Measuring and Monitoring Global Poverty at the World Bank:
A brief overview

Francisco H. G. Ferreira

(Standing on the shoulders of *many* giants)

"Poverty Smackdown" with Sanjay Reddy – World Bank HQ – March 5th, 2019

Outline

1. A brief history of global poverty monitoring at the World Bank
   - With a focus on the 2015 update (introducing the 2011 PPPs)

2. The most recent estimates of extreme consumption poverty

3. Towards a broader conception of poverty
   - Multiple lines
   - A societal (hybrid) line
   - Multidimensional poverty
   - Looking within the household

4. Many remaining challenges

1. A brief history of global poverty monitoring at the World Bank

Update:	1979 "India line"	1990 "Dollar-a-day"	2001 1.08/day	2008 1.25/day	2015 1.90/day
Source	Ahluwalia et al (1979)	Ravallion, et al (1991), WDR 1990	Chen and Ravallion (2001)	Ravallion, Chen and Sangraula (2009)	Ferreira et al. (2016), PSPR 2016
ICP data	1975 PPPs Kravis et al (1978)	1985 PPPs	1993 PPPs	2005 PPPs	2011 PPPs
Poverty lines used	1 (India)	8 countries	10 countries	15 countries	15 (same lines as 2008)
Method	India's poverty line (46th pctile)	Inspection	Median	Mean	Mean
Poverty line (ICP base year USD)	$0.56	$1.01	$1.08	$1.25	$1.90
Country coverage	36 (25)	86 (22)	88	115	133

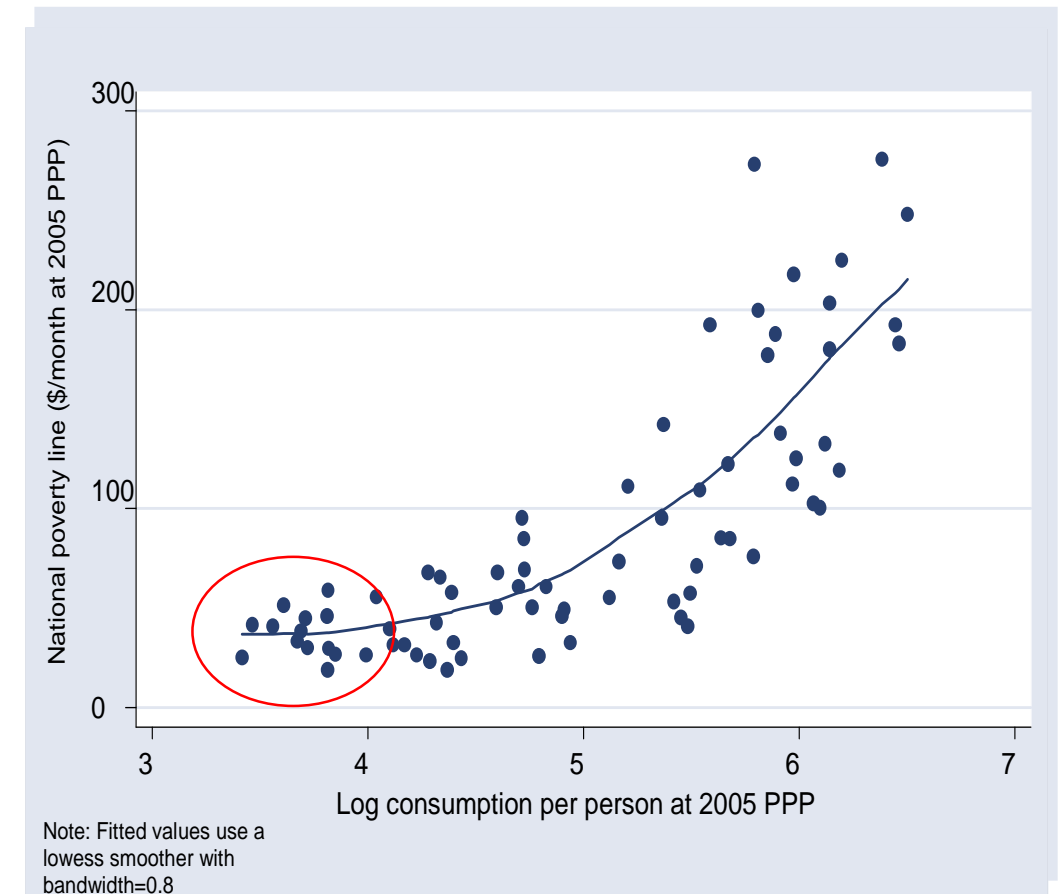# 1. A brief history of global poverty monitoring at the World Bank

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Ravallion, Chen and Sangraula (WBER, 2009):

- Update the line to $1.25-a-day using 2005 PPPs for consumption.

- New compilation of national poverty lines from the Bank's country-level Poverty Assessments (for 74 countries)

- Reference group of the poorest 15 countries.
  - Malawi, Mali, Ethiopia, Sierra Leone, Niger, Uganda, Gambia, Rwanda, Guinea-Bissau, Tanzania, Tajikistan, Mozambique, Chad, Nepal and Ghana.

- Find a poverty rate of 25% (or 1.4 billion people) in 2005.

- **UN Sustainable Development Goal 1.1 (and WB Poverty Reduction Goal) set with respect to this line**.

Figure 1: National poverty lines for 74 developing countries plotted against mean consumption using consumption PPPs for 2005

Note: Fitted values use a lowess smoother with bandwidth=0.8

1.   A brief history of global poverty monitoring at the World Bank

- **The 2011 PPPs:** ICP price data collected in 2011 (released in 2014)

- Increased coverage of countries: from 146 economies in 2005 to 199 in 2011, covering 99% of nominal world GDP

- Increased coverage of rural prices, particularly in China, India and Indonesia (as compared to 2005)

- 18-ring-country approach from 2005 replaced by subset Global Core List of items from all countries for linking regions in 2011.

- Deaton and Aten (2014) and Inklaar and Rao (2014) argue that these methodological improvements correct for errors in the 2005 PPPs that had led to an 20-30% overestimate of the price levels in Africa and Asia

- In addition, Deaton and Dupriez (2011) had estimated global poverty counts using (2005) "PPPs for the poor" and found that poverty-weighting PPPs made little difference to the size and distribution of global poverty.

1.   A brief history of global poverty monitoring at the World Bank

- But: the 2011 PPPs imply a substantial shift in the regional profile of relative price levels:

- Lower price levels in poor countries => higher PPP-adjusted USD values of consumption & income.

- Convert 2005 PPP value => 2011 PPP value:

$$\frac{CPI_{11}}{CPI_{05}} \Big/ \frac{PPP11}{PPP05}$$

Change in CPI relative to change in PPPs. Can be thought of as country-specific PPP05 -> PPP11 deflators.

For US, δ = 1.15

Figure 1: Change in PPP-adjusted dollar values between 2005 and 2011 PPPs

Note: Fitted line uses lowest smoother with bandwith 0.8. Sample limited to countries which participated in both the 2005 and 2011 ICP rounds. δ =1 means no change to the PPP-adjusted dollar value between 2005 and 2011 PPPs.

1. A brief history of global poverty monitoring at the World Bank

- Challenge: how should the IPL ($1.25 in 2005 PPPs) be updated, without moving the international community's goalposts?

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Chico Ferreira??!!

1. A brief history of global poverty monitoring at the World Bank

- ## Principles:

1. Use the most accurate set of prices available to compare the standards of living across countries with very different prices for non-tradable goods and services.

2. Acknowledge that the Bank's poverty reduction goal (and the UN's SDG #1) are set explicitly in terms of the $1.25 line at PPP2005 exchange rates. Minimize changes to that goalpost in real terms.

3. The price changes most relevant for determining 'real terms' are those faced by the world's poorest people.

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- ## Derive the new line by:

  i.   Inflating the 2005 values of the fifteen RCS lines to 2011 using domestic CPIs
  ii. Convert the resulting values to US dollars (in 2011 prices) using the 2011 PPPs

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Updating the RCS15 $1.25/day line to 2011 PPPs

Country	Year	2005 PPP	2011 PPP
Malawi*	2004-05	0.86	1.34
Mali	1988-89	1.38	2.15
Ethiopia	1999-2000	1.35	2.03
Sierra Leone	2003-04	1.69	2.73
Niger	1993	1.10	1.49
Uganda	1993-98	1.27	1.77
Gambia, The	1998	1.48	1.82
Rwanda	1999-2001	0.99	1.50
Guinea-Bissau	1991	1.51	2.16
Tanzania	2000-01	0.63	0.88
Tajikistan*	1999	1.93	3.18
Mozambique	2002-03	0.97	1.26
Chad	1995-96	0.87	1.28
Nepal	2003-04	0.87	1.47
Ghana*	1998-99	1.83	3.07
Average		**1.25**	**1.88**

*Countries use category 4 price deflators in conversion.

1. A brief history of global poverty monitoring at the World Bank

Evidence of robustness:

- Deaton (2010) had criticized the *narrow statistical support* for the $1.25 line.

- Jolliffe and Prydz (2016) propose a Low Income Country (LIC) poverty line based on the median of estimated (implicit) national poverty lines from **32** Low Income Countries. Yields **$1.25** in 2005 PPPs and **$1.91** in 2011 PPPs.

- Convert **$1.25** line to 2011 PPP value (ΔCPI/ΔPPP) for each country (for which poverty is measured). Simple average of these values is **$1.90**.
  - Similar to the "equivalent line" approach suggested by Kakwani and Son (2016). They prefer a population-weighted average, of $1.93.

1. A brief history of global poverty monitoring at the World Bank

Robustness from unexpected sources?: Robert Allen's *Basic Needs Poverty Line* – a "scientific", linear programming approach, independent from national poverty lines.

"The [WBPL] rest on contestable foundations […] as well as leading, we argue, to underestimates of poverty in much of the developing world" (Allen, 2017, p.3690)

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TABLE 11—LINEAR PROGRAM POVERTY LINES CONVERTED TO US DOLLARS PER DAY AT PPP

	1,700 cal	CPF	Basic	Full course
Developing	1.54	1.88	2.63	3.22
Middle-income OECD	1.50	1.69	2.05	2.15

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"When minimal housing and clothing and fuel adequate for tropical conditions are included, the costs of these linear programming poverty lines works out in 2011 at about $1.90 per day. The LPPL is a new basis for the World Bank Poverty Line" (p.17)

One year earlier: University of Oxford Discussion Papers in Economic and Social History No.141, March 2016

- 1700 calorie model. The only requirement is 1700 calories per day.
- CPF model. Three nutrients are required: 2100 Calories per day, 50 g. of Protein, and 55 g. of Fat
- reduced basic model. CPF requirements plus half of the Indian recommended daily allowances (RDA) of iron, folate, thiamine, niacin, and the RDA of vitamins C and B12.
- basic model. CPF requirements plus the Indian recommended daily allowances of iron, folate, thiamine, niacin, and vitamins C and B12.
- full course model. Basic model plus RDA of six more vitamins and minerals.

Linear Program Poverty Lines converted to US dollars per day at PPP

	1700 cal	CPF	reduced basic	basic	full course
Niger	0.62		0.87	1.41	1.52	1.82
Zimbabwe	0.64		0.83	1.56	1.65	1.77
Gambia	0.84		1.07	1.27	1.34	2.11
Liberia	1.50		1.92	2.28	2.65	3.17
Egypt	1.36		1.70	2.48	2.59	2.98
Algeria	1.08		1.30	2.00	2.62	3.03
non-OECD	1.02		1.45	1.90	2.14	2.57
OECD	0.55		0.78	1.15	1.28	1.73

- ## Allen's Basic Needs Poverty Line:

- "Also, I told you about how I used my model to compute poverty lines in 2011 for the 15 countries underpinning the 2005 and 2011 World Bank lines. Here' s the key graph. It is only for the African countries (Nepal fits right in and Tajikistan is an outlier but the results don't really change.) The black dots are from your paper and are the 2011 values of their national poverty lines. The red dots are my computations. As you can see the means are virtually the same. The variance of mine is smaller. So my model agrees with $1.90 when it is applied to the continent on which the $1.90 line largely rest." (Allen, 5/23/2018, personal communication")

- "I can elaborate this, but I have always believed that my work would provide a justification of the WBPL in some sense. Now I think I have done that and […] would like to contribute to your enterprise by broadcasting that finding." (Allen, 5/27/2018, personal communication)
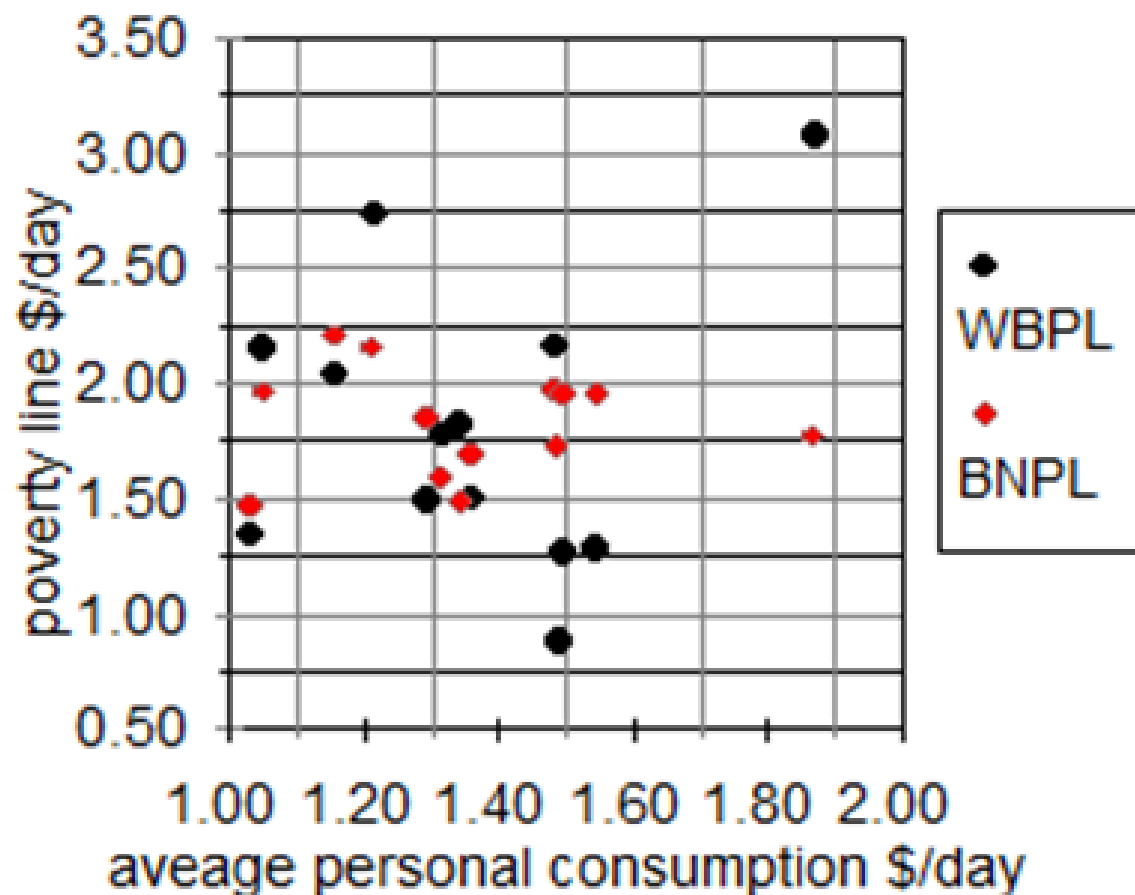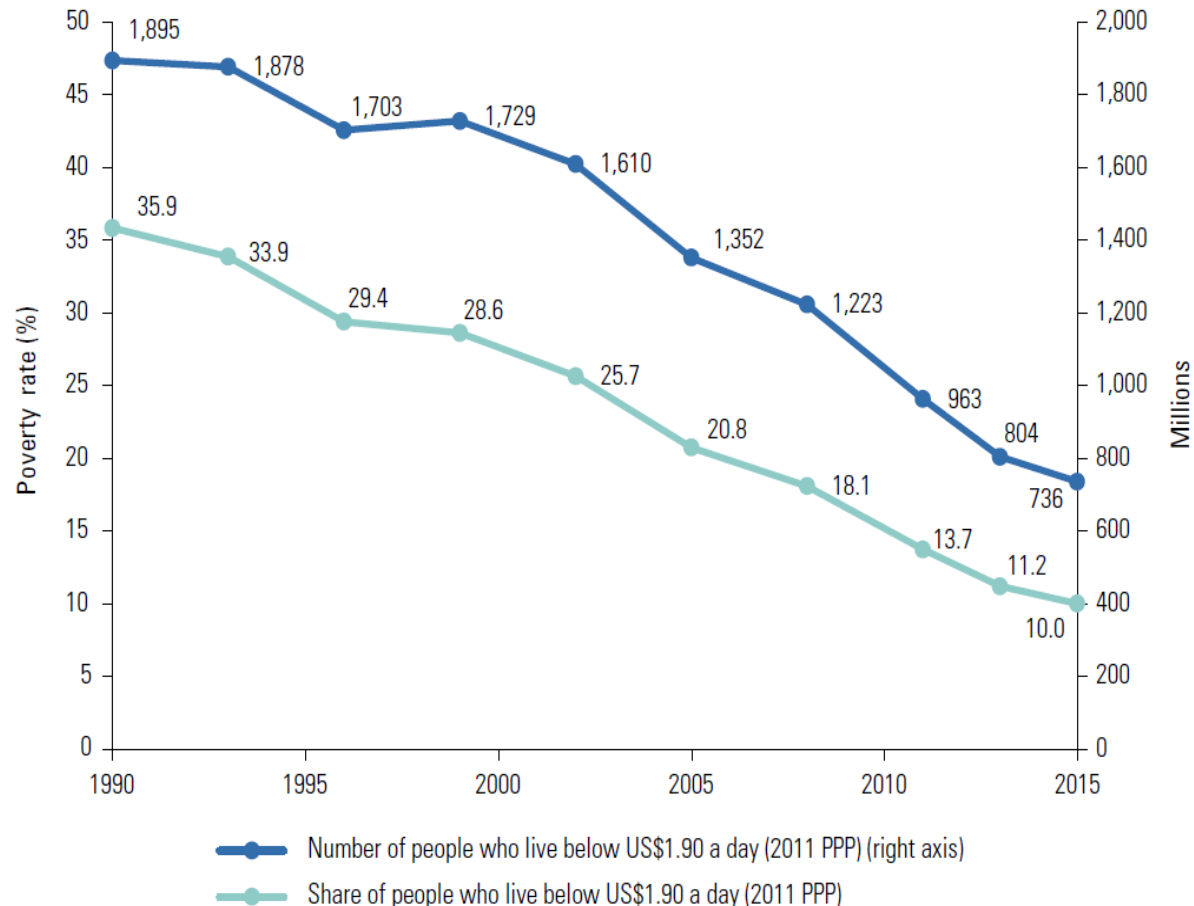
2. The most recent estimates of extreme consumption poverty

Ingredients:

- Nationally representative household surveys with consumption or income variables
  - from among the 1,600+ surveys for 164 economies between 1977 and 2017 in PovcalNet
- Population statistics (from Censuses)
- Domestic price indices (and sometimes spatial price deflators)
- Purchasing power parity exchange rates
- National accounts data on growth rates
- National poverty lines

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- Information on the joint distribution of other dimensions of well-being: health status, educational attainment, access to services, etc.

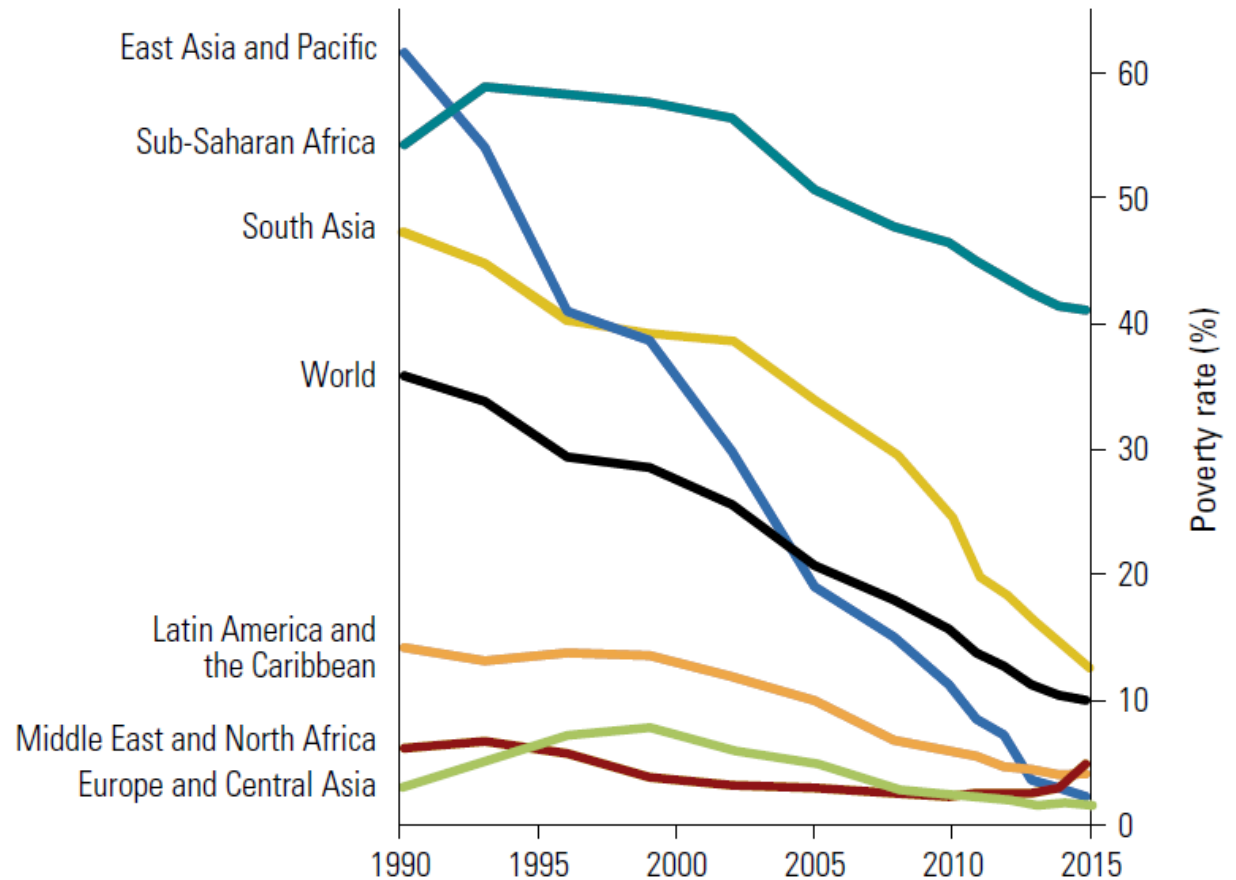# 2. The most recent estimates of extreme consumption poverty

FIGURE 0.1 Global Poverty Rate and Number of Poor, 1990–2015

1,895
1,878
1,703
1,729
1,610
1,352
1,223
963
804
736

35.9
33.9
29.4
28.6
25.7
20.8
18.1
13.7
11.2
10.0

Poverty rate (%)

Millions

—●— Number of people who live below US$1.90 a day (2011 PPP) (right axis)

—●— Share of people who live below US$1.90 a day (2011 PPP)

FIGURE 1.6 Poverty Rate, Regional and World Trends, 1990–2015

East Asia and Pacific
Sub-Saharan Africa
South Asia
World
Latin America and the Caribbean
Middle East and North Africa
Europe and Central Asia

Poverty rate (%)

i. The recent progress against extreme poverty: a changing regional profile

- With a headcount rate of 41%, sub-Saharan Africa accounted for 56% of the world's extremely poor people in 2015.

- South Asia accounted for another 29%.

- East Asia had 9% of the extreme poor – a massive reduction from its 52% in 1990.

- 7.3 million in extreme poverty in RoW ("rich countries")

FIGURE 1.8 Distribution of the Global Poor by Region and Country, 2015
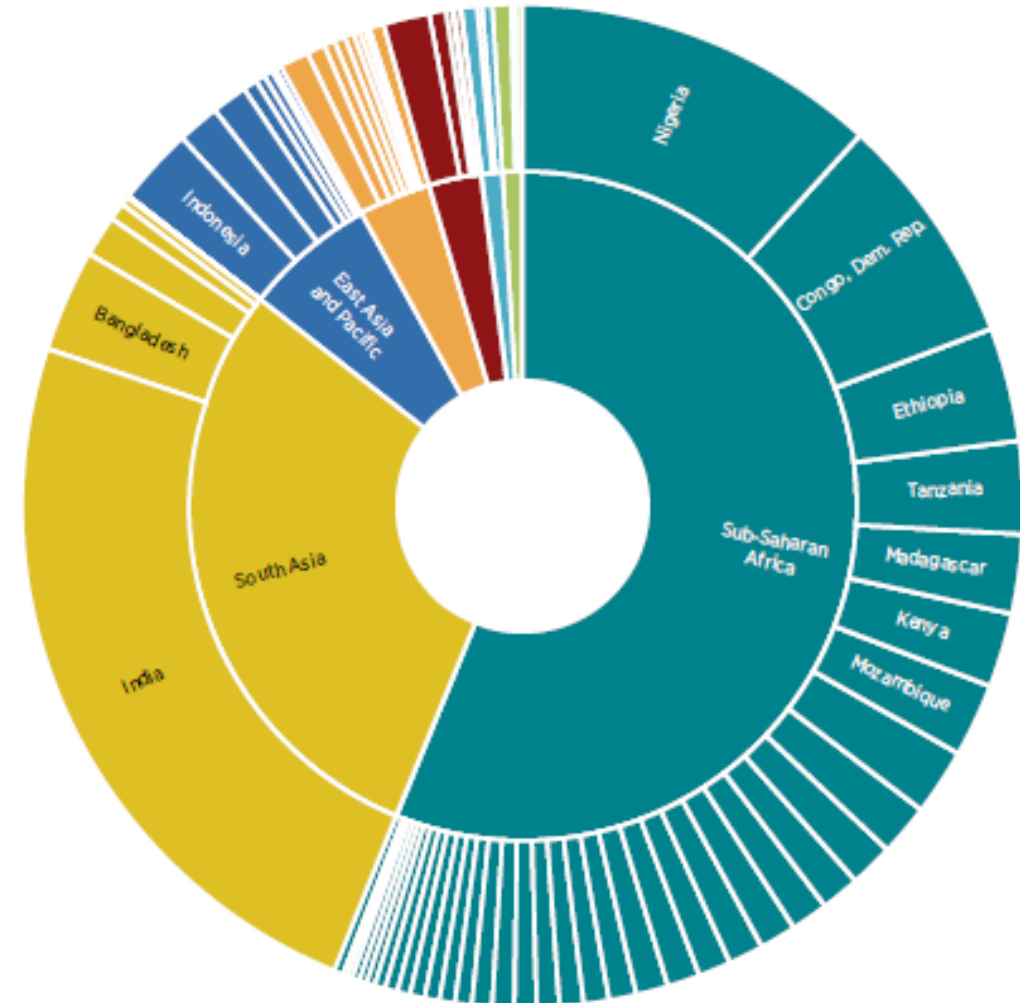
ii. The recent progress against extreme poverty: highly uneven, and slowing down.

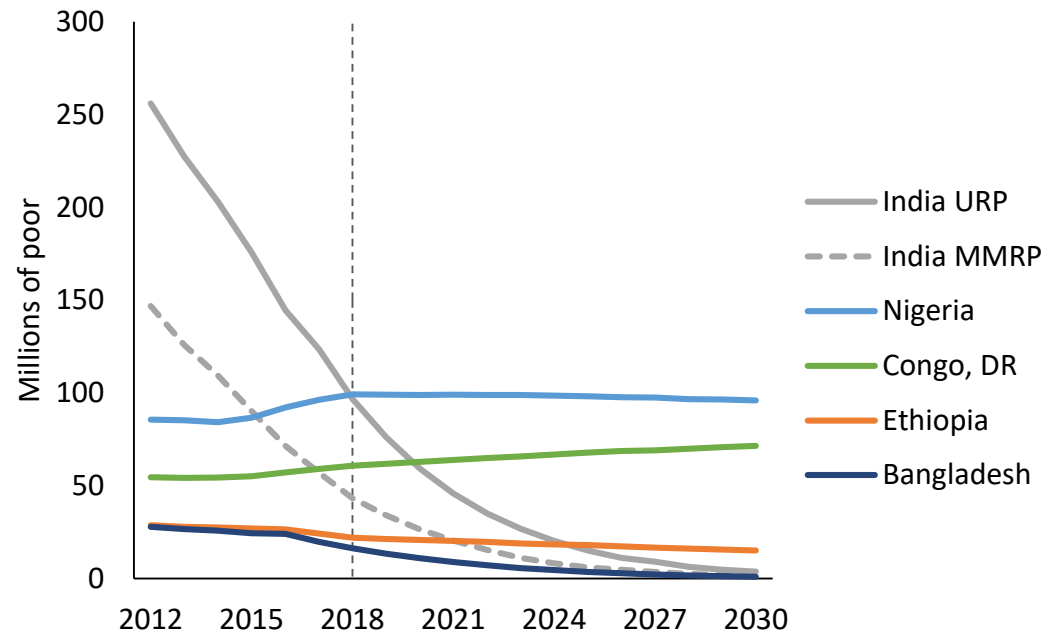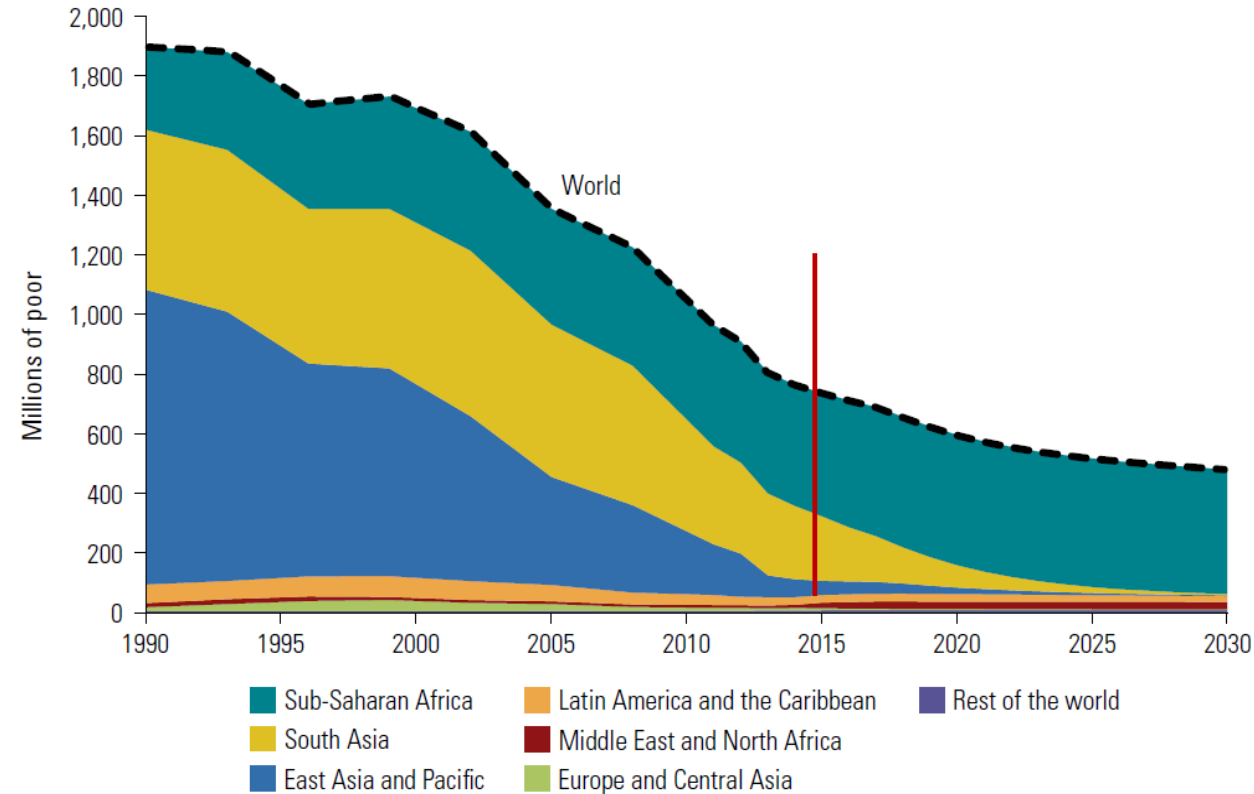**Poverty projections, five countries with the most poor in 2015**

Legend:
- India URP
- India MMRP
- Nigeria
- Congo, DR
- Ethiopia
- Bangladesh

FIGURE 1.3 Number of Poor by Region, 1990–2030

Legend:
- Sub-Saharan Africa
- South Asia
- East Asia and Pacific
- Latin America and the Caribbean
- Middle East and North Africa
- Europe and Central Asia
- Rest of the world

Source: PovcalNet (online analysis tool), World Bank, Washington, DC, http://iresearch.worldbank.org/PovcalNet/. World Development Indicators; World Economic Outlook; Global Economic Prospects; Economist Intelligence Unit.

iii. The decline over the last 25 years **is** robust to the choice of poverty line
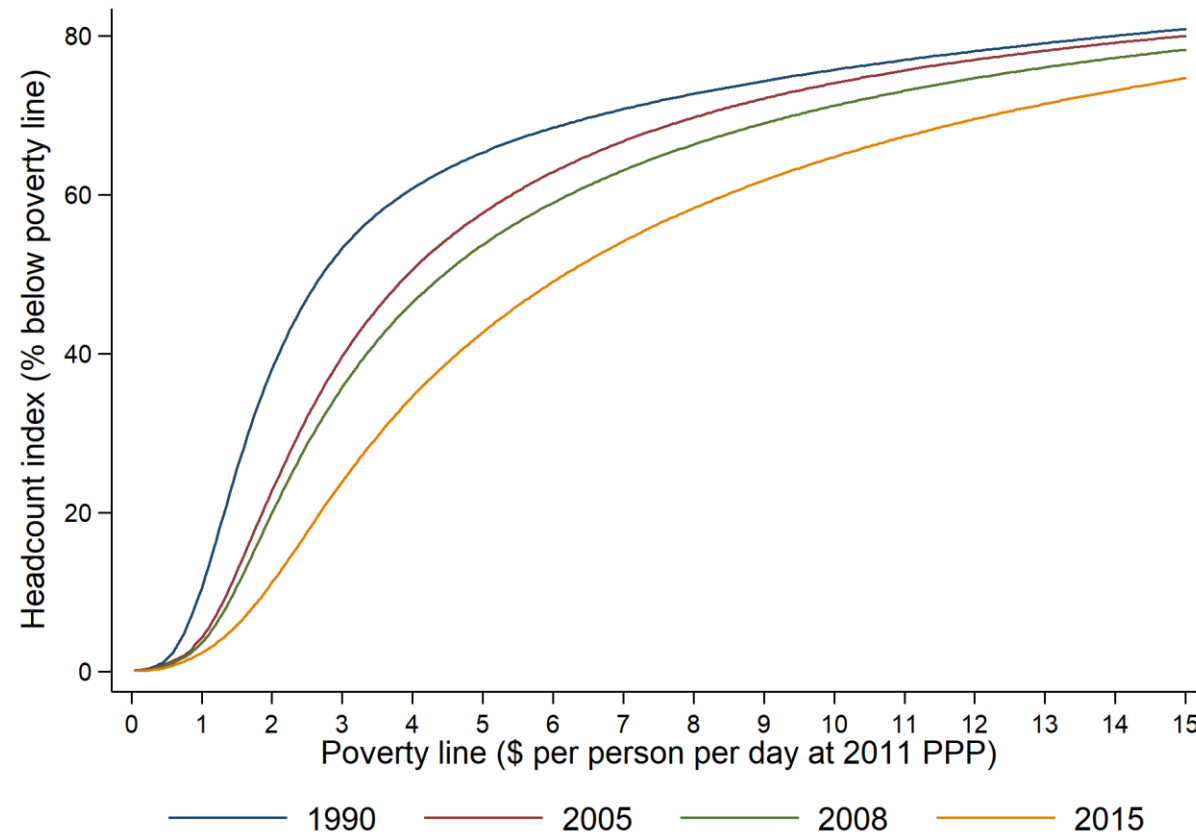
World cdf for household consumption per capita, truncated at the US poverty line. First order stochastic dominance holds across all years.
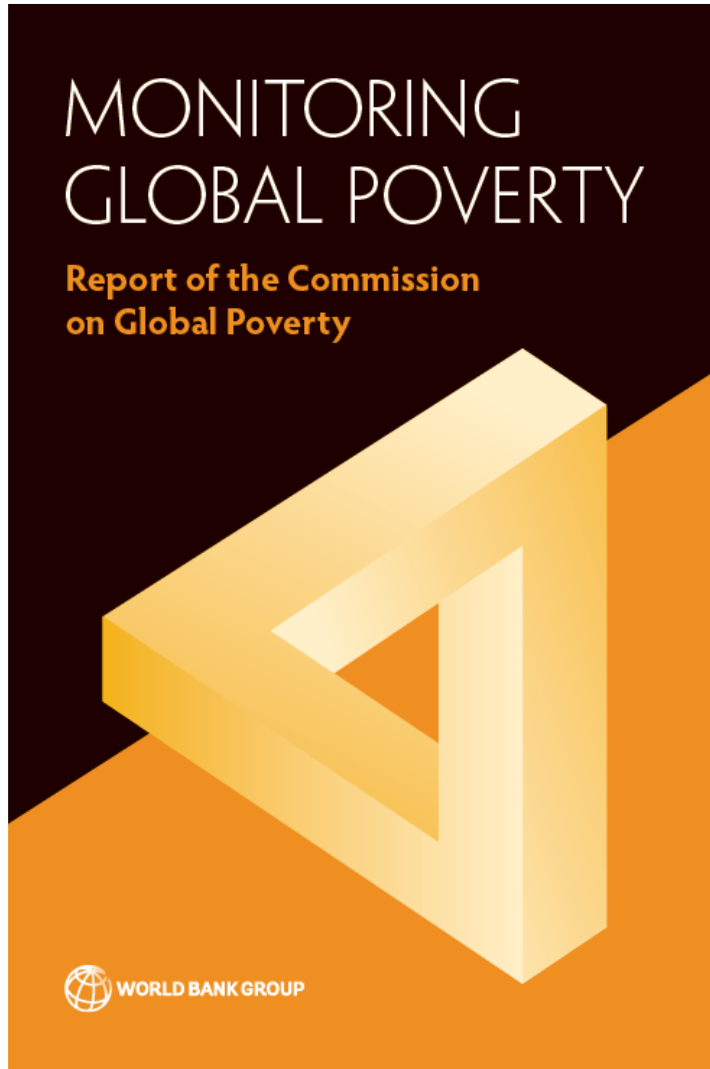
3. Towards a broader conception of poverty

But measuring extreme consumption or income poverty clearly is not the end all and be all of monitoring world poverty.

Poverty is a complex, multifaceted phenomenon.

A richer menu of poverty indicators is needed.

3. Towards a broader conception of poverty

A 24-member commission, convened in 2015 and led by Tony Atkinson, was tasked with providing advice to the World Bank's Chief Economist on:

(A) What should be the interpretation going forward of the definition of extreme poverty, set in 2015 at 1.90 Purchasing Power Parity (PPP)-adjusted dollars a day per person, in real terms?

(B) What choices should the World Bank make regarding complementary poverty measures to be tracked and made available to policy-makers?

The final report was published in October 2016, and contains 21 recommendations.

3. Towards a broader conception of poverty: Income-class poverty lines

Rationale

Poverty lines are clearly higher in richer countries. The "reference meaning" of consumption poverty is different in UMICs and LICs.

Approach

Anchored on national harmonized poverty lines.

LICs: $1.90/day

LMICs: $3.20/day

UMICs: $5.50/day

Source: Jolliffe and Prydz (2016):
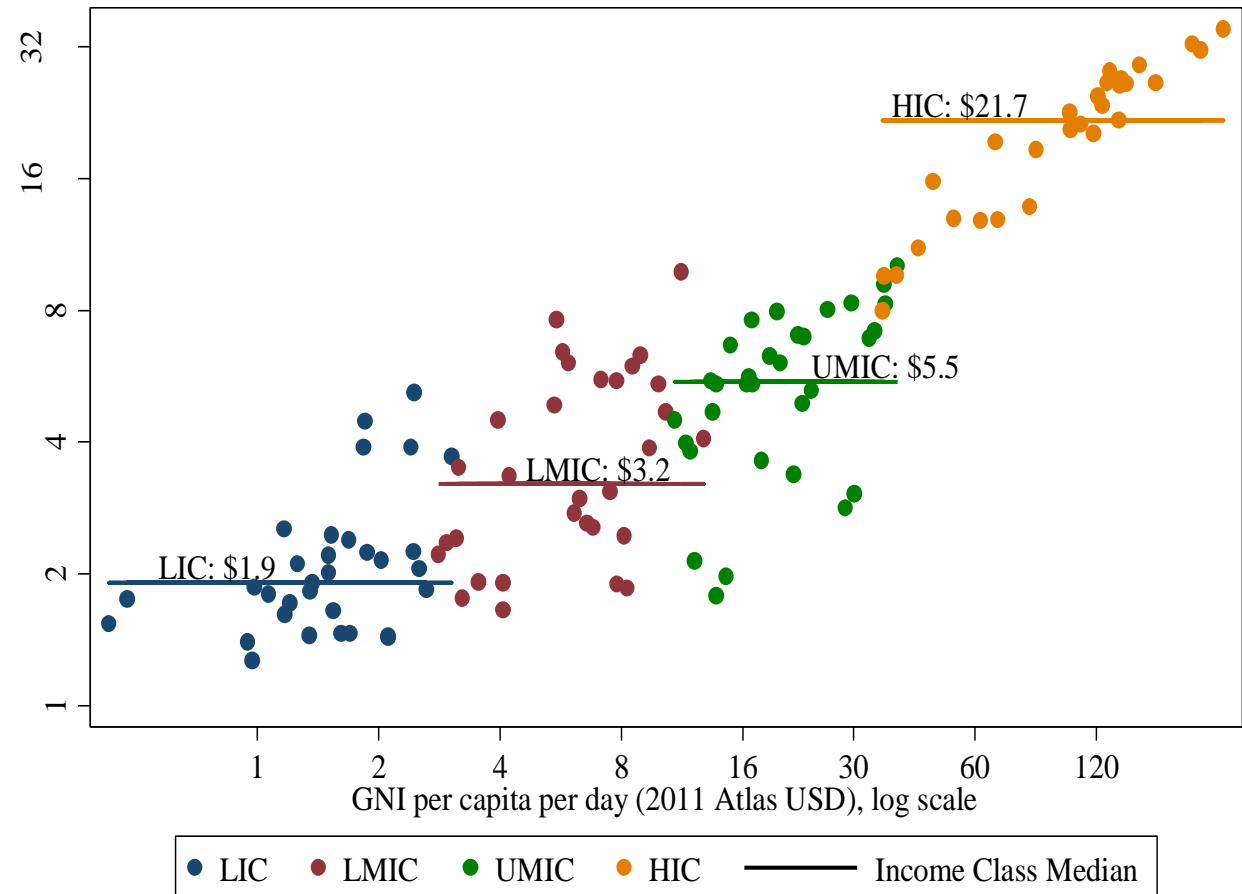115 from the 864 implicit poverty lines in their database. $z_i^* = G^{-1}(F(z_i))$

TABLE 3A.1 Historical Trends, Global Poverty Estimates, 1990–2015

a. US$3.20 Poverty

Year	Poverty rate (%)	Poverty gap (%)	Squared poverty gap	Poor (millions)	Population (millions)
1990	55.1	26.6	15.5	2,914.0	5,284.9
1993	54.4	25.6	14.7	3,013.4	5,542.9
1996	51.7	22.8	12.7	2,993.8	5,792.6
1999	50.6	22.3	12.4	3,056.1	6,038.1
2002	47.2	20.2	11.0	2,962.7	6,276.8
2005	42.2	16.9	8.8	2,753.3	6,517.0
2008	38.2	14.9	7.7	2,586.9	6,763.7
2011	32.8	12.1	6.0	2,298.8	7,012.8
2013	28.8	10.2	5.0	2,071.7	7,182.9
2015	26.3	9.2	4.6	1,932.7	7,355.2

b. US$5.50 Poverty

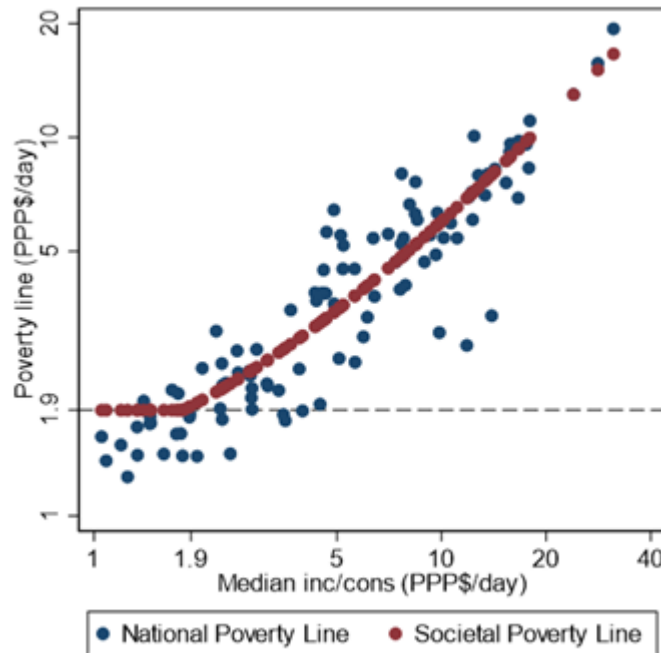| Year	Poverty rate (%)	Poverty gap (%)	Squared poverty gap	Poor (millions)	Population (millions)
1990	67.0	41.5	28.8	3,540.5	5,284.9
1993	67.9	40.9	28.0	3,761.2	5,542.9
1996	67.3	38.7	25.6	3,900.0	5,792.6
1999	66.8	38.1	25.1	4,035.2	6,038.1
2002	64.0	35.6	23.0	4,018.2	6,276.8
2005	60.4	31.9	19.9	3,939.4	6,517.0
2008	56.5	29.0	17.8	3,823.7	6,763.7
2011	52.2	25.3	15.0	3,662.3	7,012.8
2013	48.7	22.6	13.1	3,498.3	7,182.9
2015	46.0	20.9	12.0	3,386.5	7,355.2

3. Towards a broader conception of poverty: Income-class poverty lines
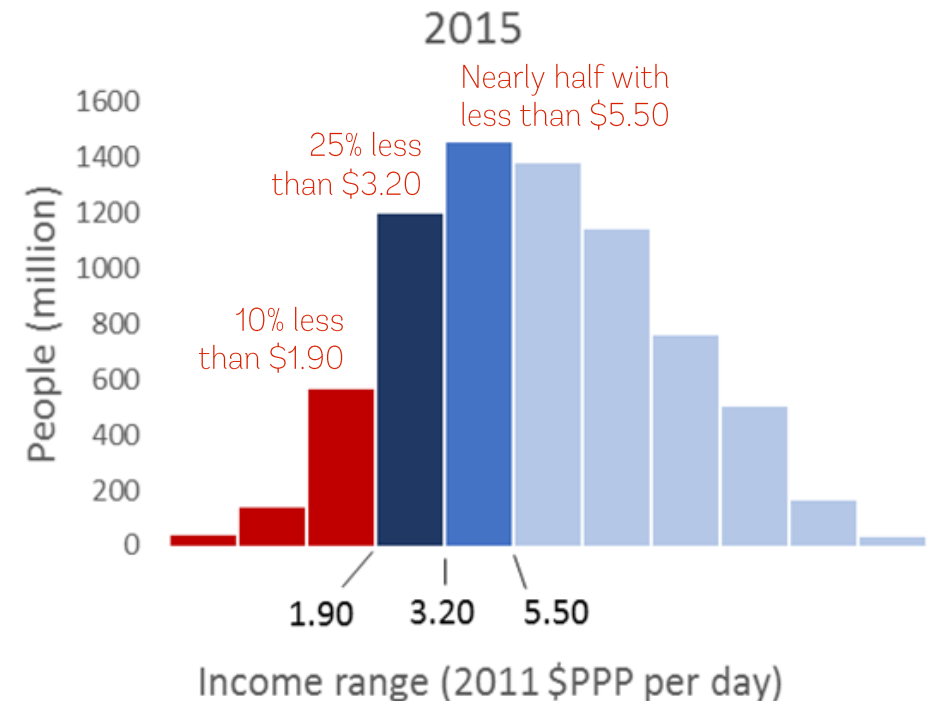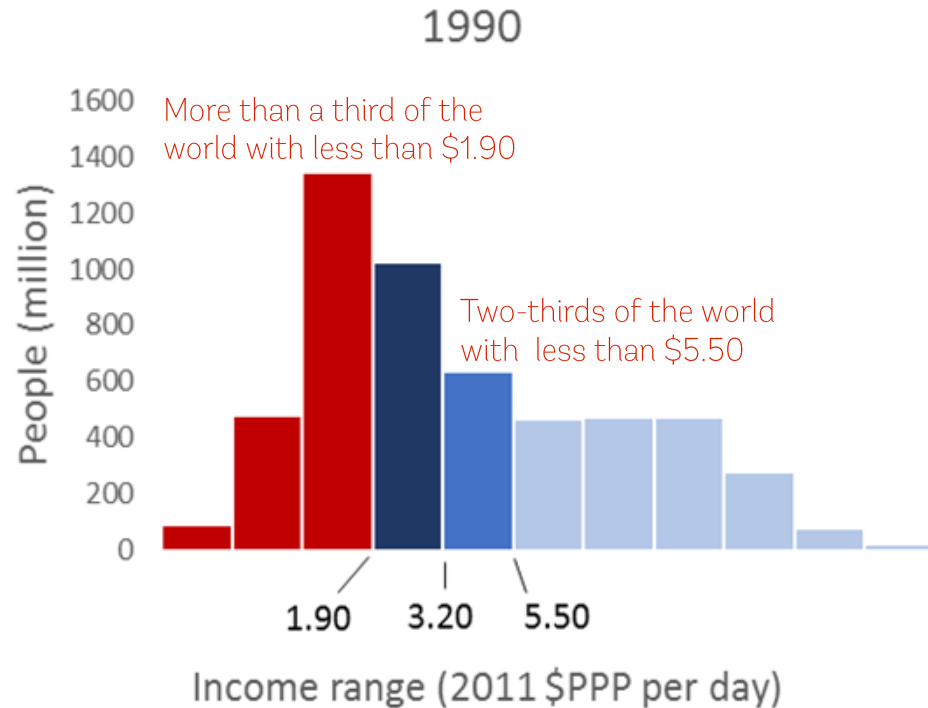
- In 1990, a majority of the poor lived in low-income countries, but today a majority of the poor live in middle-income countries

- $1.90 is not enough to live in a MIC environment

- Higher lines are lines more relevant for MIC countries

- The $3.2 and $5.5 lines are constructed based on information on the typical poverty line in LMICs and UMICs, respectively
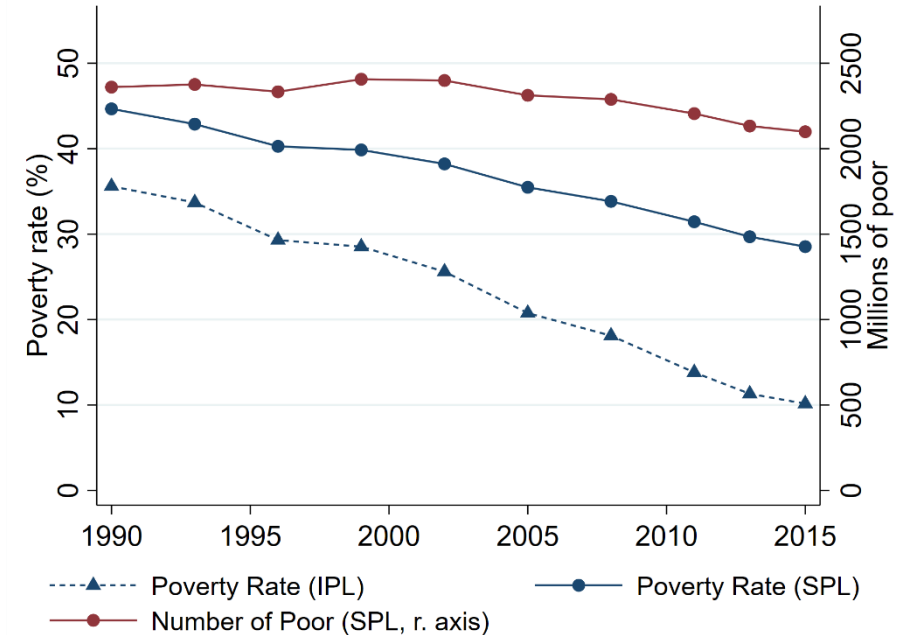
3.   Towards a broader conception of poverty: The societal poverty line

How countries define basic needs increases with income

Legend: ● National Poverty Line   ● Societal Poverty Line

Societal poverty declines more slowly with growth because the poverty line increases

Legend:
- - -▲- - - Poverty Rate (IPL)
——●—— Poverty Rate (SPL)
——●—— Number of Poor (SPL, r. axis)

- Societal Poverty Line (SPL) = max (IPL, $1+50% of median income/consumption)

- SPL reflects social & economic assessments of basic needs at different levels of development

- Combines elements of absolute and relative poverty

- 2.1 billion people are societally poor

3.   Towards a broader conception of poverty: The societal poverty line

TABLE 3.4 Societal Poverty Headcount Rates, 1990–2015

a. Region(s)	1990	1999	2008	2013	2015	Percentage change 1990–2015
East Asia and the Pacific	63.4	46.6	34.7	27.2	25.1	−38.3
Europe and Central Asia	22.2[a]	27.0	19.4	17.7	17.3	−4.9
Latin America and the Caribbean	33.9	34.0	29.4	27.5	26.9	−7.0
Middle East and North Africa	28.6	26.6	23.7	21.5	22.9	−5.7
South Asia	51.0	46.9[a]	42.0	35.4	32.9[a]	−18.0
Sub-Saharan Africa	57.9	61.2	53.3	49.9	49.0	−9.0
Sum of regions	50.6	44.3	37.0	31.9	30.6	−20.0
Rest of the world	15.5	15.2	15.4	16.0	16.0	0.5
World	44.5	39.7	33.7	29.6	28.4	−16.1

b. Income group	1990	1999	2008	2013	2015	Percentage change 1990–2015
Low income	63.6	65.0	55.6	51.4	51.2	−12.3
Lower-middle income	50.5	46.7	40.3	34.9	32.9	−17.6
Upper-middle income	50.8	39.7	30.4	24.7	23.5	−27.3
High income	15.8	15.8	15.9	16.4	16.3	0.5

Source: PovcalNet (online analysis tool), World Bank, Washington, DC, http://iresearch.worldbank.org/PovcalNet/.
Note: World Bank income classifications are current as of 2018. Change is measured in percentage points (pp). "Sum of regions" was previously referred to as "developing world" for which PovcalNet monitors poverty.
a. The criteria for estimating survey population coverage is whether at least one survey used in the reference year estimate was conducted within two years of the reference year.

3. Towards a broader conception of poverty: Multidimensional poverty

Income matters, but it is not the complete picture. Introducing a **multidimensional poverty measure**, anchored on the $1.90 international poverty line and adding non-monetary dimensions
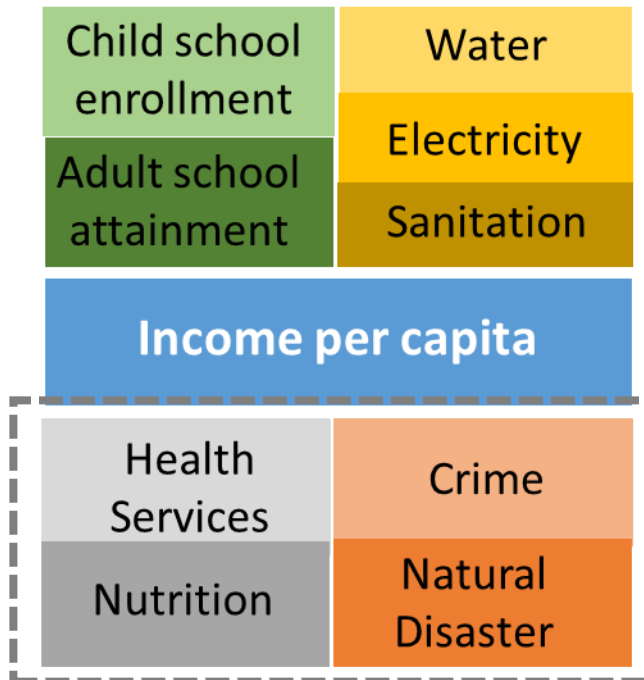
- **Motivation**: Consumption reflects command over critical goods (food, clothing, shelter), but other important services are not obtained through markets

- Main innovation: inclusion of monetary as one dimension. Allows to see the overlap between monetary and nonmonetary

- **Two complementary exercises:**

  - 119 countries, 3 dimensions

  - 6 countries, 5 dimensions

## TABLE 4.1 Dimensions of Well-Being and Indicators of Deprivation

Dimensions	Three dimensions (119 countries)	Five dimensions (6 countries)
Monetary poverty	Daily consumption or income is less than US$1.90 per person	Daily consumption or income is less than US$1.90 per person
Education	At least one school-age child up to the age of grade 8 is not enrolled in school	At least one school-age child up to the age of grade 8 is not enrolled in school
	No adult in the household (age of grade 9 or above) has completed primary education	No adult in the household (age of grade 9 or above) has completed primary education
Access to basic infrastructure	The household lacks access to limited-standard drinking water	The household lacks access to a basic-standard drinking water ("limited-standard" with an added criterion of the source being within a round trip time of 30 minutes)
	The household lacks access to limited-standard sanitation	The household lacks access to basic-standard sanitation ("limited-standard" with an added criterion of the facility for the exclusive use of the household)
	The household has no access to electricity	The household has no access to electricity
Health and nutrition		Any woman age 15–49 with a live birth in the last 36 months did not deliver at a health facility[a]
		Any child age 12–59 months did not receive DPT3 vaccination[a]
		Any child age 0–59 months is stunted (HAZ < −2)
		Any woman age 15–49 is undernourished (BMI < 18.5)
Security		The household has been subject to crime in the previous 12 months or lives in a community in which crime is prevalent
		The household has been affected by a natural disaster (including flooding, drought, earthquake) in the previous 12 months

Note: BMI < 18.5 = body mass index below 18.5 (underweight); DPT3 = diphtheria-pertussis-tetanus vaccine; HAZ < −2 = the height-for-age Z-score is below −2, that is, more than two standard deviations below the reference population mean.

a. If the indicator is not applicable, for example if the household includes no women who gave birth in the previous 36 months, the household is classified as deprived if the relevant deprivation rates in the subregion of residence are sufficiently high. Specifically, the deprivation threshold is set such that the share of individuals in nonapplicable households that are classified as deprived equals the national share of deprived individuals in applicable households who actually experienced a recent birth or have a child under age 6.

3.   Towards a broader conception of poverty: Like the SPL, the MDM contains the IPL at its core, but augments it

Poverty headcount, 119 economies, 2013
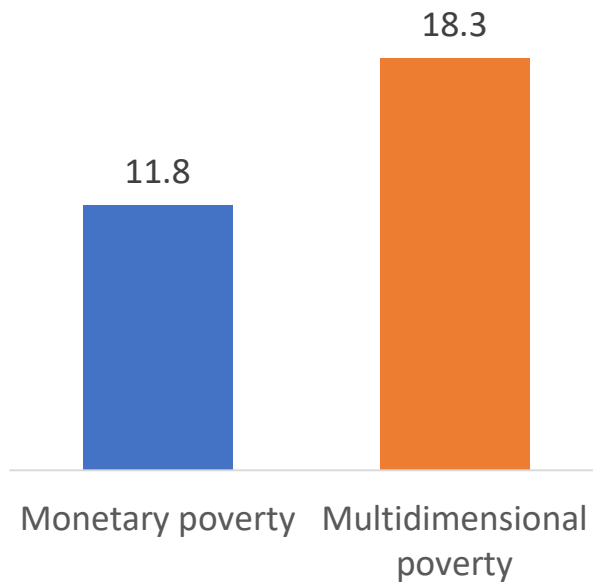
Multidimensional poor by dimension, 119 economies
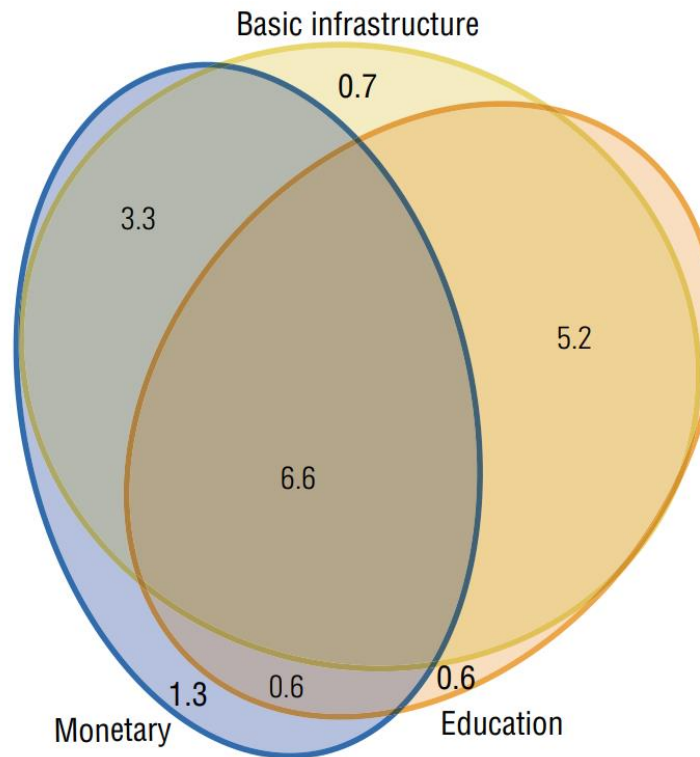
- Most of monetary poor also have deprivations in other dimensions

- In Sub-Saharan Africa the overlap is the highest

- In Middle East and North Africa, the extent of overlap between monetary and nonmonetary is lower.

- Three summary indices presented: H, M, D.

The numbers indicate the share of the total population. In the Venn diagram, the numbers represent the share of population that are multidimensionally deprived
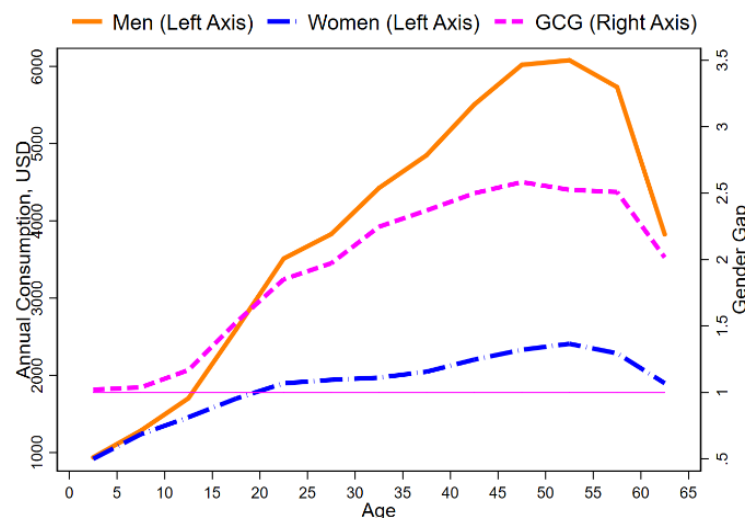
3.   Towards a broader conception of poverty: Looking inside the household, to get at "individual poverty"

There are large inequalities in consumption across gender over the life cycle in China.

Core food consumption

Extended food consumption

- Currently we are **unable to account for within-household inequality**; PSPR 2018 discusses options for overcoming this.

- In China, inequalities in consumption are largest when including tea, coffee, alcohol and tobacco

Source: Santaeulàlia-Llopis and Zheng 2017. China Health and Nutrition Survey (2009 round)

4.   Some of the many remaining challenges

1. Further harmonizing consumption aggregates
   a) Health, durables, imputed rent

2. Income aggregates
   a) Zero incomes
   b) Gross versus net

3. Spatial price deflation: documentation and harmonization
   a) Interface with PPPs and "capital city PPPs"

4. Refining line-up procedures
   a) Seeking an informed choice of pass-through parameters from NAS growth to HHS growth

5. Strengthen PovcalNet documentation
   a) Global Poverty Monitoring Technical Note series launched in April 2018

6. Further downstream:
   a) Individual poverty estimates
   b) Total error calculations

5.   Concluding thoughts

1.   **Poverty is a complex and multifaceted phenomenon**
     - Monitoring it requires a dashboard, not a single dial

2.   **Anchoring our global identification yardsticks to the choices made in countries was an excellent idea by the 'pioneers'.**
     - Beware the temptation of clinical, scientific precision
     - Some arbitrariness in the choice of poverty line is inevitable
     - Defer to people on the ground

3.   **A richer menu**
     - New servings anchored to the core dish on which SDG 1.1. is based

4.   **Please never forget: IPL(s) are meant for global comparisons**
     - National poverty discussions – the ones that ultimately matter most – should use local criteria.

5.   **Finally: Yes, we can always do better, and we welcome the critique and comments!**