Measuring Global Poverty
*Past, Present and Future*

Francisco H. G. Ferreira
The World Bank and IZA

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This presentation draws in part on “A Global Count of the Extreme Poor in 2012: Data issues, methodology and initial results”, *Journal of Economic Inequality*, 14(2): 141-172, with Shaohua Chen, Andrew Dabalen, Yuri Dikhanov, Nada Hamadeh, Dean Jolliffe, Ambar Narayan, Espen Beer Prydz, Ana Revenga, Prem Sangraula, Umar Serajuddin, and Nobuo Yoshida.
The question:

How much poverty is there in the world as a whole?
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(When poverty is thought of as extreme deprivation in the space of income or consumption expenditures, with respect to an internationally comparable poverty line)
Outline

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

2. Present: The 2015 update to the global poverty count
   i. Another new set of PPP exchange rates
   ii. Basic principles for incorporating them
   iii. Updating the poverty line
   iv. Other ingredients: incomes and prices
   v. Alternatives, robustness and remaining caveats
   vi. Results

3. Future: Whither global poverty measurement?
A brief history of global poverty monitoring at the World Bank

1. Ahluwalia, Carter and Chenery (JDE, 1979):

   • Use India’s poverty line (46\textsuperscript{th} percentile of per capita income = $0.56) and the 1975 PPPs (from the ICP covering 16 countries) to estimate the developing world’s poverty headcount.

   • Use consumption and income data from 25 countries, and predicted PPPs from Kravis, Heston, Summers to estimate poverty for 36 countries (covering “80% of the developing world excluding China”).

   • Find an in-sample poverty rate of 38% (or 644 million people) in 1975.
A brief history of global poverty monitoring at the World Bank

2. Ravallion, Datt and van de Walle (RIW, 1991) and the WDR 1990:

• Generate the original $1-a-day poverty line, using 1985 PPPs from the Penn World Tables

• This line (actually $31 per month) was “typical of poor countries” in the sense that it was shared to the nearest dollar by six low-income countries (Bangladesh, Indonesia, Kenya, Morocco, Nepal and Tanzania) and close to this range for two others (Philippines and Pakistan) from a sample of 33 national poverty lines.

• RDvW use data from 22 countries (predict to 64 countries), estimated global poverty based on 86 countries (covering 3.4 billion people).

• Find an in-sample poverty rate of 33% (or 1,137 million people) in 1985.
A brief history of global poverty monitoring at the World Bank

3. Chen and Ravallion (RIW, 2001):
   - Update the line to $1.08-a-day using 1993 PPPs for consumption.
   - Global line chosen as the median poverty line of the lowest 10 lines from WDR 1990 set.
   - Those 10 countries are Bangladesh, China, India, Indonesia, Nepal, Pakistan, Tanzania, Thailand, Tunisia and Zambia.
   - All numbers revised back in time to ensure consistency. Estimates based on data from 88 countries (297 national sample surveys)
   - Find an in-sample poverty rate of 23% (or 1,175 million people) in 1998.
A brief history of global poverty monitoring at the World Bank

4. 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.
# A brief history of global poverty monitoring at the World Bank

<table>
<thead>
<tr>
<th>Update:</th>
<th>1979 “India line”</th>
<th>1990 “Dollar-a-day”</th>
<th>2001 1.08/day</th>
<th>2008 1.25/day</th>
</tr>
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<tbody>
<tr>
<td>ICP data</td>
<td>1975 PPPs Kravis et al (1978)</td>
<td>1985 PPPs</td>
<td>1993 PPPs</td>
<td>2005 PPPs</td>
</tr>
<tr>
<td>Poverty lines used</td>
<td>1 (India)</td>
<td>8 countries</td>
<td>10 countries</td>
<td>15 countries</td>
</tr>
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<td>Method</td>
<td>India’s poverty line (46th pctile)</td>
<td>Inspection</td>
<td>Median</td>
<td>Mean</td>
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<td>Poverty line (ICP base year USD)</td>
<td>$0.56</td>
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<td>$1.08</td>
<td>$1.25</td>
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<tr>
<td>Country coverage</td>
<td>36 (25)</td>
<td>86 (22)</td>
<td>88</td>
<td>115</td>
</tr>
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</table>
(Some) critiques of the World Bank’s approach

• **Deaton (2010)** attribute the large increase in global poverty in the 2008 update to a change in the real value of the poverty line ($1.25 at 2005 PPPs).

• **Reddy and Pogge (2010)** criticize reliance on national poverty lines as a basis for the global line. They propose agreeing on a core set of capabilities to define global poverty, and then costing them in each country.

• **Klasen et al. (2016)** query certain specific choices in temporal and spatial price adjustments in the 2015 update. More fundamentally, they critique the apparent lack of robustness of GPM to new PPP rounds. Propose a short-term fix (fixing PPPs at 2011 or 2005 values, and updating lines by domestic inflation) and a longer-term approach, based on internationally-coordinated CBN poverty lines.
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3. **Future**: Whither global poverty measurement?
i. The 2011 Purchasing Power Parity exchange rates

• 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, 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 are methodological improvements, which correct for errors in the 2005 PPPs that had led to an 20-30% overestimate of the price levels in Africa and Asia
i. The 2011 Purchasing Power Parity exchange rates

• 2011 PPPs indicate **shift in regional profile of relative price levels:**
  
  • 2011 PPPs suggest **lower price levels in poor countries** (relative to US) => higher PPP-adjusted USD values of consumption & income.

• Convert 2005 PPP value => 2011 PPP value:

\[
\frac{CPI_{11}}{CPI_{05}} / \frac{PPP_{11}}{PPP_{05}}
\]

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

For US, \( \delta = 1.15 \)
ii. Basic 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 the goalpost.

3. The price levels most relevant for this exercise are those faced by the world’s poorest people.
ii. Basic Principles

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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
### iii. Updating the RCS15 $1.25/day line to 2011 PPPs

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

*Countries use category 4 price deflators in conversion.
iv. **Ingredients of the update**

1. **Distributions of Individual Wellbeing**
   - Household survey data

2. **Prices**
   - PPP conversion factors
   - Consumer price indices to deflate incomes or consumption over time
   - Spatial price adjustments in China, India, Indonesia, LAC, ECA

3. **Poverty line(s)**
   - Database of national poverty lines
Ingredient 1: Distributions of individual wellbeing

- Over 1,100 income and consumption distributions in PovcalNet, from national household surveys for ‘developing’ countries.
- Database now also contains data from rich countries, but these are not used for global poverty estimates.
- 133 countries used in the 2015 update.
- Survey data from 2010 to 2014 used in the 2012 estimate cover:
  - 86% of the developing world’s population
  - >90% in EAP, ECA, LAC and SAR
  - 68.7% in AFR
  - 37.4% in MENA

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grouped</td>
<td>Micro data</td>
</tr>
<tr>
<td>Income</td>
<td>6</td>
<td>26</td>
</tr>
<tr>
<td>Consumption</td>
<td>68</td>
<td>26</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>74</strong></td>
<td><strong>52</strong></td>
</tr>
</tbody>
</table>

Note: The tables show the number of distributions for different categories (Grouped, Micro data, Total) for the years 2014 and 2015.
Ingredient 2: Prices (changes over time)

<table>
<thead>
<tr>
<th>PovcalNet uses FOUR different categories of price deflators</th>
</tr>
</thead>
<tbody>
<tr>
<td>WDI annual CPI – general</td>
</tr>
<tr>
<td>Monthly CPI from NSO (consistent with annual number in WDI)</td>
</tr>
<tr>
<td>CPI disaggregated by urban-rural areas (official CPI for China and India)</td>
</tr>
<tr>
<td>CPI adjustment for 7 countries using alternative price indices (Bangladesh, Cambodia, Ghana, Iraq, Lao PDR, Malawi and Tajikistan).</td>
</tr>
</tbody>
</table>

Countries in blue are among the countries that define poverty line, thus choice of CPI also affects international poverty line.
Ingredient 2: Prices (differences within countries)

- Because the collection of price data for constructing PPPs still retains an urban bias – albeit to the different extents in different regions – we follow Chen and Ravallion (QJE, 2010) in making urban-rural cost of living adjustments. In particular:
  - For China, India & Indonesia, we use ratios of urban to rural poverty lines;
  - For LAC, adjust rural incomes up by a uniform factor of 15% (following SEDLAC practice, on the basis of the average cross-country difference in costs of living);
  - For ECA, consumption aggregates are adjusted for observed spatial price differences (based on unit values from food consumption in HH surveys);
- Greater cross-regional harmonization is needed!
Alignment of survey data to ICP reference years

- To estimate poverty at a common point in time, surveys are lined up to ICP reference year (e.g. 2005, 2011)

- If a survey is not available in the reference year, closest survey(s) are extrapolated to reference year using adjusted NAS growth rates.
  - GDP growth used in AFR, Private Consumption Expenditures used in other regions.
  - Using adjustment factors between survey and NAS growth from Ravallion (2003): 0.87 for most countries; lower for China, India.

Example: Surveys available before/after reference year

Source: Policy Research Report; Ravallion & Chen, 2004
This update in historical context

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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.
Remaining caveats: (i) underlying welfare aggregates

• As noted, PovcalNet includes both consumption and income distributions
  • This is possibly appropriate, given national differences and priorities
  • But the two are very different concepts, and comparability is difficult
  • Existence of zero incomes are a real problem, that is likely to grow

• Differences in questionnaires hamper comparability even among consumption distributions
  • E.g. URP vs. MMRP questionnaires in India

• MENA: Limited coverage, PPP issues, and widespread conflict precluded presentation of regional numbers.
ΔCPI and ΔPPP both reflect changes in prices, expect to co-move. Large deviations, potentially due to data quality issues in CPI and/or PPP, result in large shifts in poverty. ‘Outliers’ identified by: Ratio of ΔCPI (CPI2011/CPI 2005) to ΔPPP (PPP2011/PPP2005) for each country. Decisions also reflect concerns from country economists.

> mean + 2 S.D.:
Bangladesh, Cabo Verde, Egypt, Iraq, Jordan, Yemen
For these countries we report numbers with 2005 PPPs and $1.25 line

> mean + 1 S.D.:
Cambodia and Lao PDR and 6 other PovcalNet countries
Substitution considered on case-by-case basis with poverty economists

< mean - 1 S.D.:
BLR, UKR, MEX and OECD/Eurostat
No action taken

Remaining caveats: (ii) PPP outliers

Mean: 1.466; S.D.: 0.304
(without IRQ: 1.455; 0.277 – same countries excluded)
vi. Results (Recall basic effect of new PPPs)

- 2011 PPPs indicate shift in regional profile of relative price levels:
  - 2011 PPPs suggest **lower price levels in poor countries** (relative to US) => higher PPP-adjusted USD values of consumption & income.

- Convert 2005 PPP value => 2011 PPP value:
  \[
  \frac{CPI_{11}}{CPI_{05}} \times \frac{PPP_{05}}{PPP_{11}} = \delta_z = 1.90/1.25 = 1.52
  \]
  Change in CPI relative to change in PPPs. Can be thought of as country-specific PPP05 -> PPP11 deflators.

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

Note: Fitted line uses lowest smoother with bandwidth 0.8. Sample limited to countries which participated in both the 2005 and 2011 ICP rounds. \( \delta = 1 \) means no change to the PPP-adjusted dollar value between 2005 and 2011 PPPs.
vi. Results: global and regional patterns (mostly) preserved

Poverty headcount rate 2011

- **Sub-Saharan Africa**: 44.4 (2014 update), 46.9 (2015 update)
- **South Asia**: 22.2 (2014 update), 24.5 (2015 update)
- **East Asia and Pacific**: 7.9 (2014 update), 8.5 (2015 update)
- **Latin America and the Caribbean**: 4.6 (2014 update), 5.9 (2015 update)
- **Europe and Central Asia**: 0.5 (2014 update), 2.4 (2015 update)

- **2014 update ($1.25, 2005 PPPs)**
- **2015 update ($1.90, 2011 PPPs)**
vi. Results: Regional headcount trajectories (1990-2011) also largely preserved
vi. Results: Depth of poverty (1990-2011)
vi. Results: Absolute numbers of people in poverty (1990-2011)
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3. **Future:** Whither global poverty measurement?
The Atkinson Commission on Global Poverty

Set up in June 2015, the 24-member commission was tasked with providing advice to the World Bank’s Sr. VP and 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 2015, 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 Atkinson Commission on Global Poverty

• Final report will be launched on July 13
• 21 recommendations in total. A (non-random) selection includes:

Part A:
• Strengthen statistical foundations, on areas such as population statistics and survey coverage; measuring consumption and income; and estimating sampling and non-sampling errors
• Keep monitoring global extreme poverty w.r.t. $1.90/day at 2011 PPPs, but ignore future PPP updates. Use domestic CPIs

Part B:
• Add a set of complementary indicators, including:
  1. The poverty gap
  2. A measure sensitive to relative deprivation, where appropriate
  3. Profiles of the global poor, e.g. by gender and age
  4. Deprivations in other dimensions, and some aggregate multi-dimensional index
This homeless US citizen may well live on U$2 per day. Should he not be counted as poor in the global measure?
i. Incorporating relativity?

“To the extent that poverty means a low level of welfare and welfare depends on relative consumption as well as own consumption, higher monetary poverty lines will be needed in richer countries to reach the same level of welfare” (Ravallion, 2016)

Ravallion (2016) proposes: (i) keeping the current absolute line as a lower bound; (ii) creating an upper-bound international poverty line that is weakly relative - it rises with income with an elasticity lower than one - and is still anchored on observed national poverty lines.

**Figure 2: Strongly and weakly relative poverty lines**

i. Incorporating relativity?

• We currently plan to adopt a proposal by Jolliffe and Prydz (work in progress) for a daily weakly relative poverty line:

\[
\text{Max}(1.90, 1 + 0.5 \text{ median})
\]

• Best fit estimate from a level-on-level regression of national implicit poverty lines (for 100+ countries in 2011) on median household incomes

• Official WB counts may be based on a step function derived from a such a line.
i. Incorporating relativity?

**Poverty rate**

- 1.9/day
- \( \max(1.9, 1+50\% \times \text{med}) \)

**Number of poor**

- 1.9/day
- \( \max(1.9, 1+50\% \times \text{med}) \)

*Preliminary and incomplete analysis - NOT TO BE CITED*
ii. Incorporating non-income dimensions?

Multidimensional analysis of poverty is recommended when:

1. When there are at least two welfare dimensions of interest between which there are no natural aggregators (e.g. prices)...
2. ...and when correlations between them matter.

“It is possible for a set of univariate analyses done independently for each dimension of well-being to conclude that poverty in A is lower than poverty in B while a multivariate analysis concludes the opposite, and vice-versa. The key to these possibilities is the interaction of the various dimensions of well-being in the poverty measure and their correlation in the sampled populations” (Duclos, Sahn and Younger, EJ 2006, p.945)
ii. Incorporating non-income dimensions?

- Old debate: aggregation into an index vs. dashboard
- My take (with M.A. Lugo): a middle ground focused on making the association between dimensions explicit.
- But: how to present this information succinctly for 130 countries?
  - If you summarize the population mass in the intersections of the Venn diagram above, you are back at the MPI (Alkire & Foster, 2011):

\[ g_{ij}^\alpha(k) \quad \text{Typical entries into which are} \quad \begin{cases} 
\left[ \frac{y_{ij} - z_{ij}}{z_j} \right]^\alpha, & i : c_i \geq k \\
0, & i : c_i < k
\end{cases} \]

- Has both attractive and unattractive features.
- May be best option for a reduced, core set of three or four dimensions?
iii. Individual poverty
iv. Chronic poverty

• Two additional directions of interest in advancing global poverty measurement are:

1. Given intra-household inequalities, is poverty more severe among women than men? Or children than adults? Or the elderly?
   • Inroads into this question have been made (at the national level), and are usually based on disaggregated consumption patterns.
   • Data requirements for doing this globally are very demanding.
   • In the short run, should one report profiles based on the assumption of intra-household equality?

2. Cross-sectional household surveys are snapshots, and we typically care more about the chronically poor than about the transient poor.
   • Assessing the extent of global chronic poverty would require panel (or synthetic panel) data that are currently not available.
Conclusions (i)

1. Given the prevalent view that the 2011 PPPs capture recent price level differences across countries more accurately, global poverty comparisons needed adjusting.

2. This adjustment was implemented so as to minimize differences w.r.t. the $1.25 line at 2005 PPPs, so as to preserve goalposts for international goals.

3. Because the 2011 PPPs found lower prices in poorer countries, maintaining purchasing power parity translates into higher incomes (and poverty lines) in dollar terms.

   - On average, $1.90 at 2011 PPPs has roughly the same purchasing power in poor countries as $1.25 at 2005 PPPs.
   - As a result, changes to both levels and trends of poverty incidence (regionally and globally) are muted.
   - But there are substantial changes for some individual countries.
Significant challenges remain going forward, including:

- Better understanding the drivers of periodic changes in PPPs (for which access to ICP micro-level price data is essential)
- Improving and harmonizing within-country cost-of-living adjustments
- Defining an upper-bound international poverty line that incorporates the existence of relative deprivation
- Monitoring deprivation in key non-income dimensions – e.g. health and education – as well as associations among them (and with income)
- Investigating poverty at the individual level, accounting for intra-household differences between genders and age groups
- Investigating poverty dynamics to separate chronic from transient poverty
Thank you