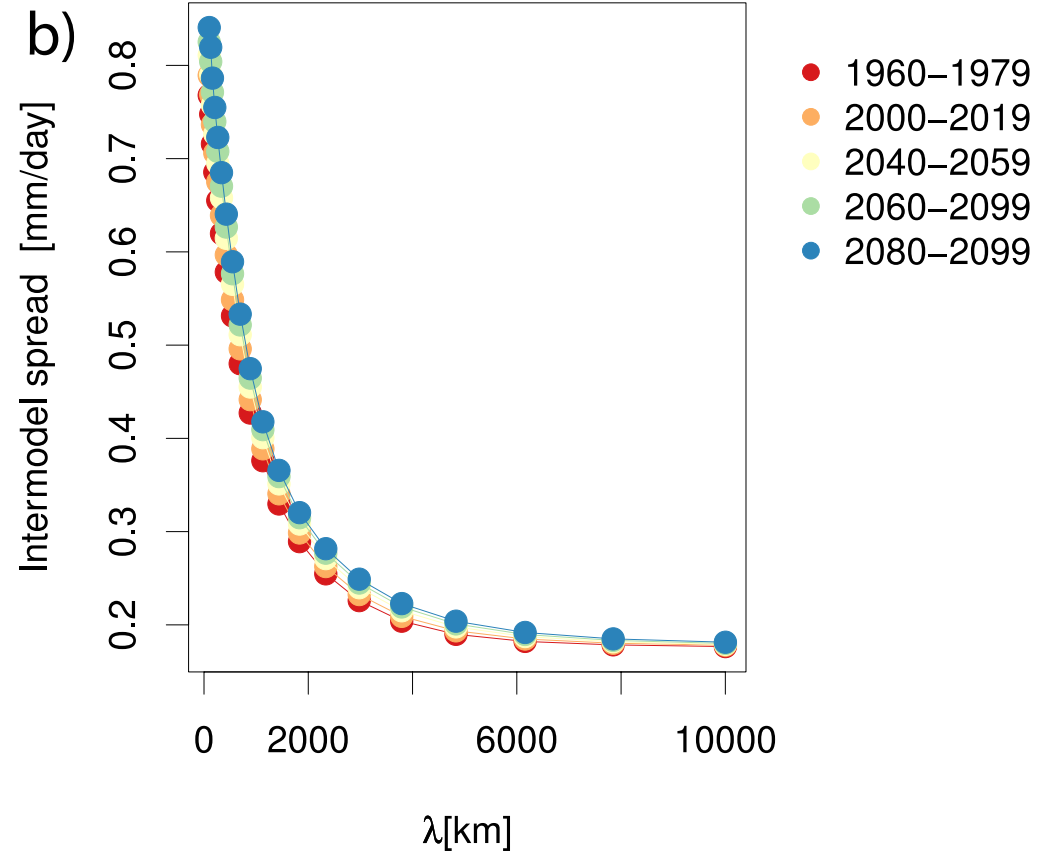


# We know much more at global/continental scales than at country scales.

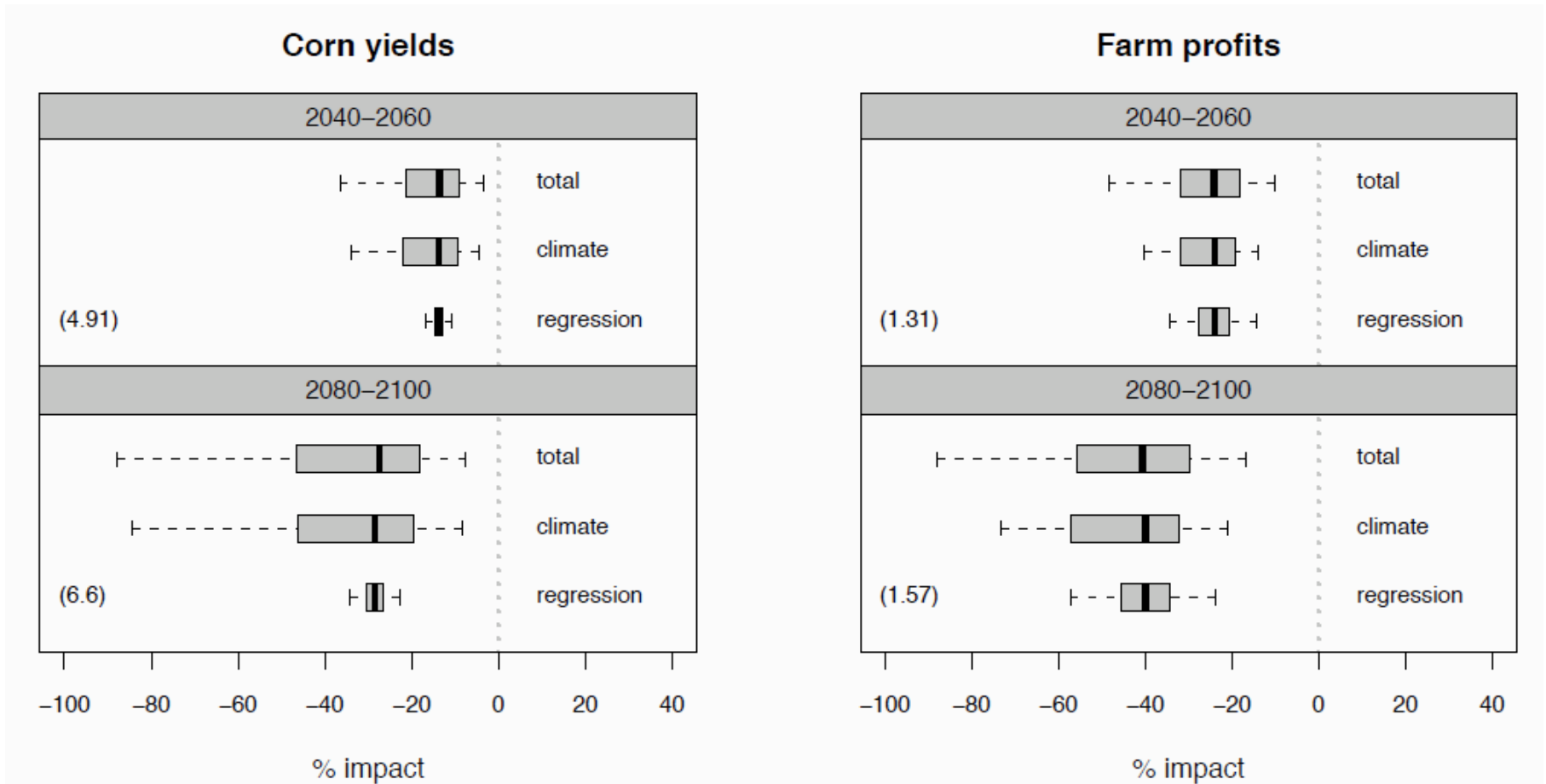
Temperature



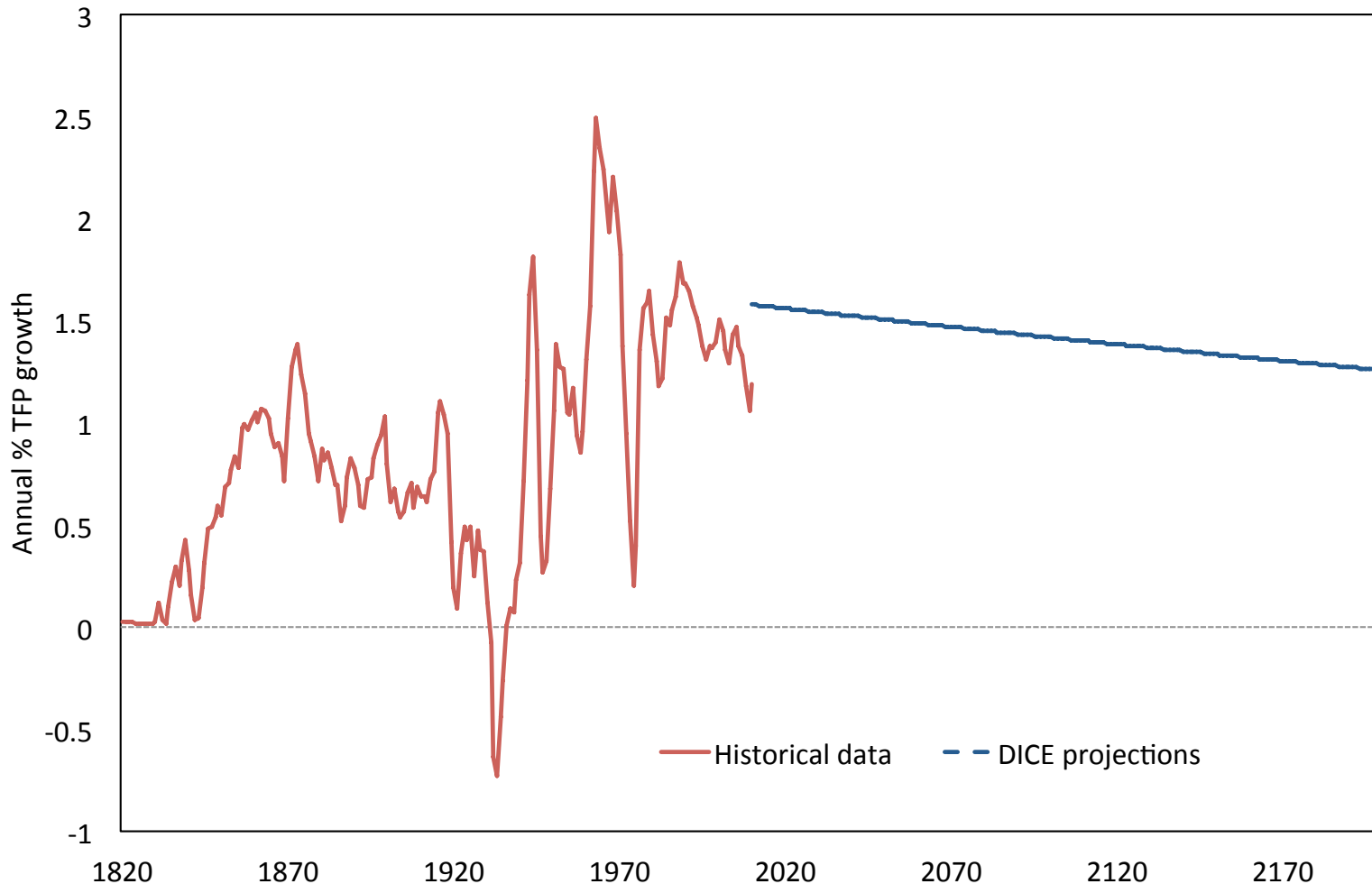
Precipitation



# Economic impacts are **much** more uncertain than changes in climate variables

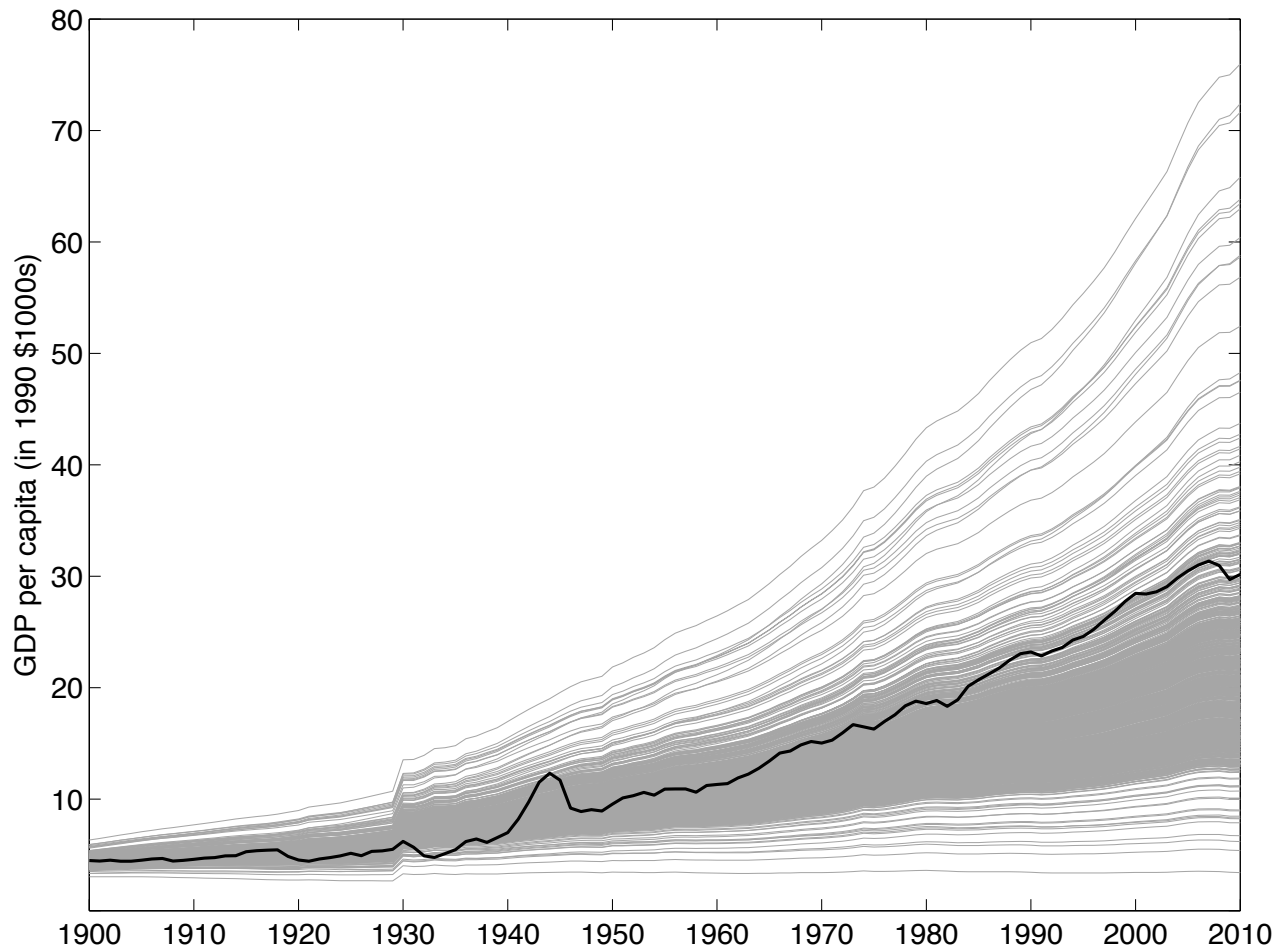


# Predicting global productivity growth



Source: McDermott & Millner

## Out-of-sample predictions of 20<sup>th</sup> Century economic growth using a growth model similar to that in climate-economy models.

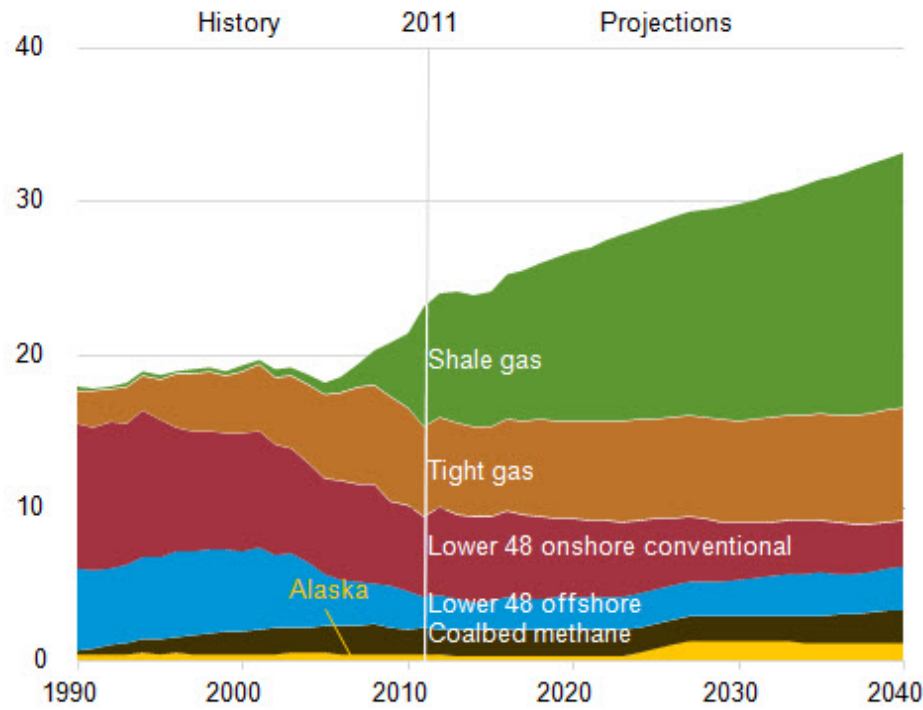


Source: McDermott & Millner



## Uncertainty in Abatement Costs: USA had largest emissions reductions over past 7 years. Why?

Figure 91. Natural gas production by source, 1990-2040 (trillion cubic feet)



**Unexpected changes in technology may have a greater impact than regulation.**

# Challenging Subjective Expected Utility Theory...

## Your Coin

Front



Back



$P(\text{Heads}) = 0.5$

## Stranger's Coin

Front



Back



$P(\text{Heads}) = 0.5$

Fair Coin

$1/3$

Heads Cheat

$1/3$

Tails Cheat

$1/3$

Arbitrary subjective weights



$$P(\text{Heads}) = (1/3)*0.5 + (1/3)*1 + (1/3)*0 = 0.5$$



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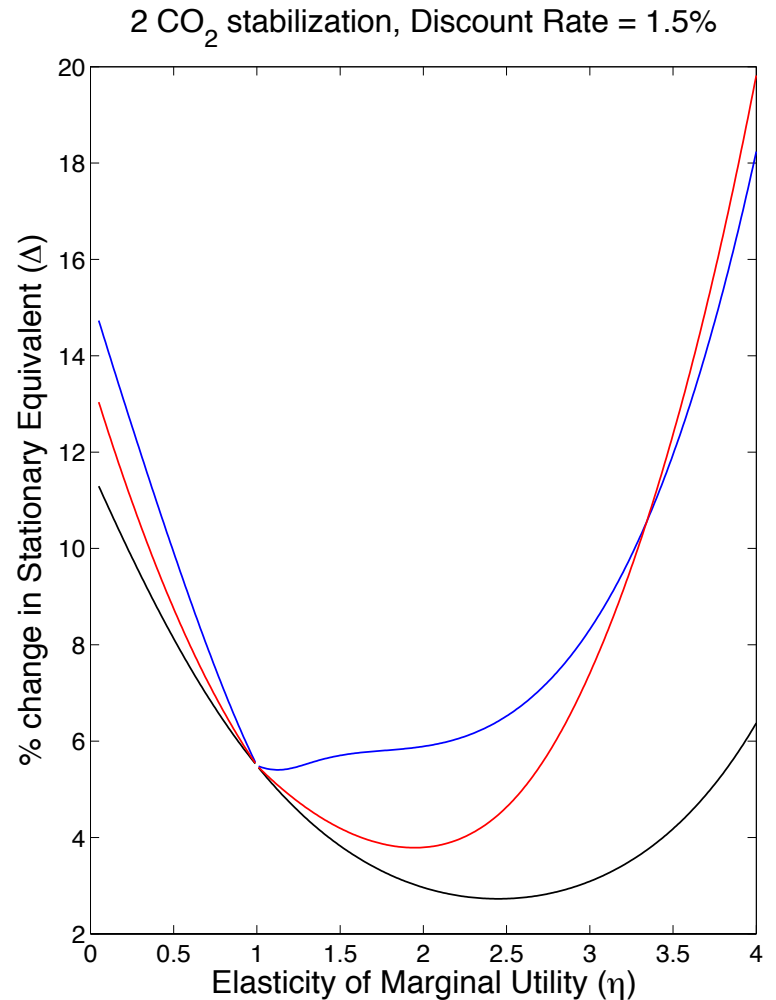
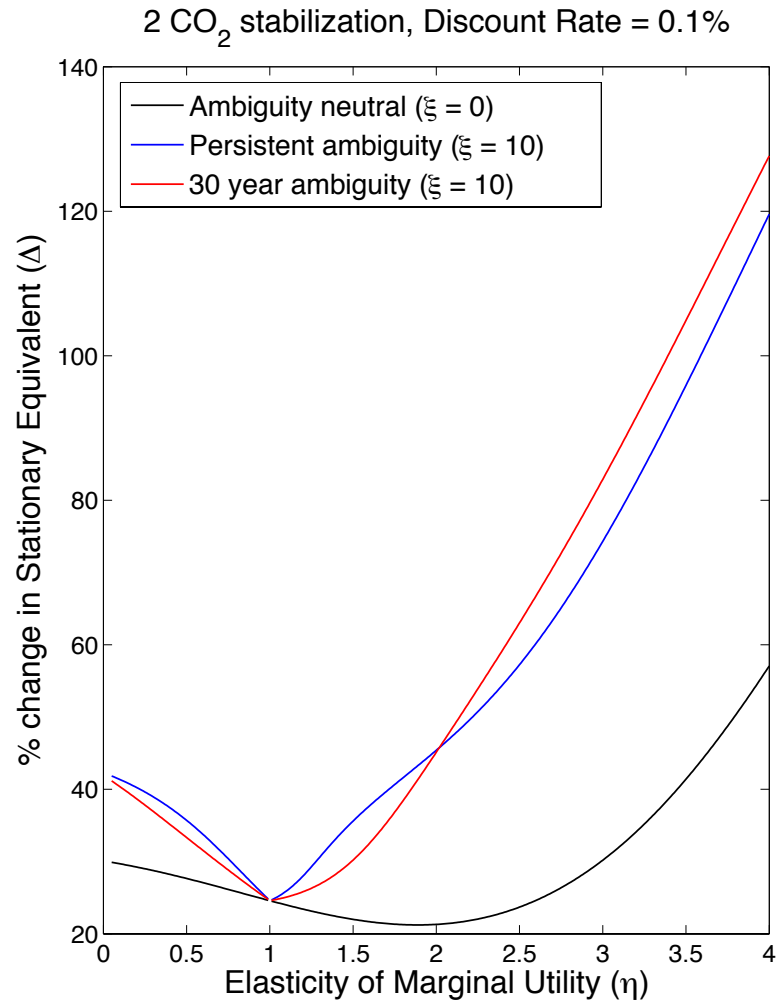
## Non-likelihood criteria

- $\alpha$ -Maxmin
- Minmax regret

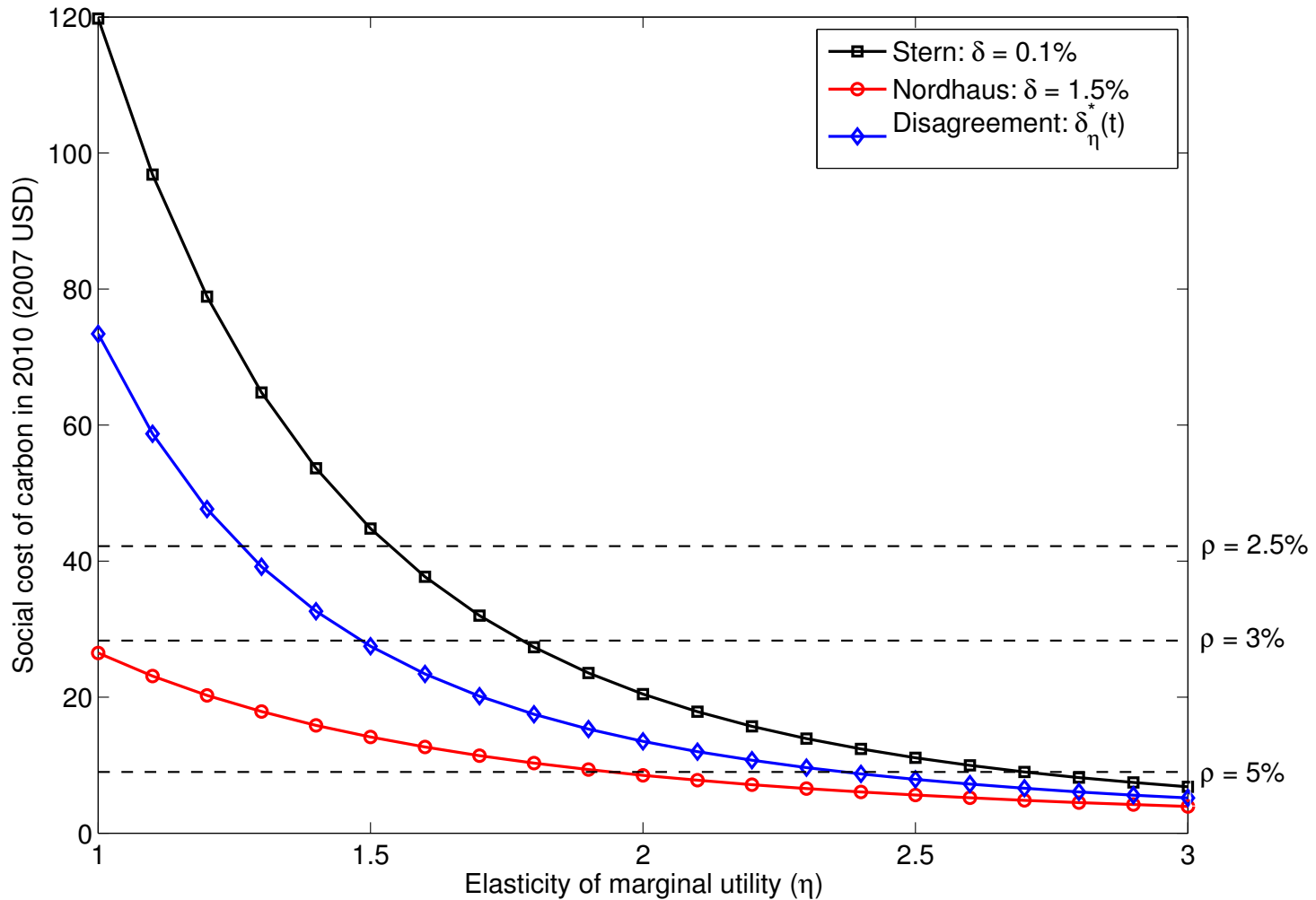
## Multiple prior criteria

- Maxmin EU
- Smooth Ambiguity
- Multiplier preferences

## Example of effects of Ambiguity Aversion: Millner, Dietz, & Heal (2013)



# Ethical *Disagreements* vs. Empirical *Uncertainties*



Source: Heal & Millner, PNAS (2014)

## Parting shots...

- **“I foresee all sorts of unforeseen problems.”**  
– **Sir Humphrey Appleby, “Yes, Prime Minister”.**
- **“Prediction is very difficult, especially about the future.”**  
- **Niels Bohr**
- **“It ain’t what you don’t know that gets you into trouble. It’s what you know for sure that just ain’t so.”**  
– **Mark Twain**