A Class of Chronic Poverty Measures

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Hypothetical Challenge

- The government would like to create an official chronic poverty indicator
- Desiderata
  - It must understandable and easy to describe
  - It must conform to “common sense” notions of poverty
  - It must fit the purpose for which it is being developed
  - It must be technically solid
  - It must be operationally viable
  - It must be easily replicable
- What would you advise?

Not Exactly Hypothetical

- Mexico
- August 2002
  - Committee with Bob Michael, John Iceland
  - Precise desired attributes
- June 2003
  - Estimates for 2000, 2002 released by government
  - Public discourse on measurement
  - Later, on public action to combat poverty
- Reference
  - “Números que Mueven al Mundo: La Medición de la Pobreza en México,” Miguel Szekely, Coordinador (2006)

My Aim

- Specific Task
  - "Explore whether 'duration' can be incorporated into the FGT measure"
- Short Answer
  - Yes
- Demystify

Outline

- Review of Static Framework
- Presentation of Family of Measures
- Empirical Example
- Reflection

Review: Static Poverty Measurement

Caveat: Single variable, e.g., consumption, income

Sen (1976) two steps

Identification step "who is poor?"

- Typically use poverty line
  - Absolute, meaning unchanging over time
  - Cutoff is always somewhat arbitrary

Aggregation step "which overall indicator?"

- Headcount ratio P_0 = percentage poor
  - Example: Incomes = (7,3,4,8) poverty line z = 5
  - Who's poor? $g^0 = (0,1,1,0)$
  - Headcount $P_0 = \mu(g_0) = 2/4$
  - Example: (7,3,3,8) No change!

Review: Static Poverty Measurement

Per capita poverty gap P_1

Example: incomes = (7,3,4,8) poverty line z = 5

Normalized gaps = g^1 = (0, 2/5, 1/5, 0)

Poverty gap = $P_1 = \mu(g^1) = 3/20$

Example: (7,3,3,8) P_1 = 4/20 (sensitive to decrements)

However: (7,2,4,8) P_1 = 4/20 (insensitive to inequality)

FGT P_2

Example: incomes = (7,3,3,8) poverty line z = 5

Squared Normalized gaps = g^2 = (0, 4/25, 4/25, 0)

FGT = $P_2 = \mu(g^2) = 8/100$

Example: (7,2,4,8)

Squared Normalized gaps = g^2 = (0, 9/25, 1/25, 0)

P_1 = 10/100 (sensitive to inequality)

Chronic Poverty Strategy

Twin cutoffs

- poverty line
- duration line

Based on P_α family

Note:

- No transfers across periods
- No discounting; ignore direction of time and “bunching”
- Crude 0-1 approach to observations over time
  - Alternative: see Foster and Santos (2006), Calvo and Dercan (2006)
- Caveat: Single dimensional, cardinal variable

Chronic Poverty: Data

Matrix of incomes

Persons

$$y = \begin{bmatrix} \mathbf{3} & \mathbf{9} & \mathbf{7} & \mathbf{10} \\ \mathbf{7} & \mathbf{3} & \mathbf{4} & \mathbf{8} \\ \mathbf{9} & \mathbf{4} & \mathbf{2} & \mathbf{12} \\ \mathbf{8} & \mathbf{3} & \mathbf{2} & \mathbf{9} \end{bmatrix}$$

Dates

Chronic Poverty: Normalized Gaps

Persons

$$g^1 = \begin{bmatrix} \mathbf{0.4} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.2} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.2} & \mathbf{0.6} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.6} & \mathbf{0} \end{bmatrix}$$ Dates

Matrix of normalized gaps = (z - income)/z if income below z

= 0 if equal or above

Chronic Poverty: Poverty Spells

Persons

$$g^0 = \begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

Matrix of poverty spells = 1 if income is below z

= 0 if equal or above

Chronic Poverty: Duration

Persons

$$g^0 = \begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

d = (0.25, 0.75, 0.75, 0)

= percent of time in poverty

Chronic Poverty: Duration Line

Persons

$$g^0 = \begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

d = (0.25, **0.75**, **0.75**, 0)

= percent of time in poverty

Duration line $\tau = .70$ Identify chronically poor

Chronic Poverty: Duration Line

Persons

$$g^0 = \begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

d = (0.25, **0.75**, **0.75**, 0)

= percent of time in poverty

Duration line $\tau = .70$ Identify chronically poor

Now turn to Aggregation question.

Headcount Ratio

Persons

$$g^0 = \begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

d = (0.25, **0.75**, **0.75**, 0)

= percent of time in poverty

Duration line $\tau = .70$

Headcount ratio **H =1/2**

Problem

Suppose time in poverty increases for person 3

Persons

$$g^0 = \begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

d = (0.25, **0.75**, **0.75**, 0)

= percent of time in poverty

Duration line $\tau = .70$

Headcount ratio $H = 1/2$

Problem

Suppose time in poverty increases for person 3

Persons

$$g^0 = \begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

d = (0.25, **0.75**, **1**, 0)

= percent of time in poverty

Duration line $\tau = .70$

Headcount ratio $H = 1/2$

Time Monotonicity

Suppose time in poverty increases for person 3

Persons

$$g^0 = \begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

d = (0.25, **0.75**, **1**, 0)

= percent of time in poverty

Duration line $\tau = .70$

Headcount ratio **H =1/2** No change! Violates Time Mon

Fixing the Problem

Return to original data

Persons

$$g^{0} = \begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

d = (0.25, **0.75**, **0.75**, 0)

= percent of time in poverty

Fixing the Problem

Now remove all poverty spells of persons not chronically poor

Persons

$$g^0 = \begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

d = (0.25, **0.75**, **0.75**, 0)

= percent of time in poverty

Focus on Chronically Poor

Now remove all poverty spells of persons not chronically poor

Persons

$$g^{0}(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

d(τ) = (0, **0.75**, **0.75**, 0)

= percent of time in poverty **for chronically poor**

Duration Adjusted Headcount Ratio

Need to augment the information of H

Persons

$$g^0(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

d(τ) = (0, **0.75**, **0.75**, 0)

= percent of time in poverty **for chronically poor**

Duration Adjusted Headcount Ratio

Persons

$$g^0(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

d(τ) = (0, **0.75**, **0.75**, 0)

= percent of time in poverty **for chronically poor**

D = average duration among chronically poor = 0.75

Duration Adjusted Headcount Ratio

Duration adjustment headcount = P_0 = HD

Persons

$$g^0(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

d(τ) = (0, **0.75**, **0.75**, 0)

= percent of time in poverty **for chronically poor**

D = average duration among chronically poor = 0.75

Duration Adjusted Headcount Ratio

Duration adjustment headcount = P_0 = HD = $\mu(g^0(\tau))$

Persons

$$g^0(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

d(τ) = (0, **0.75**, **0.75**, 0)

= percent of time in poverty **for chronically poor**

D = average duration among chronically poor = 0.75

Duration Adjusted Headcount Ratio

Duration adjustment headcount = P_0 = HD = $\mu(g^0(\tau))$

= 6/16 = 0.375

Persons

$$g^0(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

d(τ) = (0, **0.75**, **0.75**, 0)

= percent of time in poverty **for chronically poor**

D = average duration among chronically poor = 0.75

Time Monotonicity

Duration adjustment headcount = P_0 = HD = $\mu(g^0(\tau))$
= 6/16 = 0.375

Persons

$$g^0(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

d(τ) = (0, **0.75**, **0.75**, 0)
= percent of time in poverty **for chronically poor**

Obviously if person 3 is in poverty longer, P_0 will rise

Time Monotonicity

Duration adjustment headcount = P_0 = HD = $\mu(g^0(\tau))$
= 6/16 = 0.375

Persons

$$g^0(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

d(τ) = (0, **0.75**, **0.75**, 0)
= percent of time in poverty **for chronically poor**

Obviously if person 3 is in poverty longer, P_0 will rise

Satisfies time monotonicity

Problem

Duration adjustment headcount = P_0 = HD = $\mu(g^0(\tau))$
= 6/16 = 0.375

Persons

$$g^0(\tau) = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 \end{bmatrix}$$

Dates

Q/ However, what happens when an income below z falls even further (for a chronically poor person)?

Income Monotonicity

Duration adjustment headcount = P_0 = HD = $\mu(g^0(\tau))$
= 6/16 = 0.375

Persons

$$g^0(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

Q/ However, what happens when an income below z falls even further (for a chronically poor person)?

A/ **P_0 is unchanged! Violates income monotonicity.**

Duration Adjusted Poverty Gap

Need to augment the information of P_0

Persons

$$g^0(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & \mathbf{0} \end{bmatrix}$$

Dates

Duration Adjusted Poverty Gap

Return to normalized gaps

Persons

$$g^{1}(\tau)=\begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.2} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.2} & \mathbf{0.6} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.6} & \mathbf{0} \end{bmatrix}$$

Dates

Duration Adjusted Poverty Gap

Persons

$$g^1(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.2} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.2} & \mathbf{0.6} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.6} & \mathbf{0} \end{bmatrix}$$

Dates

Average gap across all poverty spells of the chronically poor: $G(\tau) = 2.4/6 = 0.4$

Duration Adjusted Poverty Gap

Duration Adjusted Poverty Gap = P_1 = **P_0G = HDG**

Persons

$$g^1(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.2} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.2} & \mathbf{0.6} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.6} & \mathbf{0} \end{bmatrix}$$

Dates

Average gap across all poverty spells of the chronically poor: $G(\tau) = 2.4/6 = 0.4$

Duration Adjusted Poverty Gap

Duration Adjusted Poverty Gap = $P_1 = P_0G = HDG = \mu(g^1(\tau))$

Persons

$$g^1(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.2} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.2} & \mathbf{0.6} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.6} & \mathbf{0} \end{bmatrix}$$

Dates

Average gap across all poverty spells of the chronically poor: $G(\tau) = 2.4/6 = 0.4$

Duration Adjusted Poverty Gap

Duration Adjusted Poverty Gap = $P_1 = P_0G = HDG = \mu(g^1(\tau))$

= 0.15

Persons

$$g^1(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.2} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.2} & \mathbf{0.6} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.6} & \mathbf{0} \end{bmatrix}$$

Dates

Average gap across all poverty spells of the chronically poor: $G(\tau) = 2.4/6 = 0.4$

Duration Adjusted Poverty Gap

Duration Adjusted Poverty Gap = $P_1 = P_0G = HDG = \mu(g^1(\tau))$

= 0.15

Persons

$$g^1(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.2} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.2} & \mathbf{0.6} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.6} & \mathbf{0} \end{bmatrix}$$

Dates

Obviously, if an income under z falls even further (for a chronically poor person), then P_1 will rise.

Duration Adjusted Poverty Gap

Duration Adjusted Poverty Gap = $P_1 = P_0G = HDG = \mu(g^1(\tau))$

= 0.15

Persons

$$g^1(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.2} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.2} & \mathbf{0.6} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.6} & \mathbf{0} \end{bmatrix}$$

Dates

Obviously, if an income under z falls even further (for a chronically poor person), then P_1 will rise.

Satisfies income monotonicity

Problem

Duration Adjusted Poverty Gap = $P_1 = P_0G = HDG = \mu(g^1(\tau))$

= 0.15

Persons

$$g^1(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.2} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.2} & \mathbf{0.6} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.6} & \mathbf{0} \end{bmatrix}$$

Dates

Problem: A decrement in income in poorest spell has same impact as a decrement in income in least poor spell.

Problem

Duration Adjusted Poverty Gap = $P_1 = P_0G = HDG = \mu(g^1(\tau))$

= 0.15

Persons

$$g^1(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.2} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.2} & \mathbf{0.6} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.4} & \mathbf{0.6} & \mathbf{0} \end{bmatrix}$$

Dates

Problem: A decrement in income in poorest spell has same impact as a decrement in income in least poor spell.

P_1 is not distribution sensitive.

Duration Adjusted FGT

Consider the matrix of squared normalized shortfalls

Persons

$$g^2(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.16} & \mathbf{0.04} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.04} & \mathbf{0.36} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.16} & \mathbf{0.36} & \mathbf{0} \end{bmatrix}$$

Dates

Duration Adjusted FGT

Consider the matrix of squared normalized shortfalls

Persons

$$g^2(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.16} & \mathbf{0.04} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.04} & \mathbf{0.36} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.16} & \mathbf{0.36} & \mathbf{0} \end{bmatrix}$$

Dates

Average squared gap across all poverty spells of the chronically poor: $S(\tau)$

Duration Adjusted FGT

Duration Adjusted FGT = $P_2 = P_0 S = HDS = \mu(g^2(\tau))$

Persons

$$g^2(\tau) = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.16} & \mathbf{0.04} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.04} & \mathbf{0.36} & \mathbf{0} \\ \mathbf{0} & \mathbf{0.16} & \mathbf{0.36} & \mathbf{0} \end{bmatrix}$$

Dates

Average squared gap across all poverty spells of the chronically poor: $S(\tau)$

Emphasizes lowest incomes

Duration Adjusted P_α

Duration Adjusted $P_\alpha = \mu(g^\alpha(\tau))$ for $\alpha \geq 0$

Persons

$$g^\alpha(\tau) = \begin{bmatrix} \mathbf{0}^\alpha & \mathbf{0}^\alpha & \mathbf{0}^\alpha & \mathbf{0}^\alpha \\ \mathbf{0}^\alpha & \mathbf{0.4}^\alpha & \mathbf{0.2}^\alpha & \mathbf{0}^\alpha \\ \mathbf{0}^\alpha & \mathbf{0.2}^\alpha & \mathbf{0.6}^\alpha & \mathbf{0}^\alpha \\ \mathbf{0}^\alpha & \mathbf{0.4}^\alpha & \mathbf{0.6}^\alpha & \mathbf{0}^\alpha \end{bmatrix}$$ Dates

Duration Adjusted P_α

Duration Adjusted $P_\alpha = \mu(g^\alpha(\tau))$ for $\alpha \geq 0$

Persons

$$g^\alpha(\tau) = \begin{bmatrix} \mathbf{0}^\alpha & \mathbf{0}^\alpha & \mathbf{0}^\alpha & \mathbf{0}^\alpha \\ \mathbf{0}^\alpha & \mathbf{0.4}^\alpha & \mathbf{0.2}^\alpha & \mathbf{0}^\alpha \\ \mathbf{0}^\alpha & \mathbf{0.2}^\alpha & \mathbf{0.6}^\alpha & \mathbf{0}^\alpha \\ \mathbf{0}^\alpha & \mathbf{0.4}^\alpha & \mathbf{0.6}^\alpha & \mathbf{0}^\alpha \end{bmatrix}$$ Dates

Satisfies numerous properties including decomposability

Duration Adjusted P_α

Duration Adjusted $P_\alpha = \mu(g^\alpha(\tau))$ for $\alpha \geq 0$

Persons

$$g^\alpha(\tau) = \begin{bmatrix} \mathbf{0}^\alpha & \mathbf{0}^\alpha & \mathbf{0}^\alpha & \mathbf{0}^\alpha \\ \mathbf{0}^\alpha & \mathbf{0.4}^\alpha & \mathbf{0.2}^\alpha & \mathbf{0}^\alpha \\ \mathbf{0}^\alpha & \mathbf{0.2}^\alpha & \mathbf{0.6}^\alpha & \mathbf{0}^\alpha \\ \mathbf{0}^\alpha & \mathbf{0.4}^\alpha & \mathbf{0.6}^\alpha & \mathbf{0}^\alpha \end{bmatrix}$$ Dates

Satisfies numerous properties including decomposability

Note: $\mu(g^\alpha(0))$ is average P_α poverty across dates

Duration Adjusted P_α

Duration Adjusted $P_\alpha = \mu(g^\alpha(\tau))$ for $\alpha \geq 0$

$$g^\alpha(\tau) = \begin{matrix} \text{Persons} \\ \begin{bmatrix} \mathbf{0}^\alpha & \mathbf{0}^\alpha & \mathbf{0}^\alpha & \mathbf{0}^\alpha \\ \mathbf{0}^\alpha & \mathbf{0.4}^\alpha & \mathbf{0.2}^\alpha & \mathbf{0}^\alpha \\ \mathbf{0}^\alpha & \mathbf{0.2}^\alpha & \mathbf{0.6}^\alpha & \mathbf{0}^\alpha \\ \mathbf{0}^\alpha & \mathbf{0.4}^\alpha & \mathbf{0.6}^\alpha & \mathbf{0}^\alpha \end{bmatrix} \end{matrix} \text{Dates}$$

Satisfies numerous properties including decomposability

Note: $\mu(g^\alpha(0))$ is average P_α poverty across dates

Hence $T_\alpha = \mu(g^\alpha(0)) - \mu(g^\alpha(\tau))$ is corresponding index of transient poverty

Example: Argentina

- **Data Source:** Instituto Nacional de Estadísticas y Censos (INDEC), Encuesta Permanente de Hogares (EPH).
- **Period:** Waves of October 2001, May 2002, October 2002 and May 2003. It is a panel of 4 observed periods.
- **Unit of Analysis:** Households.
- **Number of observations:** 2409.
- **Type of income used:** Equivalent Family Income per month

Example: Argentina

- Head Count Ratio

% of households poor in 1 or more periods	% of households poor in 2 or more periods	% of households poor in 3 or more periods	% of households poor in the 4 periods
47%	38%	30%	20%

Example: Argentina

- P_0

Of those who are poor 1 or more periods	Of those who are poor 2 or more periods	Of those who are poor 3 or more periods	Of those who are poor 4 periods
0.34	0.31	0.27	0.20

- P_1

Poverty Gap of…			
Those who are poor one or more periods	Those who are poor two or more periods	Those who are poor three or more periods	Those who are poor four periods
0.15	0.14	0.13	0.10

- P_2

Squared Poverty Gap of…			
Those who are poor one or more periods	Those who are poor two or more periods	Those who are poor three or more periods	Those who are poor four periods
0.085	0.082	0.077	0.064

Example: Argentina

- P_0

Of those who are poor 1 or more periods	Of those who are poor 2 or more periods	Of those who are poor 3 or more periods	Of those who are poor 4 periods
0.34	0.31	0.27	0.20

- P_1

Poverty Gap of…			
Those who are poor one or more periods	Those who are poor two or more periods	Those who are poor three or more periods	Those who are poor four periods
0.15	0.14	0.13	0.10

- P_2

Squared Poverty Gap of…			
Those who are poor one or more periods	Those who are poor two or more periods	Those who are poor three or more periods	Those who are poor four periods
0.085	0.082	0.077	0.064

- Note: As we go from H to P_2 the percent of total poverty that is chronic rises:

  H: 64% P_0: 79% P_1: 87% P_2: 91%

Example: Argentina

- P_0

Of those who are poor 1 or more periods	Of those who are poor 2 or more periods	Of those who are poor 3 or more periods	Of those who are poor 4 periods
0.34	0.31	0.27	0.20

- P_1

Poverty Gap of…			
Those who are poor one or more periods	Those who are poor two or more periods	Those who are poor three or more periods	Those who are poor four periods
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- P_2

Squared Poverty Gap of…			
Those who are poor one or more periods	Those who are poor two or more periods	Those who are poor three or more periods	Those who are poor four periods
0.085	0.082	0.077	0.064

- Note: As we go from H to P_2 the percent of total poverty that is chronic rises:

  H: 64% P_0: 79% P_1: 87% P_2: 91%

Second example in paper utilizing decomposability

Review Challenge

- Desiderata
  - It must understandable and easy to describe
  - It must conform to “common sense” notions of poverty
  - It must fit the purpose for which it is being developed
  - It must be technically solid
  - It must be operationally viable
  - It must be easily replicable

Thanks for your attention