

# Consumer Price Indices used in Global Poverty Measurement

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## Abstract

Temporal deflators are needed to compare welfare aggregates over time, and thus to measure real changes in poverty. This note describes the sources of the consumer price indices that are used for every country included in the World Bank's estimates of global poverty, published in PovcalNet. These deflators are used to express welfare aggregates in domestic 2011 prices, for comparison with the 2011 PPP conversion factors.

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- Description of the decimal-year CPI (section 3, bullet 4) has been corrected.
- Description of the CPI used for China (section 5) has been corrected.
- Table A.1 has been dropped. The most up-to-date table with CPI sources will be published in the “What’s New” technical note released with every PovcalNet update.

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## 1. Introduction

To compare living standards over time, it is important to account for changes in the price level faced by households. With a positive rate of inflation, a Rupee received today will buy more goods than a Rupee received next year. Hence the consumption expenditure or income that are recorded at current prices in a household survey need to be deflated to a common base year before they can be compared over time. This deflation typically uses a consumer price index (CPI), which reflects changes in average prices in an economy by measuring the prices of a representative basket of goods.

This note describes the sources of the CPI data that are currently (September 2018) used by the World Bank in its global poverty estimates published in PovcalNet. In the simple framework described in Azevedo et al. (2018), this is referred to as the between-survey temporal adjustment.<sup>1</sup> Other components of the global price adjustment are described elsewhere; for example, Atamanov et al. (2018) describe the purchasing power parity exchange rates that are used in the global poverty estimates.

The next section provides an overview of the temporal deflators used in PovcalNet, while sections 3-5 go into more detail on each of the sources. Table A.1 in the Appendix of the “What’s New” technical note released with each PovcalNet update gives the source of the deflator for all countries for which the World Bank monitors poverty. This table will be updated as estimates are revised and new country-years are added.<sup>2</sup>

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<sup>1</sup> In Azevedo et al. (2018), the between-survey temporal adjustment is denoted by  $T_{c,a,t^b,t^{PPP}}^{BS}$ . It captures the inflation between  $t^b$ , the common time period to which all welfare aggregates within a survey have been deflated, and  $t^{PPP}$ , the PPP reference year (currently 2011).

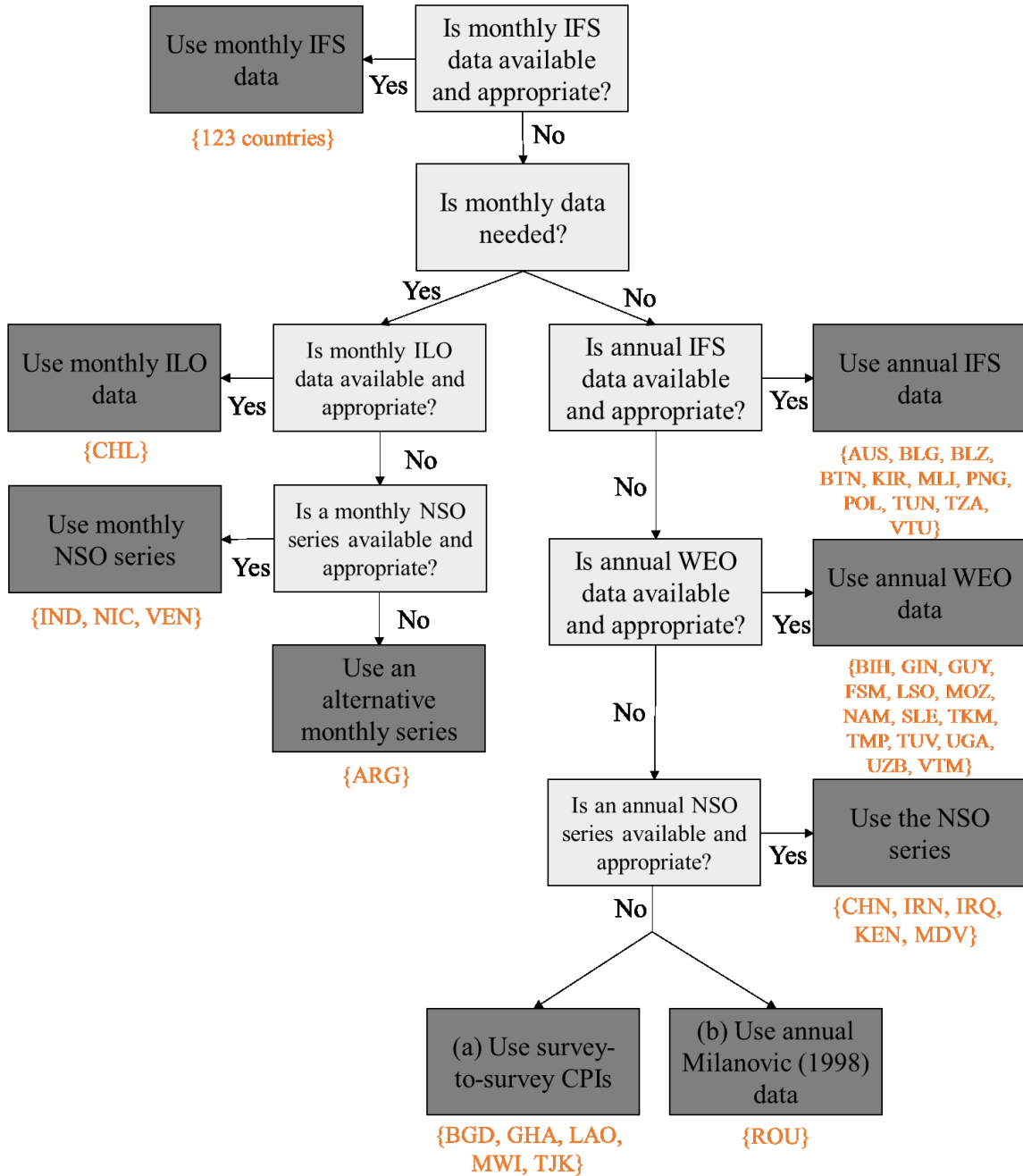
<sup>2</sup> In the report of the Commission on Global Poverty, Prof. Anthony Atkinson recommended that the World Bank, in conjunction with national and international partners, should work towards improving the quality of domestic CPIs with a particular attention to the prices faced by the poor (World Bank, 2017). We expect to update the CPIs as we make progress on these issues.

## 2. Overview of temporal deflators used

A variety of CPIs are used in the World Bank’s monitoring of global poverty. This is necessary to account for the differences in data availability, data quality, and the timing of surveys. PovcalNet uses a decision tree to choose which CPIs to use for poverty monitoring, as summarized in Figure 1. The figure and the details described below pertain to the CPIs used for the September 2018 update of PovcalNet. As new information becomes available and CPI series get updated, occasionally some countries will move up and down the tree. The CPI source for each country-year is given in the “What’s New” technical note released with every PovcalNet update (Table A.1 in the Appendix).

The CPI used in PovcalNet reflects changes in the domestic price level between the common time period to which the welfare aggregates in the survey may have been deflated ( $t^b$ ) and 2011, the purchasing power parity (PPP) reference year ( $t^{PPP}$ ) (also see Azevedo et al., 2018). Depending on the survey,  $t^b$  may be a month, a calendar year or a combination of two years, as explained below. Table A.1 in the Appendix of the “What’s New” technical note released with each PovcalNet update lists the type (monthly, annual or combined annual) and source of CPI data for each country-year. The values of the CPI used can be found at <http://iresearch.worldbank.org/PovcalNet/data.aspx>.

**Figure 1.** Decision tree over which temporal deflator to use



*Note:* The figure summarizes the decision process used to determine which deflator to use. If a country uses several sources, the country label (ISO country code) is placed at the source lowest in the tree. For example, for most of the countries listed under “Use annual WEO data”, monthly IFS data are used for most years but these data do not reach back far enough to cover the oldest survey years, where the WEO data are then used.  
*Date:* Refers to CPIs used for the September 2018 PovcalNet update.

### 3. Baseline source: IMF's International Financial Statistics

The baseline source of CPI data is the IMF's International Financial Statistics database (IFS). The vintage of the IFS data used is updated annually in December of the previous year, i.e. the April and September 2018 PovcalNet updates use the December 2017 IFS vintage. The IFS contains monthly, quarterly, and annual CPIs. As a baseline, PovcalNet uses the monthly CPIs.

The monthly IFS CPIs are applied in four different ways, depending on whether the welfare aggregate has been deflated to a particular time period and depending on the timing of the fieldwork:

- 1) If the welfare aggregate of the survey has been deflated to a particular month (meaning that  $t^b$  denotes a month), then the relevant monthly CPI is used.
- 2) If the welfare aggregate has been deflated to annual average prices (meaning that  $t^b$  denotes a calendar year) or if the welfare aggregate has not been deflated but all fieldwork took place in the same calendar year, then the 12 monthly CPIs are averaged to form an annual CPI.<sup>3</sup>
- 3) If it is known that the survey spanned several months (and the welfare aggregate has not been deflated to a particular month), or if the welfare aggregate has been deflated to a range of months, then the average monthly CPIs of these particular months is used. For some countries, this method is also used when the survey spanned two years and the welfare aggregate has not been deflated.
- 4) In some countries where the survey spanned two years (and the welfare aggregate has not been deflated), the share of the fieldwork conducted in each year is used to compute a weighted annual CPI. These country-years appear with a decimal year in the

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<sup>3</sup> In several cases, creating annual CPIs by averaging the 12 monthly CPIs results in different CPIs than the annual CPIs provided by the IFS. For this reason, we always construct the annual series from the raw monthly CPIs (as long as the latter are available).

PovcalNet database. For example, PovcalNet lists a survey for the Gambia with year 2015.31, which implies that 69% of the months of the fieldwork fall in 2015 while 31% of the fieldwork months fall in 2016. The CPI applied to this survey is given by the following expression:

$$CPI_{2015.31}^{IFS} = 0.69 * \frac{1}{12} \sum_{i=1}^{12} CPI_{2015,i}^{IFS} + 0.31 * \frac{1}{12} \sum_{i=1}^{12} CPI_{2016,i}^{IFS} \quad (1)$$

where  $CPI_{2016,i}^{IFS}$  is the IFS CPI in month  $i$  of 2016.

For 123 out of the 164 countries for which the World Bank monitors poverty, monthly IFS CPI data are the only source used.

In a further eleven countries, there is at least one year with a survey where IFS does not contain all the necessary monthly data, but it does contain the necessary annual data. This is the case for the entire series for Australia, Kiribati, Papua New Guinea and Vanuatu, as well as for certain years for Bulgaria, Belize, Bhutan, Mali, Poland, Tunisia, and Tanzania.<sup>4</sup> In these cases, the average monthly IFS CPIs are extended with the annual IFS CPIs.

#### **4. Alternative international databases: WEO and ILO**

In several cases, the monthly and annual IFS series do not reach back far enough to cover all the years for which PovcalNet monitors poverty in a country. In these cases, the alternative CPI chosen depends on whether monthly or annual data are needed. If monthly data are needed, the primary back-up source is the monthly CPIs from the International Labor Organization (ILO). For example, these are used in Chile prior to 2007 when IFS data are unavailable.

If only annual data are needed, the CPI series from the World Economic Outlook (WEO) are used as the primary back-up source. WEO CPIs are used in 14 countries (for some years): Bosnia and Herzegovina, Guinea, Guyana, Lesotho, Micronesia, Mozambique, Namibia, Sierra Leone, Timor-Leste, Turkmenistan, Tuvalu, Uganda, Uzbekistan, and Vietnam. For

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<sup>4</sup> Bhutan 2003 is an exception. Here annual CPIs are available and monthly CPIs are not, but the annual CPI is incorrect. The annual CPI has been recomputed by averaging the Q2 and Q3 CPIs (Q4 is unavailable).

Micronesia, Turkmenistan, Tuvalu, and Uzbekistan, IFS data are not available at all and the entire CPI series is taken from the WEO.

## **5. Country-specific CPI series**

In 15 countries, IFS, WEO and ILO data are either not available or not deemed appropriate for poverty monitoring. The CPIs used for these countries broadly fall into three categories: Series provided by National Statistical Offices (NSO's) (or other government agencies), CPI series from other sources, and alternative deflators between survey years.

### 5.1 NSO series

For eight countries, the CPIs are provided by NSOs (or other government agencies). This applies to China, India, Iran, Iraq, Kenya, Maldives, Nicaragua, and Venezuela. For China and India, NSO CPIs are used since PovcalNet distinguishes between rural and urban inflation rates. For India, the two series are taken from the Ministry of Labour and Employment. The rural series is the Consumer Price Index for Agricultural Labourers while the urban series is the Consumer Price Index for Industrial Workers.<sup>5</sup>

In China, from 1981-2005, both the urban and rural CPIs are from the China Statistical Yearbooks.<sup>6</sup> During the food price crisis around 2006-2008, food inflation in China was much higher than overall inflation in both rural and urban areas. Since the poor spent proportionally more on food than average, the urban and rural CPIs reported by the NSO may not reflect the price increase for poor people. Therefore, from 2006 to 2010, the rural CPI is the weighted food and non-food CPI, using the expenditure share of the poorest 5 percent as weights. Food and non-food CPIs are from China Statistical Yearbooks while expenditure shares are from the Poverty Monitoring Reports of Rural China. From 2010 onwards, the rural CPI is derived from changes in the rural poverty line as reported in the 2016 Poverty Monitoring Report of Rural China. Similar to the rural CPIs, urban CPIs from 2006-2011 are weighted by food and non-

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<sup>5</sup> For a more general discussion around the choice of price deflators in India, see Box 6.3 in Jolliffe et al. (2015).

<sup>6</sup> Rural CPIs are only available from 1985, from 1981-1984 the retail price index from the 2001 China Statistical Yearbook is used.



food CPIs using expenditure shares of the poorest 5 percent as weights. Both CPIs and the expenditure shares are from China Statistical Yearbooks. Starting in 2012, since the food share of the bottom 5 percent is no longer published, the urban CPI is taken directly from the National Bureau of Statistics of China.<sup>7</sup>

## 5.2 Alternative country-specific series

In the case of Argentina, private estimates of inflation are used from 2007 to 2012 and official NSO sources otherwise. For Romania in 1989, IFS data are lacking and WEO reports inflation rates, which yield an unrealistically high survey mean in 1989. Therefore, we use the inflation rate reported in Milanovic (1998) which is judged to be more credible.

## 5.3 Alternative deflators between survey years only

Finally, in five countries (Bangladesh, Ghana, Laos, Malawi and Tajikistan), alternative deflators have been constructed to deflate between two survey years. This method is applied when no external CPI series exists or when no external CPI series is considered adequate for poverty monitoring, as these may not accurately reflect the changes in price levels experienced by the poor (also see Ferreira et al., 2016, p. 153). Methods differ across countries – in some countries the price data in the national CPI are reweighted using a consumption basket that matches the expenditures of the poor more closely, while in other countries the price index is the inflation implicit in the cost of basic needs poverty lines.<sup>8</sup>

What these methods have in common is that they provide an inflation rate between two survey years. Unless one of the two surveys occurred exactly in 2011, an additional CPI source (typically IFS data) is needed to compute the CPI series with 2011=1, the base year of the PPPs. In other words, while the IFS CPI series did not produce credible inflation rates between the two surveys, it can be used to extend the survey-based deflator to 2011, or to interpolate

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<sup>7</sup> This implies that rather than using the expenditure shares of the bottom 5 percent to weight the non-food and food CPI, the expenditure patterns of the entire urban population are used.

<sup>8</sup> Olsen Lanjouw and Lanjouw (2001) propose such an index based on basic needs poverty lines. Also see Chapter 6 of Jolliffe et al. (2015).

in-between the two surveys. Suppose the first survey took place at time  $t_1$  and the second survey took place at time  $t_2$ . We can then distinguish between the following three scenarios:

- 1) If  $t_1 < t_2 < 2011$ , then IFS data (and if they are unavailable, WEO data) are used to construct a CPI series with base 2011=1. For example, in Tajikistan, a survey-based inflation rate is used between the 2004 and 2007 surveys. After 2007 IFS data are used to go from the 2007 value to 2011 and construct a full CPI series with value 2011=1.
- 2) Conversely, if  $2011 < t_1 < t_2$ , IFS CPIs are used between 2011 and  $t_1$ .
- 3) If  $t_1 < 2011 < t_2$ , we need to make an assumption about how much of the inflation between  $t_1$  and  $t_2$  had occurred by 2011. PovcalNet uses the following formula:

$$\widetilde{CPI}_{2011} = \widetilde{CPI}_{t_1} + \frac{CPI_{2011}^{IFS} - CPI_{t_1}^{IFS}}{CPI_{t_2}^{IFS} - CPI_{t_1}^{IFS}} (\widetilde{CPI}_{t_2} - \widetilde{CPI}_{t_1}) \quad (2)$$

where  $\widetilde{CPI}_t$  is the alternative (survey-year) deflator. The fraction in equation 2 shows the share of total inflation between  $t_1$  and  $t_2$  that had occurred by 2011 according to IFS data. If, say, 20% of the IFS inflation had occurred by 2011, we assume that 20% of the survey-year inflation between year  $t_1$  and  $t_2$  had occurred by 2011. Once  $\widetilde{CPI}_{2011}$  is computed, the entire series can be rebased such that  $\widetilde{CPI}_{2011} = 1$ .

The third approach is used in Bangladesh. The alternative deflator shows an inflation rate of 41.7% between the 2010 and 2016 surveys.<sup>9</sup> We can base this inflation rate at 2010 to create a CPI series where  $\widetilde{CPI}_{2010} = 1$  and  $\widetilde{CPI}_{2016} = 1.417$ . IFS data suggest that 20.8% of the inflation between 2010 and 2016 had occurred by 2011. Hence, PovcalNet assumes an inflation rate of 8.7% between 2010 and 2011 (41.7%\*20.8%), which yields  $\widetilde{CPI}_{2011} = 1.087$ . Now the series can be rebased to 2011, such that the final CPI value for 2010 is 0.92 (1/1.087), while the final CPI value for 2016 is 1.30 (1.417/1.087).

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<sup>9</sup> For a detailed discussion of the various price indices in Bangladesh and the implications for the trends in poverty rates, see Gimenez and Jolliffe (2014).

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## Appendix

Table A.1 in the Appendix of the “What’s New” technical note released with each PovcalNet update lists the source of CPI used for each country-year reported in PovcalNet. The columns in the table are defined as follows.

- **Code:** The 3-letter country code used by the World Bank: <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>
- **Country name:** Name of country
- **Year(s):** Welfare reporting year, i.e. the year for which the welfare has been reported. If the survey collects income for the previous year, it is the year prior to the survey. This is identical to the year variable used in PovcalNet.
- **CPI period:** Common time period to which the welfare aggregates in the survey have been deflated. The letter Y denotes that the CPI period is identical to the year column. When the welfare aggregate has been deflated to a particular month within the welfare reporting year, the month is indicated by a number between 1 and 12, preceded by an M, and similarly with a Q for quarters. The letter W indicates that a weighted CPI is used, as described in equation 1 in the main text.
- **CPI source:** Source of the deflator used. The source is given by the abbreviation, the frequency of the CPI, and the vintage; e.g. IFS-M-201712 denotes the monthly IFS database version December 2017. For country-specific deflators, the description is given in the text or further details are available upon request.

**Table A.1.** Source of temporal deflator used in PovcalNet

[See Appendix of the “What’s New” technical note released with each PovcalNet update]