Measuring Poverty Over Time –
Accounting for the intertemporal distribution of poverty

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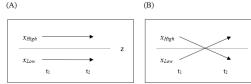
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Does the intertemporal distribution of poverty matter?

A thought experiment: Are these 2 societies equally poor?
1. Society A has no income mobility. Half its population is in chronic poverty and the other half is never poor.
2. Society B has the same amount of aggregate income over time, but has no chronic poverty, but lots of zero-sum mobility so that everyone spends some time in poverty

Figure 1 Two stylized intertemporal income distributions

(A)

x_{High} ⟶
x_{Low} ⟶
t_1 t_2 z

(B)

x_{High}
x_{Low}
t_1 t_2 z

If we believe that any of these fluctuations in income and poverty status affect welfare then our aggregate poverty measures should reflect this.

How does this relate to commonly used poverty measures?

- Standard poverty measures (e.g. the Foster-Greer-Thorbecke) are static 'snapshots' of poverty for one point in time.
- Poverty assessments over time typically use the same approach and identify poverty changes by comparing snapshot poverty measures across time.
- Traditional static poverty measures implicitly assume that the distribution of poverty across households over time does not matter
- These snapshot poverty measures are analytically simple but do not fully characterize poverty over time at the level of the individual household and at the aggregate level of society as they cannot capture effects of fluctuations in incomes within and between households.

What is new in this paper?

- **Two new classes of poverty measures** to adjust poverty indices to take account of the intertemporal distribution of poverty across households
1. **discounting household incomes**.

$$\underline{y} + \delta M_A \underline{y} = \underline{y}(I + \delta M_A) = \begin{bmatrix} (1+\delta)y_1 \\ (1+\delta)y_2 \end{bmatrix}, \text{where } \underline{y} = \begin{pmatrix} y_1 \\ y_2 \end{pmatrix} \text{ and } M_A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \text{ for (A)}$$

$$\underline{y} + \delta M_B \underline{y} = \underline{y}(I + \delta M_B) = \begin{bmatrix} y_1 + \delta y_2 \\ y_2 + \delta y_1 \end{bmatrix}, \text{where } \underline{y} = \begin{pmatrix} y_1 \\ y_2 \end{pmatrix} \text{ and } M_B = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \text{ for (B)}$$

- As δ increases, the difference in lifetime inequality of poverty between (A) and (B) gets larger.
- (A) has a more unequal intertemporal distribution of poverty than (B) since transition matrix M_B is more equal than M_A. (→ proof in paper)

2. the '***poverty inequality aversion method***'- including inequality directly into the poverty measure

$$P(\rho) = \begin{cases} \left[\frac{1}{N} \sum_{i=1}^{N} LP_i(\alpha)^{1-\rho} \right]^{\frac{1}{1-\rho}} & \text{if } \rho \neq 1 \\ \sqrt[N]{\prod_{i=1}^{N} LP_i(\alpha)} & \text{if } \rho = 1 \end{cases}$$

- ρ for inequality of lifetime poverties *across* households
- α for inequality of poverty over time *within* a household
- Can switch exponents → a concave aggregation function 'rewards' inequality of poverty across households (e.g., when concerned about irreversibilities
3. **A third new class of measures** based on Borroah's (2002) intertemporal unemployment measure.

$$A_\varepsilon = (d^*/\bar{d}) - 1 = \left[\sum N^{-1} \left(\frac{d_i}{d} \right)^{1+\varepsilon} \right]^{\frac{1}{1-(1+\varepsilon)}} - 1$$

- d is average duration of poverty
- d* is equally distributed equivalent poverty duration
- Then the duration adjusted poverty Headcount index is

$$\overline{H_0}(1 + A_\varepsilon) = H_0^*$$

4. **Adapting the Basu and Nolen (2008) measure** for poverty measurement

$$P^\beta(p_1, p_2 ..., p_n) \equiv \frac{1}{\beta} - \prod_{i=1}^{n} \left(\frac{1}{\beta} - p_i \right)^{\frac{1}{n}}$$

- p_i is household i's intertemporal poverty measure
- β is a poverty aversion parameter
- This measure rewards zero-sum symmetric income mobility

How does it make a difference? An illustration for rural Pakistan

The data - Pakistan Rural Household Survey (by IFPRI)
- 14 rounds between July 1986 and October 1991
- 667 rural households in 46 villages located in four districts in three provinces

Findings
1. Poverty rates increase in all cases (between 8 and 20%).
2. Poverty rankings change across districts.

Table 1 *Poverty Rates adjusted for the intertemporal distribution of poverty across households*

	All Districts			Faisalabad			Attock			Badin			Dir		
	α=0	α=1	α=2	α=0	α=1	α=2	α=0	α=1	α=2	α=0	α=1	α=2	α=0	α=1	α=2
Discounting Method															
δ=1	0.214	0.044	0.014	0.150	0.020	0.004	0.361	0.097	0.038	0.221	0.049	0.017	0.167	0.027	0.006
δ=0.9	0.226	0.047	0.015	0.150	0.021	0.004	0.346	0.097	0.038	0.239	0.053	0.018	0.198	0.032	0.008
δ=0.5	0.293	0.074	0.027	0.165	0.028	0.006	0.342	0.102	0.046	0.332	0.090	0.034	0.313	0.073	0.024
δ=0.1	0.360	0.124	0.058	0.211	0.050	0.017	0.365	0.115	0.061	0.440	0.157	0.075	0.378	0.145	0.069
Basu & Nolen Method															
β=0	0.296	0.096	0.046	0.234	0.061	0.025	0.413	0.151	0.081	0.305	0.091	0.041	0.264	0.086	0.040
β=0.5	0.320	0.097	0.046	0.245	0.061	0.025	0.435	0.153	0.082	0.311	0.095	0.042	0.293	0.089	0.041
β=8/9	0.373	0.101	0.047	0.275	0.063	0.025	0.511	0.161	0.085	0.364	0.096	0.044	0.334	0.092	0.041
Borooah-based Method															
ε=0	0.296	0.096	0.046	0.234	0.061	0.025	0.413	0.151	0.081	0.305	0.096	0.044	0.264	0.086	0.040
ε=0.5	0.362	0.127	0.067	0.291	0.084	0.039	0.467	0.288	0.190	0.355	0.120	0.057	0.336	0.102	0.049
ε=2	0.497	0.200	0.121	0.414	0.137	0.071	0.599	0.415	0.305	0.491	0.190	0.101	0.462	0.152	0.082
Poverty Inequality Aversion															
ρ=0	0.296	0.096	0.046	0.234	0.061	0.025	0.413	0.151	0.081	0.305	0.096	0.044	0.264	0.086	0.040
ρ=0.25	0.347	0.118	0.060	0.281	0.079	0.035	0.461	0.178	0.100	0.357	0.120	0.059	0.309	0.104	0.051
ρ=0.5	0.421	0.156	0.086	0.350	0.107	0.051	0.535	0.221	0.135	0.433	0.159	0.084	0.376	0.134	0.070
Memorandum:															
Gini Coefficient of Lifetime Poverties	0.55	0.65	0.72	0.59	0.71	0.78	0.47	0.56	0.64	0.56	0.66	0.74	0.56	0.63	0.69

3. the 'poverty distribution corrected' headcount increases by 22-68% compared to standard poverty measures

Table 2 Intertemporal Poverty Premium (*An Atkinson-type measure*)

	All Districts		
	α=0	α=1	α=2
ε=0.5	22%	32%	46%
ε=2	68%	108%	164%

CONCLUSIONS

- Accounting for the intertemporal distribution of poverty across households matters.
- The *standard practice* of using cross-sectional poverty measures at different points in time to analyze levels and changes in poverty *underestimates* the true intertemporal level of aggregate poverty in a society.
- *Poverty estimates* for rural Pakistan *are higher* for all four intertemporal poverty measures.
- Each method requires choosing a parameter representing society's preferences towards the intertemporal distribution of poverty.
- Choosing methods and parameters is not simple.
- But it's conceptually superior than ignoring the distribution of poverty across households over time!

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