



## 2nd Meeting of the TF “PPP Compilation and Computation”

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### Evaluation of the WB Extrapolation DB 2011 - 2016 (v14) and the options for determining optimal extrapolation

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The following TF topics

Determining the most feasible approach for producing “smoothened” PPP time-series for the years between the 2011 and 2017 reference year comparisons (an extension to years before 2011 at a later stage)	Prasada Rao, Robert Inklaar, Sergey Sergeev, Yuri Dikhanov	Prasada Rao
Determining the most feasible approach for linking interim regional updates in to a global comparison, considering available data and results	Erwin Diewert, Sergey Sergeev, Yuri Dikhanov	Erwin Diewert

are overlapped and both are based in somewhat degree on the Extrapolation Database.

It was not very clear during the recent TF meeting (Oct'17):

- Which Regions, for which years and have (or when will have) new Regional results?
- What linking data and when is / will be available?

The linking of Regional updates can be discussed seriously after we know – What data (for the interim Global lists and interim Regional results) is really available and the degree of accuracy of this data. It was stated during the recent TF meeting (Oct'2017) that available (to that data) Regional data related to the interim Global lists was very poor (especially for comparison resistant areas) and the comparability of this data looked as very problematic. The situation was also unclear in the interim time. So, the present notice focuses on the evaluation of the WB Extrapolation DB 2011-2016 (v14) and the respective choice of options for determining optimal extrapolation because the level of the aggregation for the Regional and Global extrapolations depending on the quality of input data.

The Regional ICP Agencies and the WB GIU are responsible for the quality of the WB Extrapolation DB. In principle, more or less validated data should be obtained from the Regional coordinators and GIU. The TF members can't do detailed check for more than 150 countries of NA expenditure data, NA deflators and CPI data or to improve these official country's data better than RC, WB GIU and IMF. The evaluation of quality and applicability

of data (CPI, NA expenditure and HH deflators) is the task, first of all, for the Regional ICP Agencies. They have (should have) much better knowledge about the countries peculiarities and practices than TF members. I do not think that we are able to estimate "true" NA HH deflators or other input data for problematic countries. Obviously, the TF members should investigate all possible versions (for example, to use the CPI-Total as a reference for questionable HH NA deflators) but, to be honest, I do not see many possibilities. However, the TF members should participate in the process of the evaluation, to do a conscious choice of the options for determining optimal extrapolation.

The GIGO situations (the term from YD => "*Garbage in - garbage out*" ☺) should be avoided. The task is not to apply just mechanically something available, but to evaluate inputs and outputs quality. The input data and its quality should be evaluated very careful, to understand – What really we can do and present this as an improvement?

Simultaneously, it should be agreed – How puristic should we be by the extrapolation and interim updates? All should understand that any extrapolation can't be so accurate as the benchmark exercise. Further, if one wants to avoid the GIGO situations in a very puristic way then even benchmark ICP 2011 input data and the results are very far from strong requests of availability and comparability. Different Regions used in several important areas very different methodologies leading to very different results. So, If Africa uses the EU-OECD "Output" approach for Education then this category will have 50% (or more) Real GDP in many AFR countries due to the demographic situation. The Global link of Housing Rents simply by No. of dwellings with very moderate Quality Adjustment is obviously a surrogate procedure [*very close to Garbage* ☺].

## **Evaluation of data from the ICP Extrapolation DB (v14)**

The 1<sup>st</sup> step should be a more detailed evaluation of data from the ICP Extrapolation DB. The recent version (v14) was distribute at the end of Feb'2018.:

### **1) Covering**

#### **- CPI**

More or less comprehensive data (at least, for the Regions participated in the Global 2011 comparison). There are some spaces but, probably, these can be filled in / estimated some later. [*It was agreed with the Regional coordinators that HA-Deflators and CPI figures should be supplied with the base "2011=100". NA-Deflators are in such form by all Regions but not all Regions have the base 2011 = 100 for CPI figures (e.g. Eurostat supplied official HICP with the base 2015 =100). All CPI figures were recalculated for the further analysis to the base "2011 = 100".*]

#### **- NA Deflators and Expenditure data**

Only the Eurostat-OECD has more or less comprehensive set. There are numerous spaces in other Regions.

### **2) Consistency of CPI figures and NA Deflators**

It is very desirable that all sets of data (CPI figures, NA Deflators, NA expenditure) are consistent, to be used for the extrapolation of the PPPs. So, **CPI-Total figures and HH-deflators** can be different due to different concepts (see point 3) below but the differences should not be very high. If a country estimates Individual HH Consumption as a residual in nominal and Real terms (it seems that this is not a rare case for the countries with less developed statistical systems) then NA deflators can't be considers as appropriate figures for the extrapolation of PPPs. The comparison between CPI-Totals and HH-Deflators was done. Generally the situation is not bad. However, there are several (African) countries where differences are higher than +-10%:

Indicator	National Accounts HH Deflators (DEF) & CPI-Total												
Source	i) RIA Submissions (AFR: Sep. 2017, ASI: Mar. 2017, CIS (indexed - chainlinked series): Feb. 2018, LAC: Jan. 2017, WAS: Sep. 2015, EUO: Oct. 2017)												
Version	v14 (Official submissions augmented by data from international databases)												
Date	26/02/2018												
Notes:													
Heading c	Heading name	Head	Count	Country na	Region	Reg	2011	2012	2013	2014	2015	2016	Nc
110000	Def HH / CPI-Total	M01	TCD	Chad	Africa	1	1.000	0.989	0.989	1.191	1.147	#WERT!	10
110000	Def HH / CPI-Total	M01	COD	Congo, Dem.	Africa	1	1.000	1.092	0.986	0.919	0.874	#WERT!	12
110000	Def HH / CPI-Total	M01	EGY	Egypt, Arab I	Africa	1	1.000	1.148	1.119	1.144	1.144	1.064	16
110000	Def HH / CPI-Total	M01	GHA	Ghana	Africa	1	1.000	1.034	1.111	1.241	1.233	1.293	21
110000	Def HH / CPI-Total	M01	GIN	Guinea	Africa	1	1.000	0.929	0.879	0.844	0.815	#WERT!	22
110000	Def HH / CPI-Total	M01	LBR	Liberia	Africa	1	1.000	1.001	1.028	1.056	0.855	#WERT!	26
110000	Def HH / CPI-Total	M01	RWA	Rwanda	Africa	1	1.000	0.964	0.941	0.936	0.899	0.865	37
110000	Def HH / CPI-Total	M01	STP	São Tomé an	Africa	1	1.000	1.005	1.363	1.285	1.281	#WERT!	38
110000	Def HH / CPI-Total	M01	LAO	Lao PDR	Asia and th	2	1.000	1.128	1.126	1.151	1.172	1.100	60
110000	Def HH / CPI-Total	M01	KAZ	Kazakhstan	CIS	3	1.000	1.009	1.112	1.100	1.159	1.166	77
110000	Def HH / CPI-Total	M01	EGZ	Egypt, Arab I	Western A:	6	1.000	1.141	1.113	1.138	1.138	1.058	148
110000	Def HH / CPI-Total	M01	SDO	Sudan (WAS)	Western A:	6	1.000	1.134	1.123	1.084	1.159	#WERT!	156

If there are doubts about the reliability of some HH Deflators (due to the use of the ratios of dual residuals) then the use of CPI-Totals would be an appropriate alternative (it is not very likely that it will be possible to correct national HH deflators).

### 3) Applicability of CPI figures as NA deflators and as PPP extrapolators

The CPI figures for COICOP12 are mostly official data obtained by the WB GIU from Regional Agencies or IMF which are responsible for the validation and accuracy of supplied figures). So, one should believe that these figures are correct from CPI point of view. However, to avoid the mechanical apply for the PPP purposes, the applicability of these figures from the PPP point of view (as NA deflators and as extrapolators) should be evaluated. CPI uses the concept “Prices actually paid by HH”. Therefore these figures should be used with big reservations for the deflation of NA aggregates and for the PPP extrapolation in such areas as Housing (Quantity approach with indirect PPPs), Health and Education (the concept of full prices). One example from the Eurostat exercise for “**Health**”: AT PLI (DE = 100) was 133% in the ICP 2011; Health-CPI “2016 / 2011” for AT – 112% and DE – 103%; however the 2016 AT PLI (DE = 100) is 118%! Another example from the Eurostat exercise for the “**Education**”<sup>1</sup> BE, DE, EE and UK have very different CPI “2016 / 2011” but the PPPs are more or less stable for these two benchmarks:

#### PPP for Education: 2011 vs. 2016

(Output approach; combined input data for HH, NPI, GG)

	PPP 2011 (EU28 = 1)	CPI 2016/2011	PPP 2016 (EU28 = 1)
BE	1.789	136.2	1.705
DE	1.322	96.6	1.382
EE	0.555	68.2	0.692
UK	1.544	159.4	1.485

There are such examples also in other ICP Regions. For example, the Asian PPP exercise – the reference Volume approach (HH without Rents) was used in the ICP 2011 to obtain indirect PPPs. The CPI data for Housing has no any relation to the indirect PPPs of Asian countries.

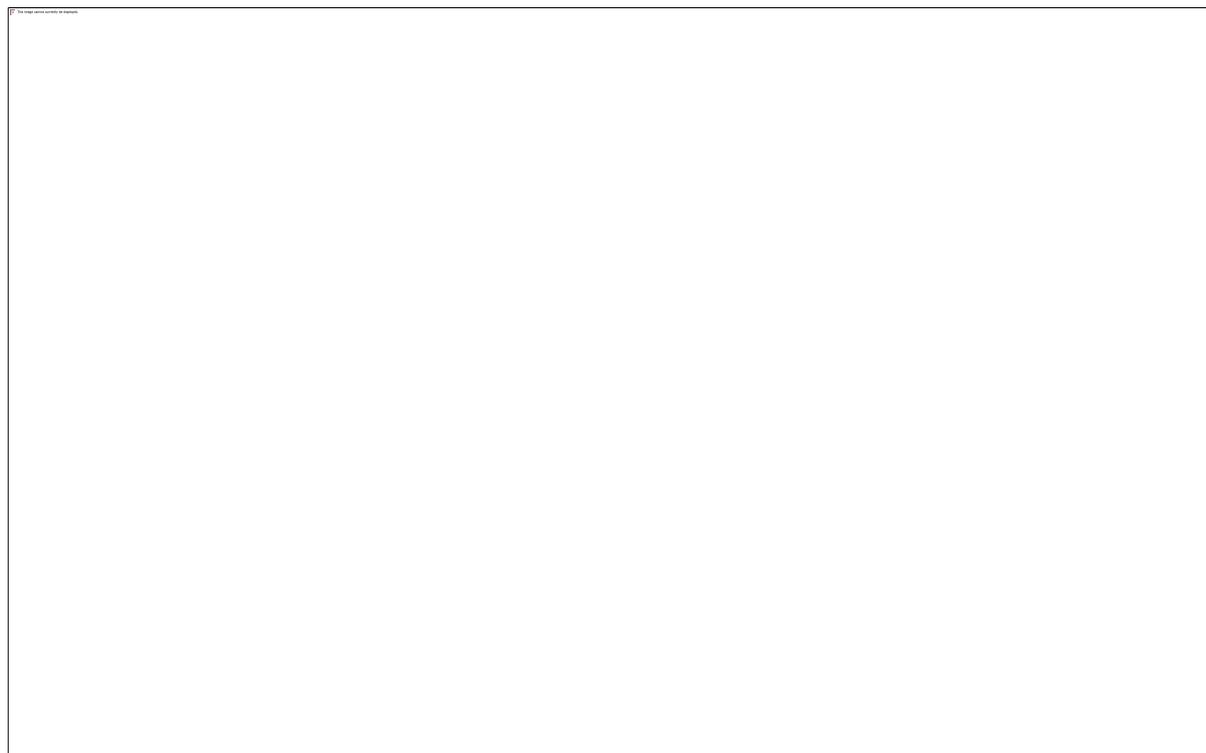
<sup>1</sup> One can say that these examples are inappropriate because there are annual results for Eurostat countries (maybe, OECD also from 2014 as well as CIS 2014 linked results). However this does not mean that one can ignore the quality of extrapolators for these countries because these results are linked only within this Region but not with other Regions. The EU-OECD CPI and NA deflators are used for the extrapolation of the 2011 Global PPPs, to have the link with other Regions for the interim years. The Global linked PPPs exist only in the ICP 2011 and new available Regional results are integrated after this.

If we use more detailed but inappropriate data then a higher degree of details can't improve the results. There are big doubts that the use of the HH aggregation with the COICOP 12 data will bring in reality better results than the extrapolation with appropriate HH NA deflators or with CPI-Total. Therefore Eurostat use the Rolling Survey approach with the CPI extrapolation for the interim years only for areas where CPI and NA price concepts are identical and has yearly Surveys for Housing rentals, Health-Hospitals, Education or use the special extrapolation but not with CPI figures. There is no much sense to use detailed data for those COICOP12, where other price concept is used, for the extrapolation of PPPs – this will not increase of the accuracy of HH-PPPs relatively the existing one-number WDI extrapolation. Of course, CPI-Total is also not fully appropriate as NA PPP extrapolator but this is less workload way with the same degree of accuracy / inaccuracy.

#### **4) Reliability of CPI & NA deflators and their consistency with NA expenditure**

All parts of the DB - price indices (CPI, NA deflators) and NA expenditure – should be consistent<sup>2</sup>. Obviously the Regional Agencies have much more information about the reliability of these data. However it is possible to carry an indirect evaluation via the calculation of the country's Real Volume indices (2011 = 100) for M aggregates and C categories. To evaluate better the reliability of CPI and NA deflators and their consistency with NA expenditure, the Real value indices (2011 = 100) are useful. These are calculated as "Real value index = "Nominal value index" / "CPI or NA deflator".

*For example, if the CPI figure and NA expenditure for Chile for the category "Clothing and footwear" are correct then the consumption of Clothing and Footwear was increased in 2016 twice relatively 2011!?*



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<sup>2</sup> Eurostat has yearly comparisons a long time [OECD – from 2014]. The experience shows that the methodological changes (in price guidelines as well as in NA), the revisions, etc. lead in many cases to jumps. One example for "Health": AT V1pc (DE=100) was 66% in the ICP 2011 but ~90% in 2016. One should think that there were big changes in Health systems of these countries but in reality this is due to new guidelines for price collections (combination of the private and public patients) as well as due to new rules for the borderlines between Market and Non-market activities in the ESA 2010.

### 5) Inter-country comparability of CPI data

One should not expect high comparability of the CPI data at the low (BH) level. The country's procedures can be very different. The Eurostat HICP figures from the public DB show this clearly. The Eurostat system is "harmonized" but this means only the harmonization of the content but not the procedures. The presence or lack of Quality Adjustment in CPI figures can produce high incomparability between the countries for areas with high technological products – one example is below:

HICP (2015 = 100) - annual data (average index) [prc_hicp_aind]							
Last update	17.01.18				17.01.18		
Extracted on	12.02.18				12.02.18		
Source of data	Eurostat				Eurostat		
UNIT	Annual average index			UNIT	Annual average index		
COICOP	Telephone and telefax equipment			COICOP	Telephone and telefax services		
GEO/TIME	2005	2017	2017/2005	GEO/TIME	2005	2017	2017/2005
EU28	325.61	87.97	<b>27.0</b>	EU28	115.77	98.99	<b>85.5</b>
EA19	321.05	89.27	<b>27.8</b>	EA19	119.12	99.24	<b>83.3</b>
Belgium	134.04	92.76	<b>69.2</b>	Belgium	120.47	107.09	<b>88.9</b>
Bulgaria	306.50	79.37	<b>25.9</b>	Bulgaria	114.55	94.18	<b>82.2</b>
Czech R.	721.5	78.4	<b>10.9</b>	Czech R.	123.2	99.2	<b>80.5</b>
Denmark	288.7	88.4	<b>30.6</b>	Denmark	120.5	85.3	<b>70.8</b>
Germany	201.6	99.4	<b>49.3</b>	Germany	119.3	97.5	<b>81.7</b>
Estonia	:	65.65	<b>#WERT!</b>	Estonia	:	97.58	<b>#WERT!</b>
Ireland	:	73.7	<b>#WERT!</b>	Ireland	:	98.7	<b>#WERT!</b>
Greece	195.53	85.95	<b>44.0</b>	Greece	107.40	102.28	<b>95.2</b>
Spain	838.74	83.78	<b>10.0</b>	Spain	116.90	104.88	<b>89.7</b>
France	417.03	83.06	<b>19.9</b>	France	133.12	97.80	<b>73.5</b>
Croatia	157.77	93.55	<b>59.3</b>	Croatia	112.76	96.31	<b>85.4</b>
Italy	363.0	96.0	<b>26.4</b>	Italy	117.8	98.0	<b>83.2</b>
Cyprus	249.50	73.66	<b>29.5</b>	Cyprus	93.39	98.61	<b>105.6</b>
Latvia	436.30	93.83	<b>21.5</b>	Latvia	140.49	107.24	<b>76.3</b>
Lithuania	224.38	82.22	<b>36.6</b>	Lithuania	134.67	96.79	<b>71.9</b>
Luxembourg	197.94	84.85	<b>42.9</b>	Luxembourg	102.55	99.00	<b>96.5</b>
Hungary	:	85.28	<b>#WERT!</b>	Hungary	:	97.95	<b>#WERT!</b>
Malta	:	77.49	<b>#WERT!</b>	Malta	:	99.89	<b>#WERT!</b>
Netherlands	:	70.55	<b>#WERT!</b>	Netherlands	:	91.14	<b>#WERT!</b>
Austria	261.32	97.82	<b>37.4</b>	Austria	100.18	96.28	<b>96.1</b>
Poland	:	86.9	<b>#WERT!</b>	Poland	:	100.3	<b>#WERT!</b>
Portugal	303.31	144.68	<b>47.7</b>	Portugal	98.18	105.03	<b>107.0</b>
Romania	99.68	99.44	<b>99.8</b>	Romania	79.04	98.71	<b>124.9</b>
Slovenia	217.60	90.08	<b>41.4</b>	Slovenia	103.19	104.56	<b>101.3</b>
Slovakia	543.50	92.53	<b>17.0</b>	Slovakia	100.54	99.95	<b>99.4</b>
Finland	444.34	64.91	<b>14.6</b>	Finland	116.36	105.42	<b>90.6</b>
Sweden	:	72.76	<b>#WERT!</b>	Sweden	:	97.58	<b>#WERT!</b>
United Kingd	:	:	<b>#WERT!</b>	United Kingd	:	:	<b>#WERT!</b>
European Ec	305.12	88.50	<b>29.0</b>	European Ec	115.95	99.02	<b>85.4</b>
Iceland	186.40	82.22	<b>44.1</b>	Iceland	60.72	71.21	<b>117.3</b>
Norway	36.7	110.4	<b>300.8</b>	Norway	138.4	103.7	<b>74.9</b>
Switzerland	243.43	97.94	<b>40.2</b>	Switzerland	127.97	96.79	<b>75.6</b>
Serbia	:	125.2	<b>#WERT!</b>	Serbia	:	104.3	<b>#WERT!</b>
Turkey	221.60	97.22	<b>43.9</b>	Turkey	74.62	106.94	<b>143.3</b>

High differences for similar countries exist also for more “simple” areas like “Garments” – see below:

<b>HICP (2015 = 100) - annual data (average index and rate of change)</b>			
<b>[prc_hicp_aind]</b>			
Last update	23.02.18		
Extracted on	08.03.18		
Source of data	Eurostat		
UNIT	Annual average index		
COICOP	Garments		
<b>GEO/TIME</b>	<b>2005</b>	<b>2016</b>	<b>2016/2015</b>
European Union (28 countries)	101.10	100.17	<b>0.991</b>
Euro area (19 countries)	95.40	100.39	<b>1.052</b>
Belgium	92.99	100.76	<b>1.084</b>
Bulgaria	80.70	100.26	<b>1.242</b>
Czech Republic	124.8	100.8	<b>0.808</b>
Denmark	110.5	95.8	<b>0.867</b>
Germany	92.2	100.3	<b>1.088</b>
Estonia	70.13	103.78	<b>1.480</b>
Ireland	158.3	97.5	<b>0.616</b>
Greece	94.70	97.41	<b>1.029</b>
Spain	95.51	100.85	<b>1.056</b>
France	97.17	100.43	<b>1.034</b>
Croatia	115.85	100.53	<b>0.868</b>
Italy	94.3	100.5	<b>1.066</b>
Cyprus	115.05	100.84	<b>0.876</b>
Latvia	116.38	99.88	<b>0.858</b>
Lithuania	128.87	101.32	<b>0.786</b>
Luxembourg	94.82	101.06	<b>1.066</b>
Hungary	98.86	100.26	<b>1.014</b>
Malta	99.59	97.59	<b>0.980</b>
Netherlands	101.59	100.76	<b>0.992</b>
Austria	93.09	100.72	<b>1.082</b>
Poland	168.2	95.0	<b>0.565</b>
Portugal	121.84	99.43	<b>0.816</b>
Romania	79.99	101.26	<b>1.266</b>
Slovenia	107.47	98.63	<b>0.918</b>
Slovakia	96.70	99.92	<b>1.033</b>
Finland	97.07	98.98	<b>1.020</b>
Sweden	90.31	103.73	<b>1.149</b>
United Kingdom	123.8	100.3	<b>0.810</b>
European Economic Area (EEA18-2)	101.39	100.24	<b>0.989</b>
Iceland	68.42	95.43	<b>1.395</b>
Norway	138.3	105.1	<b>0.760</b>
Switzerland	90.76	106.83	<b>1.177</b>
Serbia	:	99.4	<b>#WERT!</b>
Turkey	63.83	106.58	<b>1.670</b>

The reasons are different procedures used for price collection and different treatment of seasonality.

Therefore, the main idea of the Survey Rolling approach using by EU-OECD is not to have perfect consistency at the BH level (it would be desirable but unrealistic) but to obtain appropriate consistency at the level of main product groups consisting a Survey.

## 6) Inter-country comparability of NA data

In principle, all Regions should supply NA data in accordance with the SNA 2008. However it is not fully clear – What is the actual situation in the Extrapolation DB (maybe, some Regions / countries uses still SNA'93). To understand better the country's expenditure structures and the reliability of NA data<sup>3</sup>, the shares of NA aggregates and categories within the GDP and HH were calculated. Some immediate remarks:

- the shares of HH in GDP in some countries are very high (and even sometimes higher than 100%!) due to very high negative “Net exports”. Vice versa, some countries have very low shares of HH expenditure in GDP due to very high positive “Net exports”:

Indicator	National account expenditure (EXP) - Shares (%) in GDP											
Source	i) RIA Submissions [AFR: Oct. 2017, ASI: Mar. 2017, CIS: Feb. 2018, Eurostat-OECD: Oct. 2017, LAC: Nov. 2016, WAS: Sep. 2015]; ii) Intl database [WB WDI											
Version	v14 (Official submissions augmented by data from international databases)											
Date	26/02/2018											
Heading	Heading name	Head	Cou	Country na	Regi	Re	2011	2012	2013	2014	2015	2016
110000	INDIVIDUAL CONSUMPTION EXPENDITURE BY HOUSEHO M1	BDI	Burundi	Africa	1	1	82.5	85.2	88.5	83.9	101.5	
110000	INDIVIDUAL CONSUMPTION EXPENDITURE BY HOUSEHO M1	SLE	Sierra Leone	Africa	1	1	95.3	89.0	106.8	100.0	101.5	101.3
110000	INDIVIDUAL CONSUMPTION EXPENDITURE BY HOUSEHO M1	BRN	Brunei Daruss	Asia and	2	2	12.8	13.8	15.3	15.5	19.8	
110000	INDIVIDUAL CONSUMPTION EXPENDITURE BY HOUSEHO M1	KGZ	Kyrgyzstan	CIS	3	3	83.4	95.8	97.2	96.0	90.5	87.4
110000	INDIVIDUAL CONSUMPTION EXPENDITURE BY HOUSEHO M1	LUX	Luxembourg	Eurosta	4	4	31.3	32.2	31.7	30.3	30.0	30.3
110000	INDIVIDUAL CONSUMPTION EXPENDITURE BY HOUSEHO M1	VEN	Venezuela, Bol	Latin Am	5	5	55.2	59.3	65.1	75.3	121.3	

- “Imports” (negative sign) has in numerous countries very high share in GDP – in some cases higher than 100%. In effect, additional computational problems can occur during the EKS aggregation (especially if one wants to use very different separate PPPs for I / X)
- It seems there is no systematic replication of COICOP12 structures for several years. These are relatively stable and, probably, this is the reality. Consumption pattern can't change drastically during 5-6 years (of course, the exceptions can occur).

## Some considerations on determining optimal extrapolation

There is no official methodology for the extrapolation of the ICP 2011. However the best **reliable and feasible schema for the extrapolation and the consistency with the benchmark ICP 2017 should be established**. The ICP 2011 has many different problematic points and respectively different TFs were established for further improvements (PPP computations, Rents, PA, Treatment of Exports / Imports, ...). Simultaneously, it was decided that the ICP 2017 should follow the ICP 2011 methodology and the tasks and the timelines for the TFs were established in accordance with this decision. Therefore, in my understanding, the current tasks of the TF “PPP computation” are the current improvements of interim ICP 2012-2016 updates and the ICP 2017 without the introduction of big methodological changes. The general methodology of the benchmark ICP 2011 should be kept if it is possible. If we change significantly the methodology for interim updates then we should recalculate the ICP 2011 and to use revised methodology also for the ICP 2017.

The experiments with the extrapolations were started already in 2015. Therefore many general points have been investigated. The former experiments with available GIU data as well numerous experiments which were done in the past within the Eurostat comparison, to find the most reliable approach for Nowcast, confirmed that if there is no new price data then only the treatment of “Net exports” (taking into account “changes in terms of trade”) has the significant impact on the difference between the results of Global extrapolation and the

<sup>3</sup> It seems that NA expenditure data for Singapore and Turkey is not fully additive.

results at more disaggregated levels. The changes in prices of foreign trade have high impact on Nominal values of “Net exports” but they are not counted in the GDP Real values because the GDP deflators should eliminate all changes in prices. Of course, the use of XRs as PPPs for Exports / Imports (as well as for “Touristic consumption abroad”) is not the true solution of the problem<sup>4</sup> but this allows to follow, at least, the official ICP methodology. The use of separate PPPs for X and M is very serious change. Therefore we should use still in our computations current XRs for “Net exports”. The use of current XRs in the aggregation (M1-M7) allows improve the extrapolation of the GDP-PPPs relatively the use of Global GDP deflators = “producing “smoothened” PPP time-series between for the years the 2011 and 2017 reference year comparisons”. All further investigations on the treatment of M7 should be done by the TF “PPP’s for Exports and Imports”: <http://www.worldbank.org/en/programs/icp/brief/ra08> This TF should start to work in 2019 and finish in 2021. It is not planned to use the outcomes of this TF in the ICP 2017.

Therefore the most realistic version is the following approach:

- To extrapolate Global 2011 PPPs at the level of 5-6 main GDP aggregates by NA deflators to 2012-2016 and to use the actual yearly XRs for “Net exports”.
- To do new Global EKS aggregation at this level for 2012-2016
- To integrate available interim Regional results into new Global results 2012-2016 either by the CAR-Volume approach (ICP 2011 approach) or by the CAP-PPP approach (Eurostat-OECD approach).

Three approaches are more or less feasible for the extrapolation of the ICP 2011 PPPs:

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

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<sup>4</sup> There were respective discussions in the ICP 2005 and the 2011. However numerous attempts to introduce something more rational were recognized as very problematic. There is some data concerning ToT (terms of trade” in the WDI - <https://data.worldbank.org/indicator/NY.TTF.GNFS.KN>  
The PWT9.0 has separate PPPs for I and X but, as I understood, these PPPs were calculated on the basis of Unit Values from Foreign trade statistics. How accurate these PPPs obtained on the basis of UV? Nevertheless, Erwin Diewert plans to try to incorporate the terms of trade effects into making interim projections of the 2011 PPPs for OECD countries (using the PPPs for imports and exports from the PWT9.0).  
In any case, if the Global extrapolation is done with separate PPPs for X / I but the interim regional exercises as well as the official ICP 20178 - with the XRs as PPPs then the combination of two different methodologies will not improve the quality and consistency of final results. Additionally if we use the same PPPs like XRs then dividing of Net Exports into separate BHs for Exports and Imports has no impact on the results by the EKS approach. However this can have big impact by the use of separate PPPs. Some experts believe that the presence of negative values in input data for NA expenditure categories like "Net exports", etc. does not distort the calculation of the PPPs. It is possible to agree that if the shares of negative values are small then we can ignore this fact (especially by the EKS approach). However if one decides to use separate PPPs for I / X (in some case very different) then additional computational problems can occur during the EKS aggregation. “Imports” (negative sign) has in numerous countries very high share in GDP => in some cases up to -200% => even GDP-PPP can be meaningless (such cases occurred already in the provisional calculations of the ICP 2011 even with one balancing BH "Net exports" and XRs as PPPs). => Erwin Diewert: “When a value aggregate goes from plus to minus or vice versa, normal index number theory fails. Thus while the value of inventory change in current prices is not a problem, the corresponding real change can be crazy.”

It seems, it was a general opinion during the recent TF meeting (Oct'2017) that the most rational way for the extrapolation is the aggregation at the level of GDP main aggregates with the use of current XRs as PPPs for "Net exports" (**M version**).

All former experiments showed that the differences between the extrapolated results at the level of 6 main aggregates with NA deflators and the results with the inclusion of the COICOP12 product groups with CPI data (**C+M version**) are small (in the limits of the statistical accuracy of input data). The experiments for HH with recent state COICOP12 data can be done but it is questionable that this will be really an improvement. All former experiments showed that usually there are no big differences between one-number extrapolation (CPI-Total or HH Deflator) and more detailed versions. And if we have significant differences then we can't know – Are these differences due to real improvements or due to inappropriate CPI data?<sup>5</sup>

It seems that it is expected to receive the results for GDP, AIC and HH. The HH-PPPs are the most important indicator for the poverty but the ICP is designed traditionally more for the GDP and AIC. The indicator AIC is not in the WDI but this the second (after GDP) important ICP indicator. Therefore it would be desirable to experiment with all 3 aggregates and to use the following main aggregates:

110000	INDIVIDUAL CONSUMPTION EXPENDITURE BY HOUSEHOLDS <sup>6</sup>	M1
130000	INDIVIDUAL CONSUMPTION EXPENDITURE BY GOVERNMENT	M3
140000	COLLECTIVE CONSUMPTION EXPENDITURE BY GOVERNMENT	M4
150000	GROSS FIXED CAPITAL FORMATION	M5
160000	CHANGES IN INVENTORIES & VALUABLES	M6
170000	BALANCE OF EXPORTS AND IMPORTS	M7

The analysis of the input DB data showed that the Regions (but EU-OECD) have no separate deflators for Individual and Collective GG consumption (and in many cases also no separate expenditure data). Therefore either we can use the same deflators for both parts of GG expenditure or to use combination (M3+M4). In last case the following aggregation schema should be used for the Global extrapolation:

110000	<b>INDIVIDUAL CONSUMPTION EXPENDITURE BY HOUSEHOLDS (plus NPISH)</b>	<b>(M1+M2) NA deflators or CPI Total</b>
13-14 0000	<b>INDIVIDUAL AND COLLECTIVE CONSUMPTION EXPENDITURE BY GOVERNMENT</b>	<b>(M3 + M4) NA deflators</b>
150000	<b>GROSS FIXED CAPITAL FORMATION</b>	<b>M5 NA deflators</b>
160000	<b>CHANGES IN INVENTORIES AND VALUABLES</b>	<b>M6 Ref. PPPs or current XRs</b>
170000	<b>BALANCE OF EXPORTS AND IMPORTS</b>	<b>M7 Current XRs</b>

<sup>5</sup> Obviously, the impact of non-applicability of CPI figures as NA deflators for Health, Education, etc. depends on the share of public expenditure for these areas and peculiarities of the procedures using. So, in Asia, it was possible to link two comparisons, 2005 and 2011, directly at the item level, and compare the countries across time and space in a consistent way, because most of the items were kept the same between the two comparisons by design - see the paper prepared by Y. Dikhanov and E. Capilit for the ISI 2015. It was found that despite going through a heroic effort to collect and clean data and getting 5-8 countries with 12 COICOP CPI and SNA components, there were still quite a bit of unexplained discrepancies in both versions, even though variances decreased somewhat when compared with the one number extrapolation. It was also found that SNA deflators for Individual consumption components contained more noise and behaved worse than their CPI counterparts.

<sup>6</sup> It was agreed earlier that M2 (NPISH) should be combined with M1 (HH).

The benchmark ICP2011 Global PPPs for (M1+M2), (M3+M4) should be extrapolated with the most appropriate extrapolators, M7 – current XRs. It is unrealistic that we (and countries also) can produce presently reliable deflators for M6<sup>7</sup> The ICP uses reference PPPs for this aggregate and we should use the same principle – either unweighted GM from M1 and M5 or XRs (like this is used in the WB extrapolation DB for “Deflators”). It is possible also to combine M5 and M6 - GFCF and "Changes in inventories and valuables". In this case we should we use also "GFCF NA Deflator" for combined data. I believe that this will not have any serious impact of the extrapolated results.

After this Extrapolated PPPs 2012-2016 are aggregated by the EKS with respective expenditure data from the WB extrapolation database, to obtain extrapolated Global GDP-PPP. The next steps should be integration of interim Regional results in the extrapolated Global results and the analysis of possible linking of Regional interim comparisons on the basis of data from interim Global Core lists. The last step can be very problematic. Available Regional data related to the interim Global lists is presently very poor (especially for comparison resistant areas) and the comparability is very questionable. It is still unclear:

– Which Regions can supply sufficient price data for interim Global Core lists and How comparable this data?

- What to do with the linking for such specific areas as Rents, Construction, Health, Education ?

It is sensible to do concrete experiments after the WB GIU finalizes the extrapolation DB. The recent version of the WB extrapolation dataset should be used for further experiments.

In looking at the overall picture, we should evaluate the final goal of this exercise: how close do we need to be to the 2017 round, to the 2011, or to the interim results from whatever year they were. Which consistency do we care for most? The most likely answer is the 2017 one. But what do we do with the consistency with 2011? Do we smooth it? What about the interim updates?

Once the results for the 2017 comparison are available, we could compare the extrapolated (from the ICP 2011) PPPs for 2017 with the new global comparison 2017 PPPs. Assuming that we want to take the global BH PPPs for 2017 as the “truth”, then should we revise backward the 2017 PPPs to the years 2012-2016 or to use some interpolation of 2011 and 2017 PPPs?

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<sup>7</sup> It is extremely difficult to establish an appropriate product list and the use of a reference PPP is a practicable decision. Any choice is inevitable arbitrary based exclusively on some assumptions indirectly connected with the content of BH in question. Therefore the formal feature “Belonging to Goods” is used to assign reference PPPs - an average from consumer and investment goods. Is this good or bad choice? It is impossible to justify! The content and weights of goods in inventories can be very different from expenditure structure of goods in HH and GFCF. [*Additionally - Should be included or excluded "Construction"? => By the content of "Inventories" - Yes; in the ICP practice, at least EU-OECD - No* ]

Erwin Diewert investigated this tricky topic concerning the Deflators for “Change in inventories” – see “ON MEASURING INVENTORY CHANGE IN CURRENT AND CONSTANT DOLLARS”, Aug 2005; Discussion Paper No.: 05-12 - <http://papers.economics.ubc.ca/legacypapers/dp0512.pdf>

It is understandable the intention to introduce this outcome in the PPP practice. However, the same point, as for X / I, PPPs for this category are calculated in the ICP as reference PPPs. This is a very rough / arbitrary estimation but - Will be increased the general accuracy of extrapolated results if we use better Deflators to rough reference benchmark PPPs?