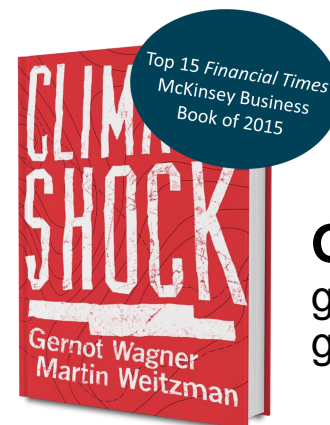


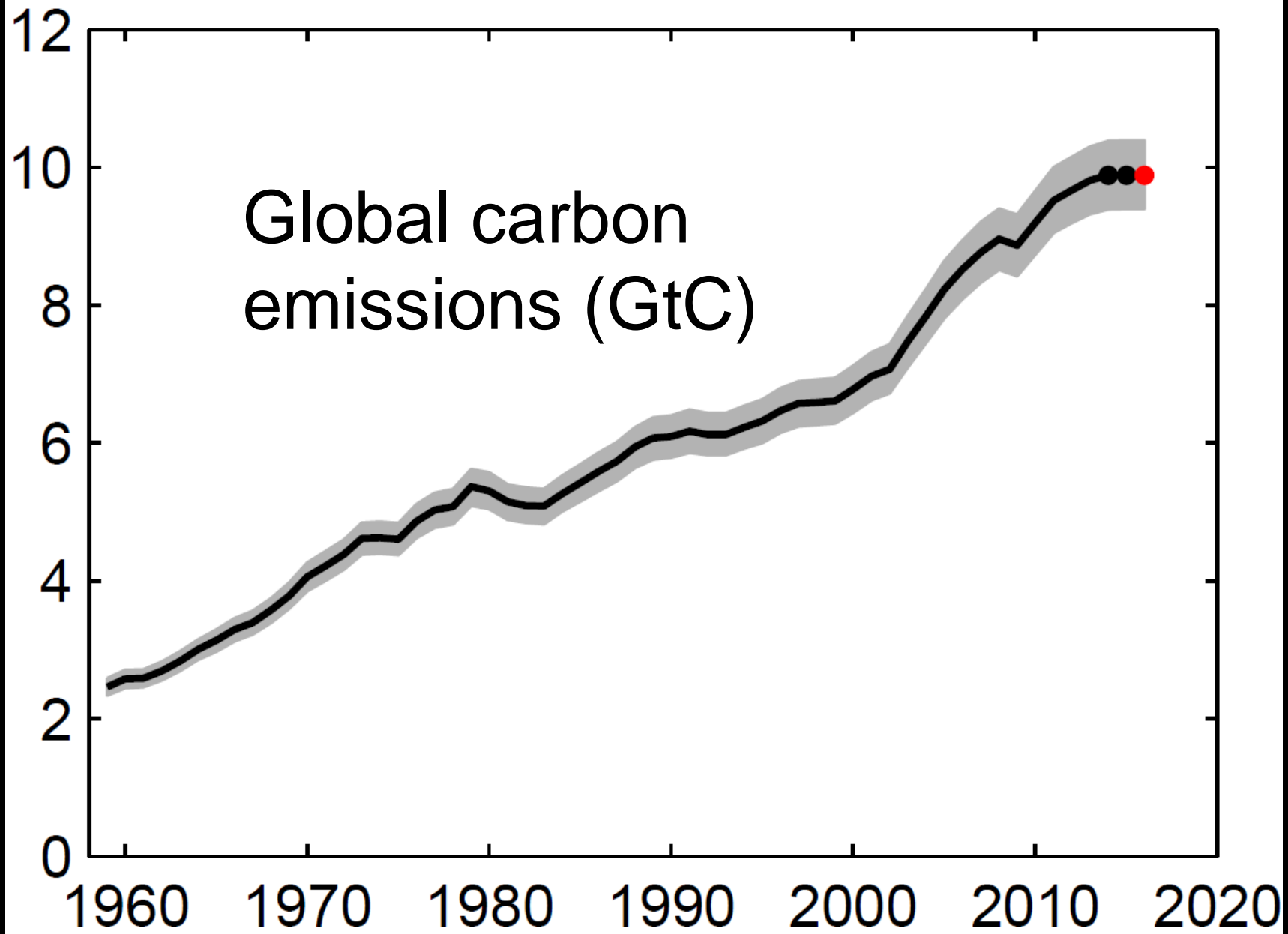
Solar geoengineering and mitigation

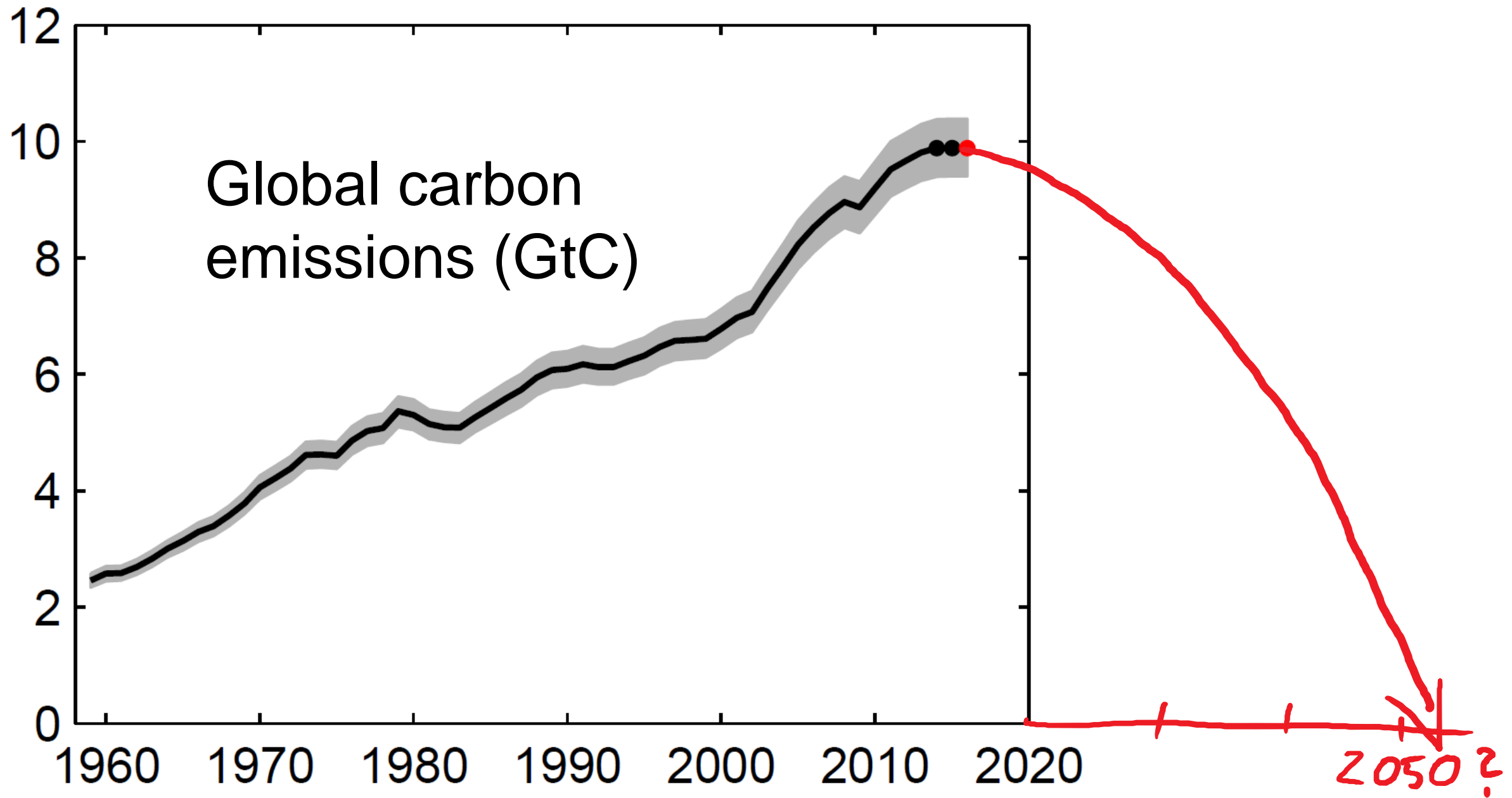


Gernot Wagner

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Free rider

Source: Every economist ever

Free rider

→ Free driver

SRM v Mitigation

- (i) Hard tradeoffs
- (ii) “Moral hazard”

carbon
emissions



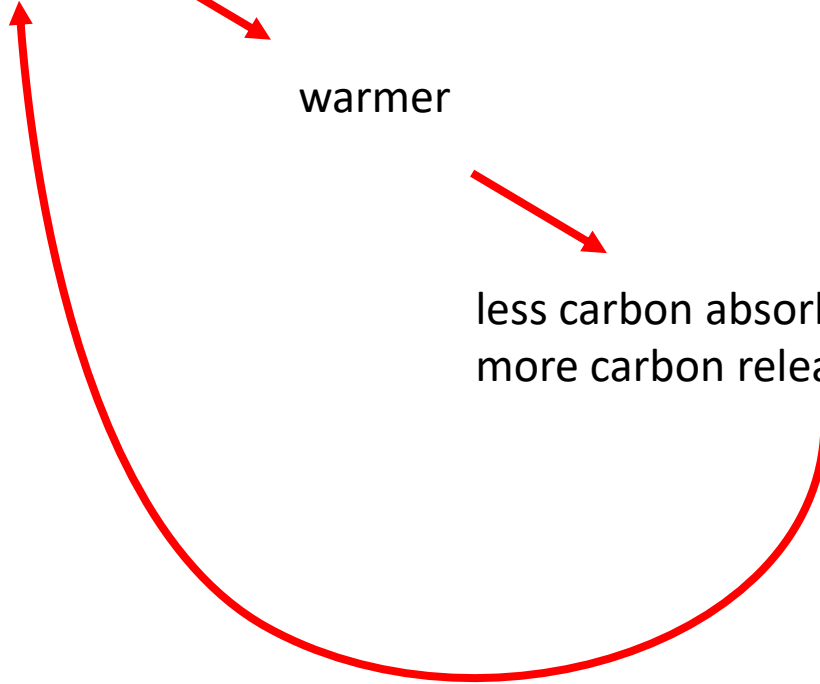
more carbon
in atmosphere



warmer



less carbon absorbed by ocean
more carbon released from permafrost



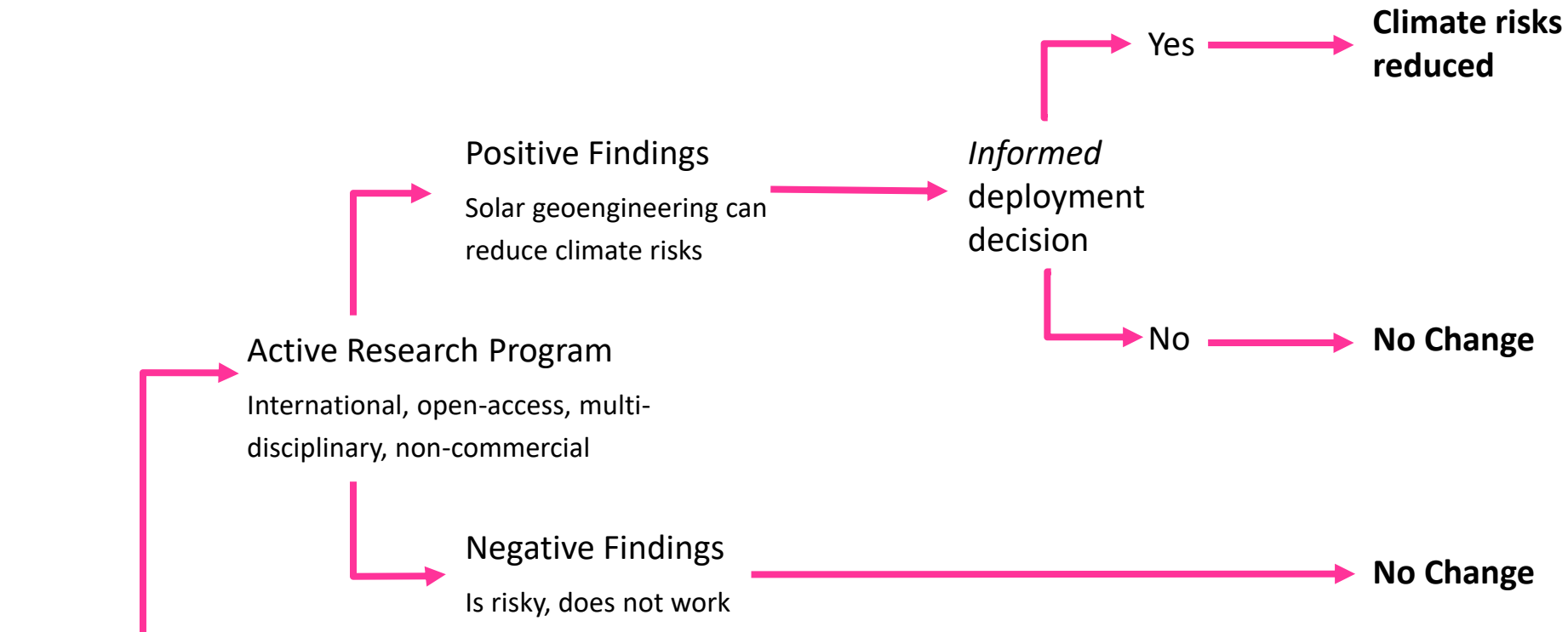
Carbon cycle feedbacks

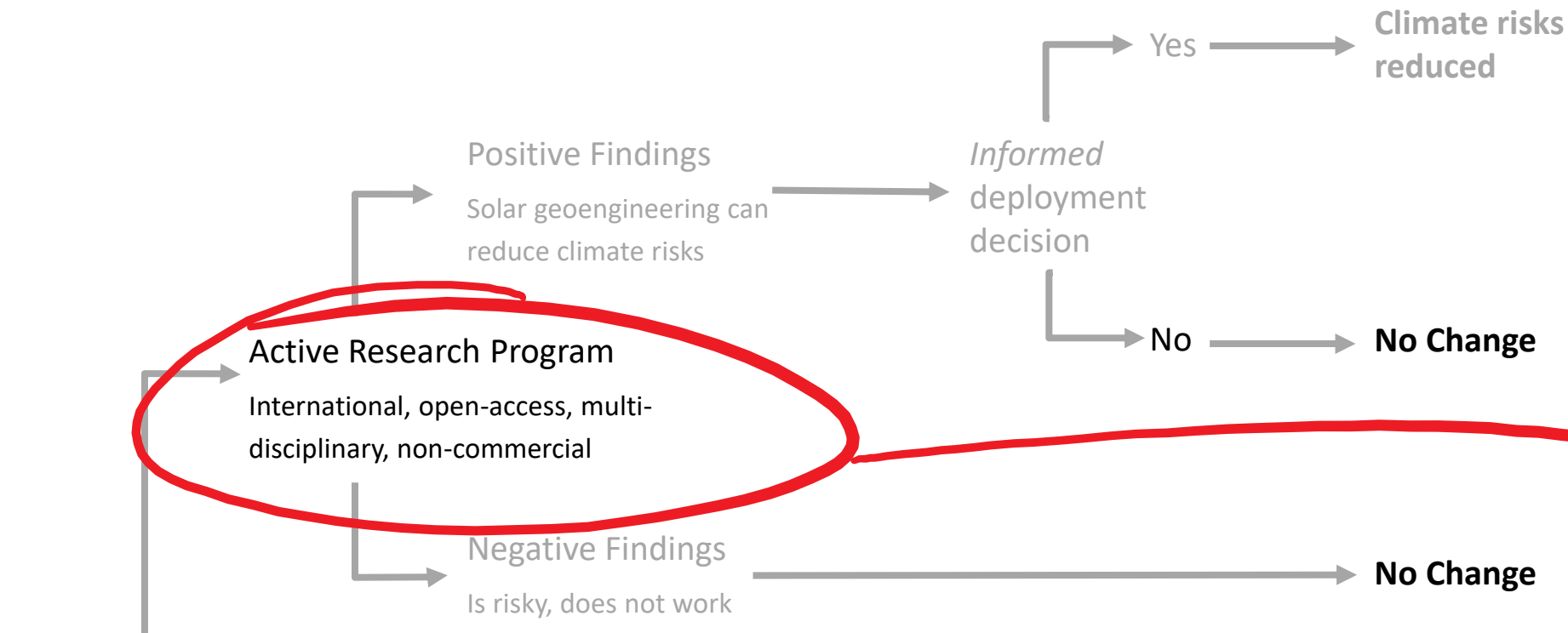
Solar geoengineering might
reduce CO₂ burden in 2100 by
5-25% at a cost of <0.5 \$/tCO₂

SRM v Mitigation

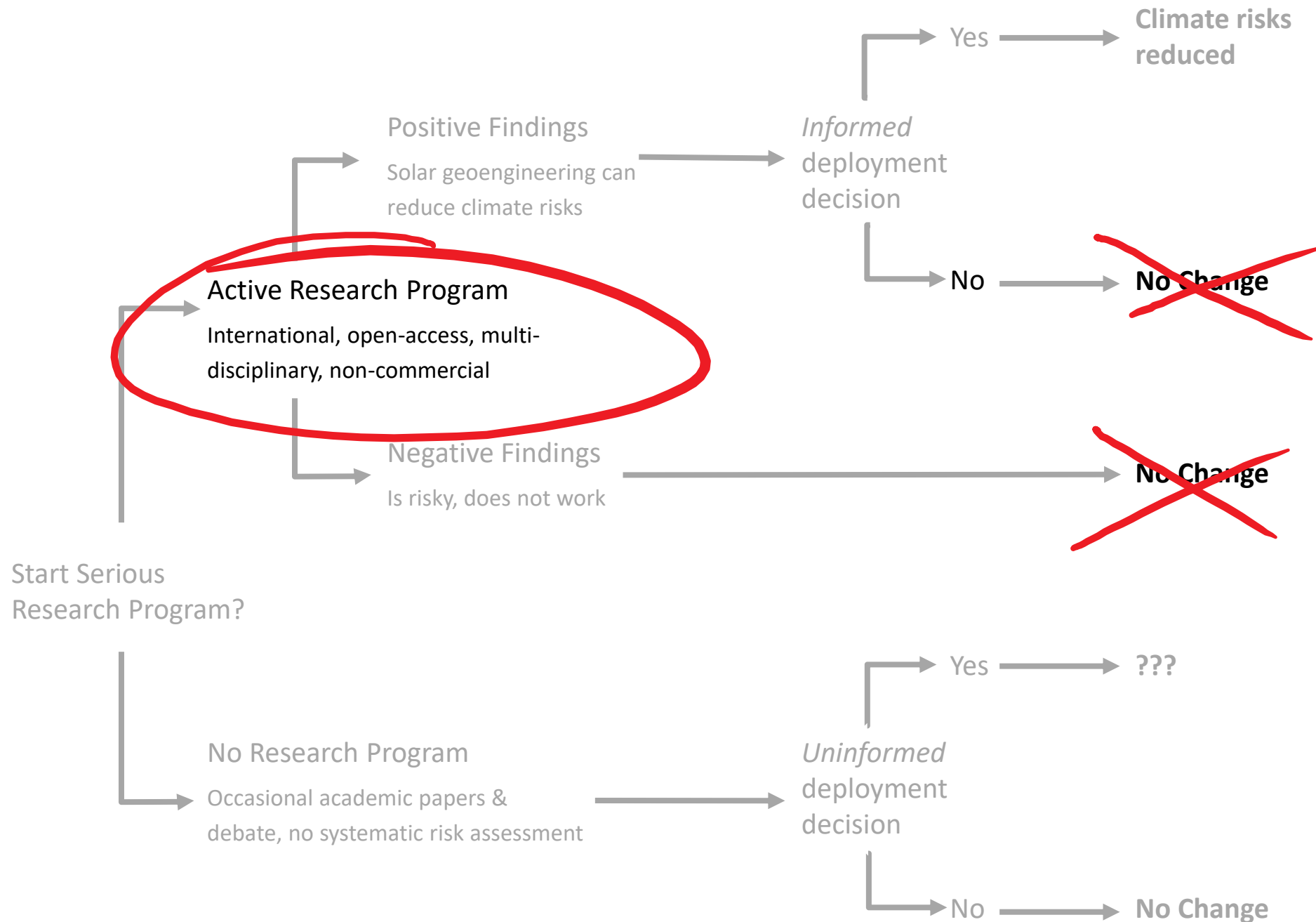
(i) Hard tradeoffs

(ii) “Moral hazard”





"Moral hazard"
2!



"Moral hazard"
2!

Harvard's Solar Geoengineering Research Program (SGRP)

A Harvard-wide interdisciplinary program housed in Harvard's Center for the Environment

Three broad research tracks:

- Science and technology (“blue team”)
- Assessing efficacy and risks (“red team”)
- Governance and social implications

Program governed by an advisory committee composed of Peter Huybers, David Keith (Faculty Director), Dan Schrag, Elsie Sunderland, Dustin Tingley, and Gernot Wagner (Executive Director)

Funding: \$10 million over 5 years

Target: \$20 million over 7 years

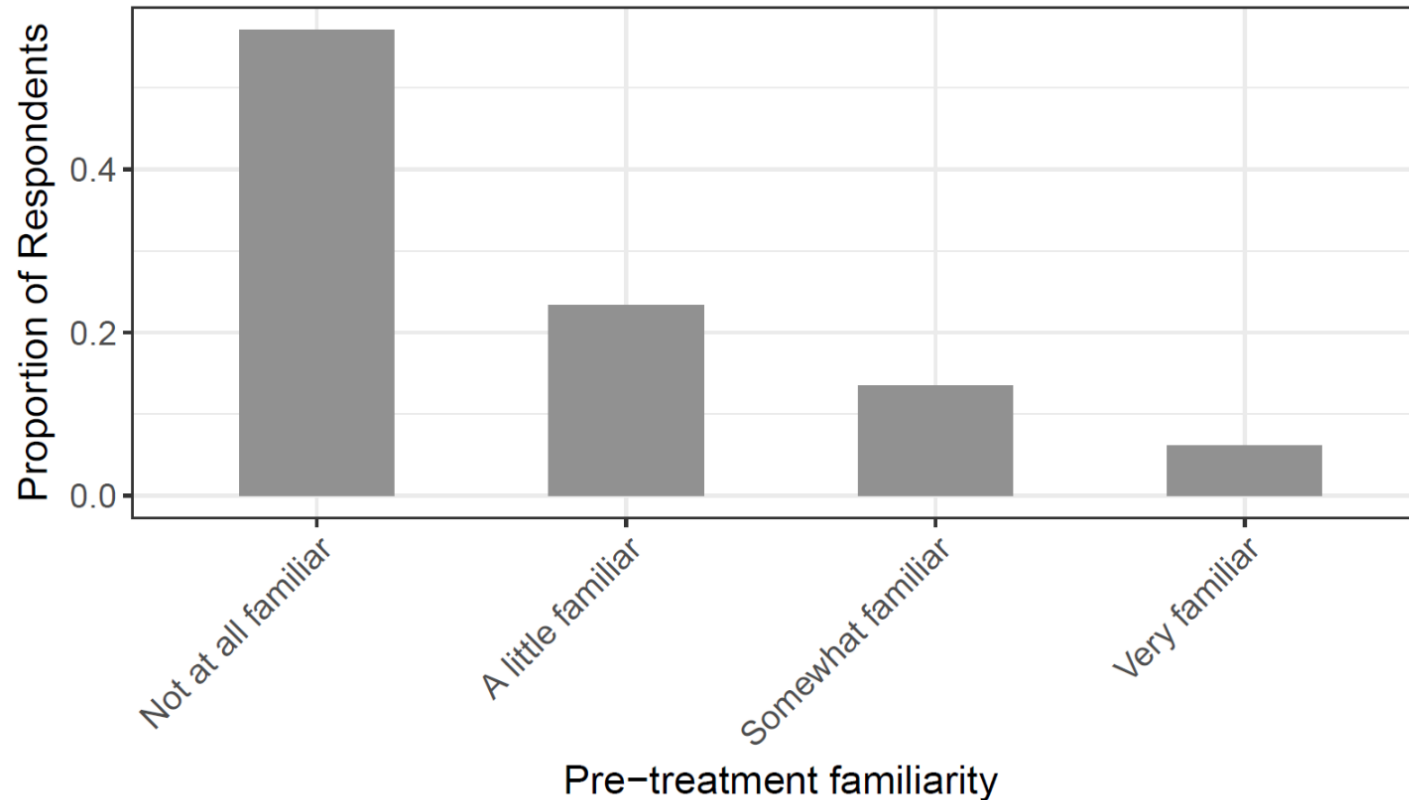
Opportunities: pre- and post-doc fellowships (**January 10th deadline for fall 2018**), and a residency program to support visiting scholars working with members of the Harvard community

geoengineering.environment.harvard.edu

Low pre-treatment familiarity

n=1,000, part of 36,000-subject 2016 Cooperative Congressional Election Study of US electorate, Oct-Nov 2016

[text on climate change and mitigation ...] Another potential solution is Solar Radiation Management, also known as solar geoengineering. How would you describe your familiarity with the term “Solar Radiation Management” (SRM) or solar geoengineering?

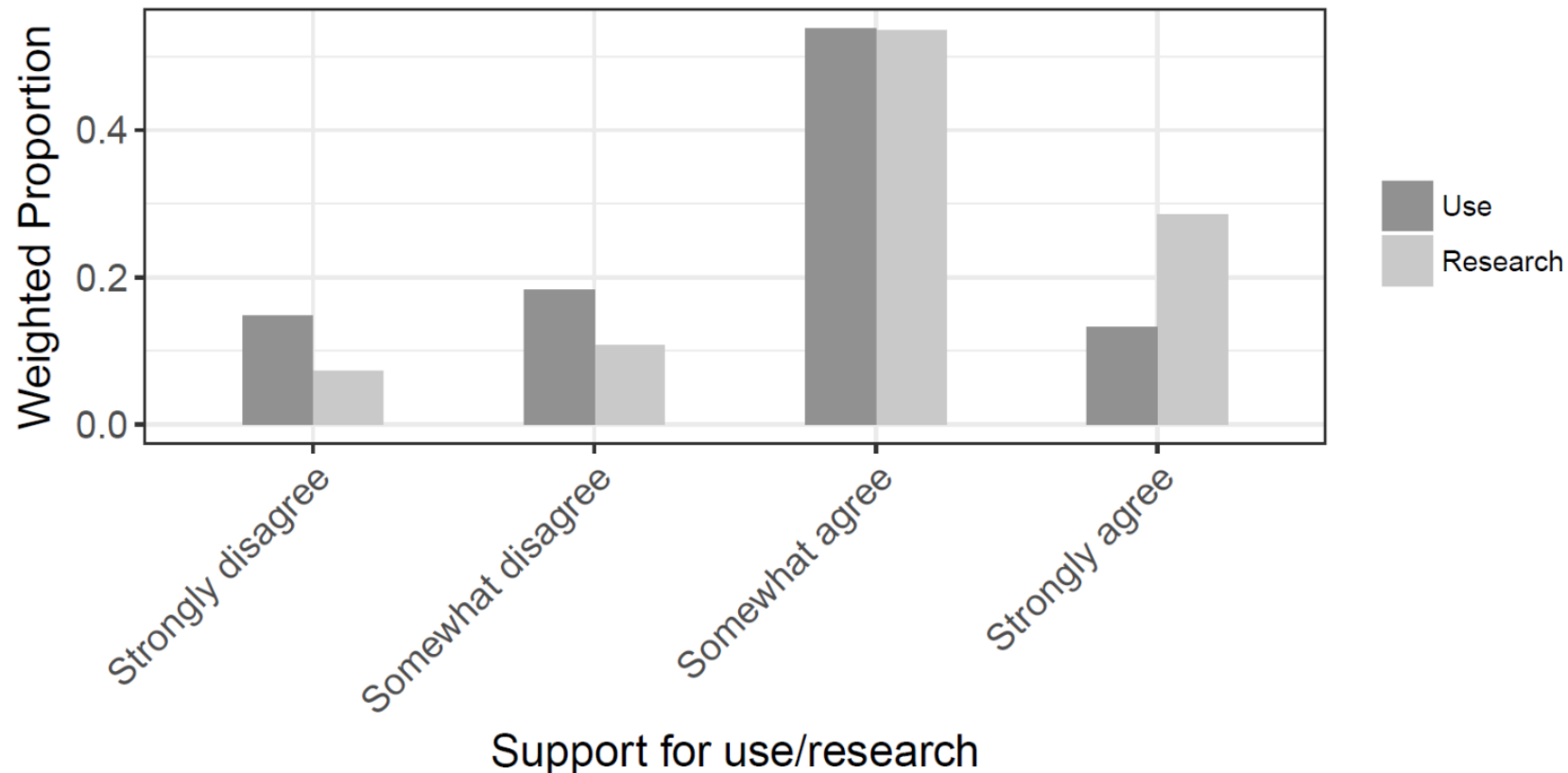


Research >> Use

n=1,000, part of 36,000-subject 2016 Cooperative Congressional Election Study of US electorate, Oct-Nov 2016

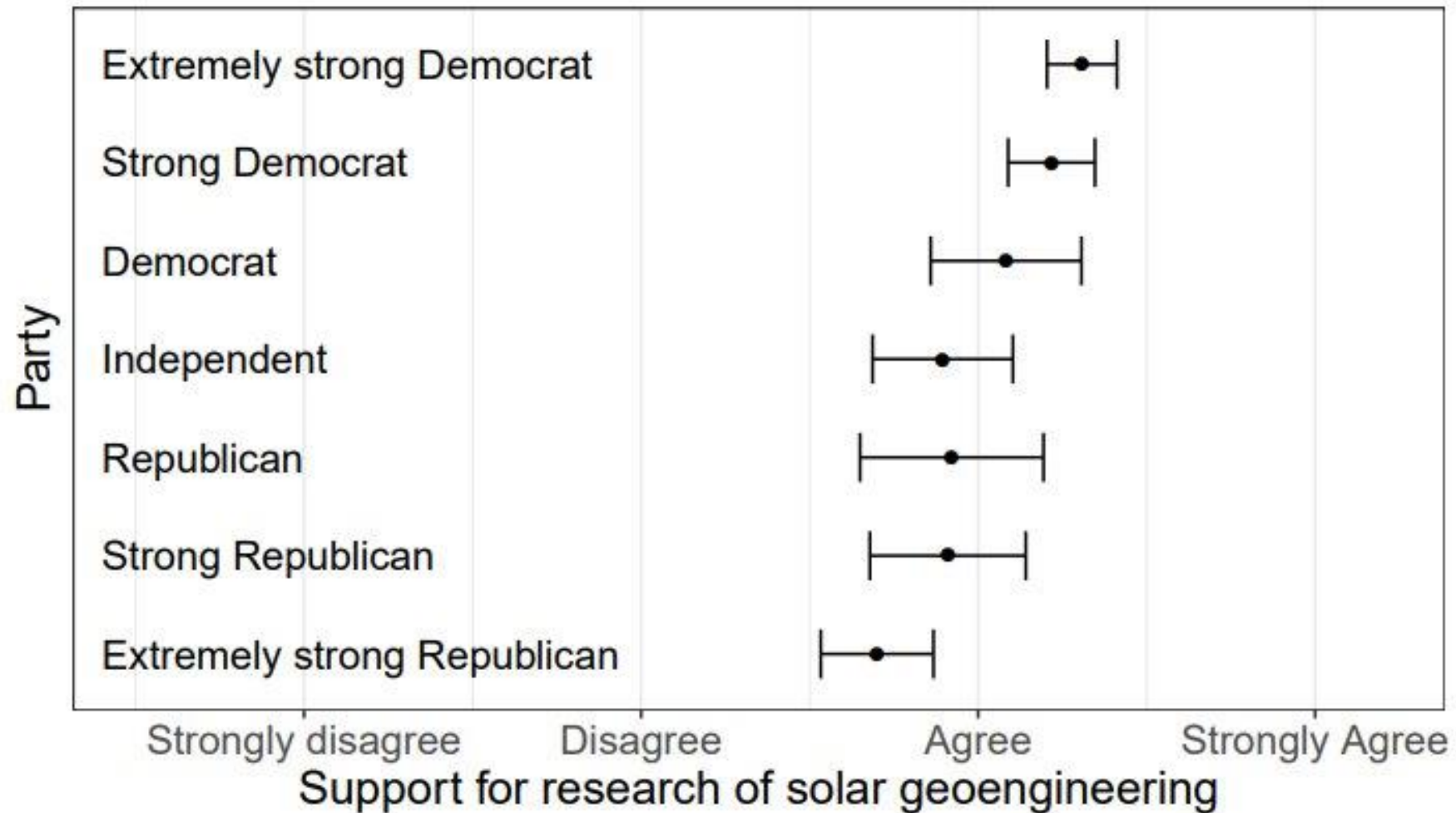
Q1: Do you think that solar geoengineering should be used to help address global warming?

Q2: What do you think about researching SRM to learn more about the technology?



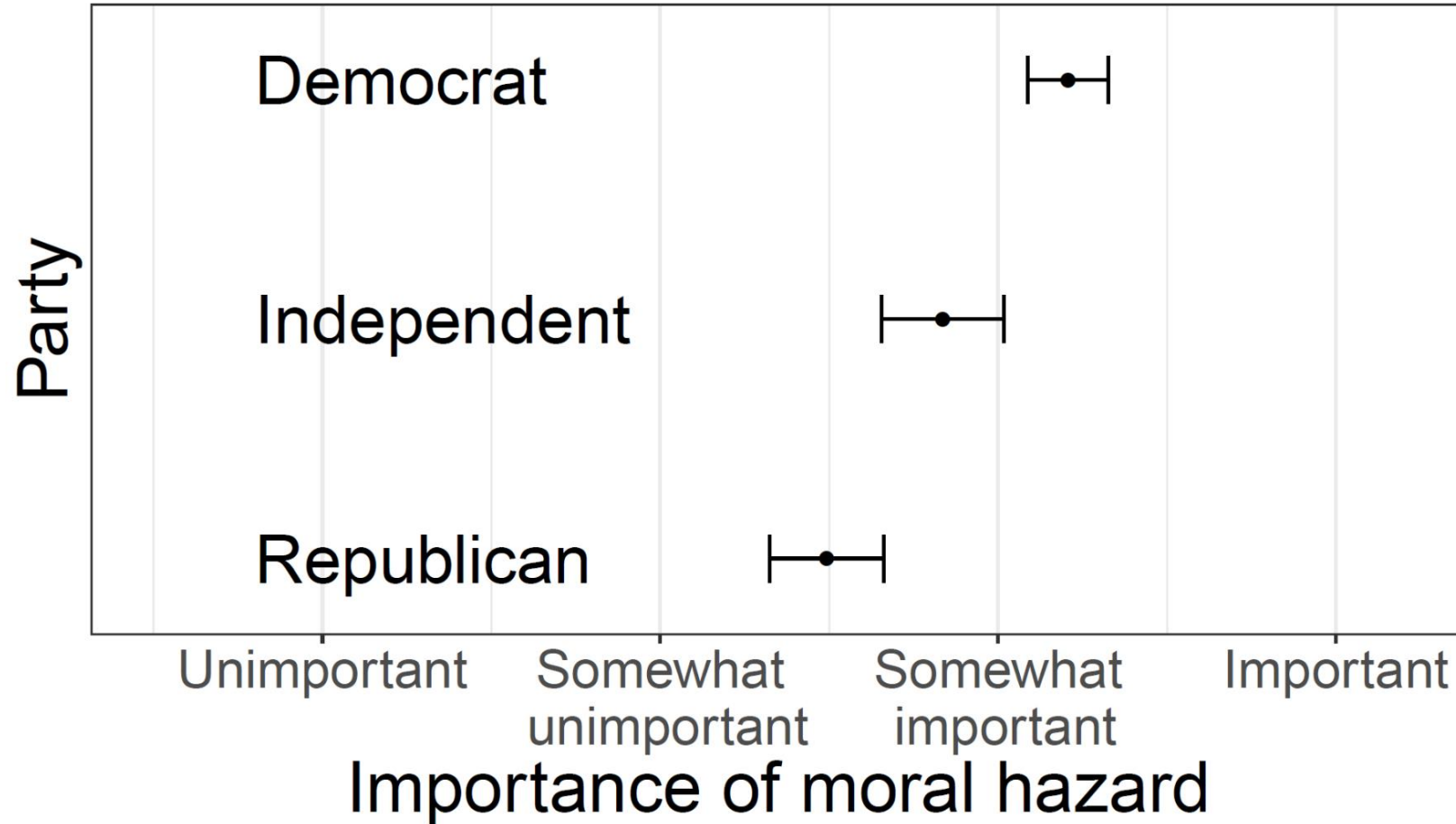
Support for research strongest among Democrats

n=1,000, part of 36,000-subject 2016 Cooperative Congressional Election Study of US electorate, Oct-Nov 2016



“Moral hazard” more important for Democrats than Republican, **but...**

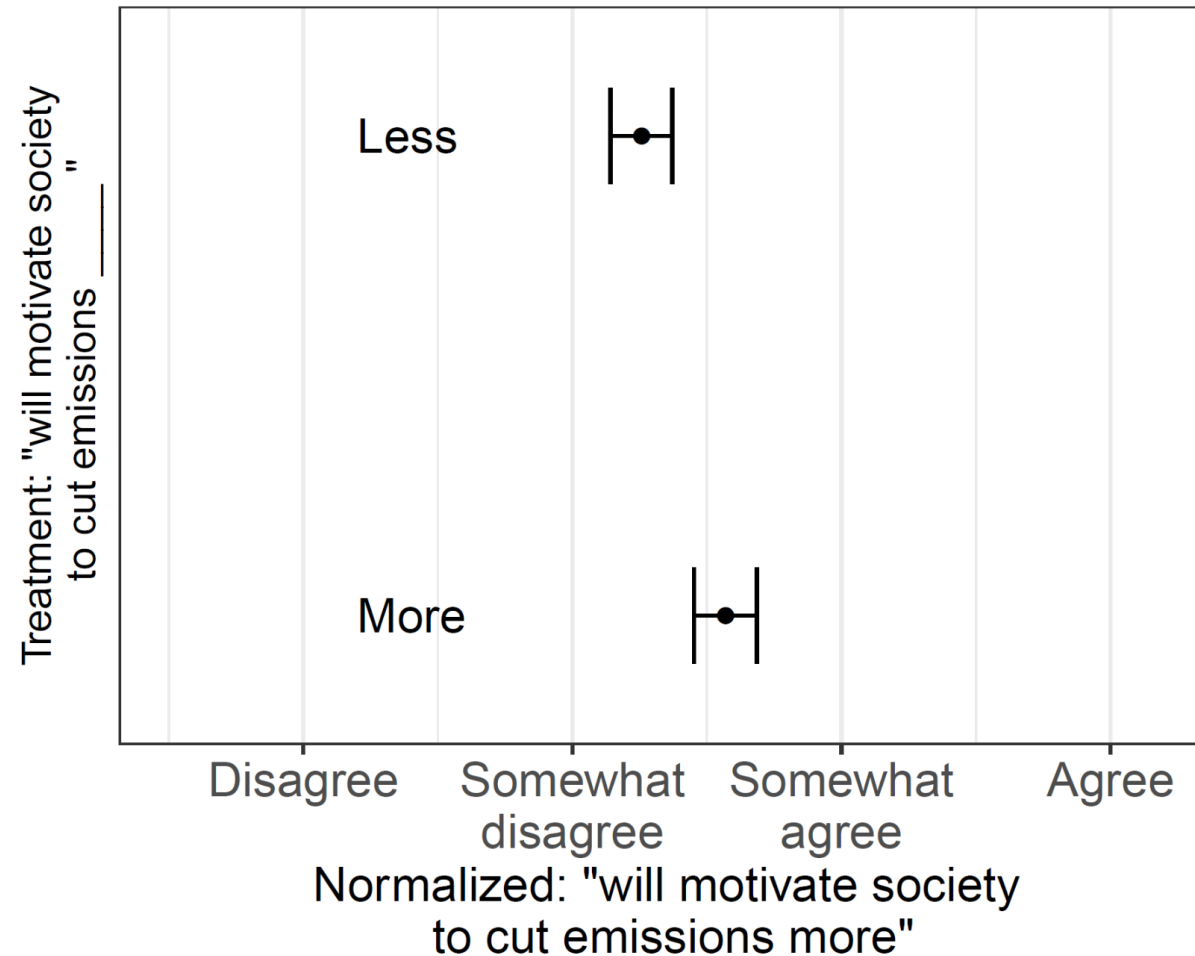
n=1,000, part of 36,000-subject 2016 Cooperative Congressional Election Study of US electorate, Oct-Nov 2016



Acquiescence bias may dominate any “moral hazard” finding

n=1,000, part of 36,000-subject 2016 Cooperative Congressional Election Study of US electorate, Oct-Nov 2016

Ask whether solar geoengineering “will motivate society to cut emissions *less*”, get (weak) agreement.
Ask whether it will cut emissions “*more*,” get (weak) agreement.

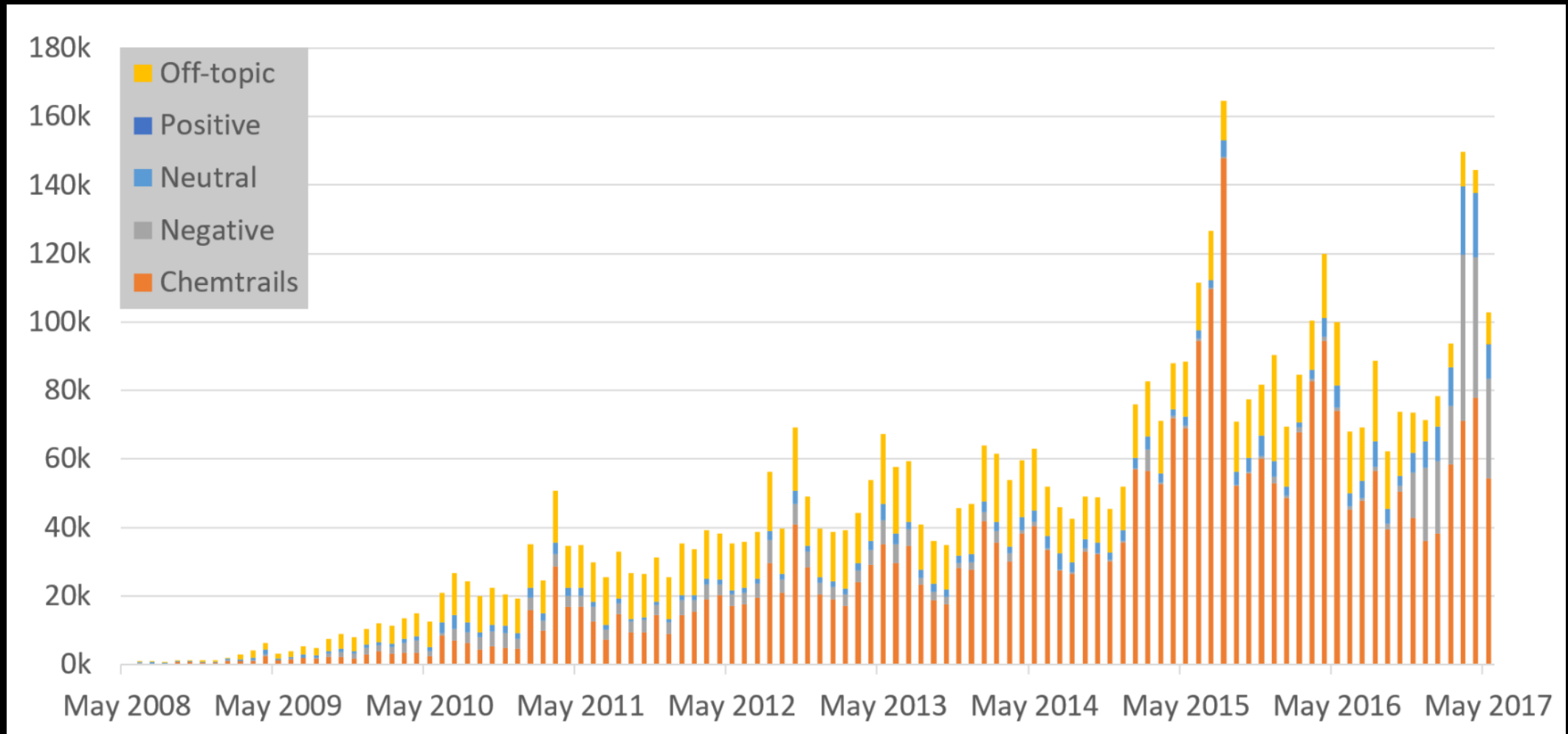


Mahajan, Tingley, Wagner, “Fast, cheap, and imperfect? U.S. public opinion about solar geoengineering” (*mimeo*, 2017)

“Moral hazard” theoretically well-founded need serious empirical research

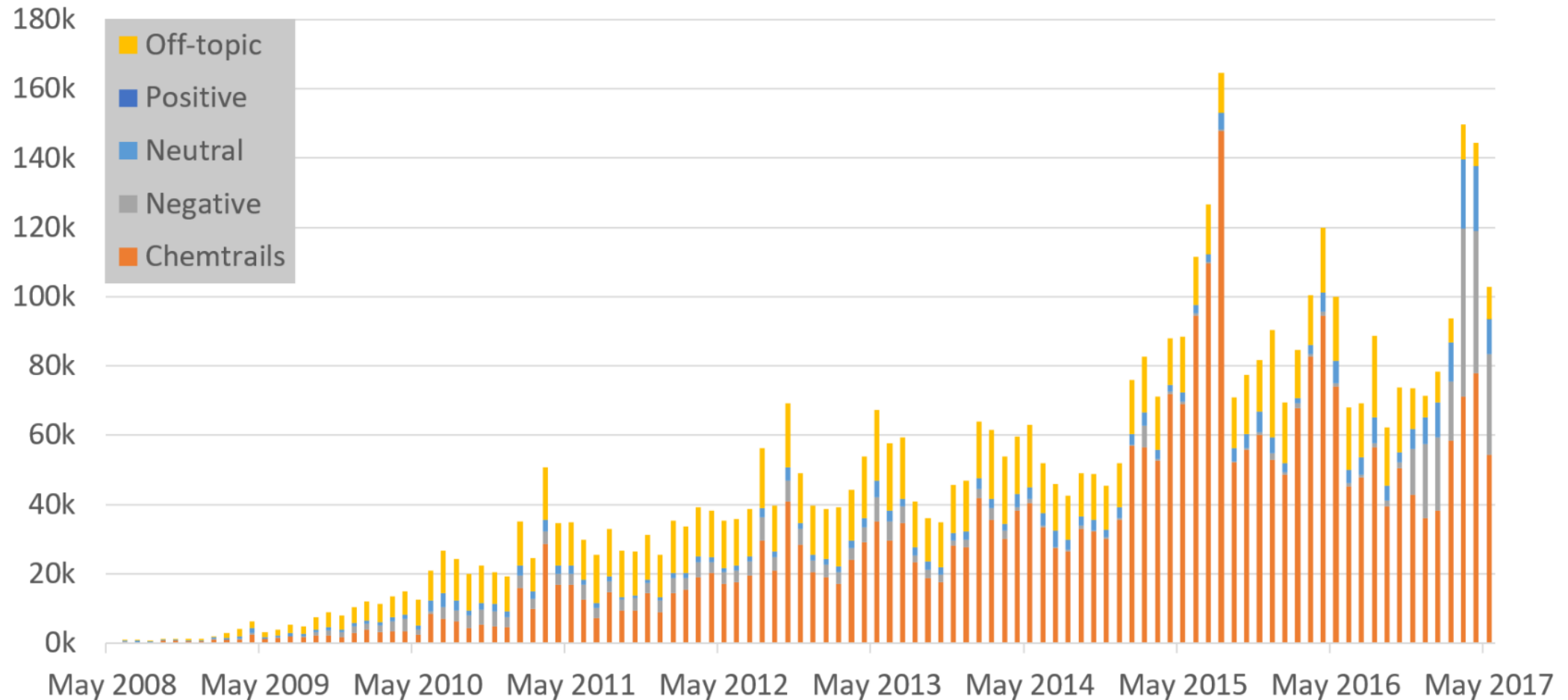
Long history of the idea

- Technically a misnomer. More like “lack of self control,” or simply “crowding out.”
 - 30+ studies find “moral hazard”, or rather: fear of moral hazard when asking respondents about it. But: acquiescence bias!
 - One study (Merk et al.) tests actual behavior and finds inverse.
- No clear answer which hypothesis holds when. Need for serious public perception and revealed behavioral research



Chemtrails conspiracy dominates social media geoengineering discourse

Analysis of totality of Twitter, (public) Facebook, YouTube, and other social media feeds



Chemtrails conspiracy: 30-40%, up from 5-10% ~5-7 years ago

n=1,000, part of 36,000-subject 2016 Cooperative Congressional Election Study of US electorate, Oct-Nov 2016

“Do you believe it is true that the government has a secret program that uses airplanes to put harmful chemicals into the air (often called ‘chemtrails’)?”

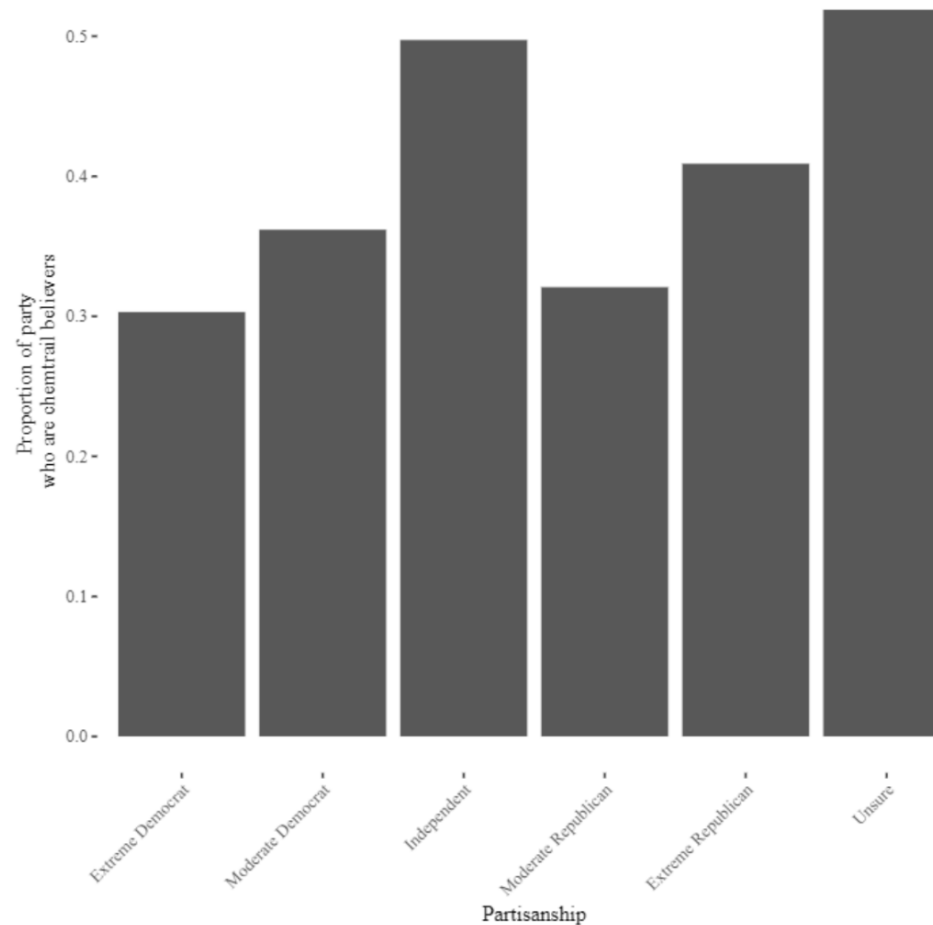
	Percentage	Percentage, including “best guess” follow-up question
Completely false	32%	34%
Somewhat false	15%	27%
Somewhat true	19%	29%
Completely true	9%	10%
Unsure	25%	n/a

} ~30% } ~40%

Chemtrails conspiracy “nonpartisan”

n=1,000, part of 36,000-subject 2016 Cooperative Congressional Election Study of US electorate, Oct-Nov 2016

“Do you believe it is true that the government has a secret program that uses airplanes to put harmful chemicals into the air (often called ‘chemtrails’)?”



Tingley & Wagner (*Palgrave Communications*, October 2017, [nature.com/articles/s41599-017-0014-3](https://www.nature.com/articles/s41599-017-0014-3))

Solar geoengineering v mitigation

Not just “moral hazard”

1 Real tradeoffs

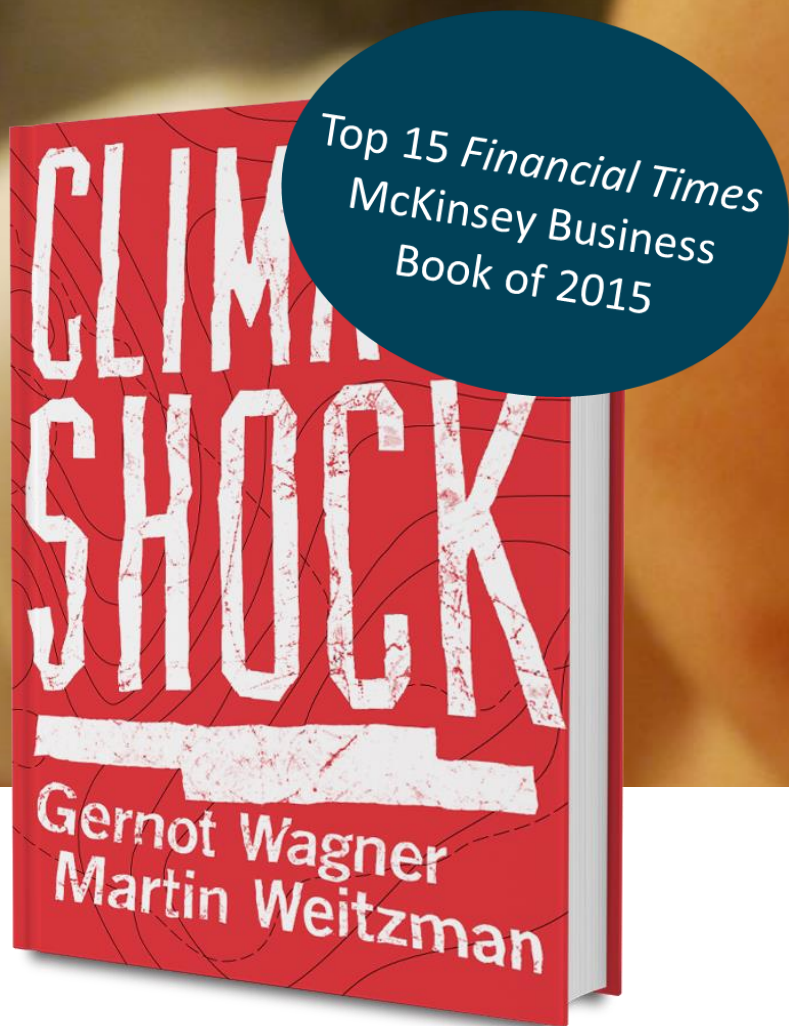
- “SRM as CDR?” (Keith, Wagner, Zabel, *Nature Climate Change*, September 2017)
- SRM leads to higher greenhouse-gas levels, lower temperatures, and—in the context of our model—higher “welfare”
(Moreno-Cruz, Wagner & Keith, *HKS Faculty Working Paper*, July 2017)

2 “Moral hazard”

- High level of conspiratorial talk (Tingley, Wagner, *Pelgrave Communications*, Oct 2017)
- High-quality surveys (e.g. Mahajan, Tingley, Wagner, *mimeo*, November 2017)
- Revealed behavior (Merk, Pönitzsch & Rehdanz, *Environ. Res. Lett.*, 2016)

Free rider

→ Free driver



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