

Income and Wealth Inequality

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Overview

1. Basics
2. Post-Keynesian & Ecological Economics
3. Income + wealth inequality and emissions
4. Excursus: Differential rates + wealth model
5. Inequality in affectedness
6. Political economy of inequality and ecology

Post-Keynesianism and Ecological Economics

Post-Keynesian approaches to the socio-ecological transition

- Takes demand effects of transition into account
- Priewe (2022): Decoupling through a technological revolution (new Kondratief cycle)
- Taylor/Semieniuk/Foley/Rezai (2021): Mitigation can be achieved by spending 3% of global output per year (initial „big push“ of 6%)
- Often critical of degrowth, but: limit and direct investment (Fontana and Sawyer 2016, 2022) and modelling possible (Cahen-Fourot and Lavoie 2016, Hein and Jiménez 2022)
- Confidence in governments' ability to stabilize capitalism
 - ⇒ Policy recommendations: carbon tax (incl. border tax), government investment (Onaran et al. 2020), green finance (Dafermos/Nikolaïdi/Galanis 2018), work time reduction (Mechler/Rezai/Taylor 2013), redistribution

Ecological Economics

- Technological solutions necessary, but not sufficient
- CO₂: required rate of reduction even harder to reach with future growth (Haberl et al. 2020);
The higher GDP growth, the higher the required rate of decoupling
- Resource use: No evidence for global decoupling (Hickel/Kallis 2019) & problematic socio-economically: worsens North-South dimension (extractivist growth model)
- Massive technological leaps required for aviation, shipping, steel & concrete (Davis et al. 2018)

Are Post-Keynesianism und Ecological Economics reconcilable?

Growth Theory (Huwe/Rehm 2022)

- Leontief production function (constant marginal cost), mark up over cost, focus on the short run
 - ✓ No contradiction: Realistic view of technological change: retro fitting, net investment
- Classes as social actors
 - ✓ No contradiction
- Steady state models
 - ✓ Growth is not baked into models, adequate parameters yield CO₂-neutral steady state (Hein/Jiménez 2022)
- Wage-/profit-led debate (Does redistribution to capital or to labor lead to more growth?)
 - ✓ Central question: is there a trade-off between equity and efficiency (actual estimates very small)

Post-Keynesianism und Ecological Economics II: Economic policy (Huwe/Rehm 2022)

- Fiscal policy for stabilization
 - ✓ No contradiction: Generating growth is not a goal
- Monetary policy is endogenous
 - ✓ Quantity of money follows output growth (horizontalist view, Cahen-Fourot/Lavoie 2016), monetary policy should be accommodating
- Industrial policy and financial policy
 - ✓ Realistic view of the functioning of the state
- Strong state
 - ✓ No contradiction: Active state (investments in socio-ecological transformation), debt thus sustainable

Post-Keynesianism und Ecological Economics III: Problems (Huwe/Rehm 2022)

- Focus on distribution: differential saving rates, demand-driven growth
 - Empirically supported, but contradiction: Redistribution to the bottom leads to higher growth, low-income groups have higher relative CO₂ emissions
- Status competition (upward-looking consumption)
 - Contradiction: If human nature always wants more, then we are doomed
- Growth imperative
 - Contradiction: Forced accumulation of capital (cut-throat competition), NOT due to money/interest
- Politic-economic power
 - Contradiction
Wealth concentration, incumbents

Post-Keynesianism und Ecological Economics III: Resolvable?

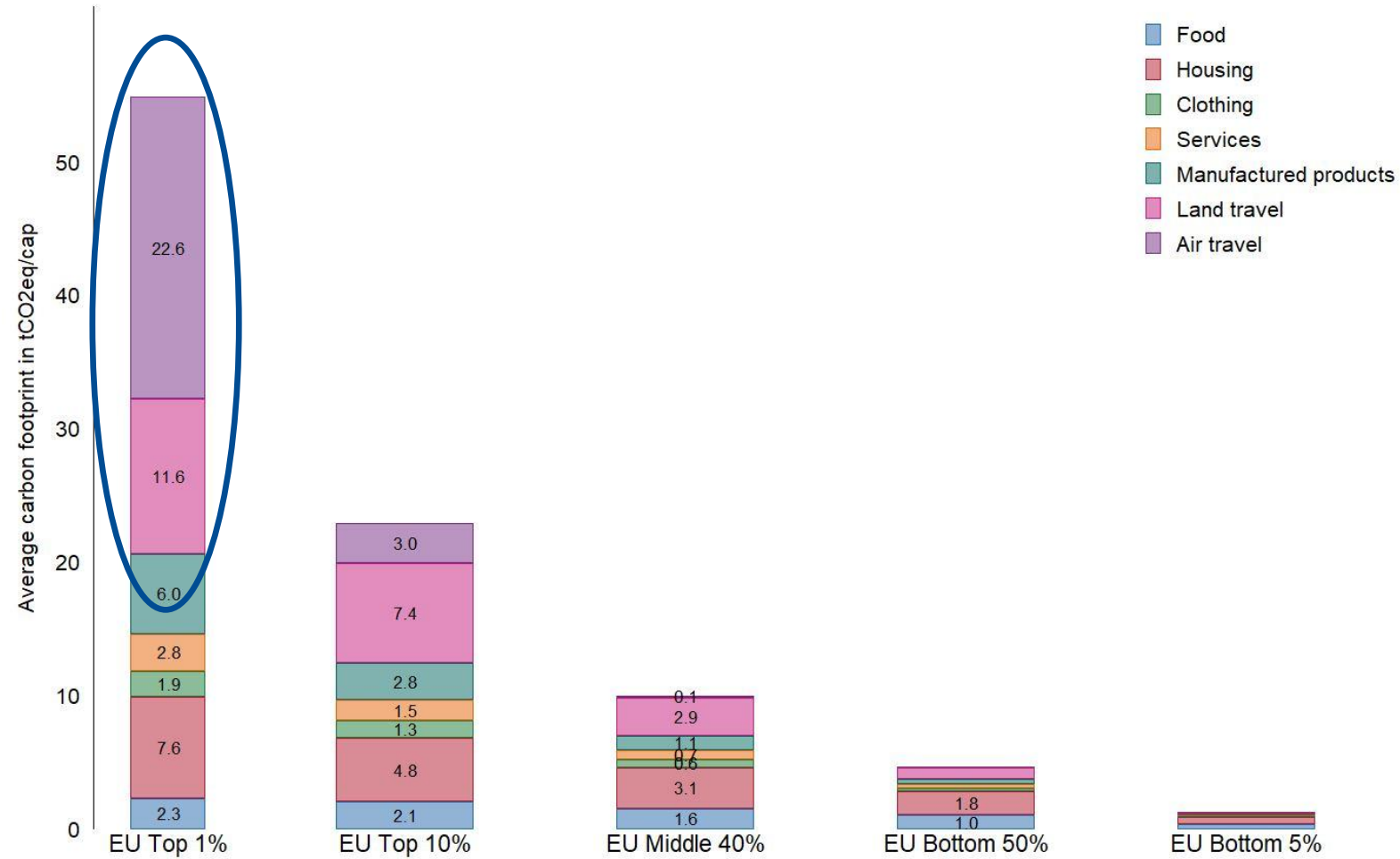
- Focus on distribution: differential saving rates, demand-driven growth
 - But: absolute CO2 level relevant for global warming
 - ⇒ Sustainable consumption paths (Fuchs et al. 2016, Gough 2020)
Public investments (insulation, public transport)
- Status competition (upward-looking consumption)
 - But: empirically unclear
 - ⇒ Eudaimonic needs theory, “good life” (Abdallah/Mahoney 2024)
- Growth imperative (Marxist)
 - Fundamental socio-ecological transformation?
 - Mixed economy?: remove economic domains from the profit/accumulation logic
 - ⇒ Not necessarily central government, can be under the auspices of cooperatives, NGOs, different levels of government etc.
- Political-economic power
 - ???

Post Keynesianism/Marxism: Growth Imperative

- Investment/accumulation is one of the key features of capitalism:
Competition forces companies to invest, or else perish
(But no monetary growth imperative, Fontana/Sawyer 2016)
- ⇒ Growth of the capital stock
- Historically, there is a near linear 1:1 relationship
of income and energy use (e.g. Semieniuk 2018)
- Ecological impact depends on quality of growth:
which sectors, which products/services, which jobs?
- Two possible strategies for severing the top link: Decoupling and mitigation (carbon capture & storage)

Income inequality and emissions

Average CO₂ emissions by use in the EU

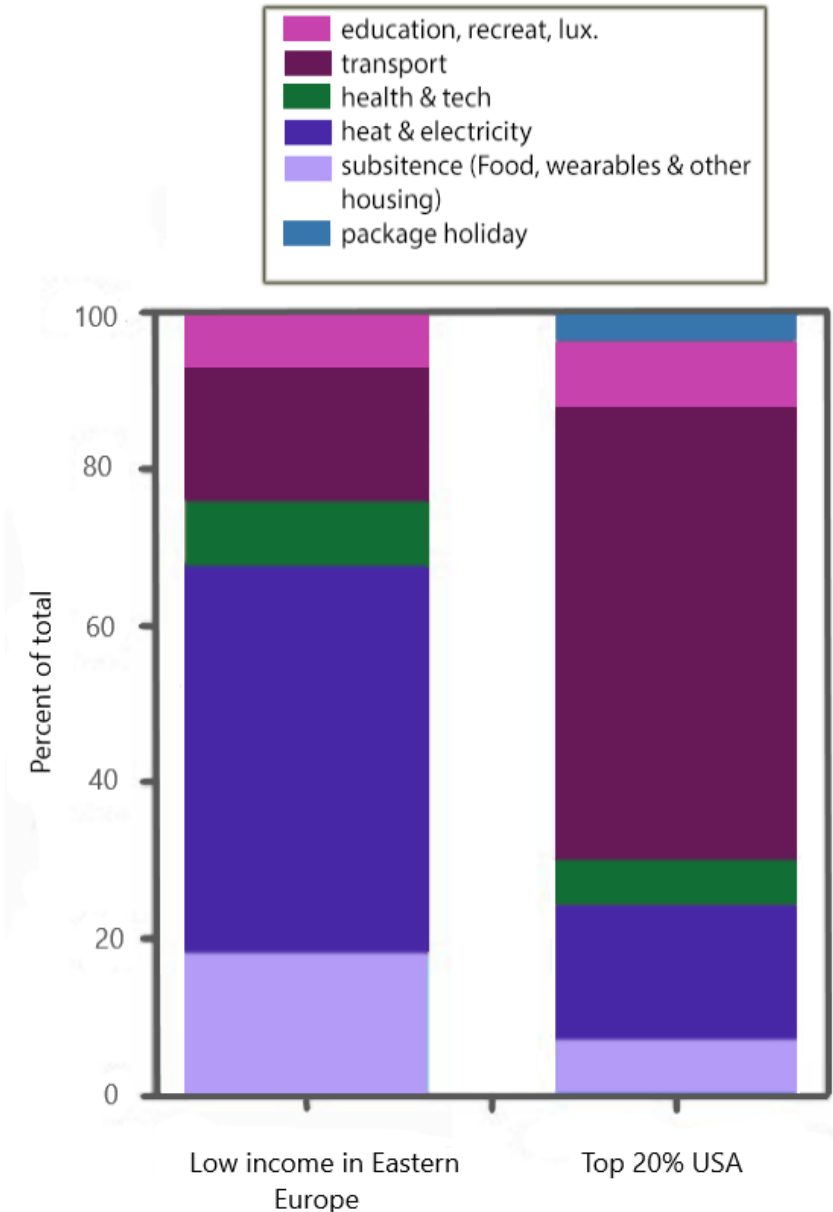


Source: Ivanova and Wood 2020

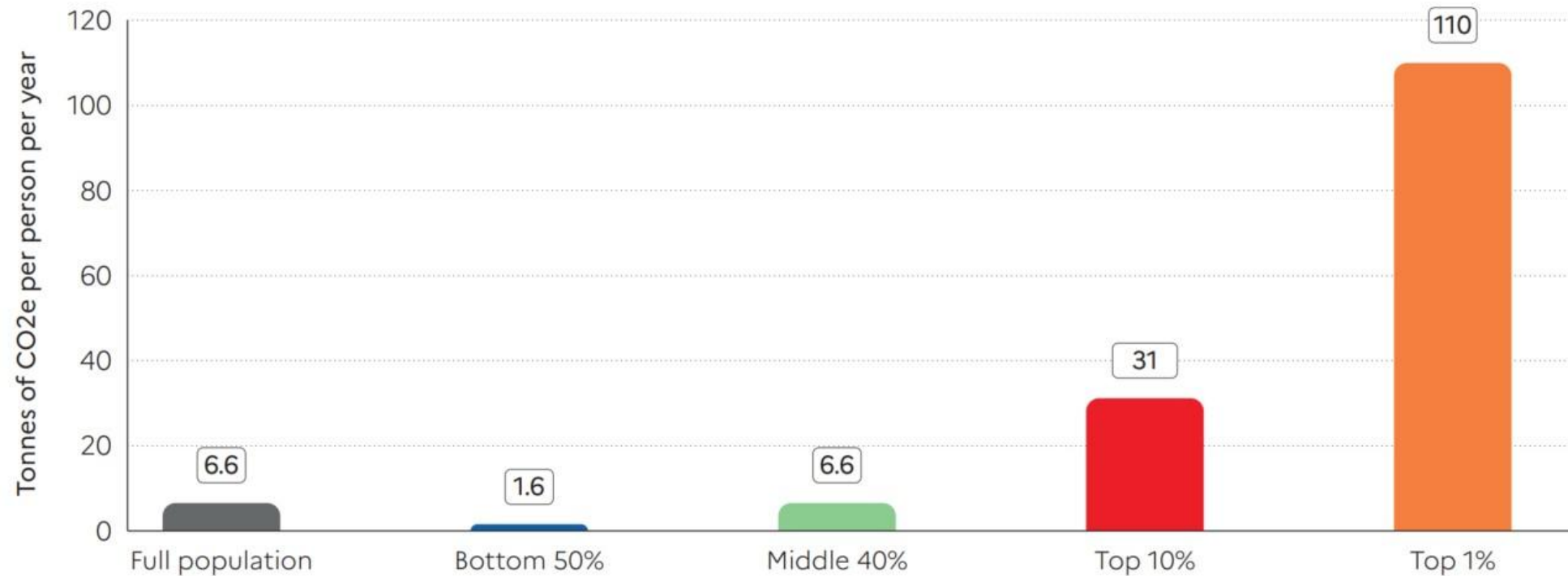
Income distribution and emissions

- High-income groups emit disproportionately for „luxuries“ (esp. unequally distributed: package holidays)
- Low-income groups emit mainly for heating and electricity (Oswald et al. 2020)
- Since luxuries are more difficult to abate, but heating relatively easy, lower inequality makes it easier to decarbonize (Oswald et al. 2021)

Source: Oswald et al. 2021, label x-axis MR



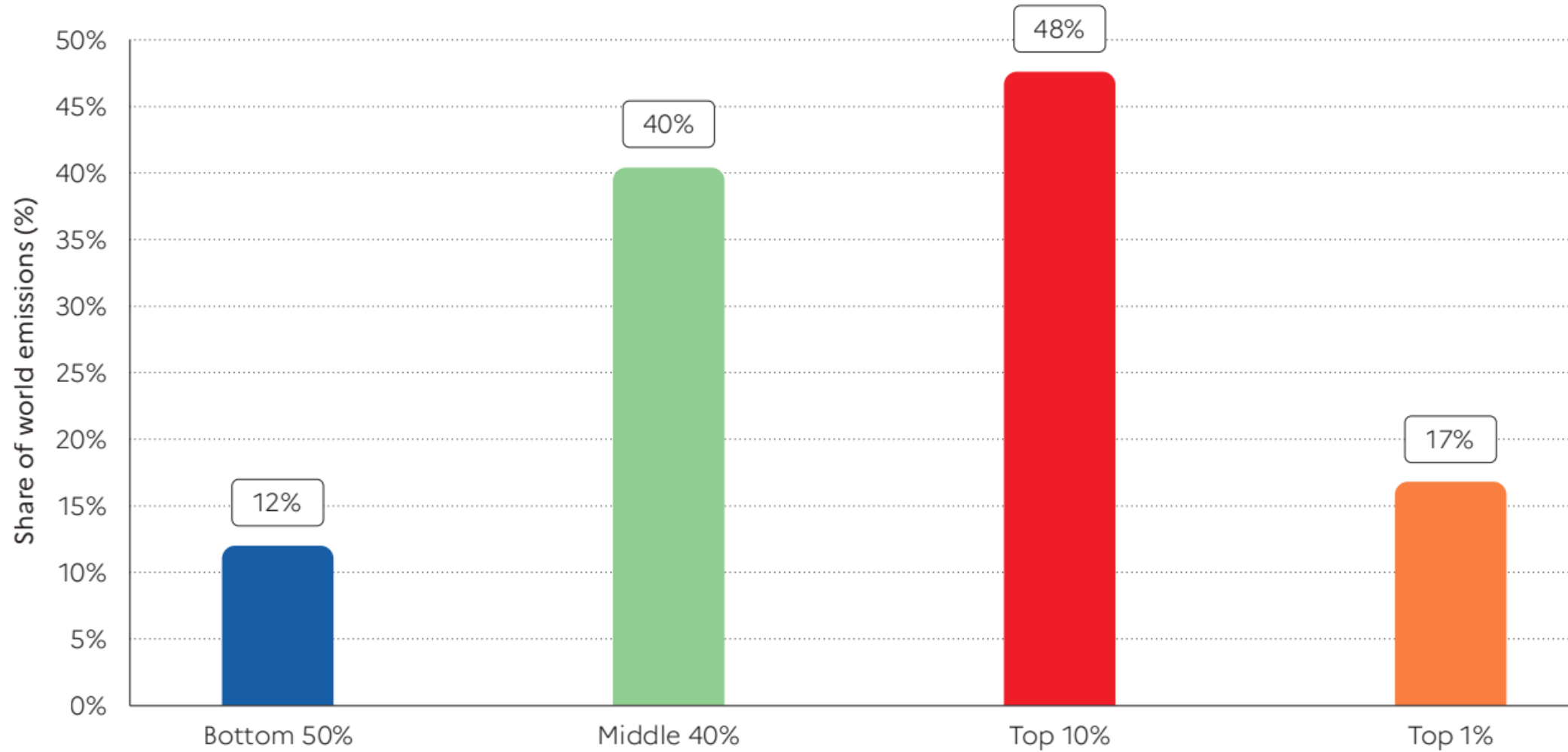
Absolute emissions per capita income (including investments)



Sourcer: Chancel et al. 2022

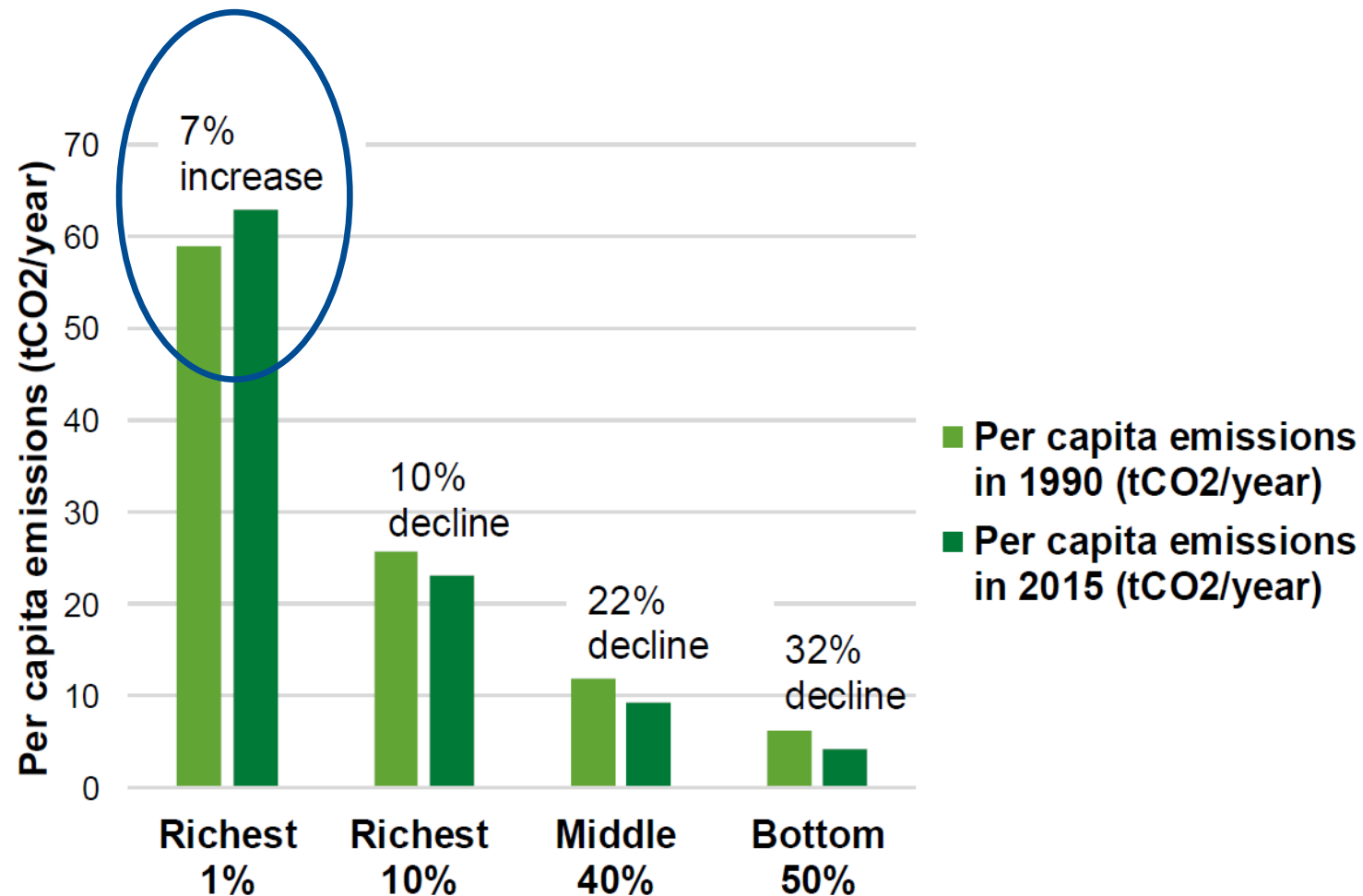
=> Emissions are concentrated at the top of the distribution

Shares in total emissions by income (including investment)



Source: Chancel et al. 2022

Change in per-capita emissions by income group in the EU 1990-2015



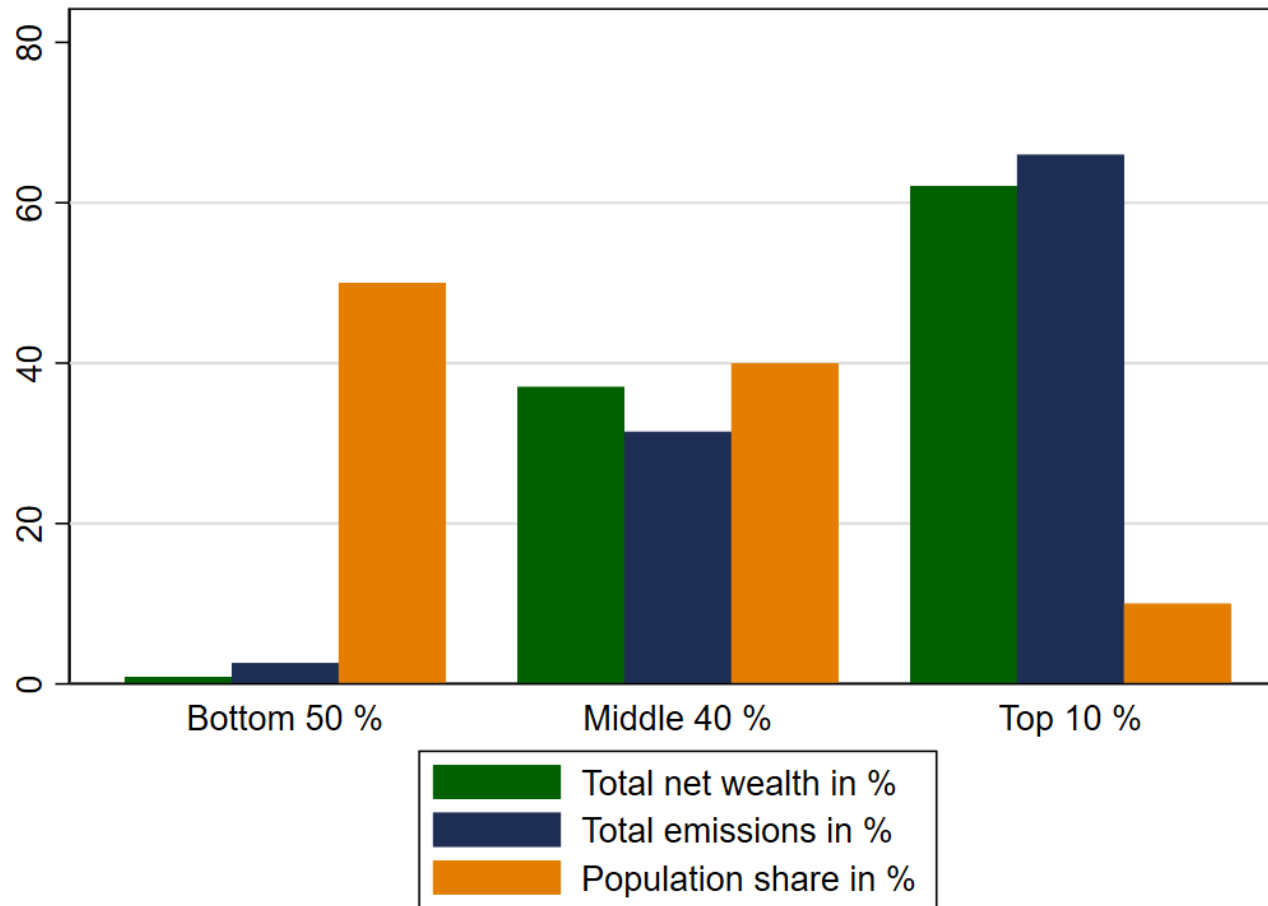
Source: Gore and Alestig 2020

Wealth inequality and emissions

Wealth inequality and capital-based emissions

- Capital-based emissions: assign emissions from production by ownership of productive capital (to ultimate wealth owners)
- Excluded: activities by households (dwellings: esp. heating/cooling, transportation, other activities) and public capital stock

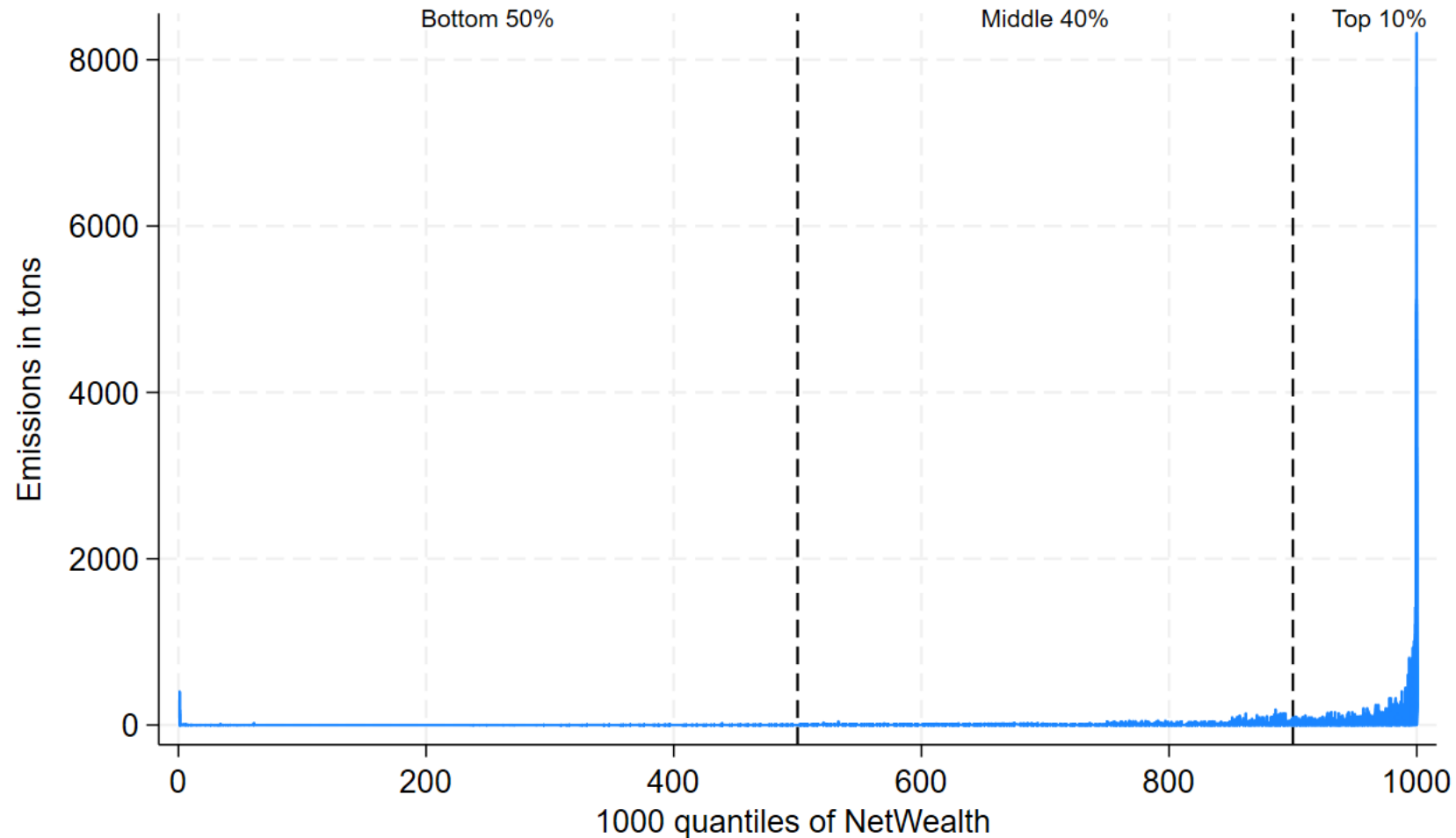
CO₂ Emissions from production by wealth (DE)



Source: Feldwisch, Rehm, Brinkmeier 2026 EcolEcon

CO₂ Emissions by wealth are distributed even more unequally than wealth itself. Other sources: Büchs 2024, Chancel/Rehm 2025

CO₂ Emissions from production by wealth (DE)



Source: Feldwisch,
Rehm, Brinkmeier
2026 EcolEcon

CO₂ Emissions by wealth are distributed extreme unequally (absolute levels)

Differential rates

Differential saving rates by income

- Core Post-Keynesian assumption in models: saving out of profits are higher than out of work income (functional income distribution)
- Links to classes: capitalists save more than workers
- Empirically: higher income groups have higher saving rates
- Macro data with some distributional information (standard calculation):

$$s_{\text{decile}} = 1 - \frac{\sum_1^n C_{\text{decile}}}{\sum_1^n Y_{\text{decile}}}$$

- Micro data:

$$s_{\text{decile}} = \sum_1^n 1 - \frac{C_{\text{household}}}{Y_{\text{household}}} / n$$

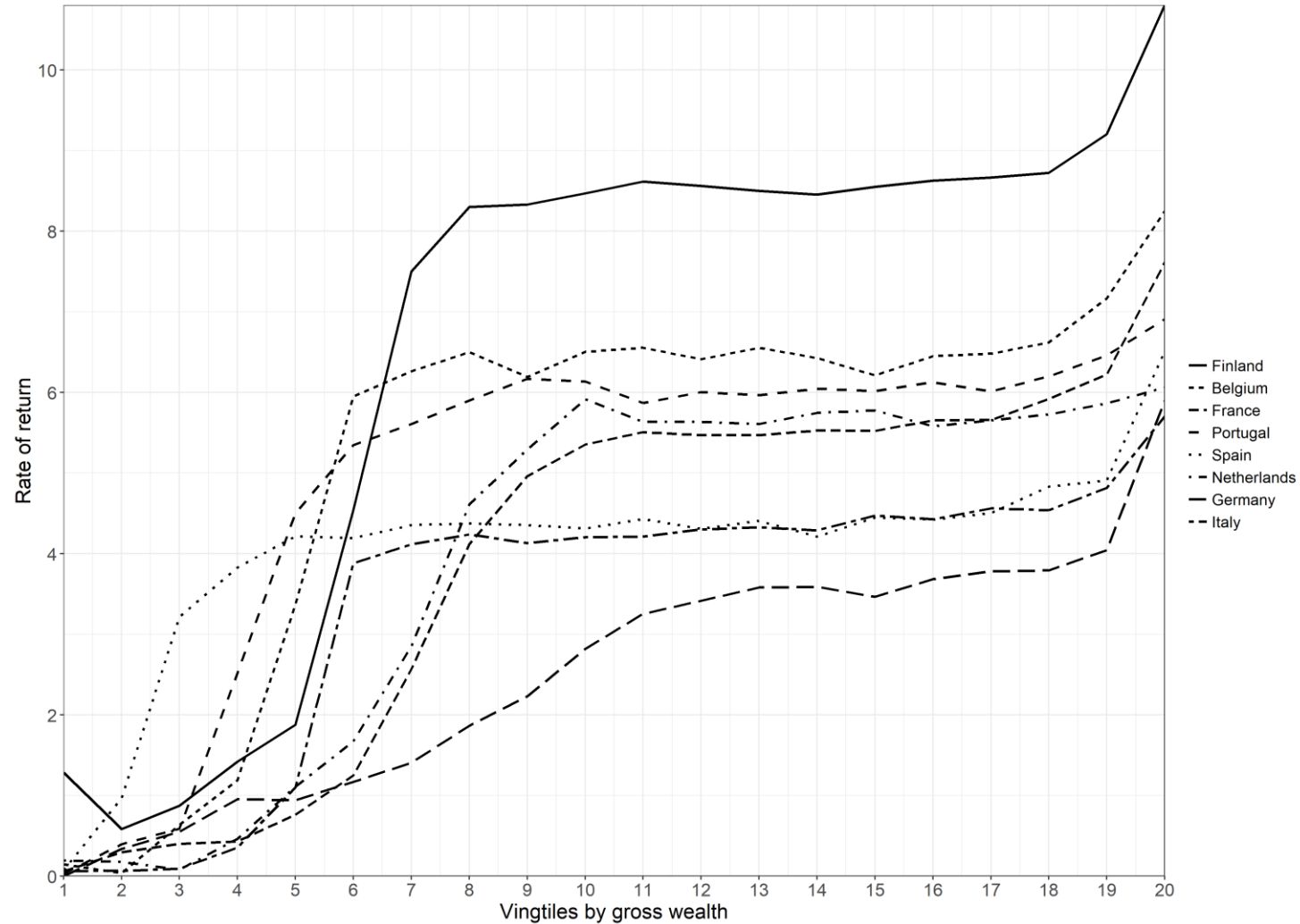
Differential rates of return

- Workers' interest rates lower than capitalists' profit rates:
Theoretical debate in the PK literature: Kahn 1959, Laing 1969, Harcourt 1972, Moore 1974, Pasinetti 1974, 1983, Fazi and Salvadori 1981
- Like differential saving rates:
 - Mixed income: capital income of workers lower than capitalists'
 - Explosive feedback in wealth inequality
 - Stability of a growth regime?
- Check empirically: Combine return data from Jordà ea. (2018) with HFCS asset categories (Ederer, Mayerhofer, Rehm 2019)

Differential rates of return: Findings

- 3 wealth groups:
 - 30% asset-poor – average rate of return 2.4%
 - 65% middle-class homeowners – average rate of return 5.7%
 - 5% capitalists – average rate of return 7.2%
- Collapse asset-poor and middle-class homeowners into 95% ,workers': avg. rate of return 5.6%

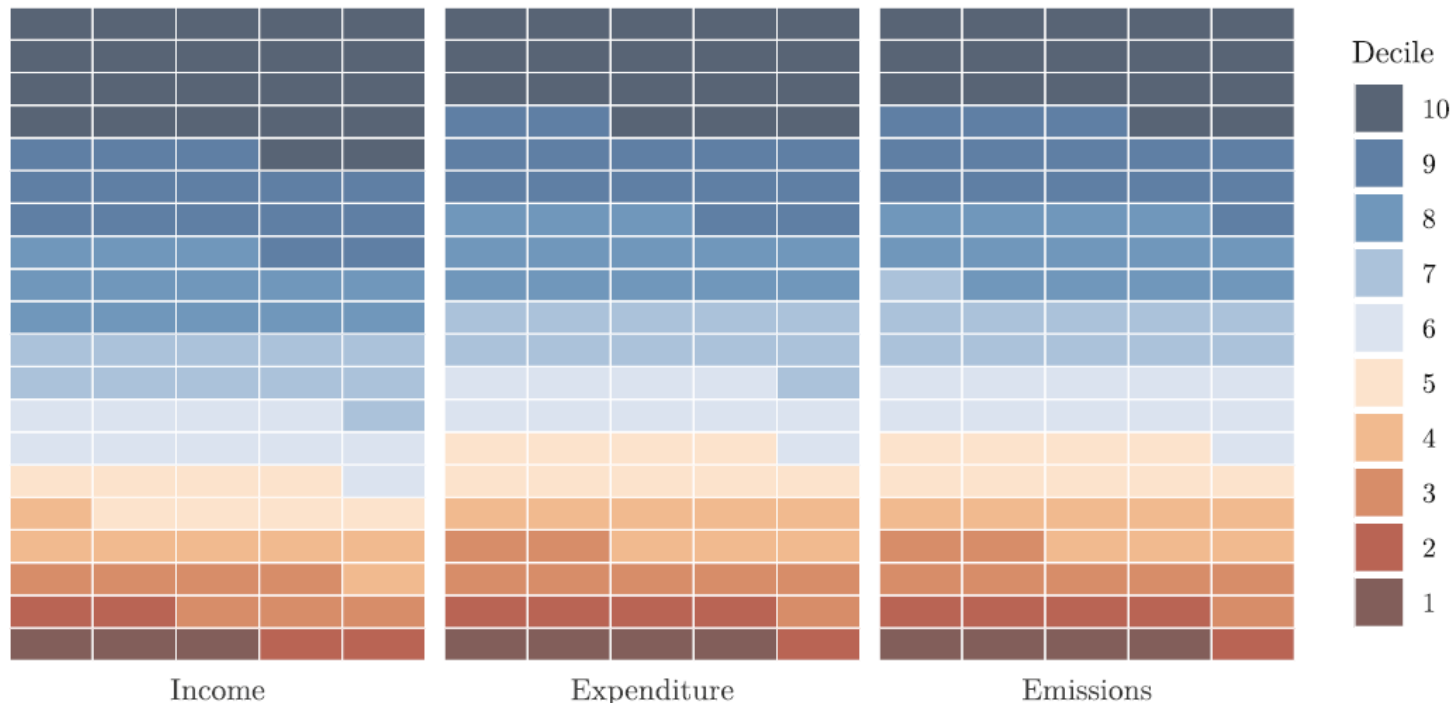
Differential rates of return across wealth vingtiles (Euro area)



Source: Ederer, Mayerhofer, Rehm (2019), data: HFCS 2014

Differential rates of emission (AT)

- Carbon intensity: Groups with lower income have higher relative CO₂ emissions
- Top 10% of the population by income receives 22% of total disposable income, generates 18% of expenditures, and emits 17% of emissions.



Source: Theine et al. 2022

Wealth model

Wealth distribution models (Ederer and Rehm 2020)

- Long history of theory of wealth models: Pasinetti 1962, Dutt 1990, Palley 2012
- Neo-Kaleckian model of personal income and wealth distribution:
 - Mixed income (profit income for workers, work income for capitalists)
 - Endogenous wealth distribution
 - Differential rates of return
- Calculate parameters from micro data
- Compare model solution with empirical data

The model

- Income is divided between wages and profits (profit share π);
wage income is divided between workers and capitalists/managers (α);
differential saving rates (s_w, s_r) and differential rates of return (γ_w, γ_r) (wealth shares held in profit-generating assets)

$$Y_w = (1 - \alpha)W + \frac{\gamma_w(1 - z)}{\gamma_w(1 - z) + \gamma_r z} R, \quad Y_r = \alpha W + \frac{\gamma_r z}{\gamma_w(1 - z) + \gamma_r z} R$$

- Workers and capitalists consume and save out of their income

$$C = (1 - s_w)Y_w + (1 - s_r)Y_r$$

- The wealth distribution (share of capitalists z) is $z = V_r/V$

Solution (long run)

- Basic version: $Z^* = \frac{s_r \pi - s_w}{(s_r - s_w) \pi}$

(no mixed income, no differential returns)

- Full version: 6 parameters (saving rates s_w, s_r , profit share π , share in labour income α , profit generating wealth share γ_w, γ_r)
define wealth distribution in equilibrium

Full solution

$$z^{**} = \frac{-D \pm \sqrt{D^2 - 4CE}}{2C}$$

$$C = -[s_w(1 - \alpha) + s_r\alpha](1 - \pi)(\gamma_r - \gamma_w) - (s_r\gamma_r - s_w\gamma_w)\pi$$

$$D = s_r\alpha(1 - \pi)(\gamma_r - \gamma_w) + s_r\gamma_r\pi - [s_w(1 - \alpha) + s_r\alpha](1 - \pi)\gamma_w - s_w\gamma_w\pi$$

$$E = s_r\alpha(1 - \pi)\gamma_w$$

Transaction flow matrix

	Households		Firms		Banks	Total
	Workers	Capitalists	Current	Capital		
Consumption	$-C_w$	$-C_r$	$+C$			0
Investment			$+I$	$-I$		0
Wages	$+W_w$	$+W_r$	$-W$			0
Profits	$+R_w$	$+R_r$	$-R$			0
Equity	$-\gamma_w \Delta V_w$	$-\gamma_r \Delta V_r$		$+\Delta E$		0
Deposits	$-(1 - \gamma_w) \Delta V_w$	$-(1 - \gamma_w) \Delta V_w$			$+\Delta D$	0
Loans				$+\Delta L$	$-\Delta L$	0
Total	0	0	0	0	0	0

Source: Ederer, Rehm (2019)

Data

- Household Finance and Consumption Survey (HFCS)
- Capitalists defined following Rehm, Naqvi, Hofmann (2017):
 - Top 1 percent wealth owners
 - Medium and large business owners (> 5 employees)
 - Capital income higher than average work income
- Workers: employment status

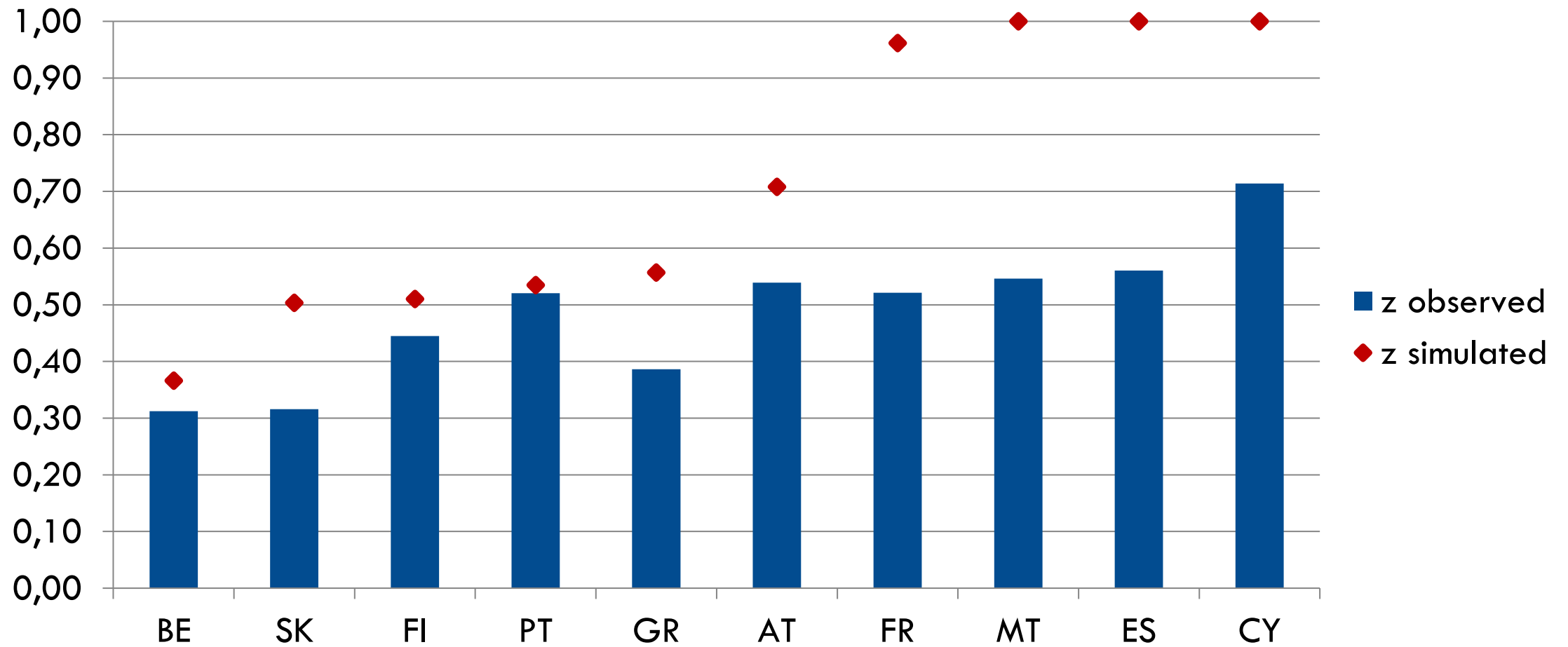
Empirical values of model parameters

	s_w	s_r	π	α	γ_w	γ_r
Austria	0.05	0.23	0.38	0.07	0.40	0.92
Belgium	0.10	0.29	0.34	0.02	0.59	0.85
Cyprus	0.00	0.10	0.37	0.18	0.81	0.96
Spain	0.00	0.07	0.41	0.10	0.53	0.90
Finland	0.12	0.39	0.37	0.02	0.55	0.93
France	0.01	0.29	0.37	0.05	0.57	0.97
Greece	0.05	0.13	0.34	0.05	0.25	0.90
Malta	0.00	0.26	0.46	0.03	0.59	0.98
Portugal	0.13	0.33	0.41	0.04	0.42	0.90
Slovakia	0.18	0.30	0.44	0.05	0.20	0.83

Note: Columns refer to (1) saving rate of workers, (2) saving rate of capitalists, (3) profit share, (4) share of capitalists in the wage bill, (5) share of workers' wealth held in profit-generating assets, (6) share of capitalists' wealth held in profit-generating assets

Source: Ederer, Rehm (2019); Data: HFCS 2010, EHBS 2010

Empirical and model share of capitalists in total wealth



Source: Ederer, Rehm (2019), data: HFCS 2010, EHBS 2010

How will the wealth distribution evolve in the future?

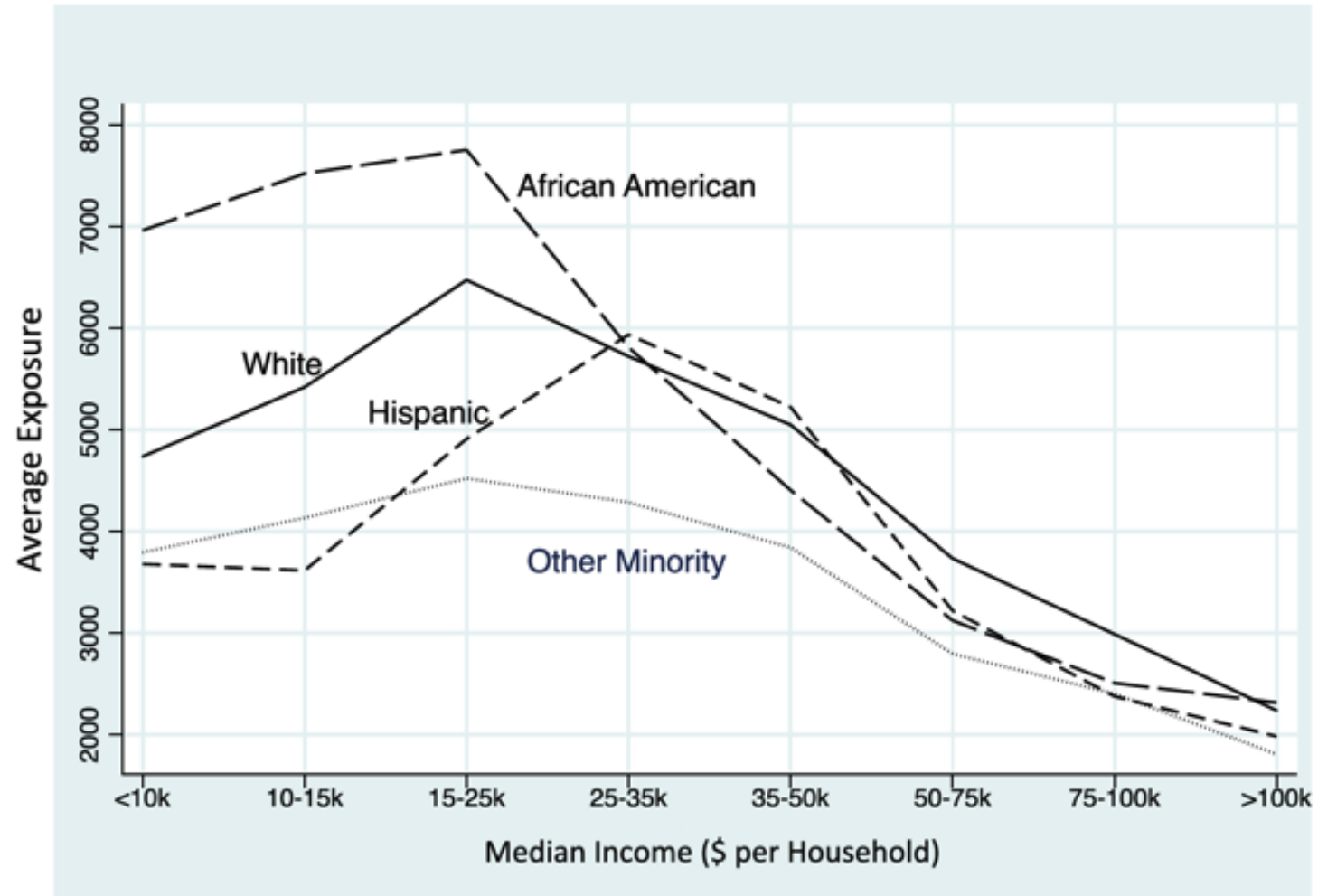
- Piketty in a neoclassical model : $r > g$
(return on capital in the long run higher than the growth rate of total income)
 - Recall the Cambridge equation $g = sr \rightarrow r = \frac{g}{s}$, and note that $s > 0$, so that r is by definition $> g$
 - Piketty's conclusion: inequality between a small group (capital owners) and large majority (workers) explodes !?
- Post-Keynesian model of the distribution of wealth:
 - How will the wealth share of capitalists develop in the future?
 - Long history of theory of wealth models: Pasinetti 1962, Dutt 1990, Palley 2012:
workers get interest, capitalist receive profits

Affectedness

Unequal affectedness by the climate crisis

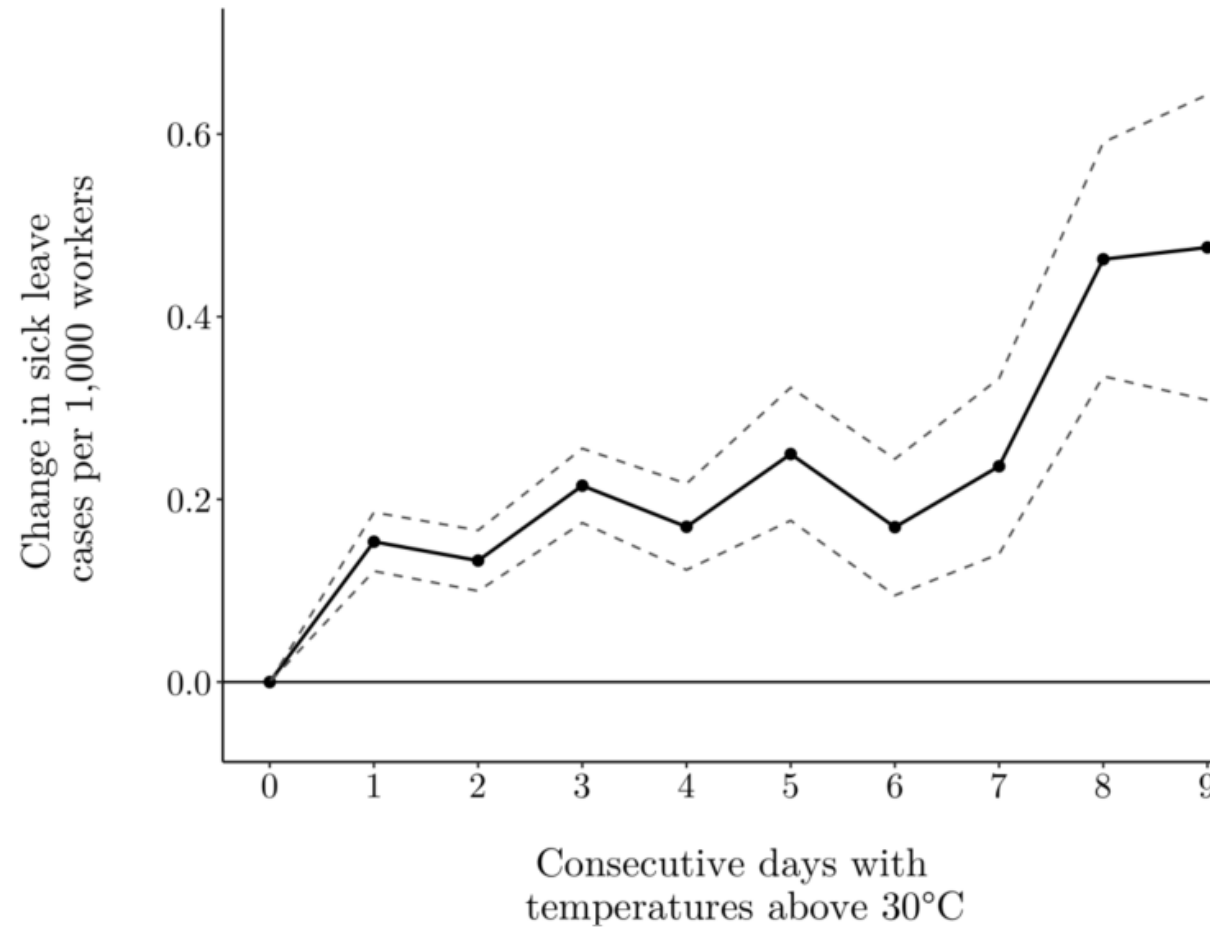
- Global: Poor countries are more affected by climate risks
- Within Germany:
 - Older literature: race (U.S., Zwickl et al. 2014) and migration background (DE/AT, Rütenauer 2018, Ituen/Hey 2021) matter, not income
 - Newest literature: poor households are more affected (Odersky/Löffler 2024 Ahrtal 2021) and have fewer capacities for adaptation (Osberghaus/Abeling 2022)

Inequality in local air pollution (US)



Source: Zwickl et al. 2014

Heat waves and sick leave in DE



Source: Klauber et al. 2025

Risk is higher in low-income sectors

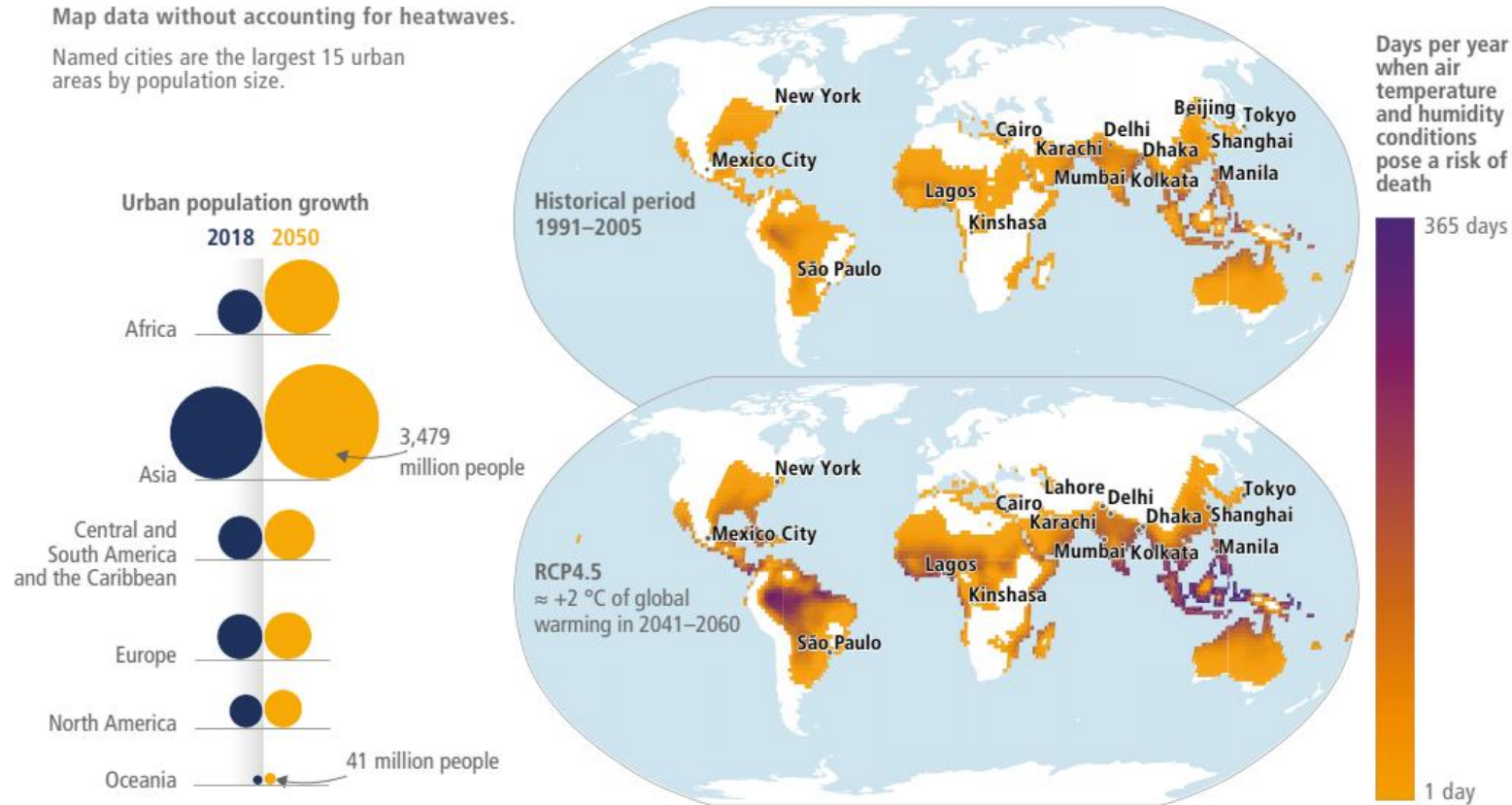
Effects of the climate crisis: energy poverty and health in DE

	(1) Good health	(2) Good health	(3) Good health	(4) Good health
Ten percent rule (tpr)	-0.00828*** [0.00268]			
Two times median share (mtwo)		-0.00879** [0.00370]		
Low income high costs (lihc)			-0.00892** [0.00396]	
subjective				-0.0323** [0.0134]

Source: Buchner/Rehm 2025

=> 4 indicators for energy poverty are linked to a lower probability of being in good health; especially in combination with poverty, the climate crisis poses a health risk in Germany

Vulnerability: deadly heat (excluding heat waves) at 2° global heating



Source: IPCC 2022

=> Being outside will be deadly 365 days per year especially in some poorer, densely populated regions

Political Economy of inequality and ecology

Transformation technically largely feasible

- Energy sector: move to 100% renewables very fast, storage capacities, local energy communities
- Construction: biogenic building materials; housing: isolation, renovation, heating transition
- Transportation: electrify wherever possible
- Manufacturing: difficult, electrify, replace fossile raw materials: large investments in research and transition, active industrial policy

Ecological economics: Reduce production and over-consumption

- Absolute reduction in energy consumption probably necessary (Millward-Hopkins 2020): transformation and conflicts
- High-emitting production technologies and –sectors need to be limited: regulation and a high and stable price for CO₂
- Consumption + income distribution: focus on needs (Steinberger ea. 2010, 2020)
- Socio-economic setup defines how efficiently energy is translated into well-being (Vogel ea. 2021)

Political Economy of a Post-Keynesian – Ecological Economics Synthesis

- Major obstacle of political feasibility: power
- The political-economic system is linked with fossil fuels at every level (Pirgmaier/Steinberger 2019, Mattioli ea. 2020)
- Incumbents: deny, deceive, delay
- Disinformation campaigns (Franta 2018, Bonneuil ea. 2021, Brulle 2021)
- Generate false hope (Carbon Capture and Storage: Minx 2018, Creutzig ea. 2021)
- Lobbying campaigns against regulation and taxation

Actors for a socio-ecological transition?

- Pressure by the majority: citizens, activists, youth
- Pressure by authority/experts: scientists (hierarchy of disciplines: law and economics; natural sciences?)
- Pressure by capitalists: strategic coalitions (factions of capital, e.g. renewables)

Conclusion

- Post-Keynesian and Ecological Economics are reconcilable theories
- Emissions are unequally distributed by income, especially when including investment
- Emissions by wealth are extremely unequally distributed, even more than wealth itself
- Post-Keynesian models of wealth inequality suggest that wealth inequality will rise
- Differential rates of savings and returns provide more explosive feedback, but differential rates of emissions are regressive
- While a socio-ecological transformation is technically feasible, its political economy is why Post-Keynesian and Ecological Economics fail to effect sufficient change so far

Thank you!

Appendix

Functional vs. personal income distribution

- Top 1% (1%)
- Rentiers (1%)
- Business owners (2%)

- Self-employed

Capital

- Highly qual. workers (26%)
- Medium qual. workers (42%)
- Low qual. workers (23%)

Labor

Income

	Wages	Profits	Interest
Top 1%	1.3	9.8	23.5
Rentiers	0.8	5.4	37.5
Business owners	0.4	10.5	2.2
Self-employed	0.2	7.1	1.0
High qual. workers	1.5	0.4	0.6
Medium qual. workers	1.0	0.2	0.4
Low qual. workers	0.7	0.1	0.1

Source: Rehm, Naqvi, Hofmann (2017), data: HFCS 2010

Wealth

	Non-fin. wealth	Safe fin. wealth	Risky fin. wealth
Top 1%	19.6	18.0	37.2
Rentiers	3.8	10.1	13.0
Business owners	4.0	2.6	3.4
Self-employed	1.6	1.0	0.8
High qual. workers	1.0	1.2	1.1
Medium qual. workers	0.6	0.6	0.3
Low qual. workers	0.5	0.3	0.2

Source: Rehm, Naqvi, Hofmann (2017), data: HFCS 2010

Debt

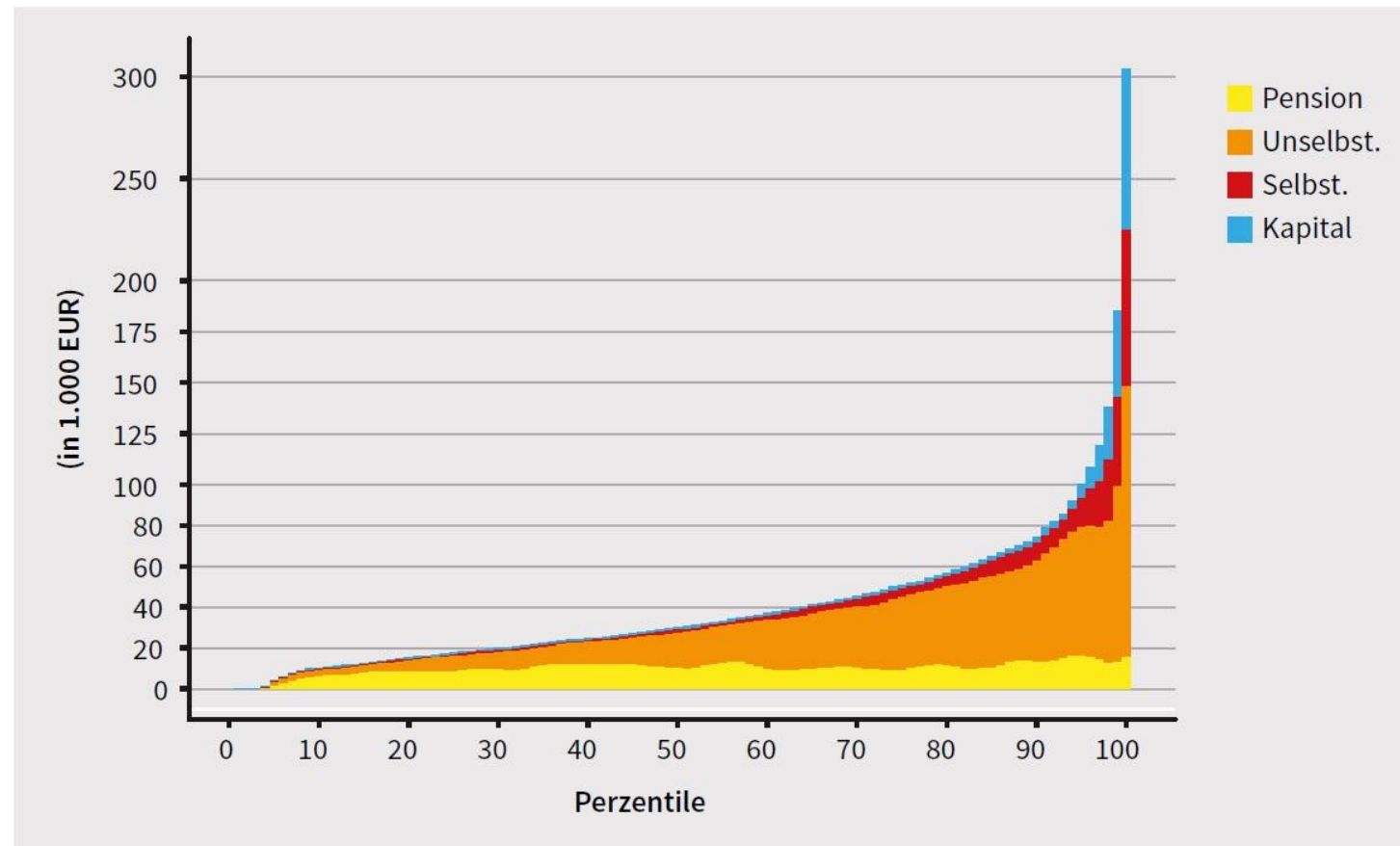
	Mortgages	Unsecured debt
Top 1%	4.8	4.6
Rentiers	3.4	1.6
Business owners	1.5	2.9
Self-employed	1.4	1.7
High qual. workers	1.5	1.3
Medium qual. workers	0.8	0.8
Low qual. workers	0.5	0.6

Source: Rehm, Naqvi, Hofmann (2017), data: HFCS 2010

Saving rates

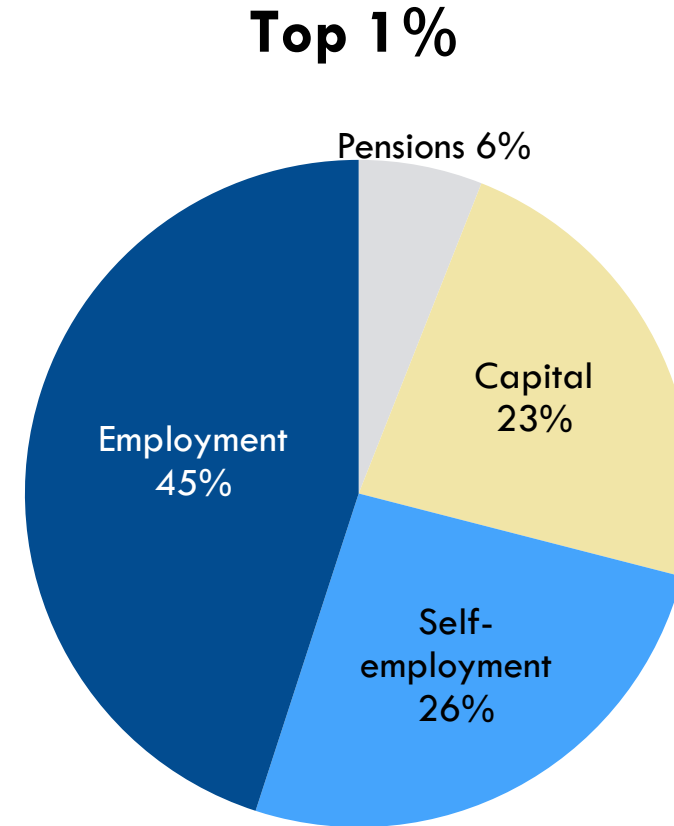
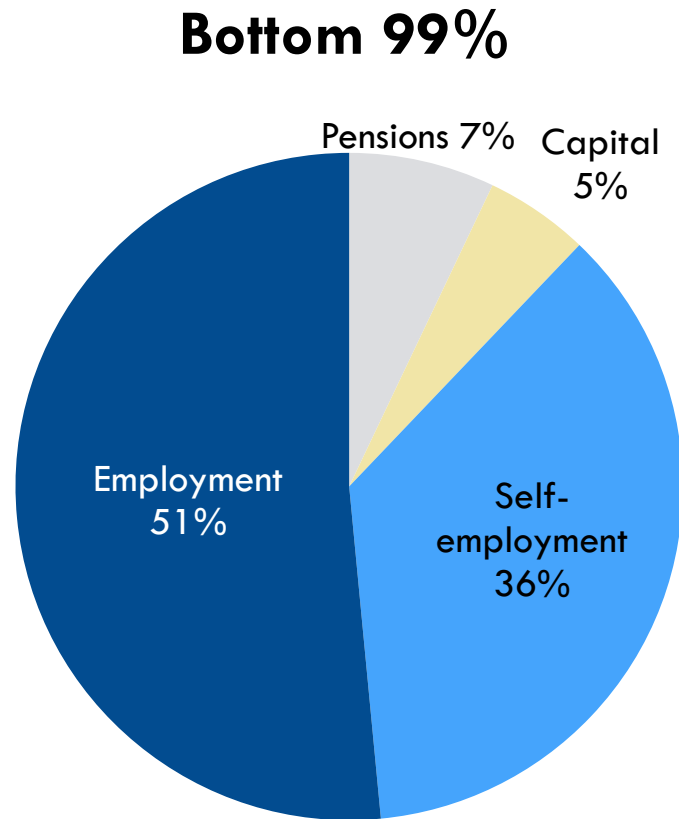
- Differential saving rates (by income): core Post-Keynesian assumption
- Calculate empirically (at least) in 3 ways:
 - Savings out of profits are (relatively) higher than savings out of work income ?
 - Savings of capitalists are (relatively) higher than of workers, ?
if the former receive mainly profit income, and **Classes!** ✓
if the latter receive mainly work income ✓
 - Savings from high incomes are (relatively) higher than from low incomes,
if high incomes have a larger share of profit income, and
if lower incomes have a higher share of work income

Income type by income level (Austria 2010)



Source: Altzinger, Humer, Moser (2016); data: HFCS 2010

Functional income distribution by income level (Austria 2010)



Source: Altzinger, Humer, Moser (2016); data: HFCS 2010

Calculation of saving rates: macro vs. micro data

- Macro data with some distributional information (standard calculation):

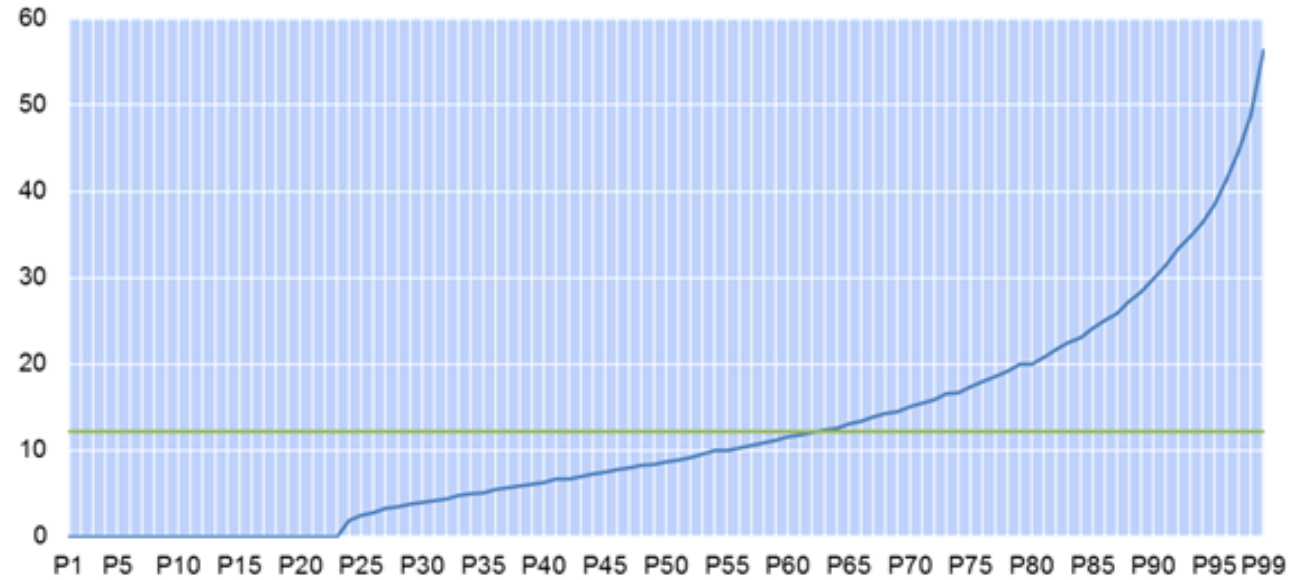
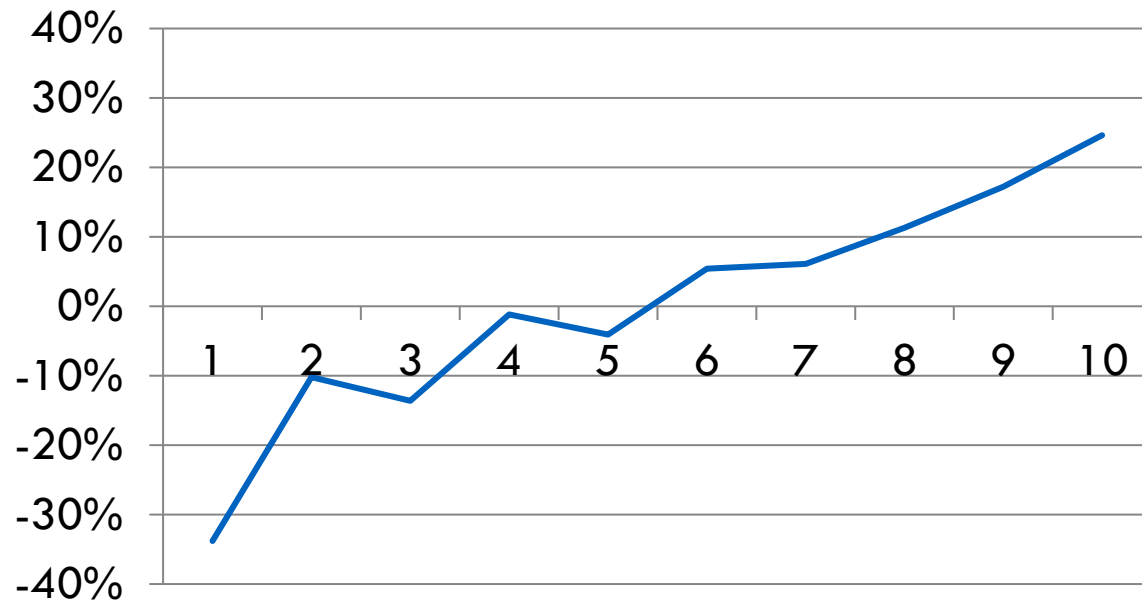
$$s_{\text{decile}} = 1 - \frac{\sum_1^n C_{\text{decile}}}{\sum_1^n Y_{\text{decile}}}$$

- Properties:
 - Upward sloping
 - Bottom 40-60% have negative saving rates
- Problem?
- Macroeconomic stability
- Micro data:

$$s_{\text{decile}} = \sum_1^n 1 - \frac{C_{\text{household}}}{Y_{\text{household}}} / n$$

- Bottom 20% have negative saving rates

Saving rates from macro data (left) and micro data (right)

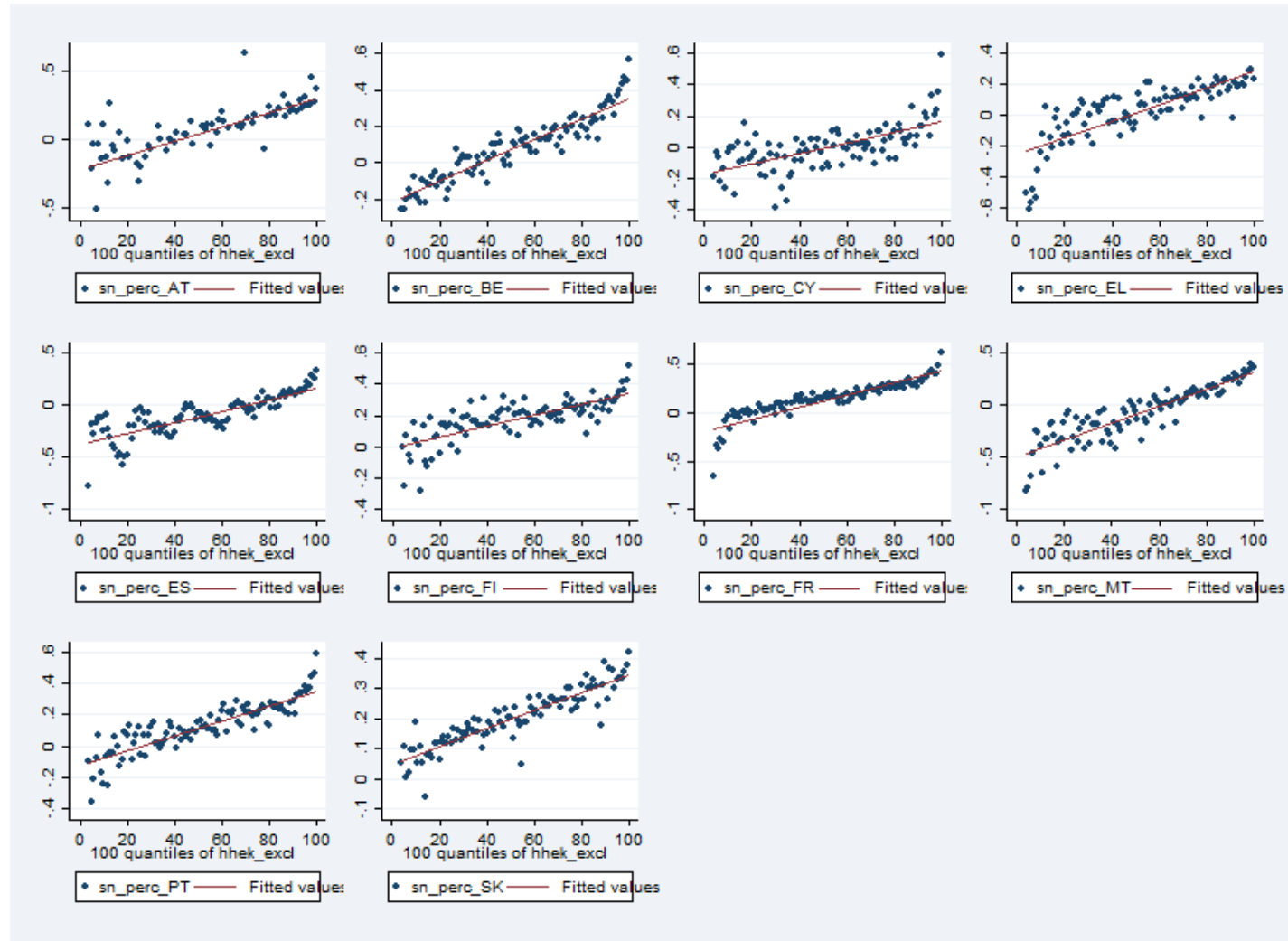


Net income percentiles

Source: Rehm; data: Consumption Survey 2009/10

Source: Fessler/Schürz (2018); data: HFCS 2014

Saving rates for Europe



Source: Ederer/Rehm (2019), data: EHBS 2010

Saving rates

- Differential saving rates (by income): core Post-Keynesian assumption
- Empirically (at least) 3 ways:
 - Savings out of profits are (relatively) higher than savings out of work income ?
 - Savings of capitalists are (relatively) higher than of workers, ?
 - if the former receive mainly profit income, and ✓
 - if the latter receive mainly work income ✓
 - Savings from high incomes are (relatively) higher than from low incomes, ✓
 - if high incomes have a larger share of profit income, and ✓
 - if lower incomes have a higher share of work income ✓