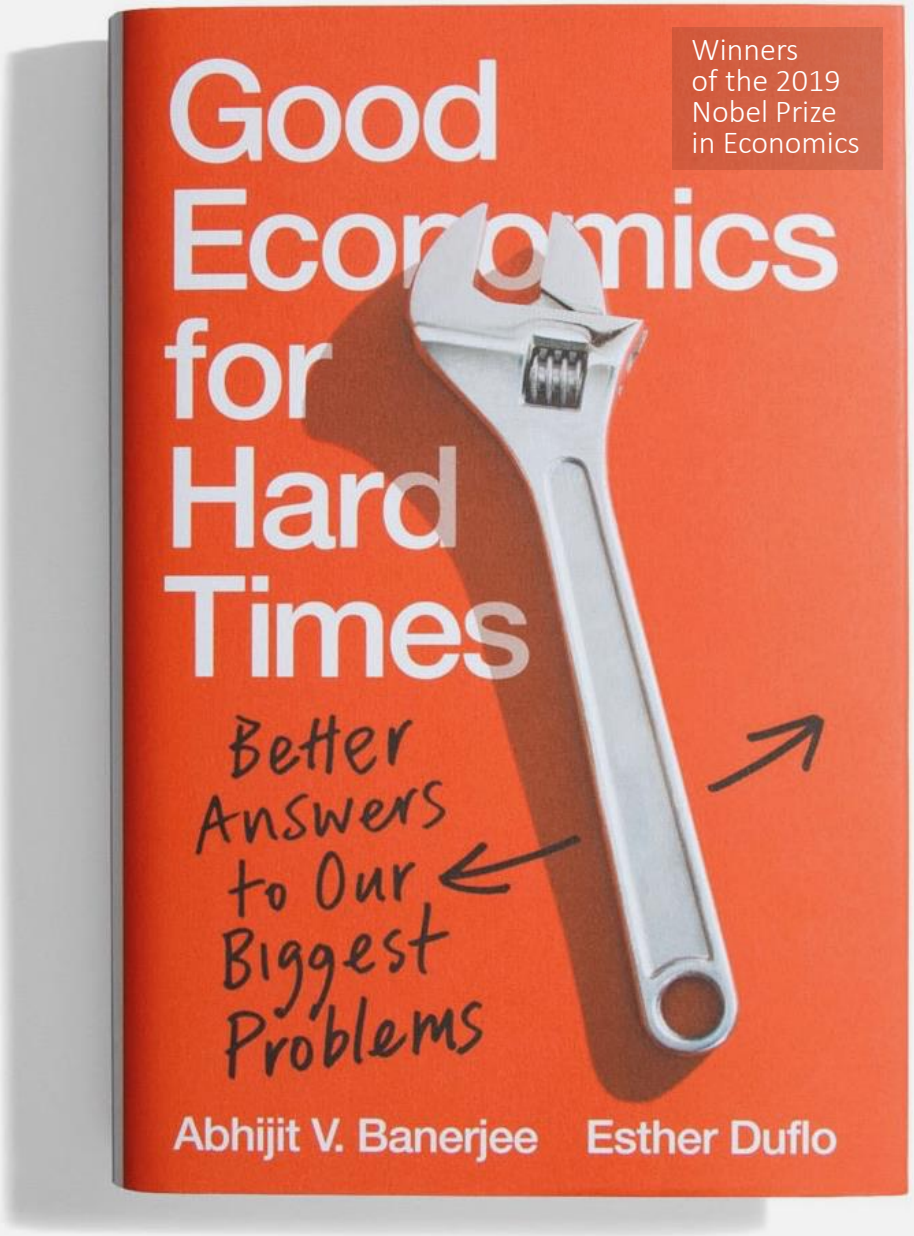
J-PAL
ABDUL LATIF JAMEEL POVERTY ACTION LAB

Massachusetts Institute of Technology

Good Economics For ~~Hard Times~~ ~~Harder Times~~ More Hopeful(?) Times

A course by Abhijit Banerjee and Esther Duflo



Lectures 12 and 13: In hot water

Thinking about climate change

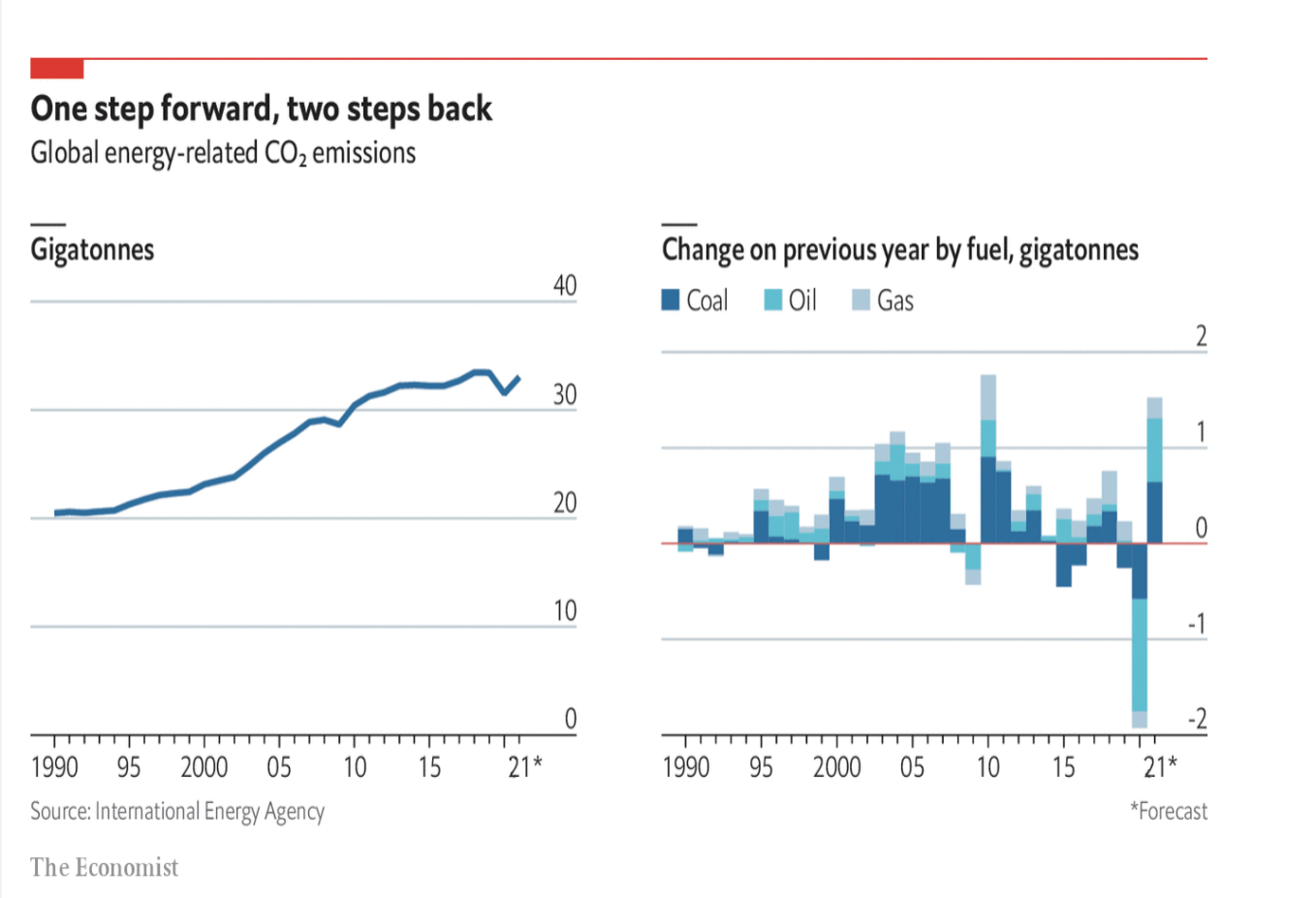
Welcome!

COP26	China	Greta Thunberg
California fires	US leadership?	Worldwide equity
Rising Sea Levels	Gilets Jaunes	Droughts and Floods

A new urgency on climate change?

Credit: hkalkan | Shutterstock.com

The pandemic progress on emissions were short lived



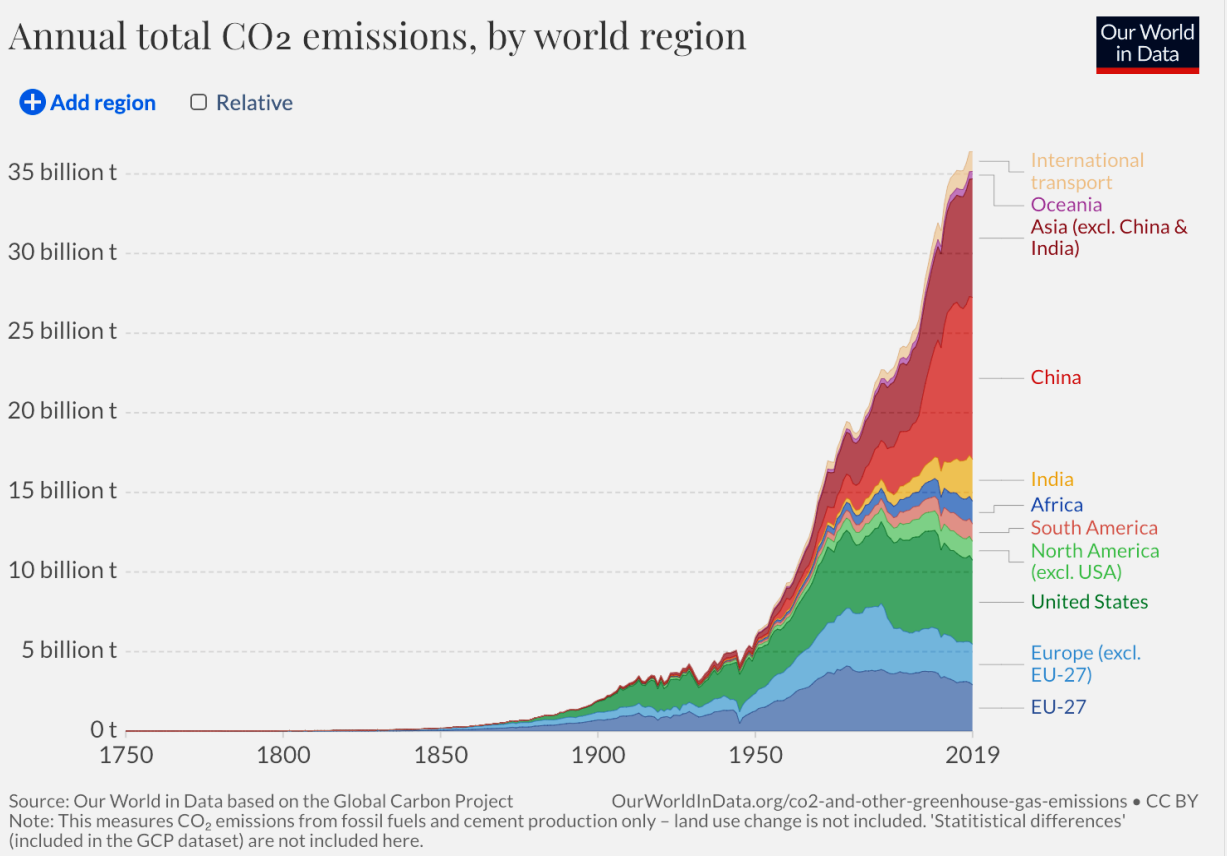
1. Emissions

The emissions responsible for climate change are mainly due to the behavior of rich country citizens

...And some rich citizen in poor countries

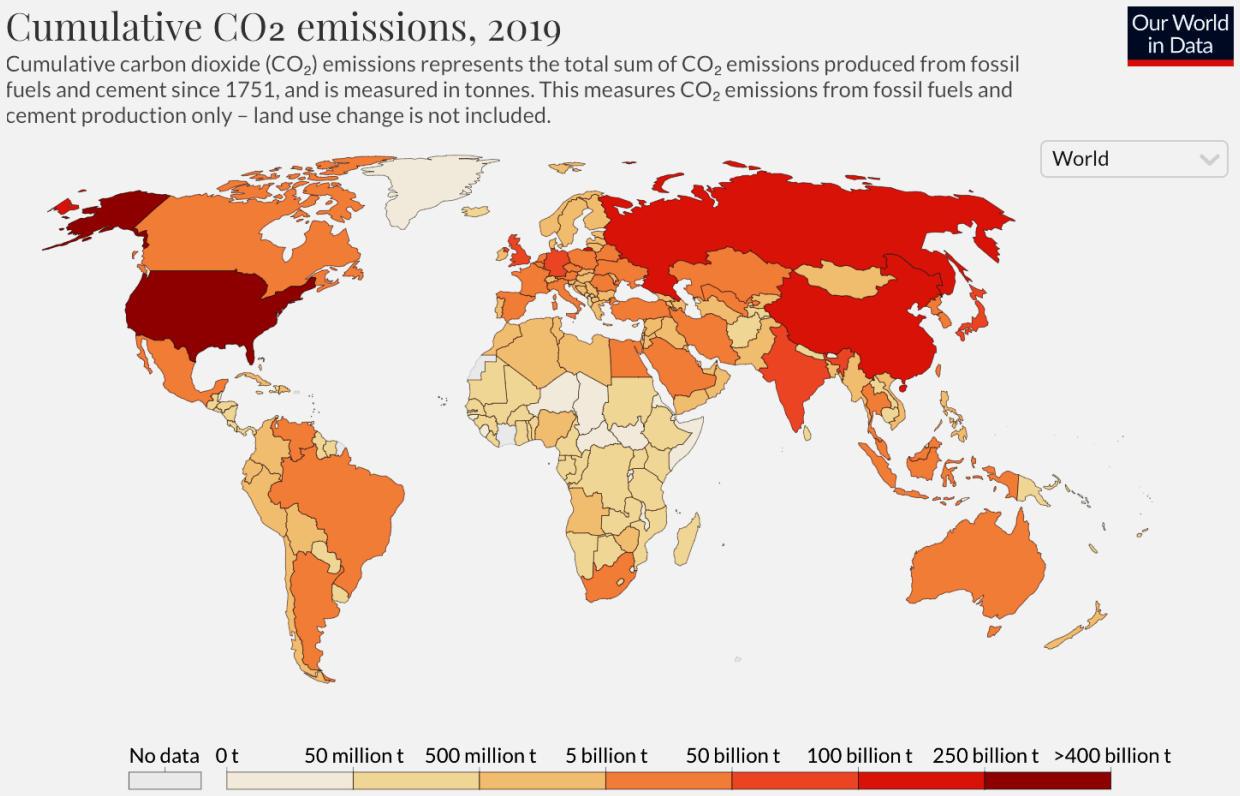
Emission location

Annual total CO_2 emissions by world region



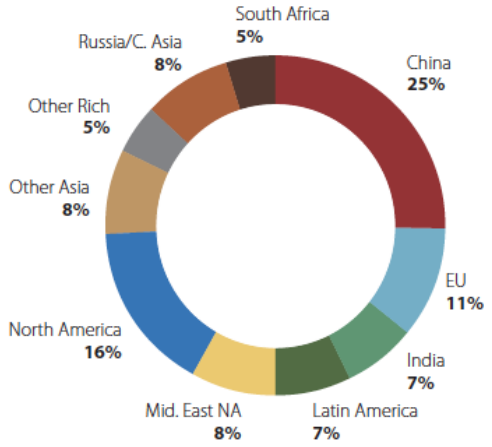
Historical emissions

Cumulative CO_2 emissions, 2019



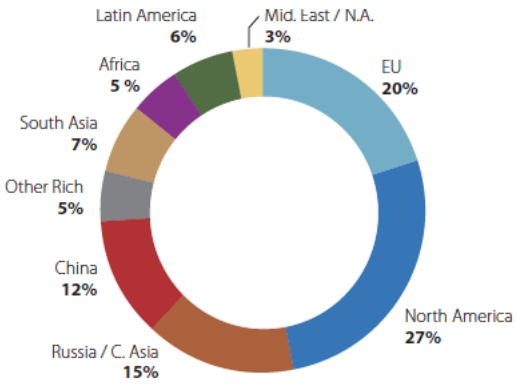
Production, historical production, and consumption

FIGURE 1.B. DISTRIBUTION OF CURRENT PRODUCTION-BASED CO_2e EMISSIONS



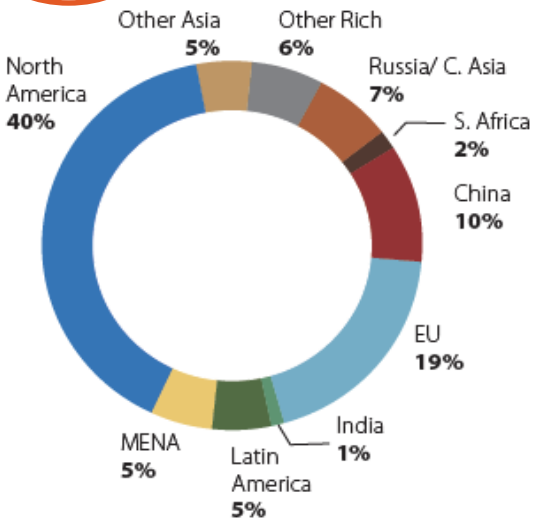
Source: authors based on CAIT (WRI, 2015). Key: China represents 25% of global CO_2e emissions when measured from a production base. Note: data from 2012.

FIGURE 1.C. DISTRIBUTION OF CUMULATED PRODUCTION-BASED HISTORICAL CO_2e EMISSIONS



Source: authors based on CAIT (WRI, 2015) and CDIAC (Boden et al., 2015). Key: Emissions from North America represent 27% of all CO_2e emissions ever emitted since the industrial revolution. Note: these are production-based emissions estimates. Regions may slightly vary from those of other graphs, see Boden el at. (2015).

Top 10% emitters: 45% of world emissions



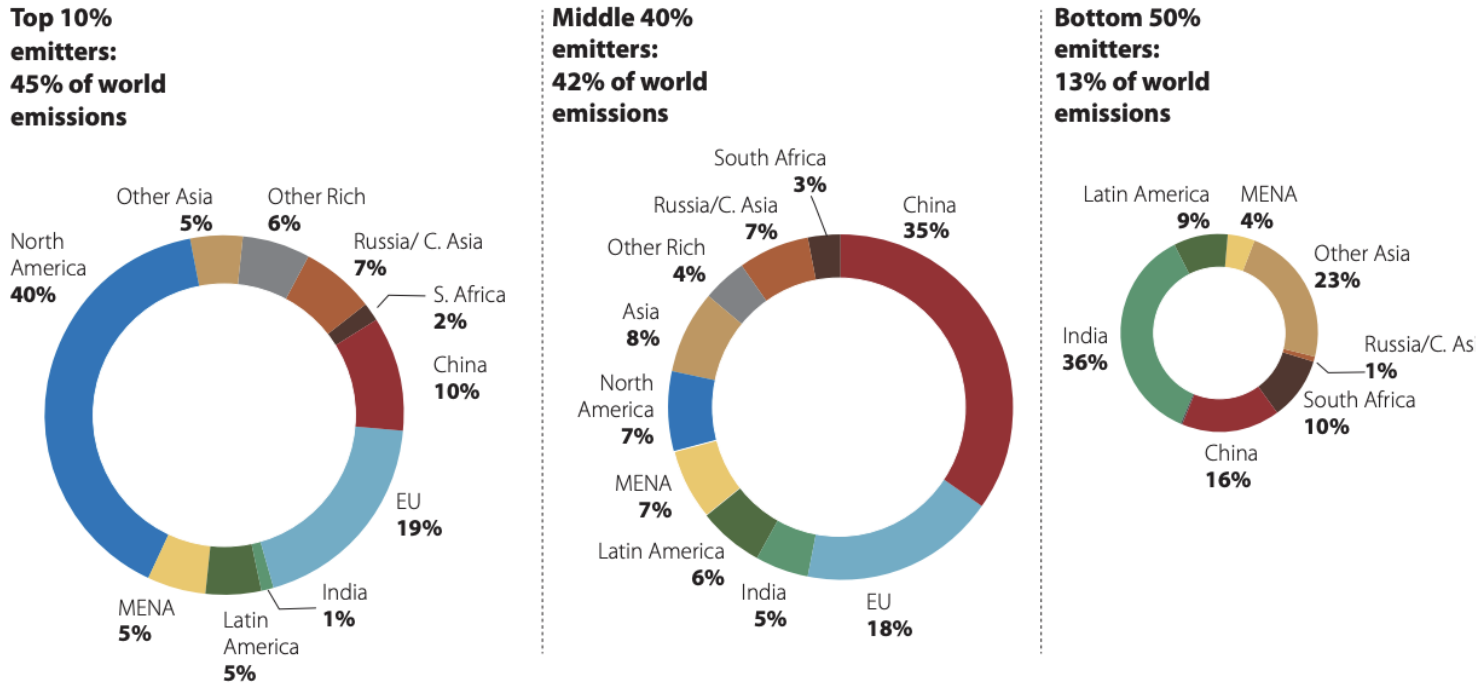
But production is not consumption! What if we attributed the CO2e to the consumption that is helps fuel?

Piketty and Chancel compute income elasticity of consumption-based emission with respect to income: 0.9

CO2e emissions based on consumption of their citizen

The “10-50 rule”

FIGURE 7. REGIONAL COMPOSITION OF TOP 10, MIDDLE 40 AND BOTTOM 50% EMITTER GROUPS



Source: authors. Key: Among the top 10% global emitters, 40% of CO_2e emissions are due to US citizens, 20% to the EU and 10% from China.

Sharing the burden of adaptation by country

Who should contribute to climate adaptation funds?

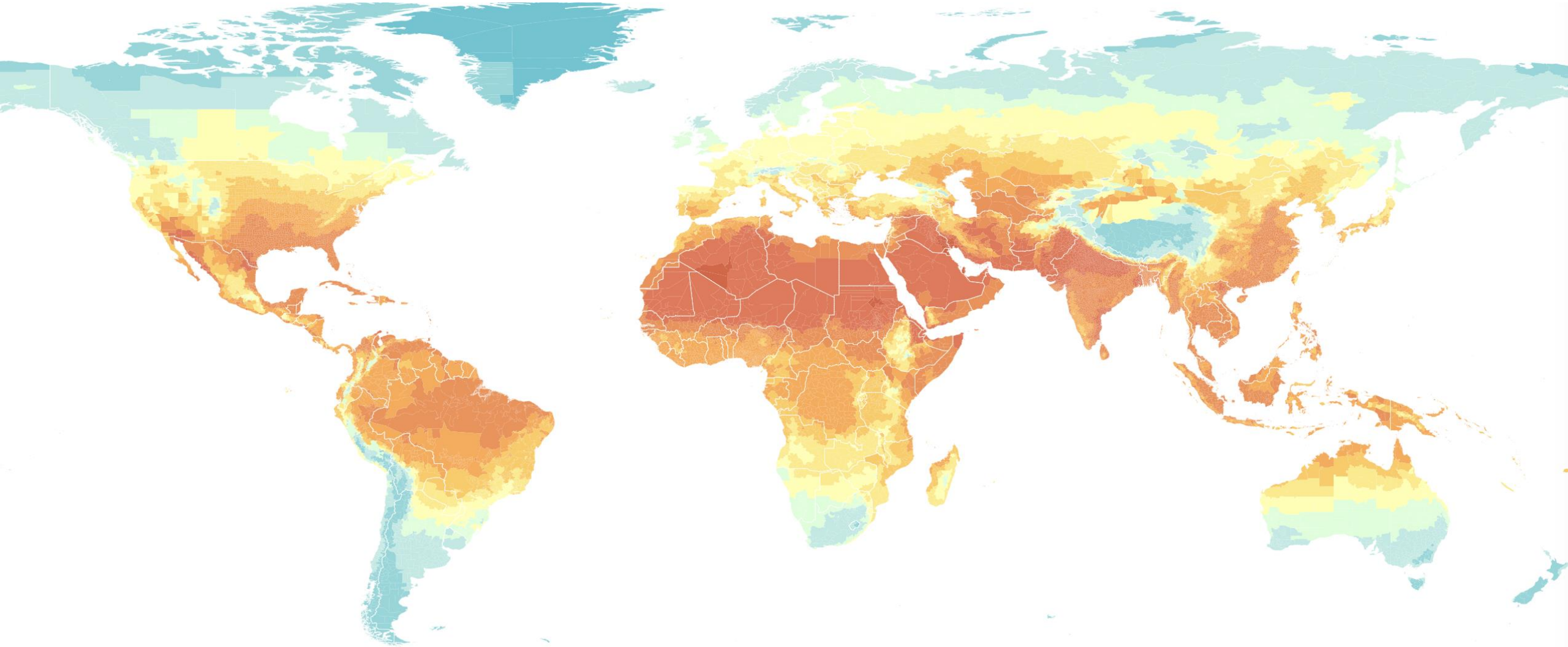
Regions	Effort sharing according to all emissions (flat carbon tax) (%)	Progressive carbon tax strategies			Effort sharing according to a global tax on air tickets (%)
		Strategy 1	Strategy 2	Strategy 3	
		Effort sharing among all emitters above world average (%)	Effort sharing among top 10% emitters (above 2.3x world average) (%)	Effort sharing among top 1% emitters (above 9.1x world average) (%)	
North America	21.2	35.7	46.2	57.3	29.1
EU	16.4	20.0	15.6	14.8	21.9
China	21.5	15.1	11.6	5.7	13.6
Russia/C. Asia	6.0	6.6	6.3	6.1	2.8
Other Rich	4.6	5.8	4.5	3.8	3.8
Middle East/N.A.	5.8	5.4	5.5	6.6	5.7
Latin America	5.9	4.3	4.1	1.9	7.0
India	7.2	1.0	0.7	0.0	2.9
Other Asia	8.3	4.7	4.1	2.7	12.1
S.S. Africa	3.1	1.5	1.5	1.1	1.1
World	100	100	100	100	100

Source: Authors. Air passenger data from World Bank (2015). Key: North Americans represent 46.2% of global emissions released by individuals who emit 2.3 times more than the global average. Individuals who emit more than 2.3 times average emissions (14.3 tCO_2e per year) belong to the top 10% emitters. Note: 27% of individuals emit more than world average emissions (Strategy 1). These estimations focus on consumption-based emissions.

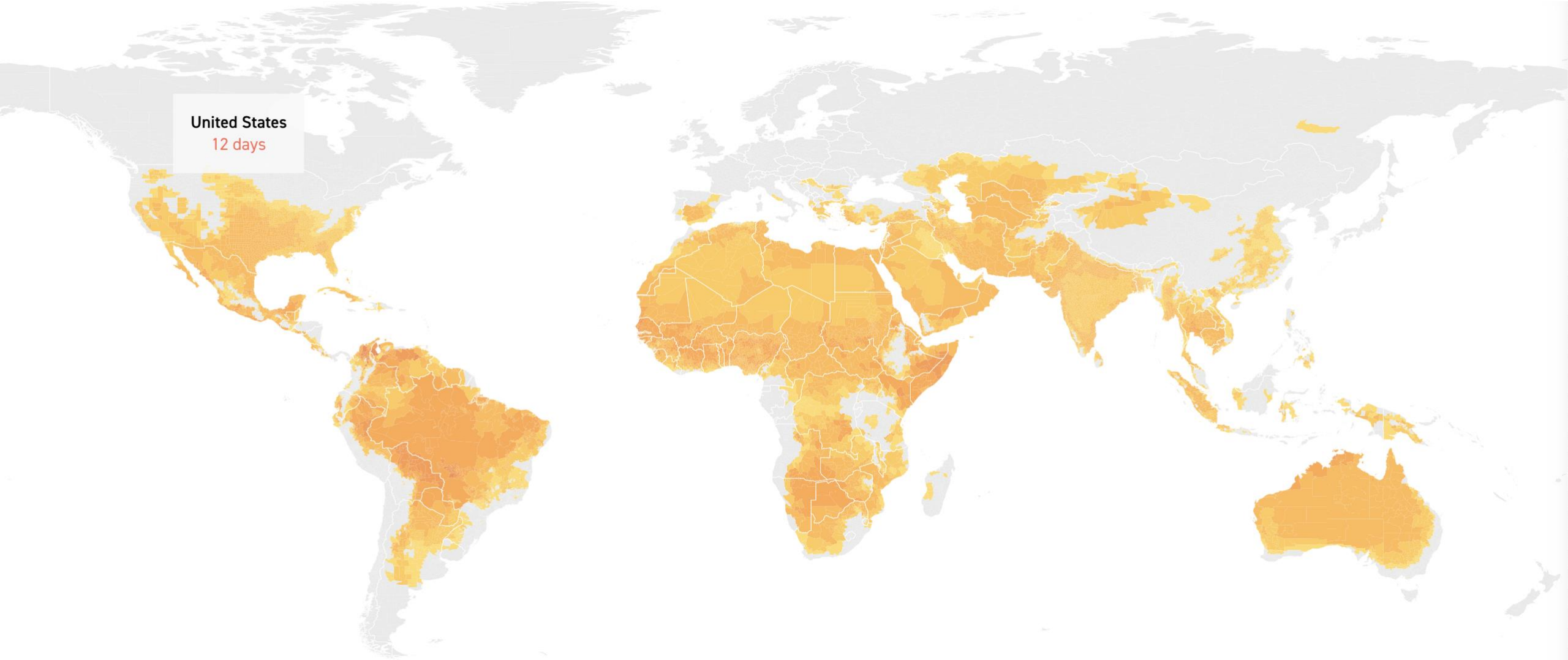
2. Costs

The Costs of Climate change are going to be felt in the poorer part of the world

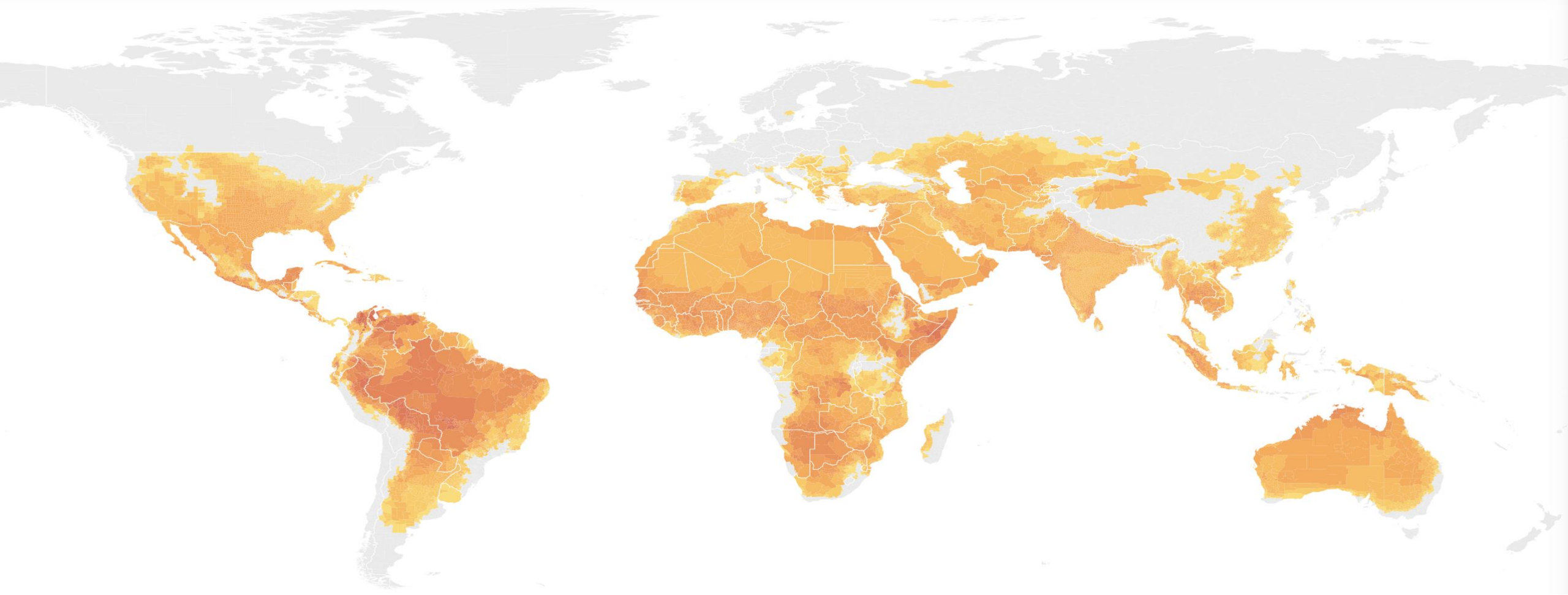
Poorer countries tend to be in warmer places



In the next 20 years they will add many more very hot days (>32 degrees)



And even more so by 2050



Poor countries suffer more from same heat

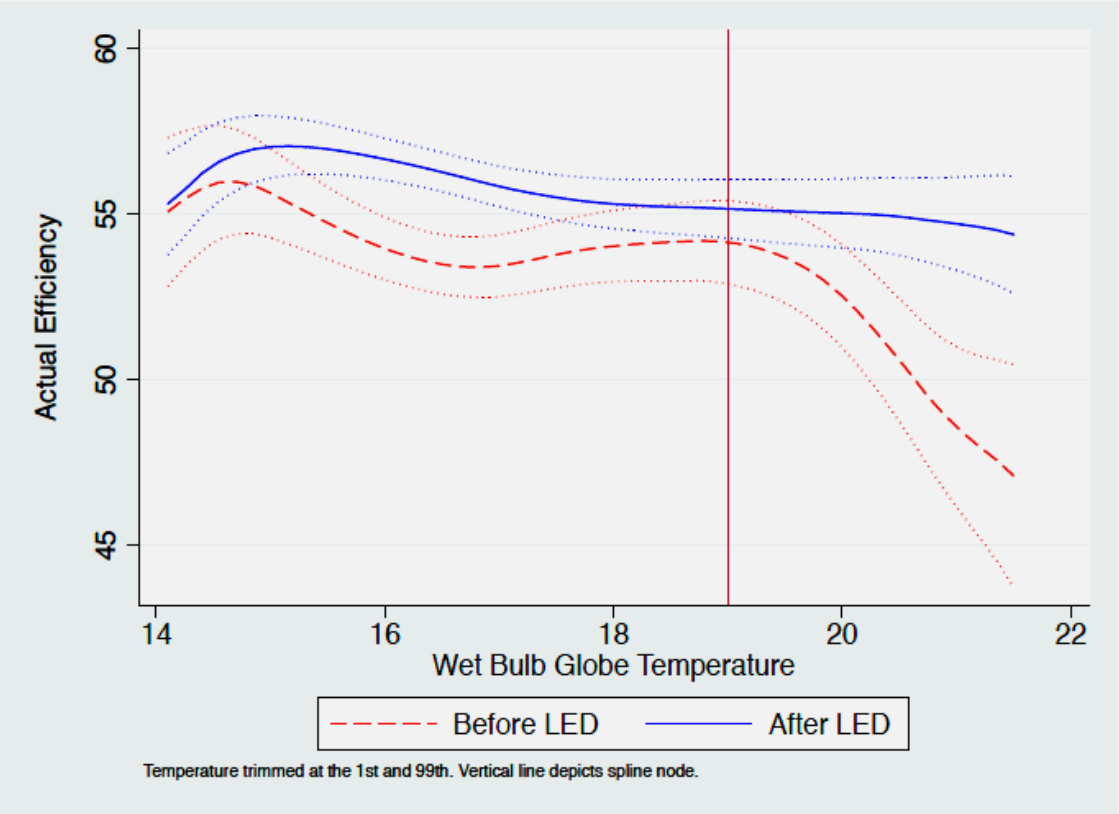
More agriculture

More work outside

Less mitigating technology (AC and others)

LED mitigates the impact of heat on productivity in Indian textile manufacturers

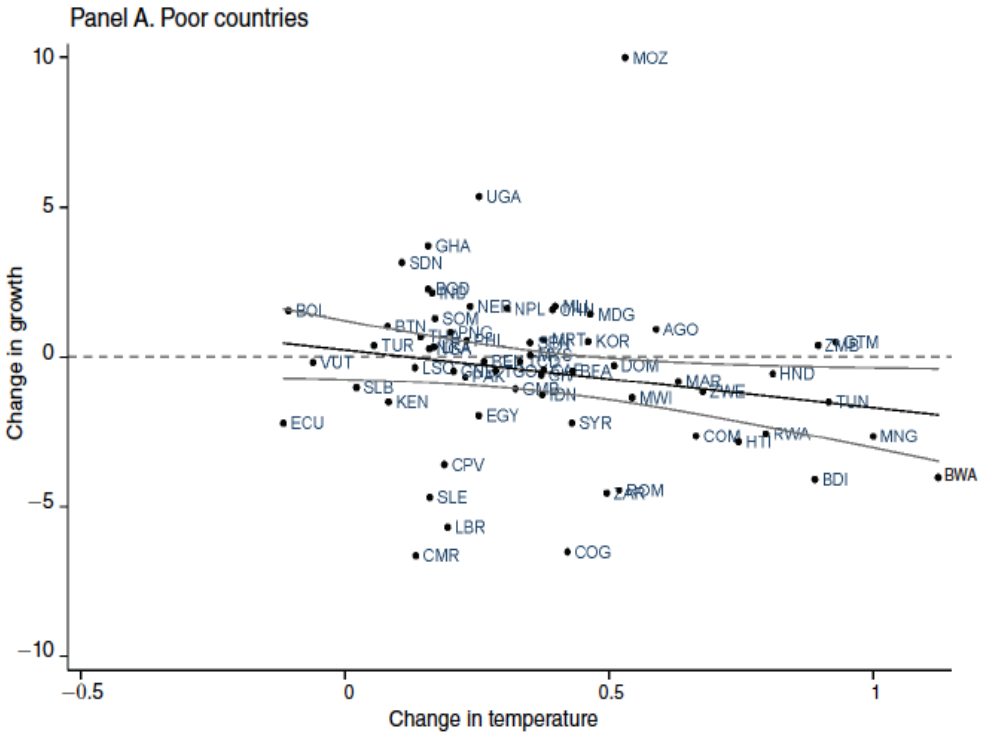
Figure 3: Efficiency Against Temperature by LED

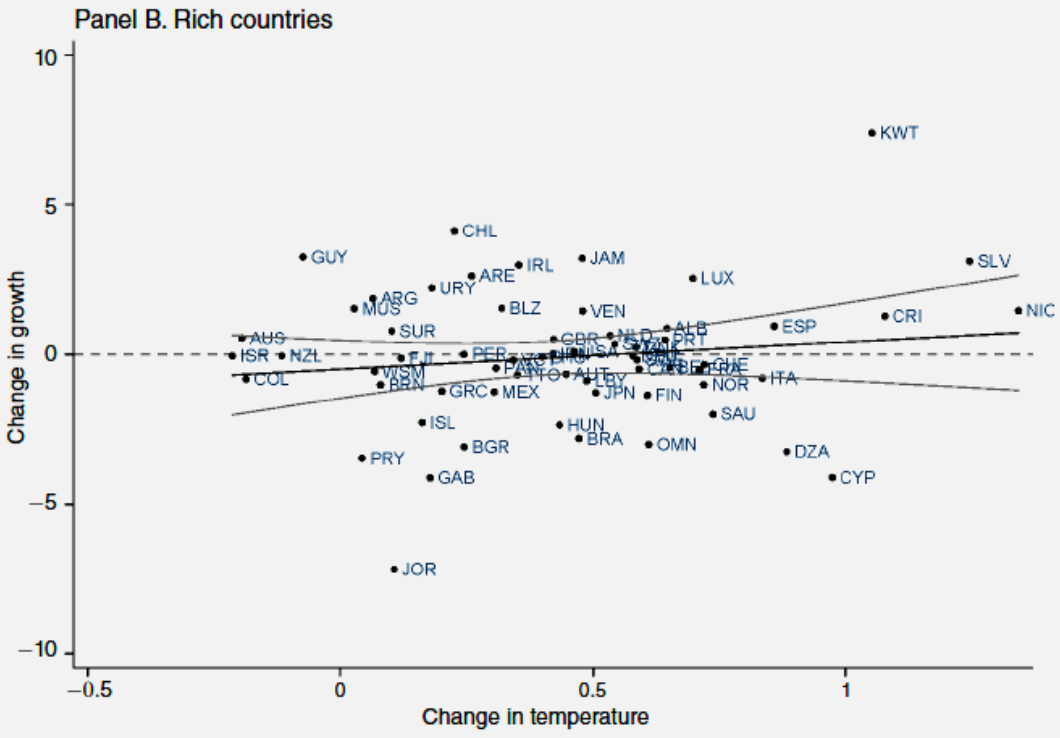


Source: Adhvaryu et al.

Impact of temperature on growth in poor countries…

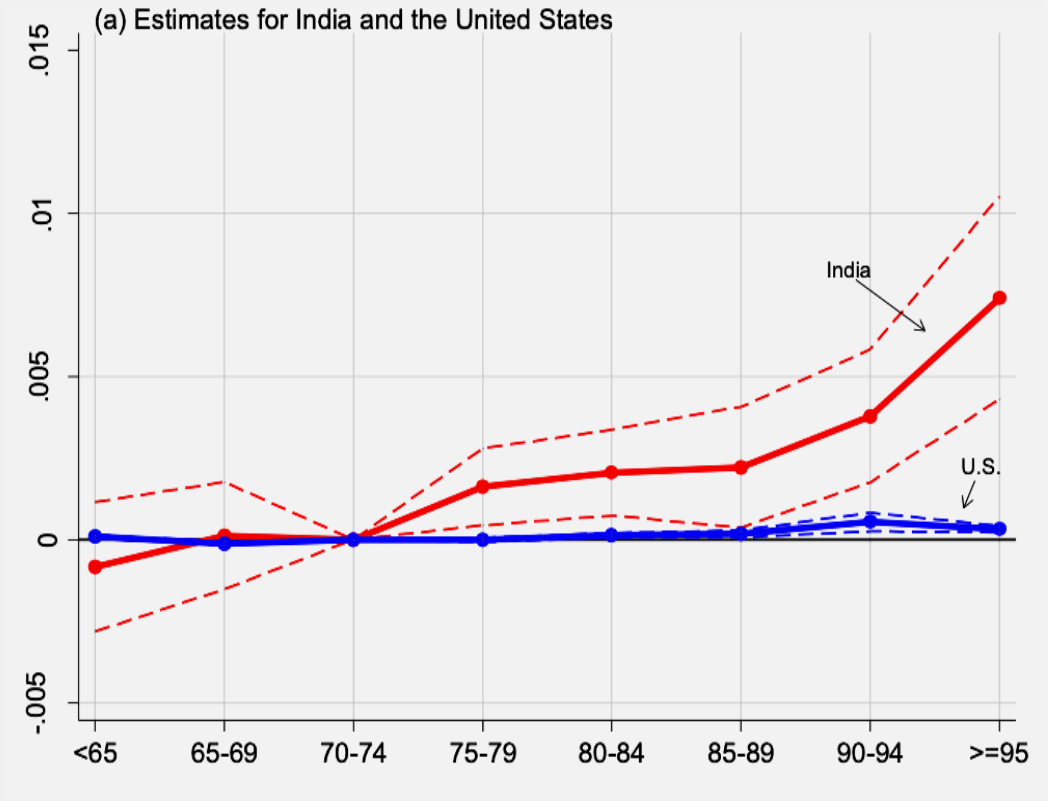
and in Rich countries



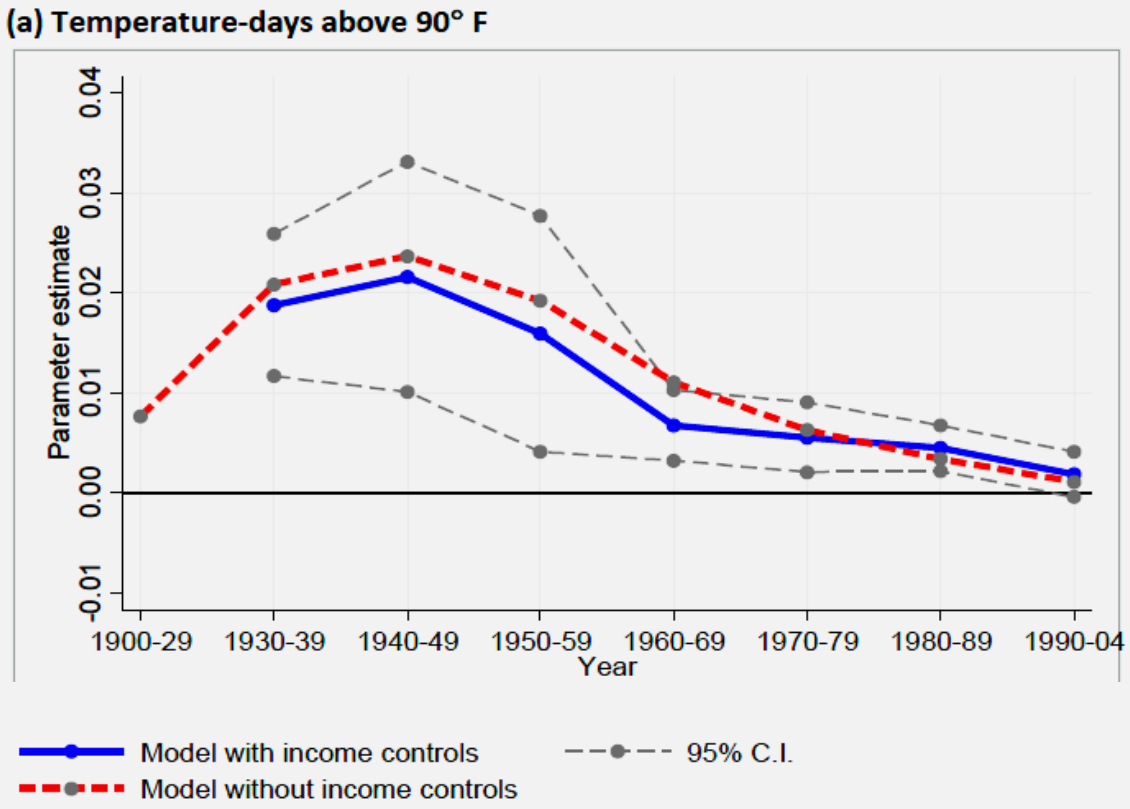


The human cost of a given hot day is larger in poor countries

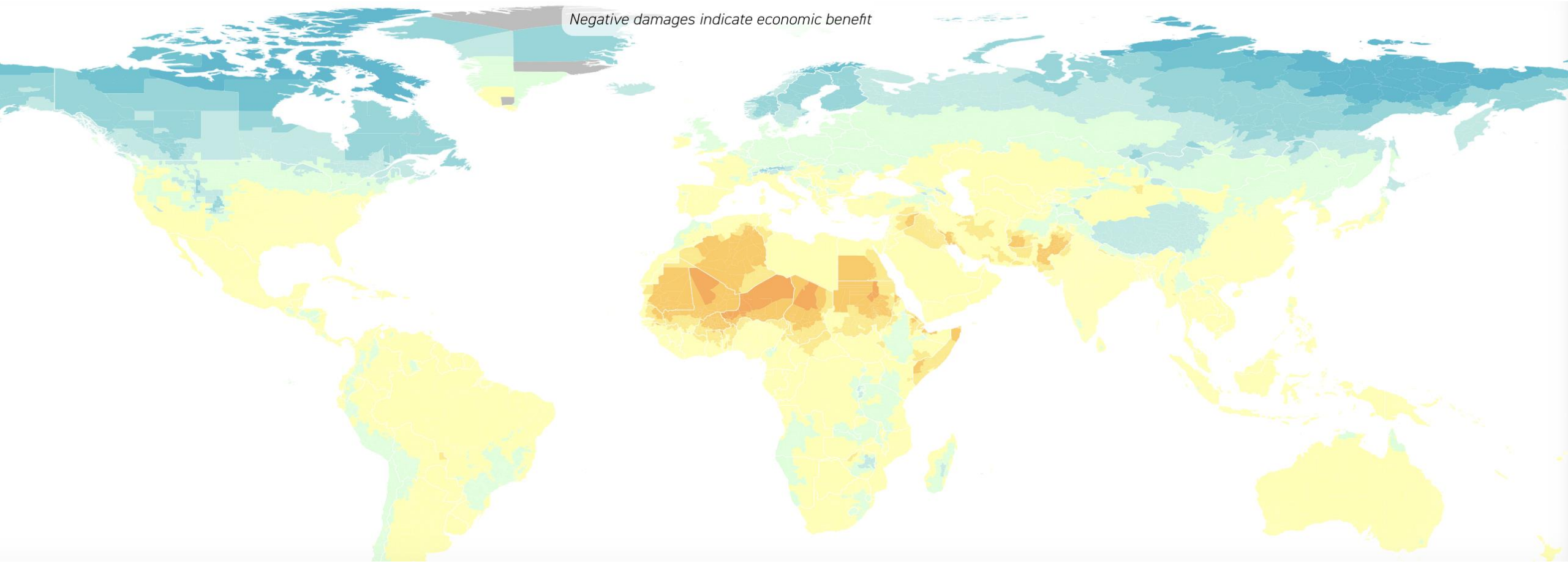
Impact of daily temperature log all-age mortality rates in India and the United States



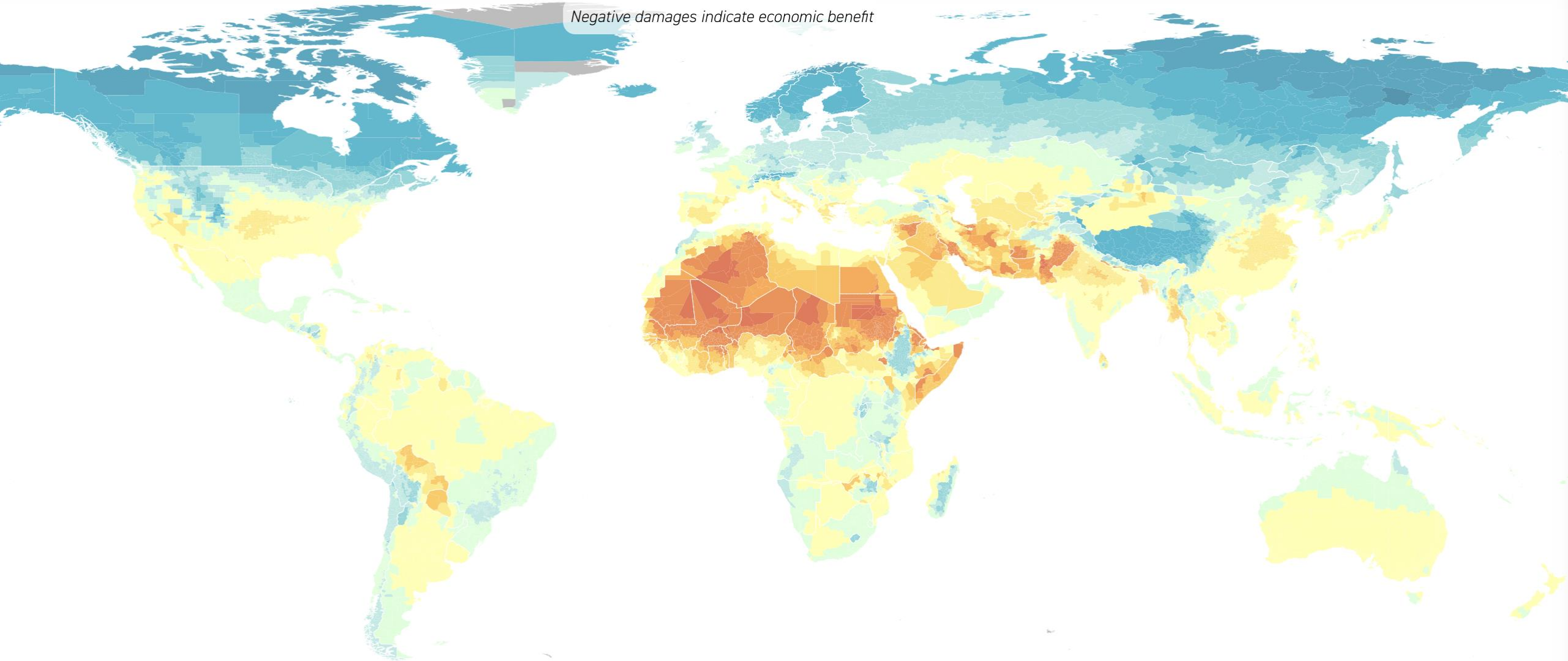
Historical relationship in the US



Mortality costs, next 20 years



Mortality costs, by mid-century



The dilemma of technology

Life saving technology now could make the problem much work in the future…

Photo: Slawomir Kowalewski | Shutterstock.com

The Kigali agreement planned for phasing out HFC in 2019 in rich countries, 2024 in China and 100 other developing countries, and 2026 in India and Pakistan

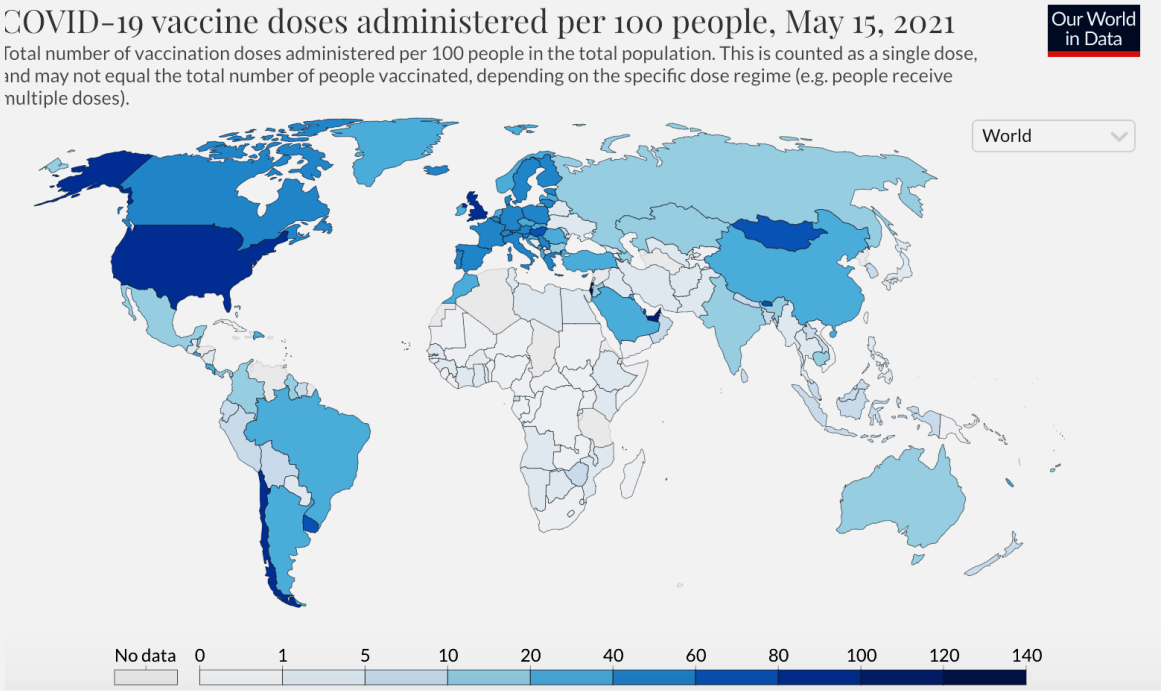
3. Act Now

We need to act NOW to prevent climate change

We don’t seem to take the idea of a global public good too seriously

When faced with a serious crisis, it is every country for themselves….

So we need to get ahead of it.



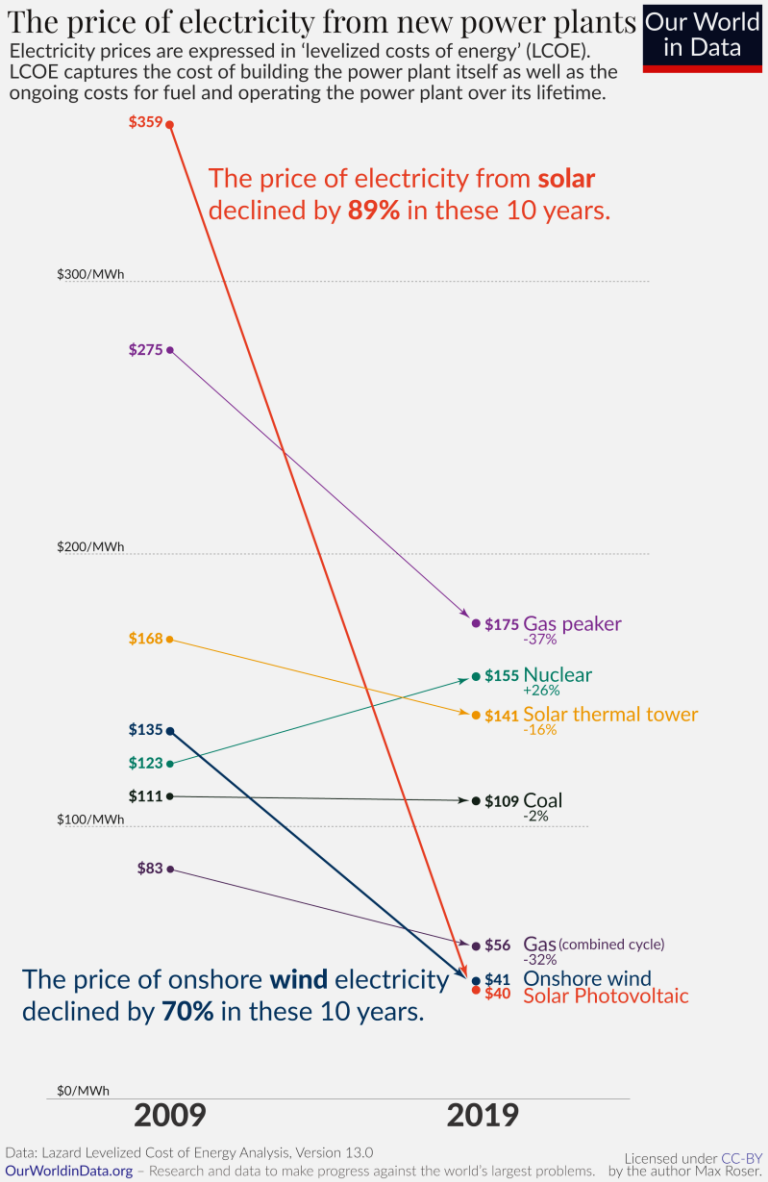
A technological free lunch?

Initial investment can create a market size effects

Old technologies would become unprofitable

And everyone will switch

Excitement around new technological solution that would have seemed pie in the sky before: carbone capture, sum dimming, etc.



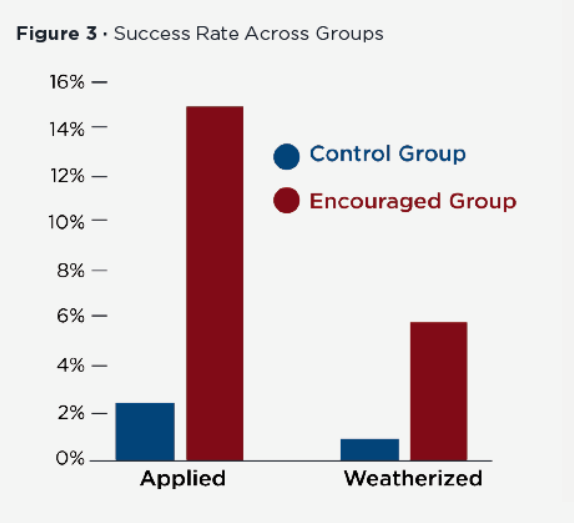
The issue with technology

Randomized experiment on a weatherization program in the US

1. Demand was low

2. Impact on energy where much lower than expected even among those who took up

3. Energy gains were twice the money spent on the weatherization



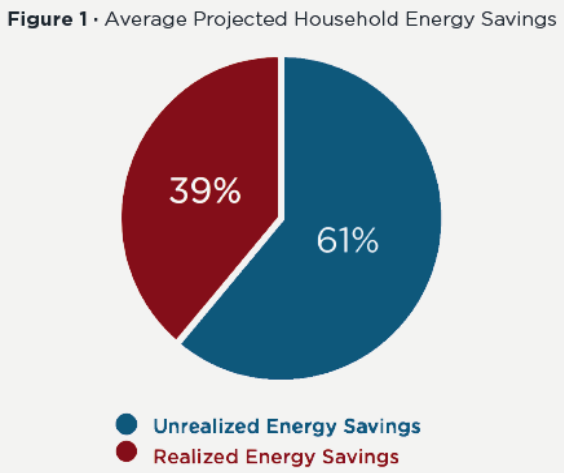
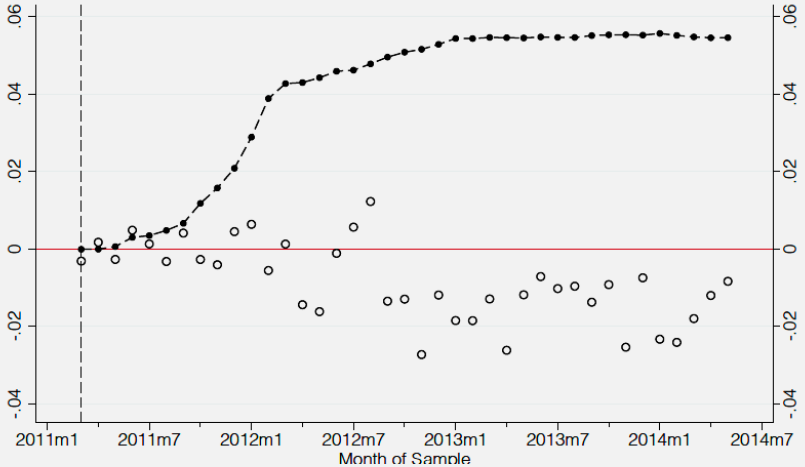


Figure 3: Effect of encouragement on participation and energy consumption

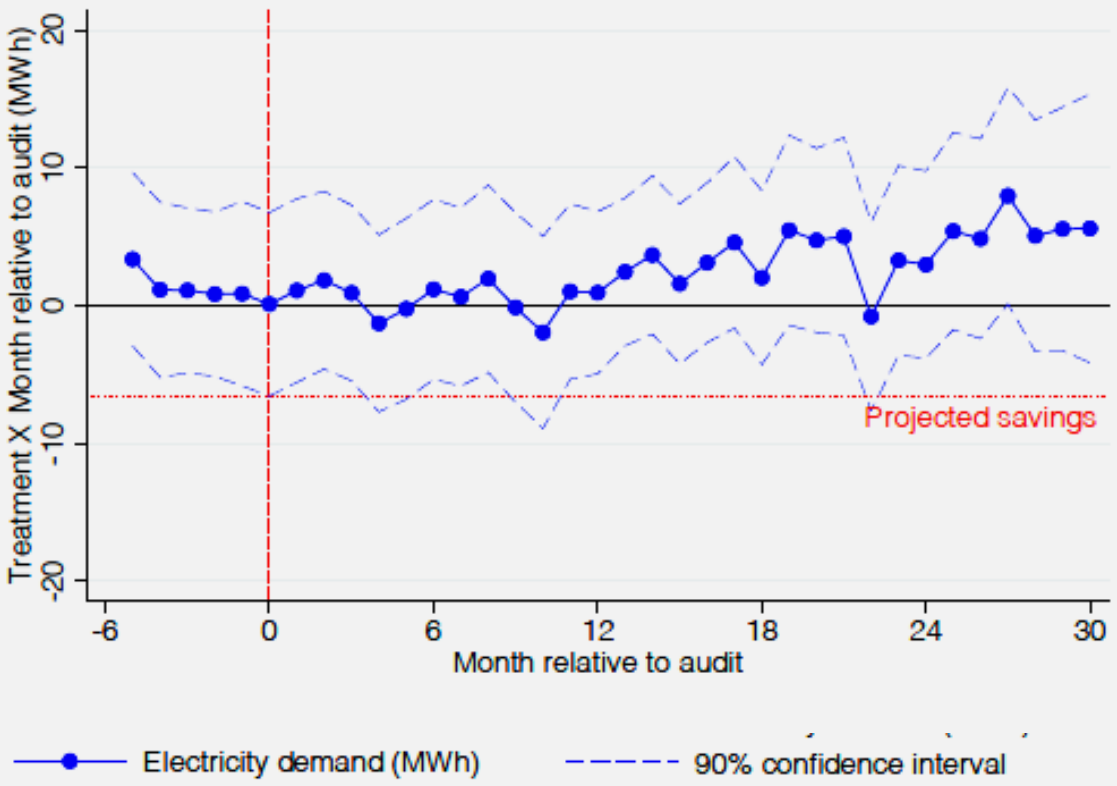


Source: Greenstone et al.

Backfiring effects

In India, free energy audits coupled with credit program to buy new more efficient equipment led to an increase in energy demand

Treatment effect on consumption in event time



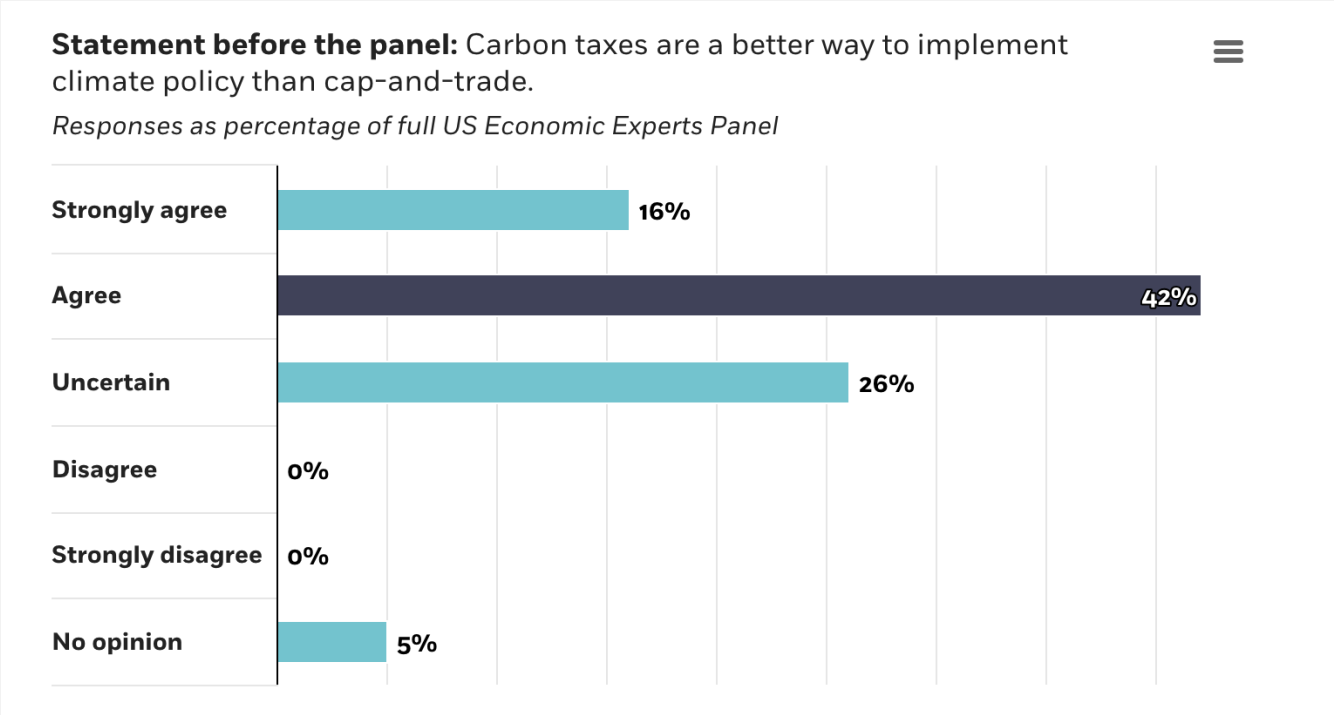
Source: Ryan, et al.

4. Policy Efforts

We cannot tackle climate change without policy efforts

Pricing carbon

- Economists love carbon taxes
- A very natural idea: CO2 emissions impose a negative externality
- By pricing it at the right level (the "social cost of carbon"), we would restore incentives for people to behave well
- And it is always better to use prices than quantities…



Rewarding conservation

	Village boundaries			PFO-level land circles		
	ΔTree cover (ha)	ΔTree cover (ha)	ΔLog of tree cover	ΔTree cover (ha)	ΔTree cover (ha)	ΔIHS of tree cover
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment group	5.549*	5.478**	0.0521**	0.245**	0.267**	0.0447*
	[2.888]	[2.652]	[0.021]	[0.110]	[0.106]	[0.023]
Control group	−13.371	−13.371	−0.095	−0.349	−0.349	−0.073
Control variables	No	Yes	Yes	No	Yes	Yes
Observations	121	121	121	995	995	995

RCT in Uganda where people were paid to not cut their trees

Source: Jayachandran et al.

Think beyond Carbon taxes: Changing preferences is possible

While we over-estimate the miracles of technology, we underestimate the capacity of the human being for change.

Remember what we learnt about preferences

- Unclear : perhaps we care about future generations and people in Bangladesh?
- Changeable
- Affected by the social environment
- Susceptible to habits

That means that government mandates and policies can work too.

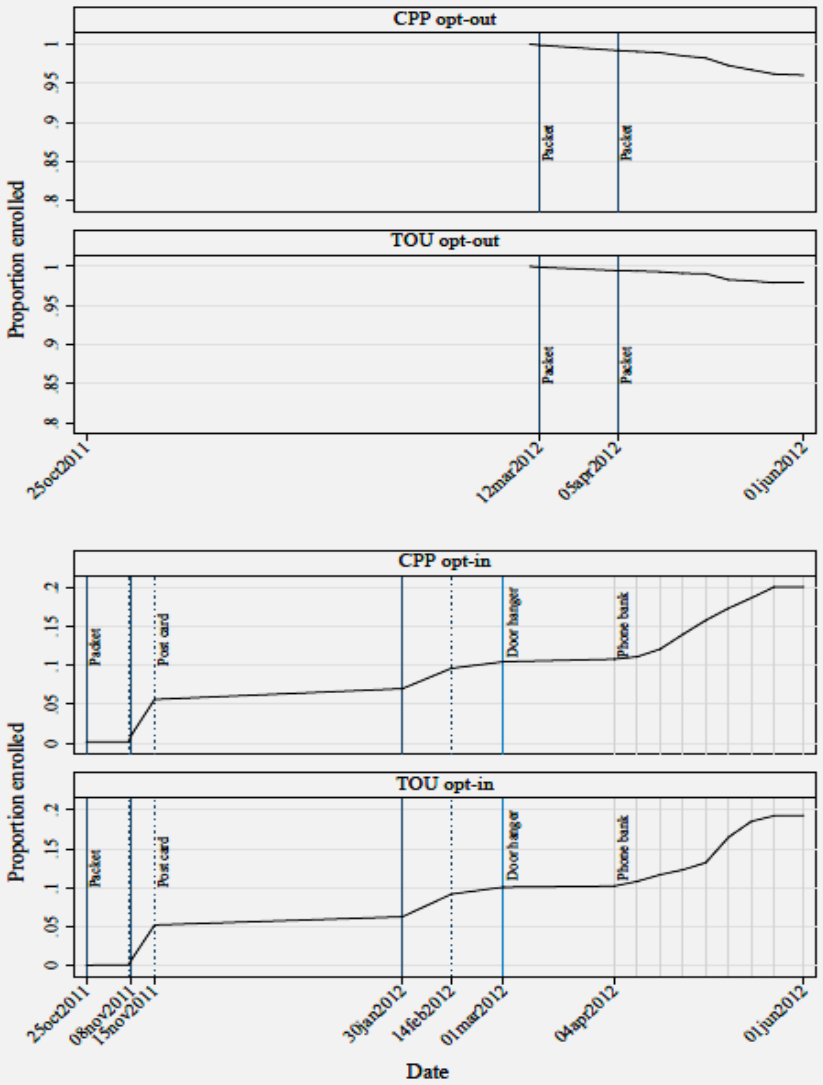
Remember cigarette bans in Italy.

Smart electricity plans in Sacramento

People show a lot of inertia when opting in the plan…

Or opting out

Figure 3: Encouragement efforts



Fowlie et al

Reduced form impact of opt in and opt out

Table 3: Average effects for encouraged groups

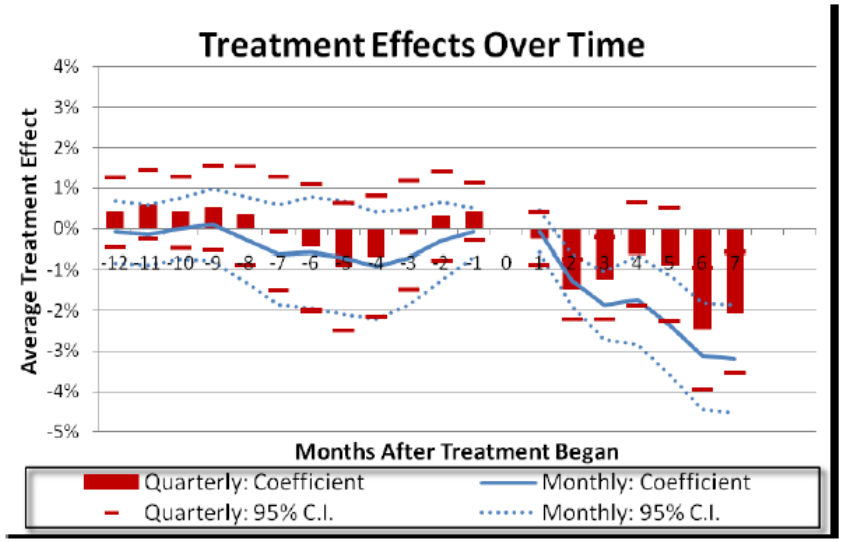
	Critical event		Non-event peak	
	Opt-in	Opt-out	Opt-in	Opt-out
Encouragement (CPP)	−0.129***	−0.305***	−0.029***	−0.094***
	(0.010)	(0.037)	(0.006)	(0.020)
Mean usage (kW)	2.49	2.5	1.8	1.8
Customers	55,028	46,684	55,028	46,684
Customer-hours	4,832,874	4,104,263	31,198,201	26,495,612
Encouragement (TOU)	−0.091***	−0.130***	−0.054***	−0.100***
	(0.008)	(0.019)	(0.006)	(0.013)
Mean usage (kW)	2.49	2.49	1.79	1.79
Customers	58,573	48,245	58,573	48,245
Customer-hours	5,141,976	4,240,163	33,195,961	27,374,276

Treatment effect of the smart plan

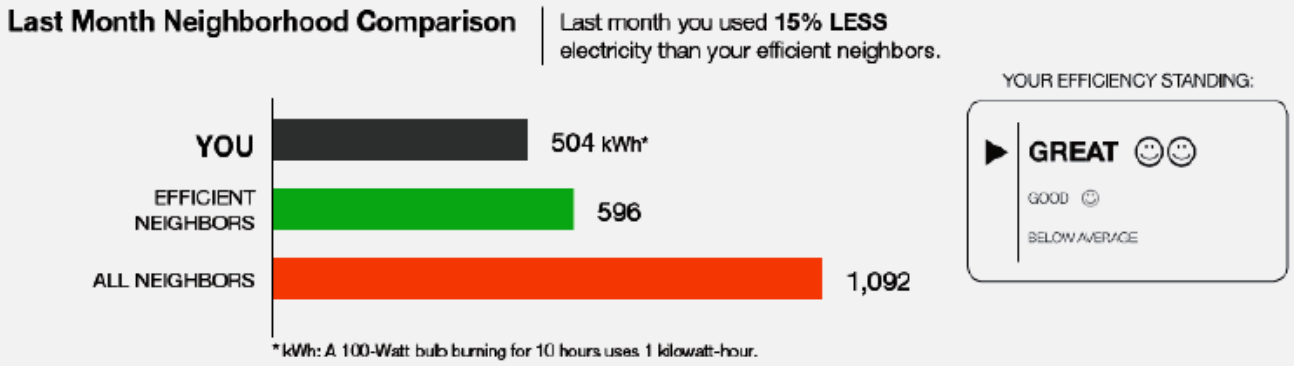
Table 4: Average effects for treated households

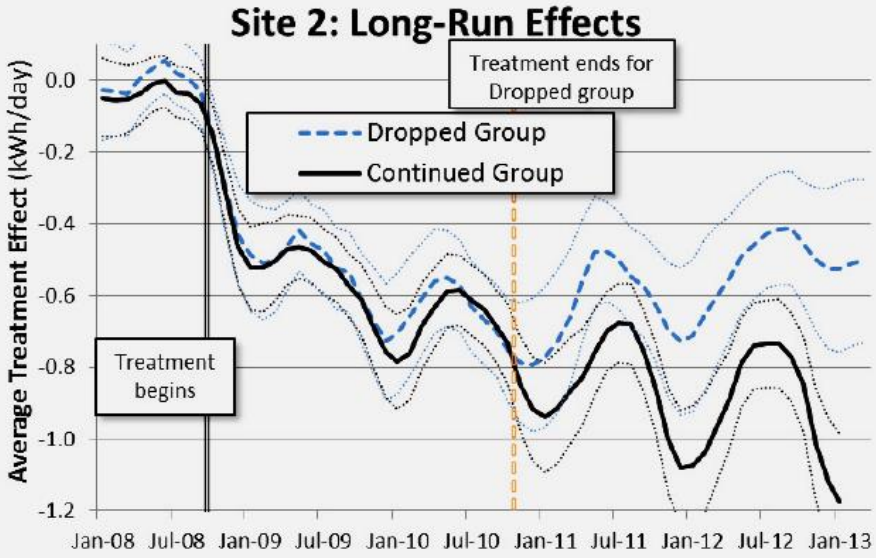
	Critical event hours			Non-event day peak hours		
	Opt-in (AJ)	Opt-out (AJ+PC)	Passive (PC)	Opt-in (AJ)	Opt-out (AJ+PC)	Passive (PC)
Treatment (CPP)	−0.658***	−0.330***	−0.242***	−0.146***	−0.101***	−0.089***
	(0.051)	(0.040)	(0.053)	(0.031)	(0.022)	(0.028)
Mean usage (kW)	2.49	2.50	2.44	1.80	1.80	1.79
Customers	55,028	46,684	10,036	55,028	46,684	10,036
Customer-hours	4,832,874	4,104,263	880,075	31,198,201	26,495,612	5,679,023
Treatment (TOU)	−0.480***	−0.136***	−0.051*	−0.287***	−0.105***	−0.059***
	(0.044)	(0.020)	(0.027)	(0.029)	(0.014)	(0.018)
Mean usage (kW)	2.49	2.49	2.43	1.79	1.79	1.75
Customers	58,573	48,245	15,142	58,573	48,245	15,142
Customer-hours	5,141,976	4,240,163	1,325,077	33,195,961	27,374,276	8,555,447

Short and long run effects of o-power experiments



Source: Hunt Alcott





The power of habits

Our tastes are to some extent a matter of habits

For example Indians like the food that was historically grown in their part of India

And migrants continue to like the food they grew up eating

So it seems hard to change…but it is possible! We need an impetus (Policy, incitation, price change) and then we will be fine

Photo: Shutterstock.com

6. Redistribution

We cannot tackle climate change without tackling redistribution and trust in government

Great discontent around carbon taxes

Credit: Guillaume Clement, l'Humanite

Hindustan Times

Punjab govt's move to stop free power to farmers 'midsummer madness': Sukhbir

Shiromani Akali Dal core committee meet in Chandigarh on May 30 to consider party's strategy on congress govt's decision to replace it with direct benefit transfer subsidy

Pollution and the difficulty of collective action

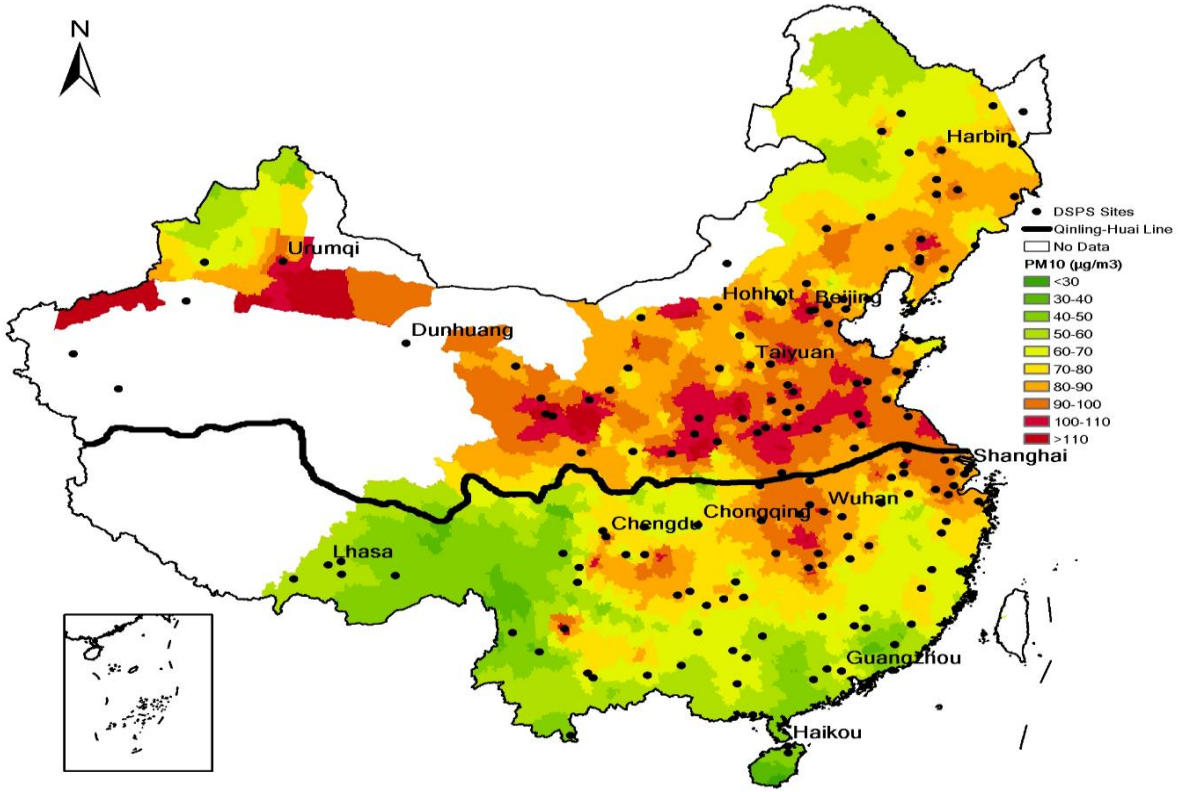
Pollution kills

And reduces productivity

TODAY

Photo: Saurav022 | Shutterstock.com

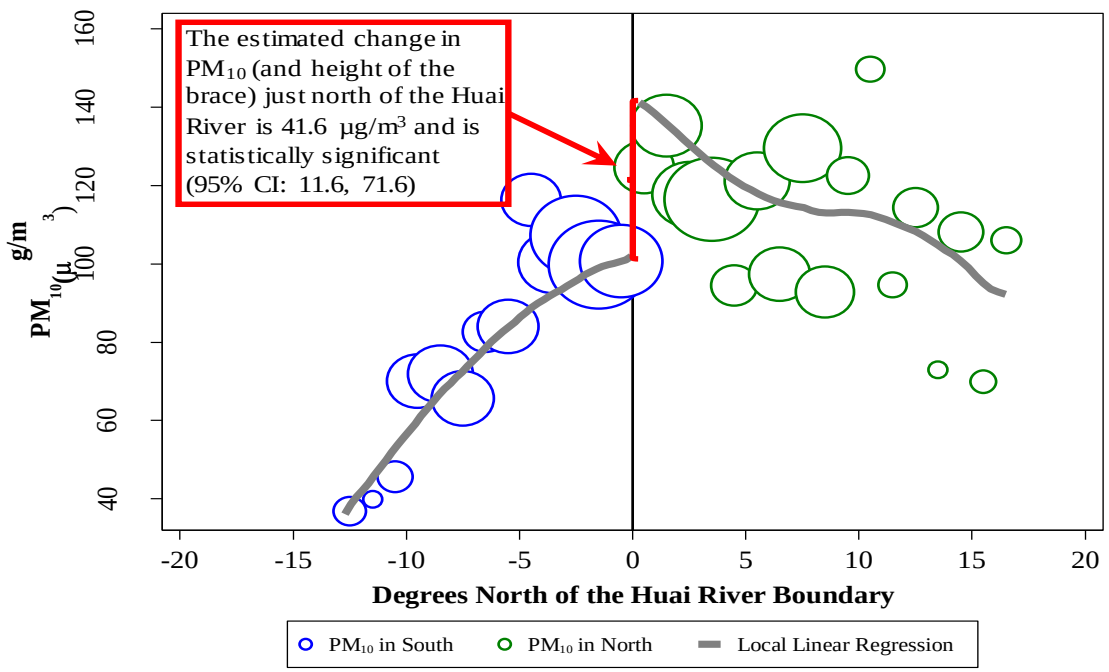
Pollution in China and the Huai River/Qinling Mountain Range



Notes : The cities shown are the locations of the Disease Surveillance Points. Cities north of the solid line were covered by the home heating policy. The figure coloring is generated by interpolating PM_{10} levels at the 12 nearest pollution monitoring stations to create a high resolution grid of pollution throughout China (.1 degree latitude cell width). Areas are left in white which are not within acceptable range of a station.

Source: Almond et al.

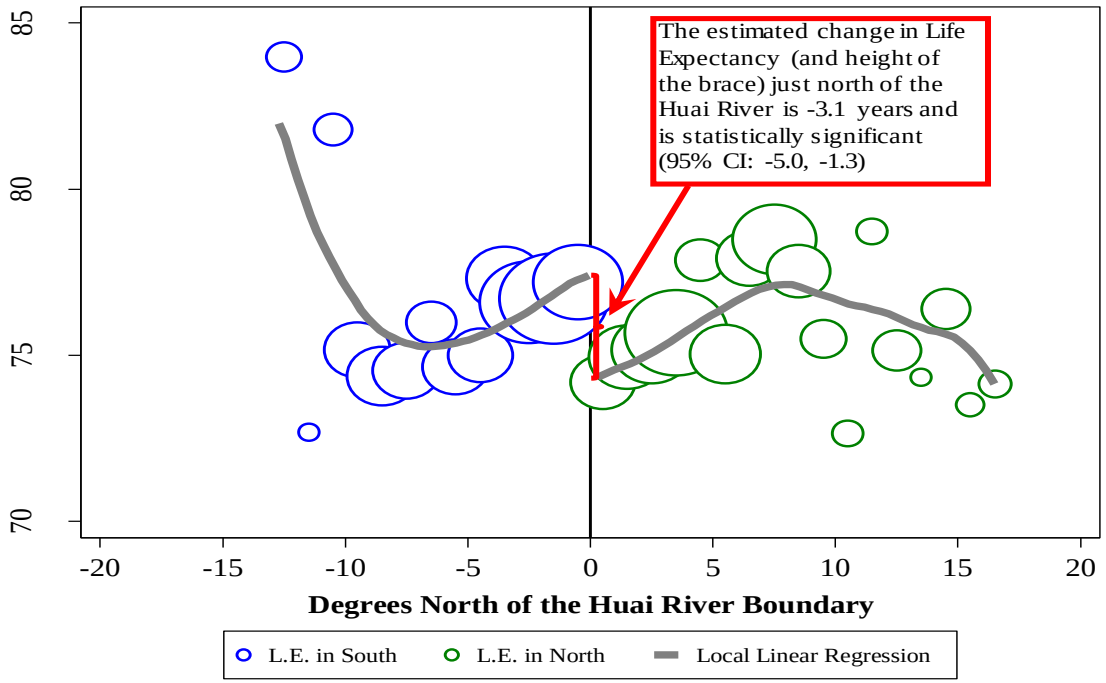
Particulate Matter Levels (PM10) South and North of the Huai River Boundary



Notes : Each observation (circle) is generated by averaging PM_{10} across the Disease Surveillance Point locations within a 1 degree latitude range, weighted by the population at each location. The size of the circle is in proportion to the total population at DSP locations within the 1 degree latitude range. The plotted line reports a local linear regression plot estimated separately on on each side of the Huai River.

Source: Almond et al.

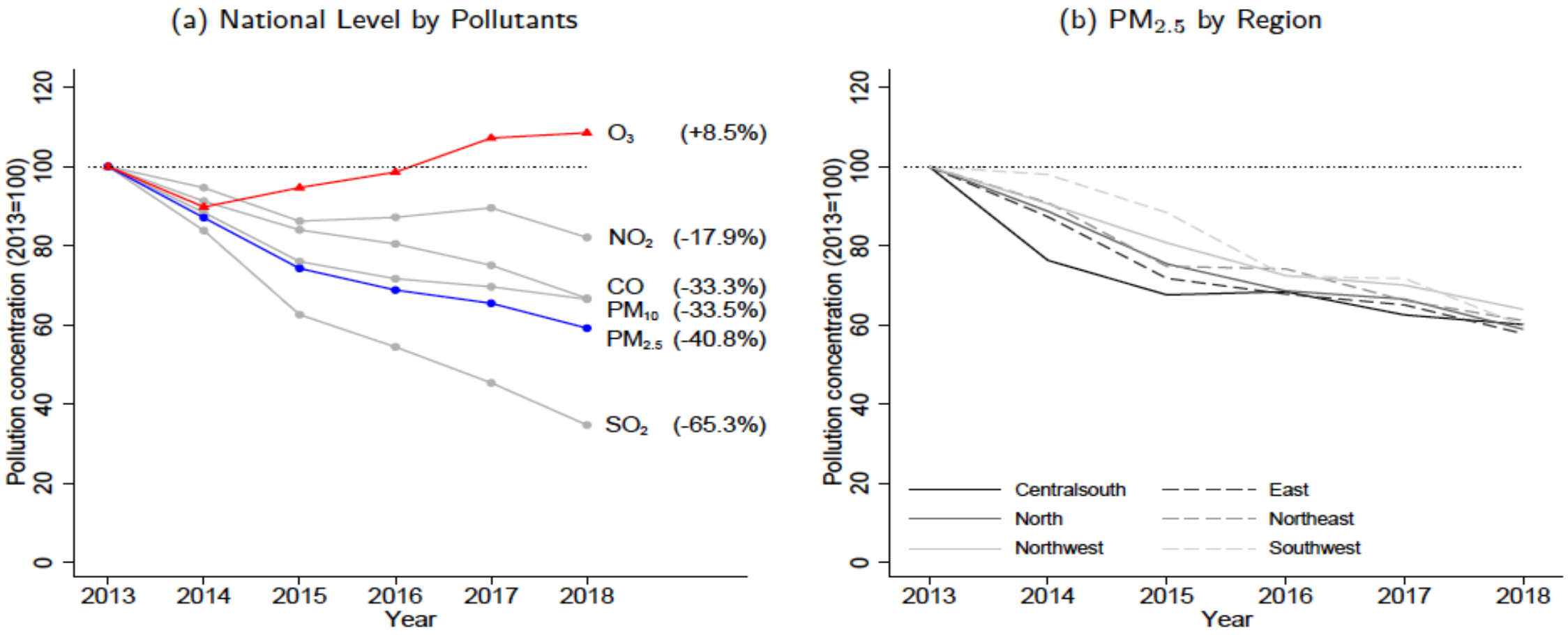
Life Expectancy South and North of the Huai River Boundary



Notes : Each observation (circle) is generated by averaging life expectancy across the Disease Surveillance Point locations within a 1 degree latitude range, weighted by the population at each location. The size of the circle is in proportion to the total population at DSP locations within the 1 degree latitude range. The plotted line reports a local linear regression plot estimated separately on on each side of the Huai River.

Source: Almond et al.

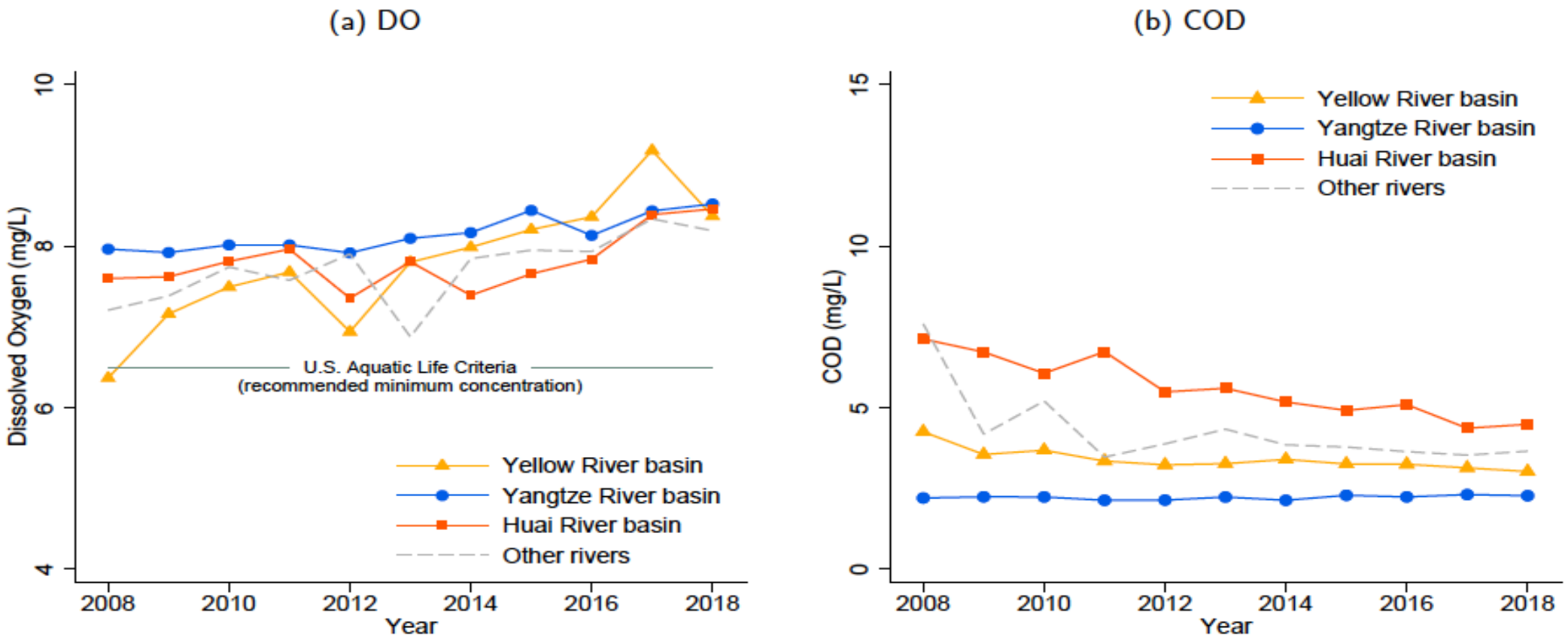
Success in China



Source: Greenstone et al.

Success in China

Figure 2. Trends in Surface Water Quality at Major River Basins, 2010-2018



Source: Greenstone et al.

Pollution and the difficulty of collective action

Not one silver bullets

But many silver pellets

That could reduce the Dellhi problem drastically

Yet, no progress: difficulty to make it an agenda and to share the gains

Photo: Saurav022 | Shutterstock.com

A green new deal? Climate change is unequal, solutions must be equitable

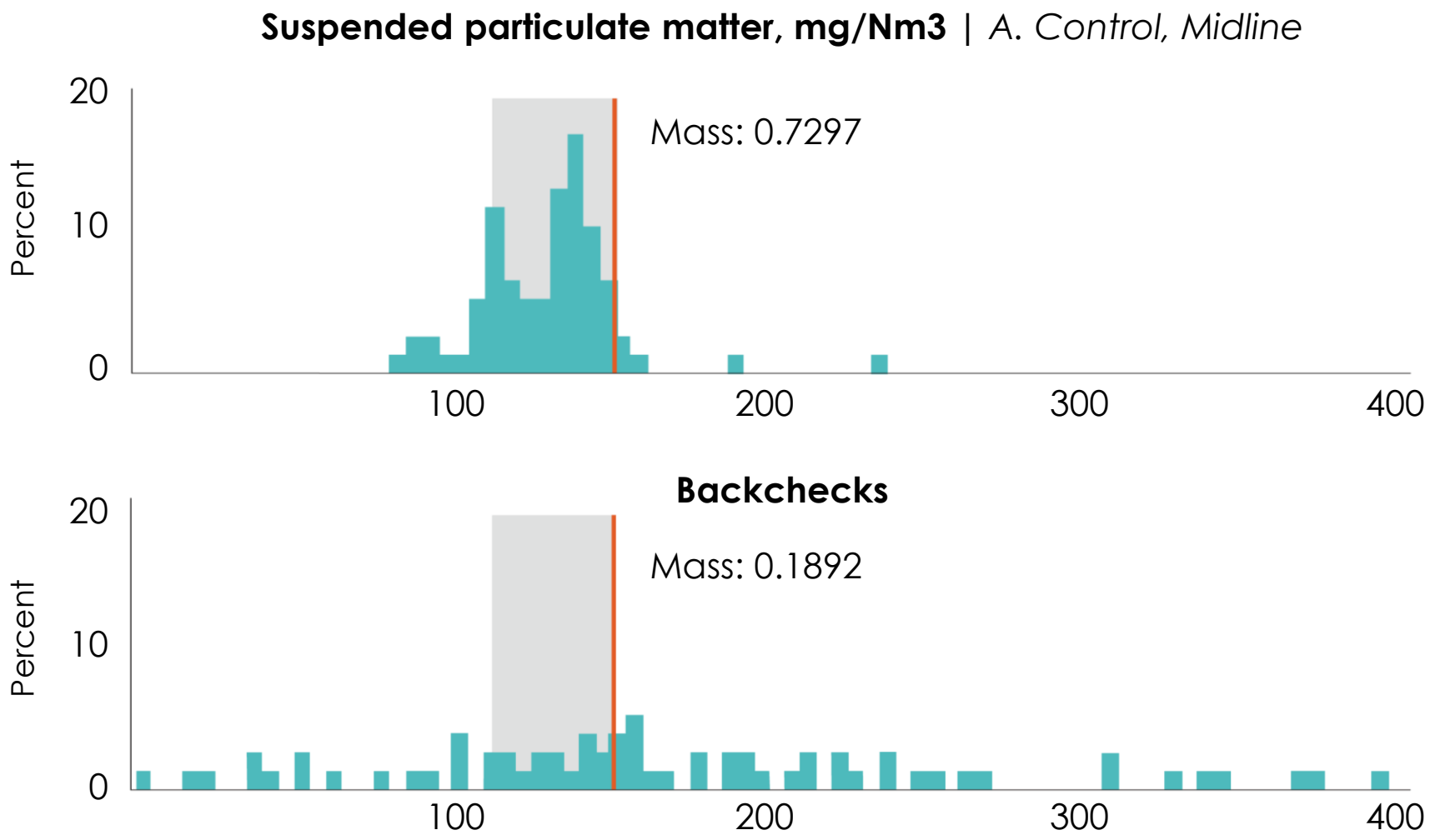
Inequality in the cost and causes of climate change tightly linked to inequality in resources and income

Yet all solutions involve some short run costs that may hit the poor harder

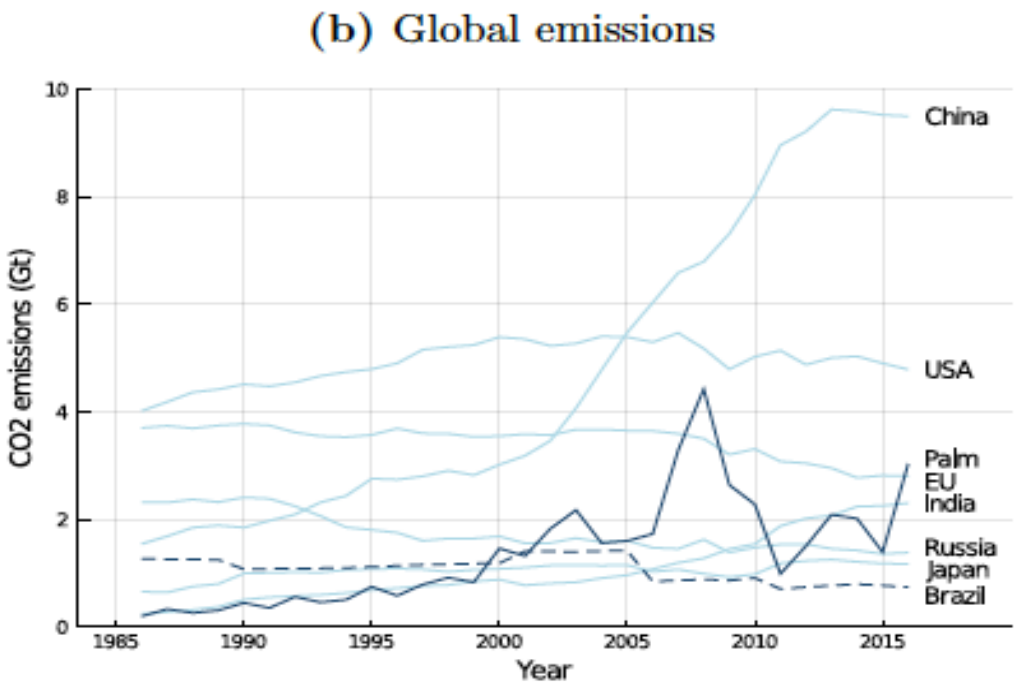
Carbon tax is OK! But it must be progressive. Unless financing is clearly linked to redistribution, it will be seen as a anti-poor program and have no change to succeed.

Belief and preferences: easy to think that climate change does not exist. But also that GDP is not the only thing that matters

Regulations must be enforced



Policy need to be coordinated



Palm oil is becoming a major Co2 emitters…
and Indonesia is a weak enforcer

The Nutella Tax

Can Europe fight Palm Oil production with Tariffs?

Photo: Shutterstock.com

Conclusion

The COVID-19 crisis is a big opportunity and a big risk

Conclusion: The COVID-19 crisis is a big opportunity and a big risk

An opportunity

It reminds us that some times, nature is just stronger than us. Some times, dire warnings by experts do come to pass…

It taught us to redistribute

It shows us that some times, we do need government to steer collective action

And it shows us that we can change our lifestyle without being so unhappy about it!

Photo: Shutterstock.com

An opportunity and a risk

For fairly little money, the rich world could do what it take take to vaccinate the world

It would do a lot to establish a common agenda and credibility

And encourage them to participate

But it does not seem to be rushing doing so

Photo: Valeriya Anufriyeva | Shutterstock.com