Considerations on production and publishing ICP additive results

Sergey Sergeev

sergey_sergeev@outlook.com

ICP: Additive results by ???

Potential methods

Averaging national prices

- **Geary-Khamis (GK)** – ICP 1970-1985

  (Arithmetic Mean with quantity weights)

- **Ikle-Dikhanov-Balk (IDB) –** Africa (AfDB) 2005

  (Harmonic Mean with expenditure weights)

- **Gerardi (G)** – Eurostat 1975

  (Unweighted GM = GM of national price ratios)

Global ICP 2017: EKS-PPPs vs PPPs by additive methods

Average absolute % difference: PPPs by additive methods vs official EKS-PPPs with fixity (W143=1)

	Abs % difference Gerardi	Abs % difference SS	Abs % difference Ikle	Abs % difference GK	Abs % difference MPCP	Abs % difference EKS / EKS fix
GDP-Av	2.9	3.0	2.9	4.0	2.8	1.2
GDP-Max	21.3	19.8	23.9	24.2	19.5	7.8
DA-Av	2.9	3.0	2.6	3.5	2.5	1.0
DA-Max	17.8	16.9	14.3	23.5	19.7	8.0
HHd-Av	2.7	2.8	2.4	3.5	2.6	1.2
HHd-Max	19.2	23.5	16.4	27.5	14.2	7.9

Additive methods: Advantages and disadvantages

- **Geary-Khamis (GK)**
  + Clear economic interpretation
  - **Potential** (see next slide) Gerschenkron effect
  - Sectoral dependent
- ***Ikle-Dikhanov-Balk (IDB)***
  + Neutral relatively the sizes of the countries
  - Sectoral dependent
- **Gerardi (G)**
  + Neutral relatively the sizes of the countries
  + **Sectoral independent**
  - Averaging of price structures is not so immediately understandable as averaging of prices

Similarity of national and average price structures

GDP: 10 highest coefficients of similarity of price structures (national with GK international prices)

	GK	Ikle	CPD-Rao	ShGK-Rao	SS Str	MPCP	Gerardi
CYP	0.9095	0.8170	0.8510	0.8686	0.8725	0.8023	0.8514
ESP	0.8987	0.7901	0.8302	0.8487	0.8442	0.7493	0.8208
EST	0.9081	0.8629	0.8920	0.8994	0.9078	0.8116	0.8971
GRC	0.9226	0.8814	0.9028	0.9095	0.9161	0.8551	0.9049
PRT	0.8921	0.8397	0.8816	0.8994	0.8985	0.7752	0.8745
SVK	0.8868	0.8655	0.8883	0.8915	0.8964	0.7901	0.8889
SVN	0.8994	0.8328	0.8692	0.8826	0.8898	0.7822	0.8702
HKG	0.8971	0.7966	0.8188	0.8329	0.8289	0.8234	0.8141
PER	0.8944	0.8928	0.9152	0.9264	0.9278	0.8649	0.9165

HH (d): 10 highest coefficients of similarity of price structures (national with GK international prices)

	GK	Ikle	CPD-Rao	ShGK-Rao	SS Str	MPCP	Gerardi
CHL	0.9232	0.8627	0.8808	0.8789	0.8591	0.7768	0.8538
CRI	0.8950	0.8922	0.9044	0.9018	0.8991	0.8318	0.8982
CYP	0.8965	0.8384	0.8760	0.8873	0.8901	0.7566	0.8742
EST	0.8964	0.8285	0.8641	0.8723	0.8843	0.7605	0.8722
GRC	0.9006	0.8852	0.9051	0.9039	0.9154	0.8070	0.9104
ITA	0.8823	0.7899	0.8191	0.8263	0.8297	0.7317	0.8171
LVA	0.9052	0.8637	0.8923	0.8963	0.9047	0.7843	0.8965
SVK	0.8881	0.8283	0.8590	0.8614	0.8678	0.7393	0.8606
HKG	0.8913	0.8368	0.8538	0.8649	0.8460	0.8017	0.8344

Problems with double set of the ICP results

- **Two different sets of the ICP results:**
  - **official EKS -** for volume and price level inter-country comparisons
  - **non-official by an additive method** - for structural analyse
- **General problem**: it is very problematic to carry out the comprehensive **consistent** analysis if different (but connected) indicators are calculated by different methods
- **Technical problem: Additivity vs Fixity of regional results**
  - ✓ If one wants to use the regional fixity also in the Global GK, IDB, G aggregations then this will distort the additivity
  - ✓ If one produces the free Global results by GK, IDB, G then these results will be inconsistent with the regional results. The differences can be very high for many important areas (Housing rents, Education, Health, Construction) due to different approaches used by the EU-OECD and other ICP Regions

OECD experience with double set of the PPP results

- Following decision by the “Great debates “ (1988-1989), the OECD started to publish two sets of the PPP results
- The comprehensive sets of the GK results (without fixity for EU countries) were published for 1990 and 1993 exercises
  - official EKS results for volume and price level comparisons
  - non-official results by the GK method for structural analyse =>
- No broad use of the GK results and there were numerous irritations with the explanation of double results for CPLI, VIpc, etc.

  => The OECD publishes in the 1996, 1999 and 2002 exercises only two Tables with the GK results: relative PLI and Volume indices =>

The GK results were practically not used (only the irritations) => **The OECD stopped the production and the publication of the GK results**

Is it possible to use the official EKS results also for the structural analyses?

- The degree of non-additivity of the EKS Real values (percentage differences between Real Values for an Aggregate-Total and the sum of its elements) depends on the currency numeraire used
- The non-additivity of the official EKS results (with Regional fixity) can be significantly reduced if the official EKS PPPs using for the calculation of Real Values are presented in a "neutral" form with the base "Region or World = 1" (unweighted GM scaling with the XRs is preferable => PPS)
- **The GM scaling of EKS-PPPs to the base "World / Region =1" brings very moderate degree of non-additivity: 2-5%**
- **Moderate degrees of non-additivity (2-5%) are sufficient for the reliable structural analysis in the practice**

Flexible non-additivity of the EKS results: ADB 2017 example

ADB 2017 results for GFCF by different presentation of the PPPs

ADB ICP 2017

Gross Fixed Capital Formation (GFCF) - analysis of thr choice of base currency on the non-additivity EKS Real Values

ADB22 2017: Real expenditure data (mio. HKD)

	Max	Min	Max-Min	BGD	BRN	BTN	CHN	FJI	HKG	IDN	IND	KHM	LAO	LKA	MDV	MMR	MNG	MYS	NPL	PAK	PHL	SGP	THA	TWN	VNM
Nod-add (%) = (Sum-T/GFCF-1)*100	37.6	-13.9	51.6	33.7	14.1	32.2	13.6	-13.9	0.0	37.6	7.0	13.4	4.9	0.7	14.7	8.9	0.2	12.7	12.3	-0.2	3.4	-9.1	-8.7	-11.2	26.8

ADB22 2017: Real expenditure data (mio. CHN)

	Max	Min	Max-Min	BGD	BRN	BTN	CHN	FJI	HKG	IDN	IND	KHM	LAO	LKA	MDV	MMR	MNG	MYS	NPL	PAK	PHL	SGP	THA	TWN	VNM
Nod-add (%) = (Sum-T/GFCF-1)*100	12.6	-9.0	21.5	10.9	1.2	10.4	0.0	-9.0	-1.6	12.6	-1.6	1.1	-2.9	-4.3	1.6	-0.8	-4.5	0.6	0.2	-4.6	-3.0	-5.0	-8.3	-6.4	6.6

ADB22 2017: Real expenditure data (mio. IND)

	Max	Min	Max-Min	BGD	BRN	BTN	CHN	FJI	HKG	IDN	IND	KHM	LAO	LKA	MDV	MMR	MNG	MYS	NPL	PAK	PHL	SGP	THA	TWN	VNM
Nod-add (%) = (Sum-T/GFCF-1)*100	5.4	-1.9	7.3	3.4	0.1	3.5	-1.9	2.5	5.3	3.4	0.0	0.7	-0.9	0.1	0.4	0.2	-0.2	-0.1	-0.7	-0.2	0.1	5.4	-0.3	4.6	0.5

ADB22 2017: Real expenditure data (mio. Asian HKD-W)

	Max	Min	Max-Min	BGD	BRN	BTN	CHN	FJI	HKG	IDN	IND	KHM	LAO	LKA	MDV	MMR	MNG	MYS	NPL	PAK	PHL	SGP	THA	TWN	VNM
Nod-add (%) = (Sum-T/GFCF-1)*100	10.3	-6.7	16.9	8.9	0.7	8.6	-0.6	-6.6	-0.2	10.3	-1.4	0.8	-2.5	-3.5	1.0	-0.8	-3.6	0.3	-0.1	-3.7	-2.5	-2.6	-6.7	-3.9	5.0

ADB22 2017: Real expenditure data (mio. Asian HKD-Unw)

	Max	Min	Max-Min	BGD	BRN	BTN	CHN	FJI	HKG	IDN	IND	KHM	LAO	LKA	MDV	MMR	MNG	MYS	NPL	PAK	PHL	SGP	THA	TWN	VNM
Nod-add (%) = (Sum-T/GFCF-1)*100	5.3	-1.3	6.6	4.2	0.4	4.4	-1.3	1.6	5.0	4.6	0.4	0.9	-0.4	-0.2	0.7	0.4	-0.1	0.4	-0.1	-0.1	0.2	5.3	-0.8	4.3	1.3

Global ICP 2017: GFCF example

- The presentation in USD brings systematic extreme non-additivity if underlying PPPs and expenditure shares are very different
- Average percentage absolute deviations for the GFCF are very high for all Regions because the PPPs for ”Construction” (USA=1) are very high relatively PPPs for “Machinery and Equipment”
- The scaling of official Global EKS-PPPs to the base “World143 =1” brings systematically very moderate degree of non-additivity: 3-5%.
- **The degrees of non-additivity = 2-5% are sufficient for the reliable structural analysis in the practice**

ICP 2017 Average percentage absolute deviations: GFCF-Total vs Sum of 3 categories

Average percentage absolute deviations: GFCF-Total vs Sum of 3 categories

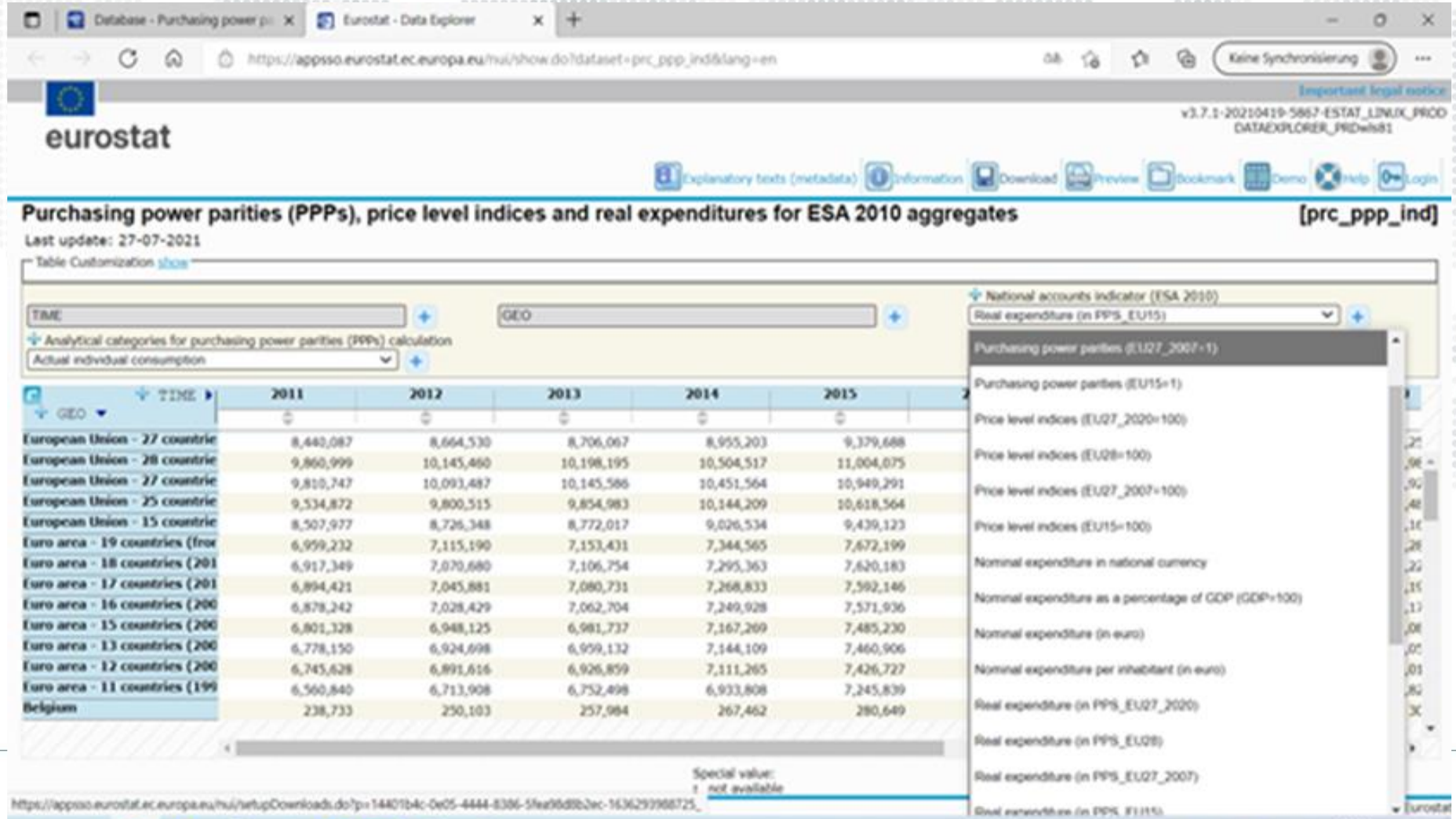
	EUO	AFR	ASI	LA	WA	W143
by PPPs scaled by GM-XRs to World = 1	6.9	3.9	4.8	2.3	2.5	4.8
by PPPs to USD	14.0	34.8	44.0	44.1	47.0	30.7
by scaled BH-PPPs (Gerardi)	7.6	4.4	5.5	2.9	4.4	5.5

Maximal percentage devitaions: GFCF-Total vs Sum of 3 categories

	EUO	AFR	ASI	LA	WA	W143
by PPPs scaled by GM-XRs to World = 1	26.8 *(USA)*	15.8 *(AGO)*	15.8 *(IDN)*	9.2 *(HTI)*	7.0 *(OMN)*	26.8 *(USA)*
by PPPs to USD	54.4 *(ALB)*	98.9 *(ETH)*	100.4 *(IDN)*	108.1 *(HTI)*	75.7 *(OMN)*	108.1 *(HTI)*
by scaled BH-PPPs (Gerardi)	26.8 *(CHE)*	17.7 *(AGO)*	16.0 *(IDN)*	9.6 *(HTI)*	10.1 *(OMN)*	26.8 *(CHE)*

Presentation in the Eurostat PPP Database

Eurostat PPP Database contains unweighted and weighted (by exp.) PPPs with the following bases: EU37, EU27_2019, EU27, EU25, EU15



GEO \ TIME	2011	2012	2013	2014	2015
European Union - 27 countrie	8,440,087	8,664,530	8,706,067	8,955,203	9,379,688
European Union - 28 countrie	9,860,999	10,145,460	10,198,195	10,504,517	11,004,075
European Union - 27 countrie	9,810,747	10,093,487	10,145,586	10,451,564	10,949,291
European Union - 25 countrie	9,534,872	9,800,515	9,854,983	10,144,209	10,618,564
European Union - 15 countrie	8,507,977	8,726,348	8,772,017	9,026,534	9,439,123
Euro area - 19 countries (fro	6,959,232	7,115,190	7,153,431	7,344,565	7,672,199
Euro area - 18 countries (201	6,917,349	7,070,680	7,106,754	7,295,363	7,620,183
Euro area - 17 countries (201	6,894,421	7,045,881	7,080,731	7,268,833	7,592,146
Euro area - 16 countries (200	6,878,242	7,028,429	7,062,704	7,249,928	7,571,936
Euro area - 15 countries (200	6,801,328	6,948,125	6,981,737	7,167,269	7,485,230
Euro area - 13 countries (200	6,778,150	6,924,698	6,959,132	7,144,109	7,460,906
Euro area - 12 countries (200	6,745,628	6,891,616	6,926,859	7,111,265	7,426,727
Euro area - 11 countries (199	6,560,840	6,713,908	6,752,498	6,933,808	7,245,839
Belgium	238,733	250,103	257,984	267,462	280,649

Treatment of negative expenditure

- Assumptions by PPP methods: price data - only positive values and expenditure / quantity data – only non-negative values
- Presence of BHs with negative expenditure introduces distorting effect in the PPP calculations as well as in the structural analysis
- Additive aggregation methods based on the simultaneous calculation of PPPs and international average prices like the GK or the IDB are very sensitive to use of negative expenditure values
- Distorting effect can be significant => recent version of the PWT10.1 contains several cases where GK PPPs are negative
- The size of distortions depends on the aggregation method per se and on the size (shares) of negative expenditure as well as the variation of underlying BH-PPP/PLIs
- The EKS method is less sensitive to negative expenditure but if the shares of negative expenditure are very high and BH-PPP/PLIs are very different then the bilateral F-PPPs can be not very reliable

Distorting effect of negative expenditure on F-PPPs

Calculation of bilateral F-PLI from DA and Net exports

ICP143 Global multilateral results

		A	B	A	B	
		STP	LUX	STP	LUX	(A+B)/2
	PLI A/B (B=100)	Sh Exp A (%)	Sh Exp B (%)	PLI A (W=100)	PLI B (W=100)	T-Sh
DA	45.8	150.7	64.8	68.7	150.1	1.078
Net exports	100.0	-50.7	35.2	100.0	100.0	-0.078
GDP	50.0	100.0	100.0	67.1	134.2	1.000

Bilateral F-PLI from DA and Net exports

L-PLI STP/LUX (LUX=100)	64.9
P-PLI STP/LUX (LUX=100)	35.9
F-PLI STP/LUX (LUX=100)	48.3
T-PLI STP/LUX (LUX=100)	43.1

ICP143 Global multilateral results

		A	B	A	B	
		NPL	CHE	NPL	CHE	(A+B)/2
	PLI A/B (B=100)	Sh Exp A (%)	Sh Exp B (%)	PLI A (W=100)	PLI B (W=100)	T-Sh
DA	26.2	133.8	89.4	46.2	176.5	1.116
Net exports	100.0	-33.8	10.6	100.0	100.0	-0.116
GDP	25.3	100.0	100.0	42.8	169.0	1.000

Bilateral F-PLI from DA and Net exports

L-PLI NPL/CHE (CHE=100)	34.0
P-PLI NPL/CHE (CHE=100)	20.9
F-PLI NPL/CHE (CHE=100)	26.7
T-PLI NPL/CHE (CHE=100)	22.4

ICP143 Global multilateral results

		A	B	A	B	
		SDN	CHE	SDN	CHE	(A+B)/2
	PLI A/B (B=100)	Sh Exp A (%)	Sh Exp B (%)	PLI A (W=100)	PLI B (W=100)	T-Sh
DA	19.7	106.0	89.4	34.8	176.5	0.977
Net exports	100.0	-6.0	10.6	100.0	100.0	0.023
GDP	20.0	100.0	100.0	33.8	169.0	1.000

Bilateral F-PLI from DA and Net exports

L-PLI SDN/CHE (CHE=100)	28.2
P-PLI SDN/CHE (CHE=100)	18.8
F-PLI SDN/CHE (CHE=100)	23.0
T-PLI SDN/CHE (CHE=100)	20.5

ICP143 Global multilateral results

		A	B	A	B	
		STP	LSO	STP	LSO	(A+B)/2
	PLI A/B (B=100)	Sh Exp A (%)	Sh Exp B (%)	PLI A (W=100)	PLI B (W=100)	T-Sh
DA	110.3	150.7	141.6	68.7	62.3	1.462
Net exports	100.0	-50.7	-41.6	100.0	100.0	-0.462
GDP	112.6	100.0	100.0	67.1	59.6	1.000

Bilateral F-PLI from DA and Net exports

L-PLI STP/LSO (LSO=100)	114.5
P-PLI STP/LSO (LSO=100)	116.3
F-PLI STP/LSO (LSO=100)	115.4
T-PLI STP/LSO (LSO=100)	115.4

Conclusions (1)

- **The Gerardi method as sectoral independent can be considered as the most appropriate for structural analysis**
  (The GK and the IDB methods are less appropriate due to sectoral dependency)

However:

- **The use the regional fixity distorts the additivity. Free additive methods can produce very different results relatively official EKS results with fixity**
- **Supplementary additive results would be non-official and therefore it is very likely that they will not be broadly used and if - then can be numerous irritations**
  (Negative OECD experience: EKS and GK)

Conclusions (2)

- **General problem**: It is very problematic to carry out the comprehensive consistent analysis if different (but connected) indicators are calculated by different methods
- Main actual reason high non-additivity is not the EKS method *per se* but the weakness of BH-PPPs due to insufficient QA and PA as well as very different approaches used by the EU-OECD and other ICP Regions for many important areas (Housing rents, Education, Health, Construction)
- **It is more desirable to focus the efforts on the improvement and unification of the methods used by the Regions for several important areas indicated above which can bring quasi-additive results than on the production and the publishing of an alternative set of the additive results**

Conclusions (3)

- **The researchers should have a possibility to produce the ICP results by use of alternative estimation methods and approaches for own analyses and be responsible for them**
- **However, it is not desirable to produce and publish officially an alternative set of the ICP results**
- **It is better to inform users that non-additivity of the EKS results is relative and the degree of non-additivity depends on the presentation of PPPs and Volumes**
- **Different scaling of official published EKS-PPPs** (e.g. unweighted GM with the XRs) **can be helpful for the different analyses**
- Negative expenditure introduces distorting effect in the PPP calculations as well as in the structural analysis. The investigations on the treatment of negative expenditure in the aggregation procedures and the structural analysis are desirable

Thank You!