Approach to produce 2017 - 2021 PPPs Time Series Calculations

International Comparison Program (ICP)
Technical Advisory Group (TAG)

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Overview

ICP2021 cycle will employ the approach developed by Inklaar and Rao (2019) and utilized for the estimation of global PPP timeseries for 2011 to 2017 during the ICP 2017 cycle.

Two main challenges to this approach in the ICP 2021 cycle:

- COVID impact on expenditure
- Change of CIS-Linking

Input Data

- ICP Global PPP estimates for two benchmark years
- Deflators (CPI and national account deflators at most detailed level available)
- Expenditure data for all years
- Exchange rate data for all years
- Regional benchmark (RBM) PPPs for interim years for EUO and WAS

	AFR	ASI	CIS	EUO	LAT	WAS
2017	ICP	ICP	ICP	ICP	ICP	ICP
2018				RBM		RBM
2019				RBM		RBM
2020				RBM		RBM
2021	ICP	ICP	ICP	ICP	ICP	ICP

STEP 1: Data preparation

Deflator data

a. CPI for main aggregates and below / deflator for GDP level
b. From BHs assign the lowest available level of deflator to each aggregate

Expenditure data

a. Data from RIAs is augmented using the expenditure share applied to the next available higher aggregate by linearly interpolating between the benchmark years as below:

$$S_c^t = S_c^{t_0} + (t - t_0)\frac{S_c^T - S_c^{t_0}}{T - t_0}$$

Where t_0 and T are the two benchmark years and S_c^t is the expenditure share in interim year t

STEP 2: BH PPPs time series interpolation

- Estimate linked BH $PPP_c^{L,t}$ for interim year t in country c using geometric version of PWT interpolation:

$$PPP_c^{L,t} = \left[PPP_c^{L,t_0} \times \frac{P_c^t \,/\, P_c^{t_0}}{P_{USA}^t \,/\, P_{USA}^{t_0}} \right]^{1-w^t} \times \left[PPP_c^{L,T} \times \frac{P_c^t \,/\, P_c^T}{P_{USA}^t \,/\, P_{USA}^T} \right]^{w^t}$$

Where P_c^t is the deflator in country C and $w^t = \frac{t-t_0}{T-t_0}$.

- For each year, calculate global productivity adjustments and apply them to basic headings 130221 and 1401111 for non-switching countries

STEP 3: Estimate PPPs time series for regions RBM estimates for interim years (WAS)

- For WAS adjust the interim RBM BH PPPs through the CAR-PPP method as below:

$$PPP_j^{F,t} = PPP_j^{R,t} \times \left[\prod_{c \in R} PPP_c^{L,t}\right]^{\frac{1}{N_R}} / \left[\prod_{c \in R} PPP_c^{R,t}\right]^{\frac{1}{N_R}}$$

Where N_R is the number of countries in the Region. $PPP_c^{L,t}$ is the linked BH PPP for interim year t, and $PPP_c^{R,t}$ is the RBM BH PPP.

- RBM PPPs are multiplied by an adjustment factor given by the geometric average of linked PPPs for the region divided by the geometric average of the regional PPPs for the region.

STEP 4: Time series aggregation and linking

For any given aggregate and any given year calculate GEKS PPPs for:

- **Each core region, using the linked BH PPPs** (needed for regional shares to obtain fixity)
- **EUO and CIS together** (needed for regional shares to obtain fixity for CIS linking for 2017)
- **CAR and LAT together** (needed for regional shares to obtain fixity for CAR linking)
- **EUO and Georgia and Ukraine together** (needed for regional shares to obtain fixity for Georgia and Ukraine linking)
- **Each core region, using country membership from the last benchmark** (this is needed for the country which switched region).
- **Each core region, using country membership from the first benchmark** (this is needed for the country which switched region).
- **Global unrestricted GEKS for the core regions.**

STEP 4: Time series aggregation and linking (ii)

The regions are then linked as follows:

- The core regions (Africa, Asia-Pacific, Eurostat-OECD, Latin America, Western Asia and CIS) using the **CAR-Volume** method
- CIS to Eurostat/OECD using the **CAR-PPP method** (for 2017)
- The Caribbean to Latin America using the **CAR-Volume method**
- Georgia and Ukraine (in 2017) using the **CAR-PPP method to Eurostat-OECD**

Countries who switched region or participation status (i.e from non-benchmarked to participating) require a special treatment:

- Adjust their linked PPPs by the geometric average of linked PPPs for the region excluding their membership divided by the geometric average of the linked PPPs including their membership.

Challenges

I. Treatment of CIS in interim year: core region vs linked to EUO

II. Impact on COVID-19 on expenditure augmentation for interim years

III. Computational intensity

Challenge 1: linking of CIS-region

- ICP 2021, CIS is treated as the **6th core region** for global linking, while **linked via RUS** to EUO in 2017.
- TAG recommended rev. 2017 PPPs to maintain the original methodology (i.e CIS linked to EUO).

What approach for interim years?

- Geometric average between the two estimates
- Geometric weighted average of the two estimates (weights depending on the proximity to the two benchmark years)
- EUO-linked estimates for 2017-2020, and benchmark estimates in 2021.

Challenge 2: Impact of COVID-19 on expenditure structure

- Two regions and some countries in other regions need "gap-filling" for detailed expenditures for interim years to be used in PPP aggregation

MA = Main Aggregate, CAT = Category, BH = Basic Heading

Region	(rev) 2017	2018*	2019*	2020*	2021
AFR	BH	BH	BH	BH	BH
ASI	BH	CAT	CAT	CAT	BH
CIS	BH	MA	MA	MA	BH
EUO	BH	BH	BH	BH	BH
LAC	BH	BH	BH	BH	BH
WAS	BH	BH	BH	BH	BH

*Indication of BH, CAT, MA for interim year is a general regional information and does not necessarily mean all the countries in the region provide the same level of information covering entire GDP for interim years.

Challenge 2: Impact of COVID-19 on expenditure structure (II)

- Current approach linearly blends weights from two benchmark years

	Year 1	Year 2	Year 3	Year 4	Year 5
ICP 2021	2017	2018	2019	2020	2021
3 year-interval	1 + 0	3/4 + 1/4	2/4 + 2/4	1/4 + 3/4	0 + 1

- However, EXP data for the two benchmark years indicate relatively large changes in expenditure structure in most countries (i.e. for passenger transport, fuels, recreation, restaurants and hotels, health, education). Not observed in 2011-17.
- Further, data from regions that provided detailed time series expenditures also indicate differences between 2017-19 and 2020-21.

Challenge 2: Impact of COVID-19 on expenditure structure (III)

- To reflect impact of COVID on expenditure, adjusting the weighting scheme where EXP is missing should be considered. Options to consider:
  1. Keep the linear blending of weights from 2017 and 2021
  2. Put more 2021 weights for 2020, and more 2017 weights for 2018-19 (Relevant weights need to be explored and tested)
  3. No blending of weights: applying 2021 weights to 2020, and 2017 weights to 2018 and 2019
  4. Any other blending scheme

Challenge 3: computational intensity

Estimating 7 full PPPs aggregation, for 6 regions for 5 years = **computation time of >24h**.

Inefficient for testing various approaches and for correcting errors.

Global Office introduced parallel computation at the aggregation step

- Program runs on multiple (7) parallel instances
- Reduced computation to <8h
- Tested on the 2011-17 time series, to be applied to the 2017-2021.