Yale University
Climate, Environment Economic Growth Conference 2023

Addressing Inequality Under Climate Change: Issues in Measurement and Policy

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November 9, 2023

- Economic inequality remains very large globally & is on the rise in major economies
- Climate change tends to exacerbate economic inequality trends
- How to address inequality on a warming planet?

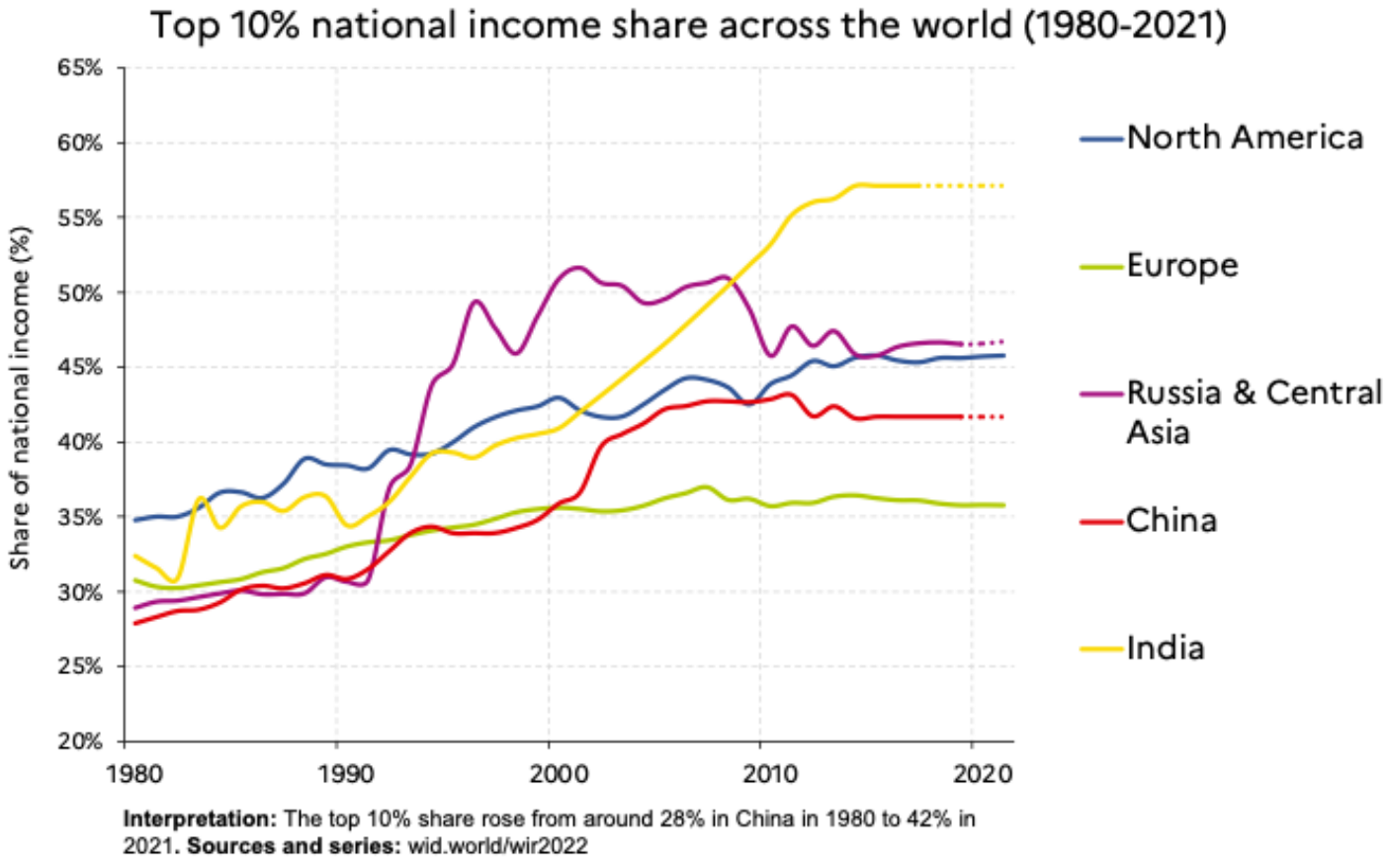
Global economic inequality today

Figure 1 ***Global income and wealth inequality, 2021***

Interpretation: *The global 50% captures 8% of total income measured at Purchasing Power Parity (PPP). The global bottom 50% owns 2% of wealth (at Purchasing Power Parity). The global top 10% owns 76% of total Household wealth and captures 52% of total income in 2021. Note that top wealth holders are not necessarily top income holders. Incomes are measured after the operation of pension and unemployment systems and before taxes and transfers.* ***Sources and series:*** *wir2022.wid.world/methodology.*

Source: Chancel et al. 2022

Inequality is rising since the 1980s at different speeds: policy matters



Source: Chancel et al. 2022

How does climate change intersect with economic inequality?

Many forms of environmental inequalities

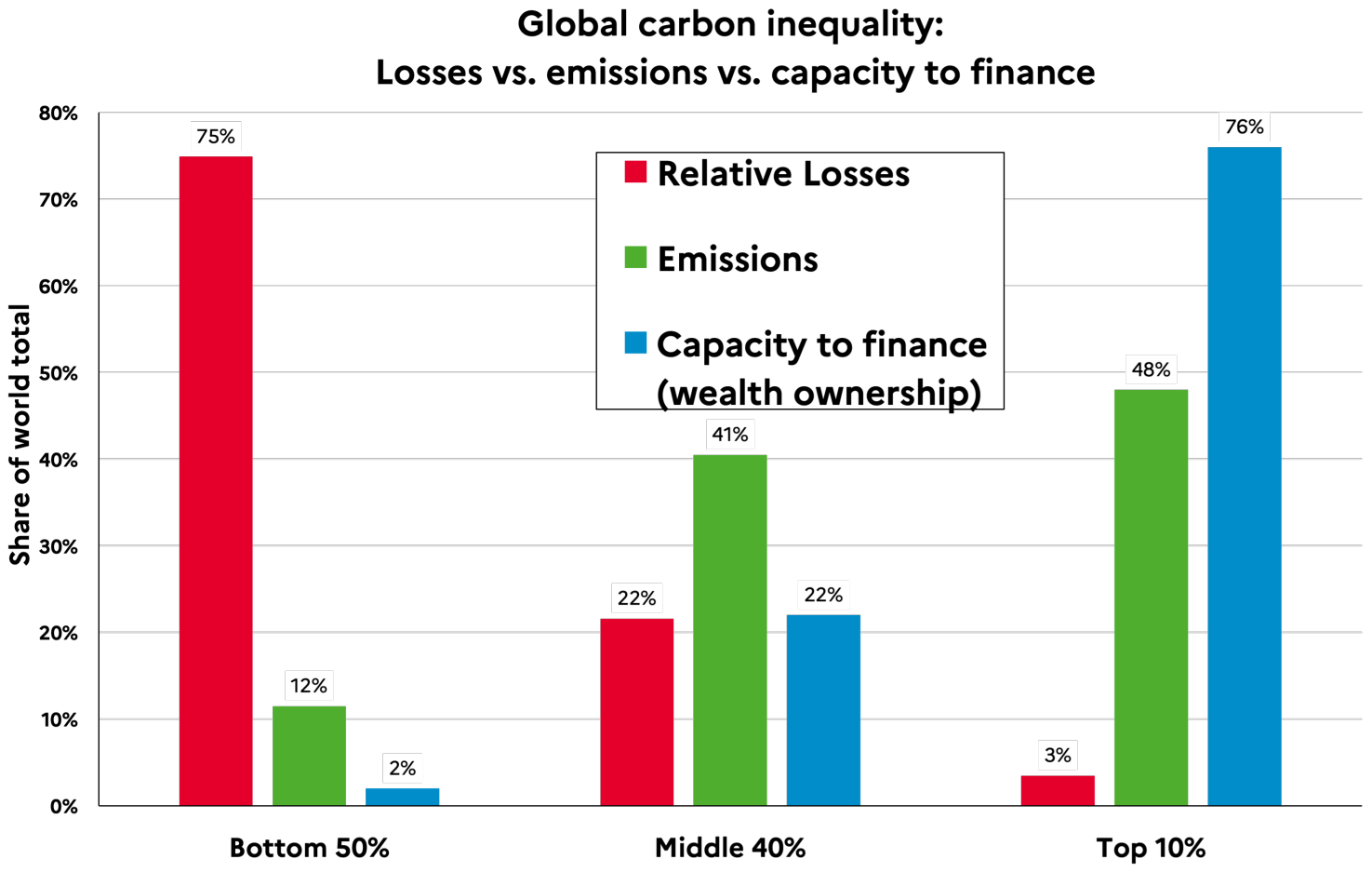
- Pollution ultimately about winners and losers (Boyce, 2002)
- Different dimensions: impacts, contributions, capacity to act.
- Different scales: global, national, local.
- Different metrics: monetary, physical, socio-demographic.

$\Rightarrow$ Burgeoning field in quantitative social sciences. Yet environmental/carbon inequality is still missing from most official statistics.

Next slides draw on recent work on climate inequality

- "The Carbon Footprint of Capital" (with Y. Rehm), *Working paper*, 2023.
- "Climate Inequality Report 2023" (with P. Bothe and T. Voituriez), and associated paper in *Nature Climate Change*, forthcoming.
- "Global Carbon Inequality over 1990-2019" *Nature Sustainability*, 2022.

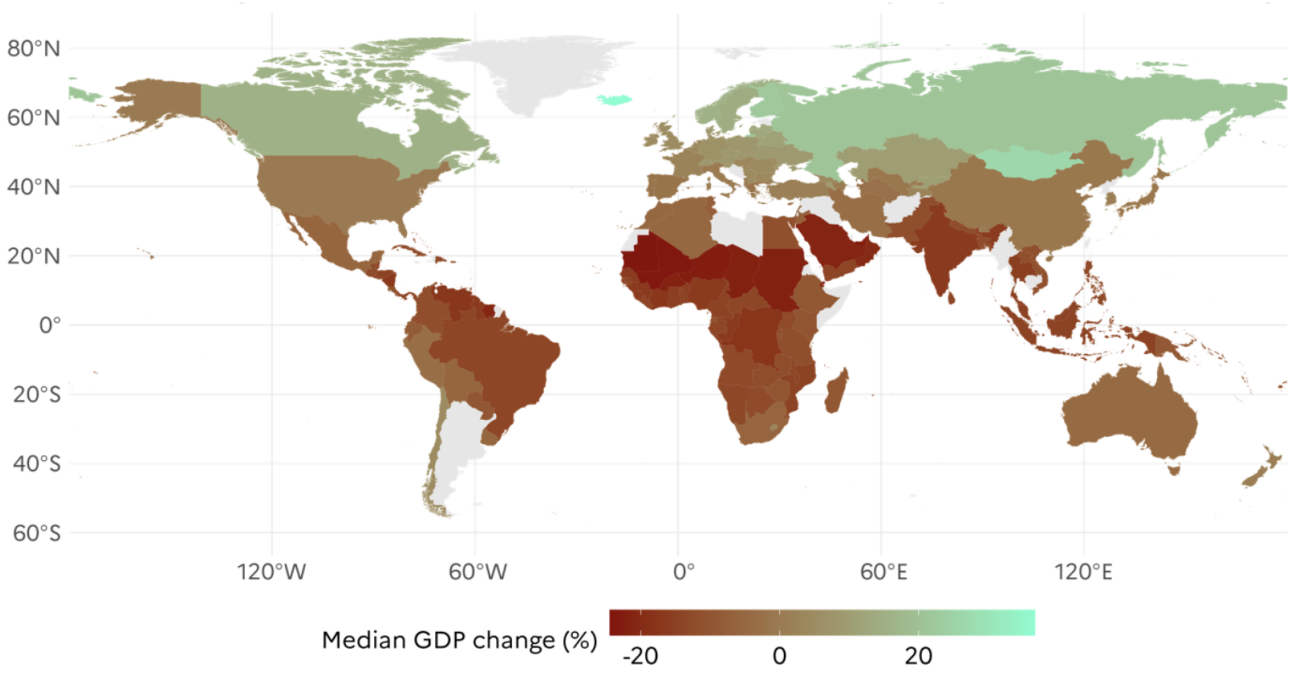
The Triple Climate Inequality Crisis



Source: Chancel, Bothe and Voituriez (2023)

Unequal losses

Climate change tends to exacerbate inequality between countries



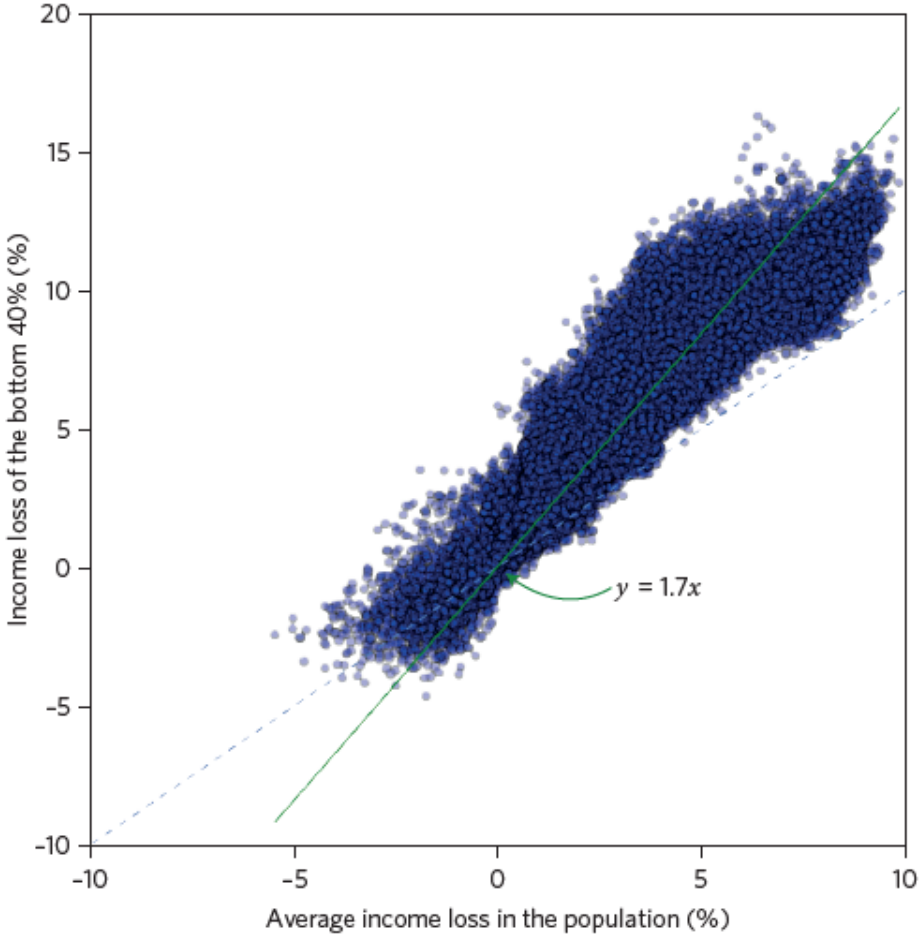
GDP change relative to no climate change scenario (1991-2010)

Source: Diffenbaugh and Burke (2019)

Poorest groups tend to be more exposed and more vulnerable within countries

Image source: AFP/AsianAge

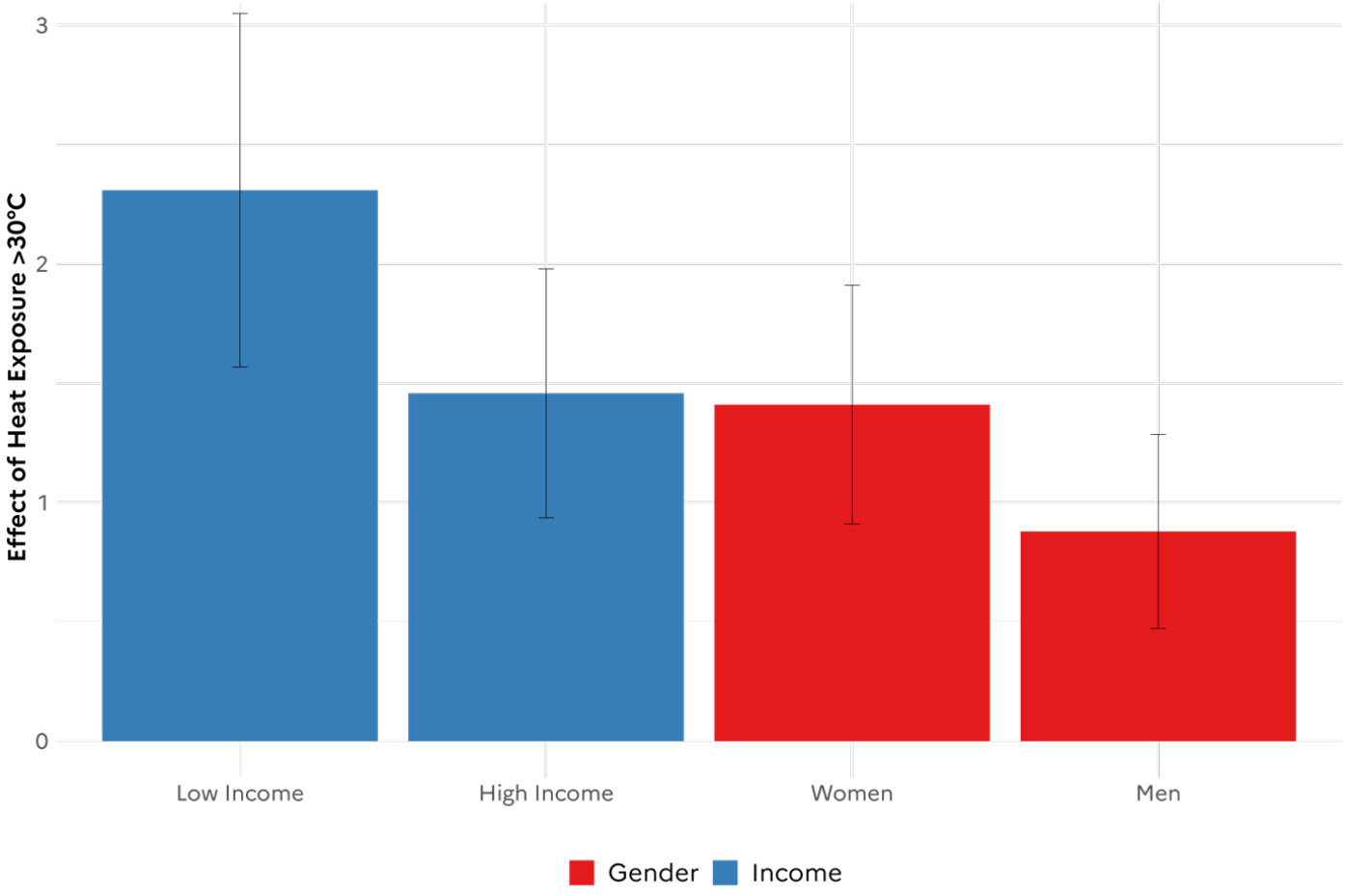
Bottom 40% estimated to lose 70% more than average in developing countries



Climate-induced income loss for bottom 40% by 2030

Source: Hallegatte & Rozenberg (2018)

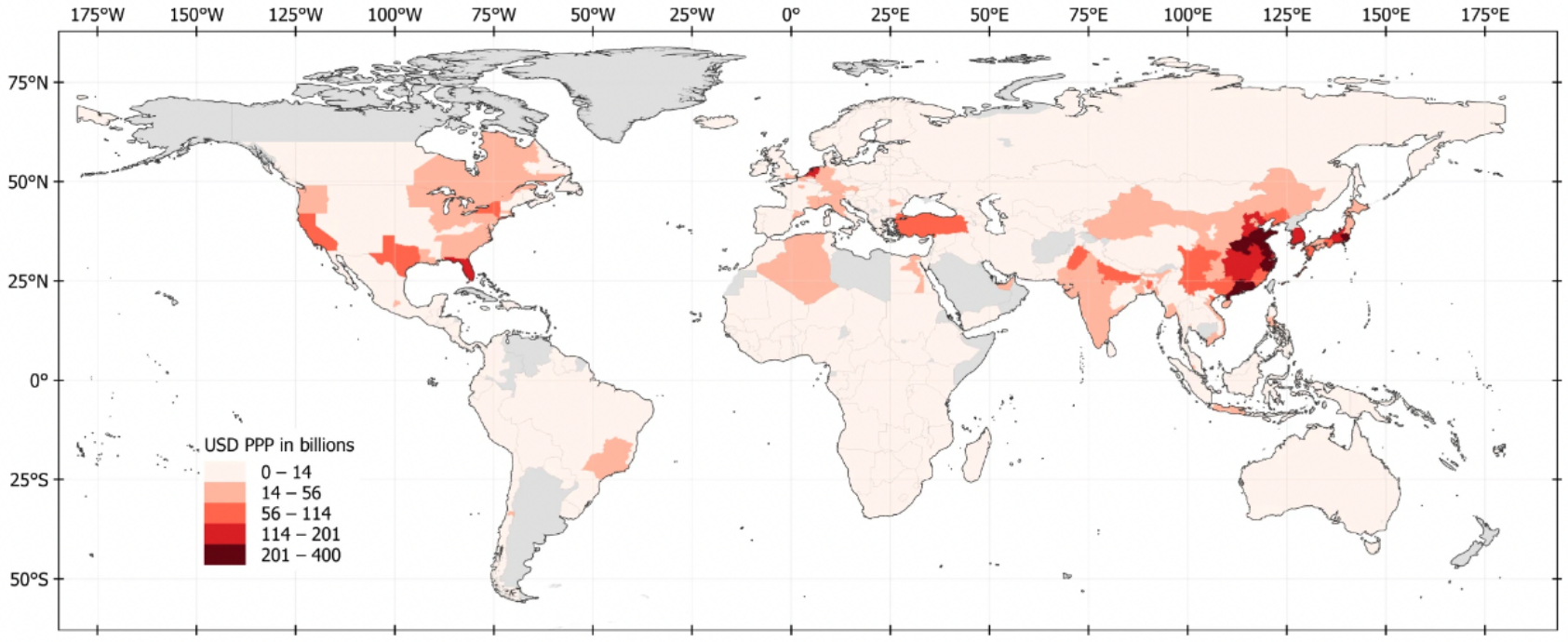
Intersection of gender, class and climate inequality: US case



Effects of heat exposure on mental health

Marginal effect of heat exposure (>30∘C) on the prob. of reporting mental health issues (in p.p.)
Source: Obradovich et al. (2018)

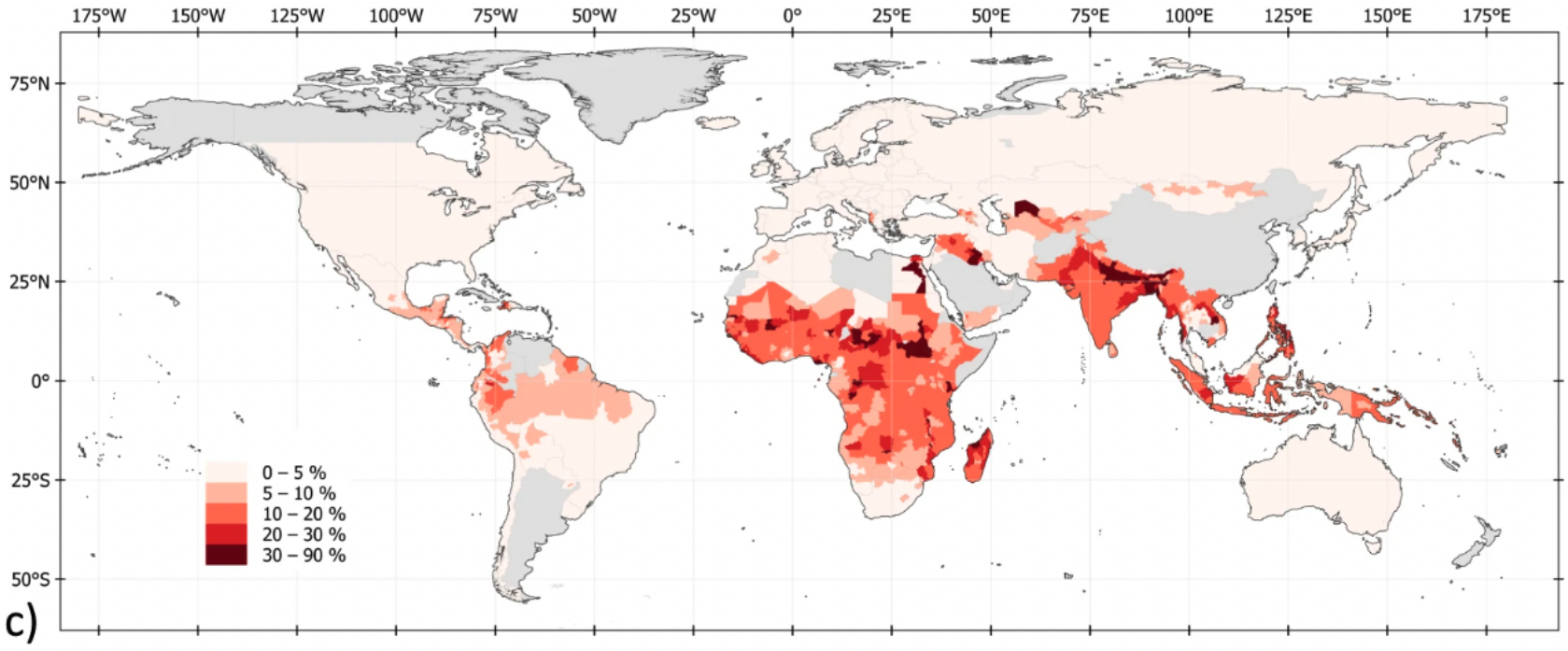
Standard approaches to measuring climate risk can lead to mistargeting



Economic value at risk of flooding

Source: Rentschler, Salhab, and Jafino (2022)

Factoring in poverty is key to effective risk assessment



Population share exposed to flood risk & below $1.90 threshold

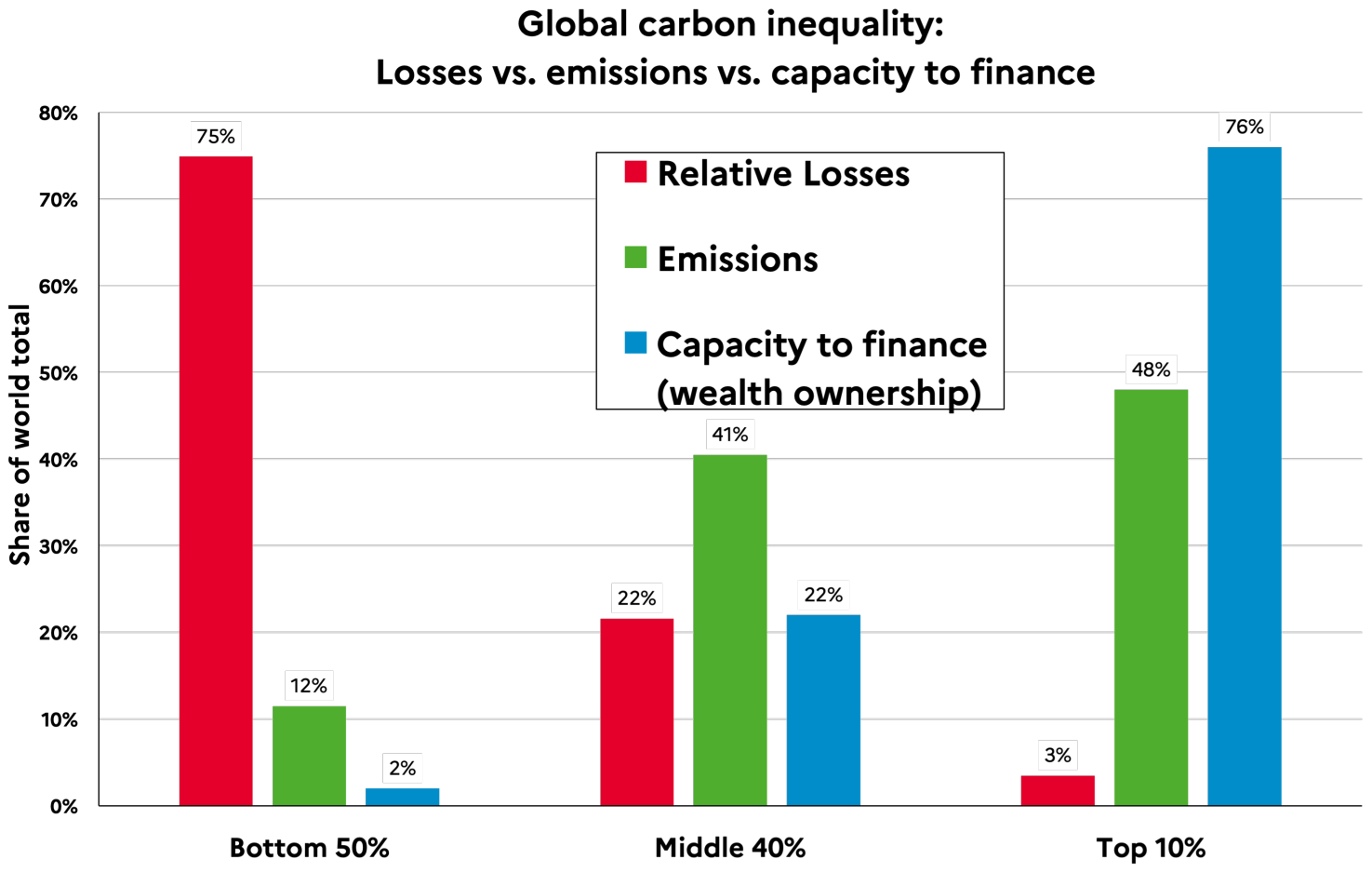
Source: Rentschler, Salhab, and Jafino (2022)

Unequal losses: summing up

- Need for more granularity (spatially & across the distribution).
- Need for more combination of monetary and non-monetary metrics $\Rightarrow$ interdisciplinarity.
- Challenge ahead: real time estimates & forecasts; joint distribution of consumption, income, capital.

# Unequal contributions

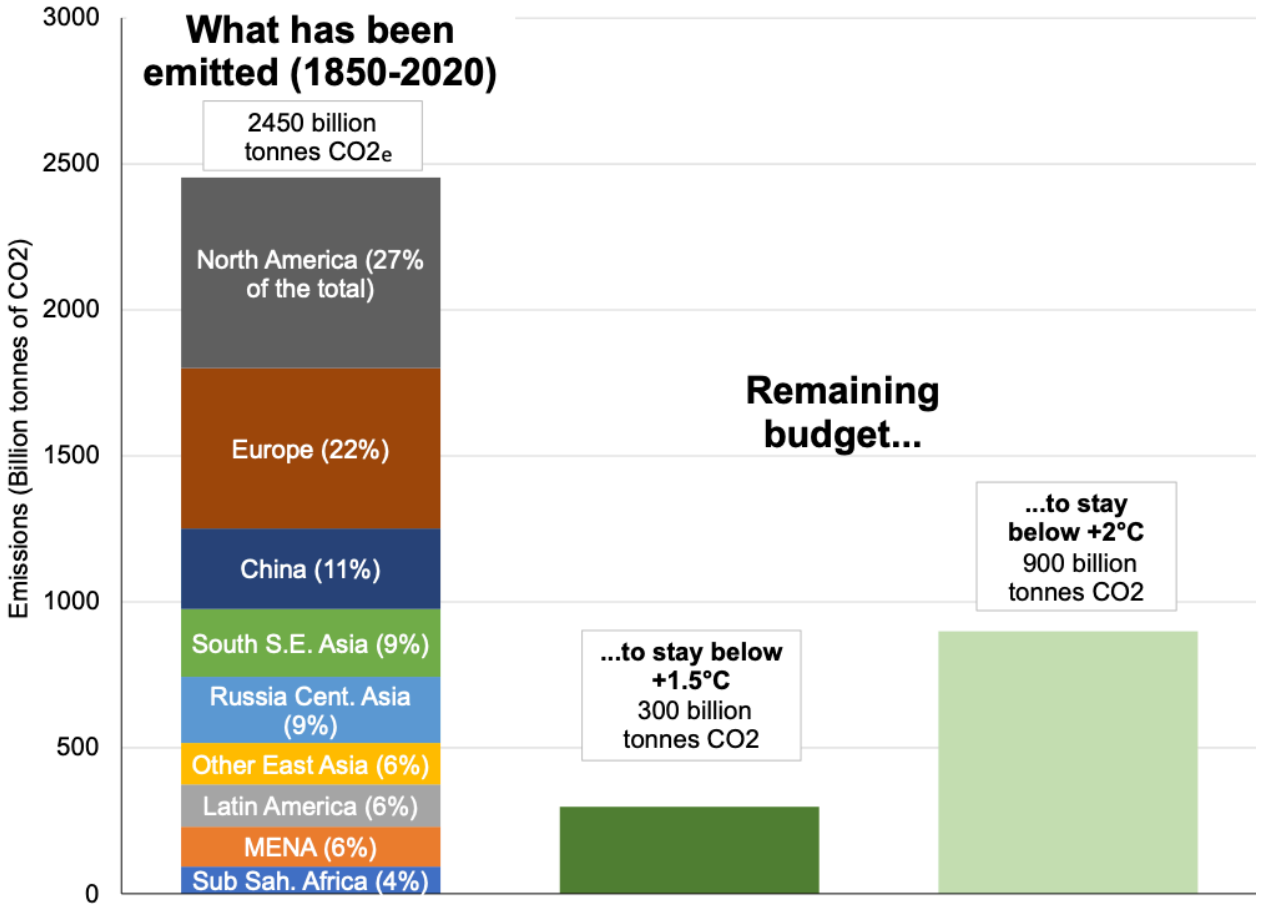
# The Triple Climate Inequality Crisis: Unequal Contributions



Global carbon inequality

Source: Chancel, Bothe, and Voituriez, 2023

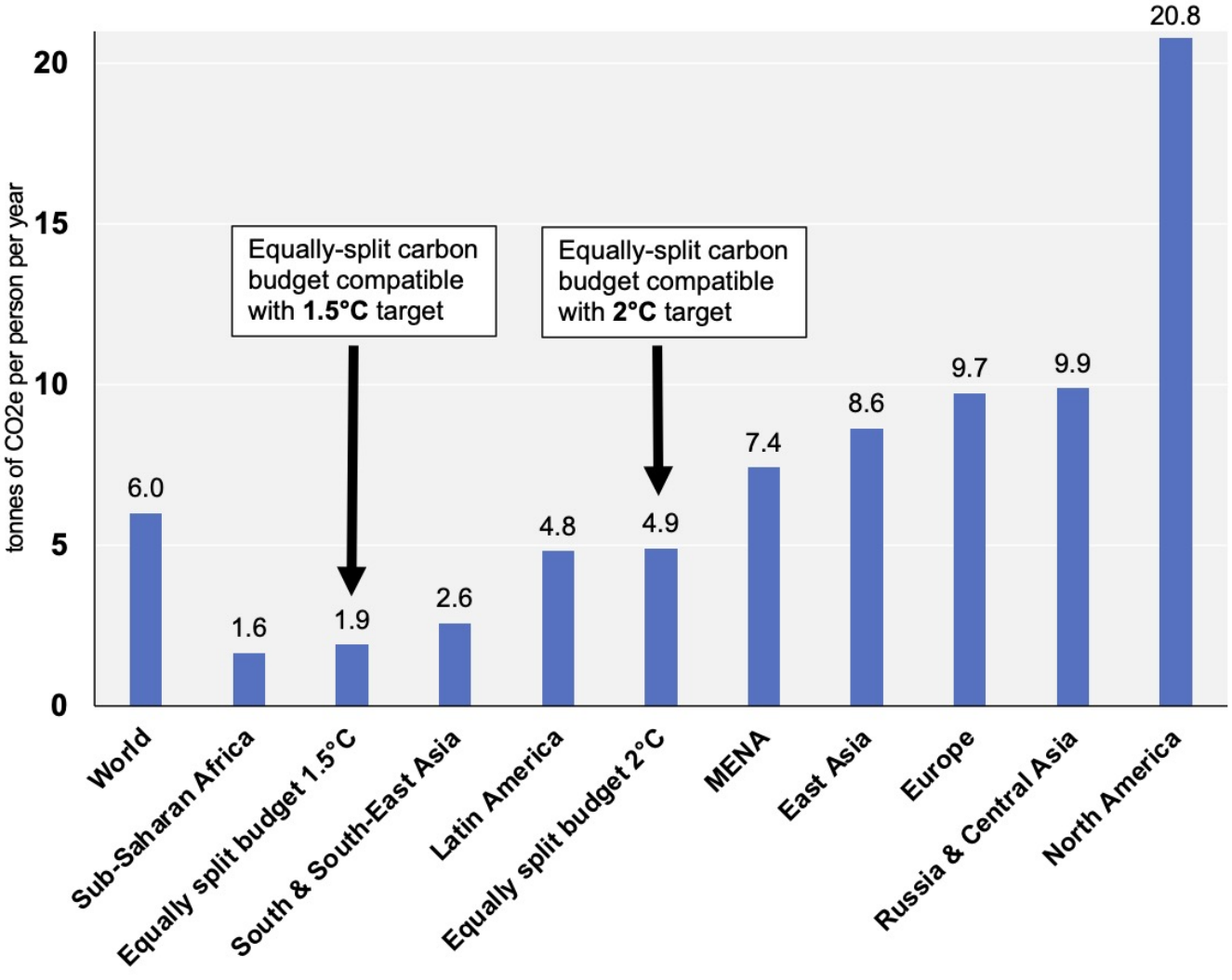
Unequal historical emissions between countries



Interpretation: The graph shows historical emissions by region (left bar) and the remaining global carbon budget (center and right bars) to have 83% chances to stay under 1.5°C and 2°C, according to IPCC AR6 (2021). Regional emissions are net of carbon embedded in imports of goods and services from other regions. **Source and series:** Chancel (2021). Historical data from the PRIMAP-hist dataset.

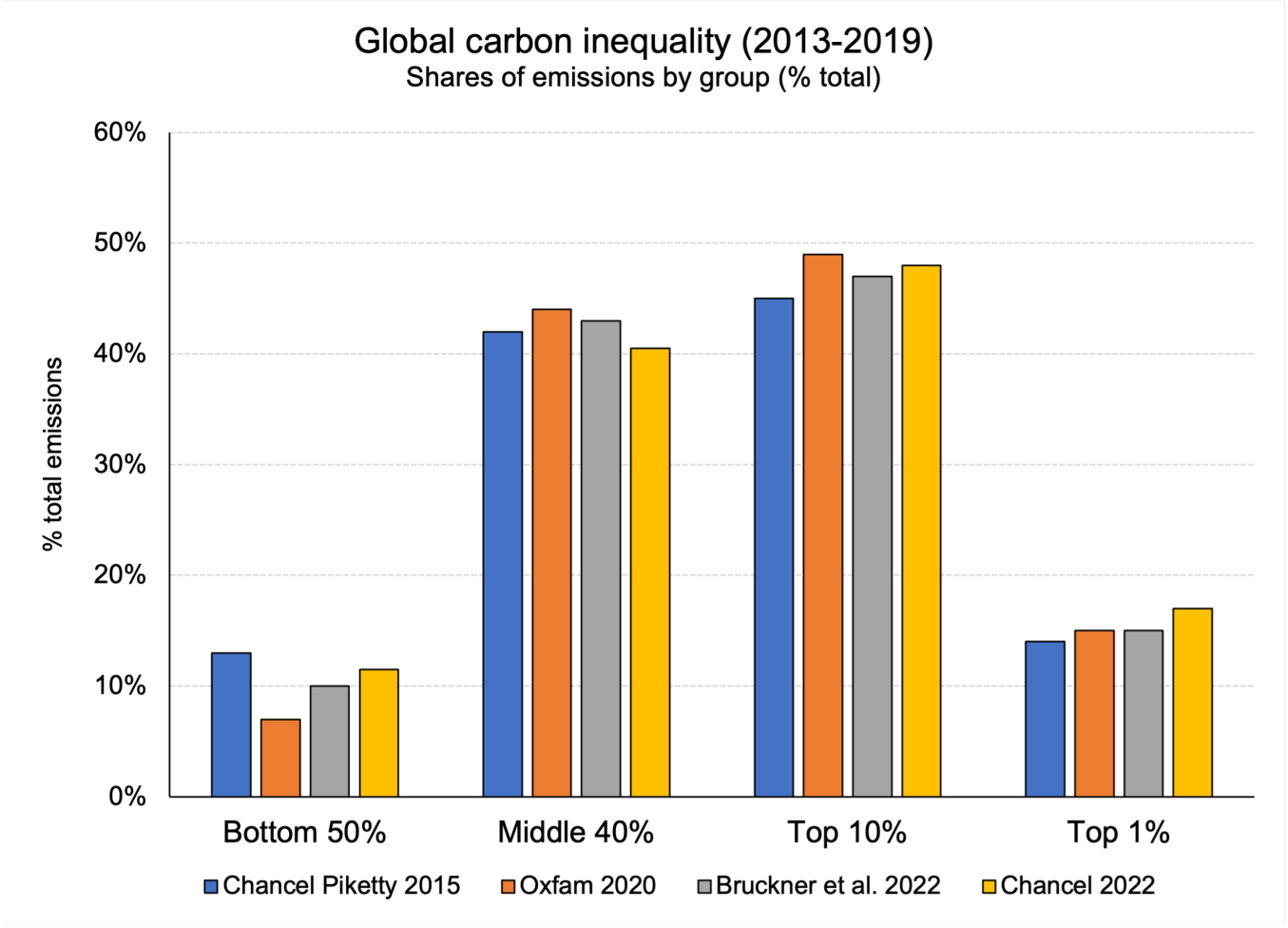
Historical emissions vs. remaining carbon budget

Inequalities in average emissions between regions



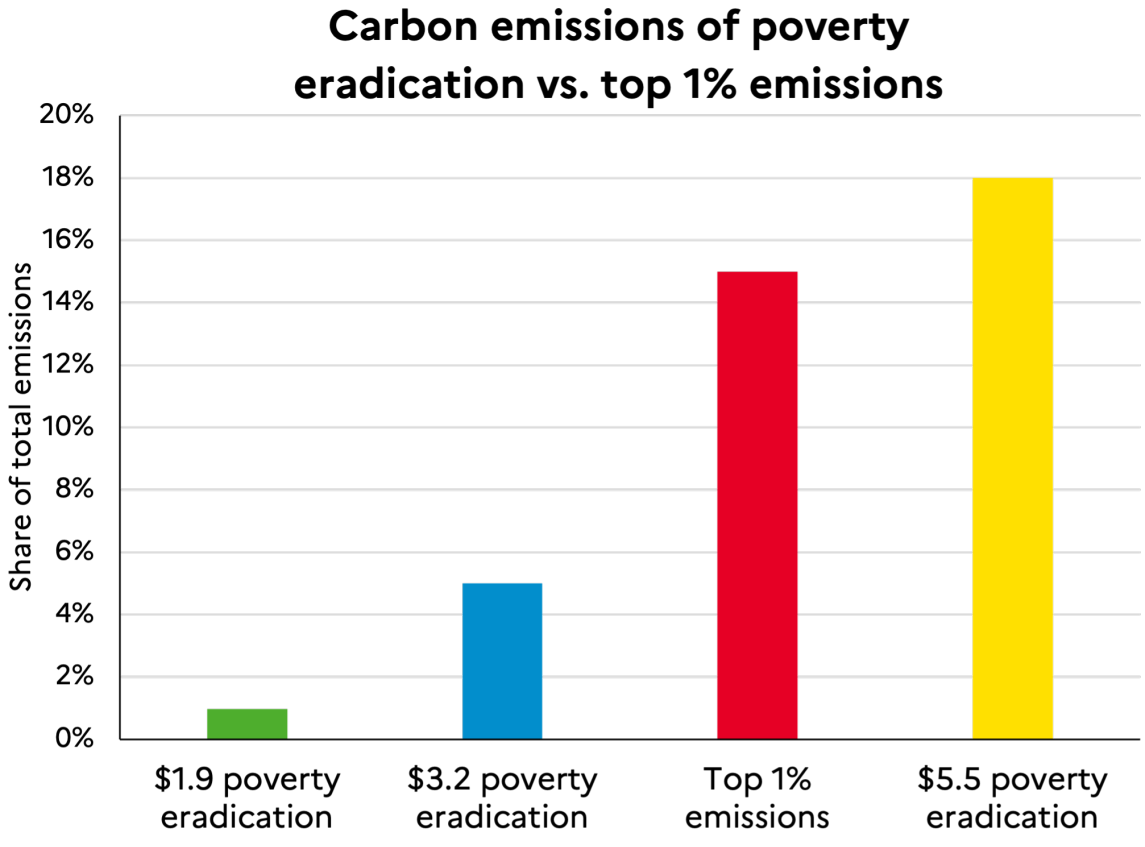
Average per capita emissions across regions, 2019

Inequalities in emissions between world individuals



Global GHG emission shares by group according to various studies

Reducing emissions at the top can free up significant development space



Source: Authors based on Bruckner et al. (2022)

Large shift in between vs. within carbon inequality since 1990

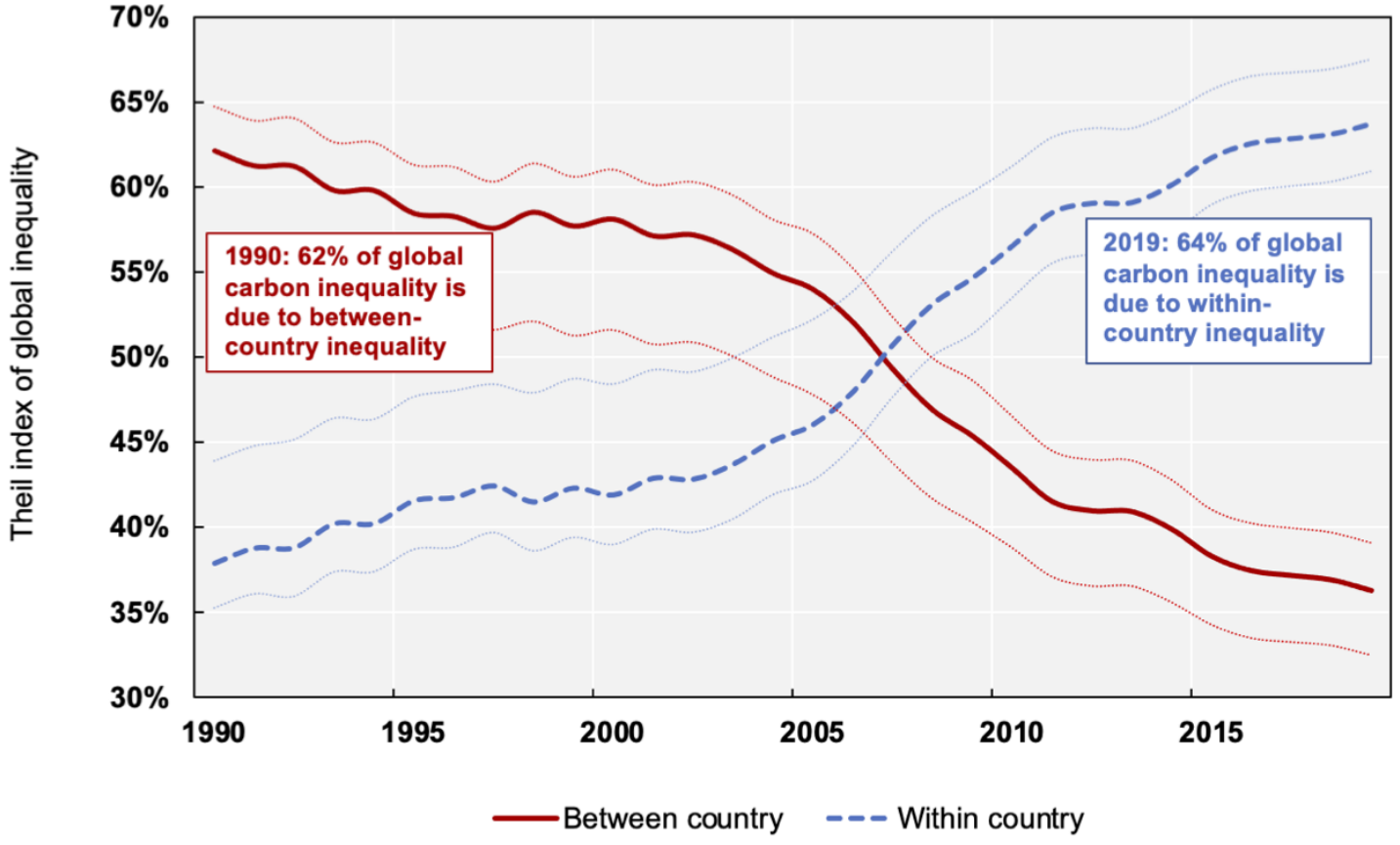
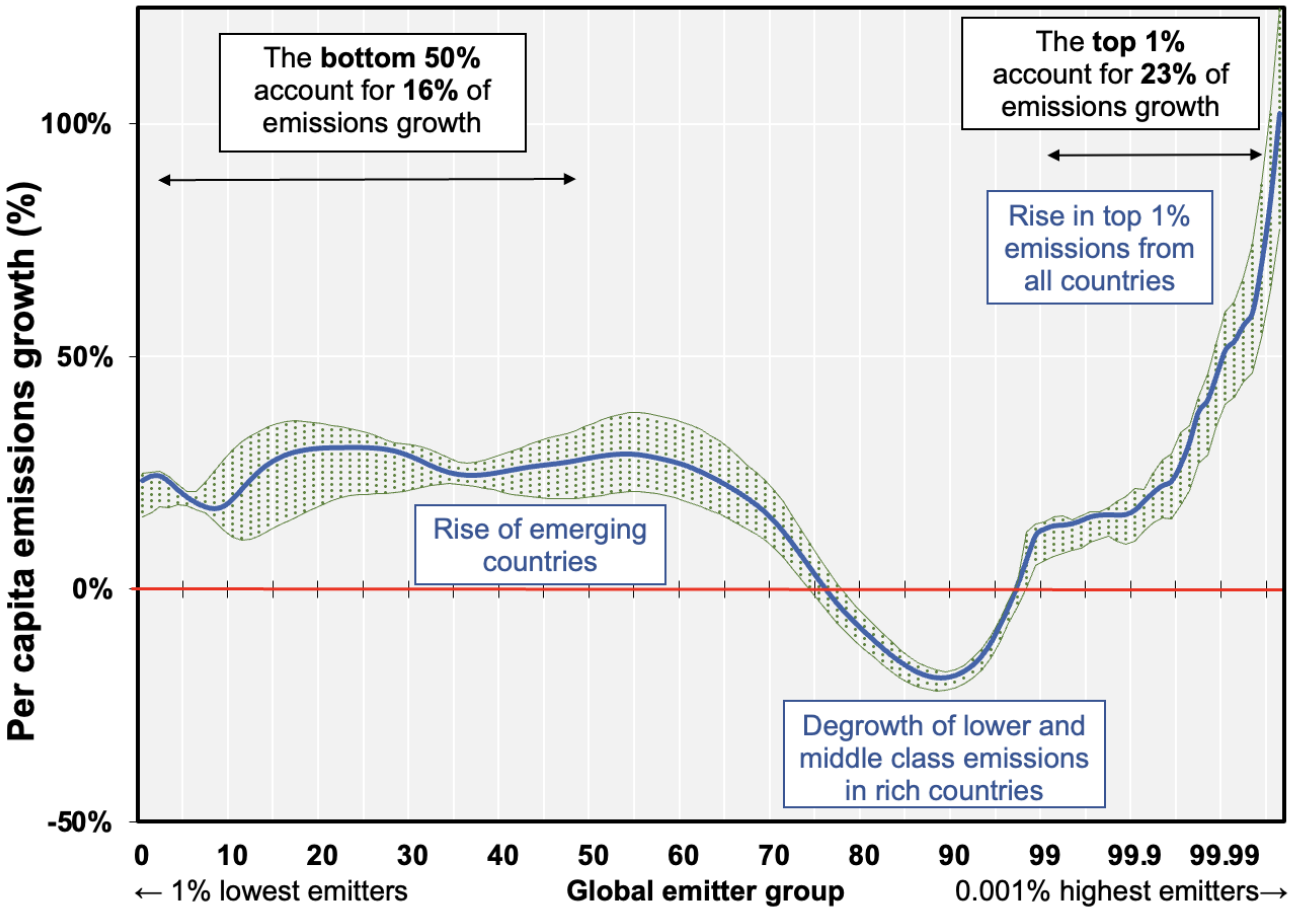


Figure 6A. Global carbon inequality: within vs. between Theil decomposition, 1990-2019

Notes: Personal carbon footprints include emissions from domestic consumption, public and private investments as well as imports and exports of carbon embedded in goods and services traded with the rest of the world. Modeled estimates are based on the systematic combination of tax data, household surveys and input-output tables. Emissions split equally within households. Benchmark scenario. Error bars show estimates for extreme scenarios values. **Source and series**: Author, see Methods and Supplementary Information.

Unequal decarbonization dynamics



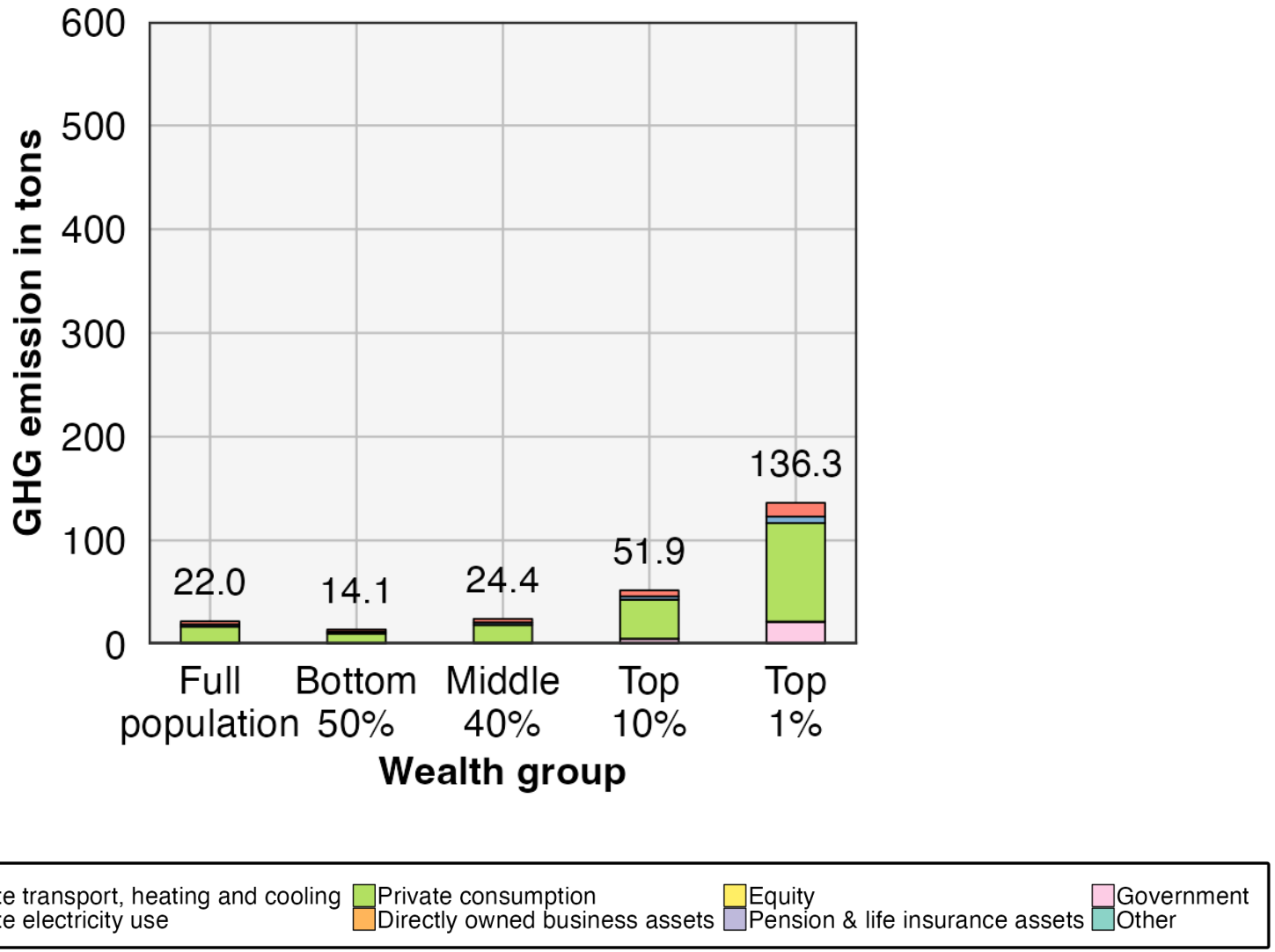
Growth in emissions by global emitter group (1990-2019)

Source: Chancel 2022

How to distribute emissions across individuals?

- Direct emissions are relatively straightforward to attribute. What about those associated with production processes?
- Carbon footprinting relies on two key criterion: *comprehensive* attribution (direct+indirect) *exclusive* attribution (no double counting). (IPCC 2022, Working group III, Annex I p. 1796)
- Standard approach: distribute all emissions to consumers (Chakravarty et al., 2009; Chancel and Piketty, 2015; Hubacek et al., 2017; Lenzen et al., 2006; Pottier, 2022).
- What about role of investments? Or limited information or agency of consumers?

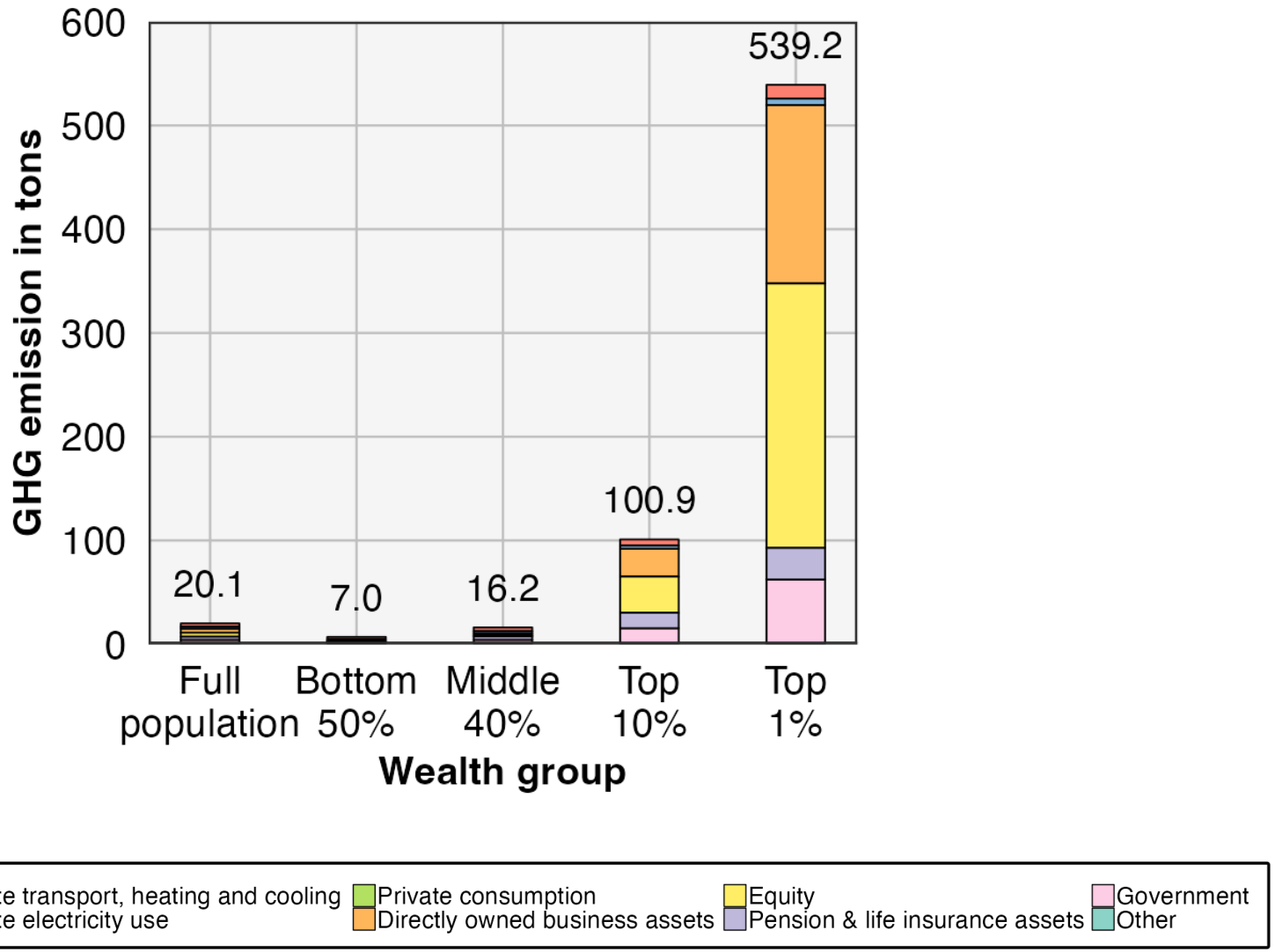
Consumption approach: US top 10% ~ 50tCO2e/cap



Per capita emissions by group in the US (consumption approach), 2019

Source: Chancel and Rehm 2023

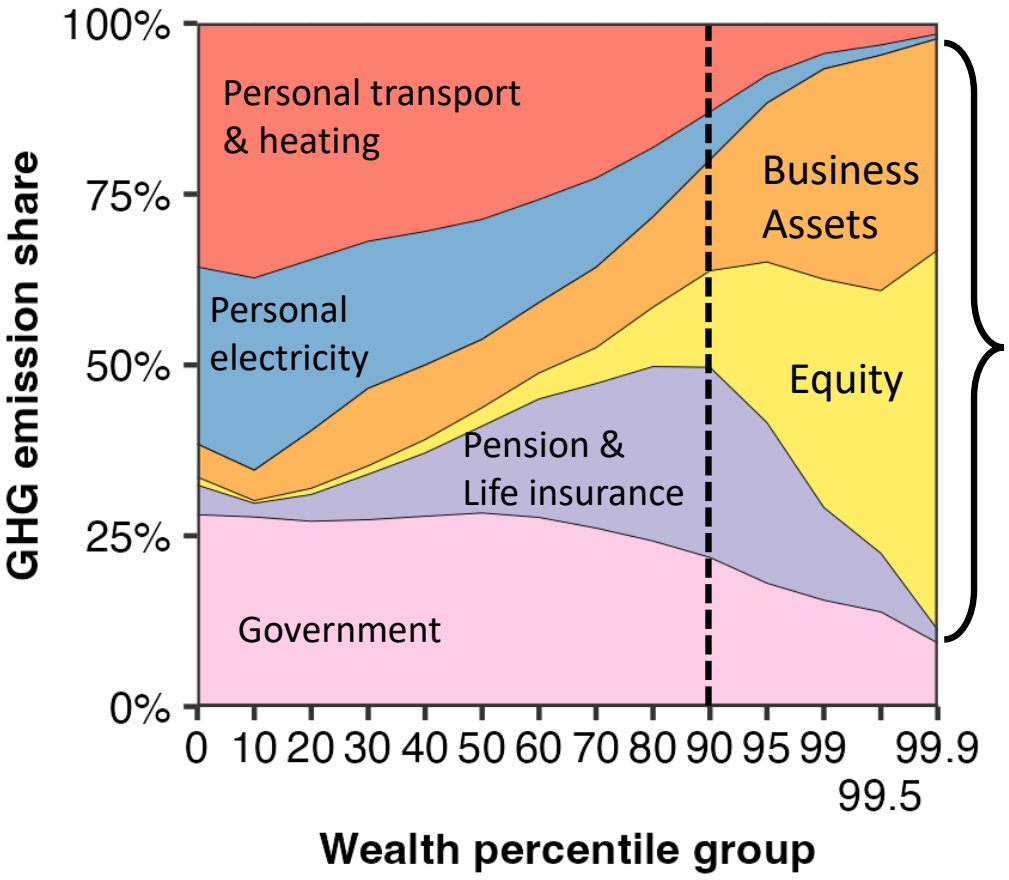
Ownership approach: US top 10% = 100tCO2e/cap



Per capita emissions by group in the US (ownership approach), 2019

Source: Chancel and Rehm 2023

Direct emissions are dwarfed by asset ownership at the top

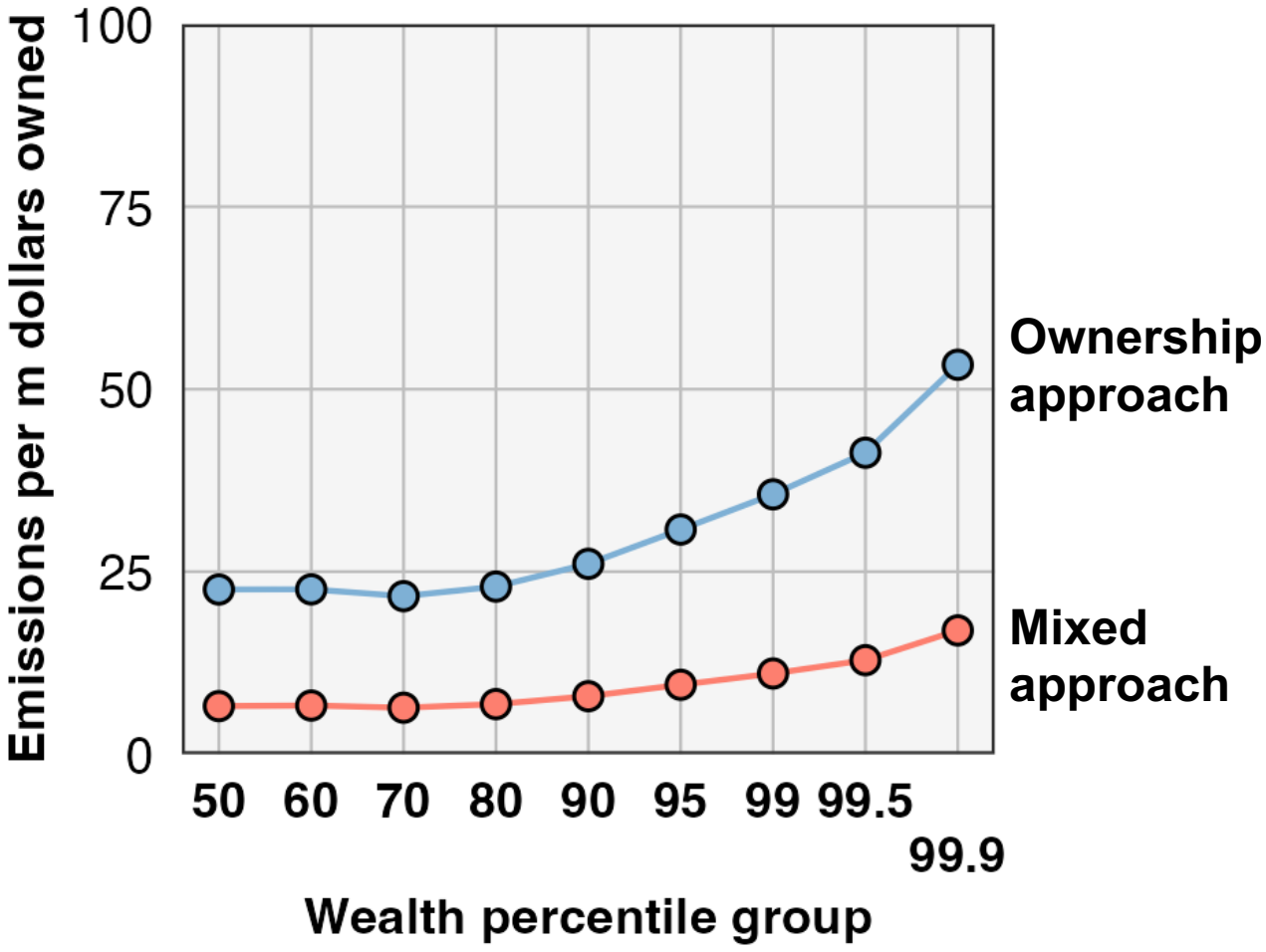


Top 10% emissions:
>75% from assets
<10% from direct energy consumption

Breakdown of emissions by wealth group in the US, 2019 (Ownership approach)

Source: Chancel and Rehm 2023

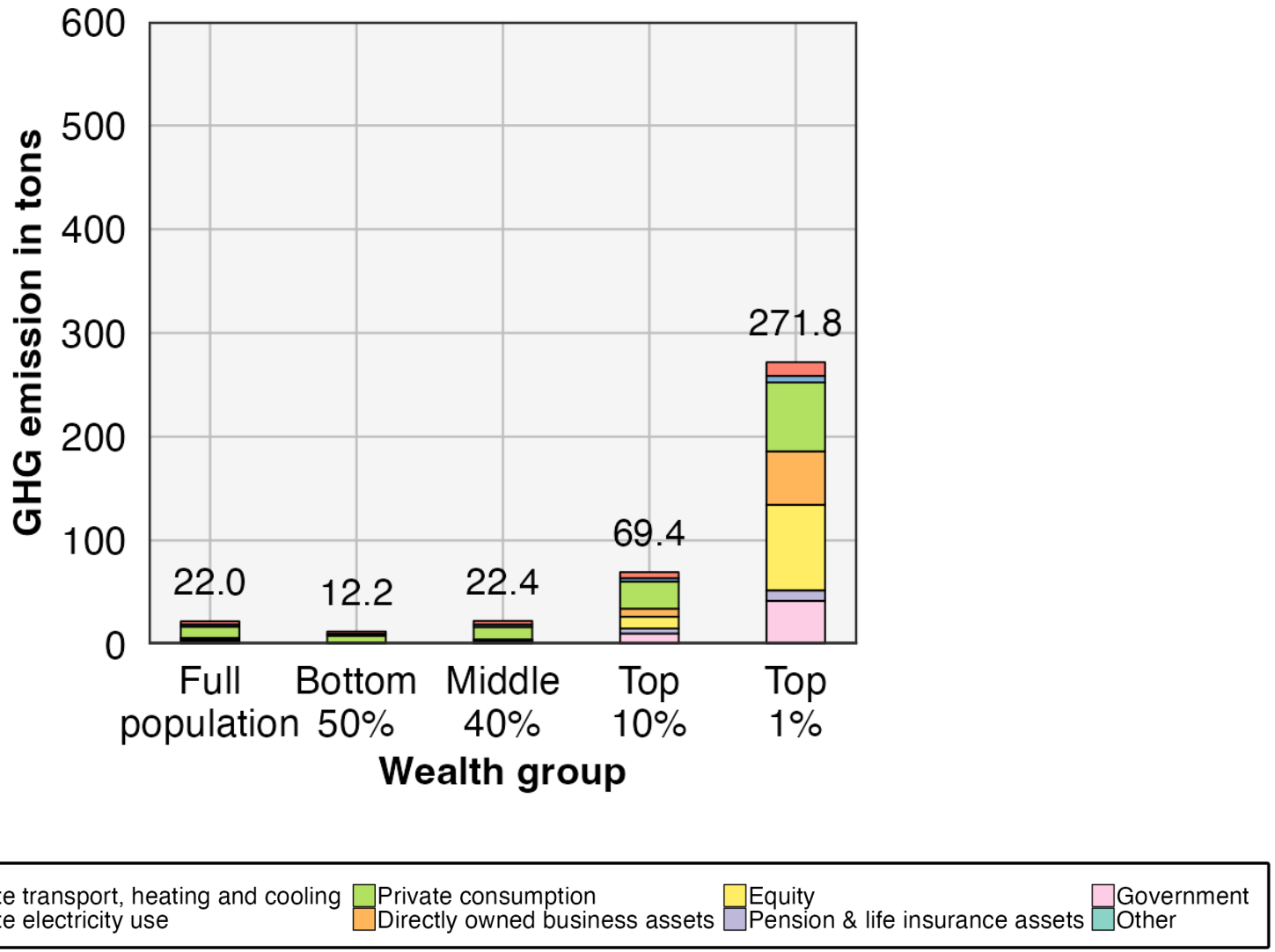
Ownership emissions intensity appears to rise with wealth



Emissions intensity of assets, US, 2019

Source: Chancel and Rehm 2023

Mixed approach: US top 10% ~ 70tCO2e/cap



Per capita emissions by group in the US (mixed approach), 2019

Source: Chancel and Rehm 2023

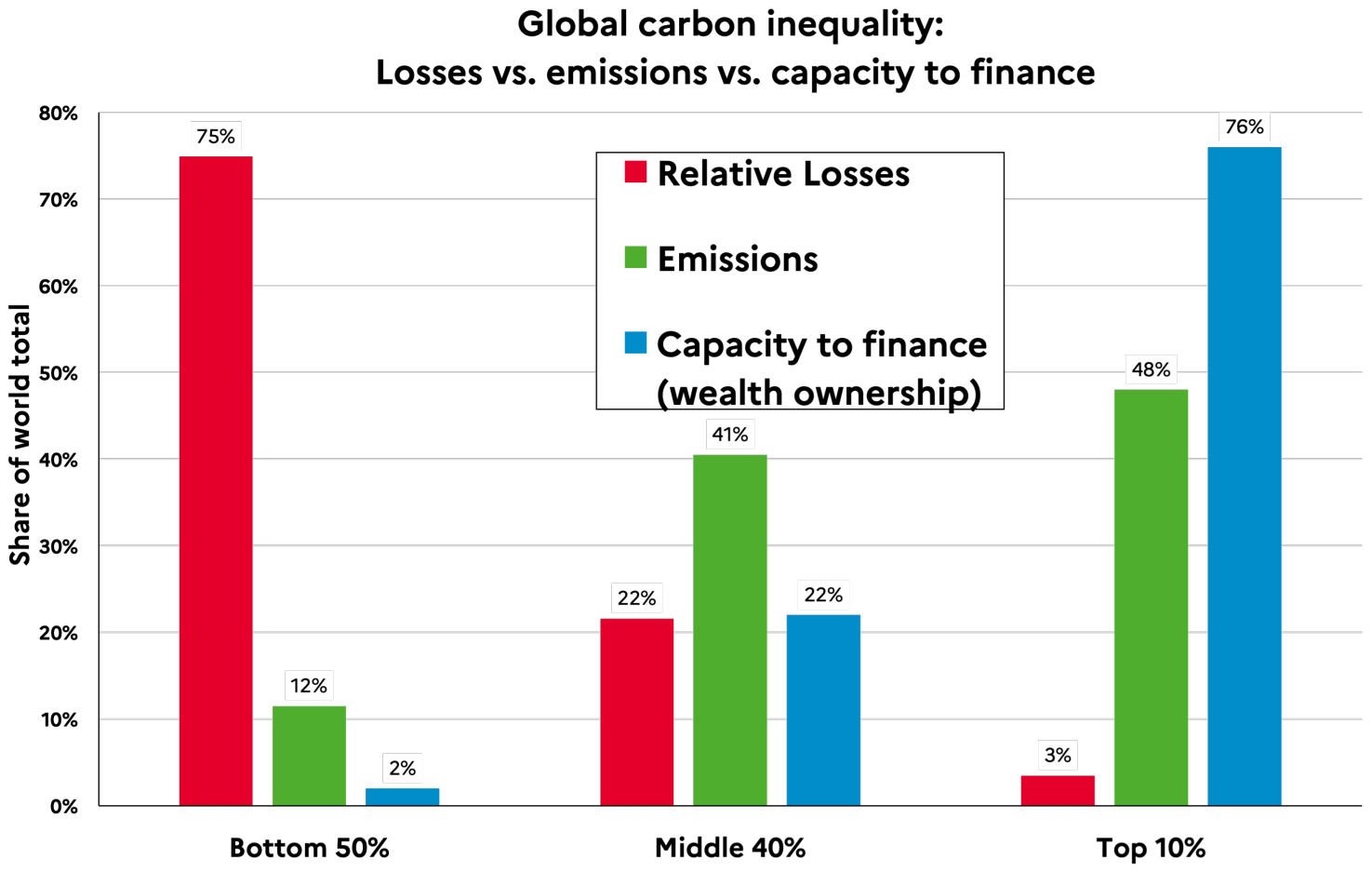
- Mixed approach used in global carbon inequality trends presented above (from "Global Carbon Inequality over 1990-2019", *Nature Sustainability*).

# Unequal contributions: summing up

- Consumption approach useful, but not sufficient
- Better measuring emissions associated with wealth is key
- Incidence of carbon taxes and regulations: still a lot of work to be done

Unequal capacities

The Triple Climate Inequality Crisis: Unequal Capacities

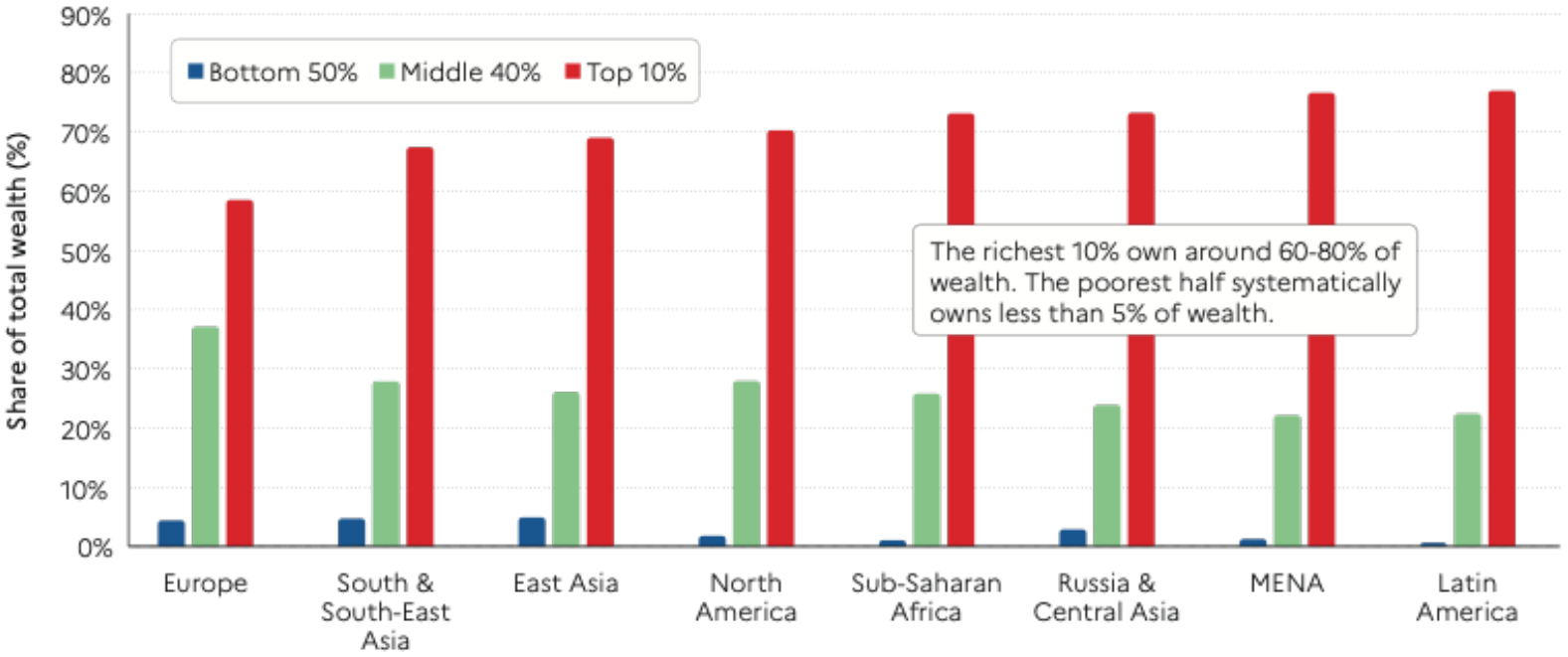


Global carbon inequality

Source: Chancel, Bothe, and Voituriez, 2023

Wealth inequality is extreme everywhere

Figure 4 ***The extreme concentration of capital: wealth inequality across the world, 2021***



Interpretation: *The Top 10% in Latin America captures 77% of total household wealth, versus 22% for the Middle 40% and 1% for the Bottom 50%. In Europe, the Top 10% owns 58% of total wealth, versus 38% for the Middle 40% and 4% for the Bottom 50%.* ***Sources and series:*** *wir2022.wid.world/methodology.*

Source: Chancel et al. 2022

Global climate finance gap: under funding of green vs. over funding of brown sectors

- Annual current climate finance: $\sim$ 1% global GDP ($1.3tn) (CPI 2023)
- Annual climate finance needs $\sim$ 5-6% global GDP ($8tn) (CPI 2023)
- Annual fossil fuels investments: $\sim$ 0.8% global GDP ($1tn) (CPI 2023); Annual fossil fuels subsidies: $\sim$ 1% global GDP ($1.3tn) (IMF 2023)

Adaptation finance gap: a fraction of the climate finance gap

- Adaptation finance needs in Global South: $\sim$ 0.15% global GDP ($200bn)
- Current adaptation finance in Global South: $\sim$ 0.05% GDP ($60bn)

Bridging the adaptation gap

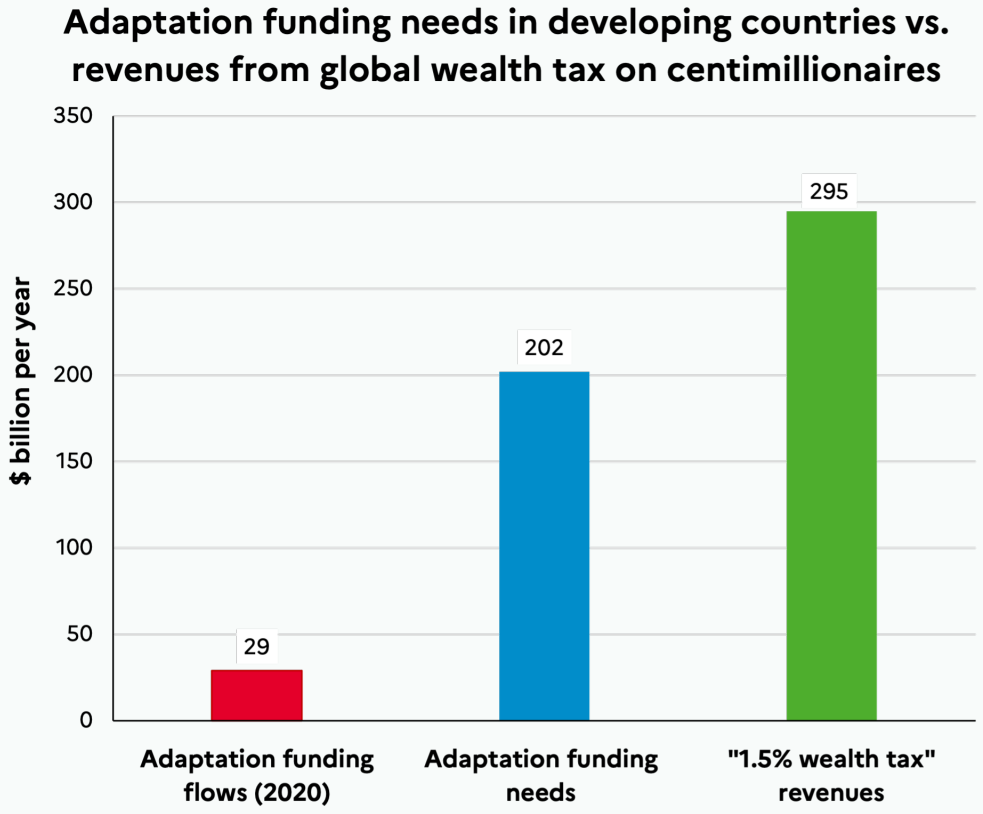


Figure E: Filling the adaptation funding gap in developing countries

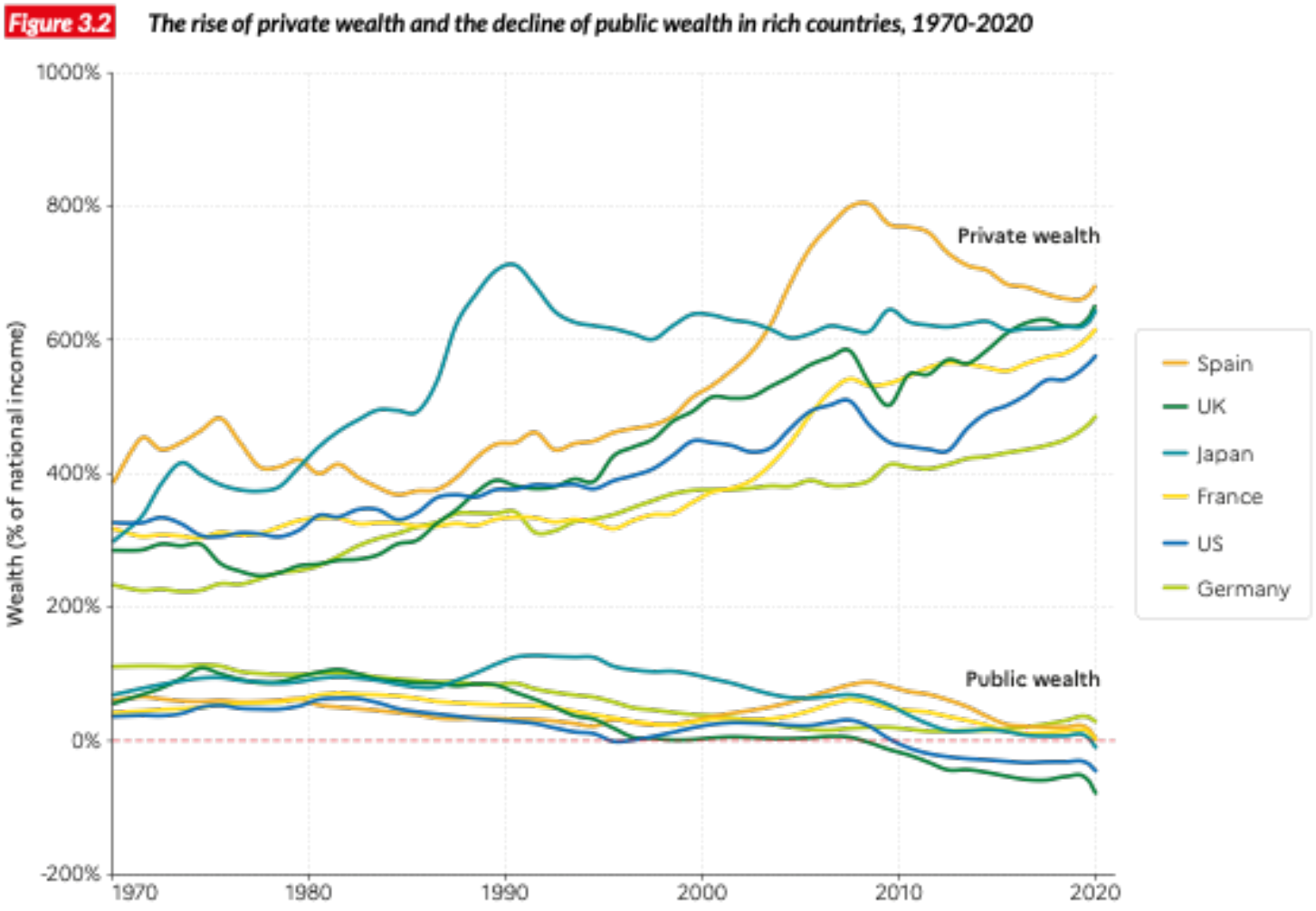
Notes: A relatively modest progressive wealth tax on global centimillionaires could fill the adaptation funding gap. See Figure 38 for more information.

Source: Chancel, Bothe, and Voituriez, 2023

Going beyond adaptation finance

- Climate finance needs in Global South by 2030: $\sim$ 1-2% global GDP / year
- This is equivalent to a 0.5% annual wealth tax on assets of Global North (or 3% income tax)
- Current development aid from Global North: 0.1% of Global North's wealth ($\sim$0.5% of its income) / year

What role for public vs. private actors in the transition?



Source: Chancel, Piketty, Saez and Zucman 2022

Unequal capacities: summing up

- Statistical agenda: Better real-time monitoring of intersections between inequality of losses, contributions, and capacities is paramount $\Rightarrow$ UN SNA revision + academic initiatives.
- Economic policy agenda: Mitigation and adaptation underfunded by and large. How to scale-up climate finance & what breakdown between public vs. private?
- Investment choices made now will not only define ecological state of the world, they will also impact future economic inequalities.