Higher-Order Uncertainty and the Methodology of Climate Economics

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Climate change as an investment problem

In economics, climate change is largely treated as an **investment problem**: how much should we invest today to decrease the future consequences of climate change?

Fair to ask whether this is the right question; see, e.g., Jamieson (2014) or Hartzell-Nichols (2017).

The Ramsey model

Rational investment is governed by the **marginal return on investment**:

$$\text{discount rate} \times \frac{\text{expected change in utility of future consumption}}{\text{change in utility of present consumption}}$$

Tells you, e.g., how much you should be willing to invest today to get \$1 of relief from climate change in the future.

Discount rate

The discount rate has been the subject of extensive discussion in climate ethics.

> See Broome (2012), Frisch (2013), Gardiner (2011), Greaves (2017), Jamieson (2014), Kelleher (2017a,b), and Mintz-Woo (2019, 2021).

By contrast, the other elements of the Ramsey model have received almost no philosophical attention.

> Exceptions: Frank (2019) and Hartzell-Nichols (2017).

Expected change in future consumption

This is somewhat surprising, because the question "what probabilities should we use when calculating expected change in future consumption?" is the subject of a massive literature in economics.

In particular, Martin Weitzman (2007, 2009a,b, 2011, 2012, 2013) set off a major debate in economics by arguing that uncertainty causes the expected change in future consumption (and thus the marginal return on investment) to go to infinity.

My positive position

Thesis: despite appearance, the economic debate is (largely?) about the question: when making climate policy, how should we account for possibilities whose probability is unknown?

Martin Weitzman's argument for "Fat tails"

Decreasing marginal return on consumption

Given a *decreasing marginal return on consumption*, if consumption is zero, the benefit of even a small change is infinite.

Mathematically unproblematic so long as the “zero-consumption” scenarios are assigned infinitesimal probabilities.

If the probability is not infinitesimal, then the expected change in the utility of future consumption goes to infinity.

Martin Weitzman

Across a series of papers, Martin Weitzman (2007, 2009a,b, 2011, 2012, 2013) argued that we should assign non-infinitesimal probabilities to zero-consumption scenarios.

In technical terminology, he was arguing that we should use a "fat-tailed" distribution—e.g., a t-distribution—when calculating the expected change in the utility of future consumption.

Weitzman's argument

(P1) A 10°C temperature change would lead to global economic collapse.

(P2) We're uncertain about the true probability of a 10°C temperature change.

(P3) If (P2), our expected utility calculations should account for our uncertainty regarding the true probability of a 10°C temperature change.

(P4) "Accounting" for our uncertainty regarding the true probability of a 10°C temperature change entails assigning a non-infinitesimal probability to a 10°C temperature change.

(P5) Global economic collapse is properly understood as a zero-consumption scenario.

∴ (C) We should assign non-infinitesimal probability to a zero-consumption scenario.

The economic debate

William Nordhaus

Lots of people disagree with Weitzman, but William Nordhaus (2007, 2011, 2012, 2013) is a useful foil:

- He's one of the most prominent economists in the field.
- He's criticized Weitzman's arguments.
- He assigns zero probability to zero-consumption scenarios.
- He's relatively explicit about his assumptions and motivations.

An empirical disagreement regarding (P1)/(P2)?

His approach assumes that "there are no genuinely catastrophic outcomes that would wipe out the human species or destroy the fabric of human civilization" (Nordhaus 2007, 33).

And in an explicit critique of Weitzman's work, he argues that true zero-consumption scenarios should not even be considered remote possibilities (Nordhaus 2011, 252–53).

Appearances are deceiving

Except, that what follows the just-quoted sentence is essentially a giant "however,":

> "At the same time, we must emphasize that, based on our formal analysis of uncertainty, we have relatively little confidence in our projections beyond 2050."
>
> "Estimating the likelihood of, and dealing with, potentially catastrophic outcomes is one of the continuing important subjects of research for the natural and social sciences." (Nordhaus 2007, 33; see also Nordhaus 2013, 59, 66)

Weitzman isn't certain either

Nor does Weitzman argue that zero-consumption scenarios are highly probable (or even somewhat probable).

Instead, his argument is that there are mechanisms that could trigger that might lead to these scenarios.

One example: there are giant deposits of methane under the ocean floor that are trapped in part by cold water and that are roughly the CO_2 equivalent of everything we've put into the atmosphere since the industrial revolution. (Weitzman 2009a, 7)

A comparison with the epistemology literature

Familiar question in the epistemic literature: what should we believe when faced with *higher-order uncertainty*, or uncertainty about which beliefs we should adopt?

Weitzman, like (e.g.) Christensen (2010), advocates building our higher-order evaluation into our first-order evaluation. Nordhaus, like (e.g.) Lasonen-Aarnio (2014), advocates keeping the two separate and adopting the "best guess" first-order evaluation.

What method should we use to make political decisions?

But: Weitzman and Nordhaus aren't concerned with rationality or ideal agents.

Instead, they're in the business of normative policy recommendations — i.e., the question is how we should make political decisions about climate change.

In other words: when making climate policy, how should we account for possibilities whose probability is unknown?

What are the open questions?

On discounting

What is the relationship between the discount rate and the choice of probability distribution?

Some of the *arguments* for various discount rates (appear to) conflict with some of the arguments for the choice of probability distribution.

On action

What should we do if Weitzman is right?

Beyond "address climate change," are there any specific policies that are recommended by including catastrophic scenarios in our planning?

What does the space of options look like

Weitzman and Nordhaus essentially offer two (relatively) principled ways of dealing with (higher-order) uncertainty about future events.

But there's a lot of space here to explore. What are the other options?

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