Universität Siegen

Wirtschaftswissenschaften
Wirtschaftsinformatik
Wirtschaftsrecht

PLURALE ÖKONOMIK
an der UNI SIEGEN

Ecology and inequality in global perspective: a research agenda

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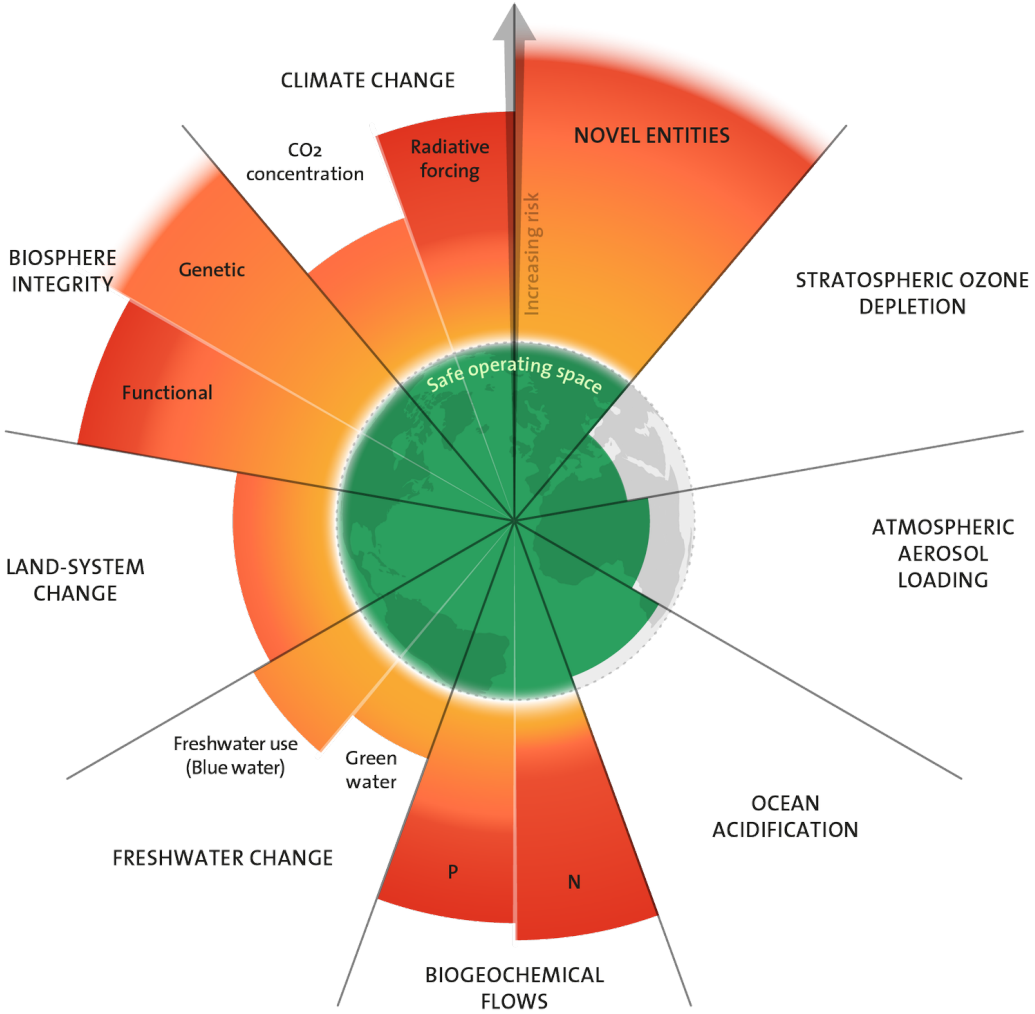
FMM Conference 2024

Sustainable sustainable development goals?

https://sdgs.un.org/goals

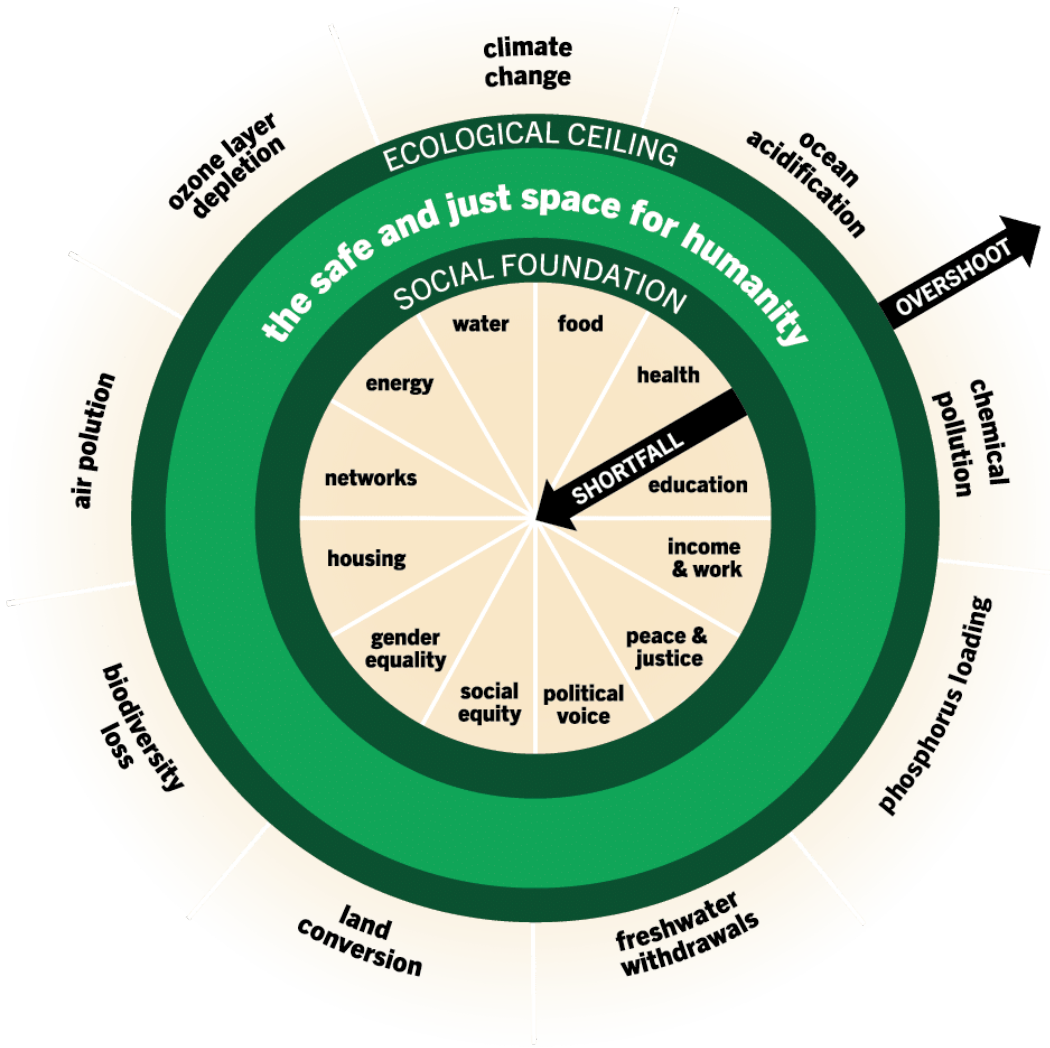
Providing decent living conditions for the world population within planetary boundaries is at the core of the concept of sustainability.

Planetary boundaries



Rockström et al. (2009), Steffen et al. (2015)

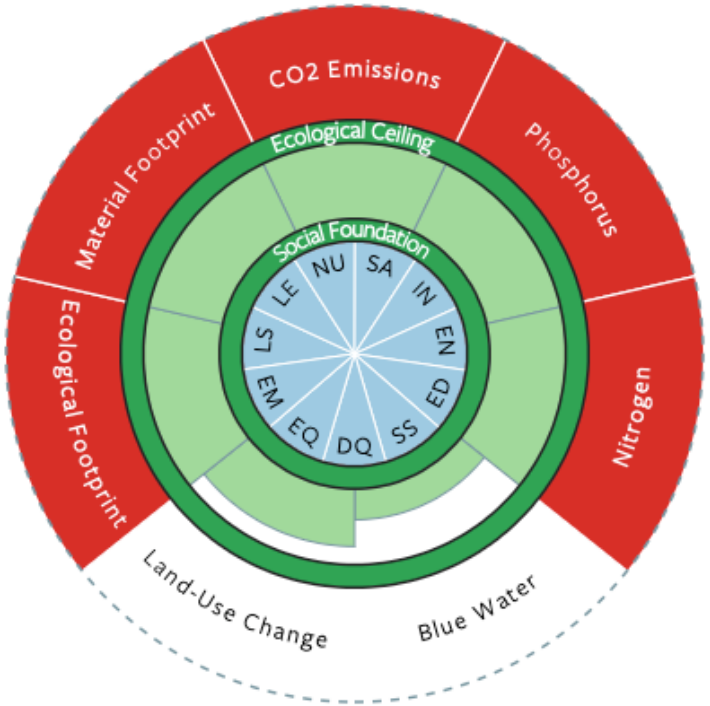
Doughnut framework



Raworth (2017)

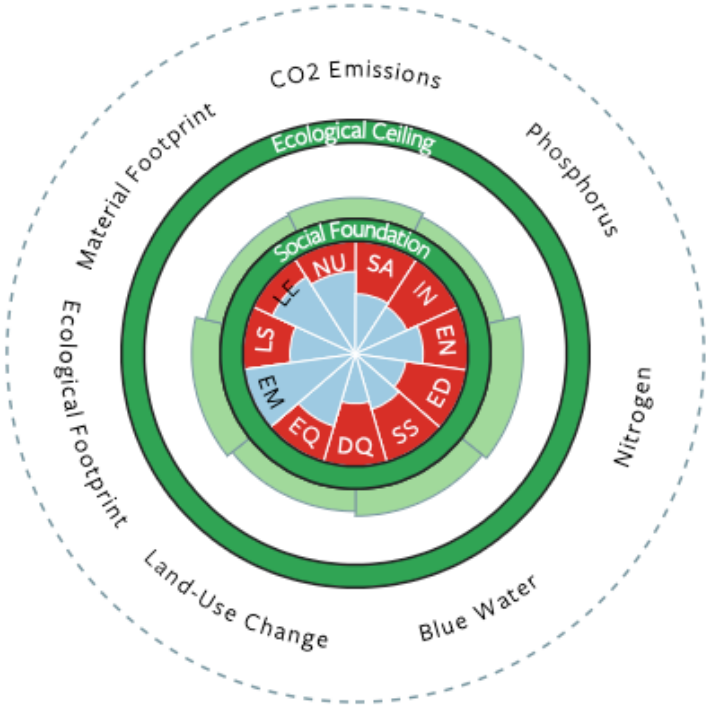
Empirical data from the project “Good Life for All”

Germany



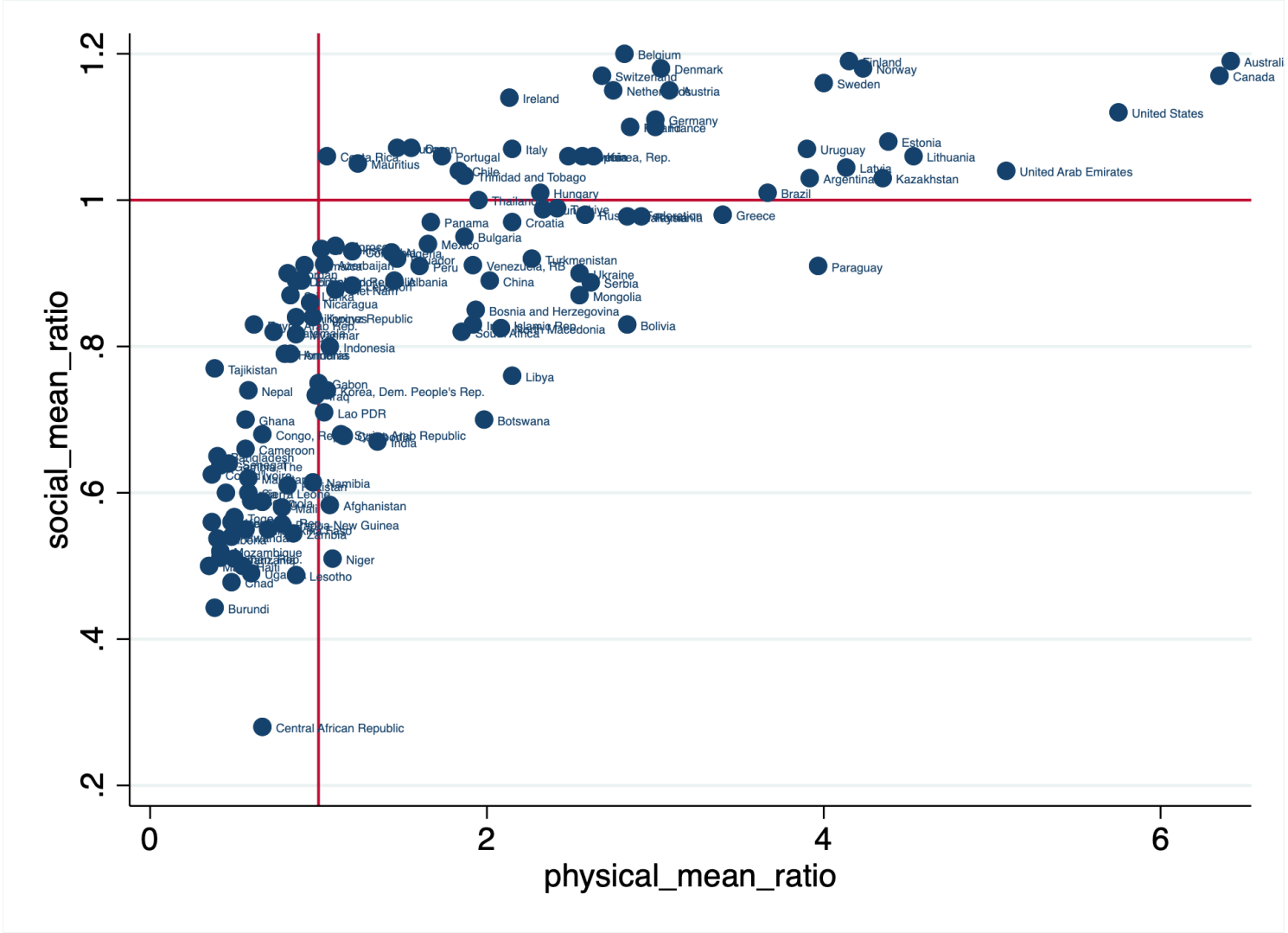
LS - Life Satisfaction
LE - Healthy Life Expect.
NU - Nutrition
SA - Sanitation
IN - Income
EN - Access to Energy
ED - Education
SS - Social Support
DQ - Democratic Quality
EQ - Equality
EM - Employment

Bangladesh



O‘Neill et al. 2018, https://goodlife.leeds.ac.uk

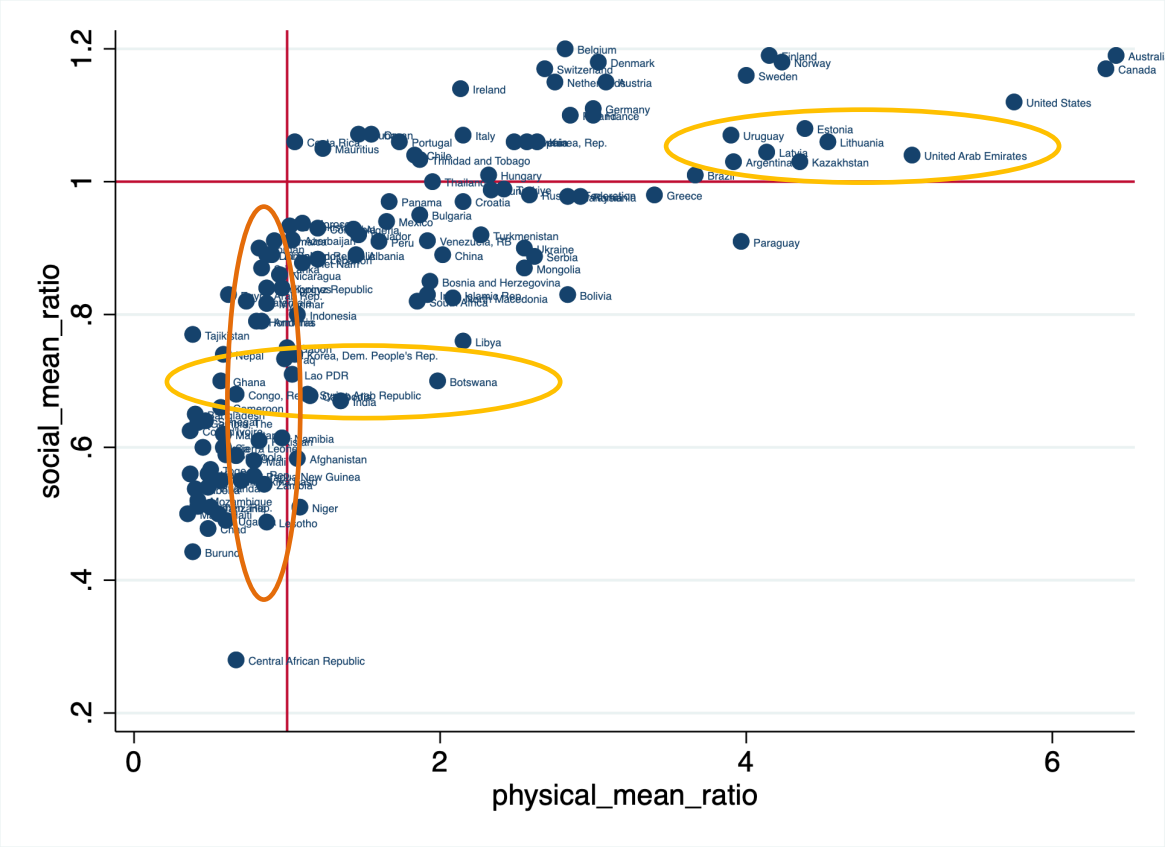
Which countries manage the trade-off?



Own graph, data from O'Neill et al. (2018)

Do more equal countries perform better?

But there is **considerable variation across countries** in the amount of ecological and environmental degradation "required" to meet certain socio-economic living standards.



Do income and wealth inequality play a role in explaining this variation?

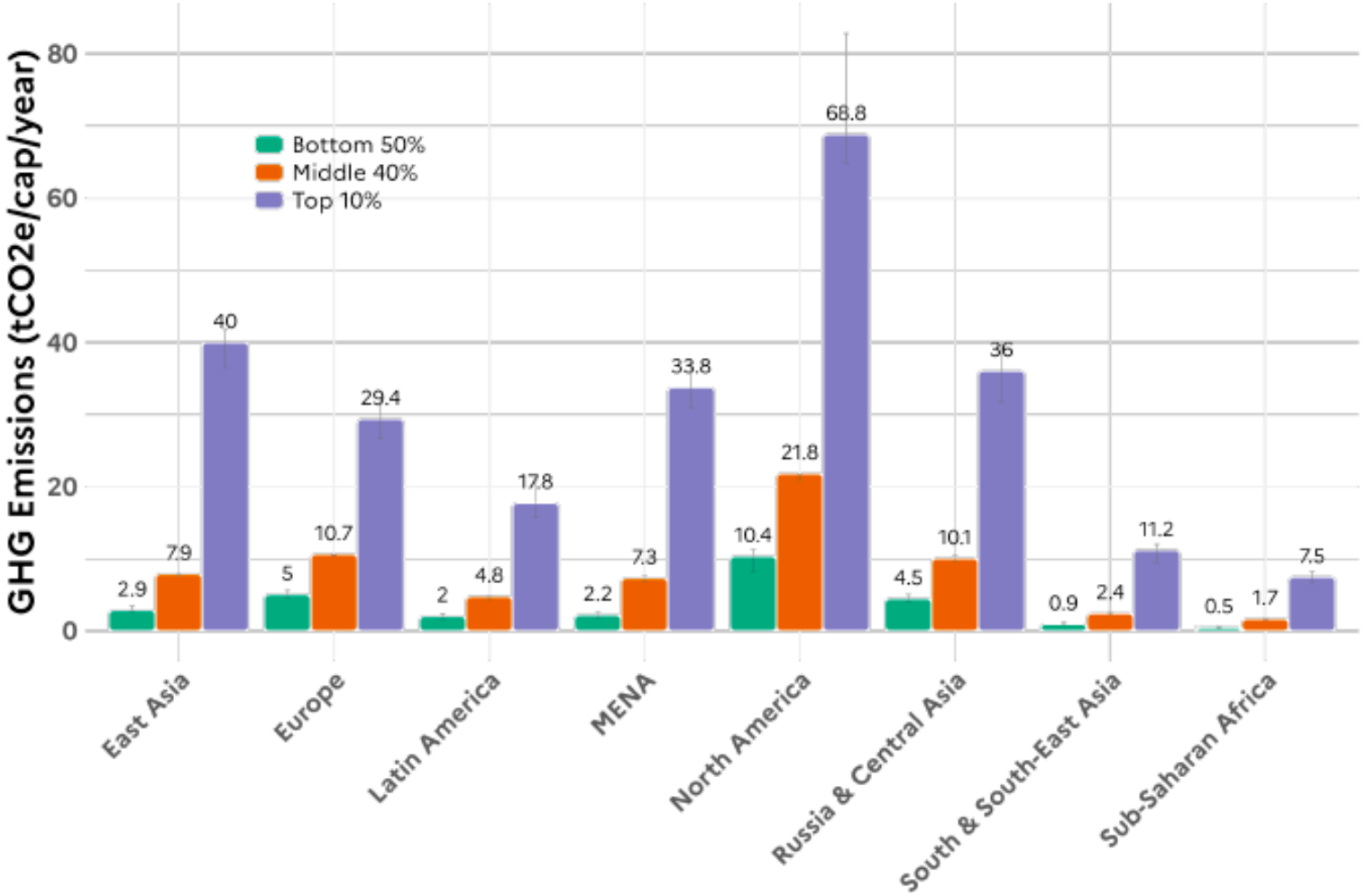
work in progress joint with Martin Middelanis

Theoretical ideas: in more unequal societies, …

- a higher average level of resource use is required for the whole population to meet the social threshold.
- the development and diffusion of new technologies is more difficult (Bai et al. 2020, Vona and Patriarca 2011)
- public policy solutions are more complicated: wealthier individuals benefit from carbon-intensive production while being less affected by environmental degradation (Boyce, 1994; Leach et al., 2018)
- economic and social problems are more important than environmental ones (Franzen & Vogl, 2013) and governance is worse (Kyriacou, 2019)
- status consumption is more impactful (Veblen 1899, Duesenberry 1949, Frank 2007, Wilkinson and Pickett 2010, Behringer et al. 2023, …)
- …

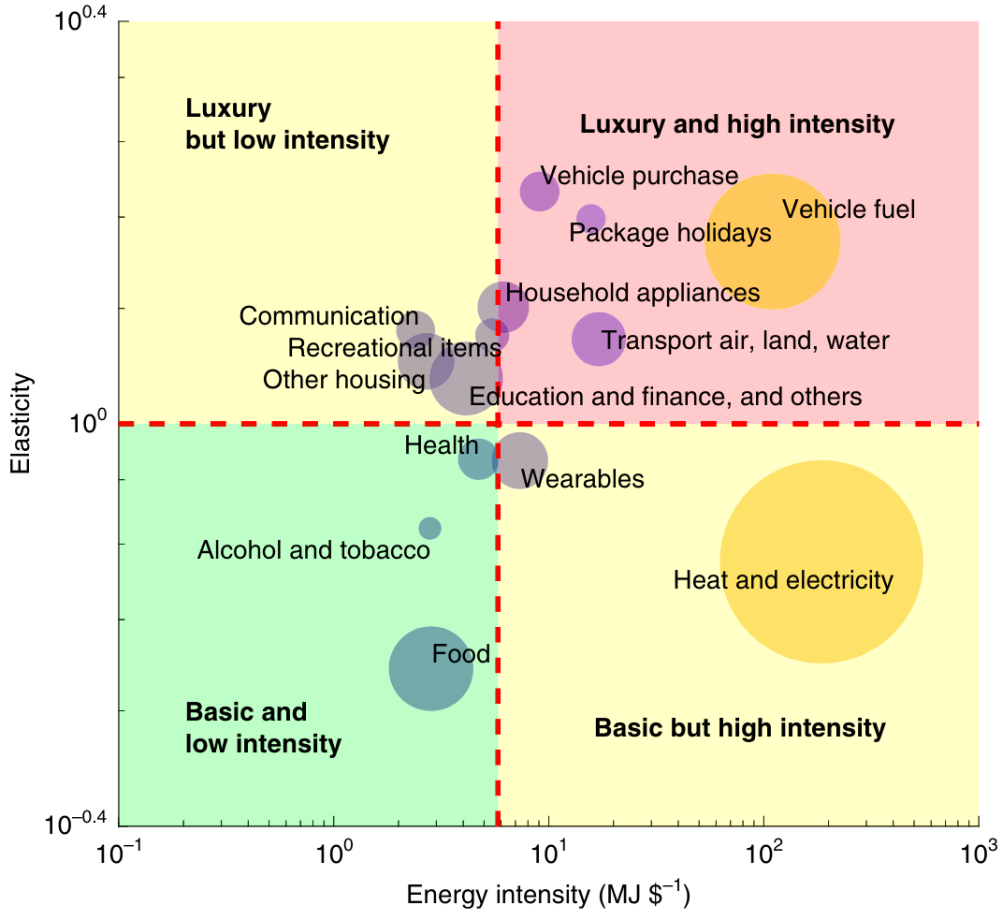
- there could be less ecological damage because of declining marginal propensity to consume and to emit (Berthe & Elie 2015, Holtz-Eakin & Selden 1995, Heerink et al. 2001, Ravallion 2000)
- there could be less ecological damage because the rich are more aware of ecological problems and can afford environmentally friendly lifestyles (Heerink et al. 2001)

Carbon footprint by income groups



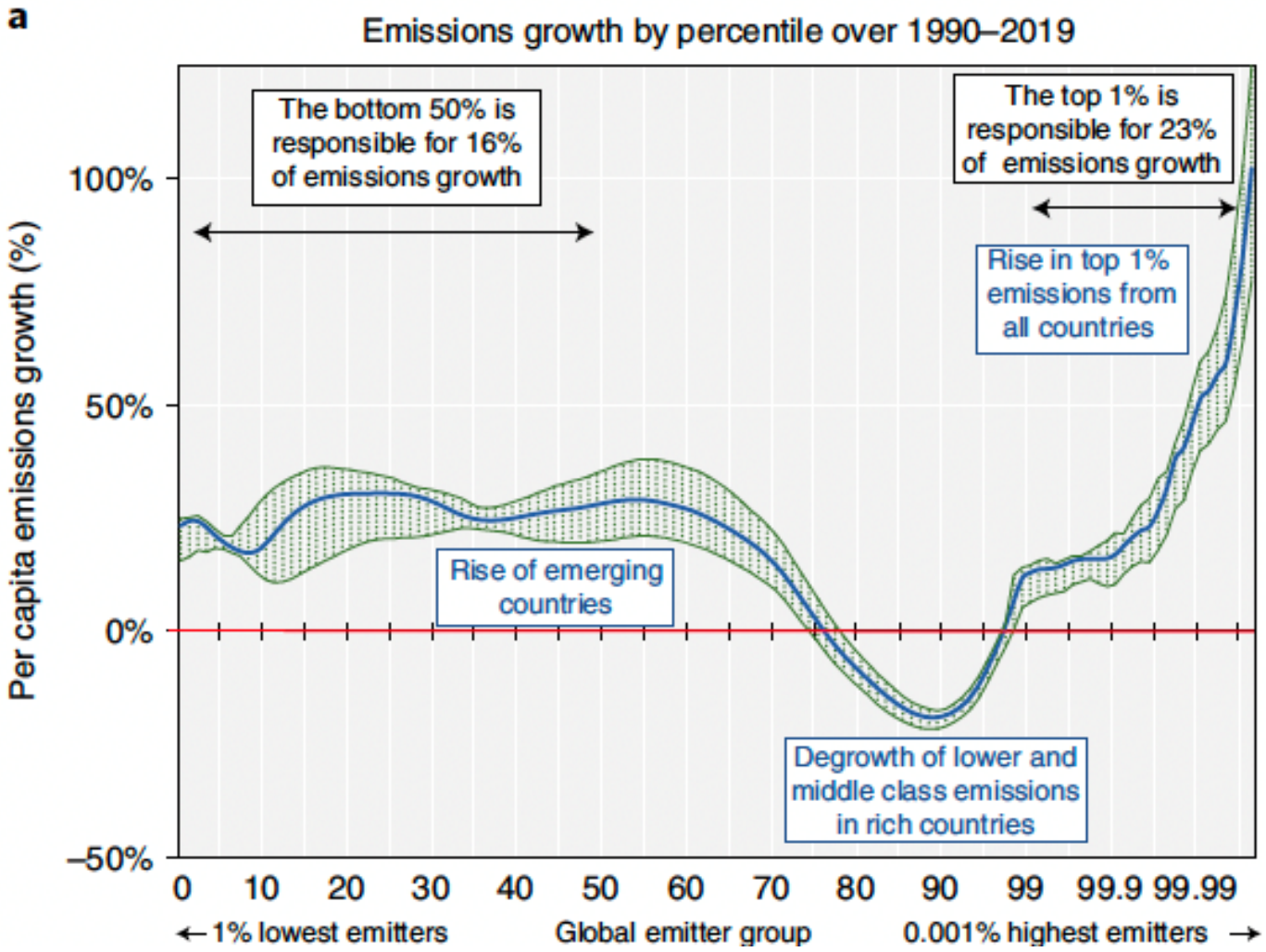
Chancel et al. (2022)

Elasticity and energy intensity of various consumption categories



Oswald, Owen & Steinberger (2020)

Emissions growth by percentile over 1990-2019



Chancel (2022)

Empirical literature (selection)

- **Grunewald et al. (*Ecological Economics* 2017):** 1980-2008, 158 countries, group FE estimator | **In low-income countries, a reduction of the disposable income Gini coefficient comes along with higher CO2 emissions. Opposite in high-income countries.**

- **Wan et al. (*Ecological Economics* 2022):** 1960-2019, 217 countries, IV panel estimation | **Reduction of disposable income Gini coefficient coincides with increase in CO2 emissions**.

- **Kopp and Nabernegg (*Ecological Economics* 2022):** 1961-2019, 116 countries, GMM panel estimation | **Reduction of disposable income Gini increases ecological and environmental damage** (several indicators). Some scope for synergies on some sub-indicators in poor countries.

- **Hou et al. (*World Development* 2024):** 1995-2019, 43 countries, several panel estimators| **a lower disposable income Gini coefficient can help to decouple GDP growth and carbon footprint** - especially in high-income countries.

Empirical literature (selection)

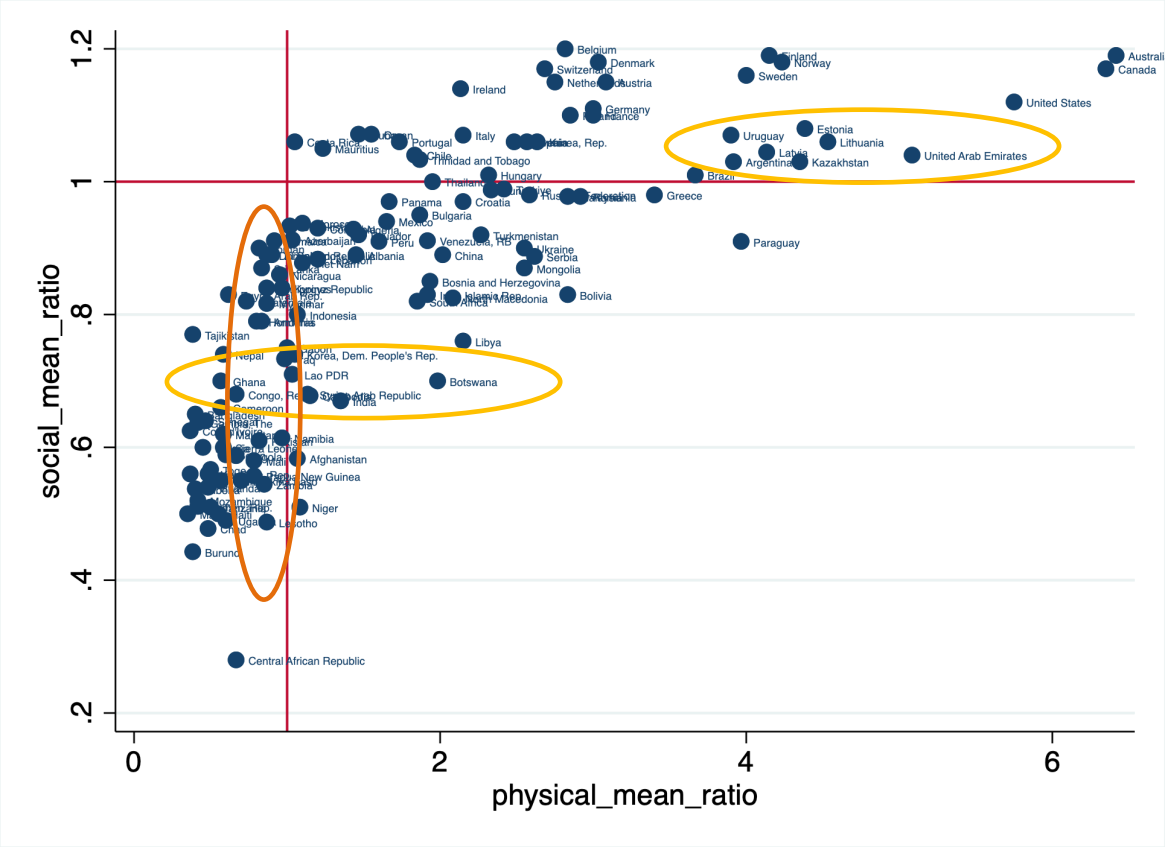
- Grunewald et al. (
- Wan et al. (*Ecolog*
- Kopp and Naberni
- Hou et al. (*World*

This (larger) literature…

- **has produced partly contradictory results.**
- **has focused on within-country variation over time, raising econometric challenges.**
- **is mostly focussed on disposable income inequality, measured through the Gini coefficient (with good reasons).**
- **often seems to equate a reduction in the Gini coefficient with pro-poor growth, and a rise with increases in top shares.**

Do more equal countries perform better?

There is **considerable variation across countries** in the amount of ecological and environmental degradation "required" to meet certain socio-economic living standards.



Do income and wealth inequality play a role in explaining this variation?

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Approach and data

Very simple OLS panel regression with time fixed effects:

$$(1)\ planetary\ boundaries_{it} = Gini_{it}\ _{+} socioeconit + yeart + \varepsilon$$

$$(2)\ planetary\ boundariesit = sharei_{tj} + share_{control} + socioecon_{it} + yeart + \varepsilon$$

planetary boundaries**: degree of transgression of planetary boundaries** (ratio indicator from O'Neill et al. 2018)

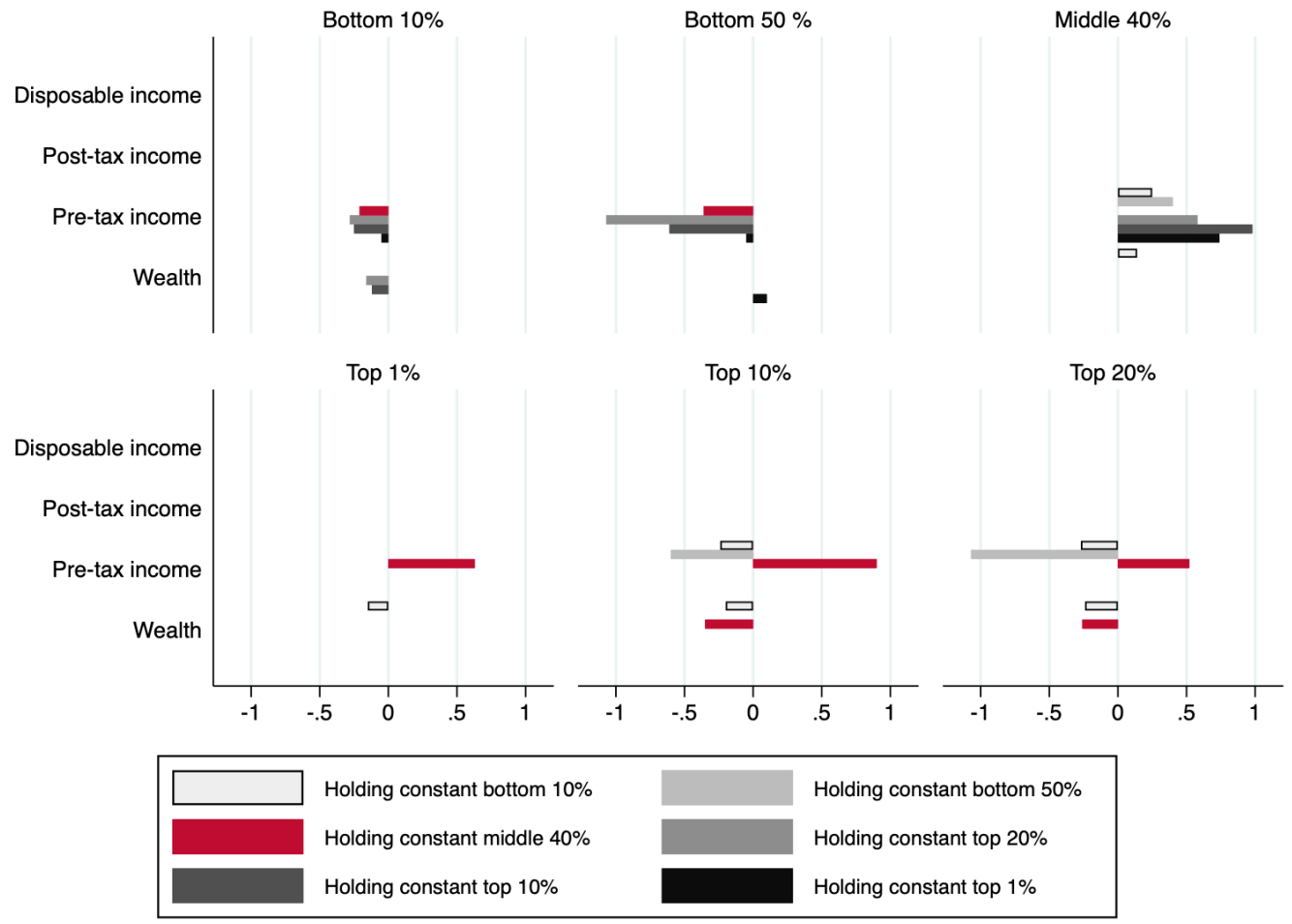
socioecon: **socio-economic living standards** (ratio indicator from O'Neill et al. 2018) excluding inequality

inequality: **various inequality indicators**

- Market and disposable income **Gini coefficients (eq. 1)** from SWIID and
- **percentile shares (eq. 2)** of pre-tax, post-tax, disposable income and wealth from the World Inequality Database
- $share_j$: bottom10, bottom50, middle40 (p50-p90), top20, top10, top1 | $share_{control}$ = all other shares, excl. overlaps, in separate estimations

Driscoll-Kraay standard errors to account for cross-sectional dependence and serial correlation.

Low-income countries



Almost no data for disposable and post-tax income.

➔ Pre-tax income:

- Higher bottom10/50 shares: lower
- Higher middle40 shares : higher
- Higher top10/20 shares : **lower** transgression **when we hold constant bottom shares** (when variations at the top imply variations in the middle) but
- **more** transgression **when we hold constant the middle40 share** (when variations at the top imply variations in the bottom half).

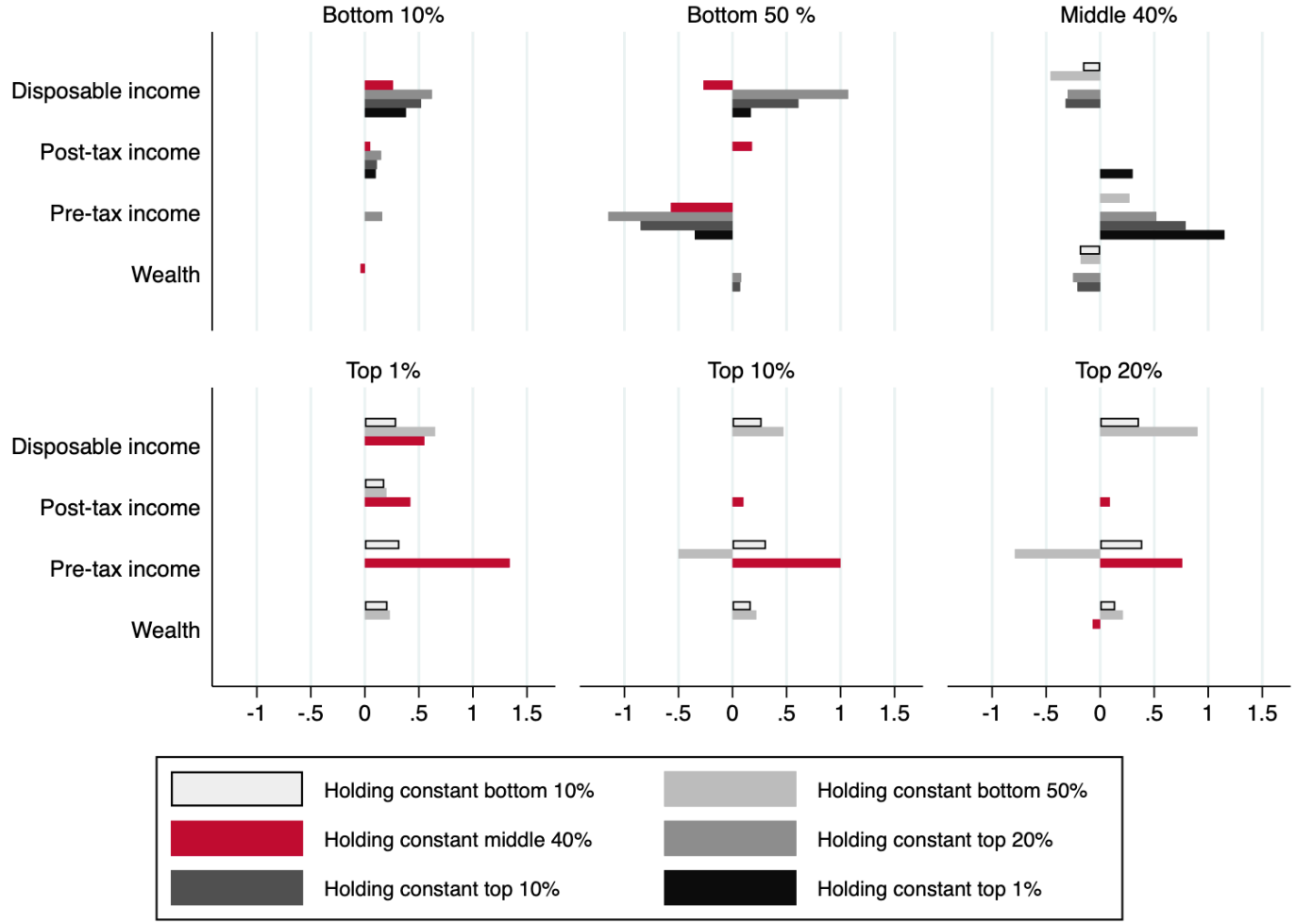
What would the Gini say?

Dependent variable: transgression of planetary boundaries

Gini coefficient of disposable income					
Post-tax Gini	(7) -0.0122***	(8) -0.0113**	(9) -0.0075	(10) -0.0134**	(11) 0.0907***
	(0.0008)	(0.0018)	(0.0047)	(0.0047)	(0.0158)
Income group	all	LI	LMI	UMI	H
# obs.	2,692	795	794	565	529
Gini coefficient of pre-tax income					
Pre-tax Gini	(1) 0.0174***	(2) -0.0106***	(3) 0.0083^{+}	(4) 0.0208***	(5) 0.0175
	(0.0019)	(0.0016)	(0.0044)	(0.0030)	(0.0167)
Income groups	all	LI	LMI	UMI	H
# obs.	2,692	795	794	565	529

Inequality data: Standardized World Income Inequality Database (SWIID), version 9.5, June 2023. Other data: O'Neill et al. (2018). Time period covered: 1992-2015. Levels of statistical significance: ***=0.1%, ***=1%, *=5%, $^{+}$=10%. Controls included in all specifications: socio-economic goal achievement and year dummies. Income groups differentiate low-income (LI), lower middle-income (LMI), upper middle-income (UMI) and high-income (HI) countries. Driscoll-Kraay standard errors control for cross-sectional dependence and serial correlation.

High-income countries



Statistically significant beta-coefficients of estimations where we estimate if countries of the same socio-economic living standards transgress planetary boundaries more or less **when we vary the income or wealth share of the bottom 10% (upper left), holding constant the shares of various other groups along the distribution**.

Which countries transgress planetary boundaries relatively less or more?

- higher disposable income of the bottom 10 & 50 and also top shares: higher
- higher disposable income share of the middle40: lower
- largely opposite findings for pre-tax income
- higher wealth shares of middle40: lower
- higher wealth shares of top20/1: higher

What would the Gini say?

Dependent variable: transgression of planetary boundaries

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Synthesis

Take this over-simplified synthesis with a grain of salt

Country group	**available and relevant indicators**	**group(s) whose income/ wealth shares have positive associations with transgression of planetary boundaries**
Low-income countries	pre-tax income	middle-class
Lower middle-income countries	post-tax income	bottom half
Upper middle-income countries	disposable income wealth pre-tax income	top middle-class middle-class
High-income countries	disposable income pre-tax income wealth	bottom and top middle top

Conclusion

To understand potential trade-offs of socio-economic and ecological goals, it seems important to

- investigate implications of shares and shifts along the distribution, rather than to rely on single-score indicators of inequality and (mis)interpret what could have been behind reductions or increases
- consider pre-tax, post-tax/disposable income and wealth inequality
- consider country circumstances

➔ and interactions between these:

For example, wealth inequality might be relevant to different degrees in different groups of countries, and for different reasons/mechanisms, and hence with different findings along the distribution.

- reflect more on nexus between levels and distribution (e.g. inequality and poverty reduction).
- consider that if income growth at the bottom poses a problem for planetary boundaries, then more rather than less redistribution (at the top) might be an effective solution.

Thank you!

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Table 1 | Country performance with respect to per capita biophysical boundaries

Biophysical indicator	*N*	Planetary boundary	Per capita boundary	Countries within boundary (%)
CO_2 emissions	145	2 °C warming	1.61 t CO_2 yr^{-1}	34
Phosphorus	144	6.2 Tg P yr^{-1}	0.89 kg P yr^{-1}	44
Nitrogen	144	62 Tg N yr^{-1}	8.9 kg N yr^{-1}	45
Blue water	141	4,000 km^3 yr^{-1}	574 m^3 yr^{-1}	84
eHANPP	150	18.2 Gt C yr^{-1}	2.62 t C yr^{-1}	44
Ecological footprint	149		1.72 gha yr^{-1}	43
Material footprint	144		7.2 t yr^{-1}	44

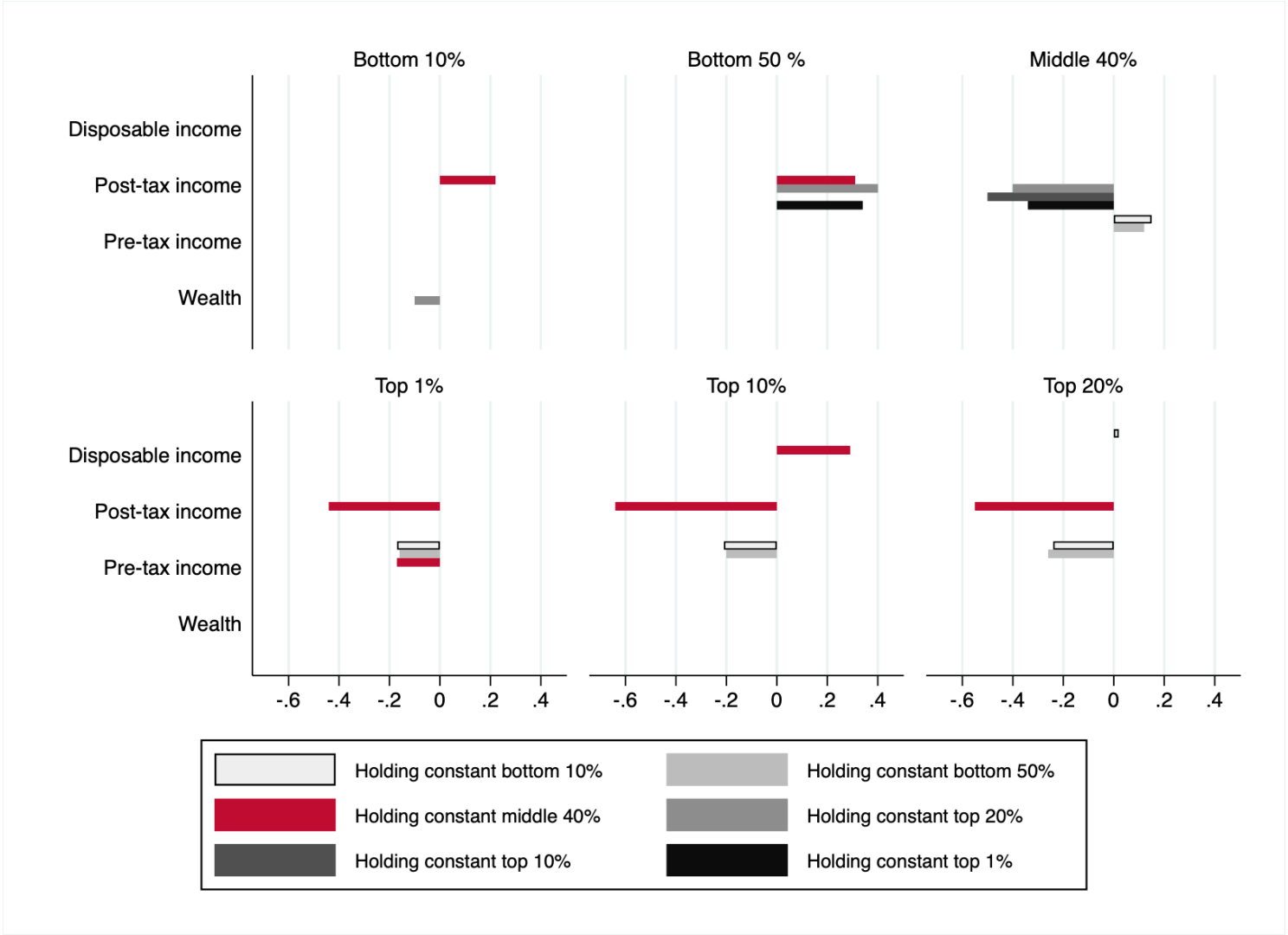
N is the number of countries.

Table 2 | Country performance with respect to social thresholds

Social indicator	*N*	Threshold	Countries above threshold (%)
Life satisfaction	134	6.5 on 0–10 Cantril ladder scale	25
Healthy life expectancy	134	65 years	40
Nutrition	144	2,700 kilocalories per person per day	59
Sanitation	141	95% of people have access to improved sanitation facilities	37
Income	106	95% of people earn above US$1.90 a day	68
Access to energy	151	95% of people have electricity access	59
Education	117	95% enrolment in secondary school	37
Social support	133	90% of people have friends or family they can depend on	26
Democratic quality	134	0.80 (approximate US/UK value)	18
Equality	133	70 on 0–100 scale (Gini index of 0.30)	16
Employment	151	94% employed (6% unemployment)	38

Within our analytic framework, life satisfaction and healthy life expectancy are classified as measures of human well-being, while the remaining nine social indicators are classified as need satisfiers. *N* is the number of countries.

Lower middle-income countries



Higher middle-income countries