Comparing latent inequality with ordinal health data

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Motivation

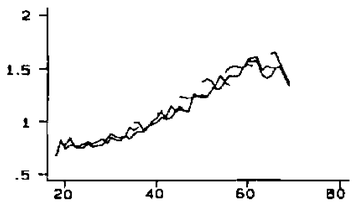
Deaton and Paxson (1998a)

Empirical questions
1. Health better? (inequality "across socioeconomic groups")
2. Health more dispersed? ("whether inequality in health ↑ with age")

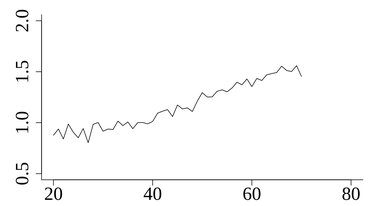
- Ordinal SRHS (self-reported health status): "excellent," "good," etc.
- SRHS benefits: 1) "useful over the complete adult life cycle," 2) strongly correlated with objective measures, 3) widely available (PSID, NHIS, etc.), 4) synthesizes all health dimensions.

Deaton and Paxson (1998a,b): SRHS "variance" ↑ with age.
But: same pattern in simulation of pure location shift of latent health.

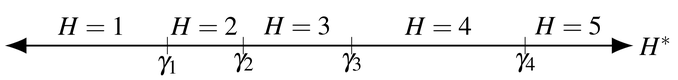
Var(SRHS) in Figure 10.4 (1998b)



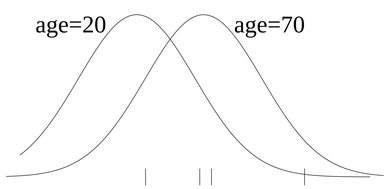
Var(SRHS) in Simulation



Latent health H^*, ordinal H, thresholds γ_j:



Simulation DGP: for ages $a = 20, \ldots, 70$, sample 1000 iid $\mathrm{N}(\mu_a, 1)$ each for increasing μ_a, convert to ordinal using fixed thresholds.



Problems with current methods in literature
1. "Cardinal sin" (treating excellent=1, ..., poor=5).
2. Treating H^* as discrete.
3. Unrealistic parametric models. (See also Bond and Lang, 2018)

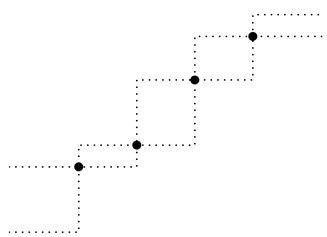
- SRHS inequality: mostly Problem 2, including Allison and Foster (2004) "median-preserving spread." Inequality indexes further rely on choice of weights, mostly ignore inference.
- Partial identification: Stoye (2010) bounds spread parameters given CDF bounds.

Identification

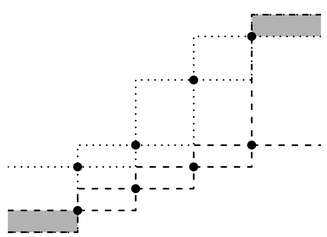
- "Restricted SD1": Atkinson (1987).
- Location–scale model $\implies$ single (or no) CDF crossing.
- Thresholds shift by: zero? constant? idiosyncratic? (Lindeboom and van Doorslaer, 2004; Hernández-Quevedo, Jones, and Rice, 2005).

Proposition 2 [SD1]: assuming same thresholds,
(i) Latent SD1 $\implies$ ordinal SD1 (testable implication).
(ii) Location–scale + ordinal SD1 $\implies$ latent "restricted SD1."
(iii) Ordinal "super-SD1" $\implies$ latent restricted SD1.

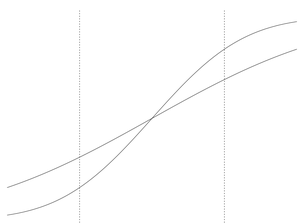
CDF bounds



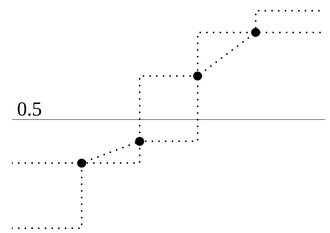
Proposition 2(iii)



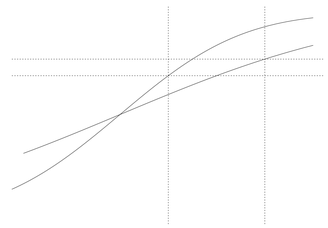
Proposition 3(i) [IQR↑]; γ_j may shift by constant



CDF bounds if unimodal/symmetric



Proposition 4(i,ii) [IQR↑]



Location–scale $\implies$ extrapolate single IQR to overall "scale."

Inference

- Statistical inference on ordinal relationships in Propositions 2–4.
- Ordinal H_2 SD_1 H_1 $\iff$ $\mathbb{E}[\mathbb{1}\{H_2 \leq j\} - \mathbb{1}\{H_1 \leq j\}] \leq 0$, $j = 1,2,3,4$. Can use moment inequality tests (Andrews and Soares, 2010, etc.)
- Other relationships: more complicated (unions of intersections of...).
- Bayesian: Dirichlet–multinomial model. Posteriors for all relationships computed easily, simultaneously, and coherently (e.g., probabilities of SD1 and non-SD1 sum to 1).

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