Extrapolation / Interpolation / Retrapolation of the ICP 2011 PPPs

(required input data and approaches)

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International Comparison Program

ICP 2017: ECLAC meeting
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ICP 2005 – ICP 2011 – ICP 2017
What in the meantime?

Users are interested in the time–series

The extrapolation/retrapolation of the ICP benchmark 2011 PPPs is a possible way

[*ICP 2005 PPPs were considered as a lower quality*]

WB decided to collect input data from the Regions and to undertake estimation of regional and global PPPs for non-benchmark years => for 2006-2010 and 2012-2016

Tasks

Reviewing the requested input data and determining the most feasible estimation approach

Estimation of the non-benchmark year regional and global PPPs by different aggregation levels

Indicators required for the PPP extrapolation

Consumer price indices (2011 = 100)

National account deflators (2011 = 100)

National accounts expenditures (LCU)

Population (for Volumes per capita)

Purchasing power parities (Global ICP 2011, USD =1)

Exchange rate (USD = 1)

Classifications (GDP Main Aggr. & HH Main Groups)

CLASSIFICATION				DATA AVAILABILITY (1 = yes; 0 = no) Note: individual coun availability may vary			
Code	Name	Aggregation level	Aggregation level code	EXP	PPP	DEF	C
100000	GROSS DOMESTIC PRODUCT	GDP	G1	1	1	1	
110000	INDIVIDUAL CONSUMPTION EXPENDITURE BY HOUSEHOLDS	Main aggregate	M1	1	1	1	
110100	FOOD AND NON-ALCOHOLIC BEVERAGES	Category	C1	1	1	0	
110200	ALCOHOL BEVERAGES, TOBACCO AND NARCOTICS	Category	C2	1	1	0	
110300	CLOTHING AND FOOTWEAR	Category	C3	1	1	0	
110400	HOUSING, WATER, ELECTRICITY, GAS, AND OTHER FUELS	Category	C4	1	1	0	
110500	FURNISHING, HOUSEHOLD EQUIPMENT AND ROUTINE MAINTENANCE OF THE HOUSE	Category	C5	1	1	0	
110600	HEALTH	Category	C6	1	1	0	
110700	TRANSPORT	Category	C7	1	1	0	
110800	COMMUNICATION	Category	C8	1	1	0	
110900	RECREATION AND CULTURE	Category	C9	1	1	0	
111000	EDUCATION	Category	C10	1	1	0	
111100	RESTAURANTS AND HOTELS	Category	C11	1	1	0	
111200	MISCELLANEOUS GOODS AND SERVICES	Category	C12	1	1	0	
111300	BALANCE OF EXPENDITURES OF RESIDENTS ABROAD AND EXPENDITURES OF NON-RESIDENTS IN THE ECONOMIC TERRITORY	Category	C13	1	1	0	
120000	INDIVIDUAL CONSUMPTION EXPENDITURE BY NPISHS	Main aggregate	M2	n/a	n/a	n/a	n
130000	INDIVIDUAL CONSUMPTION EXPENDITURE BY GOVERNMENT	Main aggregate	M3	1	1	1	
140000	COLLECTIVE CONSUMPTION EXPENDITURE BY GOVERNMENT	Main aggregate	M4	1	1	1	
150000	GROSS FIXED CAPITAL FORMATION	Main aggregate	M5	1	1	1	
160000	CHANGES IN INVENTORIES AND ACQUISITIONS LESS DISPOSALS OF VALUABLES	Main aggregate	M6	1	1	1	
170000	BALANCE OF EXPORTS AND IMPORTS	Main aggregate	M7	1	1	1	

Validation of input data

Official ICP 2011 Global PPPs => without changes

Aspects of the validation:

- **Availability**
- **Within-country consistency**
- **Inter-country comparability**

Validation (analysis) of CPI data

Covering: 12 main product HFCE groups

General points (reservations):

- Applicability as NA deflators?

- Methodological differences (different price concepts – Health, Education) => Consistency between HH deflators and CPI-Total

- Applicability as PPP extrapolators?

- significant differences between PPP and CPI baskets

- country's peculiarities in the methodology, etc. =>

- limited comparability of the CPI figures between the countries

Technical point:

CPI figures should be presented with the base 2011 = 100

Analysis of NA deflators

Covering: 6 main GDP aggregates (M1, M3-M7)
(M2 “NPISH” is combined with HFCE)

Availability

No big problems **(C13 and M7 – yearly XRs; M6 – ref. PPP)**

Reliability => Lessons

- Validation should be done very carefully
(even for the figures from the official national websites)
- Within-country consistency of NA deflators and other price indices should be checked

Analysis of GDP Expenditure data

Covering: 6 main GDP aggregates (M1, M3-M7) +
13 main product groups for HFCE (C1-C13)

Availability

- At least GDP data was mostly available
- Missing data => the use of the structure of a benchmark year

Reliability => Lessons

- Validation should be done very carefully (even for the figures from the official websites)
- Efficient way of the validation: the comparison of the structures for similar countries

General point:

SNA'93 / ESA'95 vs. SNA'08 / ESA'10

Main actions

- **Validation of input data**
- **Extrapolation of Global and Regional 2011 PPPs**

(GDP, M1 + M3-M5; C1 – C12)

- **Main aim of the experiments**

To evaluate - What the aggregated level (GDP deflator, C1-C13+M1-M7, M1-M7) is the most appropriate / practicable for the extrapolation? What are differences between results obtained by different aggregated levels?

Extrapolation of Global and Regional PPPs (GDP, M1 + M3-M5; C1 – C12)

Extrapolated Global PPP to USD:

Global PPP "Country X / USA" for year (2011+t) =
Global PPP "Country X / USA" for year 2011 * (Def $X^{2011+t/2011}$ / Def $USA^{2011+t/2011}$)

Regional PPPs to Base currency:

Regional PPP "Country X / Reg.B" for year (2011+t) =
Regional PPP "Country X/Reg.B" year 2011*(Def X2011+t/2011/Def Reg.B2011+t/2011

Extrapolation of Global and Regional PPPs is done separately for GDP, C1-C12, M1-M5

- NA deflators - for GDP and M1-M5 aggregates
- CPI data – for Consumer Headings (C1-C12)
- Yearly XRs – for M7 („Net exports") and C13 („Net touristic consumption"), M6 („Changes in inventories and valuables") – ref. PPPs

Calculation of extrapolated PPPs: possible approaches

Three approaches are feasible:

- **No aggregation** = **Global extrapolation** => G (GDP) = **G version**
- **Intermediate version** = EKS at the level of main aggregates
  M1 + M3-M7 => **M version** (6 categories)
- **Detailed version** = EKS for the combination (C1-C13 & M3-M7) =>
  => **C+M version** (13+5 = 18 categories)

Summary of experiments: Years 2005-2013 (1)

- **The comparison of extrapolated GDP-PPP/PLIs by three approaches:**
  - **Global extrapolation by the GDP deflators**
  - **Aggregation by the M version**
  - **Aggregation by the C+M version**
- **Similar analysis was done also for AIC**
- **For HFCE one can compare two versions:**
  - ❖ **by NA deflators vs. C1-C13 aggregation**

Summary of experiments: Years 2005-2013 (2)

- **PLI by different approaches for each year were compared and the differences were calculated:**
  - The PLIs of Global extrapolation was used as the basis
  - The original ICP 2011 PLIs were used for year 2011
- **All PLIs were presented the base World = 100 (unweighted GM)**

  Such presentation is more neutral and more appropriate for the evaluation than the PPPs with the base USD =1.
- **Presentation below contains Regional absolute average differences**
- **The Regional PLI averages (unweighted GM, World =100) were also calculated and compared**

  These average Regional PLIs can be used as quasi-Linking Factors = CAR-PPP approach (as it is used by the Eurostat-OECD, to keep sub-regional fixity)

Extrapolation of ICP 2011 PPP at different aggregated levels 2005-2008: Av Reg PLIs

Absolute percentage differences in PLI (World157 = 100)

	Year 2005						
	GDP (DEF = 100)			AIC (CM = 100)		HFCE (DEF=100)	
Reg. Name	by GDP Def	C13-M5	M1-M7	C13+M3	M1+M3	by HH Def	C1-C13
GM157		9.6	6.8		10.5		12.3
GM-AFR		11.2	7.9		13.5		14.9
GM-ASI		9.3	6.5		7.7		7.9
GM-CIS		25.7	13.0		22.3		43.2
GM-EUO		6.3	5.6		6.0		6.4
GM-LA		4.8	3.8		6.3		6.4
GM-WAS		11.4	7.2		17.4		17.8

	Year 2006						
	GDP (DEF = 100)			AIC (CM = 100)		HFCE (DEF=100)	
Reg. Name	by GDP Def	C13-M5	M1-M7	C13+M3	M1+M3	by HH Def	C1-C13
GM157		8.0	5.9		9.4		11.1
GM-AFR		9.9	6.7		12.1		13.8
GM-ASI		7.1	4.8		7.1		7.3
GM-CIS		21.7	11.1		21.9		38.4
GM-EUO		5.7	5.3		5.3		5.7
GM-LA		3.5	3.4		6.1		6.1
GM-WAS		7.8	7.2		14.1		14.6

	Year 2007						
	GDP (DEF = 100)			AIC (CM = 100)		HFCE (DEF=100)	
Reg. Name	by GDP Def	C13-M5	M1-M7	C13+M3	M1+M3	by HH Def	C1-C13
GM157		6.8	5.3		8.4		9.5
GM-AFR		7.3	6.6		11.2		11.8
GM-ASI		6.2	4.8		5.9		6.2
GM-CIS		18.1	8.8		19.0		32.2
GM-EUO		5.0	4.5		4.2		4.6
GM-LA		3.1	2.9		4.7		4.9
GM-WAS		9.3	6.3		15.4		15.3

	Year 2008						
	GDP (DEF = 100)			AIC (CM = 100)		HFCE (DEF=100)	
Reg. Name	by GDP Def	C13-M5	M1-M7	C13+M3	M1+M3	by HH Def	C1-C13
GM157		5.8	5.1		6.6		7.8
GM-AFR		8.1	7.0		8.3		9.7
GM-ASI		4.9	2.7		5.2		5.5
GM-CIS		10.0	7.9		15.6		26.4
GM-EUO		4.4	3.8		3.8		4.2
GM-LA		1.9	4.2		5.7		5.4
GM-WAS		6.2	5.8		7.7		8.3

Extrapolation of ICP 2011 PPP at different aggregated levels 2009-2011: Av Reg PLIs

Absolute percentage differences in PLI (World157 = 100)

	Year 2009						
	GDP (DEF = 100)			AIC (CM = 100)		HFCE (DEF=100)	
Reg. Name	by GDP Def	C13-M5	M1-M7	C13+M3	M1+M3	by HH Def	C1-C13
GM157		6.3	5.3		5.5		6.5
GM-AFR		7.6	6.6		7.8		9.4
GM-ASI		7.0	4.9		4.7		5.0
GM-CIS		9.6	9.4		7.3		8.9
GM-EUO		4.1	3.4		3.4		3.8
GM-LA		3.2	2.9		3.0		3.2
GM-WAS		9.8	8.2		7.8		9.9

	Year 2010						
	GDP (DEF = 100)			AIC (CM = 100)		HFCE (DEF=100)	
Reg. Name	by GDP Def	C13-M5	M1-M7	C13+M3	M1+M3	by HH Def	C1-C13
GM157		4.1	3.6		3.7		4.2
GM-AFR		4.1	3.6		5.4		5.9
GM-ASI		4.6	3.6		3.0		3.1
GM-CIS		8.5	9.2		7.2		8.3
GM-EUO		3.2	2.9		2.2		2.5
GM-LA		1.2	2.1		2.1		2.2
GM-WAS		6.3	5.1		3.5		4.1

	Year 2011 (% differences, Original =100)									
	GDP				AIC				HFCE	
Reg. Name	Original	C13-M5	CM vs. M	M1-M7	Original	C13+M3	CM vs. M	M1 +M 3	Original	C1-C13
GM157		2.3	1.4	1.9		1.9	1.8	1.0		2.0
GM-AFR		2.0	1.6	1.2		2.6	2.1	0.7		2.3
GM-ASI		2.5	0.9	2.2		1.3	1.4	0.5		1.5
GM-CIS		4.3	3.4	2.3		1.8	3.7	2.8		4.5
GM-EUO		2.6	1.0	2.6		1.8	1.5	1.2		1.8
GM-LA		1.1	1.2	1.5		1.5	1.4	0.7		1.5
GM-WAS		1.5	1.2	2.2		1.2	1.1	0.9		1.3

Extrapolation of ICP 2011 PPP at different aggregated levels 2012-2013: Av Reg PLIs

Absolute percentage differences in PLI (World157 = 100)

	Year 2012						
	GDP (DEF = 100)			AIC (CM = 100)		HFCE (DEF=100)	
Reg. Name	by GDP Def	C13-M5	M1-M7	C13+M3	M1+M3	by HH Def	C1-C13
GM157		3.2	3.5		3.9		4.1
GM-AFR		3.9	3.6		6.8		6.8
GM-ASI		2.8	2.6		2.3		2.6
GM-CIS		7.8	3.7		9.0		9.5
GM-EUO		2.5	2.5		1.3		1.5
GM-LA		1.6	1.9		2.0		2.1
GM-WAS		2.2	2.9		3.0		3.6

	Year 2013						
	GDP (DEF = 100)			AIC (CM = 100)		HFCE (DEF=100)	
Reg. Name	by GDP Def	C13-M5	M1-M7	C13+M3	M1+M3	by HH Def	C1-C13
GM157		3.7	3.3		4.8		5.1
GM-AFR		4.9	4.5		8.0		8.5
GM-ASI		2.5	2.6		2.5		3.0
GM-CIS		8.8	5.3		12.9		11.9
GM-EUO		2.7	2.7		1.6		1.9
GM-LA		1.9	2.4		1.8		1.9
GM-WAS		3.6	2.3		5.4		6.3

Extrapolation of ICP 2011 PPP: Av Reg PLIs as LFs
PLI"Country/World"=PLI"Country/Region"*PLI "Region/ World"

	Year 2005						
	GDP			AIC		HFCE	
Reg. Name	by GDP Def	C13-M5	M1-M7	C13+M3	M1+M3	by HH Def	C1-C13
GM157	100.0	100.0	100.0	100.0	100.0	100.0	100.0
GM-AFR	83.8	86.2	85.1	84.9	83.5	83.8	85.2
GM-ASI	72.4	69.9	71.7	71.0	73.9	74.3	71.2
GM-CIS	62.9	73.2	63.3	67.8	54.7	59.9	76.7
GM-EUO	169.6	161.2	167.8	164.7	173.7	172.8	162.5
GM-LA	88.3	89.0	90.2	87.3	88.6	86.8	85.6
GM-WAS	81.7	79.1	79.8	81.5	82.7	79.4	78.5

	Year 2005						
	GDP (by Def =100)			AIC (M =100)		HFCE (by Def=100)	
	by GDP Def	C13-M5	M1-M7	C13+M3	M1+M3	by HH Def	C1-C13
		2.8	1.5		-1.6		1.7
		-3.5	-1.0		4.0		-4.2
		16.4	0.6		-19.4		28.1
		-4.9	-1.1		5.5		-6.0
		0.9	2.1		1.4		-1.4
		-3.3	-2.3		1.4		-1.1

	Year 2006						
	GDP			AIC		HFCE	
Reg. Name	by GDP Def	C13-M5	M1-M7	C13+M3	M1+M3	by HH Def	C1-C13
GM157	100.0	100.0	100.0	100.0	100.0	100.0	100.0
GM-AFR	83.7	85.8	85.2	84.8	84.0	84.3	85.2
GM-ASI	72.9	70.6	71.9	71.3	73.6	73.9	71.4
GM-CIS	67.7	77.2	67.1	70.5	57.2	62.3	78.9
GM-EUO	165.6	158.8	164.3	162.3	170.1	169.1	160.2
GM-LA	88.4	89.3	90.4	87.6	89.0	87.3	85.8
GM-WAS	83.5	80.9	80.8	84.2	84.0	81.1	81.5

	Year 2006						
	GDP (by Def =100)			AIC (M =100)		HFCE (by Def=100)	
	by GDP Def	C13-M5	M1-M7	C13+M3	M1+M3	by HH Def	C1-C13
		2.4	1.8		-0.9		1.0
		-3.2	-1.4		3.2		-3.4
		14.0	-0.9		-18.8		26.7
		-4.1	-0.8		4.8		-5.3
		1.1	2.3		1.6		-1.6
		-3.0	-3.2		-0.2		0.5

Evaluation of the experiments

- **From the theoretical point of view, the C+M version would be preferable**
- **However data had numerous spaces and the comparability of detailed figures between the countries was in numerous cases questionable**
- **Version M seems to be the best practicable option**

[The Eurostat-OECD experience shows that if there is no new price data then the Global extrapolation at the GDP level brings very close results as the aggregation of extrapolated PPP – only the use of new XRs for "Net exports" in the M version brings some advantages – mailny for exporting countries]

Conclusions, recommendations, further steps

- Problematic points should be reviewed further together with the ICP Regional coordinators
- Problematic points should be solved and the extrapolated results should be recalculated
- Provisional conclusion => The extrapolation and further aggregation at the level of the NA main aggregates (M version) seems to be the most practicable version, to obtain plausible GDP and AIC PPPs
- Regional updates (PPPs, etc.) should be collected, to obtain extrapolated results with regional fixity

ICP challenge:

From the Benchmark Year approach to the Rolling Benchmark Year approach

- **Main aim**: to have **yearly ICP results** without significant increase of the workload
- **Distribution of Consumer Surveys** between several years

(Eurostat-OECD: tri-years cycle) with the CPI extrapolation / retrapolation in interim years)

- **Other Surveys: yearly, bi-years cycle, … -** depends on avaialability and quality of the extrapolators
- **GDP**: yearly BH expenditure data

Input data required for the rolling benchmark approach

(additionally to price data from the PPP Survey)

- **Yearly detailed (BH level) Consumer price indices**
- **Yearly detailed (maximal possible level) National account deflators**
- **Yearly detailed (BH level) National accounts expenditures** (LCU)

Principal schema of ICP Rolling benchmark year approach starting from Year T for the yearly comparisons: T, T+1, T+2, …

	ICP (T)				ICP (T+1)				ICP (T+2)			
	t-1	T=t	t+1	t+2	t	T+1=t+1	t+2	t+3	t+1	T+2=t+2	t+3	t+4
Survey "Food, beverages, tobacco"	X =>			PUBLICATION			<= X	PUBLICATION		X		PUBLICATION
Survey "Clothing and footwear"	X =>						<= X			X		
Survey "Technical and HH products"		X			X =>						<= X	
Survey "Health"		X			X =>						<= X	
Survey "Services"			<= X			X			X =>			
Survey "Furniture"			<= X			X			X =>			
Housing		X				X				X		
Machinery and Equipment		X				X				X		
Construction		X				X				X		
Non-Market services (Salaries)		X				X				X		
CPI		X				X				X		
GDP		X				X				X		

General scheme of ICP rolling benchmark year approach starting from 2017 as the first benchmark year

		Consumer Survey cycle 2018-2020									Consumer Survey cycle 2021-2023								
		ICP 2018			ICP 2019			ICP 2020			ICP 2021			ICP 2022			ICP 2023		
Survey	2017	2017	2018	2019	2018	2019	2020	2019	2020	2021	2020	2021	2022	2021	2022	2023	2022	2023	2024
Survey "Food, beverages, tobacco"	X			<= X		X		X =>					<= X		X		X =>		
Survey "Clothing and footwear"	X			<= X		X		X =>					<= X		X		X =>		
Survey "Technical and HH products"	X		X		X =>					<= X		X		X =>					<= X
Survey "Health"	X		X		X =>					<= X		X		X =>					<= X
Survey "Services"	X	X =>					<= X		X		X =>					<= X		X	
Survey "Furniture"	X	X =>					<= X		X		X =>					<= X		X	
Housing	X		x			x			X			x			x			X	
Machinery and Equipment	X		x			x			X			x			x			X	
Construction	X		x			x			X			x			x			X	
Non-Market services (Salaries)	X		x			x			X			x			x			X	
CPI	X		x			x			X			x			x			X	
GDP	X		x			x			X			x			x			X	
Publication of results	2019		2020			2021			2022			2023			2024			2025	

("X" – direct use; "X =>" – with CPI extrapolation; "<= X" – with CPI retrapolation)

2017 - comprehensive benchmark year

International Comparison Program

ICP 2017: ECLAC meeting
28-30 June 2017
Santiago de Chile

Thanks for listening