Economics of climate change and mitigation

Aleh Cherp (Lund University, Sweden; Central European University, Austria)
with Jessica Jewell, Vadim Vinichenko, Lola Nacke and Avi Jakhmola (Chalmers University of Technology)
27 December 2023 | BEROC 11th conference on Economics and Finance

Introduction

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We know how to save the climate in mathematical models. Can we do it in the real world?

The POLET (*Perspectives on technOLogical change and Energy Transitions*) research group explores this question by analyzing change and continuity in energy systems.

We strive for rigorous, accessible and informative scholarship that facilitates a dialogue between energy system modellers, socio-technical transition scholars, political scientists and historians

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how much, how fast, and how costly?

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We have a problem!

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The Economic Journal, 101 (July 1991), 920–937
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TO SLOW OR NOT TO SLOW: THE ECONOMICS OF THE GREENHOUSE EFFECT

William D. Nordhaus

God does not play DICE – but Bill Nordhaus does! What can models tell us about the economics of climate change?

Claudia Elisabeth Wieners, Institute for Marine and Atmospheric research, Utrecht And Centre for Complex Systems Studies, Utrecht University · December 3, 2018 · Climate of the Present, Uncategorized · No Comments

Nordhaus in Stockholm, December 2018

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- 1996 Germany adopts the 2°C warming target

German Advisory Council on Global Change (WBGU)

Scenario for the derivation of global CO_2 reduction targets an implementation strategies

Statement on the occasion of the First Confe of the Parties to the Framework Conventi on Climate Change in Berlin

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Nordhaus 2016

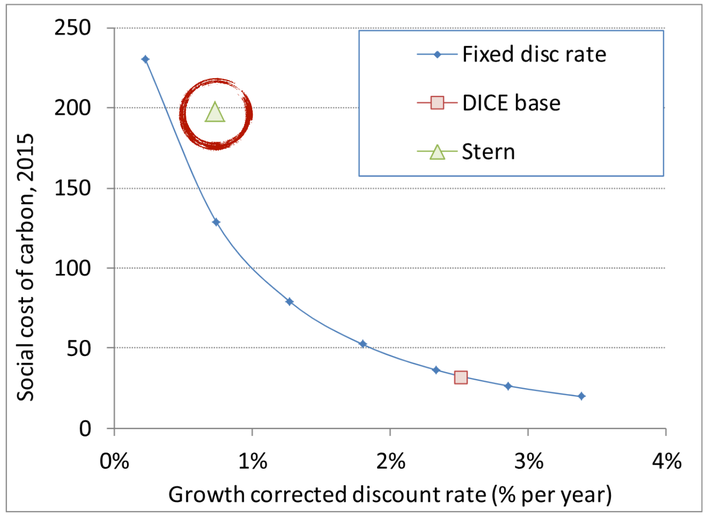

Fig. 3. Social cost of carbon and growth-corrected discount rate in DICE model. The growth-corrected discount rate equals the discount rate on goods minus the growth rate of consumption. The solid line shows the central role of the growth-corrected discount rate on goods in determining the SCC in the DICE model. The square is the SCC from the full DICE model, and the triangle uses the assumptions of *The Stern Review* (10). A further discussion and derivation of the growth-corrected discount rate is given in *Supporting Information*.

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FOCUS ARTICLE

WIREs CLIMATE CHANGE WILEY

A history of the 1.5°C target

Béatrice Cointe[1] | Hélène Guillemot[2]

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  - Science becomes political
  - Fewer economists at the IPCC
  - Natural and social scientists dominate

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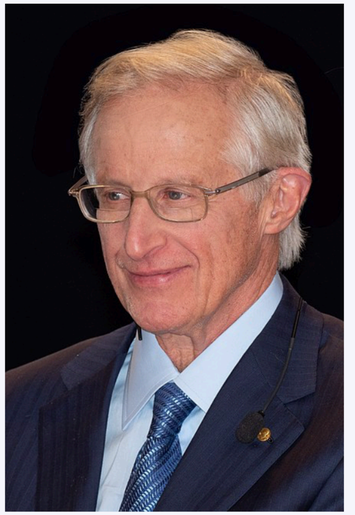

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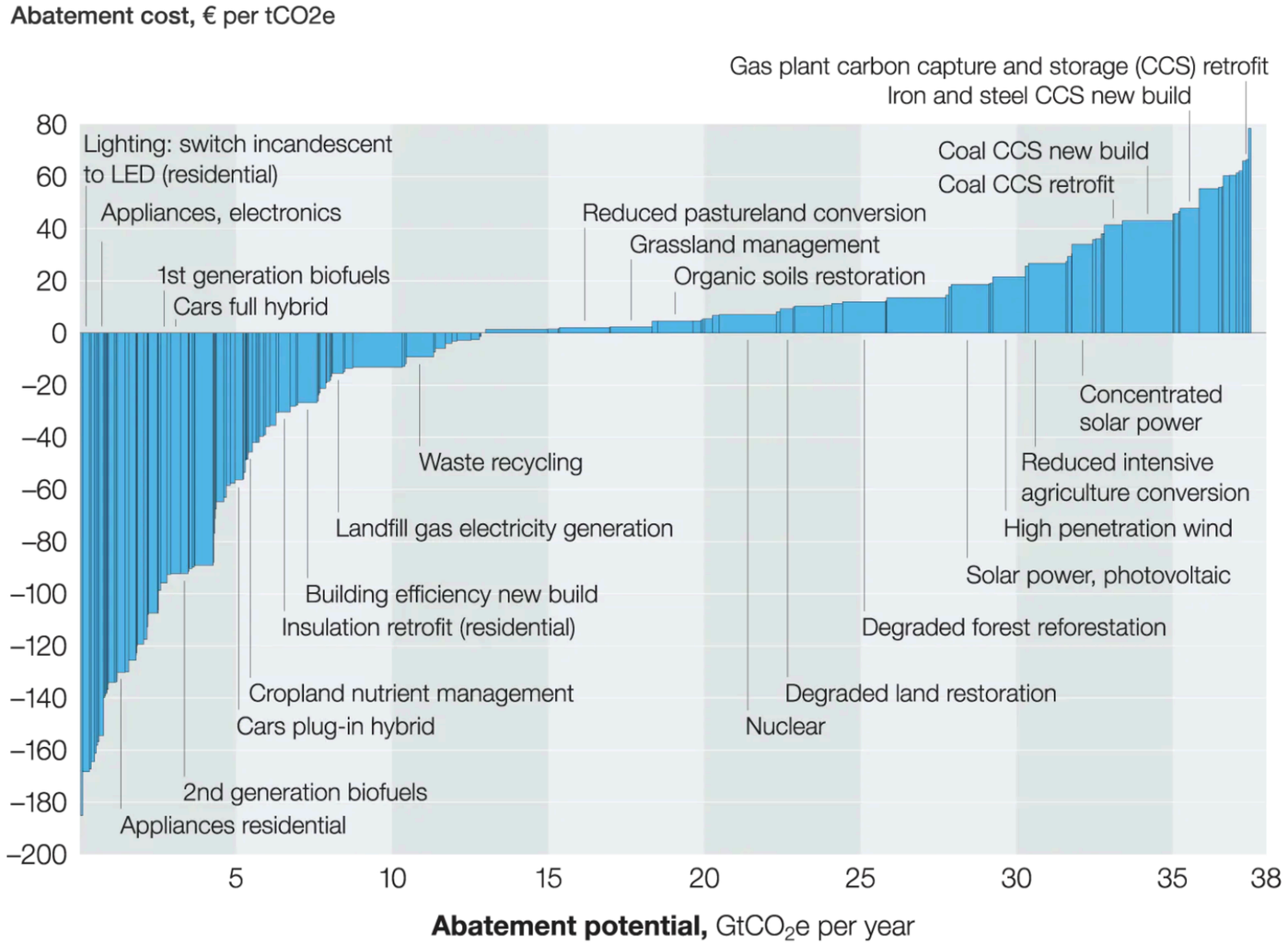

Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €80 per tCO2e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.

McKinsey&Company | Source: McKinsey Global GHG Abatement Cost Curve v2.1

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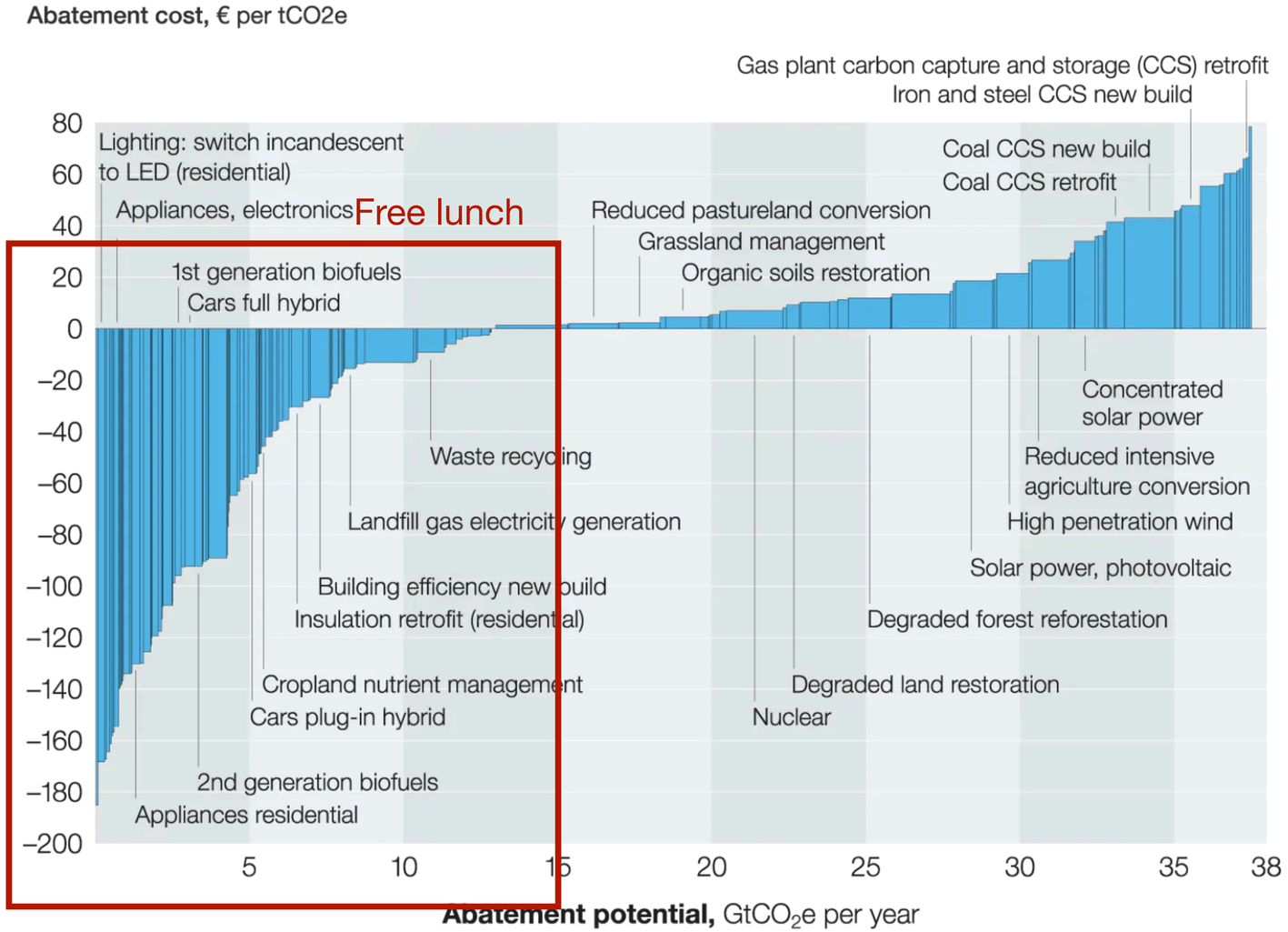

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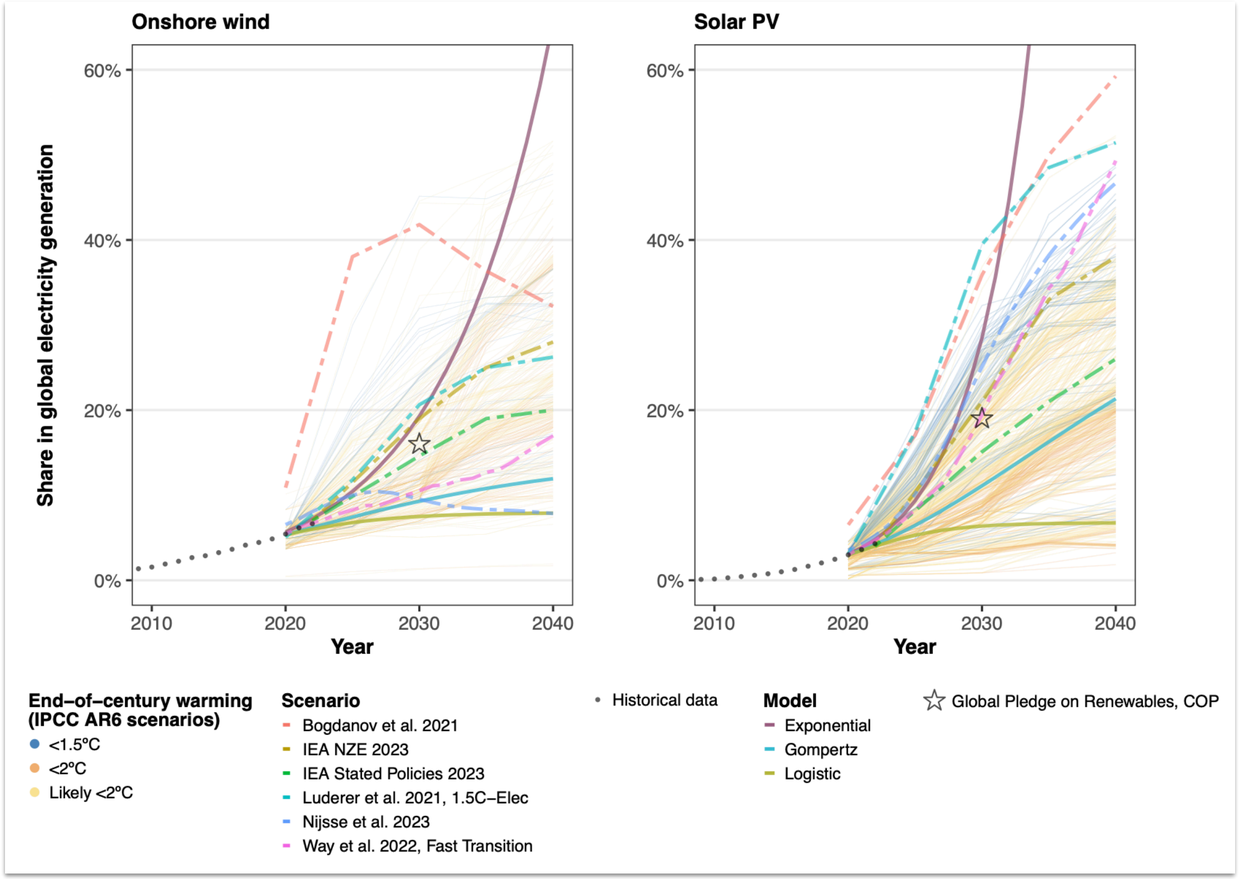
- After 2011 - Climate mitigation pathways
  - Bottom-up energy modelling
  - Exploratory or normative (no probabilities)



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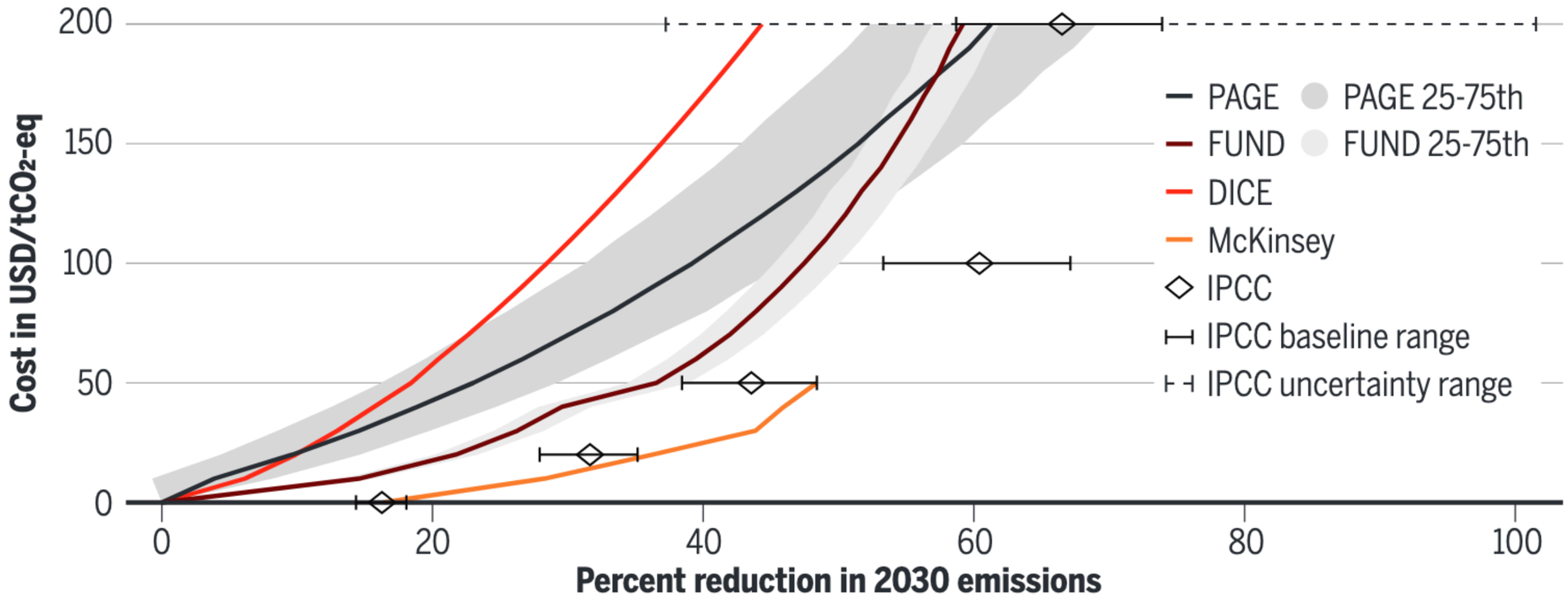
Research Puzzle

Research Puzzle

Global mitigation potentials at different costs



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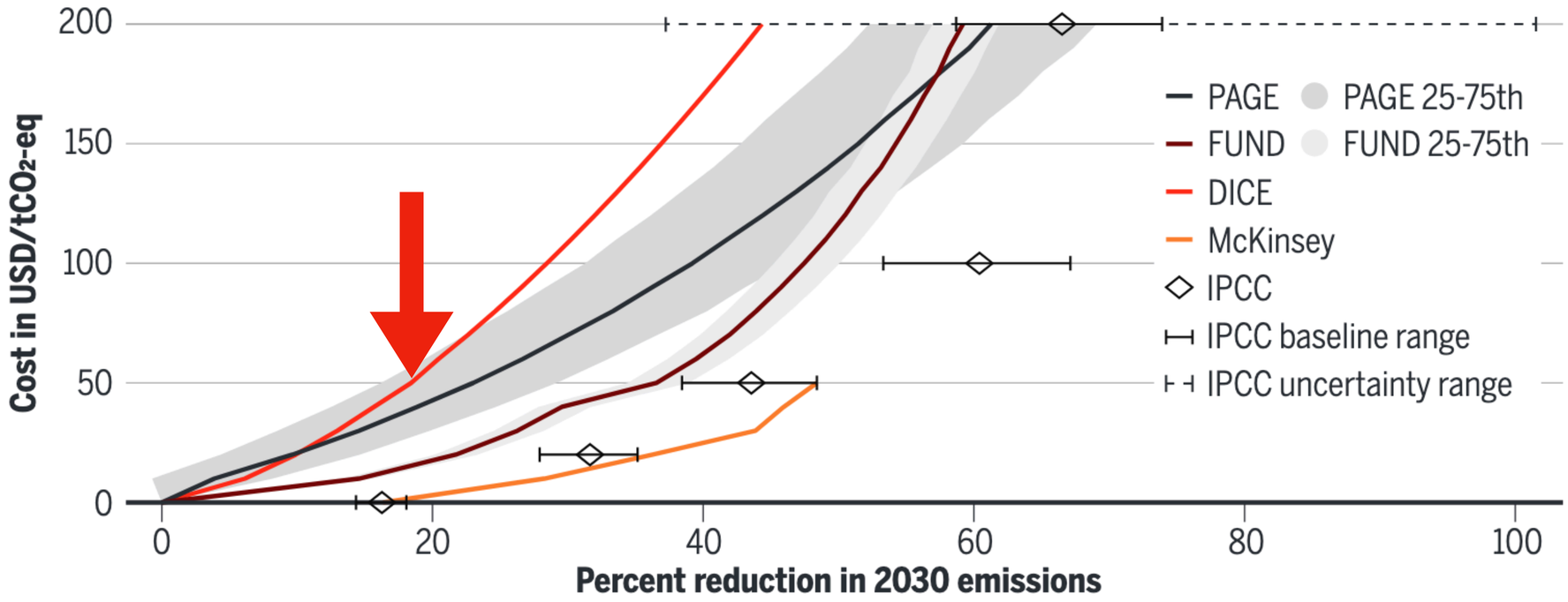

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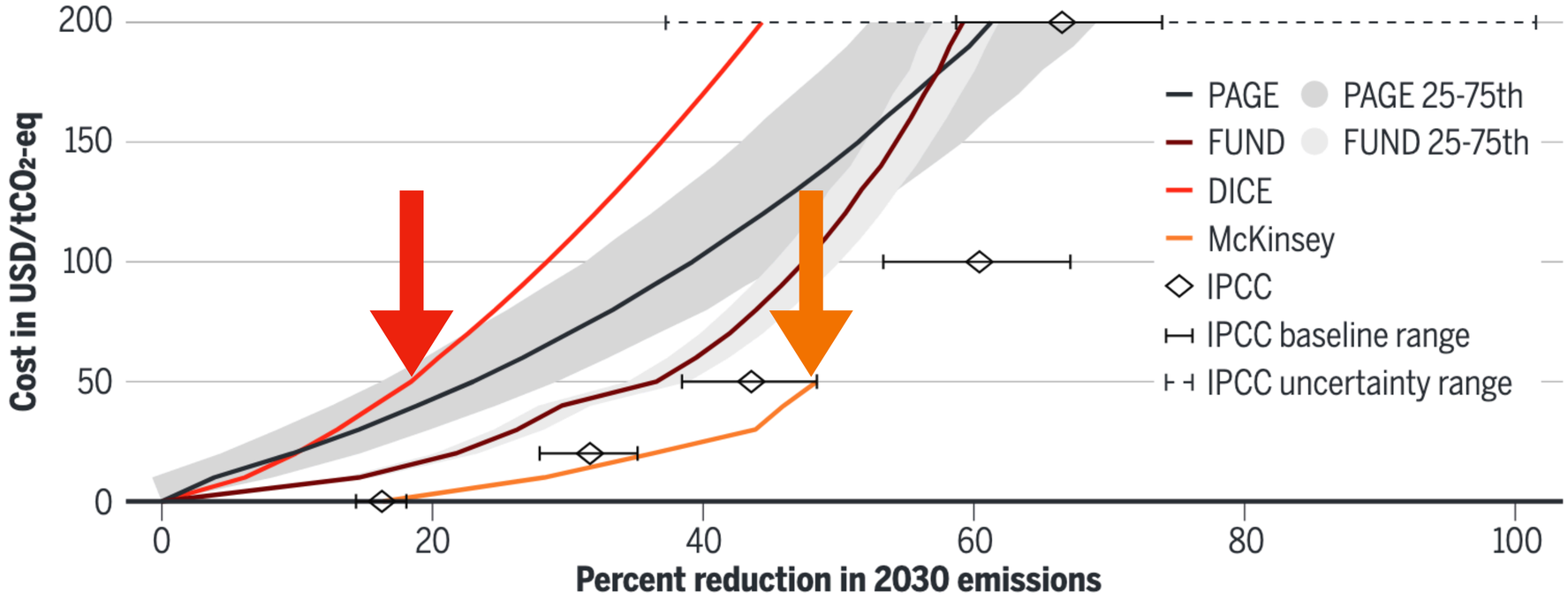

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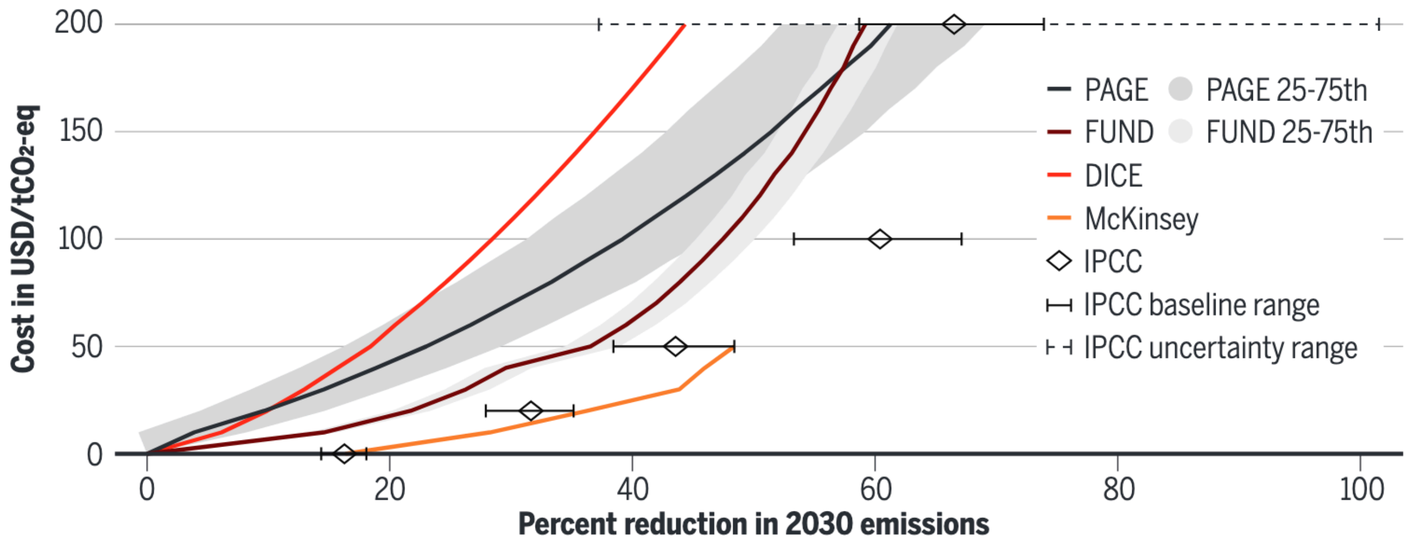

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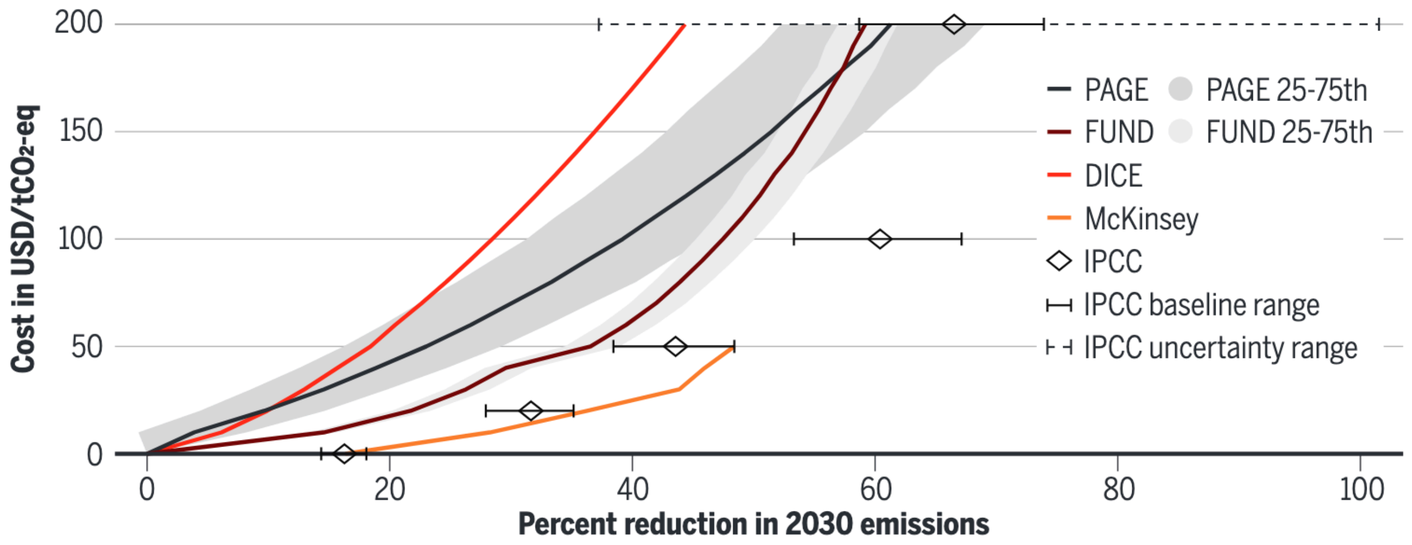

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Jessica Jewell[1,2,3] | Aleh Cherp[4,5]

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Letter | Published: 01 July 2019

Prospects for powering past coal

Jessica Jewell, Vadim Vinichenko, Lola Nacke & Aleh Cherp

Nature Climate Change **9**, 592–597 (2019) | Cite this article

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Phasing out coal for 2 °C target requires worldwide replication of most ambitious national plans despite security and fairness concerns

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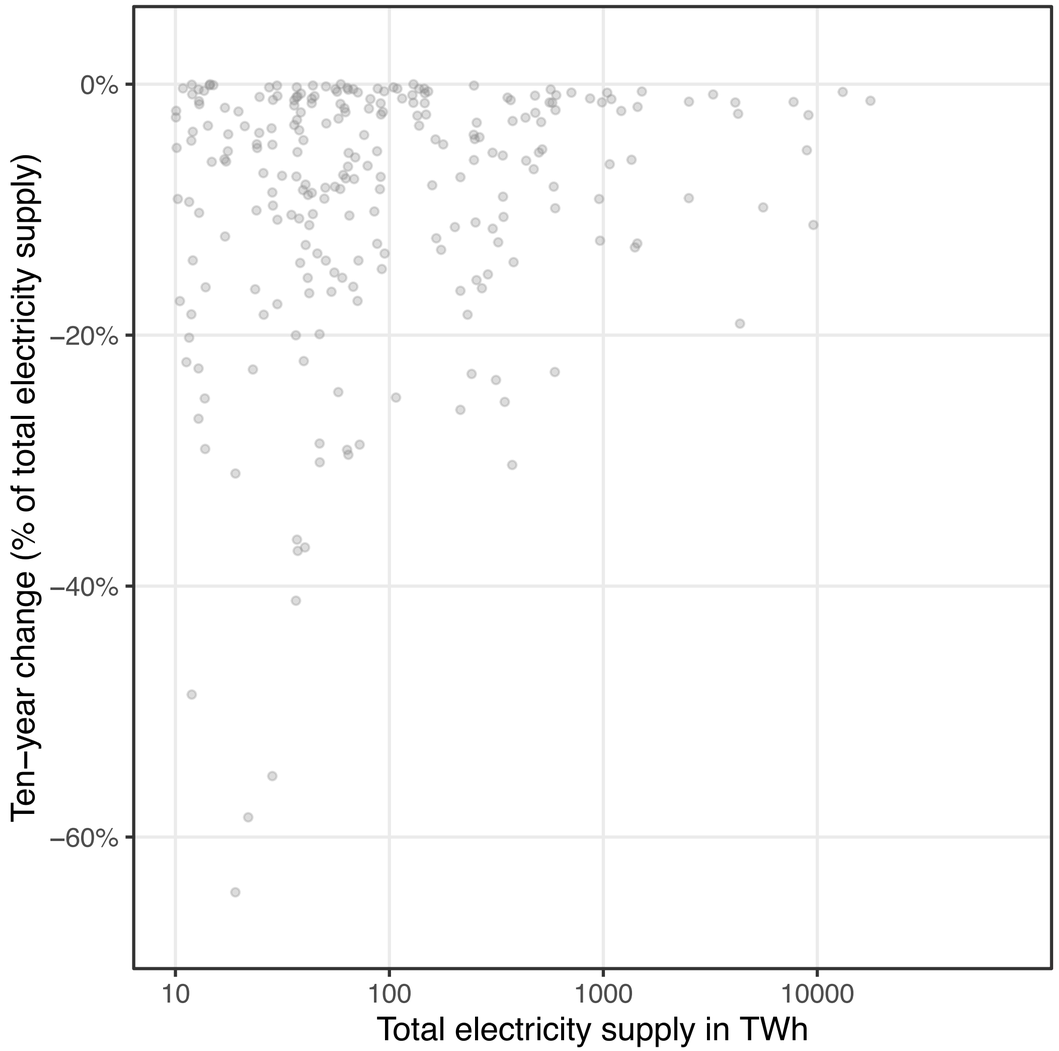
Realistic speed of coal power decline



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One Earth

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Vinichenko et al. 2021

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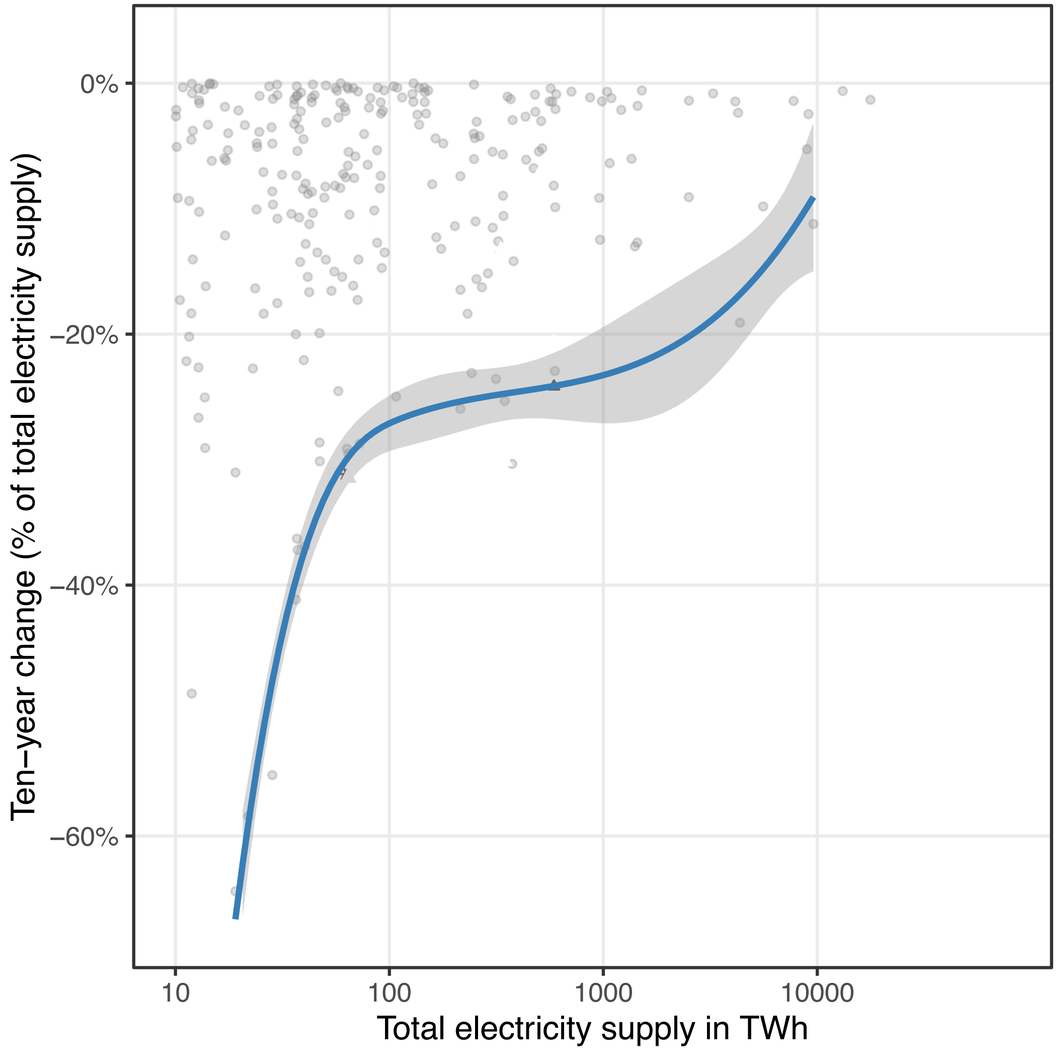
Larger countries decline at slower rates



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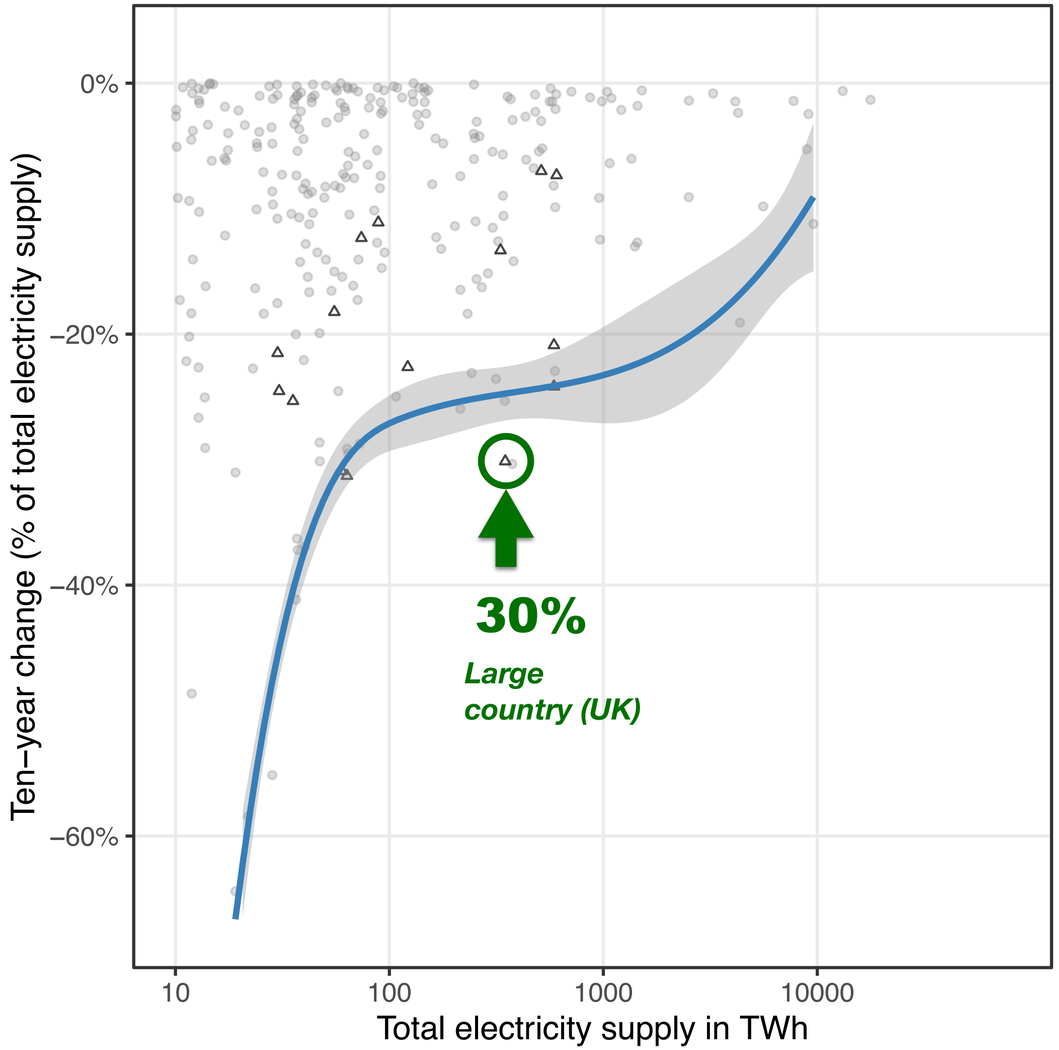

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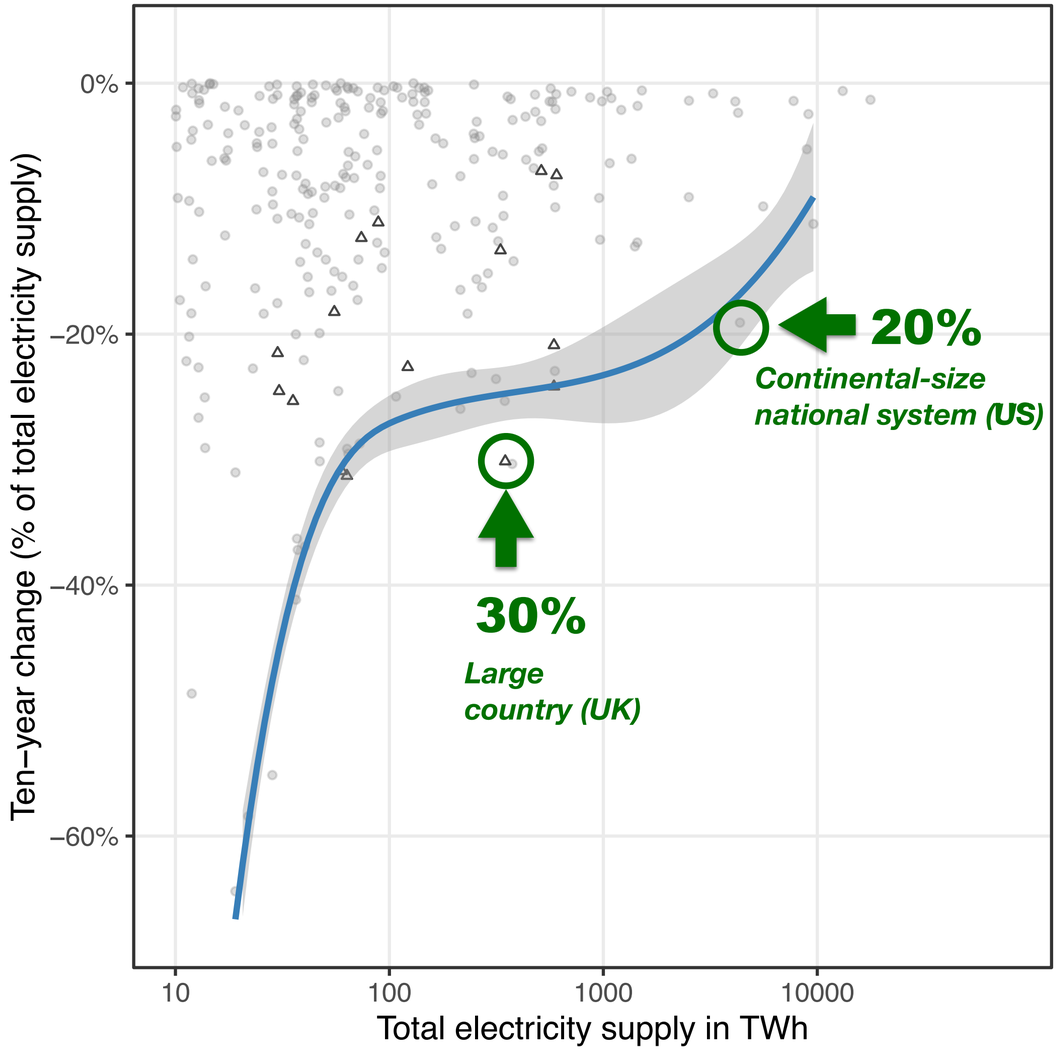

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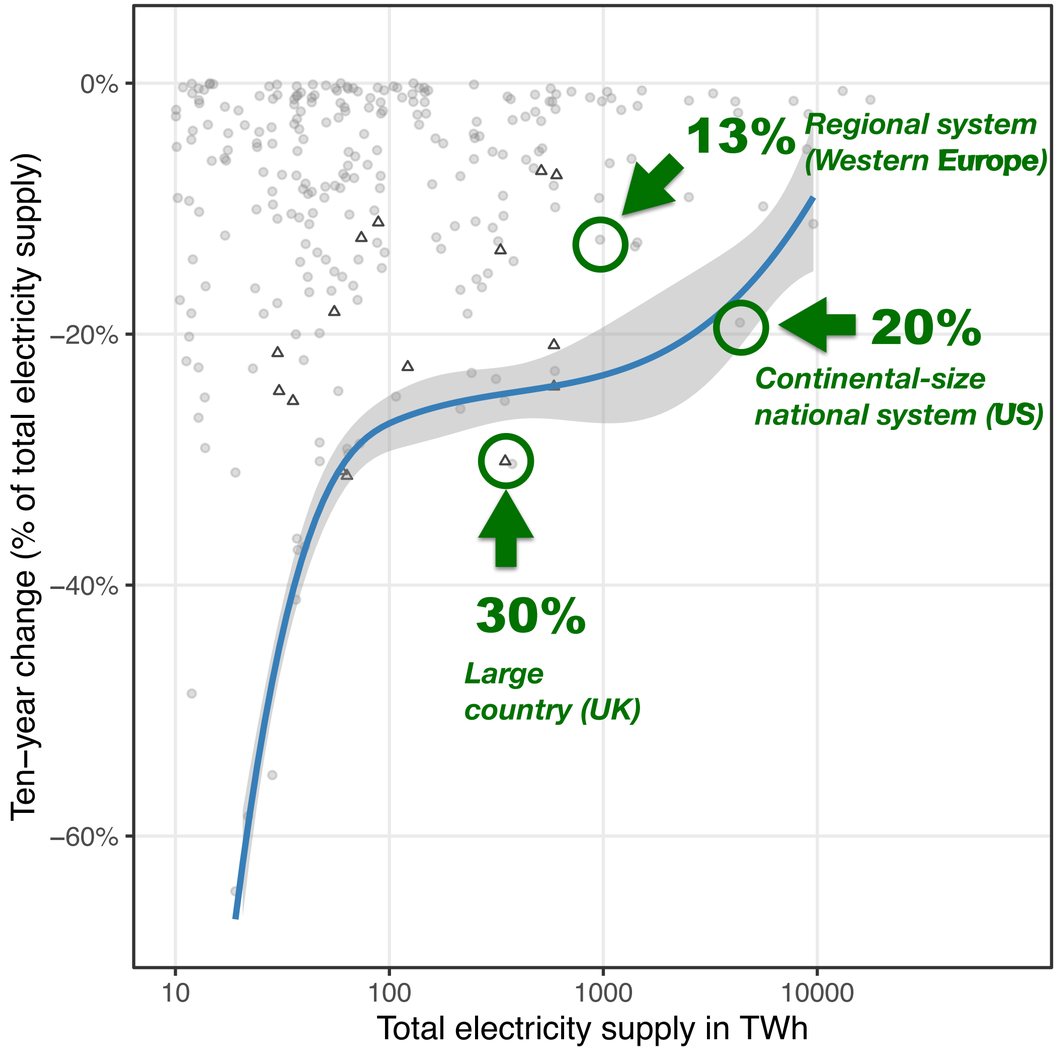

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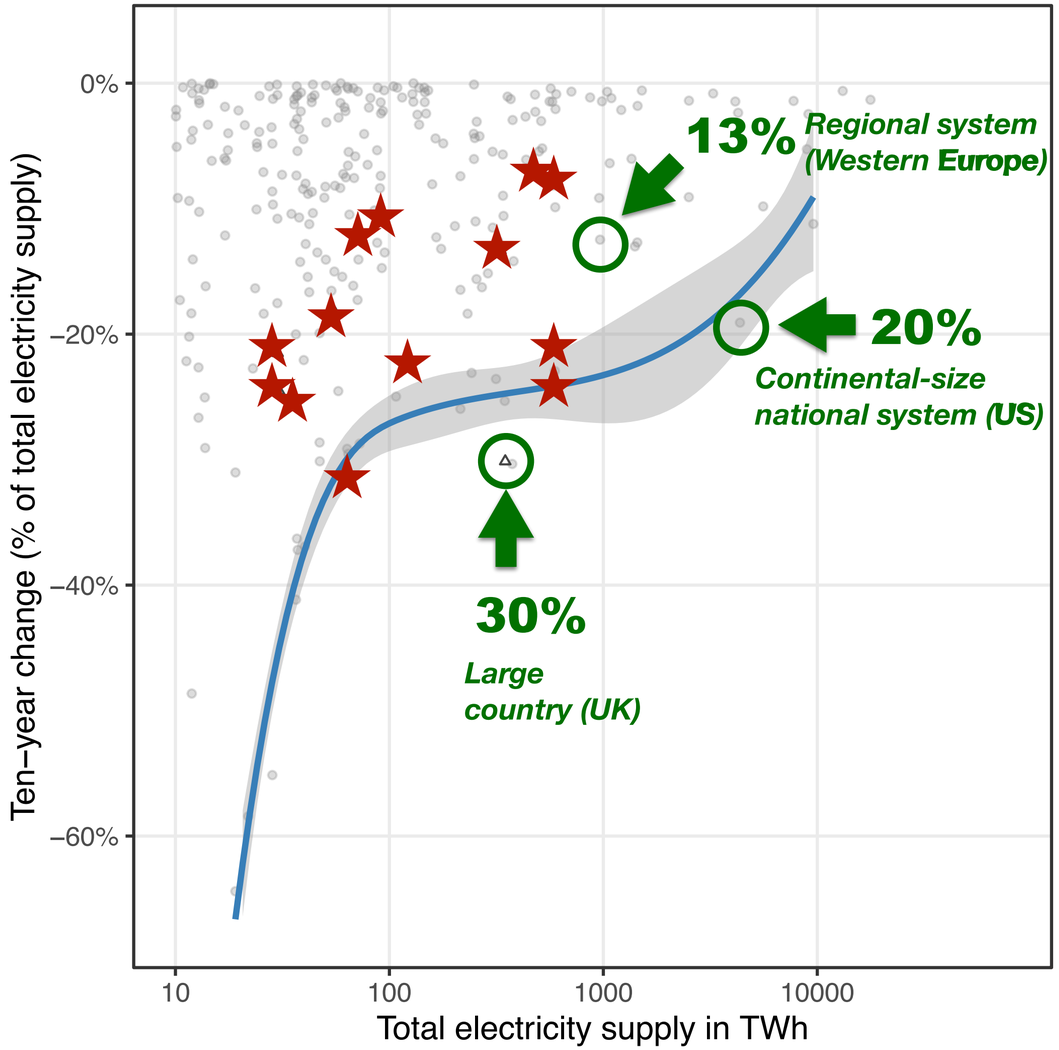

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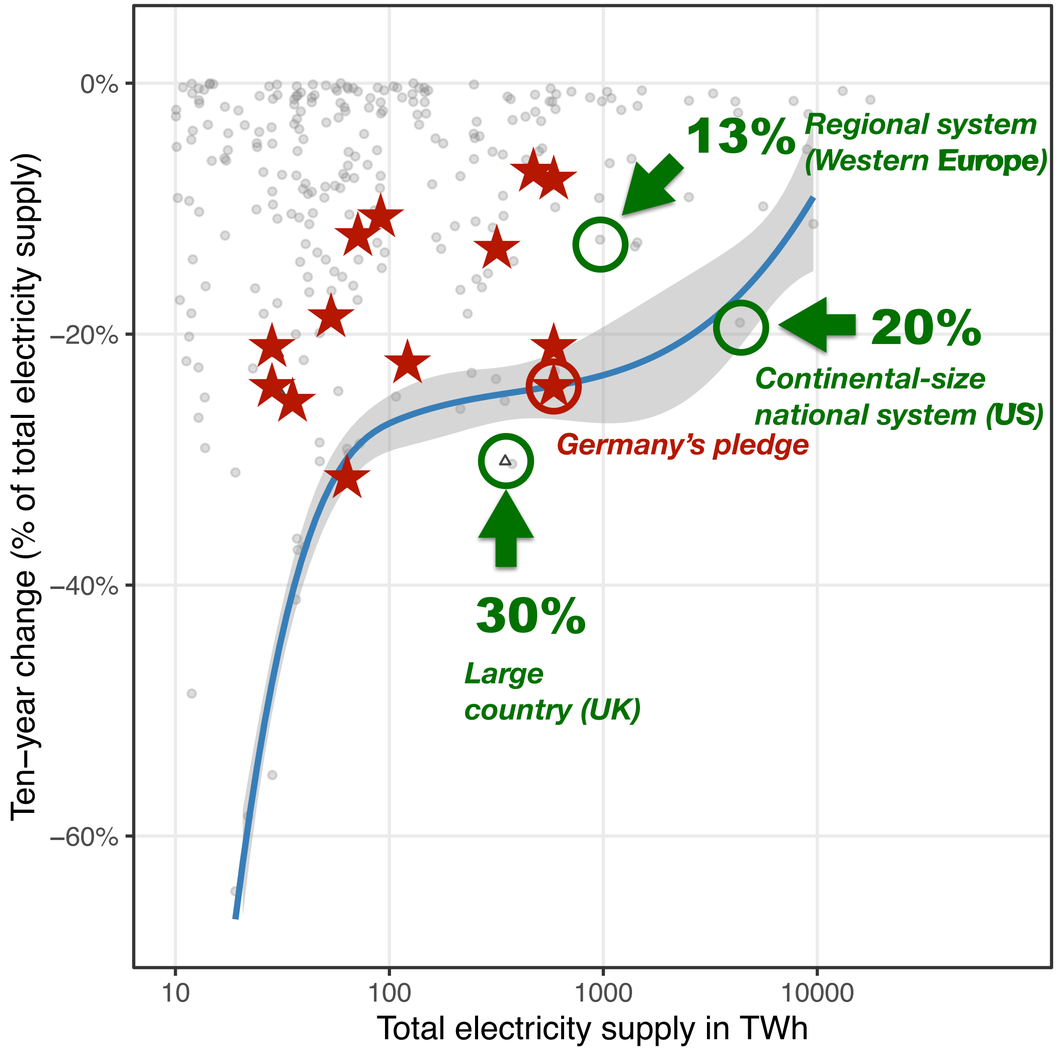

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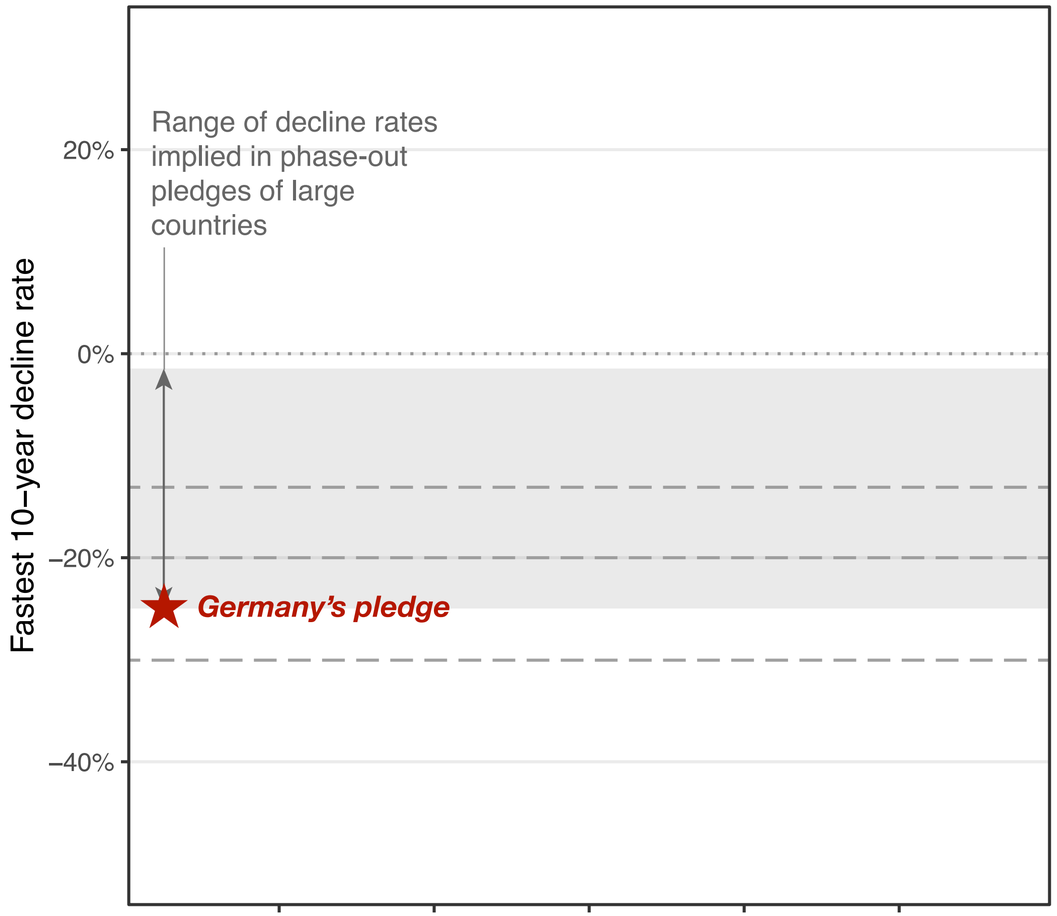

Historical benchmarks

Europe decline rate

the US decline rate

the UK decline rate

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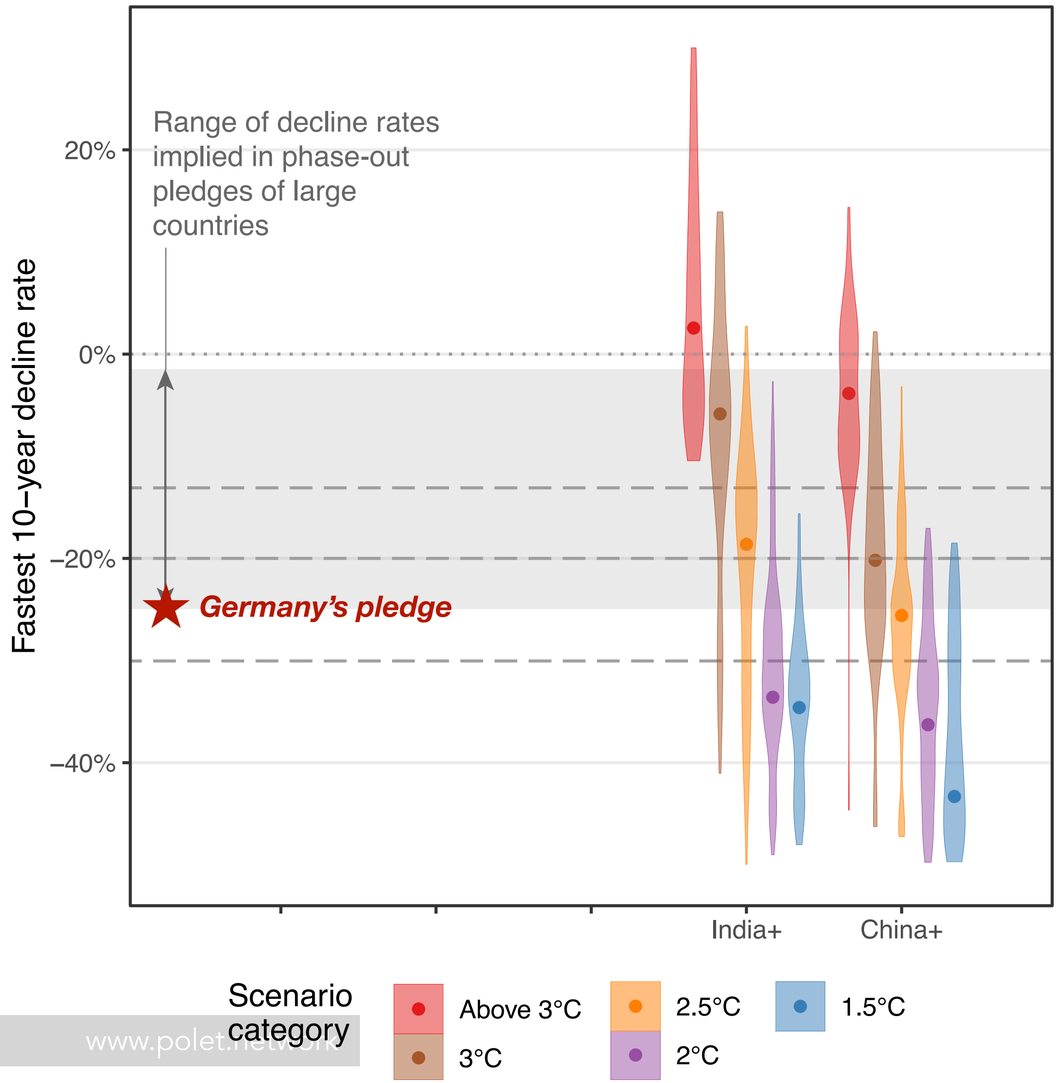

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[3] Centre for Climate and Energy Transformation, University of Bergen, Bergen, Norway
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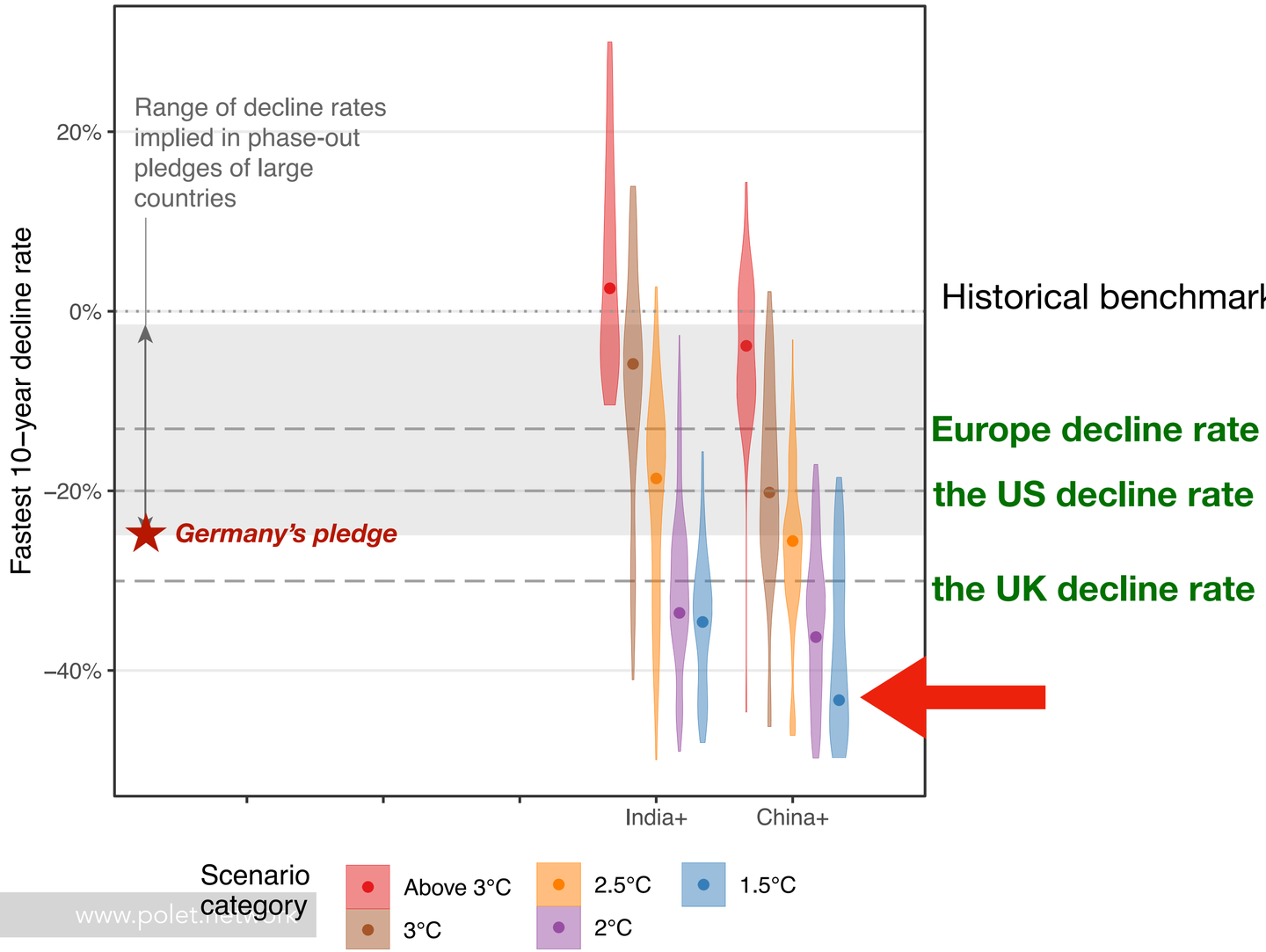

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[3] Centre for Climate and Energy Transformation, University of Bergen, Bergen, Norway
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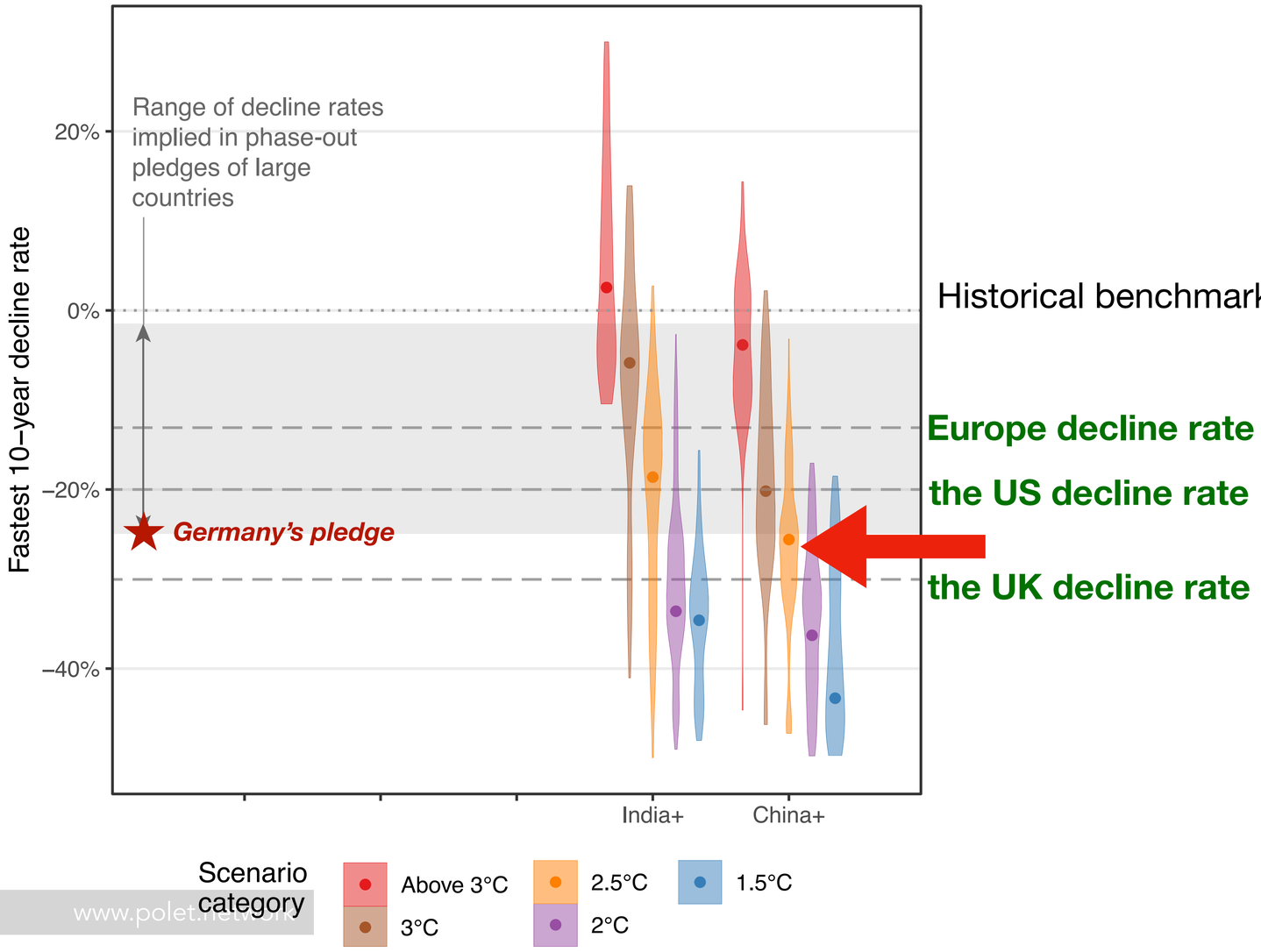
Vinichenko et al. 2023

Feasibility of coal phase-out

Decline rates in IPCC pathways raise feasibility and fairness concerns



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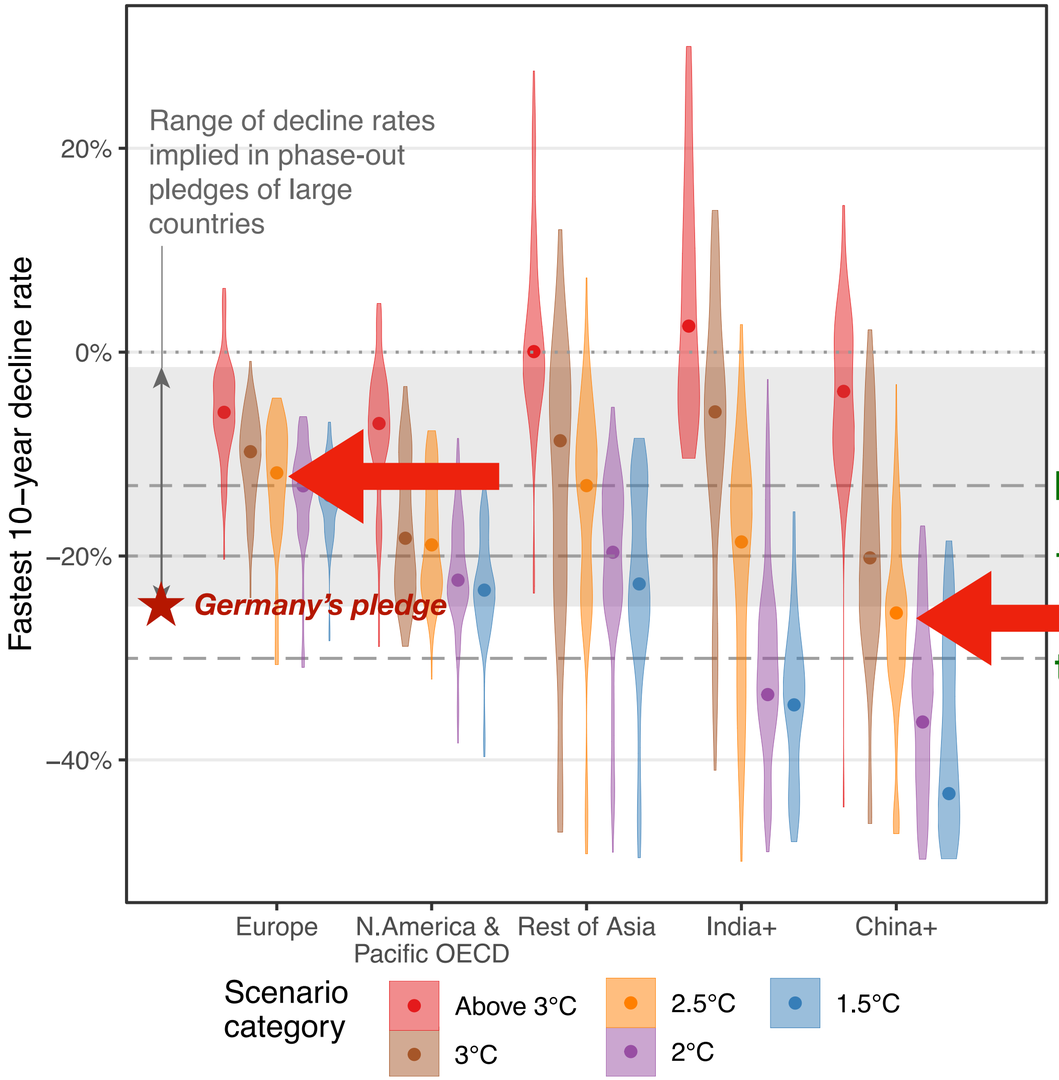

Historical benchmarks

Europe decline rate

the US decline rate

the UK decline rate

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Vinichenko et al. 2023

How much would it really cost to phase out coal in Asia?

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"*For Indonesia, retiring coal early will cost us…we have to have funding to retire coal earlier.*" (Indonesia's finance minister 2021)

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"we know very well that if we don't have credible just transition policies […] we will not be able to convince our population to be […] part of the transition. We have to mobilise funds…" (Timmermans 2021)

Article

Socio-political cost of accelerating coal phase-out

Lola Nacke, Vadim Vinichenko, Aleh Cherp, Avi Jakhmola, Jessica Jewell

https://doi.org/10.21203/rs.3.rs-2733550/v1

Abstract

While macroeconomic models highlight rapid coal phase-out as an urgent climate mitigation measure, its socio-political feasibility is unclear. The negative impacts of coal phase-out for companies, workers and coal-dependent regions, and the unequal global distribution of the coal phase-out burden has triggered resistance and calls for just transitions. Here, we construct a database of domestic and international just transition policies and partnerships that compensate affected actors of coal phase-outs. By comparing coal phase-out in countries which have compensation plans with those that

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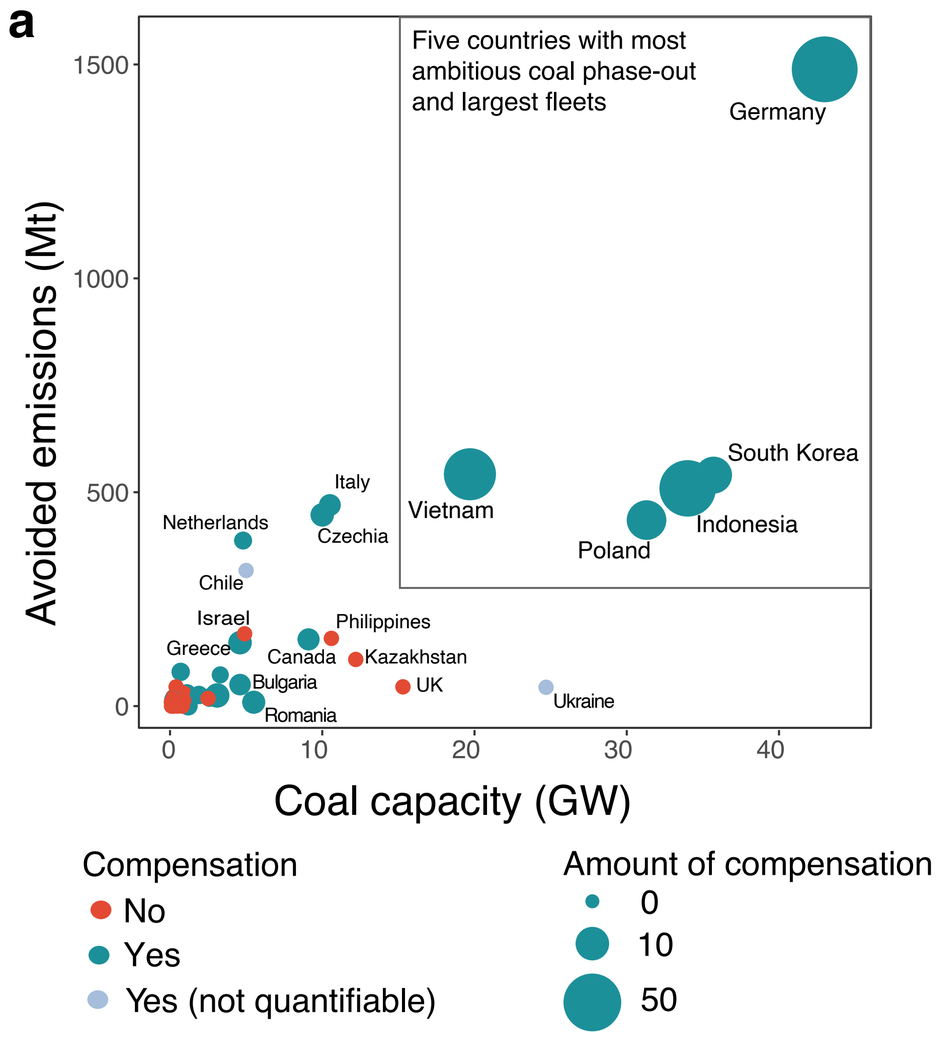
Countries with more coal always compensate for phase-out



- **Compensation packages**: Transfers from governments to actors affected by coal phase-out, such as workers, regions, or coal companies

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Quantifying compensation levels

- **Compensation packages**: Transfers from governments to actors affected by coal phase-out, such as workers, regions, or coal companies
- We identify all countries with coal phase-out commitments and associated compensation packages
- We quantify their cost by reviewing national policy documents, EU policy document, and grey literature

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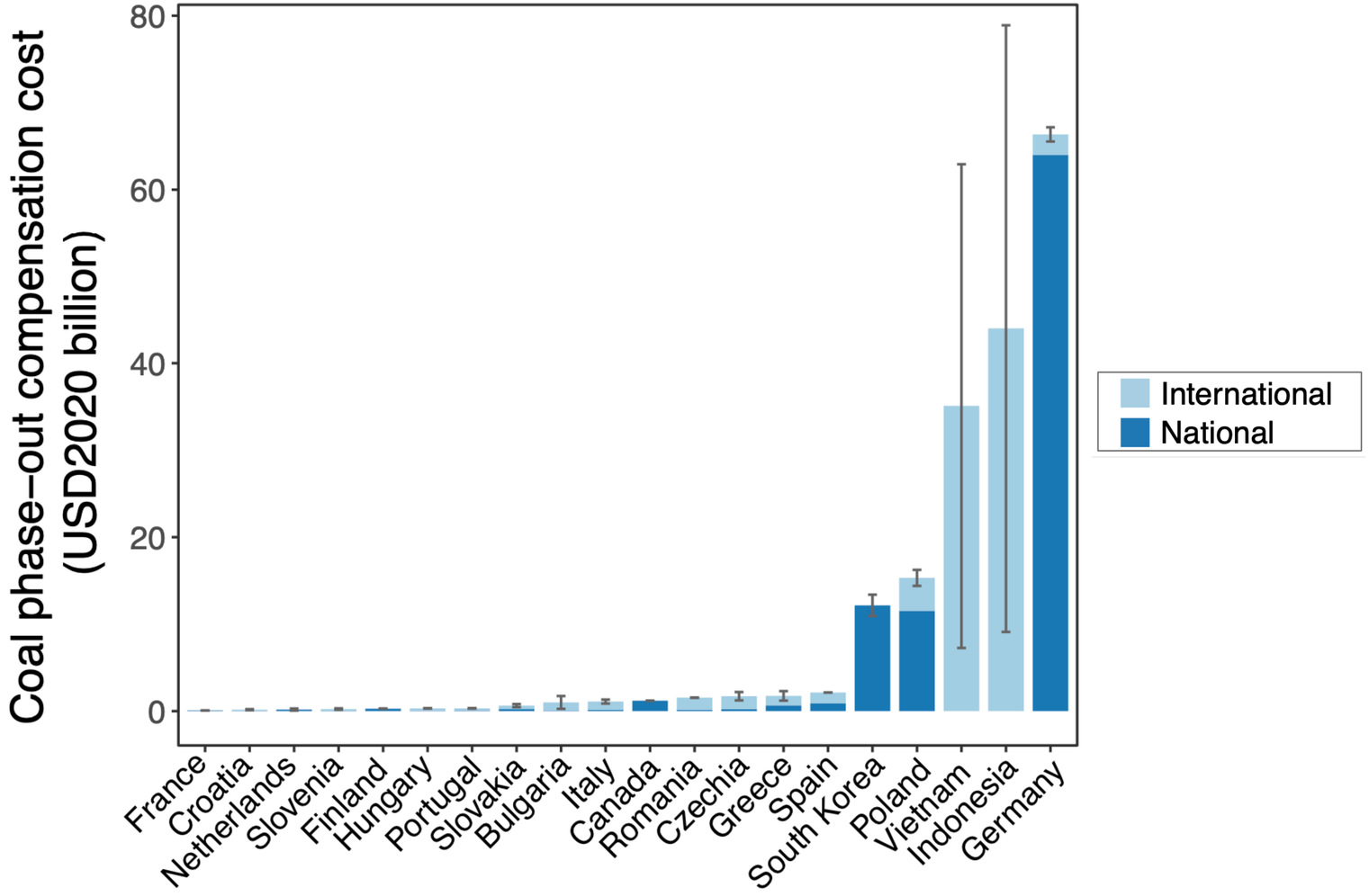
Compensation packages for different countries: About half international half national



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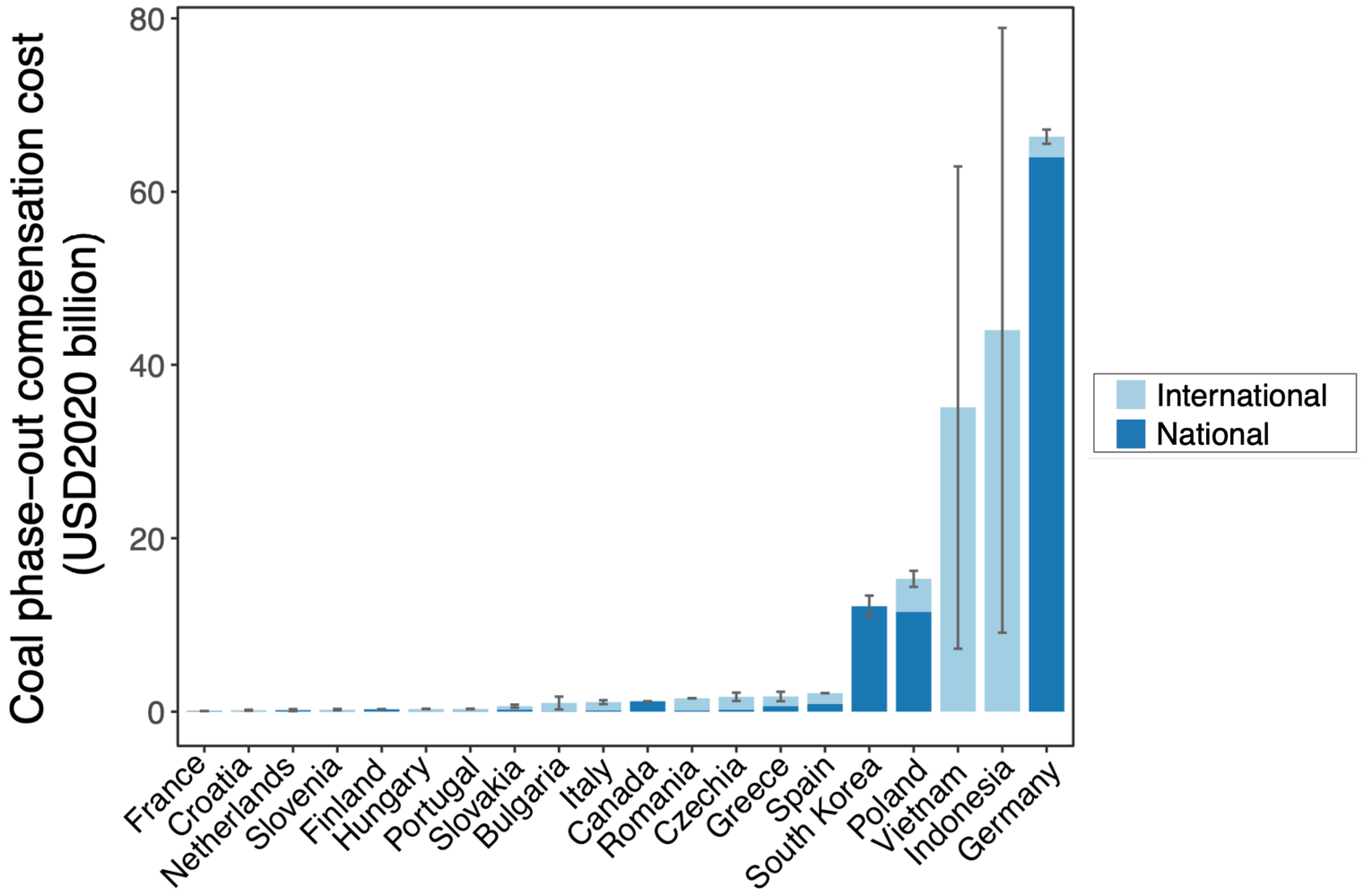
What predicts the size of compensation?



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Supplementary Table 11. Coefficients from ten best-performing regression models with central pledges and central compensation estimates.
"***" indicates that variables are found significant at the 0.1% level. "**" Indicates that variables are found significant at the 1% level. "*" Indicates that variables are found significant at the 5% level. "." Indicates that variables are found significant at above 5% levels.

Variable	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
Avoided emissions (Gt CO2)	39.8*** (3.8)	36.7*** (4.6)	42.2*** (4.2)	34.9*** (4.4)	40.3*** (3.8)	39.8*** (3.9)	40.6*** (4.3)	39*** (4.6)	37.5*** (3.8)	34*** (4.5)
Coal mined (Mt)	0.003*** (0.0001)		0.003*** (0.0005)		0.003*** (0.0005)	0.003*** (0.0005)	0.003*** (0.0005)	0.003*** (0.0005)	0.003*** (0.0005)	
Coal jobs		0.2*** (0.03)		0.2*** (0.03)						0.1*** (0.03)
Coal power concentration		-9204. (4658)	-5748 (4498)	-10460* (4633)			-6908 (4583)			
ODA.EU_ recipient	4044. (2065)	2944 (2102)	3659. (2069)		7017* (3238)	5318. (2777)		4432. (2385)		3746. (2146)
GDP								0.0005 (0.002)		
Gov_effect					2154 (1815)					
SH_cap						1373 (1982)				
AIC	794.4	794.4	794.6	794.6	794.8	795.8	796	796.3	796.4	796.6
Adj R2	0.84	0.85	0.85	0.84	0.85	0.84	0.84	0.84	0.83	0.83

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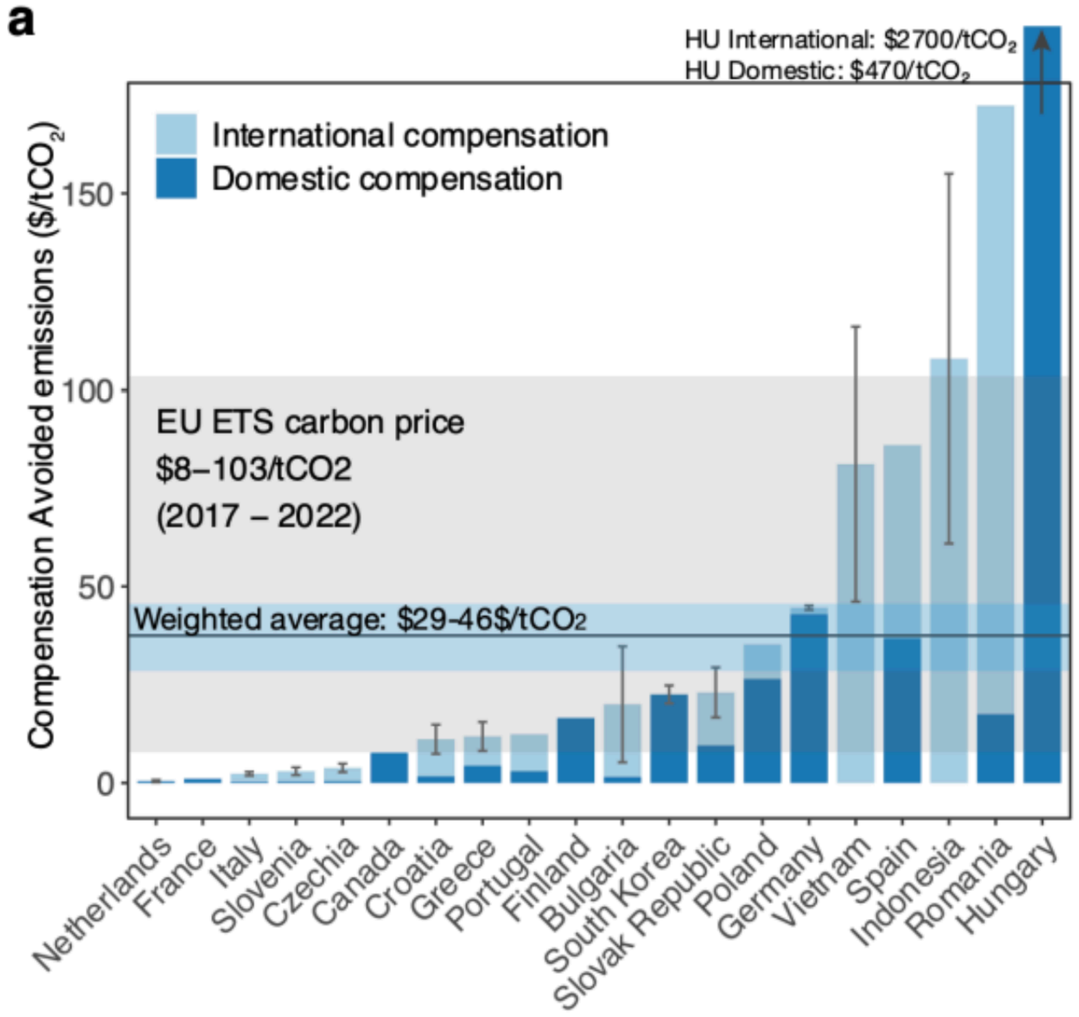
Compensation levels similar to social cost of carbon



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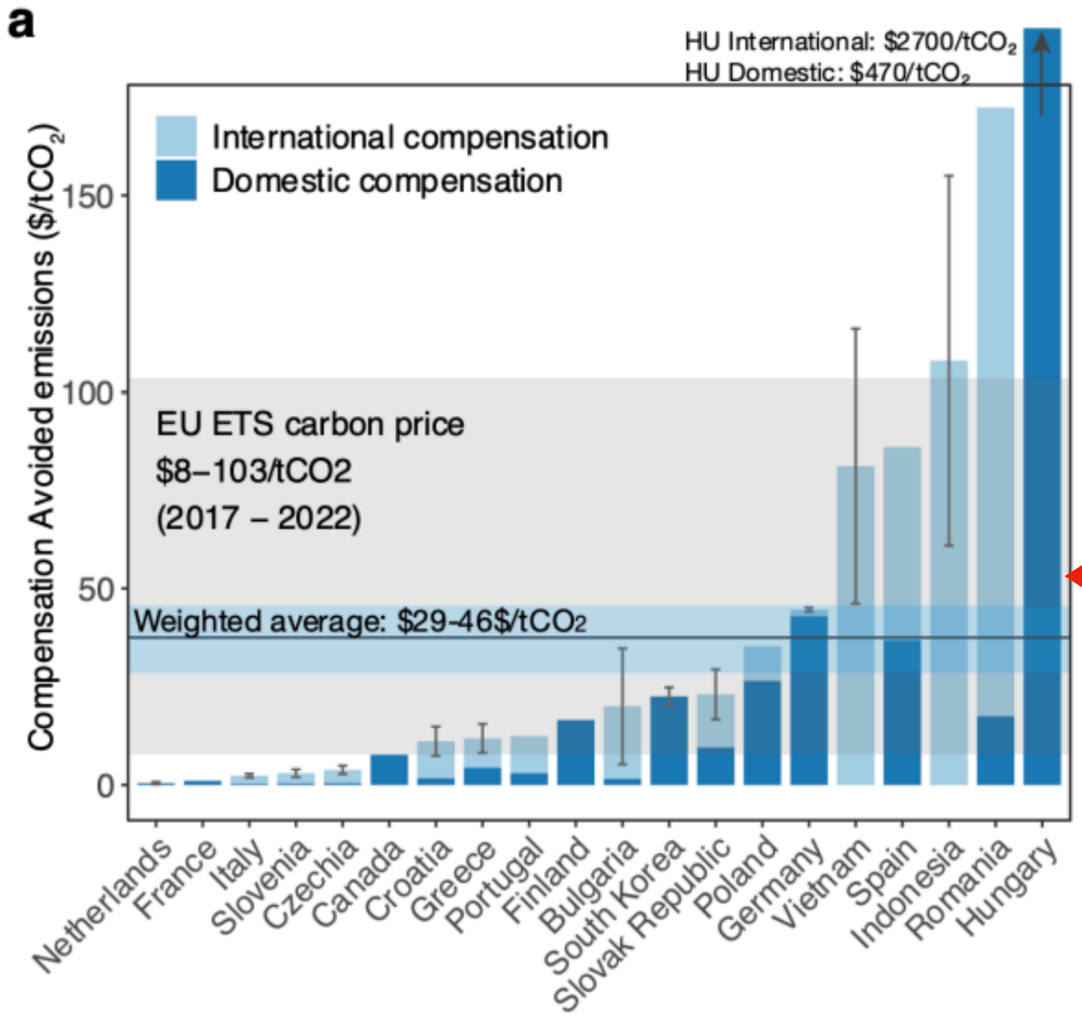

$52/ton CO_2

Social cost of carbon 2030
(Nordhaus 2016)

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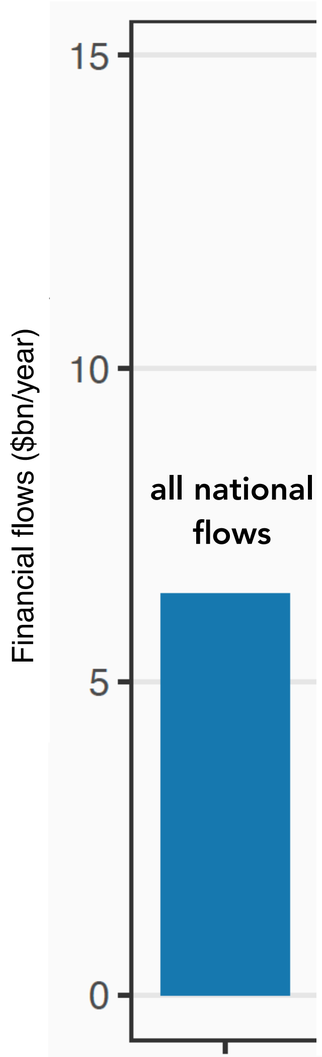

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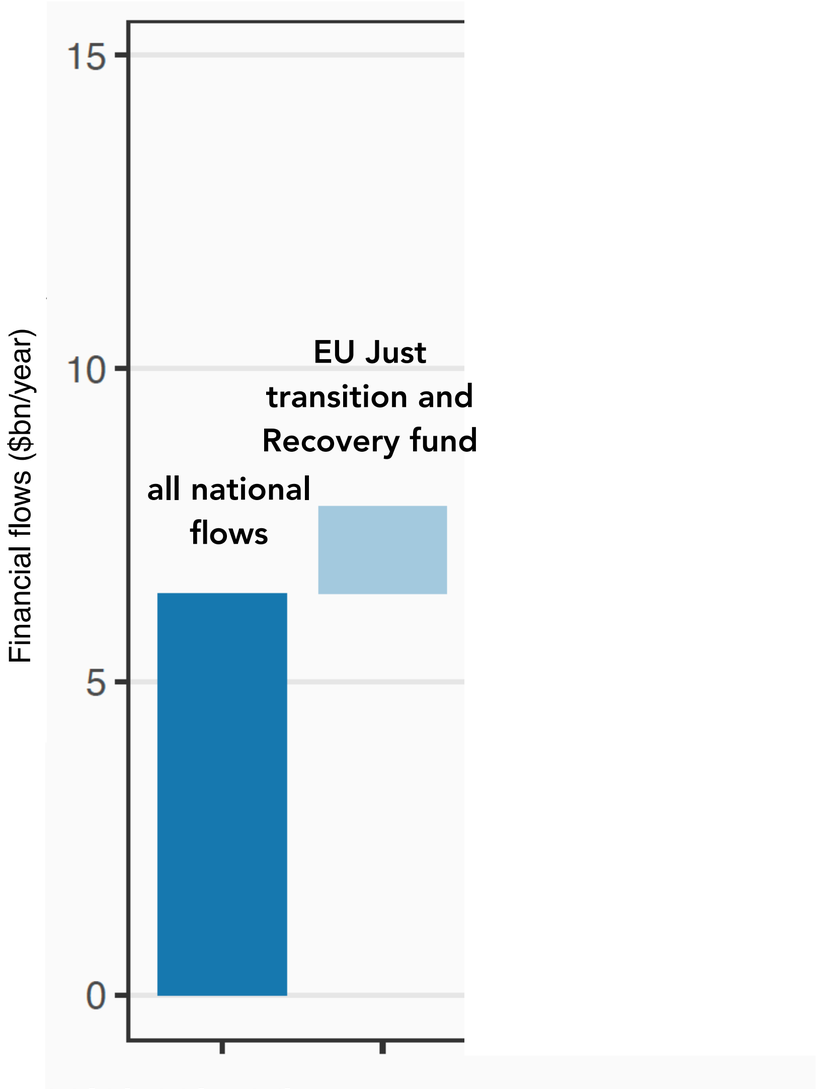

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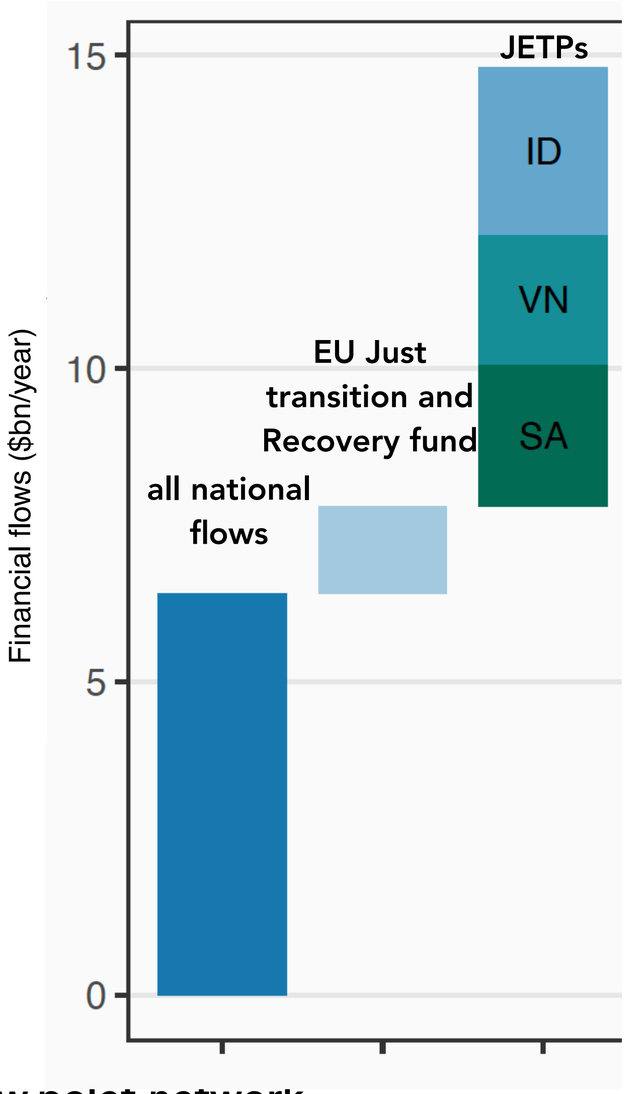

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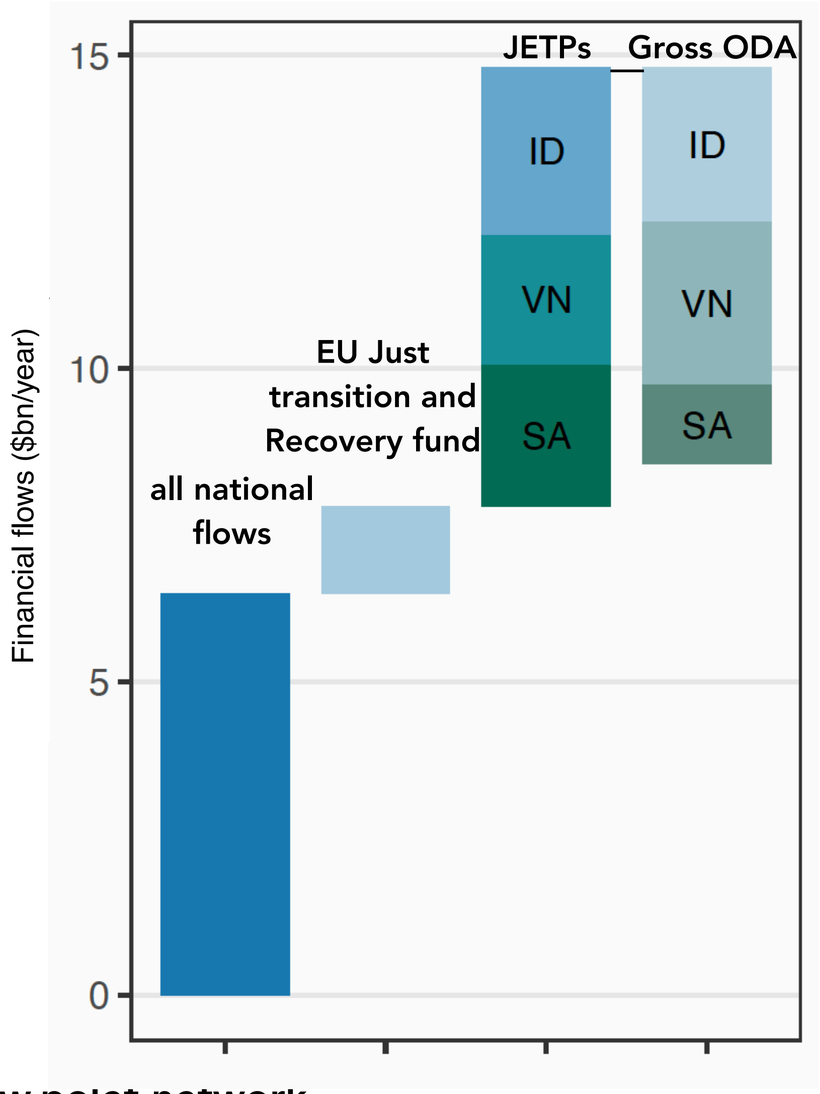

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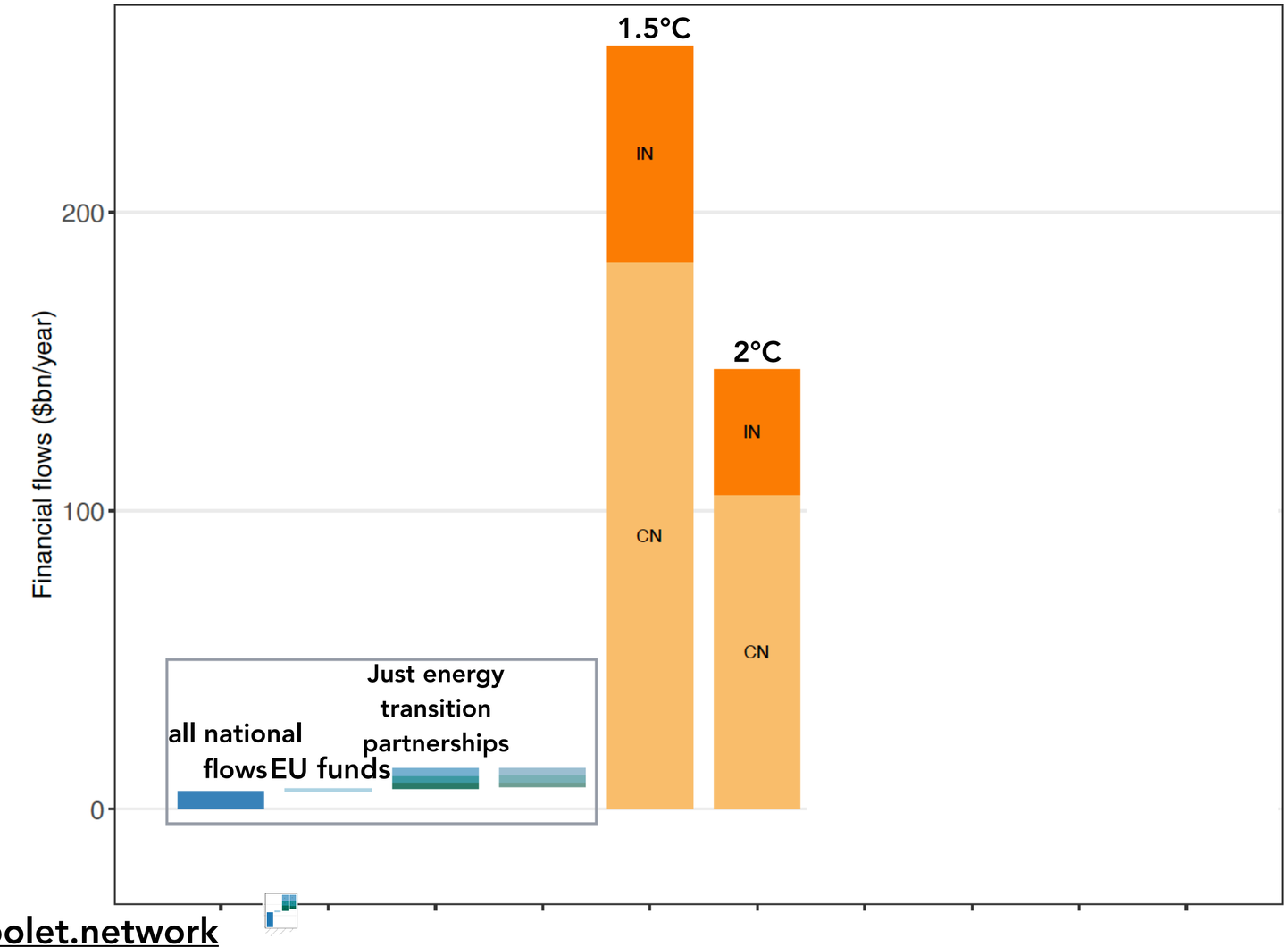

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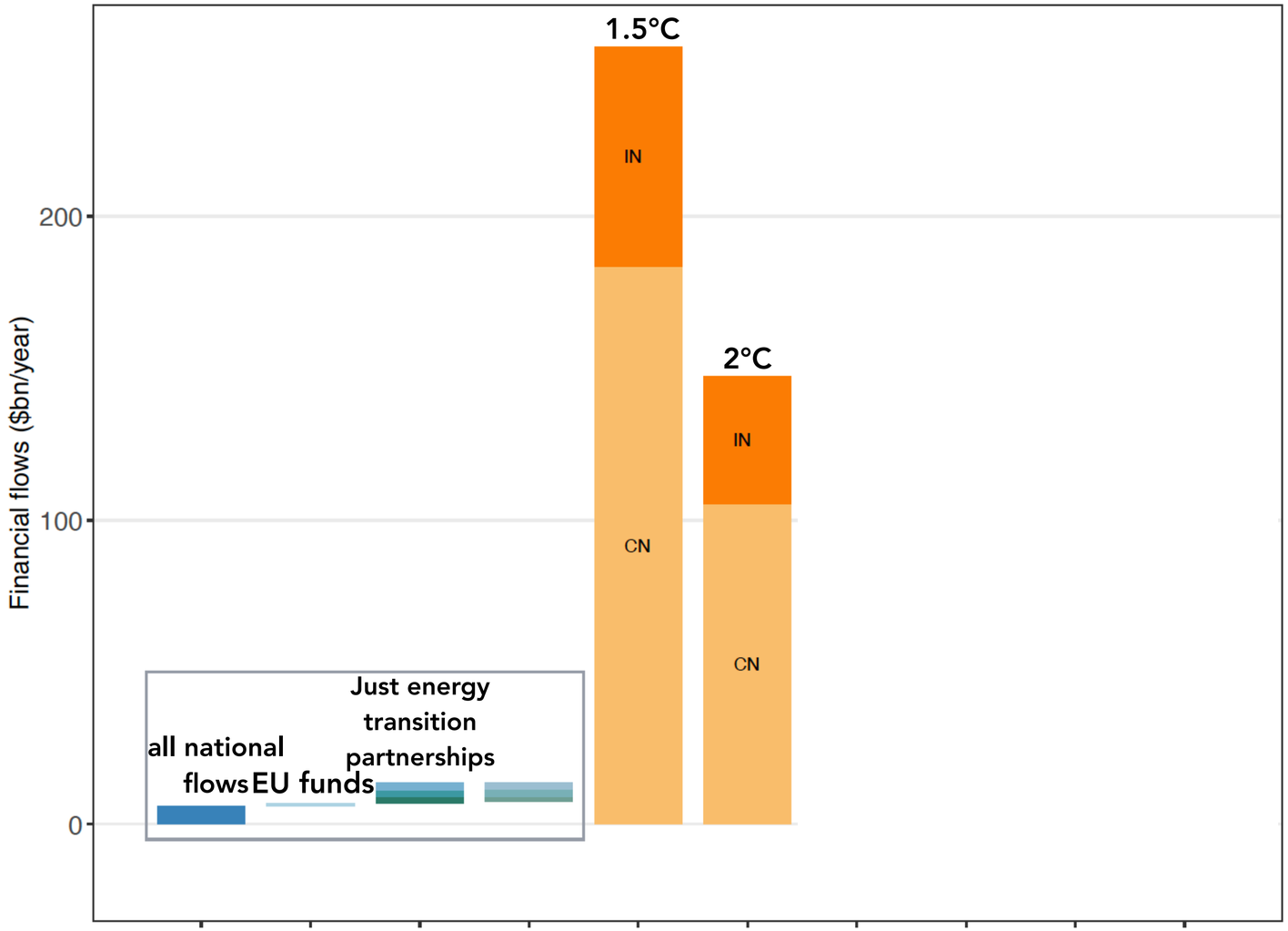

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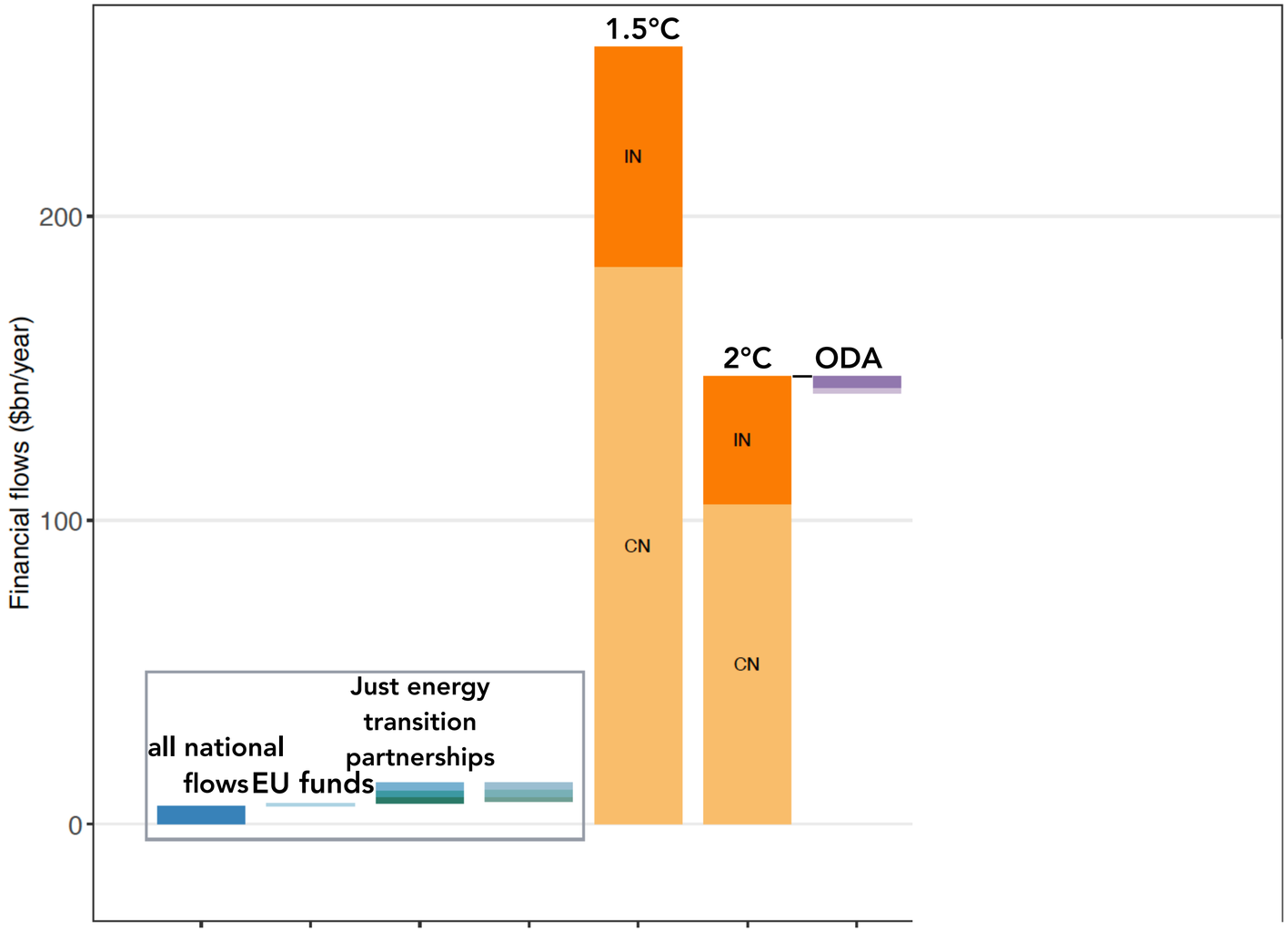
Can international financial flows support compensating Asian countries coal phase-out in line with climate targets?



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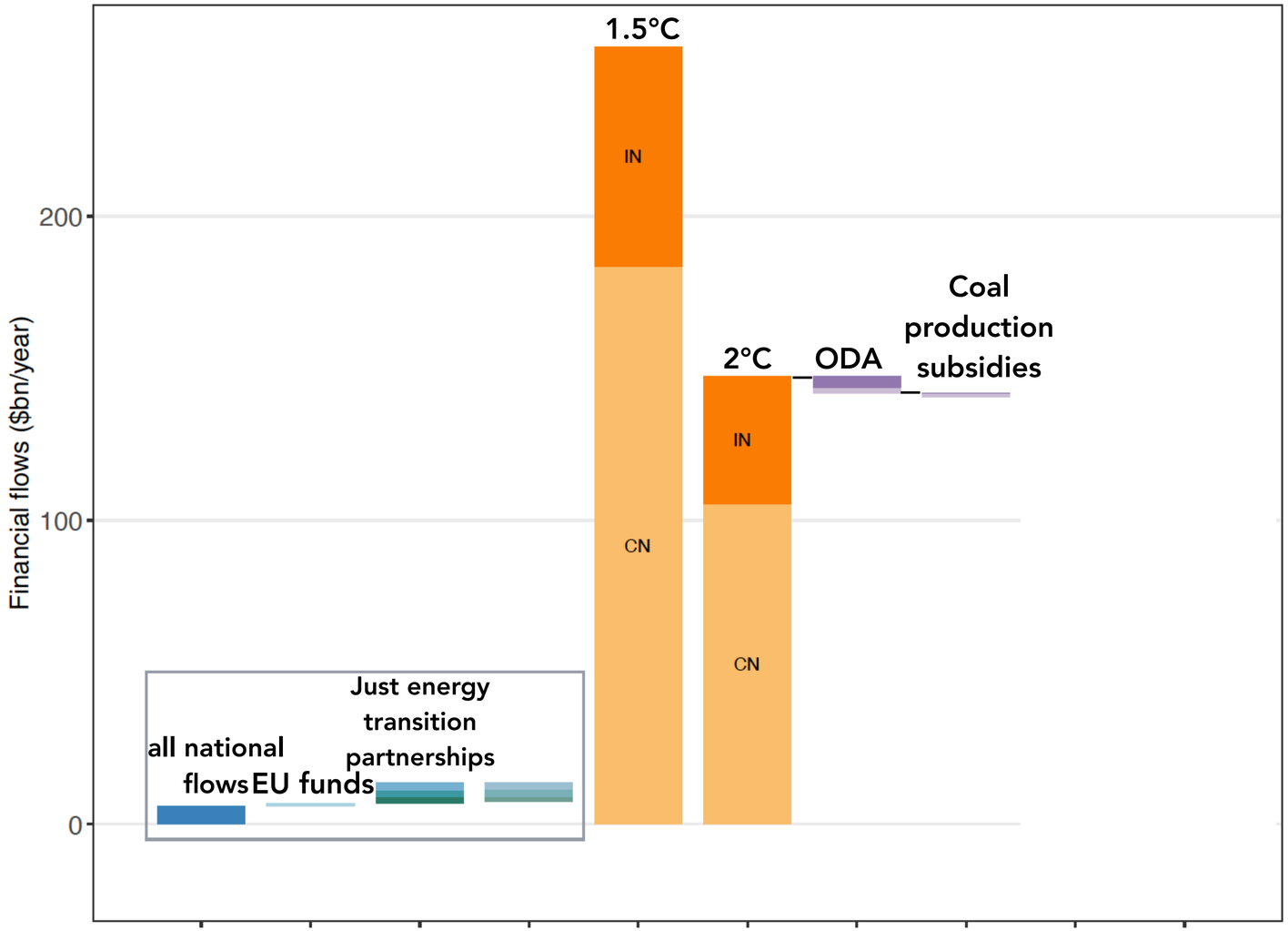

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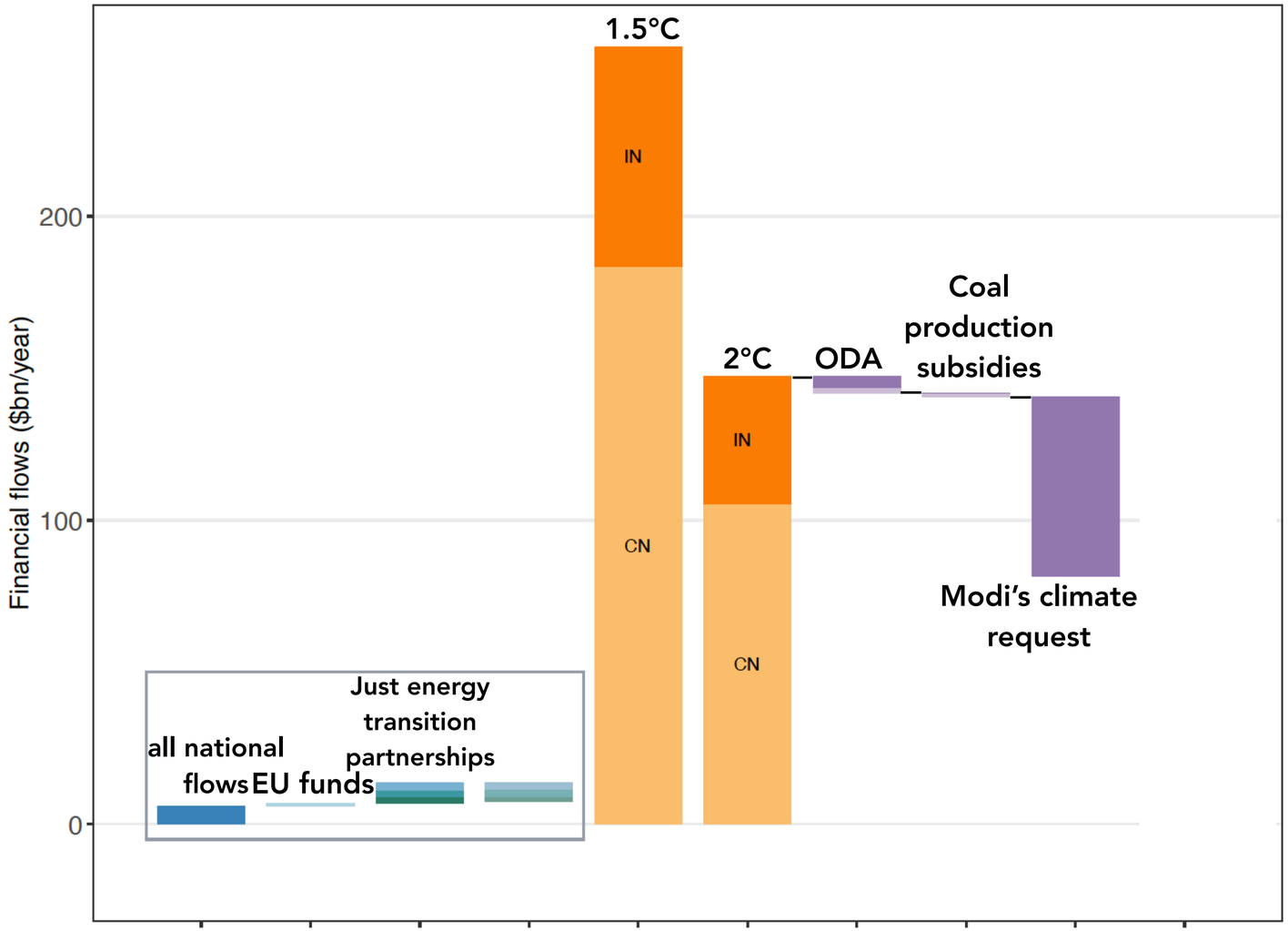

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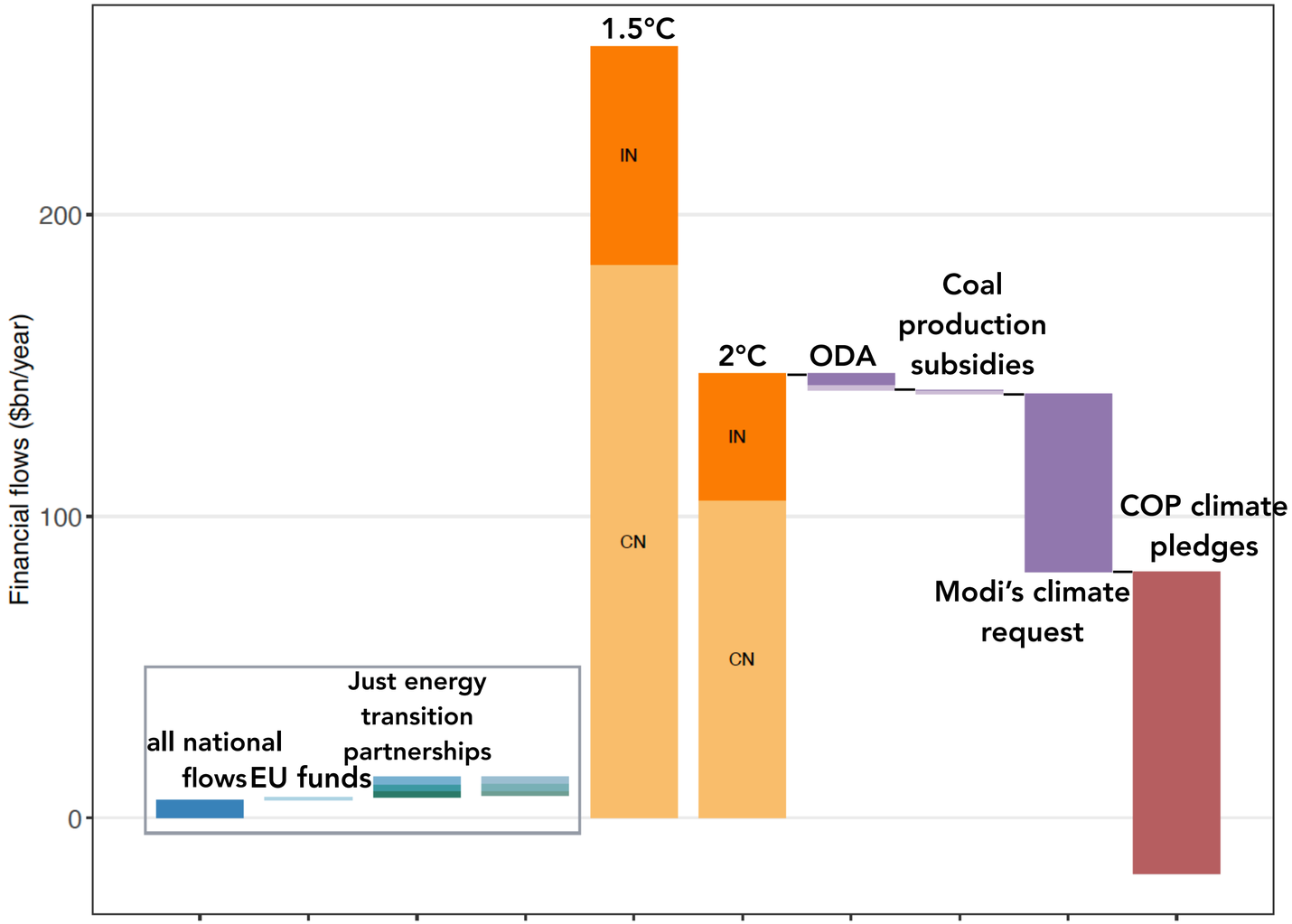

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