

Development economics

Lecture 6: Measuring poverty, inequality, and discrimination

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Where are we on our path?

► Lectures

1. Introduction
2. Traditional growth models
3. Modern (endogenous) growth models
4. Taking stock on growth models and poverty traps
5. Games in economic development
6. **Measuring poverty and inequality**
7. Group differences and discrimination
8. Culture, institutions, and the role of history
9. Health and nutrition
10. Education
11. The role of foreign aid
12. Credit markets and microcredit
13. Risk and insurance
14. Behavioral development economics

Conceptual issues regarding Inequality measurement

Measuring inequality

History of poverty measurement and poverty lines

Poverty measurement and conceptual issues

Multidimensional poverty

Inequality: conceptual issues

"No society can surely be flourishing and happy, of which by far the greater part of the numbers are poor and miserable." — Adam Smith (1776)

- ▶ Why we should care about inequality?
 - ▶ **Ethical issues:** How to deal with inheritance? Is egalitarianism always preferred?
 - ▶ **Functional issues:** Inefficiency of uneducated workforce. Riots and grievances. Poor sanitary conditions.
- ▶ What is inequality?
 - ▶ Temporary or permanent?
 - ▶ Inequality in income or in opportunities?
- ▶ We'll concentrate on *economic inequality*

Inequality: conceptual issues

- ▶ But even economic inequality two dimensions:
 - ▶ **Vertical inequality:** comparing incomes of individuals at a given time.
 - ▶ We focus on this!
 - ▶ **Horizontal inequality:** income differences for individuals with equal income initially. E.g., before a policy reform, price rise, exogenous shock...
 - ▶ Important to think about distributional effects of policies.
- ▶ Distinguishing between good and bad inequality: empirical (and philosophical) question!
 - ▶ **Good inequality:** reinforces incentives to foster innovation, entrepreneurship
 - ▶ **Bad inequality:** prevents market access, limits capital accumulation (poverty traps), including human capital accumulation

Inequality views in moral philosophy

- ▶ **Philosophy:** Rawls (1971): *Theory of Justice*: Principles:
 1. Every person should have access to the same, most extensive set of liberties compatible with the **same set of rights for all**.
 - ▶ Rights on top of resources (distinguishing from standard economics view of utility)! Highest priority principle!
 2. Social choices should only permit inequality if it was efficient to do so (difference principle).
 - 2.1 Inequalities are to be attached to positions and offices open to all under conditions of fair **equality of opportunity**
 - 2.2 Inequalities are to be to the **greatest benefit of the least advantaged members of society**.

- ▶ In other words: given full set of liberties, policies should always consider those at the bottom of the income distribution. If their state is improved, it does not matter that inequality may increase.
 - ▶ Motivation for consumption floors → Link to poverty lines.

Inequality views in economics

- ▶ **Economics:** Keynes (1936): *The General Theory of Employment, Interest and Money*, ch. 24:
 - ▶ No moral judgements, purely rational: Poor have higher marginal propensity to consume out of income gains relative to the rich (at least in short term)
 - ▶ Redistribution from rich to poor increases aggregate demand → spurs consumption → reduces unemployment and increases growth
 - ▶ Motivation for current day stimulus policies that are often progressive (see, short term!)

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Income distribution in a typical developing country

TABLE 5.1 Typical Size Distribution of Personal Income in a Developing Country by Income Shares—Quintiles and Deciles

Individuals	Personal Income (money units)	Share of Total Income (%)	
		Quintiles	Deciles
1	0.8		
2	1.0		1.8
3	1.4		
4	1.8	5	3.2
5	1.9		
6	2.0		3.9
7	2.4		
8	2.7	9	5.1
9	2.8		
10	3.0		5.8
11	3.4		
12	3.8	13	7.2
13	4.2		
14	4.8		9.0
15	5.9		
16	7.1	22	13.0
17	10.5		
18	12.0		22.5
19	13.5		
20	15.0	51	28.5
Total (national income)	100.0	100	100.0

Source: Todaro and Smith (2012)

Measuring Inequality

- ▶ Many possible ways how to evaluate inequalities. Which is more unequal?
 1. Example 1: (50,50) vs. (10, 90)
 2. Example 2: (25,25,25) vs. (10,10,55)
 3. Example 3: (10,10,55) vs. (5, 20, 50)
 4. Example 4: (5, 20, 50) vs. (200, 32, 50)
- ▶ Q: What counts as income? How to measure it?
- ▶ Let's find some useful criteria for designing a measure of inequality that allow us to do the comparison.

Measuring Inequality: 4 principles

1. **Anonymity principle**

- ▶ It does not matter who earns how much, only the total income distribution matters:

$$y_1 \leq y_2 \leq \dots \leq y_n$$

$$I(y_1^{Bob}, y_2^{Anne}, \dots, y_n^{Cecilia}) = I(y_1^{Anne}, y_2^{Bob}, \dots, y_n^{Cecilia})$$

2. **Population principle**

- ▶ If we have $2n$ instead of n people and the population is just "cloned", this should not affect the measure of inequality

$$I(y_1, y_2, \dots, y_n) = I(y_1, y_2, \dots, y_n, y_1, y_2, \dots, y_n)$$

Measuring Inequality: 4 principles

3. Relative income principle

- ▶ To be able to compare inequality across countries with different levels of wealth, inequality has to be measured in *relative incomes*, rather than in *absolute*.

$$I(y_1, y_2, \dots, y_n) = I(\gamma y_1, \gamma y_2, \dots, \gamma y_n) \quad \forall \gamma > 0$$

- ▶ We can normalise the data to percentiles

4. Dalton-Pigou principle

- ▶ "*If one income distribution can be constructed from another using a series of regressive transfers then the former distribution has to be more unequal.*"

$$I(y_1, y_2, \dots, y_n) < I(y_1 - \delta, y_2 + \delta, \dots, y_n) \quad \forall \delta > 0$$

- ▶ Both *regressive* and *progressive* transfers possible

Measuring Inequality: issues with principles

- ▶ **Anonymity principle possible objections:**
 - ▶ Income distribution A: $(0,10,10,10)$ vs. B: $(10,10,10,0)$ following a redistribution
 - ▶ Inequality the same; but the person who no longer has 10 in B would surely object.

Measuring Inequality: issues with principles

▶ **Relative income principle possible objections:**

- ▶ Income distribution A: (0,10,10,10) vs. B: (0,20,20,20)
 - ▶ But relative income gap much larger, even if inequality the same. Perceptions by individuals matter!

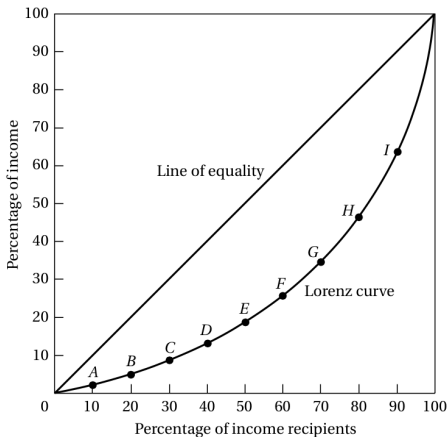
▶ **Dalton-Pigou (Transfer) principle possible objections:**

- ▶ Income distribution: A: (0,10,10,10) → B: (3,7,10,10)
(transfer)
 - ▶ In A, one person relatively deprived; in B, 2 persons relatively deprived
 - ▶ Rich individuals may feel more for the loss of income of "one of their own", rather than appreciate the gain for the poor.

Decomposing inequality

- ▶ Note that income inequality can be decomposed by groups, say: $A(0,10,10,10) \rightarrow A1(0,10)$ and $A2(10,10)$.
 - ▶ A1 has high inequality, A2 none. Weighting can be applied to measure total inequality.
 - ▶ But think of A1 and A2 as specific groups (race, gender,...) \rightarrow group identity matters, not only income within those groups! (lecture on discrimination)

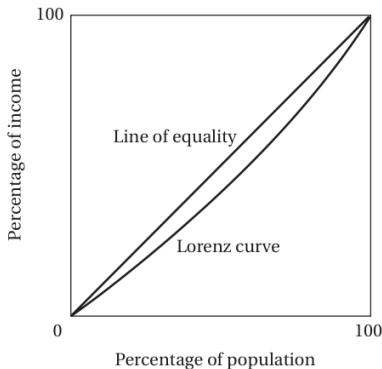
Lorenz curve



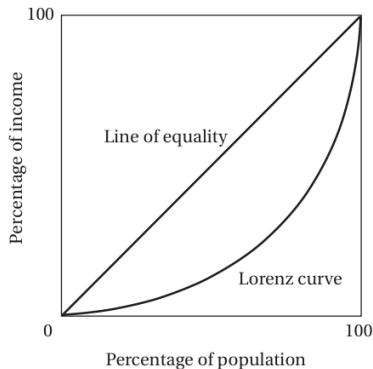
- ▶ Q: How to read the graph?
- ▶ Q: How does a Lorenz curve look like if $y_i = y \forall i$?
- ▶ Q: How to create a more unequal distribution from this one (recall Dalton-Pigou)?

Source: Todaro and Smith (2012)

Empirical measurement: Lorenz curve



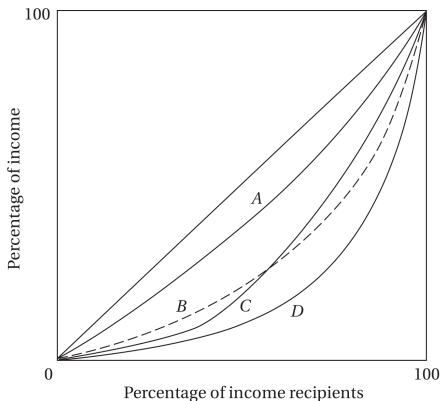
(a) A relatively equal distribution



(b) A relatively unequal distribution

Source: Todaro and Smith (2012)

Lorenz curve



- ▶ Q: But what if two curves cross (B & C)?
- ▶ We need some unified value that allows ranking.

Source: Todaro and Smith (2012)

Measuring Inequality: towards Gini index

- ▶ **Philosophy:** Should inequality among the poorest count more than among middle class?
 - ▶ We disregard these issues and treat all inequality equally. If interested → Hufe, Kanbur, and Peichl (2019) on measuring "unfair inequality"
- ▶ Notation:
 - ▶ n ... total population
 - ▶ n_j ... number of people in income group j ($\sum_{j=1}^m n_j = n$)
 - ▶ $\mu = \frac{1}{n} \sum_{j=1}^m n_j y_j$... average income

Measuring Inequality: towards Gini index

► **Mean absolute deviation:**

$$MAD = \frac{1}{\mu n} \sum_{j=1}^m n_j |y_j - \mu|$$

- Problems? *All* regressive Dalton-Pigou transfers must result in increased inequality.
 - Here income transfers across individuals above/below mean do not change MAD.
 - Take any two incomes $y_i > y_j$, both above mean. Transfer from y_i to y_j . As long as both stay above mean, no effect on MAD.

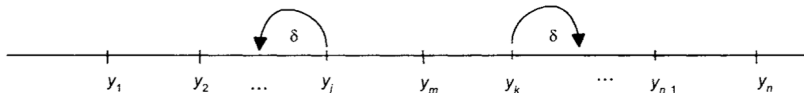
Measuring Inequality: Gini index

- ▶ **Gini coefficient** (Corrado Gini, 1912):

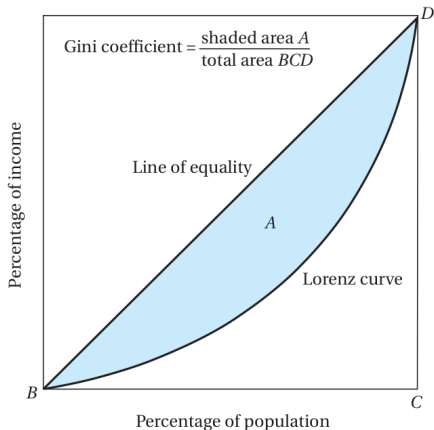
$$Gini = \frac{1}{2n^2\mu} \sum_{i=1}^m \sum_{j=1}^m n_i n_j |y_i - y_j|$$

- ▶ Satisfies all principles for inequality index:

1. Anonymity: obvious
2. Population: dividing by n^2
3. Relative income: dividing by μ
4. Dalton-Pigou: yes, see below



Lorenz curve vs. Gini index



► Gini coefficient:

$$Gini = \frac{1}{2n^2\mu} \sum_{i=1}^m \sum_{j=1}^m n_i n_j |y_i - y_j|$$

Source: Todaro and Smith (2012)

Inequality: conceptual
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Measuring inequality
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Poverty history
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Measuring poverty
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Multidimensional poverty
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Poverty

- ▶ While income inequality can be bad in itself (both in rich & poor countries alike), we mainly care about people who are most desperate and vulnerable
- ▶ There is still about 700 million people living at less than 1.9\$ (2011 PPP) a day (World Bank 2013)
 - ▶ Q: What is the *1.9\$ PPP a day* measure? What does it represent? (World Development Report, 1990)

Poverty: quick history

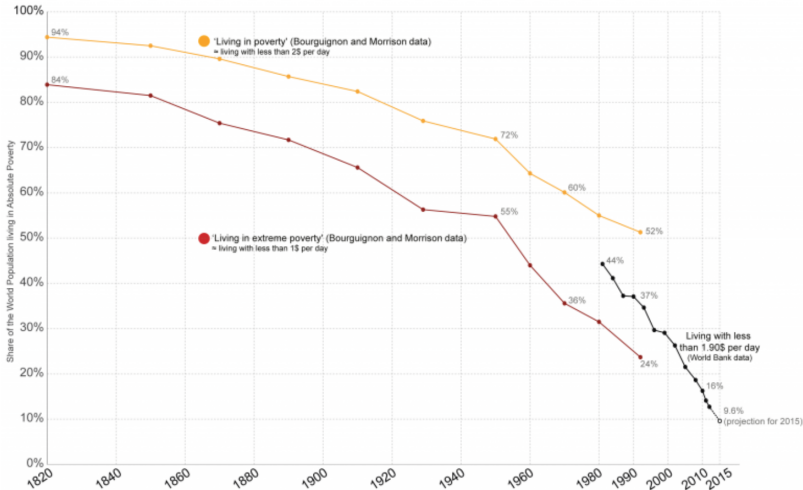
- ▶ Put today's poverty in perspective: about 40% poor in the UK, about 50% in Europe in 1820 (Bourguignon and Morrisson, 2002)
 - ▶ This is close to Sub-Saharan Africa rates today.
 - ▶ Angus Maddison's (1995) historical reconstruction of GDP starts 1820, prior to that annual growth estimated to be 0.05%.
- ▶ Social science research starting with Charles Booth and Benjamin Rowntree mapping poverty in London using household surveys (1886) → started serious discussion about modern welfare state
- ▶ Prior social welfare: English Poor laws (17th century): subsistence aid to poor outside of church
- ▶ Even earlier: mostly religious obligations against starvation of the poorest; moral obligations

Poverty: quick history



Share of the World Population living in Absolute Poverty, 1820-2015

All data are adjusted for inflation over time and for price differences between countries (PPP adjustment).



Data sources: 1820-1992 Bourguignon and Morrison (2002) - Inequality among World Citizens, In The American Economic Review; 1981-2015 World Bank (PovcalNet)

The interactive data visualisation is available at OurWorldinData.org. There you find the raw data and more visualisations on this topic.

Licensed under CC-BY-SA by the author Max Roser.

Poverty line origins

- ▶ Charles Booth (late 19th century): study of poverty in London using household surveys; origins of poverty line.
 - ▶ 21 shillings → 700g wheat / person/ day.
 - ▶ Corresponds to 400g wheat, remainder for meat, vegetables, and very minimal non-food needs
 - ▶ Similar to India's 1993 national poverty line: 400g rice, 200g vegetables, lentils, and fruit, plus a little milk, eggs, oil, spices, and tea + \$0.3 for non-food items per day (world Bank 1997)
 - ▶ Very similar to back \$1 in 1990s; currently revised to \$1.9.
- ▶ US poverty line officially developed in 1969 (Mollie Orshansky)
 - ▶ Derived from a cost of a minimally adequate diet multiplied by 3 → budget share of food one third of total budget.
 - ▶ Food *budget shares* (not bundles!) estimated from household surveys

US Poverty line origins: family food plan

FAMILY FOOD PLANS AND FOOD COSTS

By Eloise Cofer, Evelyn Grossman, and Faith Clark, *Consumer and Food Economics Research Division, Agricultural Research Service*

PART I.—THE FOOD PLANS AND THEIR USE

Five food plans at four levels of cost are described in this report. They include a plan at liberal cost, one at moderate cost, two at low cost, and an economy plan for emergency use. These plans are guides for estimating the quantities of food from each of 11 groups needed in a week to provide meals for individuals in 17 sex-age groupings and for women during pregnancy and lactation. From the suggested quantities for individuals, food budgets for families of varying size and composition can be constructed. Any one of the plans can be a basic part of a total plan for family or individual budgeting.

ties in the food plans are for food as it enters the kitchen, some of which may not be eaten. Since there is little information about the amount of edible food discarded in households in the United States, an arbitrary calorie allowance above the NRC allowance was made for the plans at each cost level. It seemed reasonable to assume that losses and discards on a low-cost food plan would be minimum, with larger discards at the moderate-cost and liberal levels. Therefore, foods purchased in accordance with the low-cost plans have an average calorie value of 105 to 108 percent of the NRC allowances, the moderate-cost 115 percent, and the liberal 120 percent.

Source: <https://aspe.hhs.gov/system/files/pdf/106751/familyfoodplan.pdf>

US Poverty line origins: family food plan

TABLE 3.—Food Plan at Low Cost: Suggested weekly quantities of food (as purchased) for 17 sex-age groups, pregnant and lactating women

Sex-age group ¹	Milk, cheese, ice cream ¹¹		Meat, poultry, fish ²	Eggs	Dry beans, peas, nuts	Flour, cereals, baked goods ⁴	Citrus fruit, tomatoes	Dark-green and deep-yellow vegetables	Potatoes	Fats, oils	Sugars, sweets
	Qt.	Lb. Oz.	No.	Lb. Oz.	Lb. Oz.	Lb. Oz.	Lb. Oz.	Lb. Oz.	Lb. Oz.	Lb. Oz.	Lb. Oz.
Children:											
7 months to 1 year.....	5½	1 0	5	0 0	0 12	1 8	0 2	0 8	1 0	0 1	0 2
1-3 years.....	5½	1 4	5	0 1	1 4	1 8	0 4	0 12	2 4	0 4	0 4
4-6 years.....	5½	1 8	5	0 2	2 0	1 12	0 4	1 4	3 4	0 6	0 6
7-9 years.....	5½	2 0	6	0 4	2 4	2 0	0 8	2 0	4 4	0 8	0 10
10-12 years.....	6½	2 4	6	0 6	3 0	2 4	0 8	2 8	5 0	0 8	0 12
Girls:											
13-15 years.....	7	2 8	6	0 4	3 0	2 4	0 12	2 8	5 0	0 10	0 12
16-19 years.....	7	2 8	6	0 4	2 12	2 4	0 12	2 4	4 12	0 6	0 10
Boys:											
13-15 years.....	7	2 8	6	0 6	4 4	2 8	0 12	3 4	5 4	0 12	0 12
16-19 years.....	7	3 4	6	0 8	5 4	2 8	0 12	4 12	5 8	0 14	0 14
Women:											
20-34 years.....	3½	2 8	5	0 4	2 8	2 0	0 12	2 0	5 0	0 6	0 10
35-54 years.....	3½	2 8	5	0 4	2 8	2 0	0 12	1 8	4 8	0 4	0 10
55-74 years.....	3½	2 8	5	0 4	2 4	2 0	0 12	1 4	3 0	0 4	0 6
75 years and over.....	3½	2 8	5	0 4	2 0	2 8	0 12	1 4	3 0	0 4	0 6
Pregnant.....	7	2 8	7	0 4	2 8	3 8	1 8	2 0	5 0	0 6	0 8
Lactating.....	10	3 4	7	0 4	3 0	4 8	1 8	3 4	5 8	0 8	0 10
Men:											
20-34 years.....	3½	3 12	6	0 6	4 4	2 4	0 12	3 4	5 8	0 12	1 0
35-54 years.....	3½	3 8	6	0 6	3 12	2 4	0 12	3 0	5 0	0 10	0 12
55-74 years.....	3½	3 4	6	0 4	3 8	2 4	0 12	2 8	4 12	0 10	0 10
75 years and over.....	3½	3 4	6	0 4	3 4	2 0	0 12	2 4	4 8	0 8	0 10

¹ Quantities of food suggested here are based on growth needs and activity levels suitable for people in the U.S.A.

² Fluid whole milk, or its equivalent in cheese, evaporated milk, dry milk, or ice cream. See p. 16 for factors to convert milk products to calcium equivalent of whole fluid milk.

³ Includes bacon and salt pork not to exceed 1/3 pound for each 5 pounds of meat group.

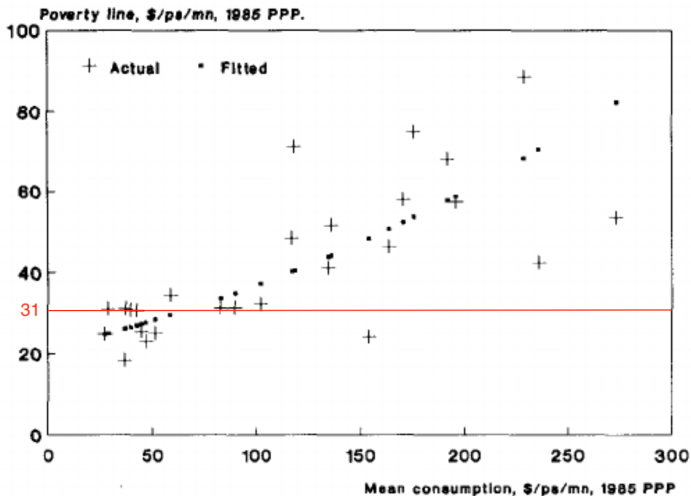
⁴ Weight in terms of flour and cereal. See p. 16 for factors to convert baked goods to flour and cereal equivalent.

Source: <https://aspe.hhs.gov/system/files/pdf/106751/familyfoodplan.pdf>

Absolute poverty line: \$1

- ▶ Ravallion, Datt, and van de Walle (1991): Quantifying absolute poverty in the developing world.
 - ▶ Data on poverty lines for 33 countries (very poor to rich)
 - ▶ Poverty lines converted to \$ (1985 PPP) and plotted the lines against per capita consumption
 - ▶ Poverty lines of 6 poorest countries clustered around \$1/day → benchmark for **absolute poverty** measure (World Development Report 1990)
 - ▶ Updated to \$1.08 (1993 PPP), (with data from more countries; estimates stable) \$1.25 (2005 PPP), \$1.90 (2016)

Absolute poverty line: \$1



Source: Ravallion, Datt, and van de Walle (1991)

Poverty line issues and justification

- ▶ Note: food plans maximize nutritional intake given limited budget (optimization problem)
 - ▶ Problem: optimal solution often does not reflect actual food purchases!
 - ▶ Critical assumption: nutrition = welfare!
- ▶ Yet still, poverty lines:
 - ▶ Give a sense of urgency
 - ▶ Allow comparability across time and space

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Multidimensional poverty

Poverty: Conceptual issues

1. Income or consumption?

- ▶ Income represents capacity to consume, not consumption itself.
- ▶ Income used more often (also better data availability, even though more prone to measurement error; recall: What is income?).

2. Absolute or relative poverty?

- ▶ What is adequate level of nutrition, housing, education, clothing, assets (e.g. fridge), car ownership (EU vs. USA) in a given country? What are the basic needs for functioning in such society.
- ▶ Distinction important: otherwise mixed up with *inequality*
- ▶ Absolute used (although always with certain amount of relativity).

Poverty: Conceptual issues

3. Temporary or chronic poverty?

- ▶ Agricultural societies often go through seasonal income cycles. Poverty fluctuates throughout the year.
- ▶ Case: Afghanistan: 20% food poverty after harvest, 45% food poverty before harvest (NRVA, 2008)
- ▶ Very different policies when tackling either type.

4. Household or individual poverty?

- ▶ Potentially unequal access to resources across household members.
- ▶ Discrimination of females, elderly, minority groups (lecture on discrimination)

Poverty: Conceptual issues

5. How to set a **poverty line**?

- ▶ Critical threshold
- ▶ Often comes from a detailed household survey, which determines a typical consumption basket for a poor.
- ▶ Often also calorie based (see discussion earlier)
- ▶ **Note:** With all the conceptual issues, the poverty line and all poverty measures need to be taken as approximations and tools for first-glance
 - ▶ Refer to WDR (1990): also uses multiple measures; Recall Banerjee and Duflo (2007) in Lecture 1.

Poverty measures

▶ Notation:

- ▶ $y_p \dots$ poverty line
- ▶ $y_i \dots$ income of individual i
- ▶ $n \dots$ population
- ▶ $\mu = \frac{1}{n} \sum_{i=1}^n y_i$

- ▶ **Head count:** number of individuals for whom $y_i < y_p$: HC
- ▶ Issues: population principle?

- ▶ **Head count ratio:** $HCR = \frac{HC}{n}$

- ▶ Q: Imagine a policy aimed at reduction of poverty where some poor have incomes of 1\$ and some of 10\$ and the poverty rate is 12\$. Who would you help first if you want to minimize HCR?

Poverty measures

► Poverty gap ratio:

$$PGR = \frac{\sum_{i=1}^{HC} (y_p - y_i)}{n\mu}$$

- How much money would we need to get everyone above y_p relative to total income available in the country.
- But: what about very unequal countries with some very rich individuals?

► Income gap ratio: $IGR = \frac{\sum_{i=1}^{HC} (y_p - y_i)}{y_p HC}$

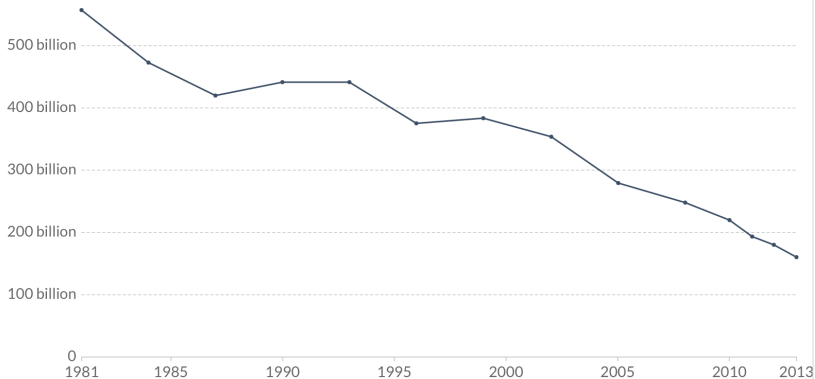
- Or normalised income shortfall

The global poverty gap (in international \$)

The global poverty gap, in international-\$

Our World
in Data

The poverty gap is the amount of money that would be theoretically needed to lift the incomes of all people in extreme poverty up to the international poverty line of \$1.90 a day. These estimates are expressed in international dollars using 2011 PPP conversion rates. This means that figures account for differences in prices levels, as well as for inflation.



Poverty measures

- ▶ Often we care also about *inequality* among the poor:
- ▶ **Foster-Greer-Thorbecke index:**

$$FGTI = \frac{1}{n} \sum_{i=1}^{HC} \left(\frac{y_p - y_i}{y_p} \right)^\alpha$$

- ▶ $\alpha = 0 \dots$ Headcount ratio
 - ▶ $\alpha = 1 \dots$ "Poverty gap index"
 - ▶ $\alpha > 1 \dots$ More weight assigned to those way below y_p
- ▶ FGT with $\alpha = 2$ is a part of the Mexican poverty alleviation program Oportunidades/Progresa (chap. 5, art. 34). It uses this index to allocate funds for education, health, and welfare programs for the poor. Why?

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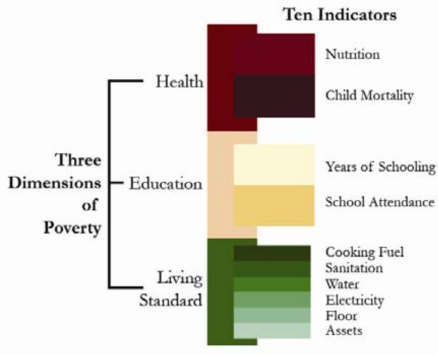
History of poverty measurement and poverty lines

Poverty measurement and conceptual issues

Multidimensional poverty

Multidimensional poverty index

► Multidimensional poverty index: UNDP (2010)



Source: Alkire and Santos (2010)



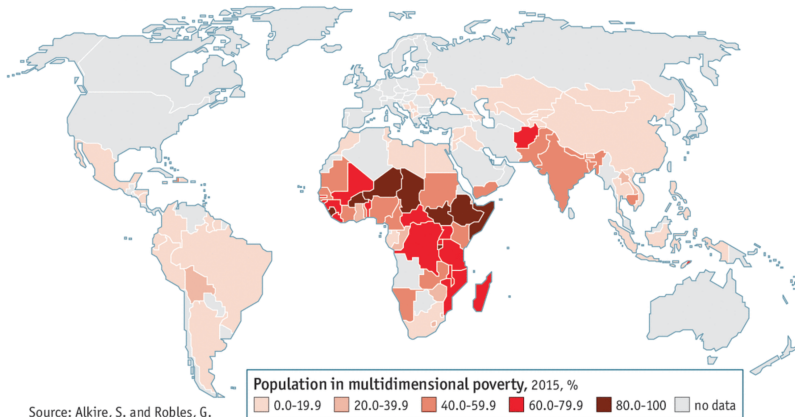
Source: The Economist (2010)

Multidimensional poverty index

- ▶ Q: Why good measure? Why bad measure?
- ▶ Can be tailored for local conditions: Mexico is using its own to assess its antipoverty programs, France is introducing one too.
- ▶ MPI measured using headcount ratio (HR_M) or an adjusted HR (HR_{MA}), where A stands for the average intensity of deprivation based on the actual number of indicators below multidimensional poverty among the poor.
 - ▶ Poor are those who score 3 out of 10 points on the indicator scale.
- ▶ 1.6 billion people living in "acute" poverty using MPI (1.4 billion using \$1.25) - data from 2005 as in UN Rethinking poverty 2010 report
 - ▶ Niger only country with MPI above 0.6 (0.50 using \$1.25)
 - ▶ Georgia at 0.003 (0.11 using \$1.25)
 - ▶ Guatemala at 0.127 (0.11 using \$1.25)
 - ▶ Kenya at 0.302: but inequalities across ethnic groups: 29% among Embu, 96% among Turkana and Masai

Multidimensional poverty index

The unlucky 1.6 billion



Source: Alkire, S. and Robles, G.

Source: The Economist (2015)

Multidimensional poverty index: issues

- ▶ Plenty of possible dimensions to choose. How to agree on which are most relevant?
- ▶ Arbitrary choice of weights. Note an ethical issue: implicit pricing of dimensions
 - ▶ In MPI: school years can be traded off for child mortality 1 to 1
 - ▶ More reading in Ravallion (2012): Troubling trade-offs in HDI.
 - ▶ (Paper on Human Development Index; very similar to MPI, only uses data from different sources rather than from a single dataset as MPI)

Taking stock

We discussed:

1. Conceptual issues of inequality and poverty
 2. Brief history of thought about inequality and poverty
 3. Measurement of inequality and poverty
 4. Rationale for and foundations of poverty lines
 5. Issues with multidimensional indices of measuring poverty
 6. **Key take away:** good descriptive tools (alongside other indicators) but important to understand conceptual issues
- ▶ Where next? Group differences and discrimination