How Many Days to Get a Dollar?

A Robust and Inclusive Measure of Poverty

Olivier Sterck

References

Sterck, O. (2024). Poverty without Poverty Line. CSAE working paper.

Kraay, A., Decerf, B., Jolliffe, D., Lakner, C., Ozler, B., Sterck, O., & Yonzan, N. (2023). *A New Distribution Sensitive Index for Measuring Welfare, Poverty, and Inequality*. World Bank Policy Research Working Paper 10470.

Moramarco, D., & Sterck, O. (2025). A New Class of Decomposable Inequality Measures. *Available at SSRN*.

An investor called $140,000 the new poverty line. Experts disagreed but said he had a point.

A viral post claims $140,000 is the new poverty line. Here's the math
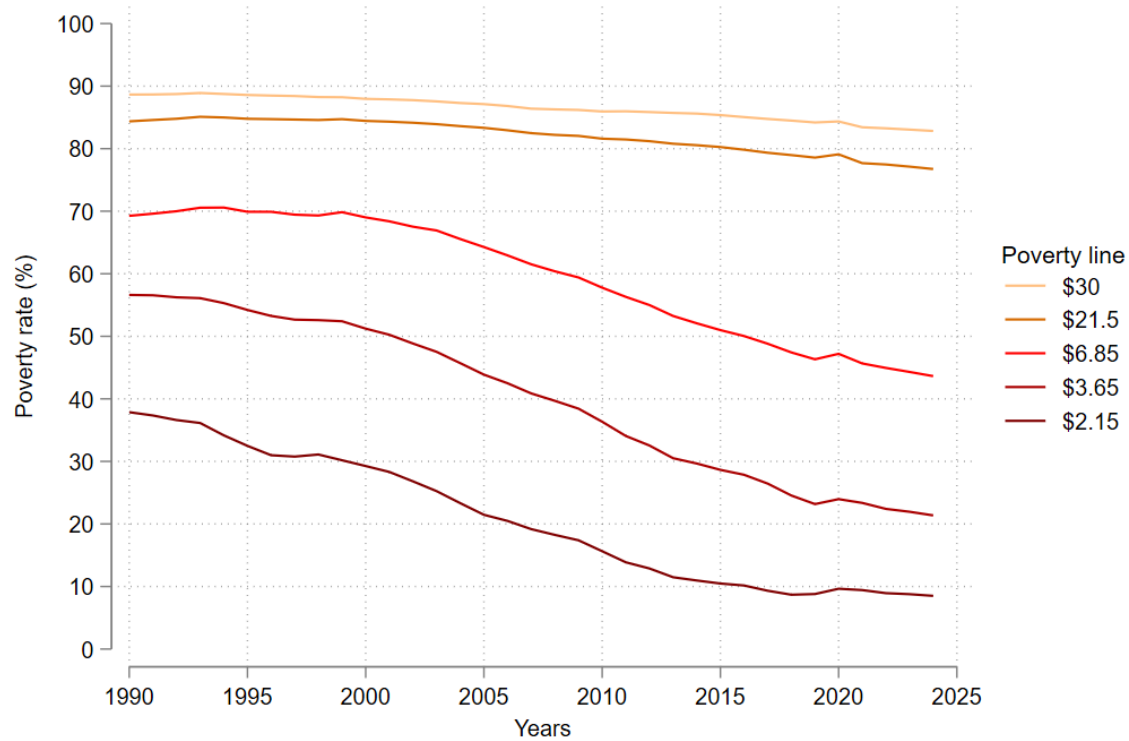
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"MEASURING STARVATION"
GREEN ON THE OBSOLESCENCE OF TODAY'S POVERTY METRIC

S&P 500
6,743.12
▲ 38.00
+0.57%

BITCOIN 86,169.00 ▼ 2728.00 -3.07% ETHEREUM 2,889.54 ▼ 72.30 -2.44%
LAST TRADES ▶ SLA) 415.60 ▼ 2.18 | PFIZER (PFE) 25.63 ▲ 0.41 | NVID

Making Money With Charles Payne · November 25, 2025 · 05:40 · CLIP

The real poverty line is $140,000, investment strategist asserts

Simplify Asset Management chief strategist Mike Green breaks down the true cost of living in America and today's metric of poverty on 'Making Money.'

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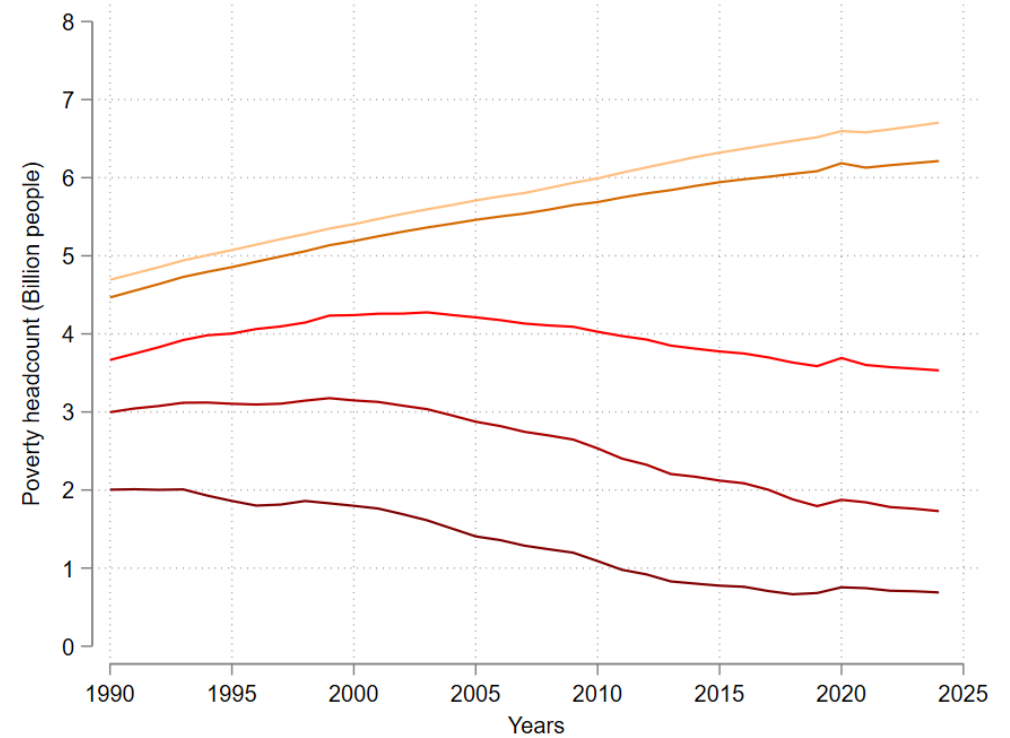
ECONOMY • POVERTY

Wall Street strategist explains today's political rage with a poverty line that should be $140,000 and the 'Valley of Death' trapping people below it

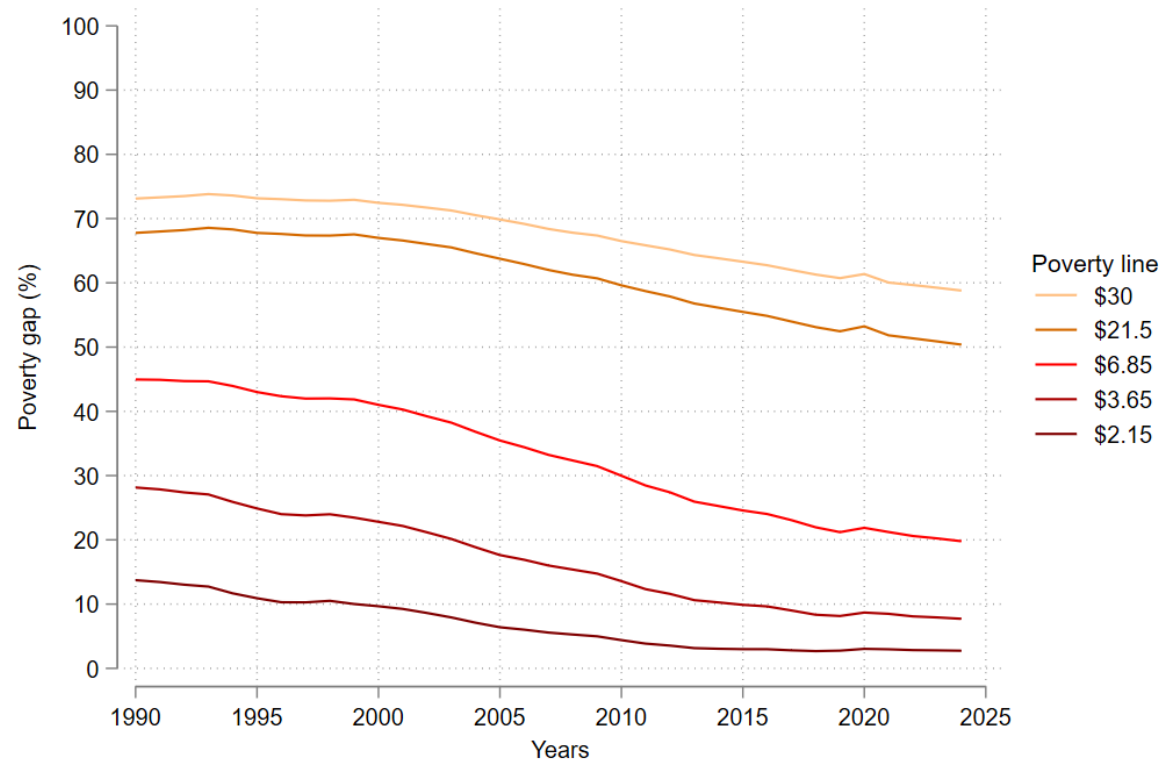# Has poverty decreased over the past 35 years?
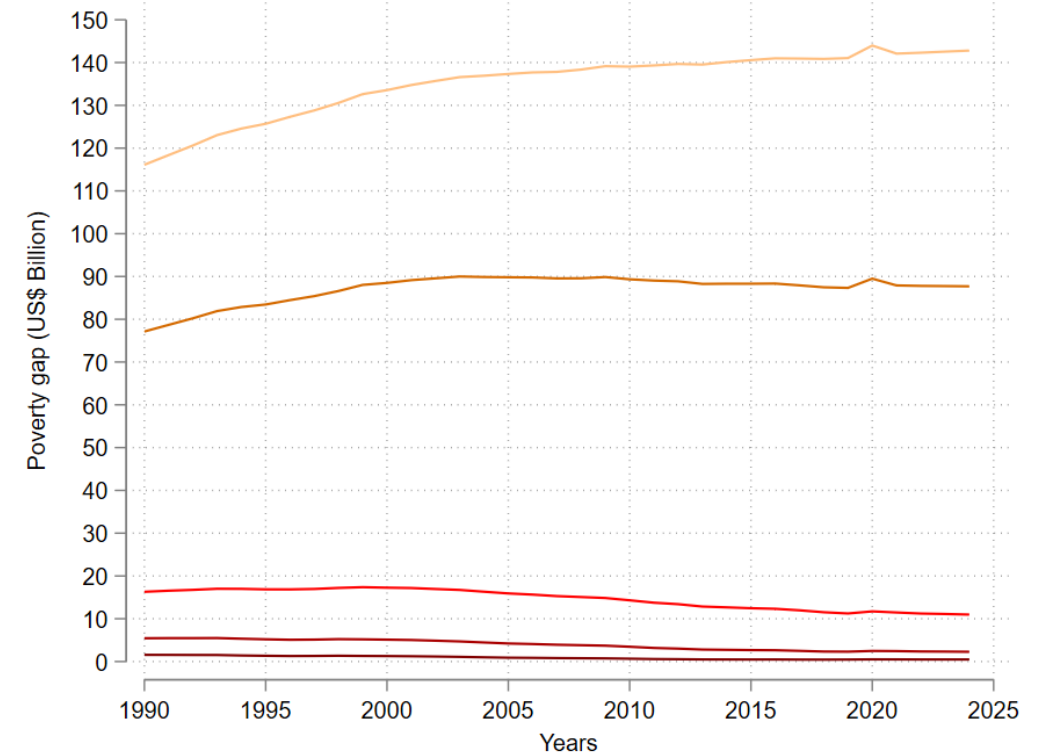

a) Poverty rate

b) Poverty headcount

Answers to this question strongly depend on poverty line (PL). With low PL, such as the WB extreme poverty line, we observe a massive poverty reduction over the past 35 years. With a high line, as promoted e.g. by Roser (2024), the poverty rate is stagnating at extremely high levels, and the poverty headcount is increasing, suggesting a complete failure of anti-poverty programming.

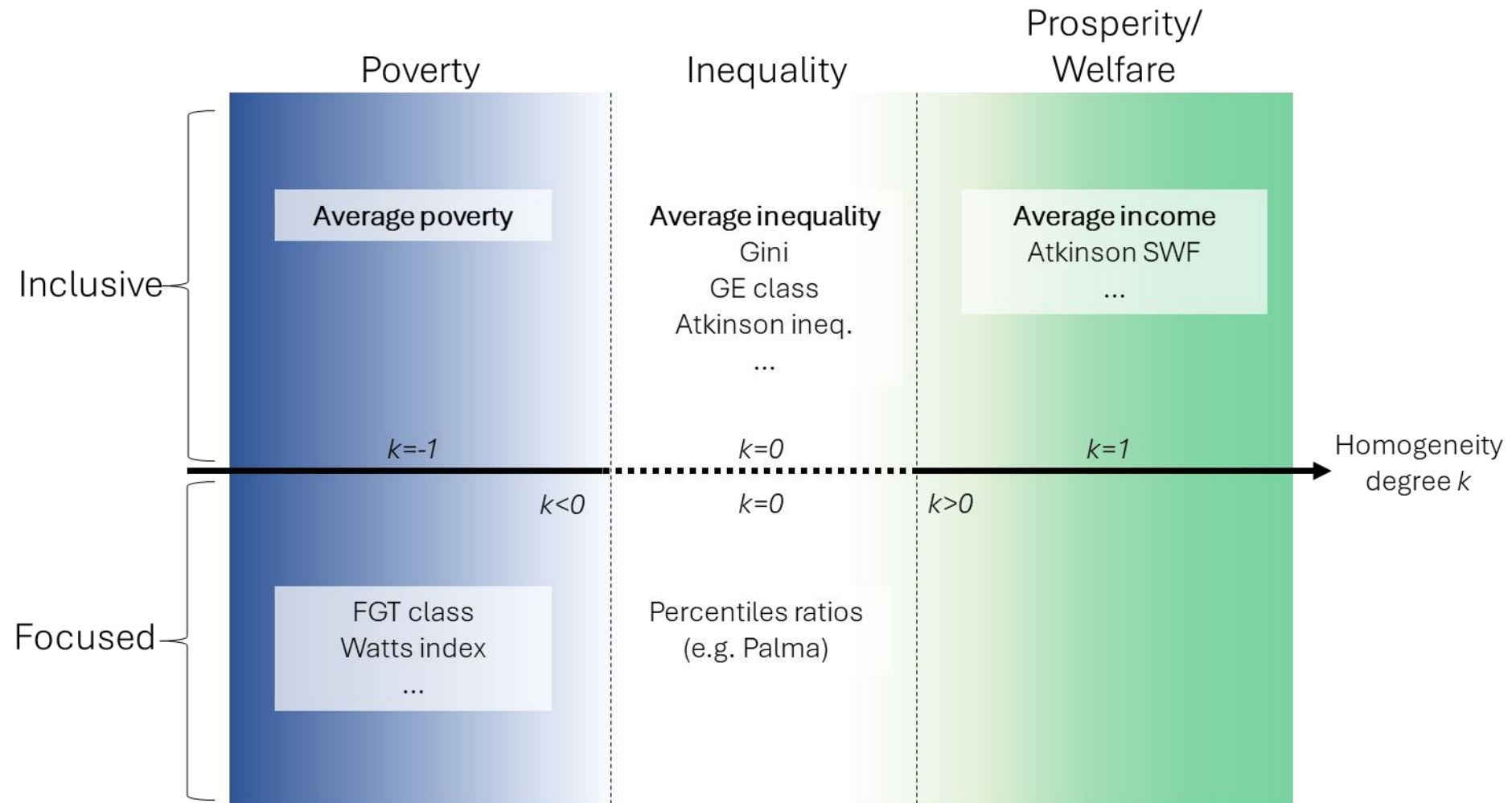# Has poverty decreased over the past 35 years?

a) Poverty gap (%)

b) Poverty gap (in US$ Billion)

We obtain similar conclusions with the poverty gap.

Motivation: general

- **Poverty headcount & gap** are extremely sensitive to poverty line (PL)

- **Multiplication of PL** adding to confusion

- These measures are *not distribution-sensitive* while policymakers care about inequality.
  - Regressive transfers do not (always) affect these measures.

- **Clever distribution-sensitive indices are available**, *but they are almost never used in academia, policy, and public discourse:*
  - *Watts (1969), Atkinson (1970), Sen (1976), Thon (1979), Takayama (1979), Kakwani (1980), Clark, Hemming, and Ulph (1981), Donaldson and Weymark (1980), Chakravarty (1983), Foster, Greer, and Thorbecke (1984), Hagenaars (1987), Morduch (1998), Chakravarty (2009).*

My contribution is to propose the first inclusive and distribution-sensitive measure of poverty. It is a poverty measure because it decreases with income. It is inclusive because all incomes are considered, without a poverty line excluding high incomes. It is distribution sensitive because it gives greater weight to the poorest incomes.

Today's talk

1. **New inclusive, distribution-sensitive poverty index**
   a) Intuition and axiomatization
   b) Why using this index?
      - It is intuitive
      - It is empirically grounded
      - It has interesting properties
      - It is relevant for policy

2. **Application:** Using World Bank PIP data & US data to illustrate how welfare and inequality have evolved since 1990s.

3. **Conclusion**

A. Intuition and axiomatization

Analogy with running

- 10 km/h is twice as fast as 5km/h.

- 5 km/h is twice as slow as 10km/h.

- Slowness = "pace" = 1/speed (usually in min/km).

- There is no threshold above/under which this stops being true

→**Slowness/pace is the reciprocal of speed**

Physics: reciprocal relationships are widespread (resistance/conductance , specific volume/density, period/frequency, slowness/speed, …)

Proposition: **poverty is the reciprocal of income**.

A. Intuition and axiomatization

What does it mean in terms of aggregate measurement, e.g. for a marathon?

- Denote , y_i the speed of individual *i* and *k* is a constant determining the unit (e.g. km/h)

- **Average speed** is the only decomposable measure satisfying these intuitions:

$$\bar{y} = \frac{1}{n} \sum_{i=1}^{n} \frac{y_i}{k}$$

- **Average pace** is the only decomposable measure of slowness that satisfies these intuitions:

$$P = \frac{1}{n} \sum_{i=1}^{n} \frac{k}{y_i}$$

- **What about other cardinal quantities?** The same formulas can be used for tallness/shortness, weight/lightness, distance/closeness... and **income prosperity/poverty**.

B. Why using P?

Average Poverty (Ratio)

$$P = \frac{1}{n}\sum_{i=1}^{n}\frac{k}{y_i}$$

1. **It is intuitive**

2. It is empirically grounded

3. It has interesting properties

4. It is relevant for policy

Interpretation

1) Reciprocal, so units are inverted

- Average income = $/day

- Average poverty (ratio) = days/$

P is the average number of days a typical person needs to get $k.

2) Growth interpretation: average factor by which incomes need to be multiplied to attain $k (Kraay et al. 2025)

Example: in 2024, people in DR Congo needed on average 1 days to get $1, but half day in Haiti, 2h in China, 85' in the US, and 25' in Switzerland.

B. Why using P?

Average Poverty (Ratio)

$$P = \frac{1}{n}\sum_{i=1}^{n}\frac{k}{y_i}$$

1. It is intuitive

2. **It is empirically grounded**

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4. It is relevant for policy

Online survey

Two samples:

1. Experts (N=245): from talks I gave (Oxford, Oslo, FAO, Ghent, LSE, Sheffield)

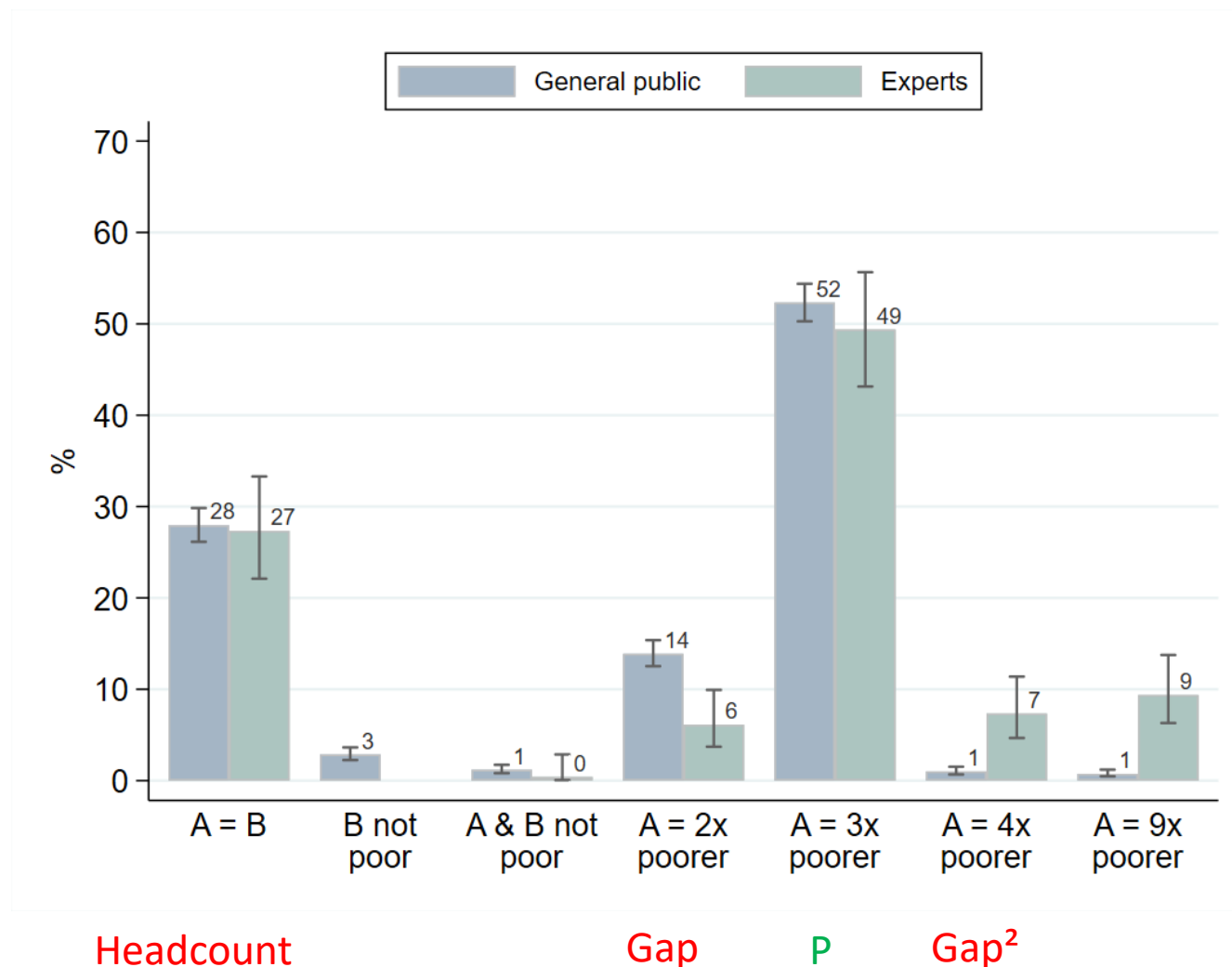2. General public (N=2,762): online samples from Kenya, India, South Africa and the US.

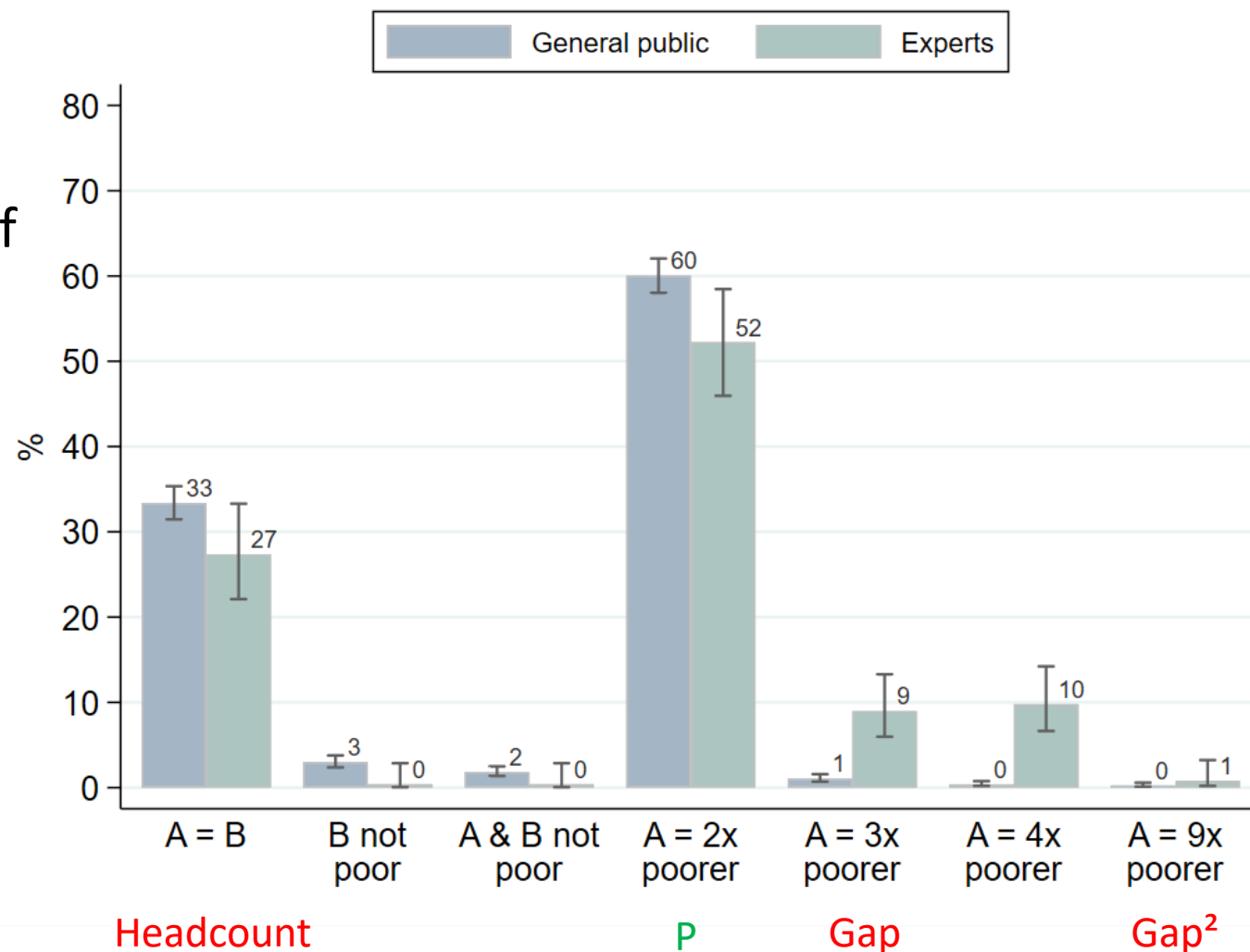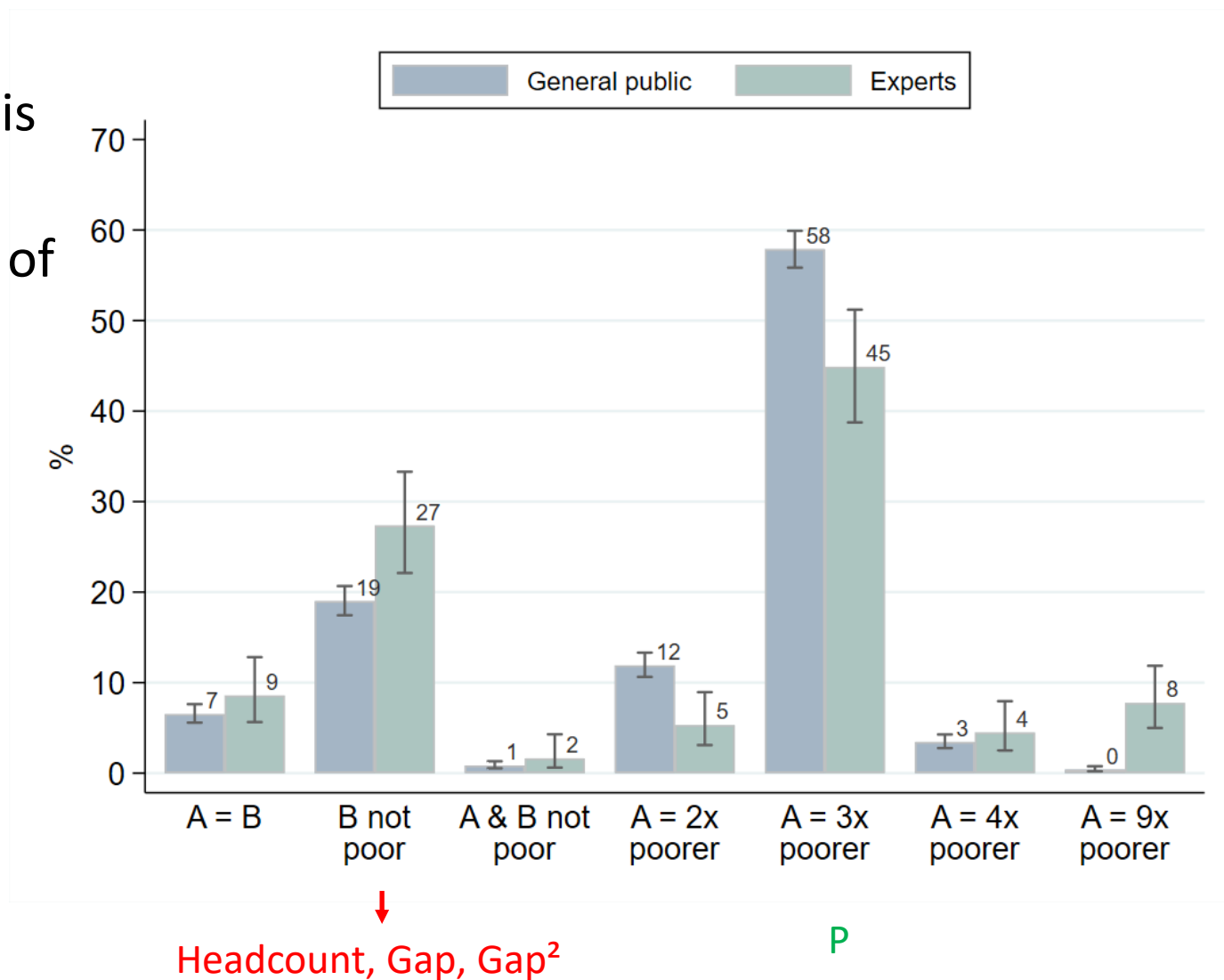**Randomization:** (1) ordering of answers, (2) parameters, (3) info. on poverty line.

Online survey

The World Bank determined that it is impossible for a person or family to meet basic needs below an income of $2.5 a day per person.

A earns $0.5 and B earns $1.5 per day

Which statement is consistent with how you think about poverty?

Online survey

The World Bank determined that it is impossible for a person or family to meet basic needs below an income of $2.5 a day per person.

A earns $1 and B earns $2 per day

Which statement is consistent with how you think about poverty?

Online survey

The World Bank determined that it is impossible for a person or family to meet basic needs below an income of $2.5 a day per person.

A earns $1 and B earns $3 per day

Which statement is consistent with how you think about poverty?

Headcount, Gap, Gap²

P

B. Why using P?

Average Poverty (Ratio)

$$P = \frac{1}{n}\sum_{i=1}^{n}\frac{k}{y_i}$$

1. It is intuitive

2. It is empirically grounded

3. **It has interesting properties**

4. It is relevant for policy

Properties

1. **Subgroup decomposability** with population weights.

2. **P is distribution-sensitive,** satisfying Transfer, Transfer Sensitivity, growth sensitivity, and s-th degree sensitivity for s approaching infinity.

3. **Orderings** (e.g., country ranking) **and comparisons** (e.g., over time or across countries) **do not depend on k.**
    → Sensitivity tests irrelevant (e.g. dominance analysis).

Properties

4. Associated inequality measure (Kraay et al. 2023):

$$P(y, \bar{y}) = I(y) = \frac{1}{n} \sum_{i=1}^{n} \frac{\bar{y}}{y_i}$$

The resulting index is a measure of inequality: it is homogenous of degree zero, it satisfies the transfer and transfer sensitivity axioms (+ other usual axioms).

Intuitive interpretations
1. Expected ratio between the income of two randomly selected individuals.
2. Average number of days needed to get average income.
3. Average factor by which incomes must be multiplied to attain average income.

Example: 4.9 in the US and 1.4 in Switzerland (equal to 1 if all incomes are equal)

Properties

Decomposition 1: Poverty-Growth-Inequality Triangle of Bourguignon (2003)

$$P = \frac{I}{\bar{y}} \quad \Rightarrow \quad \frac{P_{t+1}}{P_t} = \frac{I_{t+1}}{I_t} \frac{\bar{y}_t}{\bar{y}_{t+1}} \quad \Rightarrow \quad g_P \approx g_I - g_{\bar{y}}.$$

Decomposition 2: multiplicative decomposition in between- and within-group I (see Moramarco & Sterck 2025 for broader class):

$$I(y) = \underbrace{I(\bar{y})}_{\text{Between-group}} \cdot \underbrace{\sum_{g=1}^{G} \nu_g I(y^g)}_{\text{Within-group}}, \text{ with weights } \nu_g = \frac{N_g/\bar{y}_g}{\sum_{g'=1}^{G} N_{g'}/\bar{y}_g} \text{ summing to 1}$$

Decomposition 3: Additive decomposition: $I(y) = \sum_{g=1}^{G} \omega_g I(y^g)$ with $w_g = \frac{N_g}{N} \frac{\bar{y}}{\bar{y}_g}$

Properties

5. Focus axiom (Sen 1982) not satisfied

Not a problem:

- Little evidence of discontinuity or sharp non-linearity around poverty lines

"Poverty is not really a discrete condition. One does not immediately acquire or shed the afflictions we associate with the notion of poverty by crossing any particular income line. The constriction of choice becomes progressively more damaging in a continuous manner."

Watts (1968)

Properties

5. Focus axiom (Sen 1982) not satisfied

Not a problem:

- Little evidence of discontinuity or sharp non-linearity around poverty lines
- Survey experiment shows participants attach little importance to poverty line

Online survey

The World Bank determined that it is impossible for a person or family to meet basic needs below an income of $2.5 a day per person.
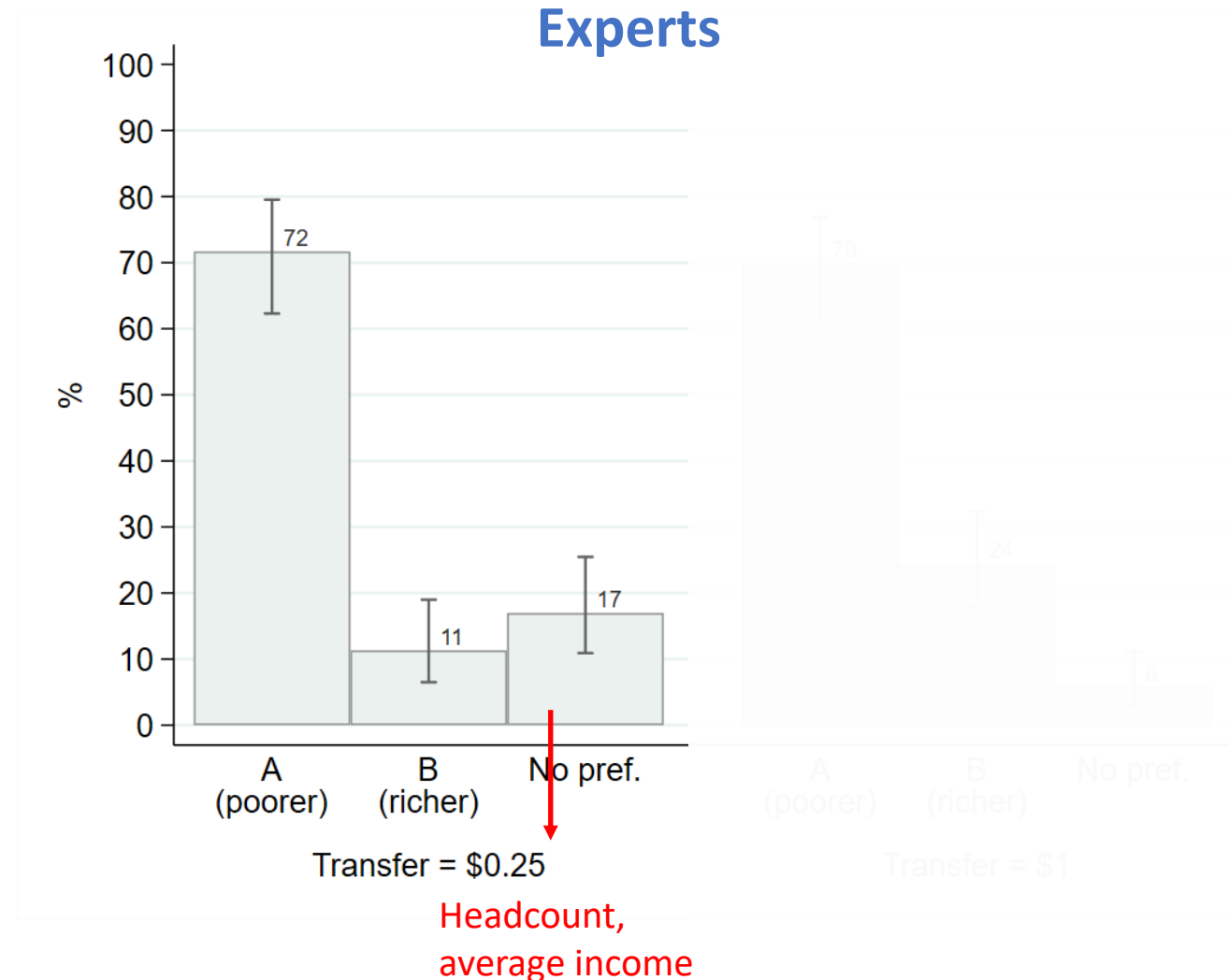
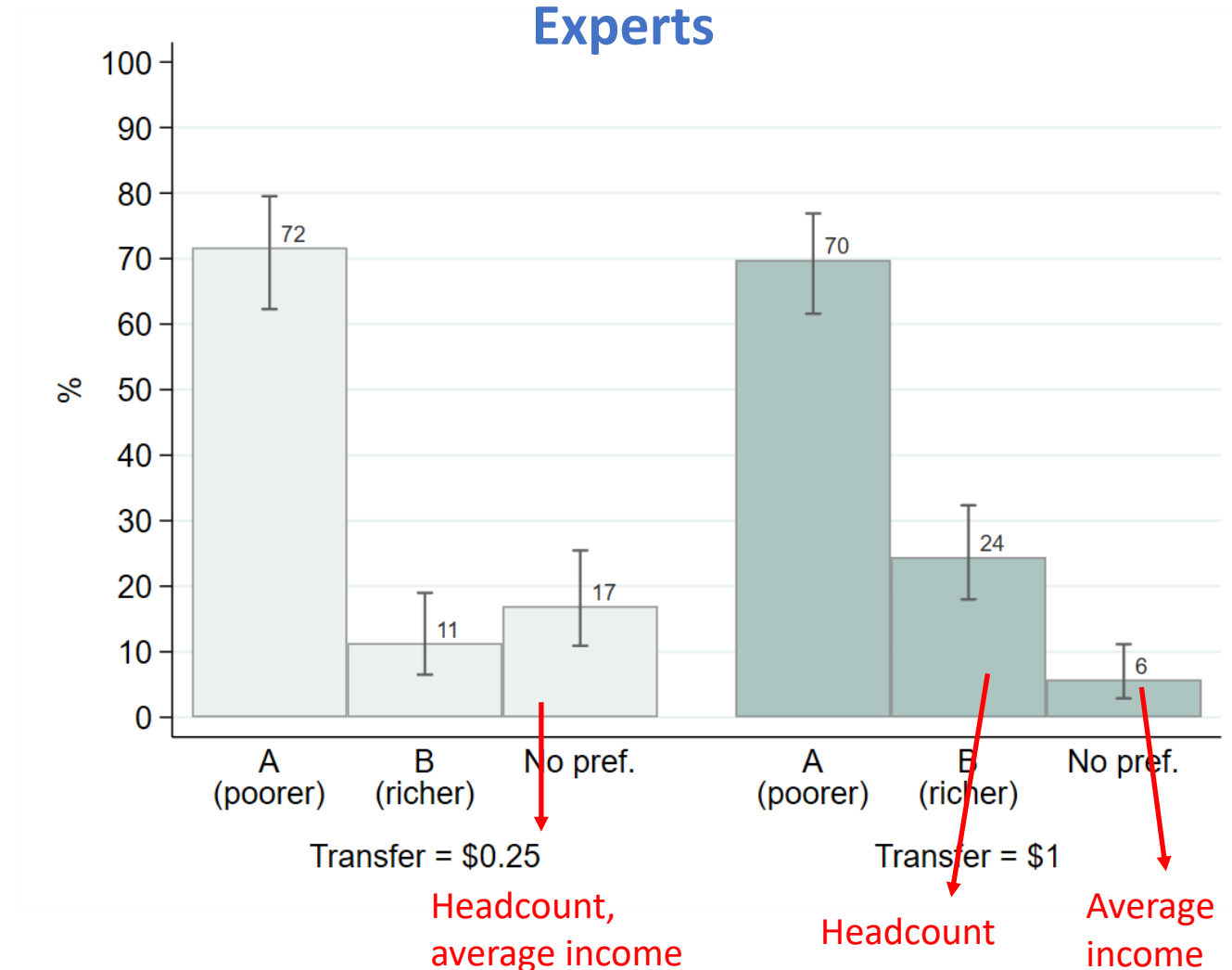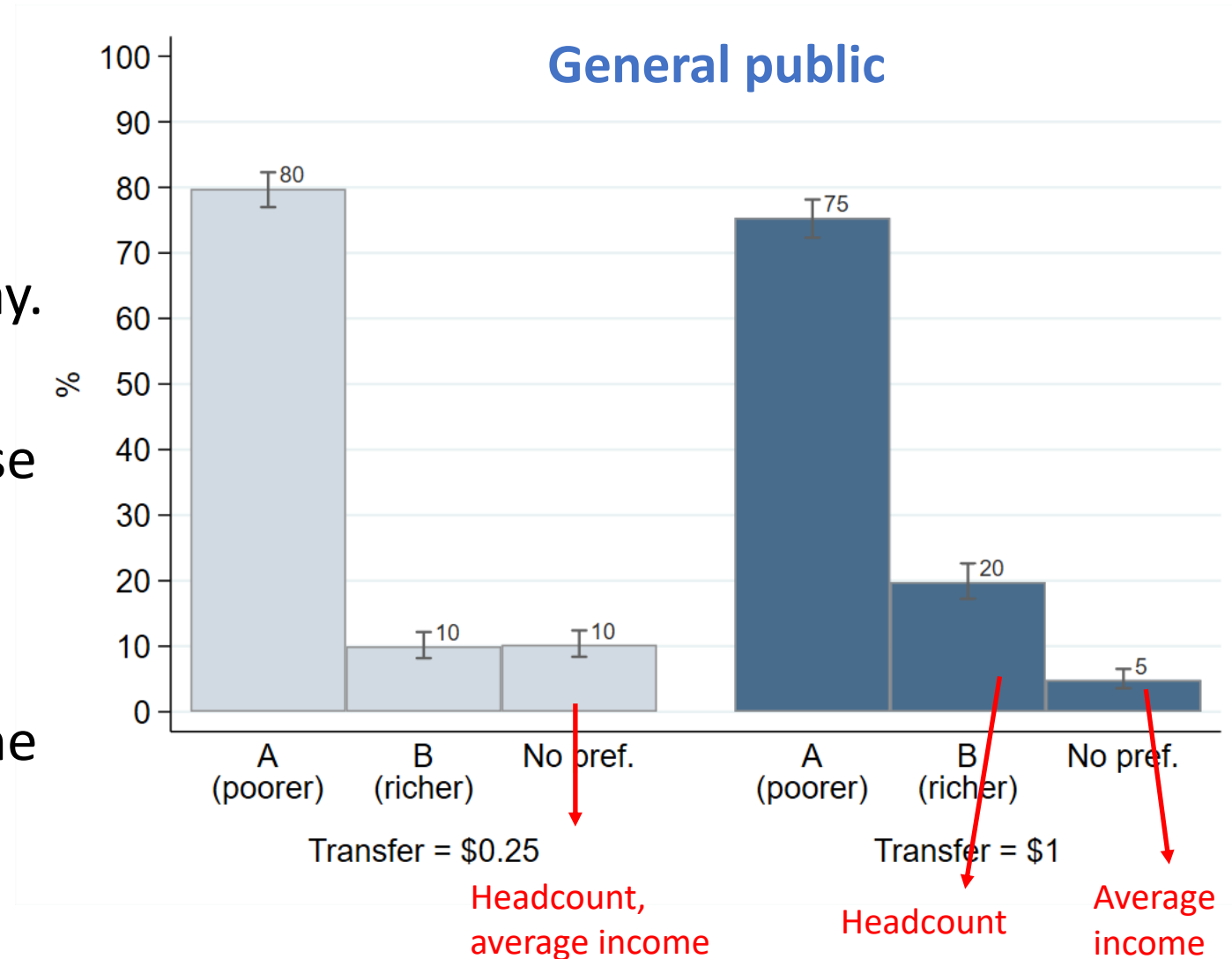A earns $1 and B earns $3 per day

Headcount, Gap, Gap²

P

Online survey

The World Bank ... (z=$2.5)

An individual A earns $1 per day while individual B earns $2 per day.

You have the possibility to increase the income of one of these two individuals by **$0.25** per day.

To which individual do you give the money to reduce poverty?

Experts

Transfer = $0.25

Headcount, average income

Online survey

The World Bank … (z=$2.5)

An individual A earns $1 per day while individual B earns $2 per day.

You have the possibility to increase the income of one of these two individuals by **$1** per day.

To which individual do you give the money to reduce poverty?

Experts

Online survey

The World Bank … (z=$2.5)

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You have the possibility to increase the income of one of these two individuals by **$1** per day.

To which individual do you give the money to reduce poverty?

Properties

5. Focus axiom (Sen 1982) not satisfied

Not a problem:

- Little evidence of discontinuity or sharp non-linearity around poverty lines
- Survey experiment shows participants attach little importance to poverty line
- Robustness to the choice of k

The **focus axiom** can still make sense in some contexts (speeding tickets analogy).

B. Why using P?

Average Poverty (Ratio)

$$P = \frac{1}{n}\sum_{i=1}^{n}\frac{k}{y_i}$$

1. It is intuitive

2. It is empirically grounded

3. It has interesting properties

4. **It is relevant for policy**

Policy relevance

Normative purpose: can be used to guide policies. Depends on underlying SWF.

Minimizing P is equivalent to maximizing the Atkinson SWF with ε=2.

$$\min \ P(Y,z) \quad \Leftrightarrow \quad \max \ A(\epsilon) = \left(\frac{1}{n} \sum_{i=1}^{n} y_i^{1-\epsilon} \right)^{1/(1-\epsilon)} \quad \text{and} \quad \epsilon = 2$$

Is this a reasonable value?

Limited evidence from leaky-bucket experiments:

• Evidence from survey experiments coming from high-income countries.
• Trade-offs involving high levels of income.

Online survey

The World Bank ... (z=$2.5)

An individual A earns $1 per day while individual B earns $1.5 per day.

Two options to reduce poverty:

1) Increase the daily income of A by $0.2.

2) Increase the daily income of B by $0.5.

Average ε: 2.11 among experts (95% CI:1.93-2.30, median=2)
2.41 among general public (95% CI: 2.35-2.47, median = 2.75).

Generalizations

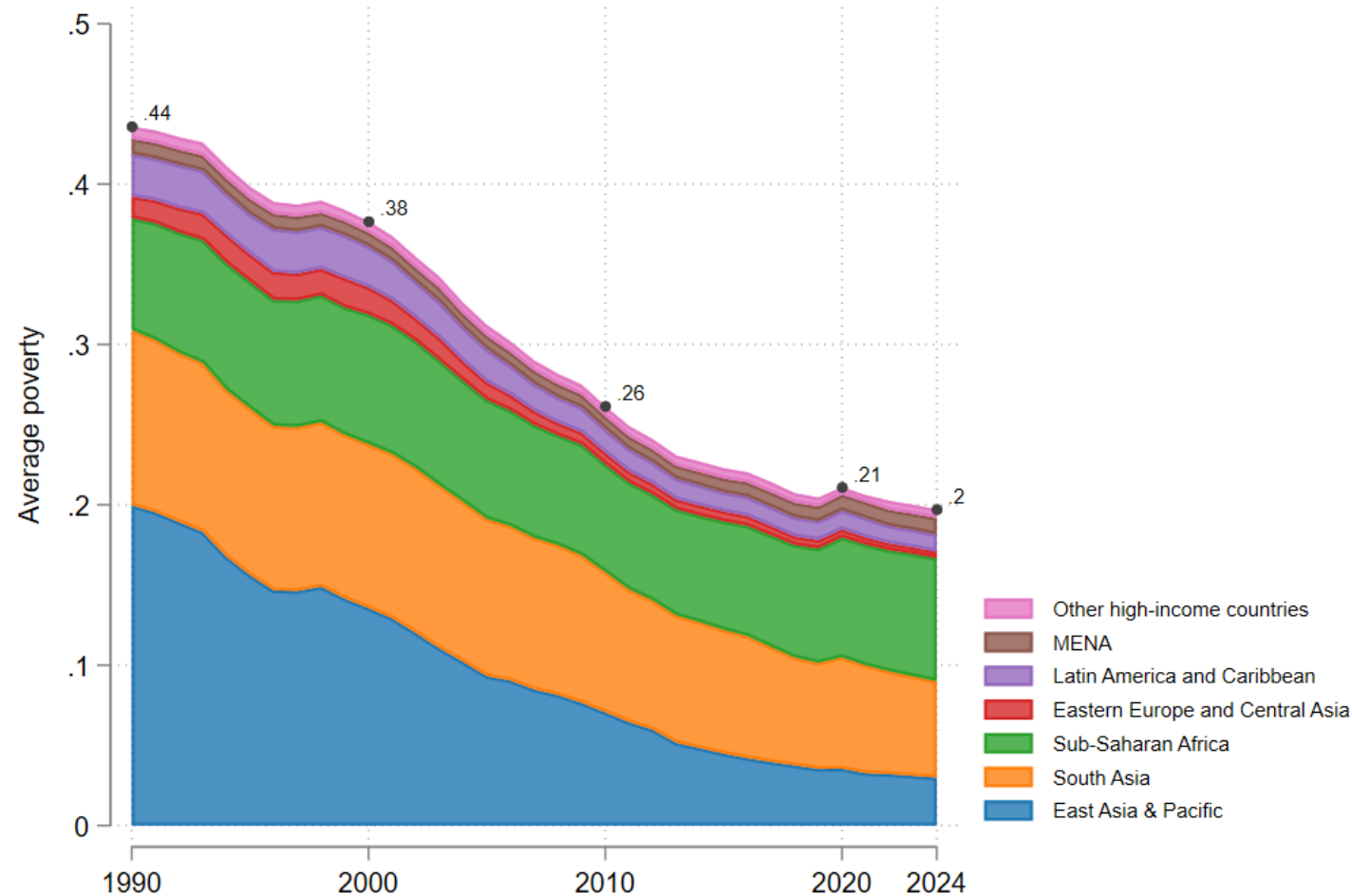$$M^\epsilon(Y, k) = \frac{1}{n} \sum_{i=1}^{n} \left(\frac{y_i}{k}\right)^{1-\epsilon}.$$

- For ε>1, only class of poverty measures that satisfies additive decomposability (A1), Normalization (A4), Comparisons Invariance (A5), and Monotonicity (A6). It satisfies *s*-th degree sensitivity for *s* approaching infinity.

- Moramarco and Sterck (2025) shows the associated class of inequality measures is unique in being multiplicatively decomposable in between- and within-group inequality components and additively decomposable in subgroups.

2. Applications
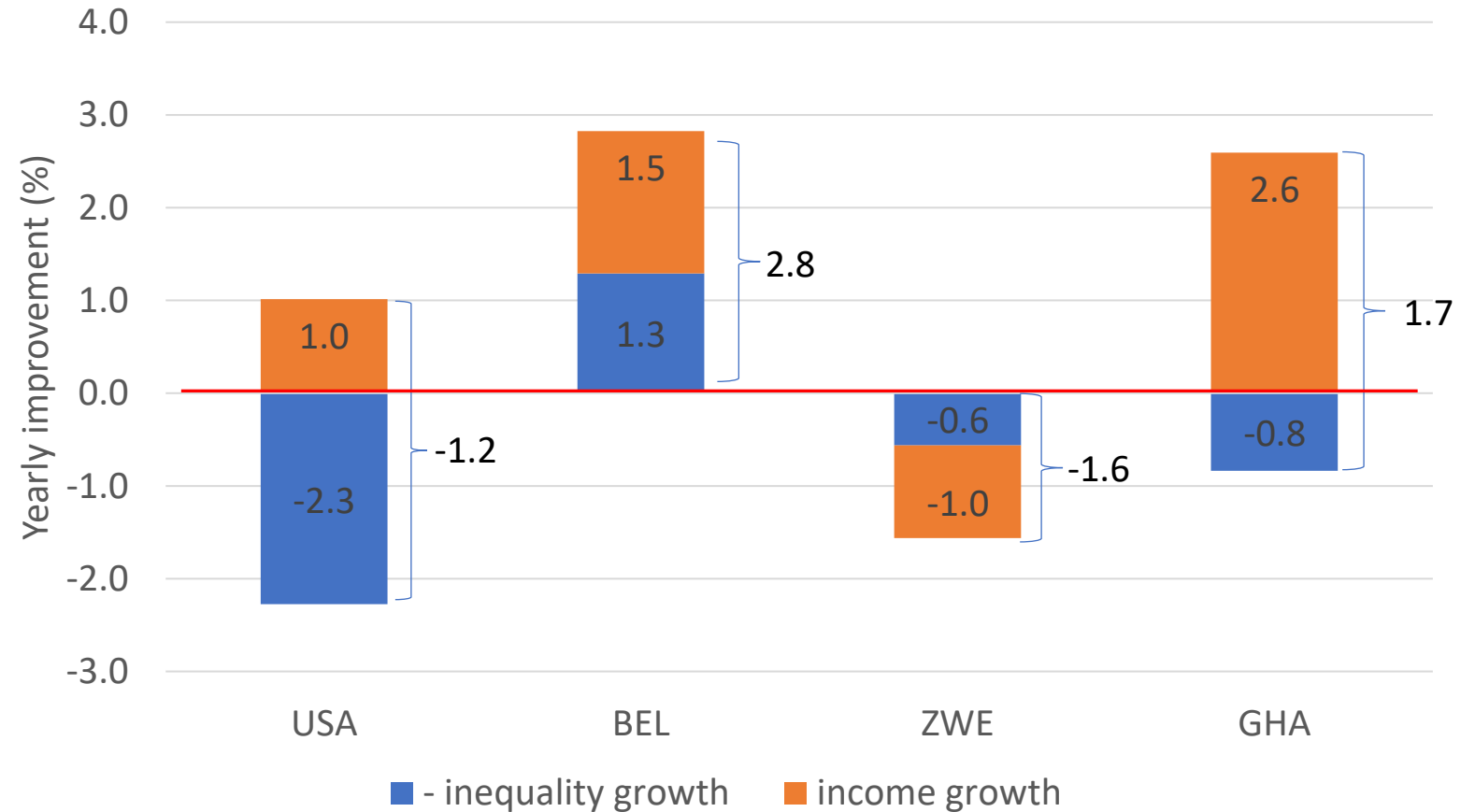
Has poverty decreased over the past 35 years?

Average poverty provide a unique, clearcut answer. Average poverty has declined from about 0.44 days to get $1, to 0.2 days to get $1 (from 11 hours to 5 hours). The decline is primarily driven by East and South Asia, while average poverty stagnated in SSA.
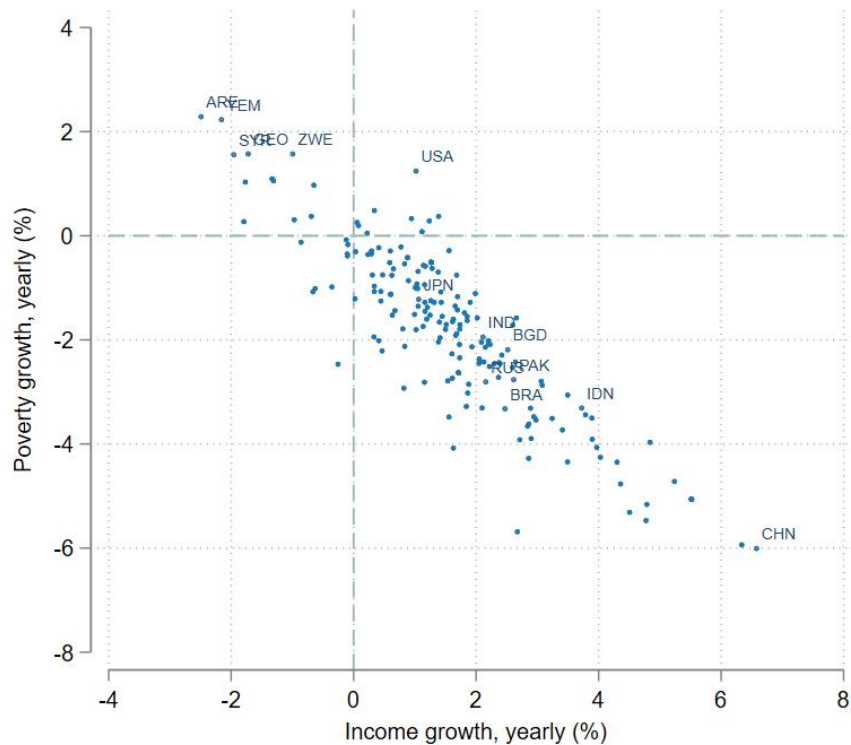
Why?

Poverty-Growth-Inequality Triangle (Bourguignon 2003)

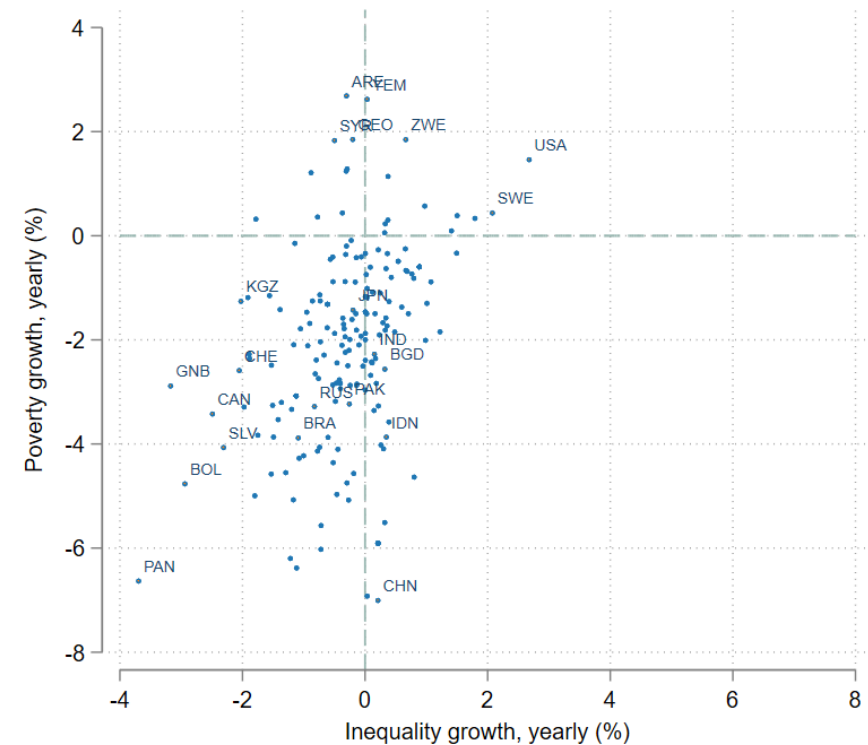$$g_P \approx g_I - g_{\bar{y}}$$

We can look at each country separately and assess whether changes in poverty are driven by economic growth and/or changes in inequality. In the US, inequality increases outpaced economic growth, so poverty increased. In Belgium, inequality declined while average income increased. In Zimbabwe, inequality increased, and average income declined, leading to sharp increases in poverty.
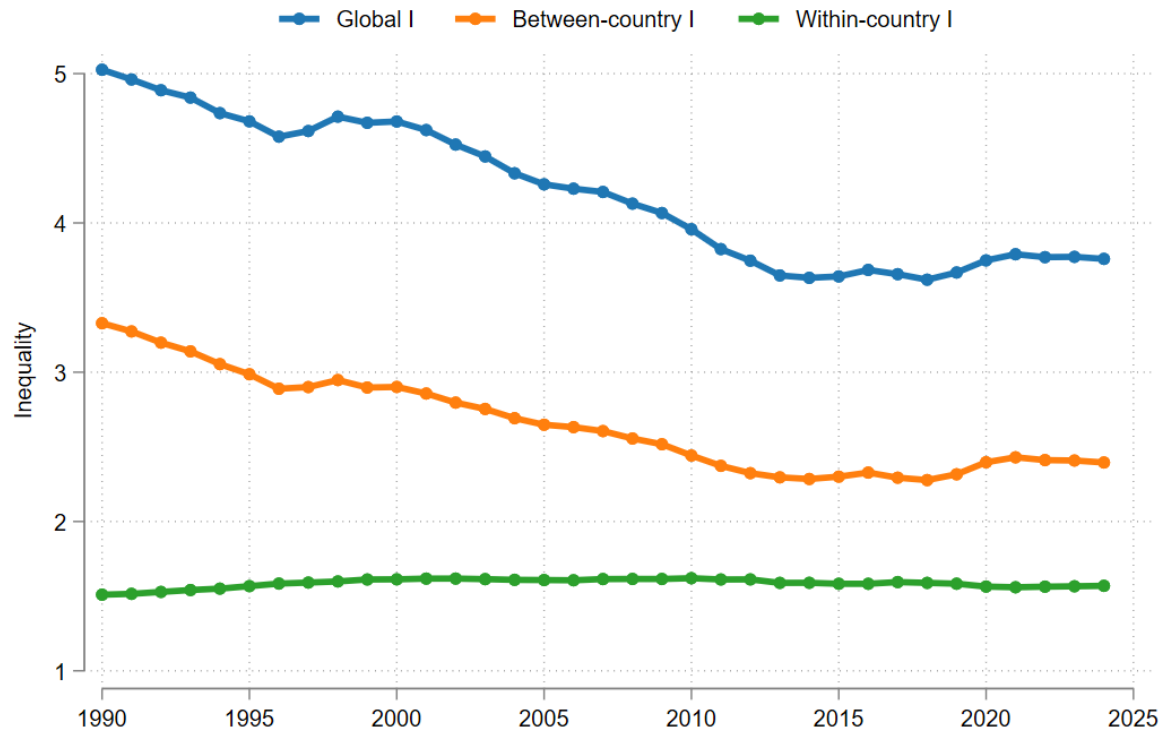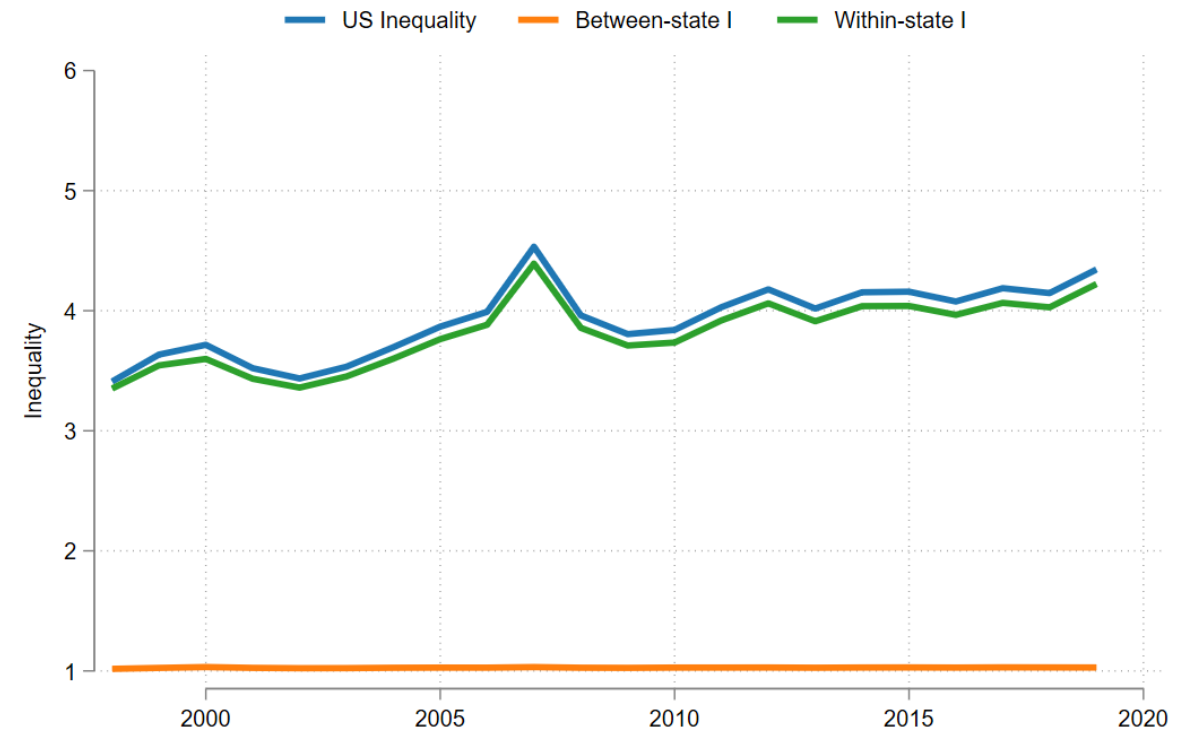
Why?

A. Income growth channel

B. Inequality channel

Looking at all countries together, we see that poverty reduction over the past 35 years was primarily driven by economic growth. By contrast, inequality has barely changed, and its correlation with poverty changes is low. Economic growth explains 78% of poverty reductions versus 22% only for inequality changes.

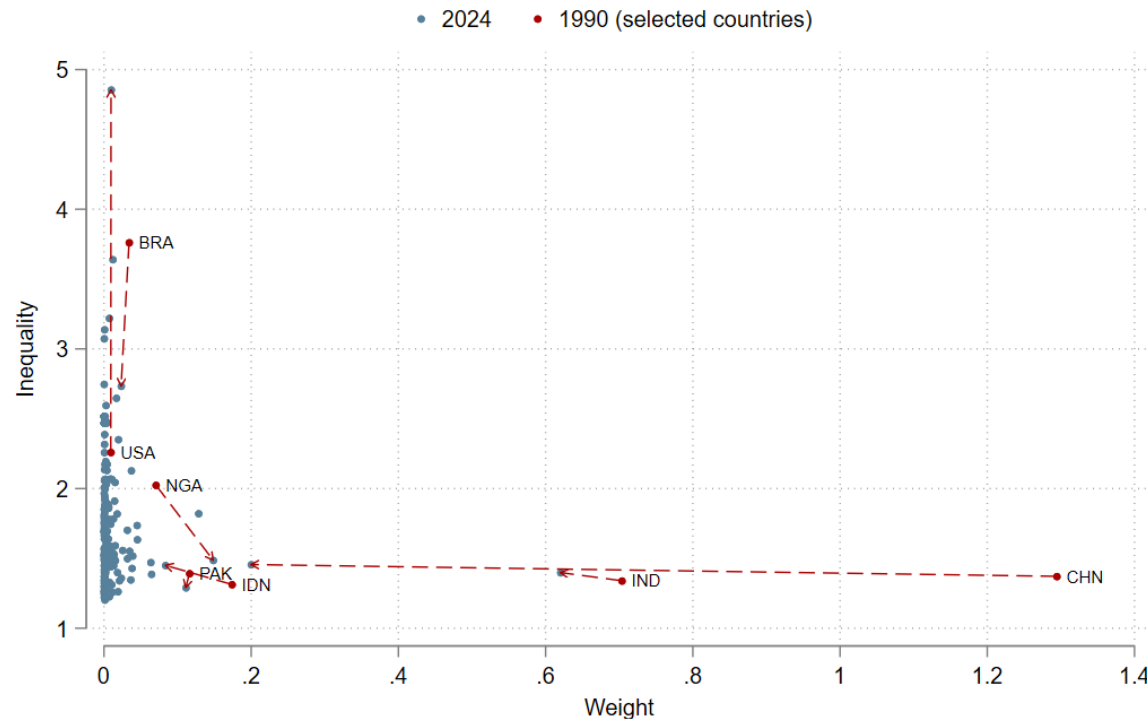# Inequality between- vs. within group
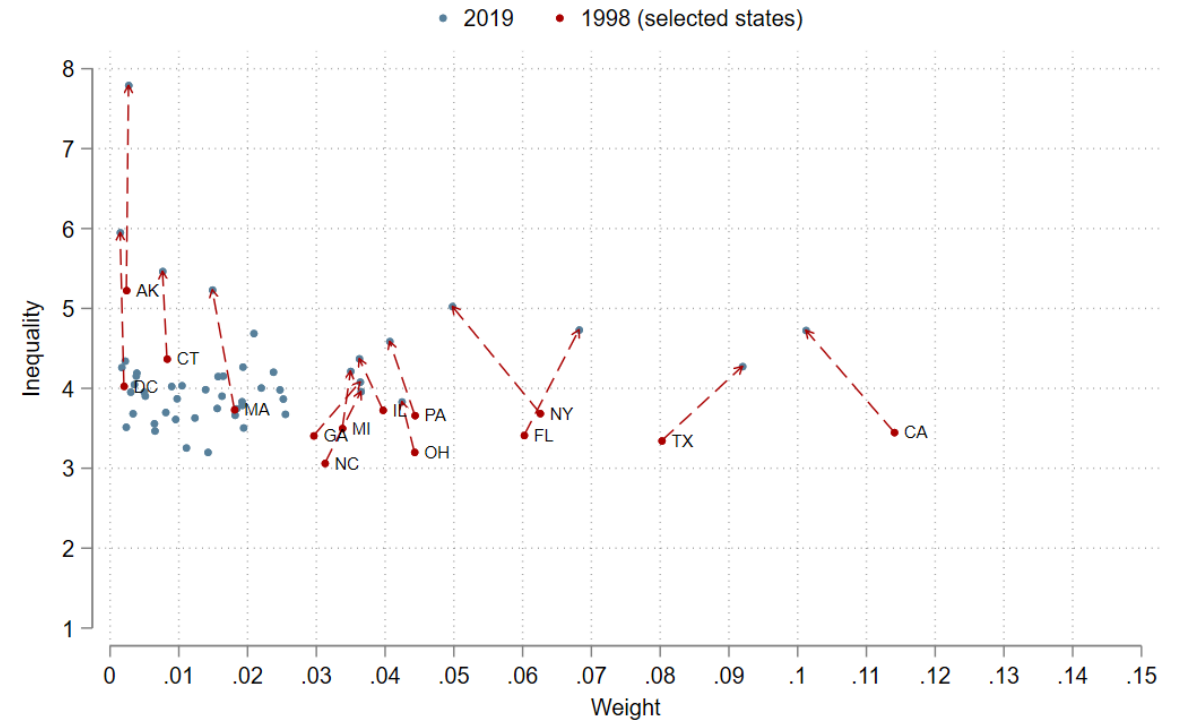

A. Global inequality

B. US inequality

We can also look at inequality trends over time and decompose inequality in within- and between-group components (Moramarco & Sterck, 2025). Figure A. shows global inequality declined between 1990 and 2024 because inequality between countries declined, while inequality within countries stagnated; if anything, it slightly increased. We observe the contrary in the US: inequality increased because within-state inequality increased, while between-state inequality remains extremely low.

Additive inequality decomposition

A. Global inequality

B. US inequality

We also examine where inequality is coming from (Moramarco & Sterck, 2025). Two factors matter: within-group inequality and the weights, which increase with a population size and decrease with a group's average income. Globally, China and India are the biggest contributor, but their share decreased thanks to economic growth. Other countries have a large share: high-inequality countries like the US, and poor countries like DR Congo. In the US, inequality increased in all states, with California and Texas being the largest contributors because of their population sizes. Alaska has the highest within-state inequality, but a low contribution because of its small population.

3. Conclusion

An investor called $140,000 the new poverty line. Experts disagreed but said he had a point.

A viral post claims $140,000 is the new poverty line. Here's the math
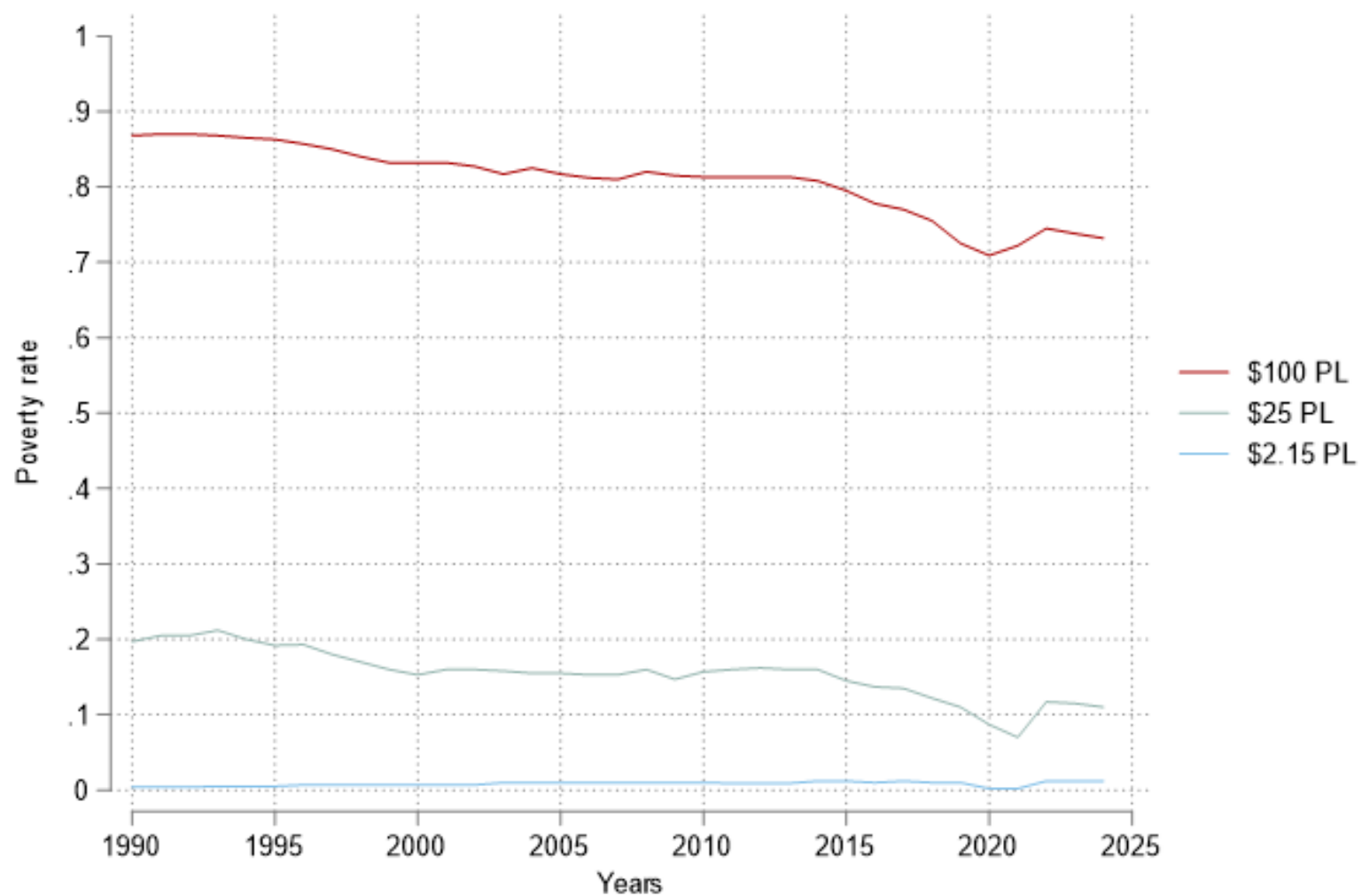
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Wall Street strategist explains today's political rage with a poverty line that should be $140,000 and the 'Valley of Death' trapping people below it
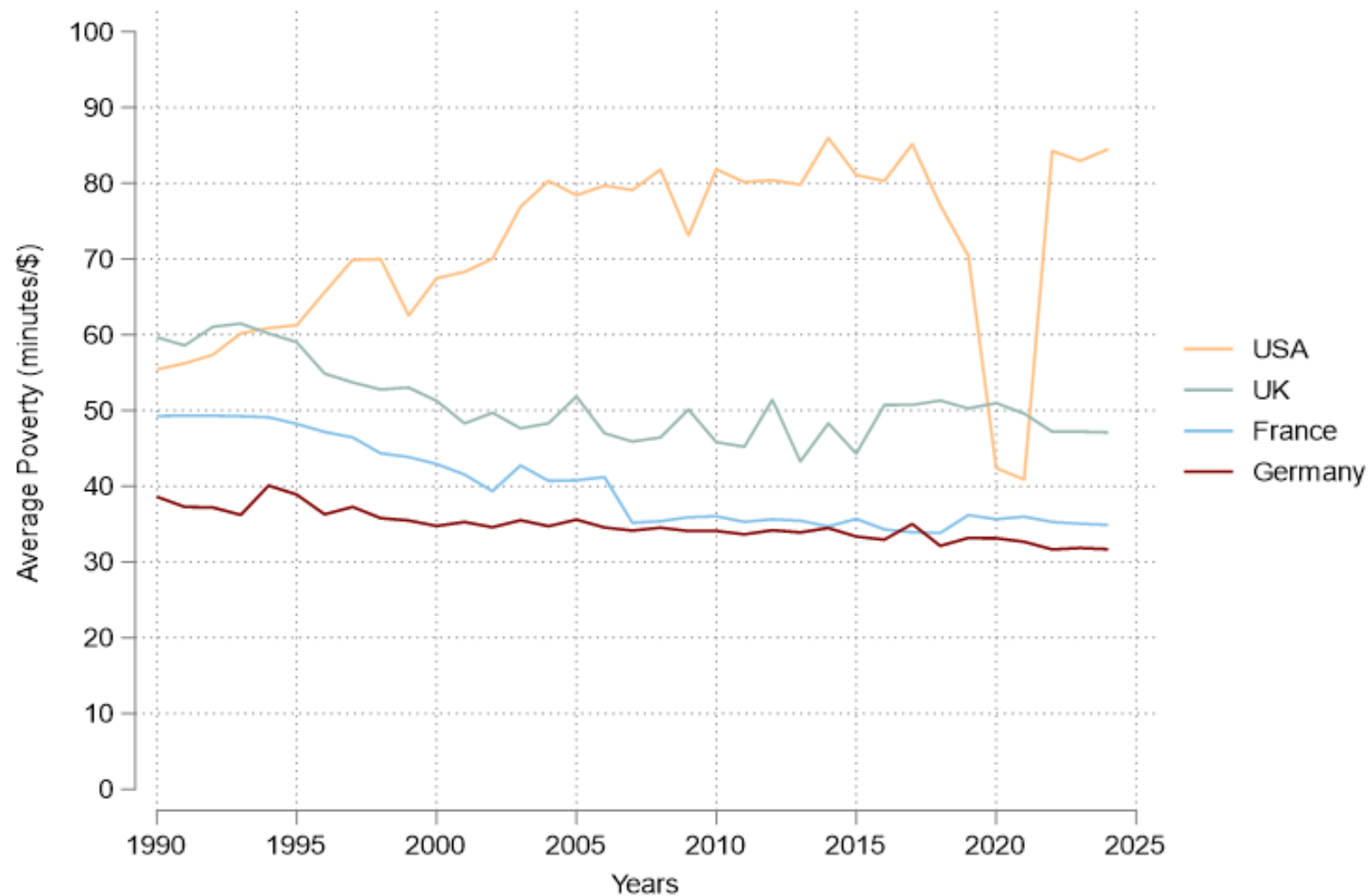
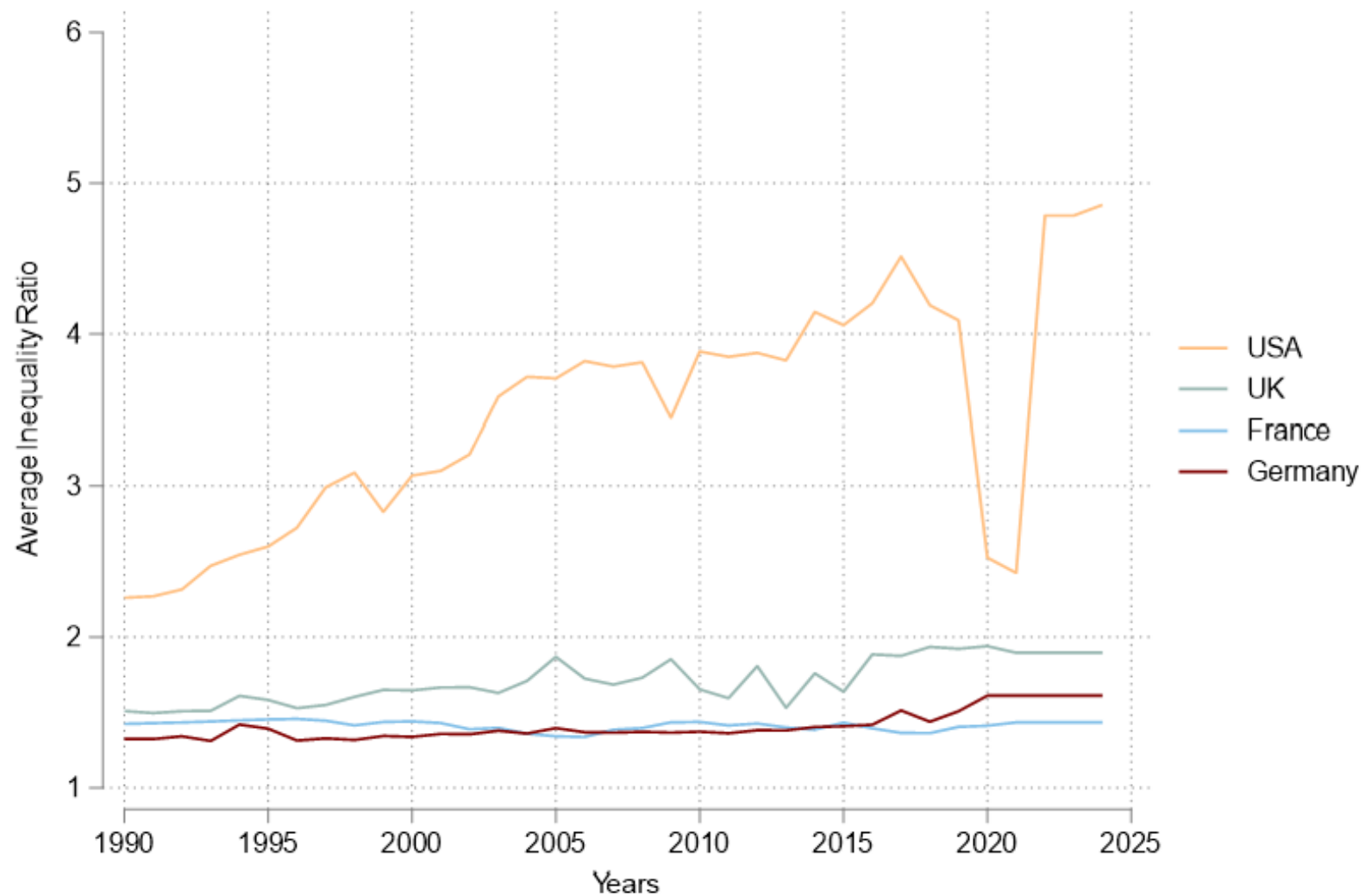**Figure 1 – U.S. Poverty rate with various poverty lines**

Note: World Bank PIP data. 100$ per day per person ~ 146,000 per year for a 4-person household. 25$ per day per person ~ US poverty line for a 4-person household. $2.15 per day per person is the extreme poverty line of the World Bank (in 2017-$)

Figure 2 – Average poverty: How many minutes to get $1?

Note: World Bank PIP data. Average Poverty as in Sterck (2025). Poverty without Poverty line. SSRN Working Paper.

Figure 3 – Inequality

Note: World Bank PIP data. Average Inequality as in Moramarco Sterck (2025) Who Drives Inequality? SSRN Working Paper.

Conclusion

P has:

- **Intuitive interpretations**:
  - *"Average number of days needed to get $1"*
  - *"Average factor by which incomes must increase…" (Kraay et al. 2025)*
- **Nice properties:**
  1. Population-weighted sub-group decomposable
  2. Satisfies all three definitions of distribution-sensitivity
  3. Comparisons and orderings do not depend on k
  4. Interesting link with inequality and income
- **Empirical support** among experts, general public,…
- **Adopted by the World Bank** with k=$25 to measure shared prosperity (Kraay et al. 2023)

Thank you – comments and questions welcome!

Sterck, O. (2024). Poverty without Poverty Line. CSAE working paper.

Kraay, A., Decerf, B., Jolliffe, D., Lakner, C., Ozler, B., Sterck, O., & Yonzan, N. (2023). *A New Distribution Sensitive Index for Measuring Welfare, Poverty, and Inequality*. World Bank Policy Research Working Paper 10470.

Moramarco, D., & Sterck, O. (2025). A New Class of Decomposable Inequality Measures. *Available at SSRN*.

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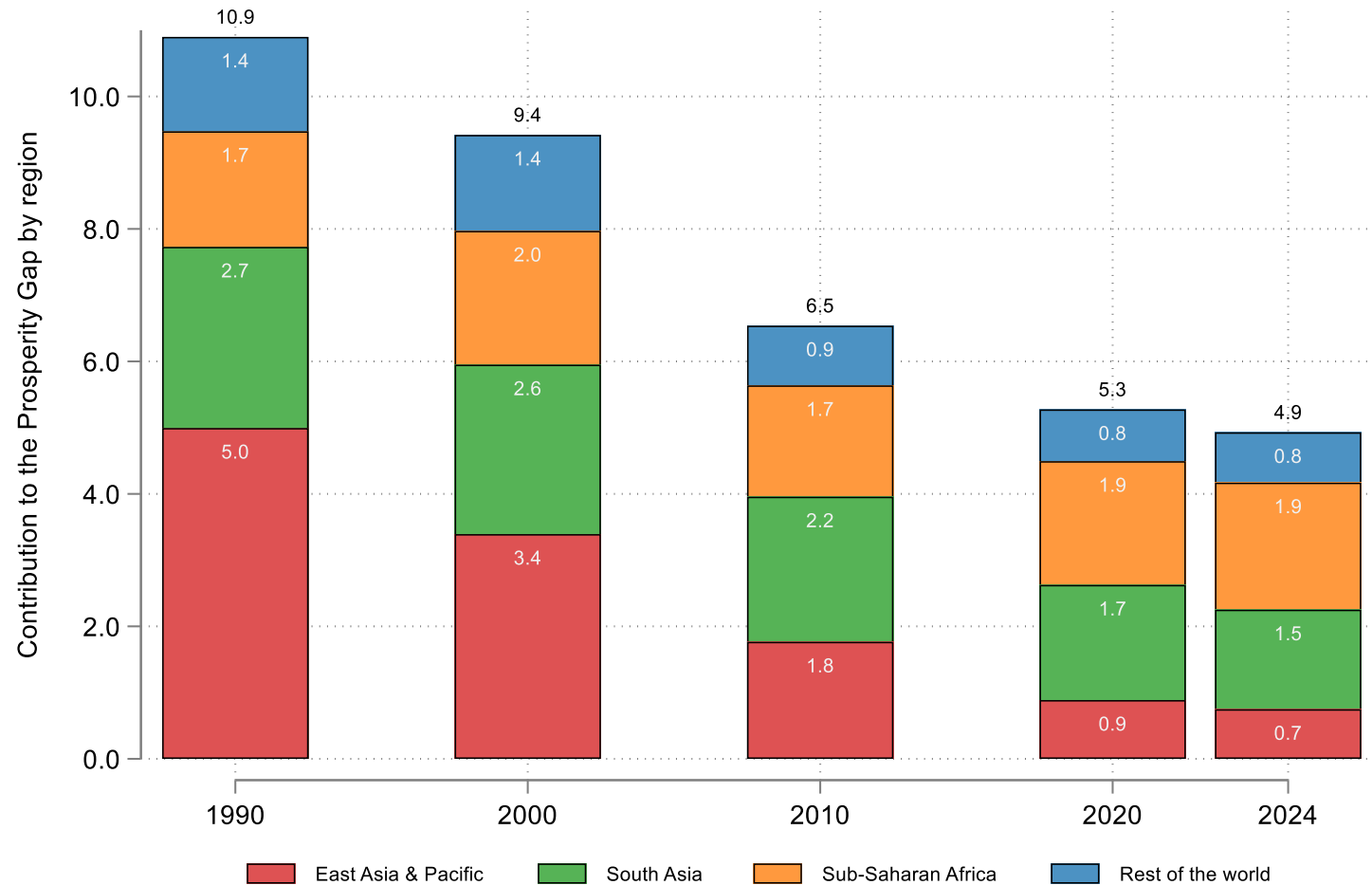
Appendix

A. Shared prosperity (Kraay et al. 2023)

- Since 2013 the **World Bank** has monitored "shared prosperity" as one of its **Twin Goals:** "*good progress is judged to occur not merely when an economy is growing, but, more specifically, when that **growth is reaching the least well-off in society**. Thus, the shared prosperity goal seeks to **increase sensitivity to distributional issues**, …. (World Bank (2015), p.10)*"

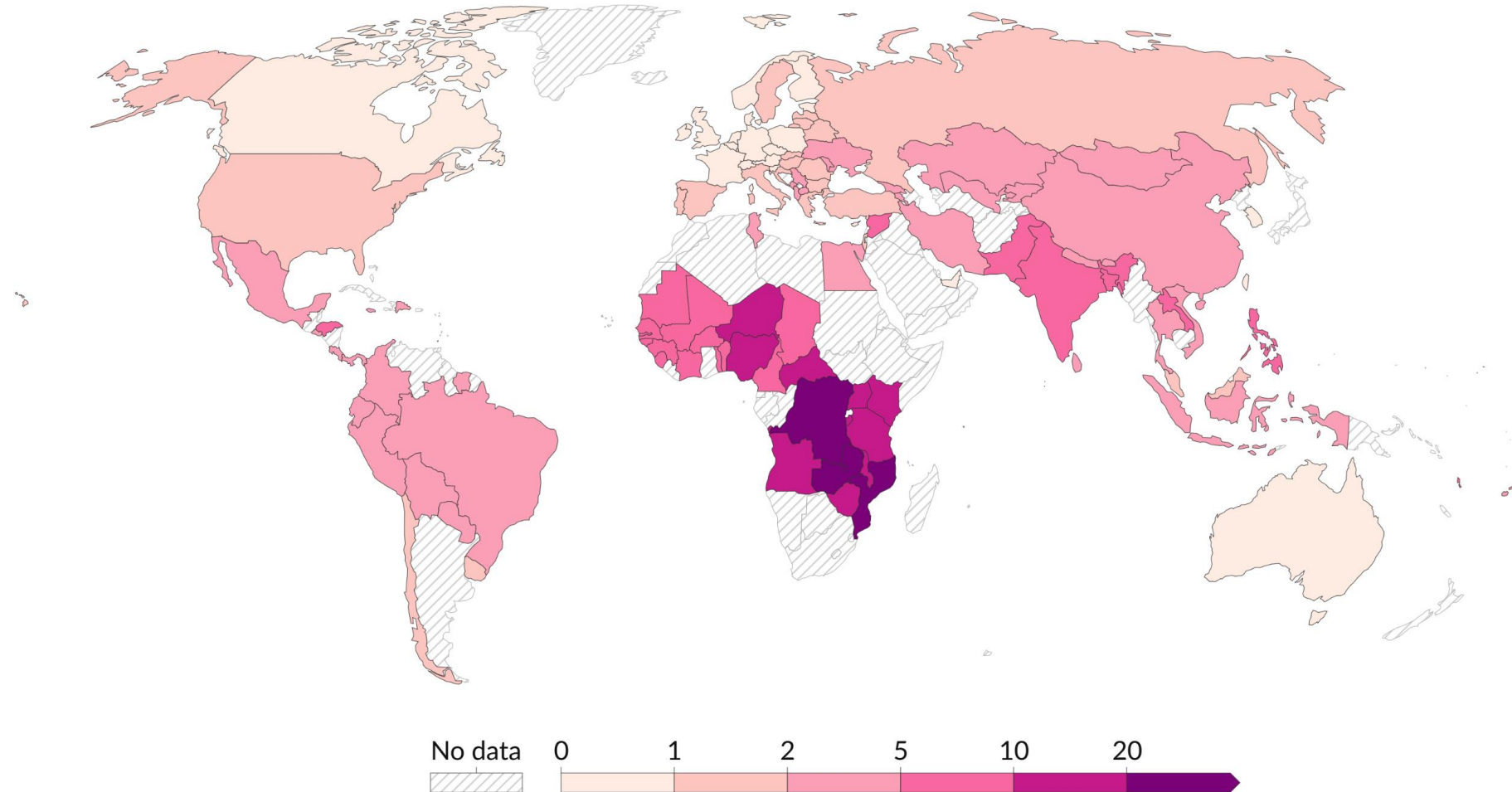$$Prosperity\ Gap = W(y,z) = \frac{1}{N} \sum_{i=1}^{N} \frac{z}{z_i}$$

- **Prosperity standard: z=$25 PPP** per day

  - Median poverty line of High-Income Countries is $24.4

  - Average daily per capita income at high-income graduation is $23

Prosperity Gap & Regional contributions

Prosperity gap, 2023

Average factor by which incomes need to be multiplied to bring everyone to the prosperity standard of $25 per person per day. This data is adjusted for inflation and for differences in living costs between countries.

No data   0   1   2   5   10   20

OurWorldinData.org/poverty | CC BY

Note: This data is expressed in international-$[1] at 2017 prices. Depending on the country and year, it relates to income measured after taxes and benefits, or to consumption, per capita[2].

Data

- **Global data:**
  - Data from the World Bank's Poverty and Inequality Platform (PIP).
  - Over 2000 household surveys covering 168 countries and over 97 percent of the world's population.
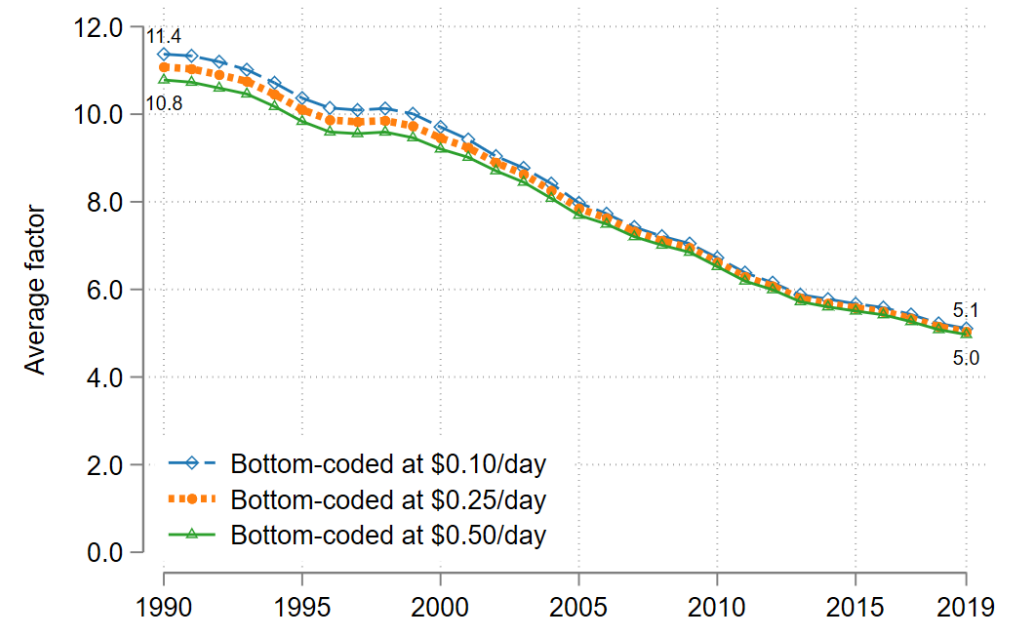- **US data:**
  - Kindly shared by Rinz, K., & Voorheis, J. (2023). *Re-examining Regional Income Convergence: A Distributional Approach*. US Census Bureau, Center for Economic Studies.
  - IRS Tax Form 1040 on Adjusted Gross Income (AGI), by percentile and state.
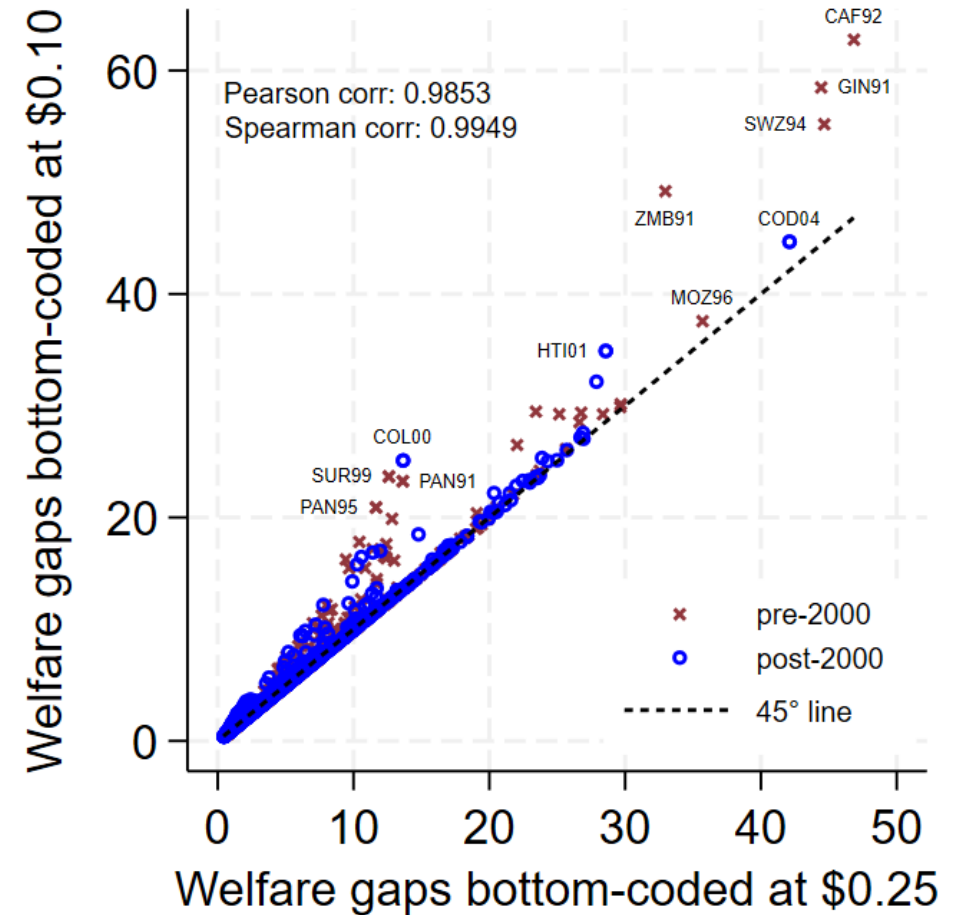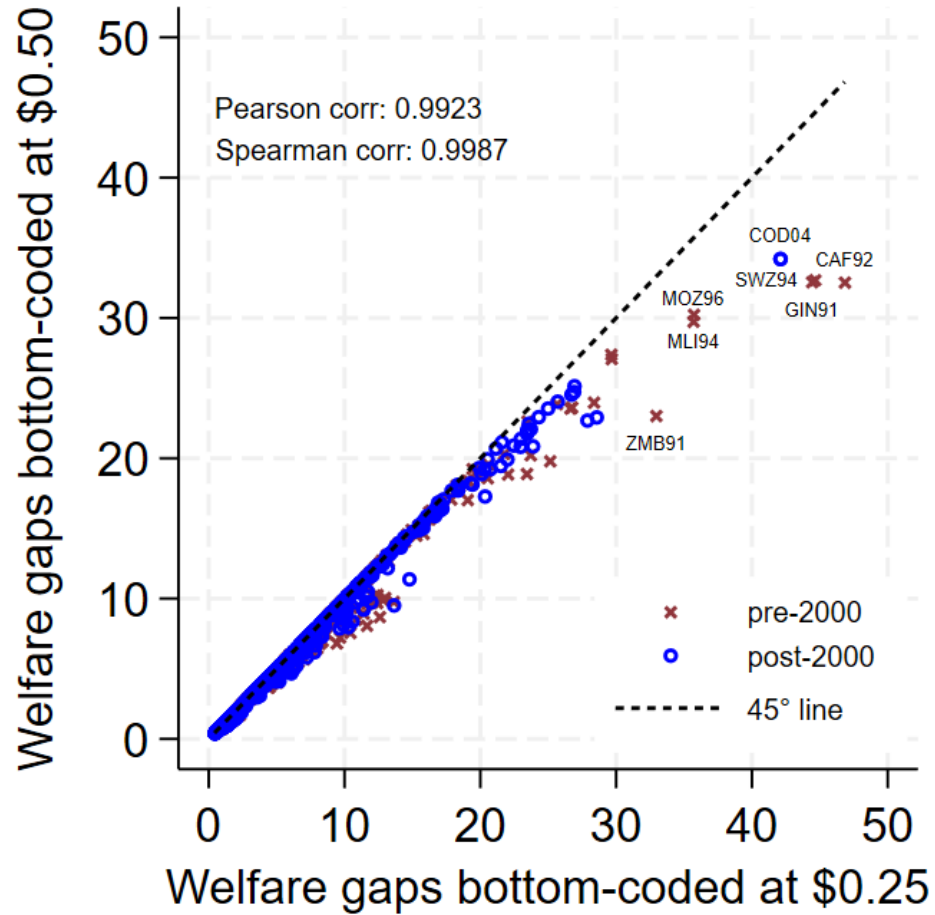
Limitation

P does not accept 0 or negative incomes

- Bottom-coding: $0.25 = least expensive bundle providing 2,330 kcal per day

- Robust results with 0.1 (Neugschwender, 2020) or 0.5 (Ravallion, 2016)

- Works better with consumption data

Sensitivity to bottom-coding

Generalization

1/x transformation can replace the log transformation:

- Deal with outliers while magnifying effects at the bottom of the distribution

- Calories in "days to get 2100kcal" to measure food insecurity (Bruni & Sterck 2025 a,b)

- Total expenditures in "days per $" to measure household poverty

More direct interpretation of impacts:

- Log-transformed variable: impact is given by $\exp(\beta)-1$

- 1/x transformation: impact in "days needed to get…" and in welfare terms