Estimate Under-5 Mortality Rate by Household Economic Status

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- We need to better understand who and where the most disadvantaged and vulnerable children are, and how U5MR disparity changes overtime;
- This project dis-aggregated U5MR by household economic status using wealth quintile.

Wealth quintile: refer to 5 equal-size birth groups with different levels of household economic status according to the wealth index assigned to each household.

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  - Type of flooring (dirt/cement/parquet)? Type of toilet (bush/flush)? Has electricity? Number of members per sleeping room? etc.
- Use principal component analysis (PCA) to assign the indicator weights, and get the weighted sum as the wealth index.

Wealth quintiles

- 5 equal-size birth groups based on the distribution of the wealth index from household population;
- The 1st quintile group refers to the poorest household;
- The 5th quintile group is the richest.

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- Estimate the expected relation between the relative disparity of quintile-specific U5MR and the national-level U5MR (all quintiles combined);
- Identify countries with the highest U5MR disparity on absolute and relative scales.

Data

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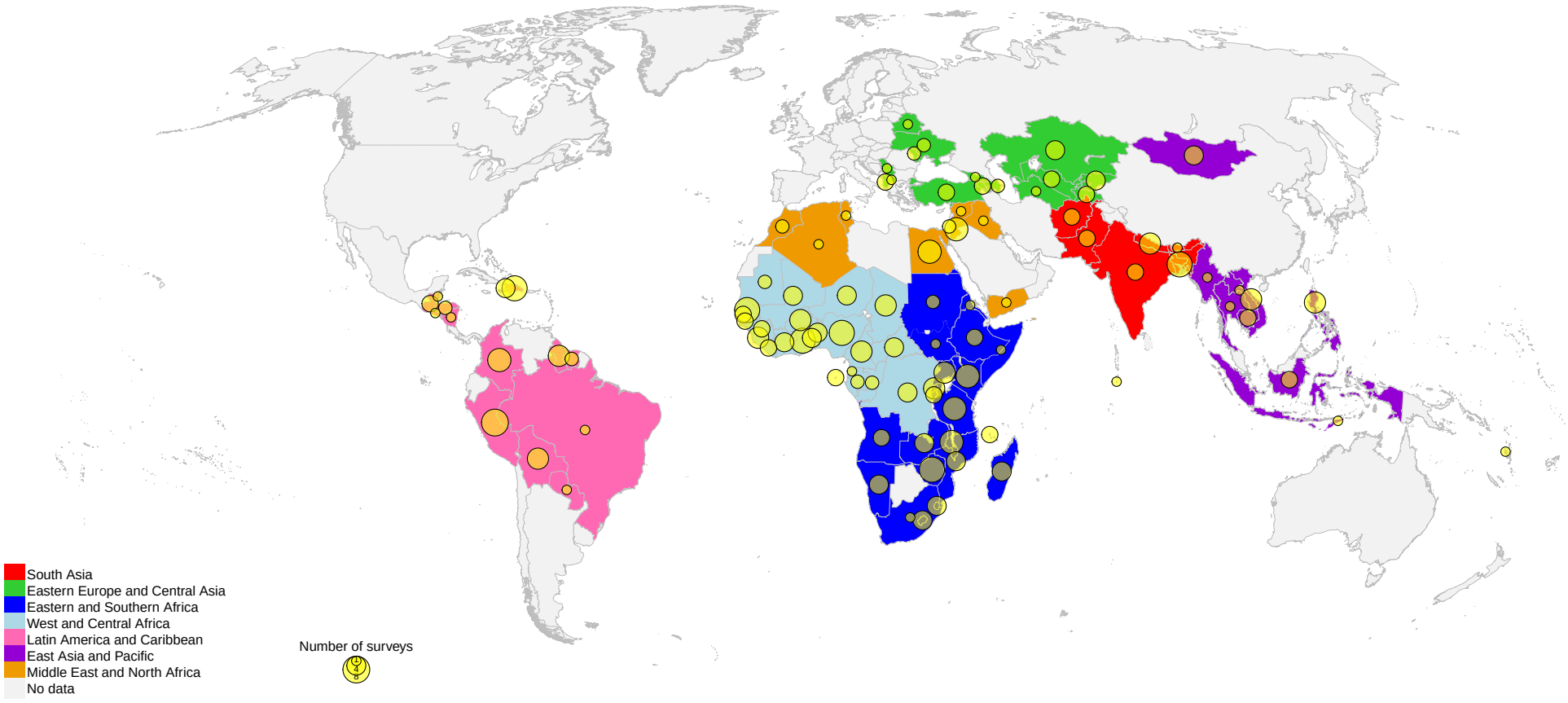
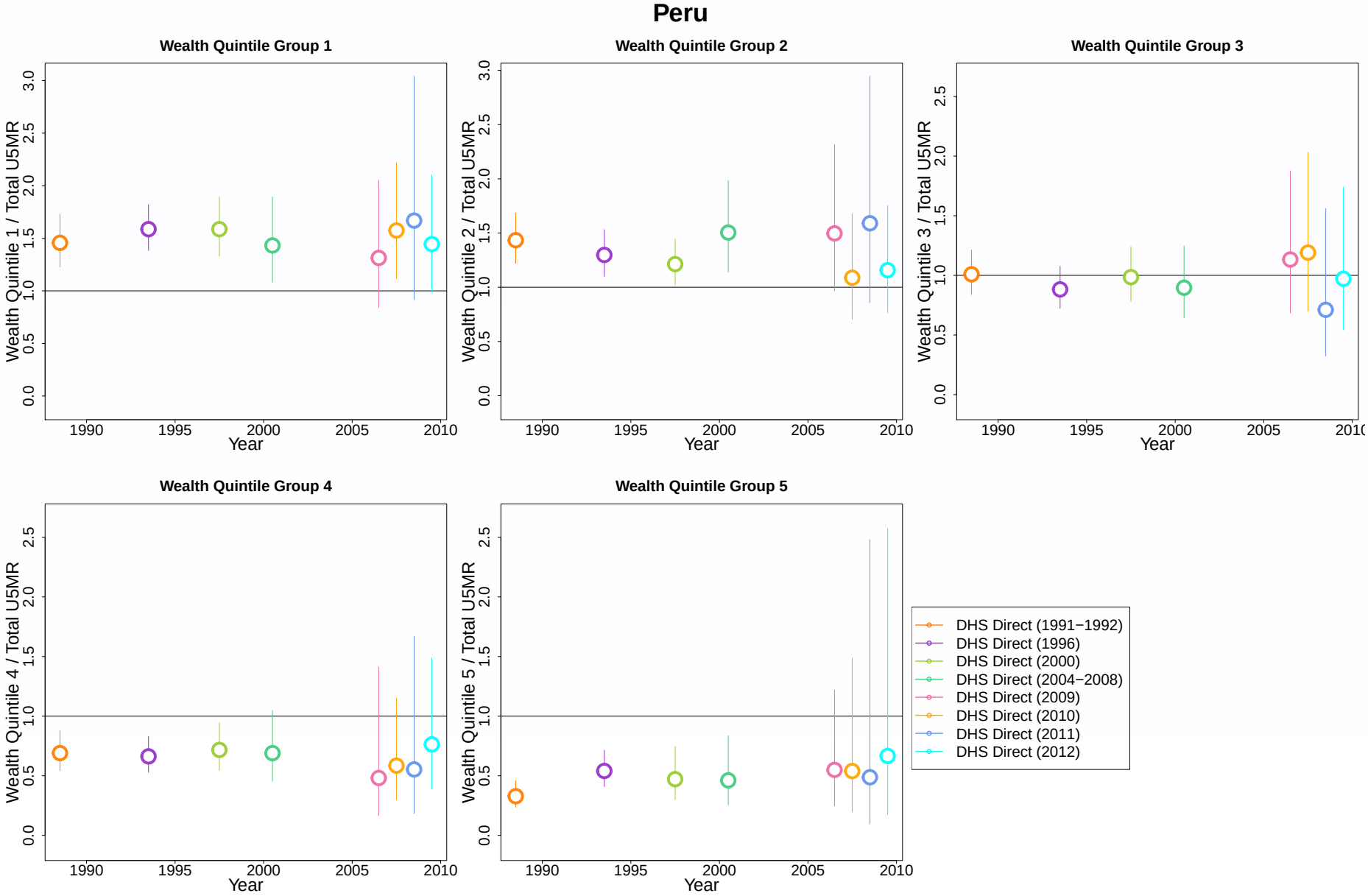
- 319 surveys in total (each country has 1–8 surveys);
- Each survey has 1 data point for each wealth quintile;
- Range of reference year from observations: 1987–2012;

Data


South Asia
Eastern Europe and Central Asia
Eastern and Southern Africa
West and Central Africa
Latin America and Caribbean
East Asia and Pacific
Middle East and North Africa
No data
Number of surveys

Data


Peru
Wealth Quintile Group 1
Wealth Quintile Group 2
Wealth Quintile Group 3
Wealth Quintile Group 4
Wealth Quintile Group 5
Wealth Quintile 1 / Total U5MR
Wealth Quintile 2 / Total U5MR
Wealth Quintile 3 / Total U5MR
Wealth Quintile 4 / Total U5MR
Wealth Quintile 5 / Total U5MR
Year
DHS Direct (1991−1992)
DHS Direct (1996)
DHS Direct (2000)
DHS Direct (2004−2008)
DHS Direct (2009)
DHS Direct (2010)
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DHS Direct (2012)

Model Overview

$$Q_w \xleftarrow[w=1,\ldots,5]{Q_w/Q_{total}} R_w \xrightarrow[w=1,2,4,5]{Q_w/Q_3} S_w \xrightarrow[w=1,2,4,5]{U_w \cdot P_w} \begin{cases} U_w & \text{splines function} \\ P_w & \text{time series} \end{cases}$$

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The data model is:

$$\log(r_i) \quad \sim \quad N(\log(R_{w[i]}), \gamma_i^2), \text{ for } w = 1, \ldots, 5.$$

- r_i: input data points, is the i-th observed ratio of the wealth quintile-specific U5MR to the national-level U5MR;

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Relation between R_w and S_w

$$Q_w \xleftarrow[w=1,\ldots,5]{Q_w/Q_{total}} R_w \xrightarrow[\boldsymbol{w=1,2,4,5}]{\boldsymbol{Q_w/Q_3}} S_w \xrightarrow[w=1,2,4,5]{U_w \cdot P_w} \begin{cases} U_w & \text{splines function} \\ P_w & \text{time series} \end{cases}$$

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To incorporate above constraint, and given that we define $R_w = Q_w/Q_{total}$ and $S_w = Q_w/Q_3$, we have:

$$R_w = f_w(S_1, S_2, S_4, S_5).$$

Model for S_w

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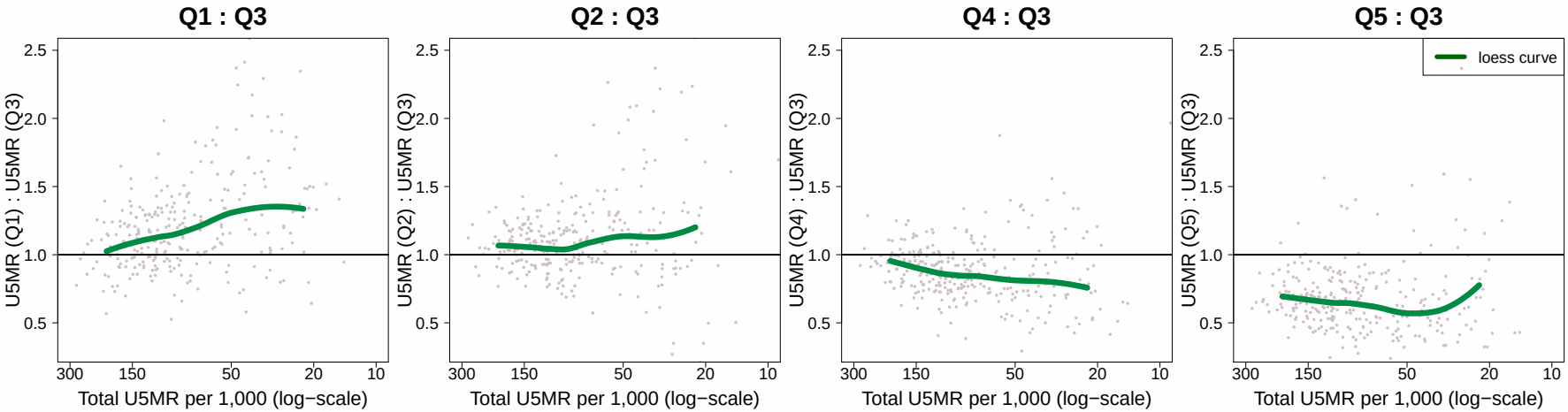

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  - Q_{total}: the UNICEF estimates of national U5MR
- P_w: multiplier to capture the deviations of ratio S_w from the expected ratio U_w, modeled by a time series model.

Compute Q_w

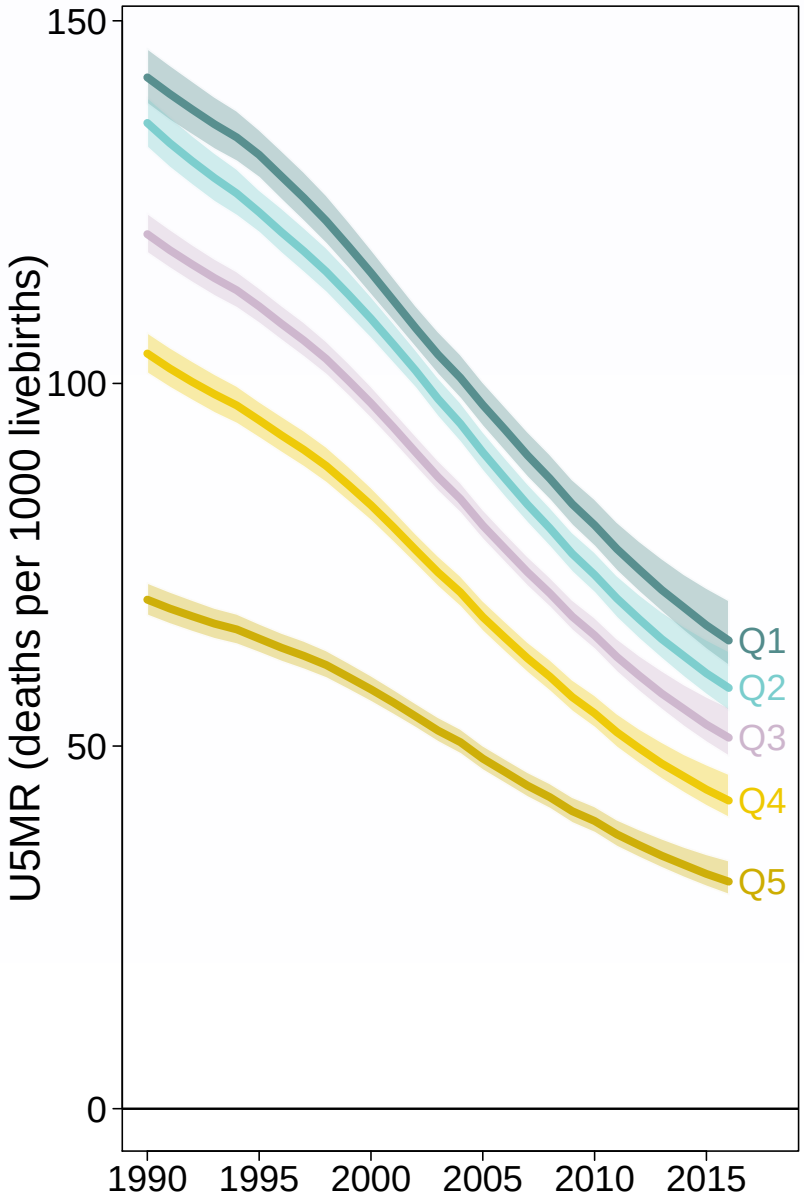
$$Q_w \xleftarrow[w=1,\ldots,5]{Q_w/Q_{total}} R_w \xrightarrow[w=1,2,4,5]{Q_w/Q_3} S_w \xrightarrow[w=1,2,4,5]{U_w \cdot P_w} \begin{cases} U_w & \text{splines function} \\ P_w & \text{time series} \end{cases}$$

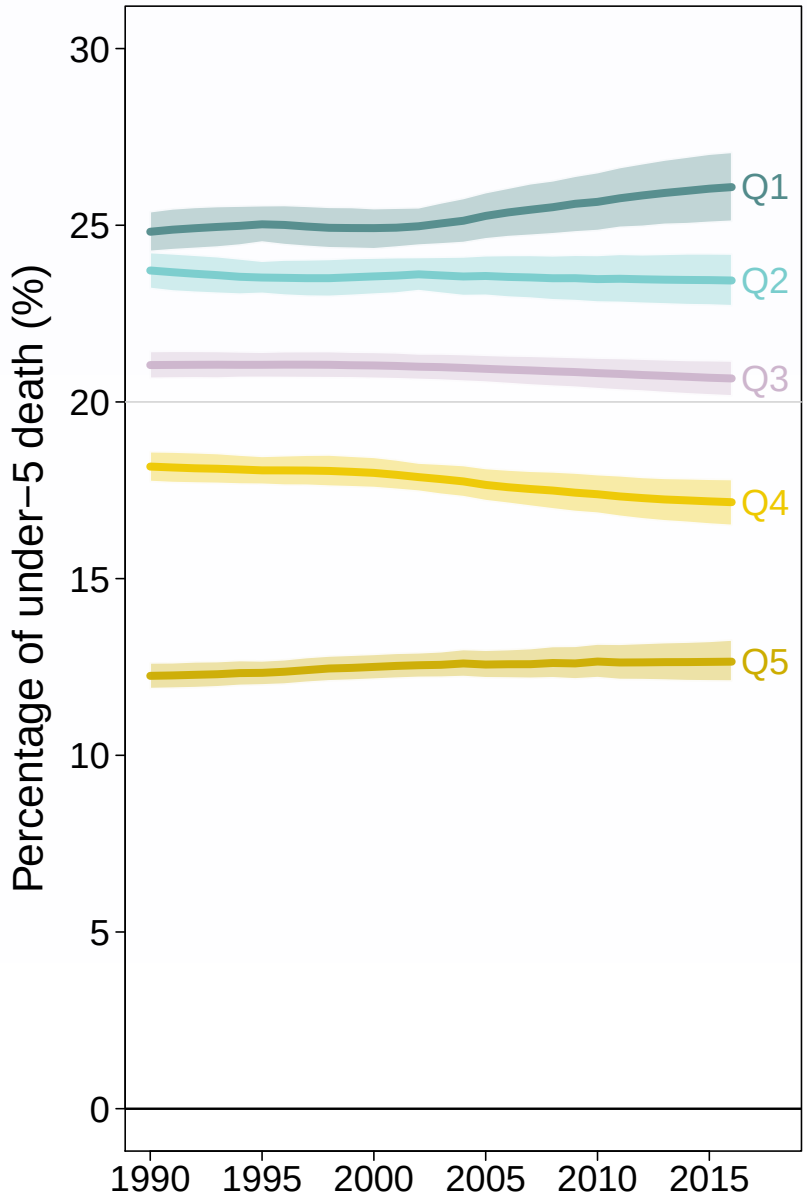
With the modeled R_w, the quintile-specific U5MR Q_w is computed as:

$$Q_w = R_w \cdot Q_{total}, \text{ for } w = 1, \ldots, 5.$$

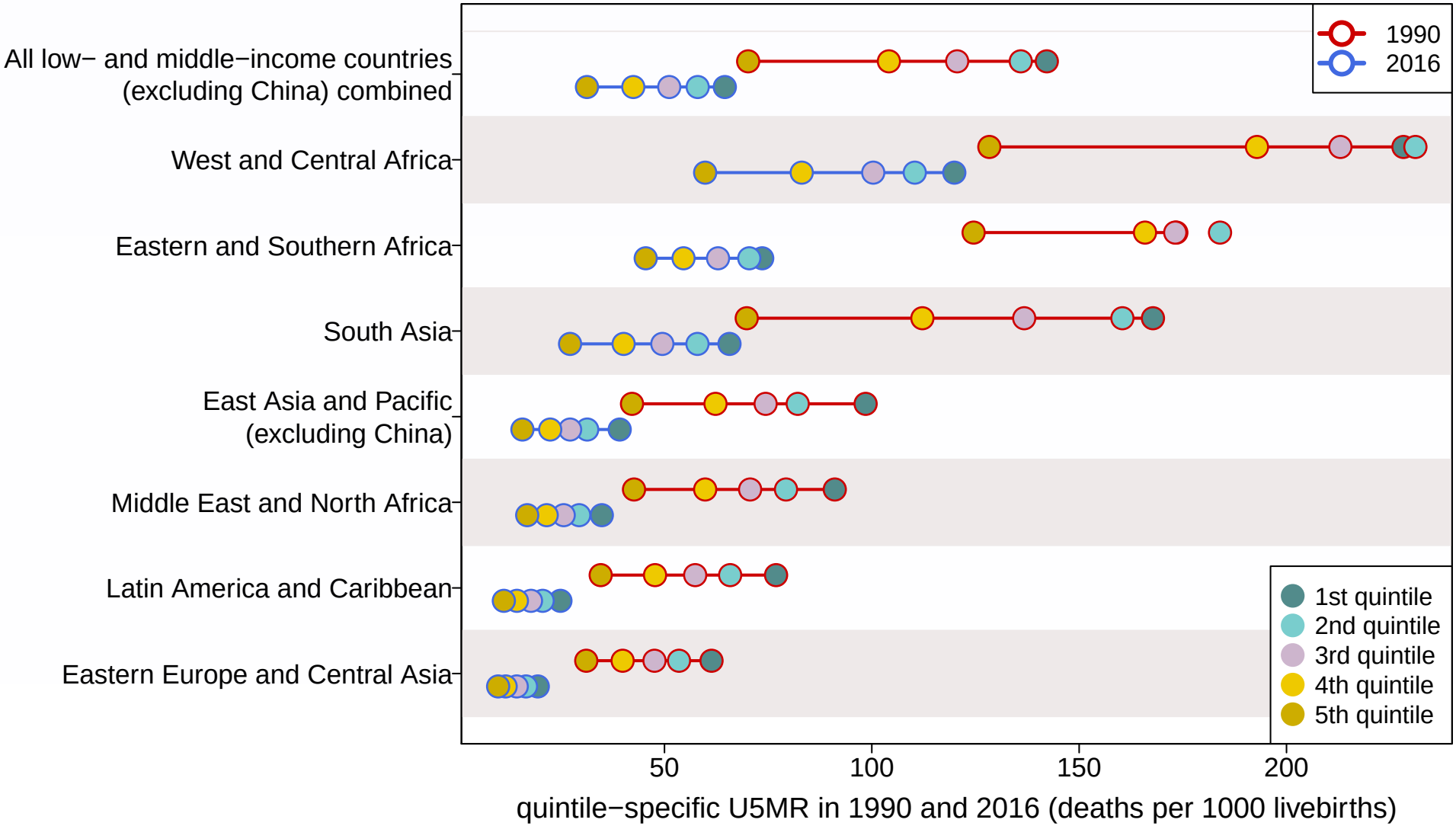
- Q_{total}: given values; the UNICEF estimates of national U5MR.

Aggregated results for all LMICs (excluding China)





Regional results: absolute disparity



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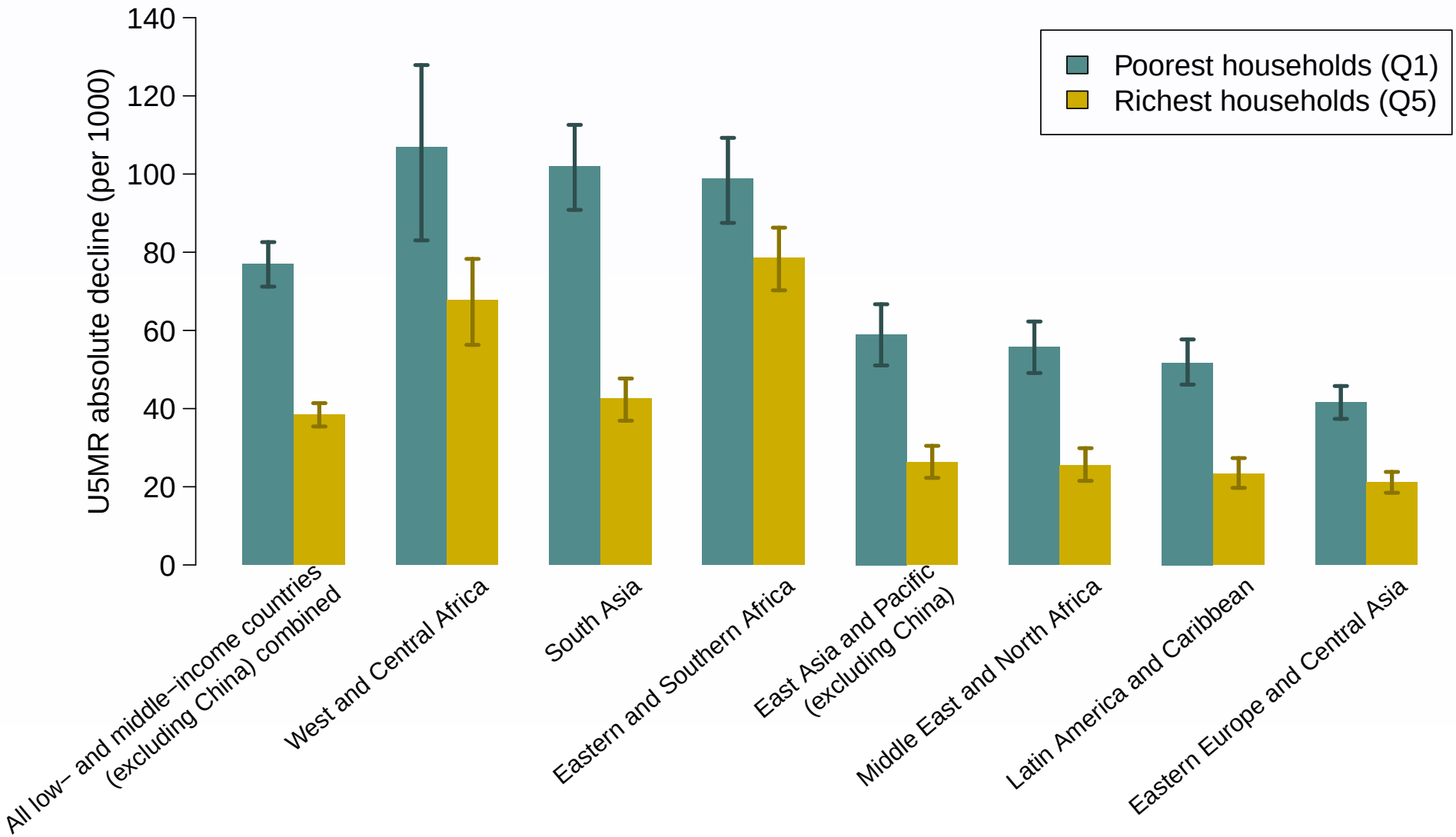
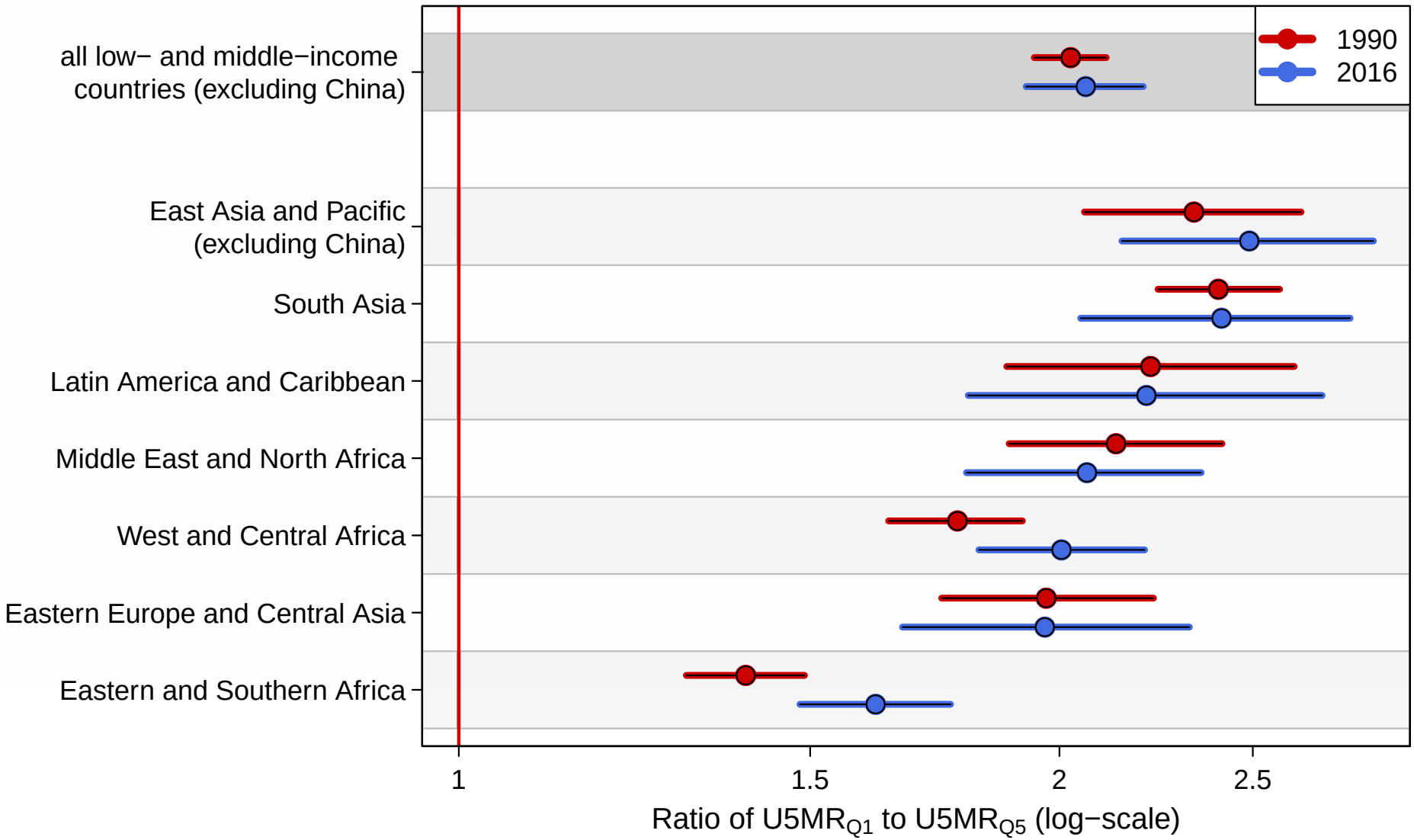


Regional results: relative disparity



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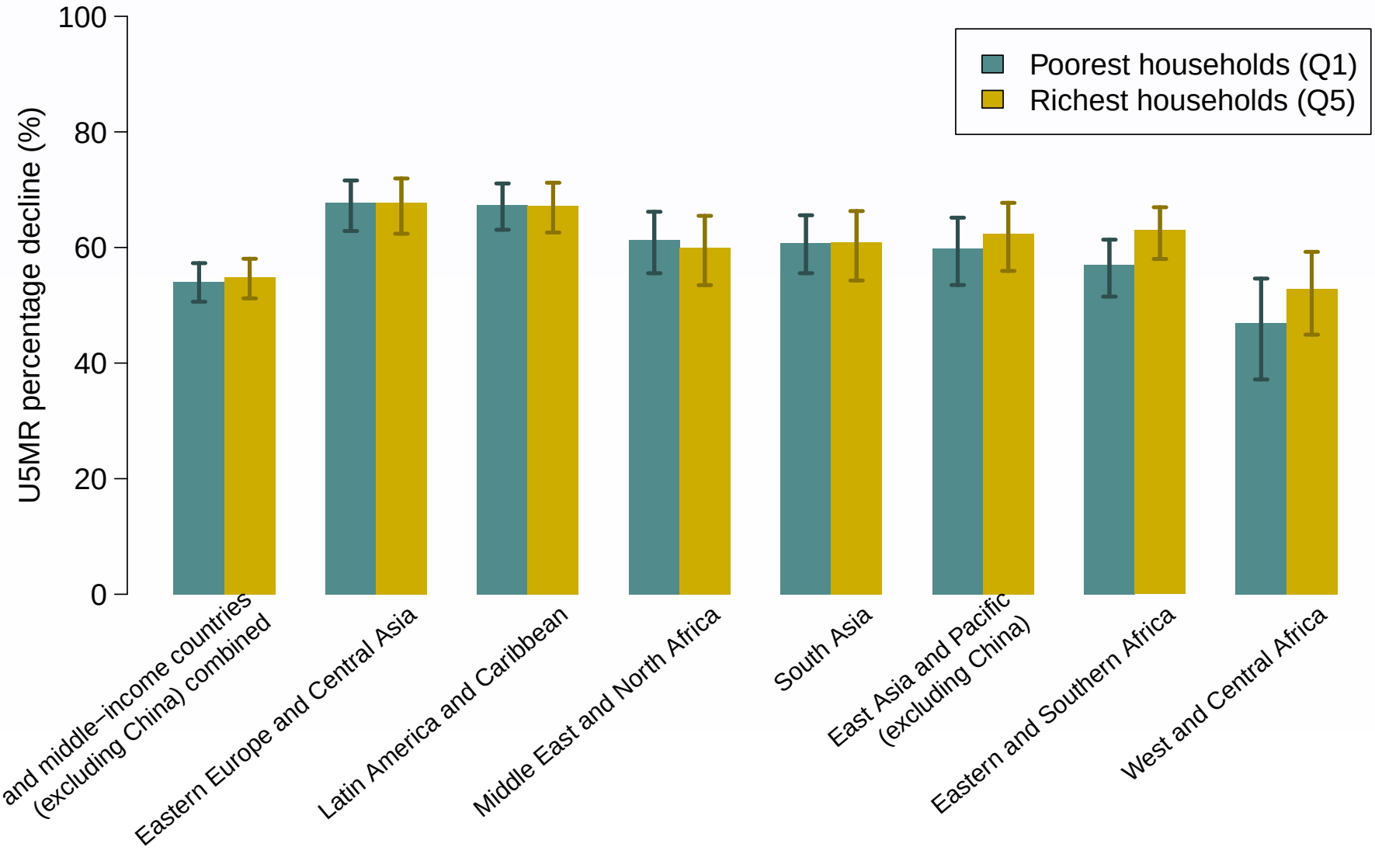
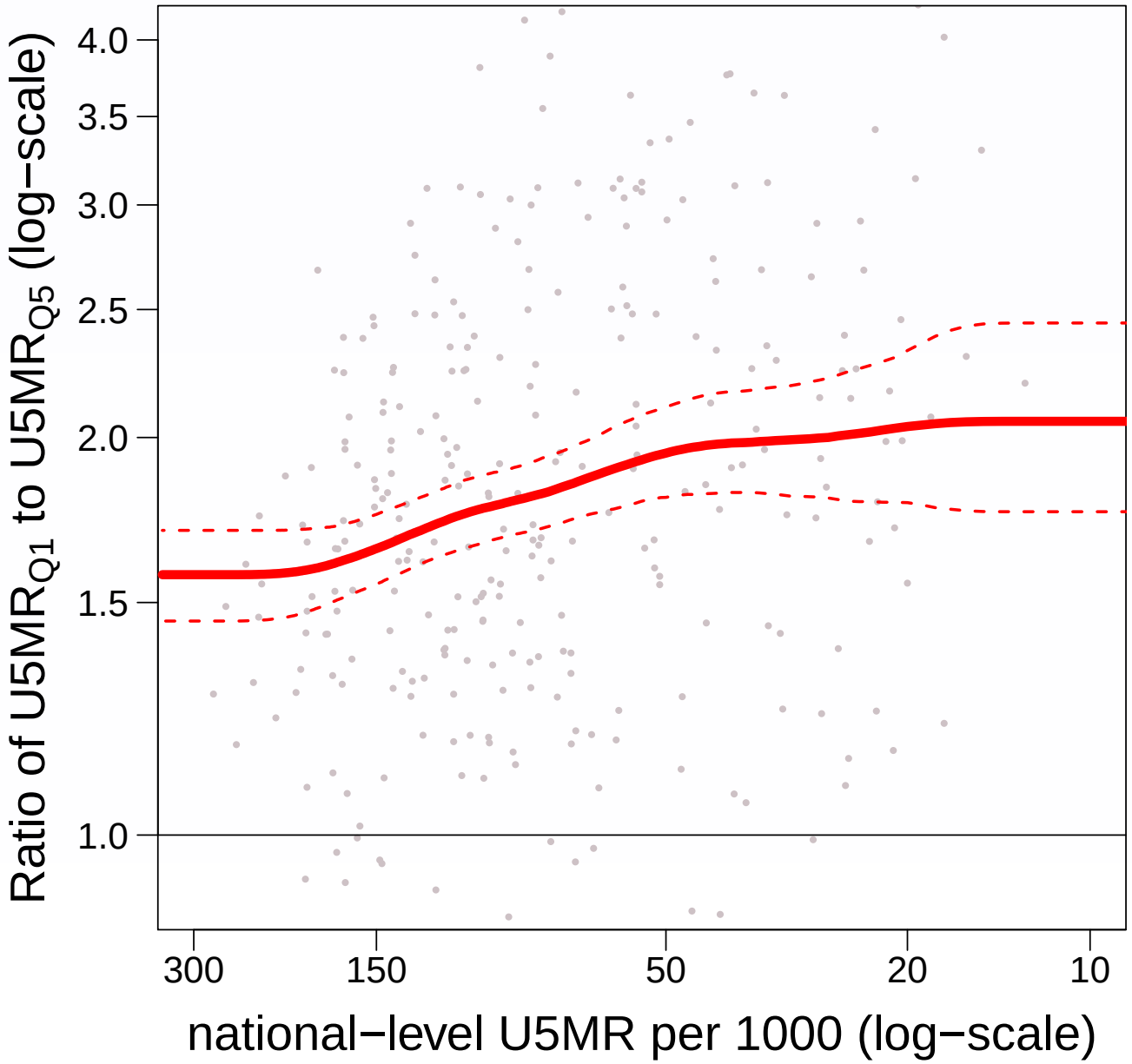
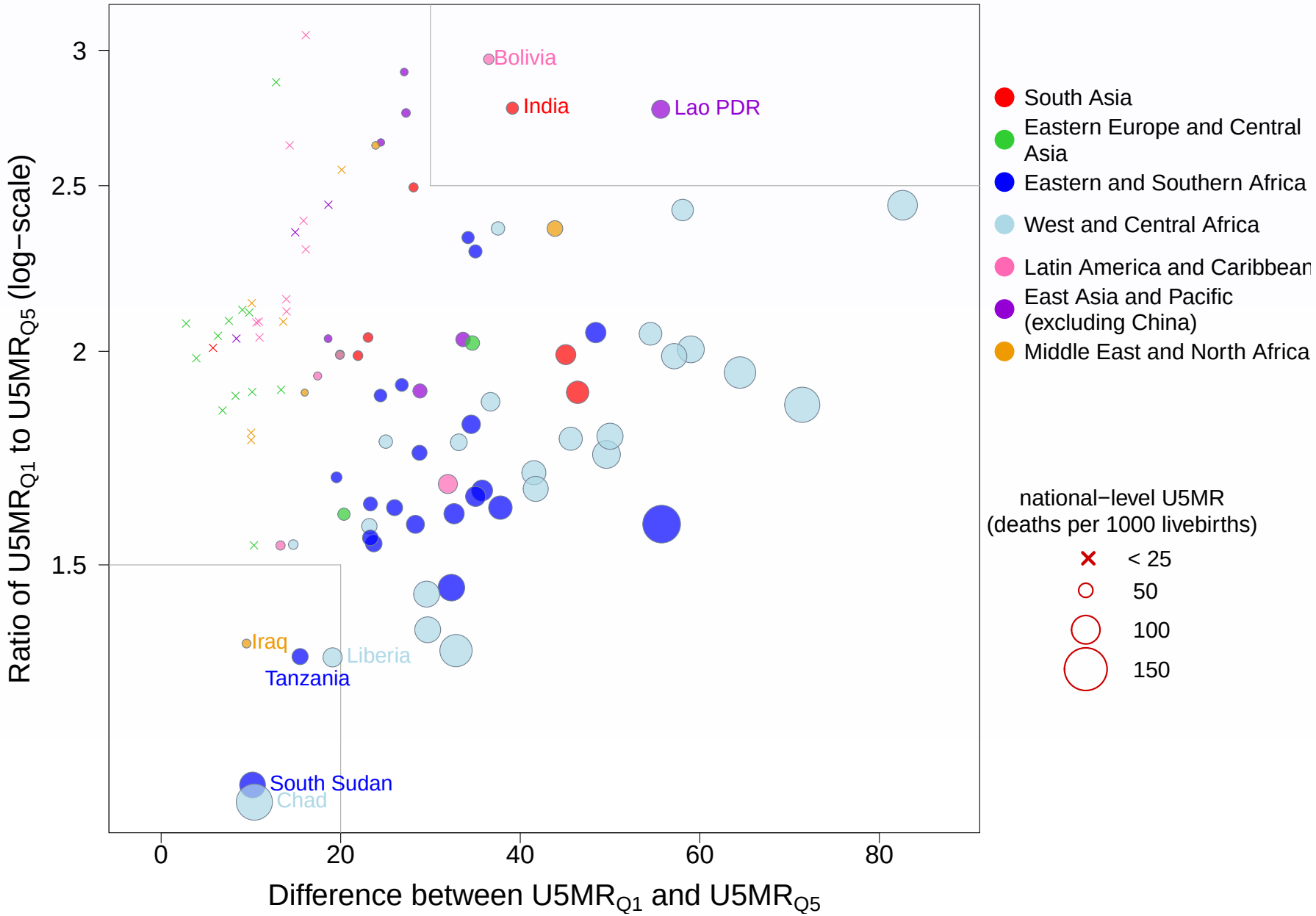


Relative disparity vs national U5MR



Country disparity in 2016



Summary

- We assessed the absolute and relative disparities of U5MR between the poorest and the richest quintiles;
- The poorest households in LMICs (excluding China) have greater reduction in U5MR than their richest counterparts;
- On relative scale, the poorest subpopulations remain at a disadvantage in most LMICs.
- This work is recently published:

Chao F, You D, Pedersen J, Hug L, Alkema L. National and regional under-5 mortality rate by economic status for low-income and middle-income countries: a systematic assessment. *The Lancet Global Health*. 2018 May 31;6(5):e535-47.

Thank you!

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