The Marginal Impact of Emission Reductions

Estimates, Beliefs and Behavior

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“I am just one person. My emission reductions will not have any tangible impact.”

“My emission reductions will not have any impact if we cannot avoid disastrous climate change.”

“My emission reductions will only have a tangible impact if other people also reduce their emissions.”

“France is just one country. Its emission reductions will not have any tangible impact.”

“France’s emission reductions will not have any impact if we cannot avoid disastrous climate change.”

“France’s emission reductions will only have a tangible impact if China also reduces its emissions.”

This Paper

1. What is the impact of marginal emission reductions?
2. How accurate are peoples' beliefs?
3. What is the effect of correcting any misbeliefs?

Definition

Marginal impact: expected damage avoided in a physical climate change outcome by 2100 due to decreasing emissions by 1 tCO_2, given current expected overall emissions

Example actions emitting 1 tCO_2 (IPCC 2022):

- Driving 10 miles (16 km) day^{-1} for 1 year (average Diesel car)
- Eating 5 meat servings $week^{-1}$ for 1 year (beef, lamb or pork)

Marginal Impact

“I am just one person. My emission reductions will not have any tangible impact.”

Subjects’ beliefs

Marginal impact underestimated by 2 orders of magnitude on average

Climate models

Marginal impact tangible:

1. 4 kiloliters (1000 gallons) less glacier ice melting
2. 6 hours longer aggregate life expectancy
3. 5 m^2 (50 ft^2) less vegetation undergoing ecosystem change

Structure of Climate Change I

"My emission reductions will not have any impact if we cannot avoid disastrous climate change."

Subjects' beliefs

Threshold public good

- Threshold known → marginal impact discontinuous
- Marginal impact = 0 after threshold

Climate models

Continuous/monotonous public good

- Thresholds unknown → marginal impact continuous
- Marginal impact > 0, even after thresholds

Structure of Climate Change II

"My emission reductions will only have a tangible impact if other people also reduce their emissions."

Subjects' beliefs

Strategic complementarity

- Marginal impact is increasing in others' emission reductions

Climate models

Strategic substitutability

- Marginal impact is constant or decreasing in others' emission reductions

Randomized Controlled Trial

Providing subjects with the climate scientific information causally increases:

1. Perceived self-efficacy (d=0.29, 3 days later)
2. Intentions to reduce emissions (d=0.11, 3 days later)
3. Donations to reduce global emission (d=0.23, ↑18%, ↑£14)

Conclusion

Impact of individual emission reductions is large, even if other people do not reduce their emissions.

- Contrary to conventional wisdom and beliefs
- Marginal impact of emission reductions is a good measure to correct misbeliefs
- Providing information is a cost-effective way to increase mitigation efforts

Next Steps

At the Stanford Environmental and Energy Policy Center, together with Prof. Hunt Allcott:

Currently looking for partners to test the effect of this information on support for green – private or public sector – policies

If interested, find me later or email me at christoph.semken@upf.edu