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Treatment of basic headings with negative expenditure within the PPP aggregation procedures

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I. Why special treatment of negative expenditure is necessary in the PPP aggregation procedures?

The most popular PPP aggregation procedures using within the ICP/ECP are the EKS method[1] (the averaging of bilateral PPPs) and the Geary-Khamis (GK) method (averaging of national prices into a common currency by PPPs). Both multilateral aggregation methods are described in details in many reports[2]. However one particular problem for the PPP aggregation as well as for the structural analysis should be still investigated. A. Heston and R. Summers indicated: "*In our increasingly interdependent world economy, both real and financial, there are some methodological issues that the ICP clearly needs to face in the future in the treatment of the foreign balance*".[3]

All PPP and structural methods are based on the assumption that price data contains only positive values and expenditure / quantity data – only non-negative values. This is not so in the practice. GDP contains several basic headings (BH) where negative expenditure are occurred. Mainly, these are, so called, "Balancing categories": "Net exports", „Change in inventories", „Net expenditures of residents abroad", „Acquisitions less disposals of valuables". Several SNA positions like "Receipts from sales" in Government have negative expenditure by the definition. Additionally, even BHs from the „Machinery and Equipment" can have negative values[4] due to the export of „second hand equipment".

Additive aggregation methods like the GK or the IDB based on the simultaneous calculation of PPPs and international average prices are very sensitive to negative expenditure values - negative average prices or even negative aggregated PPPs can be obtained. So, recent version of the PWT10.1 (version of 23 Jan 2023) contains the cases where GK GDP-PPP/PLIs are negative. For example, **Bermuda**[5] had for several years very specific structure of main GDP components:

csh_c	Share of household consumption at current PPPs
csh_i	Share of gross capital formation at current PPPs
csh_g	Share of government consumption at current PPPs
csh_x	Share of merchandise exports at current PPPs
csh_m	Share of merchandise imports at current PPPs
csh_r	Share of residual trade and GDP statistical discrepancy at current PPPs
cgdpo	Output-side real GDP at current PPPs

[1] The EKS method was first proposed by C. Gini (1931).It was later rediscovered by three independent researchers: Ö. **E**lteto, P. **K**öves (1964, Hungary), B. **S**zulc (1964, Poland). The name GEKS is used in the last ICP publications.

[2] Detailed description of the multilateral methods (include desired properties of aggregation procedures) and the analysis of its advantages and disadvantages can be found in the large literature:
Kravis I. a.o. *A System of International Comparisons of GDP and Purchasing Power*,1975;
Kravis I. a.o. *World Product and Income. International Comparisons of Real Gross Product*. Baltimore, 1982.
Hill P. *Multilateral Measurements of Purchasing Power and Real GDP*. SOEC, 1982.
World bank (2011): ICP Book - Measuring the Real Size of the World Economy
https://www.worldbank.org/en/programs/icp/brief/2011-icp-book
Eurostat-OECD PPP Manual (edition of 2024)
Short but strong description of multilateral methods is done in the *SNA 2008, chapter XYI, part F*.

[3] ICP Bulletin, Vol.5, No.1, March 2008 (page 4).

[4] So, data for the Eurostat 1997 contained really several BHs from GFCF with negative expenditure values.

[5] Bermuda is an exotic specific country but large country Nigeria (very high negative Imports) was dropped from the PWT calculations based on 2005 ICP data, to obtain meaningful G-K results. In other case some average world prices would be negative. See „*Estimating Real Production and Expenditures Across Nations: A Proposal for Improving the Penn World Tables*" by R. Feenstra; A. Heston; M. Timmer; Haiyan Deng, July 2007 http://pwt.econ.upenn.edu/papers/Feenstra-Heston-Timmer-Final_new.pdf

In effect, the indicator “pl_gdpo” => Price level of CGDPo (PPP/XR) [price level of USA GDPo in 2017=1] was negative!?

country	country	currenc	year	pl_con	pl_da	pl_gdpo	i_cig	i_xm	i_xr	i_outlie	i_irr	csh_c	csh_i	csh_g	csh_x	csh_m	csh_r
BMU	Bermuda	Bermudia	1999	1.232	1.307	-24.708	Interpolat	Benchmar	Market-ba	Outlier	Regular	-12	-3	-3	-2	33	-13
BMU	Bermuda	Bermudia	2000	1.229	1.296	-3.752	Interpolat	Benchmar	Market-ba	Outlier	Regular	-2	0	0	0	7	-3
BMU	Bermuda	Bermudia	2001	1.187	1.238	-3.274	Interpolat	Benchmar	Market-ba	Outlier	Regular	-1	0	0	0	6	-3
BMU	Bermuda	Bermudia	2003	1.266	1.285	-12.750	Interpolat	Benchmar	Market-ba	Outlier	Regular	-6	-1	-2	-2	21	-9

The presence of negative expenditure brings also the problems for the structural analysis. For example, A. Heston and P. Rao examined in their paper[6] evolution of economic structures of countries in terms of price and quantity similarity and the global price structures. They excluded all BHs with negative expenditure during the calculation of coefficients of price similarity and all BHs where some countries have zero or negative expenditure during the calculation of coefficients of quantity similarity. Obviously, simple exclusion of some data is not the actual solution of the problem.

It is true that the cases with the negative PPPs were very rare in the actual ICP rounds (mostly in very provisional calculations). However this does not mean that negative expenditure values have no impact on the accuracy / bias of PPPs. All theoretical investigations on the PPPs are done by the assumption that all expenditure / quantity values are non-negative. Therefore, negative expenditure bring inevitably distorting effect. The size of distortions depends on the aggregation method *per se* and the size (shares) of negative expenditure as well as the variation of underlying BH-PPP/PLIs.

The most important BH with potential negative expenditure is "Net exports". This category has very significant negative value in many countries (in some extreme cases, the share of “Net exports” in GDP is minus 30-50% and respectively the share of Domestic Absorption (DA) 130-150 %!?). Distorting effect can be significant. This topic was intensively discussed in the earlier ICP rounds when the G-K aggregation was used. It was proposed to distribute „Change in stocks“ and „Net exports“ proportionally between representing BHs, to avoid the treatment of negative values.[7] Obviously, this approach is very disputable.

The EKS aggregation using in the next ICP rounds is much less sensitive than the GK concerning the presence of the negative expenditure values. Therefore the discussions on this topic were practically stopped. The BHs with negative expenditure (and correspondingly - negative notional quantities) are treated presently in the ICP aggregations in the standard way. However this does not mean that this practice is straightforward. The aggregated Laspeyres and Paasche PPPs (and, in final effect, F- and EKS-PPPs) can be calculated as correct averages only on the basis of non-negative input data for prices and quantities / expenditures (even strictly positive for prices). Therefore the inclusion of the BHs with negative expenditure in the aggregation procedures without a special treatment leads to the distortions.

[6] https://thedocs.worldbank.org/en/doc/f60d81b4360769d233c638017e5a5c6b-0050022021/original/1-02-Understanding-the-World-Economy-Insights-from-ICP-2017-Heston-and-Rao.pdf

[7] Kravis I. a.o. *World Product and Income. International Comparisons of Real Gross Product*. Baltimore,1982 (see page.90) – a proposal concerning the distribution of „Changes in stocks“.
Ahmad S. „*A Note on the Treatment of Net Foreign Balance in the Calculation of Real Values*“. Vienna Consultation on the ECP (point 8 of the Agenda); Vienna, 1998 – a proposal concerning the distribution of „Net foreign balance“ (= “Net exports“).

The author started to investigate this problem many years ago during the COMECON comparisons for years 1978 and 1983. Mongolia had very high negative "Change in stocks" (mainly, negative changes in livestock) and this lead to irrational PPP for Mongolian Gross National Income (GNI). Much later the author obtained this problem in the Eurostat comparison by the use of the EKS aggregation. The EKS method is less sensitive to the presence of negative expenditure. Nevertheless, if the shares of negative expenditure are very high and BH-PPP/PLIs are very different then the bilateral F-PPPs can be not reliable and even meaningless because of very high difference between L- and P- PPPs due to high share of negative expenditure and high differences in the PLIs for underlying components. For example, Eurostat 1997 comparison produces at the initial stages negative PPPs in some specific cases. Two BHs from the aggregate „Machinery and Equipment":

- 14130211 „Boats, etc." – for Sweden,
- 14130231 „Aircrafts, etc." – for Sweden and Iceland.

had negative values within the 1997 Eurostat comparison with 18 countries. The reason of this phenomenon was the export of second hand equipment. In effect, Sweden and Iceland had negative expenditure data for the whole Heading 141302 „Other Transport equipment". This led to several negative binary Laspeyres-PPP and to impossibility to calculate the respective Fisher-PPPs in the initial versions of the 1997 calculations because of many binary meaningless PPPs for Sweden and Iceland. The "normal" limits for the L/P ratio (so called, LPS - Laspeyres - Paasche Spread = ratio between Laspeyres and Paasche PPPs) for more or less homogeneous countries are: **1.0 < L/P < 1.5.** Numerous L/P ratios for Sweden (14 from 18) were outside this zone, two bilateral PPPs (with Switzerland and Norway) were negative (?!)[8]. The similar situation is for Iceland: 13 L/P ratios were outside the „normal" zone and some L/P ratios were fully curious, e.g. L/P ratio for „Iceland/Switzerland" is **0.08**, i.e. Paasche PPP is more 12 times higher than Laspeyres PPP (?!). Obviously, such bilateral PPPs are fully non-realistic / meaningless.

The reliability of the bilateral F-PPPs is measured usually by the analysis of the Laspeyres - Paasche Spread (LPS). If one looks in the official Global ICP bilateral F-PPPs then it is visible that no. of cases with extreme L/P ratios is very high. The borders for acceptable LPS values are depended on homogeneity of the set of the countries. The Global ICP contains very heterogeneous set. The set of the ICP countries have very different structures of expenditure and prices (BH-PPPs). Therefore liberal borders like (**LPS<0.9 or LPS > 2.0)** were selected. The Table 1 presents the no. of the cases with extreme L/P ratios for the GDP from the ICP 2021 (159 countries, free EKS calculation, **Act. V**, v16.04.24) from the official calculations by the use of actual expenditure values. Total No. of bilateral Global F-PPPs for 159 countries is = 12561 (159*158/2). Total No. of bilateral Global F-PPPs with L/P ratios outside the range **0.9 < L/P < 2.0** is 2216**.** It means that the share (%) of extreme L/P ratios is **17.6** (2216 / 12561*100). It means that circa 20% of bilateral F-PPPs were not very reliable.

[8] The Fisher PPP is calculated as a geometric mean from L- and P – PPPs. Should we legalize in this case the use of imaginary numbers like (a***i**), where i is √-1?

Table 1: No. of extreme L/P ratios for GDP

ICP 2021 (159 countries, free EKS calculation, **Act. V**, v16.04.24)

	Shares of Net Exports (%)	L/P MAX	L/P MIN	No. of L/P > 2.0	No. of L/P < 0.9	No. of L/P (>2.0; <0.9)
AGO	31.0	2.248	0.492	1	33	34
BDI	-19.1	3.998	0.857	24	1	25
BEN	-6.2	3.440	0.896	5	1	6
BFA	-0.6	4.580	0.925	12	0	12
BWA	-4.9	2.245	0.797	4	1	5
CAF	-18.0	3.969	0.801	5	2	7
CIV	0.1	3.700	0.933	3	0	3
CMR	-3.7	3.349	0.929	19	0	19
COD	0.2	3.891	0.925	1	0	1
COG	13.6	2.756	0.995	3	0	3
COM	-20.0	3.691	0.849	32	1	33
CPV	-36.6	3.469	0.334	11	24	35
DJI	28.0	5.098	1.000	2	0	2
DZA	0.3	2.852	0.764	6	1	7
EGY	-7.8	3.884	0.931	17	0	17
ETH	-9.7	3.380	1.000	26	0	26
GAB	37.9	4.003	1.000	3	0	3
GHA	-2.5	3.432	1.000	7	0	7
GIN	-20.1	3.607	1.000	19	0	19
GMB	-28.9	3.419	0.896	14	1	15
GNB	-12.7	3.769	0.875	4	1	5
GNQ	8.9	3.355	1.000	27	0	27
KEN	-9.1	3.204	0.886	13	1	14
LBR	-21.1	5.745	1.000	14	0	14
LSO	-49.1	3.238	0.536	8	6	14
MAR	-9.3	3.058	0.854	2	1	3
MDG	-8.9	4.438	0.908	24	0	24
MLI	-8.5	4.196	0.957	29	0	29
MOZ	-31.4	3.233	0.978	3	0	3
MRT	-8.6	3.452	0.821	6	2	8
MUS	-9.7	2.494	0.908	4	0	4
MWI	-16.5	4.203	1.000	45	0	45
NAM	-16.3	3.154	0.761	4	1	5
NER	-16.8	2.963	0.905	7	0	7
NGA	-1.1	2.386	0.924	4	0	4
RWA	-15.6	4.005	1.000	30	0	30
SDN	-4.4	2.513	0.761	4	4	8
SEN	-19.9	3.818	0.923	3	0	3
SLE	-24.5	4.074	1.000	37	0	37
SOM	-65.7	4.073	0.778	18	4	22
SSD	-1.3	2.720	0.925	4	0	4
STP	-28.3	3.207	0.858	13	1	14
SWZ	-0.9	2.846	0.899	4	1	5
SYC	-10.4	3.007	0.901	3	0	3
TCD	6.9	5.022	0.953	8	0	8
TGO	-10.2	3.740	0.819	10	1	11
TUN	-10.1	3.147	0.908	8	0	8
TZA	-0.9	3.644	0.819	16	7	23
UGA	-9.9	4.023	0.954	21	0	21
ZAF	6.1	3.868	1.000	5	0	5
ZMB	18.2	2.484	0.774	1	7	8
ZWE	-5.5	3.503	0.838	6	1	7
BGD	-7.3	3.193	0.904	8	0	8
BRN	13.2	2.928	0.968	4	0	4
BTN	-19.2	3.793	0.694	15	2	17
CHN	2.6	3.258	0.970	2	0	2
FJI	-27.3	2.623	0.842	3	5	8
HKG	5.6	3.745	0.988	5	0	5
IDN	2.6	2.797	0.917	4	0	4
IND	-2.4	3.200	0.778	7	1	8
KHM	-1.4	4.715	0.945	4	0	4
LAO	-5.9	2.819	0.803	4	2	6
LKA	-7.4	3.748	0.736	17	2	19
MDV	3.4	3.962	1.000	11	0	11
MNG	-1.9	2.767	0.976	7	0	7
MYS	7.2	3.140	1.000	2	0	2
NPL	-34.1	3.647	0.884	16	1	17
PAK	-10.6	3.492	0.863	13	1	14
PHL	-12.0	3.848	0.997	4	0	4
SGP	35.8	5.460	0.988	21	0	21
THA	0.0	3.145	0.850	4	1	5
TWN	14.2	3.513	1.000	3	0	3
VNM	0.1	2.768	0.836	5	2	7
ARM	-7.9	3.409	0.765	11	2	13
AZE	16.7	2.562	0.643	3	6	9
BLR	5.6	2.744	0.649	4	6	10
KAZ	8.6	2.544	0.665	2	4	6
KGZ	-28.7	4.633	0.861	34	2	36
MDA	-27.2	3.049	0.908	8	0	8
RUT	9.2	2.715	0.745	1	4	5
TJK	-23.5	4.952	0.682	37	2	39
UZB	-16.5	4.397	0.720	22	2	24

Table 1: No. of extreme L/P ratios for GDP (contd.)

ICP 2021 (159 countries, free EKS calculation, **Act. V**, v16.04.24)

	Shares of Net Exports (%)	L/P MAX	L/P MIN	No. of L/P > 2.0	No. of L/P < 0.9	No. of L/P (>2.0; <0.9)
ALB	-13.4	3.015	0.852	4	1	5
AUS	5.4	5.829	1.000	23	0	23
AUT	0.9	5.666	1.000	13	0	13
BEL	1.8	6.181	1.000	14	0	14
BGR	1.8	3.058	0.877	2	1	3
BIH	-11.3	3.171	0.861	2	1	3
CAN	0.0	4.498	0.977	9	0	9
CHE	12.3	9.427	1.000	82	0	82
CHL	-0.8	3.943	0.931	1	0	1
COL	-7.6	3.530	0.886	5	1	6
CRI	1.6	3.159	0.892	1	1	2
CYP	4.0	3.916	0.832	2	1	3
CZE	3.0	4.572	0.929	3	0	3
DEU	5.4	6.214	1.000	22	0	22
DNK	6.7	6.560	1.000	34	0	34
ESP	1.0	5.674	0.898	4	1	5
EST	-1.0	4.532	0.907	4	0	4
FIN	0.0	4.877	0.880	6	1	7
FRA	-1.9	4.971	0.937	5	0	5
GBR	-0.2	5.907	0.852	14	1	15
GRC	-7.8	3.797	0.709	1	4	5
HRV	-2.7	3.412	0.713	1	5	6
HUN	0.2	4.129	0.898	1	1	2
IRL	40.1	12.011	1.000	94	0	94
ISL	-2.0	4.586	0.815	4	1	5
ISR	3.6	4.863	0.946	12	0	12
ITA	2.2	5.304	0.988	8	0	8
JPN	-0.5	5.951	1.000	23	0	23
KOR	3.6	4.314	1.000	14	0	14
LTU	4.5	3.925	0.938	1	0	1
LUX	33.3	8.225	1.000	78	0	78
LVA	-3.2	3.996	0.843	1	1	2
MEX	-1.9	3.031	0.920	2	0	2
MKD	-15.8	2.704	0.903	4	0	4
MLT	17.8	4.271	0.994	3	0	3
MNE	-19.4	2.585	0.726	4	4	8
NLD	11.3	5.894	1.000	22	0	22
NOR	12.9	6.712	1.000	42	0	42
NZL	-3.2	5.294	0.946	21	0	21
POL	3.3	3.431	0.986	1	0	1
PRT	-2.8	4.195	0.785	2	1	3
ROU	-5.7	3.235	0.834	1	1	2
SRB	-8.0	3.105	0.850	2	1	3
SVK	-0.1	4.325	0.870	2	1	3
SVN	5.8	4.777	0.916	3	0	3
SWE	4.7	5.566	0.972	20	0	20
TUR	0.4	3.022	0.835	4	2	6
USA	-3.6	6.388	1.000	29	0	29
ARG	3.1	2.514	0.946	5	0	5
BOL	-3.4	3.611	0.823	5	1	6
BRA	0.1	3.473	0.944	2	0	2
DOM	-9.2	3.271	0.947	13	0	13
ECU	1.0	3.044	0.935	1	0	1
GTM	-14.1	4.513	0.982	4	0	4
HND	-23.5	3.284	0.790	3	2	5
NIC	-13.5	3.263	0.855	7	1	8
PAN	3.4	2.943	0.915	3	0	3
PER	3.0	3.706	0.960	4	0	4
PRY	1.2	3.110	1.000	3	0	3
SLV	-24.2	3.656	0.911	6	0	6
URY	6.5	3.292	0.966	1	0	1
ARE	18.7	4.689	1.000	42	0	42
BHR	19.5	3.304	1.000	10	0	10
EGZ	-7.8	3.727	0.724	12	2	14
IRQ	14.2	2.625	0.882	3	1	4
JOR	-21.0	2.405	0.765	3	3	6
KWT	2.0	4.830	1.000	38	0	38
LBN	-31.2	4.626	0.930	48	0	48
MAS	-9.3	3.610	0.895	1	1	2
MRU	-8.6	2.445	0.802	4	3	7
OMN	11.1	3.086	1.000	12	0	12
PSE	-38.4	2.118	0.404	1	22	23
QAT	24.8	6.280	1.000	47	0	47
SAU	8.4	4.443	1.000	20	0	20
SDO	-4.4	3.392	0.334	7	7	14
SYR	-48.3	12.011	1.000	152	0	152
TUO	-10.1	3.126	0.917	7	0	7
Max	40.1	12.011				
Min	-65.7		0.334			
			Total	1994	222	2216

94 counties had negative Net export and 65 countries had positive Net export. The shares of Net exports vary from – 65.7% (SOM) till 40.1% (IRL). The **LPS** values vary from **12.011** till 0.**334**. Many countries have more than 30 extreme LPS – see Table 2.

Table 2: Countries with extreme high No. of extreme L/P ratios for GDP

ICP 2021 (159 countries, free EKS calculation, **Act. V**, v16.04.24)

	Shares of Net Exports (%)	L/P MAX	L/P MIN	No. of L/P > 2.0	No. of L/P < 0.9	No. of L/P (>2.0; <0.
AGO	31.0	2.248	0.492	1	33	34
COM	-20.0	3.691	0.849	32	1	33
CPV	-36.6	3.469	0.334	11	24	35
MWI	-16.5	4.203	1.000	45	0	45
RWA	-15.6	4.005	1.000	30	0	30
SLE	-24.5	4.074	1.000	37	0	37
KGZ	-28.7	4.633	0.861	34	2	36
TJK	-23.5	4.952	0.682	37	2	39
CHE	12.3	9.427	1.000	82	0	82
DNK	6.7	6.560	1.000	34	0	34
IRL	40.1	12.011	1.000	94	0	94
LUX	33.3	8.225	1.000	78	0	78
NOR	12.9	6.712	1.000	42	0	42
ARE	18.7	4.689	1.000	42	0	42
KWT	2.0	4.830	1.000	38	0	38
LBN	-31.2	4.626	0.930	48	0	48
QAT	24.8	6.280	1.000	47	0	47
SYR	-48.3	12.011	1.000	152	0	152

Such countries like CHE (significant positive share of Net exports and very high PLI for DA), IRL (extreme positive share of Net exports and high PLI for DA) and SYR extreme negative share of Net exports and very low PLI for DA) have more than half number of not very reliable bilateral F-PPPs (CHE – 82, IRL - 94 and SYR – 152! => only 6 reliable bilateral F-PPPs!).

The Global ICP contains very heterogeneous set. However this situation is obtained also in much more homogeneous regions like EU-OECD. This region is relatively homogeneous and the annual comparisons are carried out (=> more possibilities for the deep validation of input data). Therefore tighter borders were selected (LPS<0.95 or LPS > 1.5) were selected. The shares of Net exports vary from 40.1% (IRL) till – 19.4% (MNE). The LPS values vary from 3.669 till 0.864. Total No. of bilateral F-PPPs for 50 EU-OECD countries is = 1225 (50*49/2). Total No. of bilateral F-PPPs with L/P ratios outside the selected range **0.95 < L/P < 1.5** is **252.** It means that the share (%) of extreme L/P ratios is **20.6** (252 / 1225*100) – see Table 3. It means that circa 20% of bilateral F-PPPs within the EU-OECD comparison for GDP are not very reliable.

Table 3: Analysis of Ratios of extreme L/P ratios

(**OECD 2021** GDP, 50 countries, w/o 0-BH, **Act.V**., w/o fixity, w/o PA)

	Shares (%) of Net Exports	MAX	MIN	No. L/P >1.5	No. L/P <0.95	Total no. (>1.5;<0.95)
ALB	-13.4	2.227	0.951	13	0	13
AUS	5.4	2.211	1.000	8	0	8
AUT	0.9	2.022	1.000	1	0	1
BEL	1.8	2.161	1.000	4	0	4
BGR	1.8	2.050	1.000	3	0	3
BIH	-11.3	2.214	0.997	6	0	6
CAN	0.0	1.838	1.000	1	0	1
CHE	12.3	3.295	1.000	15	0	15
CHL	-0.8	1.484	1.000	0	0	0
COL	-7.6	2.185	1.000	5	0	5
CRI	1.6	1.836	1.000	3	0	3
CYP	4.0	1.707	1.000	1	0	1
CZE	3.0	1.673	0.992	1	0	1
DEU	5.4	2.240	1.000	6	0	6
DNK	6.7	2.246	1.000	6	0	6
ESP	1.0	1.720	1.000	1	0	1
EST	-1.0	1.570	1.000	1	0	1
FIN	0.0	1.750	0.983	1	0	1
FRA	-1.9	1.816	1.000	1	0	1
GBR	-0.2	1.961	1.000	2	0	2
GRC	-7.8	1.497	0.981	0	0	0
HRV	-2.7	1.761	0.925	3	1	4
HUN	0.2	1.620	1.000	3	0	3
IRL	40.1	3.669	1.000	17	0	17
ISL	-2.0	1.698	0.961	1	0	1
ISR	3.6	1.865	1.000	1	0	1
ITA	2.2	1.948	1.000	1	0	1
JPN	-0.5	1.975	1.000	3	0	3
KOR	3.6	1.807	1.000	2	0	2
LTU	4.5	1.512	0.976	1	0	1
LUX	33.3	3.456	1.000	16	0	16
LVA	-3.2	1.555	1.000	1	0	1
MEX	-1.9	1.721	1.000	3	0	3
MKD	-15.8	2.705	0.968	12	0	12
MLT	17.8	1.768	0.993	1	0	1
MNE	-19.4	2.319	0.864	12	1	13
NLD	11.3	2.226	1.000	6	0	6
NOR	12.9	2.429	1.000	9	0	9
NZL	-3.2	1.912	1.000	4	0	4
POL	3.3	1.710	0.986	3	0	3
PRT	-2.8	1.523	1.000	1	0	1
ROU	-5.7	1.841	1.000	3	0	3
SRB	-8.0	2.128	1.000	6	0	6
SVK	-0.1	1.492	0.990	0	0	0
SVN	5.8	1.737	0.961	1	0	1
SWE	4.7	1.947	1.000	1	0	1
TUR	0.4	2.491	0.986	9	0	9
USA	-3.6	2.302	1.000	9	0	9
GEO	-16.4	3.669	1.000	31	0	31
UKR	-1.3	2.848	0.864	9	2	11
			Total =>	248	4	252
MAX	40.1	3.669				
MIN	-19.4		0.864			
			Total No.	1225		
			No.of prob. L/P	252		
			Sh.(%)	20.6		

The EKS PPPs can look formally more or less realistic even by the presence of high number of problematic bilateral F-PPPs due to some compensation multilateral effect. However this situation cannot be regarded as satisfactory - the compensation effect can be an accidental case. The presence of BHs with negative values within an aggregate leads inevitably to their special treatment[9]. I.Kravis, R.Summers, A.Heston indicated this clearly: *"All of the commonly considered methods are designed to compare physical volumes. It is not to be expected that without appropriate adjustments they can be routinely applied to net items in the national accounts that are different in character from the physical flows of the other components of final expenditures on GDP*."[10]

Eurostat experiment in the past with, so called, **selective EKS approach**: F-PPPs with the L/P ratios outside the selected range are excluded from the EKS procedure and replaced by indirect PPPs obtained as GM from "reliable" PPPs via 3rd countries. The experimental GDP results from the Global ICP 2021 with LPS borders (0.9; 2.0) in the comparison with the results obtained by the official method are presented below – see Tables 4b.[11] This approach softs the impact of negative expenditure within the EKS procedure in an indirect way. Therefore the differences with the official results are rather moderate. Only few countries have differences more than +-1% - see Table 4a:

Table 4a: GDP differences not more than +-1% by the use of the LPS [0.9; 2.0]
ICP 2021 (159 countries, free EKS calculation, Act. V, v16.04.24)

	Exp. (mio. NC)		Shares of								
AggrL	5th	4th	Net Exports	Free EKS PPPs ($=1)		Free EKS PPPs GDP ($=1)			Volume Index pc (ICP159=100)		
	GDP	Net Exports	(%)	DA	NetExp-XR	Oficial	LPS (0.9,2.0	% Diff.	Oficial	LPS (0.9,2.0	% Diff.
COM	558 319	-111 398	-20.0	192.556	415.956	187.668	195.779	4.3	18.9	18.2	-3.6
CPV	164 544	-60 271	-36.6	49.068	93.218	49.521	48.595	-1.9	29.5	30.2	2.5
GNQ	6 803 761	604 119	8.9	235.754	554.531	234.125	238.470	1.9	92.8	91.7	-1.3
MWI	9 975 522	-1 649 065	-16.5	316.370	799.650	303.702	317.889	4.7	8.6	8.3	-3.9
SGP	569 364	203 635	35.8	0.974	1.344	0.902	0.916	1.6	604.3	598.1	-1.0
CHE	743 330	91 571	12.3	1.107	0.914	1.032	1.051	1.9	432.1	426.6	-1.3
IRL	434 070	173 949	40.1	0.812	0.845	0.723	0.778	7.5	624.3	584.0	-6.5
LUX	72 361	24 099	33.3	0.951	0.845	0.811	0.828	2.2	727.9	716.6	-1.6
ARE	1 524 744	285 085	18.7	2.557	3.673	2.478	2.457	-0.9	343.0	348.0	1.4
LBN	192 669 936	-60 141 536	-31.2	4416.086	11200.000	4167.482	4350.902	4.4	43.2	41.6	-3.7
PSE	58 526	-22 475	-38.4	1.923	3.232	1.987	1.954	-1.6	29.4	30.1	2.2
SYR	25 936 805	-12 517 413	-48.3	498.627	2150.833	423.146	434.058	2.6	11.9	11.7	-2.0
		MIN	-65.7				MIN	-1.9		MIN	-6.5
		MAX	40.1				MAX	7.5		MAX	2.5

[9] The treatment of BHs with negative expenditure is the problem also for double deflation in the NA. See, for example, the paper by Douglas S. Meade "*Why Real Value Added Is Not My Favorited Concept*" http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.407.2552&rep=rep1&type=pdf
Therefore the calculations of correct indices by the presence of negative values need some special treatment also in the NA like E. Diewert did this in the paper "*On Measuring Inventory Change in Current and Constant Dollars*" concerning the NA deflators for "Changes in inventories" - https://users.nber.org › ~confer › prcr › diewert.pdf

[10] See paper by I. Kravis, R. Summers and A. Heston "Comments on D. Gerardi -Selected problems of intercountry comparisons on the basis of the experience of the EEC". The Review of Income and Wealth, Journal of the International Association for Research in Income and Wealth, 1982, Series 28 – https://www.roiw.org/1982/381.pdf (page 409)

[11] The possibility to use selected LPS range in the PPP calculations as an option is included in the VBA program for the EKS aggregation procedure prepared by the author of this paper for the ICP purposes. The users have the choice and can select the desirable version for the PPP calculation (use selected LPS range versus non-use LPS) in accordance with concrete circumstances.

Table 4b: ICP 2021: Differences in the GDP results by the use of the LPS [0.9; 2.0]

	Exp. (mio. NC)		Shares of								
AggrL	5th	4th	Net Exports	Free EKS PPPs ($=1)		Free EKS PPPs GDP ($=1)			Volume Index pc (ICP159=100)		
	GDP	Net Exports	(%)	DA	NetExp-XR	Oficial	LPS (0.9,2.0	% Diff.	Oficial	LPS (0.9,2.0	% Diff.
AGO	44 541 004	13 811 739	31.0	185.543	631.442	193.103	195.707	1.3	34.9	34.6	-0.8
BDI	7 506 400	-1 435 000	-19.1	674.472	1975.951	639.454	648.303	1.4	4.9	4.8	-0.8
BEN	9 809 694	-609 893	-6.2	234.520	554.531	228.606	230.119	0.7	17.2	17.2	-0.1
BFA	11 317 126	-63 531	-0.6	219.076	554.531	214.287	215.645	0.6	12.5	12.5	-0.1
BWA	207 743	-10 256	-4.9	5.143	11.087	5.050	5.086	0.7	83.0	82.9	-0.1
CAF	1 431 537	-257 750	-18.0	256.315	554.531	250.281	251.952	0.7	5.5	5.5	-0.1
CIV	39 190 371	38 300	0.1	247.326	554.531	242.639	244.088	0.6	30.7	30.7	0.0
CMR	25 141 470	-918 714	-3.7	208.072	554.531	202.653	205.196	1.3	23.8	23.7	-0.7
COD	135 923 497	319 717	0.2	962.631	1989.391	945.252	951.473	0.7	7.1	7.1	-0.1
COG	8 172 514	1 110 000	13.6	240.610	554.531	238.235	239.740	0.6	30.7	30.7	-0.1
COM	558 319	-111 398	-20.0	192.556	415.956	187.668	195.779	4.3	18.9	18.2	-3.6
CPV	164 544	-60 271	-36.6	49.068	93.218	49.521	48.595	-1.9	29.5	30.2	2.5
DJI	609 208	170 548	28.0	92.582	177.721	91.260	92.179	1.0	31.5	31.4	-0.4
DZA	22 079 279	60 392	0.3	43.132	135.064	42.151	42.429	0.7	61.9	61.9	-0.1
EGY	7 226 500	-560 600	-7.8	4.434	15.645	4.238	4.254	0.4	81.5	81.6	0.2
ETH	5 249 281	-507 357	-9.7	15.230	48.567	14.570	14.691	0.8	15.6	15.6	-0.3
GAB	11 208 063	4 252 899	37.9	262.588	554.531	263.336	265.164	0.7	94.9	94.8	-0.1
GHA	470 592	-11 993	-2.5	2.278	5.806	2.230	2.246	0.8	33.6	33.5	-0.2
GIN	154 656 800	-31 143 700	-20.1	3439.807	9728.774	3258.614	3286.939	0.9	18.3	18.3	-0.3
GMB	105 487	-30 447	-28.9	17.106	51.484	15.926	16.038	0.7	13.1	13.1	-0.1
GNB	997 023	-126 331	-12.7	228.150	554.531	221.023	222.610	0.7	11.4	11.4	-0.2
GNQ	6 803 761	604 119	8.9	235.754	554.531	234.125	238.470	1.9	92.8	91.7	-1.3
KEN	12 027 662	-1 099 439	-9.1	45.426	109.638	44.185	44.652	1.1	26.8	26.7	-0.5
LBR	621 270	-130 957	-21.1	77.682	165.352	75.531	76.507	1.3	8.3	8.2	-0.7
LSO	35 076	-17 219	-49.1	6.827	14.779	6.624	6.652	0.4	12.1	12.1	0.1
MAR	1 274 727	-118 098	-9.3	4.121	8.988	4.035	4.064	0.7	45.4	45.4	-0.1
MDG	55 744 386	-4 965 967	-8.9	1281.582	3829.978	1231.952	1242.799	0.9	8.2	8.1	-0.3
MLI	12 738 656	-1 080 118	-8.5	224.372	554.531	217.363	219.492	1.0	14.0	13.9	-0.4
MOZ	1 058 442	-332 118	-31.4	26.417	65.465	25.175	25.354	0.7	6.8	6.8	-0.1
MRT	332 596	-28 586	-8.6	13.229	36.063	12.774	12.854	0.6	29.5	29.4	-0.1
MUS	480 511	-46 673	-9.7	17.836	41.692	17.402	17.550	0.8	111.0	110.7	-0.3
MWI	9 975 522	-1 649 065	-16.5	316.370	799.650	303.702	317.889	4.7	8.6	8.3	-3.9
NAM	181 935	-29 570	-16.3	7.107	14.779	6.980	7.030	0.7	53.8	53.7	-0.2
NER	8 270 826	-1 389 510	-16.8	236.836	554.531	228.975	230.697	0.8	7.5	7.5	-0.2
NGA	176 075 502	-1 936 176	-1.1	158.102	401.152	154.742	155.670	0.6	27.8	27.8	0.0
RWA	10 929 200	-1 707 000	-15.6	335.419	988.625	318.854	321.385	0.8	13.3	13.3	-0.2
SDN	18 703 277	-820 711	-4.4	128.306	370.791	124.582	125.377	0.6	17.2	17.2	-0.1
SEN	15 287 932	-3 048 827	-19.9	239.297	554.531	232.055	233.767	0.7	20.4	20.3	-0.2
SLE	44 359 564	-10 883 417	-24.5	3633.245	9829.927	3424.932	3459.473	1.0	8.0	8.0	-0.4
SOM	7 628	-5 012	-65.7	0.436	1.000	0.409	0.411	0.5	5.7	5.7	0.1
SSD	4 245 061	-54 302	-1.3	139.207	306.355	136.616	137.499	0.6	15.1	15.1	-0.1
STP	10 716	-3 035	-28.3	8.883	20.710	8.550	8.661	1.3	29.3	29.1	-0.7
SWZ	66 270	-604	-0.9	6.413	14.783	6.290	6.336	0.7	46.1	46.1	-0.2
SYC	26 751	-2 784	-10.4	8.999	16.921	8.881	8.954	0.8	147.7	147.3	-0.3
TCD	8 537 038	588 729	6.9	234.599	554.531	231.771	233.722	0.8	11.2	11.2	-0.3
TGO	4 661 118	-477 687	-10.2	217.641	554.531	211.182	213.171	0.9	13.3	13.3	-0.4
TUN	130 466	-13 178	-10.1	0.980	2.794	0.943	0.948	0.6	58.9	58.9	-0.1
TZA	153 874 086	-1 363 659	-0.9	825.842	2297.764	805.844	817.151	1.4	15.7	15.5	-0.8
UGA	153 589 883	-15 238 045	-9.9	1290.416	3587.052	1245.517	1264.563	1.5	14.0	13.9	-1.0
ZAF	6 230 743	381 096	6.1	8.033	14.779	7.899	7.928	0.4	69.3	69.5	0.2
ZMB	442 337	80 610	18.2	7.227	20.018	7.230	7.315	1.2	16.4	16.3	-0.6
ZWE	36 044	-1 979	-5.5	0.559	1.000	0.552	0.558	1.1	21.3	21.2	-0.5
BGD	37 509 506	-2 721 153	-7.3	29.817	85.100	28.810	28.971	0.6	39.9	39.9	0.0
BRN	18 822	2 487	13.2	0.574	1.344	0.571	0.576	0.8	390.3	389.4	-0.2
BTN	204 664	-39 265	-19.2	21.723	73.940	20.322	20.440	0.6	69.5	69.5	0.0
CHN	114 923 700	2 991 342	2.6	4.310	6.452	4.230	4.267	0.9	100.4	100.1	-0.3
FJI	8 896	-2 426	-27.3	0.980	2.071	0.959	0.964	0.5	54.2	54.2	0.1
HKG	2 867 622	159 713	5.6	6.458	7.774	6.265	6.306	0.7	322.4	322.1	-0.1
IDN	16 976 690 800	444 533 794	2.6	5073.518	14308.144	4989.272	5017.275	0.6	65.2	65.2	0.0
IND	227 242 946	-5 478 906	-2.4	22.236	73.918	21.548	21.681	0.6	40.3	40.3	-0.1
KHM	110 505 916	-1 540 285	-1.4	1537.753	4098.723	1503.932	1510.982	0.5	23.1	23.1	0.1
LAO	184 982 069	-10 960 088	-5.9	3326.694	9697.916	3221.288	3235.606	0.4	40.9	40.9	0.1
LKA	17 600 190	-1 301 049	-7.4	58.048	198.880	55.578	56.073	0.9	74.6	74.4	-0.3
MDV	83 095	2 848	3.4	9.033	15.375	8.887	8.898	0.1	85.9	86.3	0.4
MNG	44 702 733	-871 262	-1.9	963.830	2849.289	941.067	944.836	0.4	75.6	75.7	0.2
MYS	1 548 898	111 973	7.2	1.578	4.143	1.563	1.574	0.7	158.9	158.6	-0.1
NPL	4 543 219	-1 550 409	-34.1	36.871	118.134	33.747	33.929	0.5	24.2	24.2	0.0
PAK	61 229 896	-6 475 177	-10.6	47.156	162.625	44.853	45.035	0.4	31.7	31.8	0.2
PHL	19 410 614	-2 325 496	-12.0	20.400	49.255	19.822	19.961	0.7	46.4	46.3	-0.1
SGP	569 364	203 635	35.8	0.974	1.344	0.902	0.916	1.6	604.3	598.1	-1.0
THA	16 188 611	-6 478	0.0	12.168	31.981	11.918	11.996	0.7	101.8	101.7	-0.1
TWN	21 663 231	3 074 798	14.2	15.532	28.022	15.220	15.361	0.9	316.7	315.5	-0.4
VNM	8 479 666 500	9 761 865	0.1	7412.852	23159.888	7241.360	7288.595	0.7	62.1	62.0	-0.1
ARM	6 991 778	-549 344	-7.9	153.096	503.770	147.227	148.393	0.8	83.7	83.5	-0.2
AZE	93 203	15 556	16.7	0.481	1.700	0.486	0.491	0.9	99.7	99.3	-0.4
BLR	176 879	9 992	5.6	0.727	2.539	0.716	0.724	1.1	138.6	137.9	-0.5
KAZ	83 951 588	7 237 564	8.6	138.801	426.030	137.768	139.040	0.9	167.4	166.8	-0.4
KGZ	782 854	-224 289	-28.7	21.236	84.641	19.277	19.427	0.8	31.0	30.9	-0.2
MDA	242 079	-65 781	-27.2	6.075	17.682	5.711	5.749	0.7	84.6	84.5	-0.1
RUT	135 773 769	12 479 579	9.2	25.560	73.646	25.393	25.644	1.0	189.6	188.8	-0.4
TJK	101 076	-23 715	-23.5	2.680	11.309	2.450	2.477	1.1	22.0	21.9	-0.5
UZB	738 425 246	-121 802 161	-16.5	2740.154	10609.980	2561.255	2583.051	0.9	43.1	43.0	-0.3

Table 4: ICP 2021: Differences in the GDP results by the use of the LPS (contd.)

AggrL	Exp. (mio. NC) 5th GDP	Exp. (mio. NC) 4th Net Exports	Shares of Net Exports (%)	Free EKS PPPs ($=1) DA	Free EKS PPPs ($=1) NetExp-XR	Free EKS PPPs GDP ($=1) Oficial	Free EKS PPPs GDP ($=1) LPS (0.9,2.0	Free EKS PPPs GDP ($=1) % Diff.	Volume Index pc (ICP159=100) Oficial	Volume Index pc (ICP159=100) LPS (0.9,2.0	Volume Index pc (ICP159=100) % Diff.
ALB	1 856 172	-248 720	-13.4	45.640	103.539	44.528	44.827	0.7	77.4	77.3	-0.1
AUS	2 206 533	119 118	5.4	1.492	1.331	1.431	1.432	0.1	313.5	315.1	0.5
AUT	405 242	3 723	0.9	0.739	0.845	0.727	0.731	0.5	325.1	325.3	0.1
BEL	507 930	8 961	1.8	0.766	0.845	0.752	0.754	0.4	304.5	305.1	0.2
BGR	138 979	2 540	1.8	0.754	1.654	0.741	0.747	0.7	142.3	142.1	-0.2
BIH	39 145	-4 439	-11.3	0.728	1.654	0.712	0.716	0.7	87.8	87.7	-0.1
CAN	2 517 123	215	0.0	1.263	1.254	1.246	1.251	0.3	275.9	276.4	0.2
CHE	743 330	91 571	12.3	1.107	0.914	1.032	1.051	1.9	432.1	426.6	-1.3
CHL	240 371 473	-1 832 326	-0.8	465.363	758.955	458.805	462.527	0.8	139.0	138.7	-0.2
COL	1 192 586 000	-90 505 000	-7.6	1566.699	3744.244	1529.118	1540.835	0.8	81.5	81.4	-0.2
CRI	40 326 626	633 560	1.6	348.977	620.785	343.218	345.882	0.8	118.9	118.6	-0.2
CYP	24 928	987	4.0	0.649	0.845	0.634	0.638	0.7	228.2	227.9	-0.1
CZE	6 108 717	180 907	3.0	13.162	21.678	12.933	13.012	0.6	230.6	230.4	0.0
DEU	3 617 450	195 268	5.4	0.766	0.845	0.743	0.745	0.3	305.6	306.3	0.2
DNK	2 550 606	170 729	6.7	6.904	6.288	6.597	6.595	0.0	344.8	346.9	0.6
ESP	1 222 290	11 753	1.0	0.631	0.845	0.621	0.625	0.6	217.0	216.9	-0.1
EST	31 169	-313	-1.0	0.557	0.845	0.550	0.554	0.7	222.4	222.2	-0.1
FIN	250 923	84	0.0	0.856	0.845	0.845	0.849	0.5	279.9	280.1	0.1
FRA	2 502 118	-47 098	-1.9	0.755	0.845	0.750	0.754	0.5	255.3	255.5	0.1
GBR	2 284 079	-3 518	-0.2	0.688	0.727	0.679	0.681	0.3	261.9	262.7	0.3
GRC	181 500	-14 107	-7.8	0.573	0.845	0.574	0.579	0.8	155.0	154.8	-0.2
HRV	58 408	-1 604	-2.7	0.469	0.845	0.463	0.466	0.7	166.6	166.3	-0.2
HUN	55 198 927	107 099	0.2	161.501	303.127	159.026	160.323	0.8	186.7	186.2	-0.3
IRL	434 070	173 949	40.1	0.812	0.845	0.723	0.778	7.5	624.3	584.0	-6.5
ISL	3 250 399	-65 146	-2.0	147.801	126.951	147.744	148.442	0.5	308.4	308.7	0.1
ISR	1 581 860	56 803	3.6	3.922	3.230	3.781	3.791	0.2	233.2	233.9	0.3
ITA	1 822 345	40 687	2.2	0.681	0.845	0.668	0.671	0.5	240.9	241.1	0.1
JPN	549 379 200	-2 952 200	-0.5	109.104	109.754	107.927	107.784	-0.1	211.8	213.3	0.7
KOR	2 080 198 465	73 951 200	3.6	886.944	1143.952	868.663	872.150	0.4	241.6	242.0	0.2
LTU	56 478	2 539	4.5	0.462	0.845	0.454	0.458	0.8	231.2	230.6	-0.2
LUX	72 361	24 099	33.3	0.951	0.845	0.811	0.828	2.2	727.9	716.6	-1.6
LVA	33 349	-1 051	-3.2	0.505	0.845	0.499	0.503	0.8	185.3	184.9	-0.2
MEX	26 619 086	-515 362	-1.9	10.829	20.272	10.656	10.733	0.7	102.2	102.0	-0.2
MKD	729 445	-115 498	-15.8	19.403	52.113	18.659	18.784	0.7	104.5	104.4	-0.1
MLT	15 327	2 727	17.8	0.589	0.845	0.562	0.566	0.8	274.6	274.0	-0.2
MNE	4 955	-959	-19.4	0.380	0.845	0.371	0.372	0.3	112.7	113.0	0.2
NLD	870 587	97 978	11.3	0.794	0.845	0.752	0.755	0.4	344.9	345.3	0.1
NOR	4 211 620	544 521	12.9	9.831	8.593	9.098	9.158	0.7	447.0	446.5	-0.1
NZL	353 054	-11 437	-3.2	1.546	1.414	1.549	1.546	-0.1	232.8	234.4	0.7
POL	2 631 302	87 277	3.3	1.869	3.860	1.839	1.853	0.8	195.8	195.4	-0.2
PRT	216 053	-6 098	-2.8	0.606	0.845	0.601	0.605	0.7	182.3	182.1	-0.1
ROU	1 189 090	-67 435	-5.7	1.944	4.161	1.908	1.922	0.8	170.2	169.8	-0.2
SRB	6 271 988	-501 370	-8.0	45.705	99.408	44.813	45.134	0.7	106.9	106.8	-0.2
SVK	100 256	-80	-0.1	0.538	0.845	0.530	0.534	0.7	181.6	181.3	-0.2
SVN	52 279	3 053	5.8	0.568	0.845	0.556	0.559	0.6	233.1	232.9	-0.1
SWE	5 486 558	260 464	4.7	8.718	8.579	8.425	8.450	0.3	326.5	327.3	0.3
TUR	7 256 142	29 384	0.4	3.075	8.888	3.007	3.030	0.8	149.7	149.4	-0.2
USA	23 594 031	-858 239	-3.6	1.000	1.000	1.000	1.000	0.0	370.7	372.8	0.6
ARG	46 282 065	1 429 642	3.1	41.069	97.174	40.401	40.657	0.6	132.1	132.0	-0.1
BOL	279 206	-9 411	-3.4	2.619	6.948	2.557	2.579	0.8	47.2	47.1	-0.3
BRA	8 827 241	12 333	0.1	2.545	5.404	2.501	2.519	0.7	86.0	85.8	-0.1
DOM	5 392 714	-497 719	-9.2	23.499	57.233	22.851	23.178	1.4	110.8	109.9	-0.9
ECU	106 166	1 052	1.0	0.469	1.000	0.461	0.465	0.8	67.5	67.4	-0.2
GTM	665 568	-93 628	-14.1	3.464	7.749	3.379	3.397	0.5	58.4	58.4	0.0
HND	684 204	-160 473	-23.5	11.337	24.093	11.095	11.165	0.6	31.3	31.3	-0.1
NIC	497 524	-66 960	-13.5	11.689	35.236	11.183	11.263	0.7	33.9	33.9	-0.1
PAN	67 407	2 325	3.4	0.531	1.000	0.523	0.526	0.6	154.7	154.6	-0.1
PER	868 149	26 191	3.0	1.848	3.880	1.822	1.829	0.4	73.8	73.9	0.2
PRY	270 633 896	3 333 971	1.2	2750.732	6691.350	2704.696	2725.354	0.8	77.9	77.8	-0.2
SLV	29 451	-7 129	-24.2	0.460	1.000	0.448	0.450	0.5	54.4	54.4	0.0
URY	2 674 701	174 710	6.5	28.413	40.990	27.669	27.889	0.8	147.3	147.0	-0.2
ARE	1 524 744	285 085	18.7	2.557	3.673	2.478	2.457	-0.9	343.0	348.0	1.4
BHR	14 778	2 879	19.5	0.198	0.376	0.196	0.197	0.6	262.3	262.2	0.0
EGZ	7 226 500	-560 600	-7.8	4.117	15.645	3.927	3.952	0.6	87.9	87.9	-0.1
IRQ	281 641 285	39 952 720	14.2	562.818	1471.000	563.748	567.664	0.7	63.8	63.7	-0.1
JOR	32 033	-6 735	-21.0	0.333	0.708	0.326	0.328	0.6	46.9	46.9	-0.1
KWT	42 766	850	2.0	0.205	0.302	0.202	0.202	-0.1	254.8	256.6	0.7
LBN	192 669 936	-60 141 536	-31.2	4416.086	11200.000	4167.482	4350.902	4.4	43.2	41.6	-3.7
MAS	1 274 727	-118 098	-9.3	4.257	8.988	4.175	4.208	0.8	43.9	43.8	-0.2
MRU	332 596	-28 586	-8.6	13.386	36.063	12.956	13.064	0.8	29.0	29.0	-0.3
OMN	33 910	3 777	11.1	0.197	0.385	0.195	0.195	0.0	200.2	201.3	0.5
PSE	58 526	-22 475	-38.4	1.923	3.232	1.987	1.954	-1.6	29.4	30.1	2.2
QAT	654 225	162 083	24.8	2.506	3.650	2.424	2.447	0.9	512.7	510.9	-0.4
SAU	3 278 085	275 572	8.4	1.967	3.750	1.946	1.957	0.6	257.8	257.8	0.0
SDO	18 703 277	-820 711	-4.4	78.473	370.791	75.018	75.882	1.2	28.5	28.3	-0.6
SYR	25 936 805	-12 517 413	-48.3	498.627	2150.833	423.146	434.058	2.6	11.9	11.7	-2.0
TUO	130 466	-13 178	-10.1	0.926	2.794	0.889	0.894	0.5	62.5	62.5	0.0
		MIN	-65.7				MIN	-1.9		MIN	-6.5
		MAX	40.1				MAX	7.5		MAX	2.5

The aggregated Laspeyres and Paasche PPPs (and, in effect, EKS-PPPs) can be calculated as correct averages only on the basis of non-negative input data for prices and quantities / expenditures. Therefore the use of LPS limits does not solve the general problem because all Laspeyres – Paasche PPPs are calculated in any case with the actual expenditure values.

There were in the past the suggestions to use Tornqvist bilateral indexes in the EKS calculation[12] which ensures that all bilateral PPPs are well defined unlike the case of Fisher where negative or zero Laspeyres or Paasche index makes Fisher undefined.

[12] For example, this option was included in the initial version of the ICP ToolPack.

T-index guarantees formally the obtaining positive bilateral PPPs by negative expenditure. However, this is not the solution of the problem. The aim is not to obtain somehow any positive PPPs but to obtain the reliable PPPs in a straightforward way based on strong theoretical assumptions. The aggregated PPPs are defined as weighted average indices. Correct averages can be obtain only by positive weights. Let us look for the demonstration in the calculation of bilateral T-PPP between SYR and IRL from the ICP2021. SYR has very high negative share of Net exports ~ -50% (respectively, the share of DA ~150% !) and very low DA-PLI ~ 20% (IRL=100), IRL has very high positive share of Net exports ~ +40% (respectively, the share of DA -+60%). Average T-shares for DA and Net export are 105% - DA and -5% for Net exports. So, Net export which is very important for both countries was included in the T-PPPs with very small weight. In effect, SYR-PLI for GDP (~24%, IRL =100) is very close to PLI for DA. Is there sense to calculate the average bilateral PPP with the weights which are very far from the weights of both countries?

Generally, F-PPP and T-PPP are not very fare from each other[13]. The author carried out the calculations "EKS-F *vs.* EKS-T" from Global ICP 2021 for the GDP with actual expenditure weights[14]. The differences are generally very small. There are only very few cases with very moderate differences - see Table 5:

Table 5: "EKS-F *vs.* EKS-T" differences more than +-3% for the VIpc (World159=100)

ICP 2021 (159 countries, free EKS calculation, Act. V, v16.04.24)

	Exp. (mio. NC)		Shares of									
AggrL	5th	4th	Net Exports	Free EKS DA PPPs ($=1)			Free EKS PPPs GDP ($=1)			Volume Index pc (ICP159=100)		
	GDP	Net Exports	(%)	EKS-F	EKS-T	% Diff.	EKS-F	EKS-T	% Diff	EKS-F	EKS-T	% Diff.
BDI	7 506 400	-1 435 000	-19.1	674.472	681.465	1.0	639.454	643.798	0.7	4.9	4.7	-3.5
CAF	1 431 537	-257 750	-18.0	256.315	257.433	0.4	250.281	251.555	0.5	5.5	5.3	-3.3
COM	558 319	-111 398	-20.0	192.556	198.223	2.9	187.668	195.244	4.0	18.9	17.7	-6.6
GNQ	6 803 761	604 119	8.9	235.754	239.892	1.8	234.125	235.062	0.4	92.8	89.9	-3.2
LBR	621 270	-130 957	-21.1	77.682	79.351	2.1	75.531	77.534	2.7	8.3	7.8	-5.3
MDG	55 744 386	-4 965 967	-8.9	1281.582	1300.355	1.5	1231.952	1239.181	0.6	8.2	7.9	-3.4
MWI	9 975 522	-1 649 065	-16.5	316.370	321.177	1.5	303.702	306.993	1.1	8.6	8.3	-3.8
SSD	4 245 061	-54 302	-1.3	139.207	141.667	1.8	136.616	138.074	1.1	15.1	14.5	-3.8
CHE	743 330	91 571	12.3	1.107	1.108	0.1	1.032	1.035	0.3	432.1	418.6	-3.1
KWT	42 766	850	2.0	0.205	0.216	5.2	0.202	0.210	4.2	254.8	237.8	-6.7
LBN	192 669 936	-60 141 536	-31.2	4416.086	4446.346	0.7	4167.482	4192.235	0.6	43.2	41.7	-3.4
QAT	654 225	162 083	24.8	2.506	2.373	-5.3	2.424	2.246	-7.4	512.7	537.9	4.9
SAU	3 278 085	275 572	8.4	1.967	2.003	1.9	1.946	1.952	0.3	257.8	249.9	-3.1
SDO	18 703 277	-820 711	-4.4	78.473	73.930	-5.8	75.018	69.721	-7.1	28.5	29.8	4.6
		MIN	-65.7			-5.8		MIN	-7.4		MIN	-6.7
		MAX	40.1			5.2		MAX	4.2		MAX	4.9

One additional thing is also very important for the proposals discussed above. The use of the LPS borders as well as the Tornqvist bilateral indexes is applicable only for the EKS method. How should be treated negative expenditure in other multilateral aggregation methods like GK or IDB? To guarantee meaningful results for the

[13] L-PPP is AM and P-PPP is HM. The Tornqvist PPP can be present as GM from L-PPP in geometric terms which is lower than AM L-PPP and P-PPP in geometric terms which is higher than HM P-PPP. So, there is a compensation effect.

[14] The possibility to use bilateral T-PPP for the EKS PPP calculations as an option was included in the VBA program for the EKS aggregation procedure prepared by the author of this paper for the ICP purposes. The users have the choice and can select the necessary version for the bilateral PPP calculation (F-PPP vs T-PPP) in accordance with concrete circumstances.

aggregates in the general case, special treatment for „balancing“ categories is needed for all methods based on averaging of input data.[15] One possible approach to include the balancing categories in the EKS and in the GK aggregation procedures is described below (see, para. II for the EKS and Annex 1 for the GK).[16]

II. Possible treatment of balancing Basic Headings within the EKS method

The EKS method utilizes direct and indirect bilateral indices (usually of Fisher's type). The starting point of the EKS method is the calculations of bilateral PPPs: Laspeyres and Paasche PPPs with further geometric averaging by Fisher's formula. Laspeyres-PPP is arithmetic mean from particular PPPs with weights of base country and Paasche-PPPs is harmonic mean from particular PPPs with weights of counterpart country. Strictly theoretically correct average price indices (as well as quantity indices) can be calculated on the basis of non-negative input data for prices and quantities / expenditures. Actual ICP input data contains several BHs with negative expenditure („Balancing categories“). Such BHs (especially, "Net exports") can have very high expenditure shares in the GDP. The mechanical application of standard formulas violates the average test in the cases when headings with negative value have a significant share of the aggregate and this can lead to non-reliable bilateral F-PPPs with extreme L/P ratios or even to fully meaningless results - negative Laspeyres or Paasche PPPs. To avoid such cases, it is possible to use a simple modification of the standard formulas of Laspeyres and Paasche PPPs: **absolute nominal expenditure values should be used instead of actual nominal values of expenditure data** (official present methodology) for the calculation the weights for BH-PPPs. So, according to the modified method the PPPs of Laspeyres-type and Paasche-type have to be calculated as the following:

1) **Laspeyres - Type:**

$$(II.1)\quad PPP_L^{j/k} = \frac{\Sigma\, p_j * |q_k|}{\Sigma\, p_k * |q_k|} = \frac{\Sigma\, ppp^{j/k} * |w_k|}{\Sigma\, |w_k|}$$

$PPP_L^{j/k}$ - Laspeyres-PPP for the aggregate (Country „j“ to Country „k“),

$ppp^{j/k}$- PPPs for basic headings (Country „j“ to Country „k“),

w_k - nominal values for basic headings in Country „k“.

2) **Paasche - Type:**

$$(II.2)\quad PPP_P^{j/k} = \frac{\Sigma\, p_j * |q_j|}{\Sigma\, p_k * |q_j|} = \frac{\Sigma\, |w_j|}{\Sigma |w_j| / ppp^{j/k}}$$

$PPP_P^{j/k}$ - Paasche -PPP for the aggregate (Country „j“ to Country „k“),

$ppp^{j/k}$- ppp for basic headings (Country „j“ to Country „k“),

[15] Some aggregation procedures like Walsh-GM needs also special treatment of zero quantities – see Annex 2.

[16] This approach was proposed for the first time by the author of this paper in his Ph.D dissertation „*Multilateral methods for international comparisons*“ (Researcher Institute by the Statistical Office of the Soviet Union), published in Russian, Moscow, 1982.

w_j - nominal value for basic headings in Country „J“.

Sometimes, there is an overlap between „positive“ and „negative“ BHs. To avoid the double counting of overlapped BHs, it is desirable to combine (to add) the expenditure of the overlapped BHs before the calculation of the GDP-PPPs. So, BH „Net purchases abroad“ is included in the GDP twice with different signs: expenditure for this BH are included in the aggregate „FCP (national)“ as well as in the position „Net exports“ with opposite signs. Therefore expenditure data for these two BHs („Net purchases abroad“ and „Net exports“) should be combined before the calculation of the PPP for GDP[17]. Of course, this is possible if the same PPP is used for these BHs. Fortunately, this is the present case in the ICP: the exchange rate is used as reference PPP for these BHs. Additionally, if separate BHs “Exports and ”Imports” are used then these should be combine into BH “Net exports” before the calculation of the PPP for GDP.

The modified method guarantees the obtaining strictly positive average L-, P-PPPs. **The absolute values are used for the calculation of bilateral L-, P-PPPs only.** Real values, etc. are calculated on the basis of actual nominal values (with actual signs).

It is obvious from (II.1) and (II.2) that the size of the differences between the results obtained by official method (the use of actual nominal values) and the modified method (the use of absolute nominal values) depends on two factors: share of negative expenditure data and the variation of BH-PPPs. For example, if BH-PPPs are the same for all BHs within an aggregate then the impact of BH with negative nominal values is eliminated for this aggregate. So, the ICP uses BHs “Exports” (positive nominal values) and “Imports” (negative nominal values) instead one BH “Net exports”. However both BHs (“Exports” and “Imports”) use the XR as reference PPPs then the EKS-results are the same as by the use BH “Net exports”.[18] This is not so if different PPPs are used for “Exports” and “Imports”. For example, BHs Exports“ and „Imports“ with different Exchange Rates (specific PPPs) were used in the first phases of **the CIS comparisons (1994-1995).** Exports and Imports were treated in this way because monthly exchange rates of CIS countries and structures of foreign trade (E / I) were extremely volatile. It was believed that the timing of foreign trade could have strong influence on results. This treatment was done due to some objective reasons but nevertheless this led to the situation that many XRs = F-PPPs for „Net exports“ (1994 as well as 1995) were very fare from the diapason: XR for „Exports“ - XR for „Imports“:

CIS 1994 comparison: Exchange Rates (RUR=1) for Imports, Exports and Net Exports

	XR Net exports	XR Imports	XR Exports
Azerbaijan	**251**	368	321
Kazakhstan	**11.54**	16.30	15.88
Kyrgyz Rep.	**3.10**	5.37	5.51
Tajikistan	**631**	1040	1083
Turkmenistan	**1.16**	6.87	7.86
Turkey	**12 324**	13 590	13 591

The most extreme case was PPP „Manat / 1000 Russian Rouble“ for „Net exports“ of Turkmenistan in 1994 comparison:

[17] See, S. Sergeev (Statistics Austria) “*The treatment of touristic consumption in the ECP*”, ECP´96/II meeting on methodological issues, (Vienna, 10 - 14 June 1996).

[18] This is not so in the GK method. The use of BHs “Exports” and “Imports” instead one BH “Net exports” leads to different results than the use of BH “Net exports” even if the same XR uses as reference PPPs for these BHs.

PPP for „Exports“ = **6.87** M/RUR,

PPP for „Imports“ = **7.86** M/RUR,

F-PPP for „Net exports“ = **1.16** M/RUR.

It was very difficult to interpret obtained results (gigantic differences between aggregated PPP and PPPs for particular headings) in the economic terms. The estimates by the EKS method for any aggregation level are based on the basic heading data (not on sub aggregate data). Therefore the indicated anomalies for the PPPs for „Net export“ do not affect the estimates of real GDP[19]. However, there was no sense to publish the meaningless average PPPs for „Net export“ at all. Therefore the method was abandoned in the further phases of the CIS comparison. The CIS experience shows that if Export / Imports are treated separately with different XR/PPPs then the importance of the investigations on the treatment of negative expenditure is increased.

The Table 6 presents the no. of the cases with extreme L/P ratios for the GDP from the ICP 2021 (159 countries, free EKS calculation, **Abs. V**, v16.04.24) from the experimental calculations by the use of absolute expenditure weights. Total No. of bilateral Global F-PPPs for 159 countries is = 12561 (159*158/2). Total No. of bilateral Global F-PPPs with L/P ratios outside the range **0.9 < L/P < 2.0** is **950.** It means that the share (%) of extreme L/P ratios by the use of absolute expenditure weights is **7.6** (950 / 12561*100), i.e. there is drastic reduction the share of the cases with problematic LPS relatively the official version with the use of actual expenditure weights.[20]

The Table 7 contains the information on the input data and the differences in the results obtained by the official and modified methods for the GDP.[21] The differences are presented in two aspects: from the point of view of EKS-PPPs to USD ($=1) and from the point of view of GDP Volume indices per capita (World159=100). The range of the percentage differences for EKS-PPPs ($=1) is remarkable: from -2.6% (PSE) till + 30.7% (SYR). Many developing countries have remarkable increase of the EKS-PPPs ($=1) by the use of the modified method. The use of the USA as the base country by the presentation of the PPPs is the tradition for practical reasons. However, it is not desirable to use one country (especially such country like USA which has remarkable different price and expenditure structure even with other EU-OECD countries as the base during the evaluation of the multilateral results. The Volume indices per capita with multilateral base “World159=100” are more appropriate for this aim. It is visible that the Volume indices per capita (“World159=100”) show moderate differences.

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[19] This consideration by use of separate PPP/XRs for ”Exports” / “Imports” is valid if BH “Net purchases abroad” is divided also in two sub BHs:

- Purchases by residential households in the rest of the world (positive expenditure).
  These expenditure are considered as Imports and included in BH “Imports”, i.e. as negative expenditure.
- Purchases by non-residential households in the economic territory of the country (negative expenditure).
  These expenditure are considered as Exports and included in BH “Exports”, i.e. as positive expenditure.

It means that these two sub-BHs from “Net purchases abroad” should have the same PPPs as the PPPs for ”Imports” and “Exports”. If the balancing BH “Net purchases abroad” is used the F-PPPs for “Net exports” should be used as reference PPPs. Obviously this F-PPPs for “Net exports” should be a meaningful value.

[20] The use of absolute shares reduces significantly / drastically the no. of the cases with extreme LPS but does not eliminate fully the presence of such LPS due to very high differences in BH-PPPs.

[21] The possibility to use absolute values of expenditure data for the PPP calculations as an option was included in the VBA program for the EKS aggregation procedure prepared by the author of this paper for the ICP purposes. The users have the choice and can select the necessary version for the PPP calculation (actual expenditure data versus absolute values) in accordance with concrete circumstances.

Table 6: No. of extreme L/P ratios for GDP

ICP 2021 (159 countries, free EKS calculation, **Abs. V**, v16.04.24)

	Shares of Net Exports (%)	L/P MAX	L/P MIN	No. of L/P > 2.0	No. of L/P < 0.9	No. of L/P (>2.0; <0.9)
AGO	31.0	1.795	0.838	0	13	13
BDI	-19.1	3.236	0.922	8	0	8
BEN	-6.2	2.314	0.955	3	0	3
BFA	-0.6	3.012	0.943	11	0	11
BWA	-4.9	2.052	0.840	1	1	2
CAF	-18.0	2.672	0.990	1	0	1
CIV	0.1	2.451	0.936	2	0	2
CMR	-3.7	3.173	0.950	13	0	13
COD	0.2	2.549	0.925	1	0	1
COG	13.6	2.147	0.994	2	0	2
COM	-20.0	2.628	1.000	9	0	9
CPV	-36.6	3.086	0.984	1	0	1
DJI	28.0	2.823	0.978	1	0	1
DZA	0.3	2.853	1.000	4	0	4
EGY	-7.8	3.418	1.000	7	0	7
ETH	-9.7	2.958	1.000	12	0	12
GAB	37.9	2.556	1.000	1	0	1
GHA	-2.5	2.314	1.000	6	0	6
GIN	-20.1	2.796	1.000	7	0	7
GMB	-28.9	2.432	0.963	4	0	4
GNB	-12.7	2.541	0.932	1	0	1
GNQ	8.9	2.988	1.000	20	0	20
KEN	-9.1	2.418	0.930	6	0	6
LBR	-21.1	3.598	1.000	4	0	4
LSO	-49.1	2.554	0.909	1	0	1
MAR	-9.3	2.160	0.954	1	0	1
MDG	-8.9	2.975	0.976	10	0	10
MLI	-8.5	3.076	0.989	11	0	11
MOZ	-31.4	2.282	0.970	1	0	1
MRT	-8.6	2.375	0.953	2	0	2
MUS	-9.7	2.132	0.992	1	0	1
MWI	-16.5	3.380	1.000	22	0	22
NAM	-16.3	2.352	0.965	1	0	1
NER	-16.8	2.159	0.967	2	0	2
NGA	-1.1	2.250	0.930	2	0	2
RWA	-15.6	2.693	1.000	12	0	12
SDN	-4.4	2.369	0.832	1	1	2
SEN	-19.9	2.624	0.985	1	0	1
SLE	-24.5	2.703	1.000	8	0	8
SOM	-65.7	3.112	0.913	3	0	3
SSD	-1.3	2.205	0.957	2	0	2
STP	-28.3	2.358	1.000	3	0	3
SWZ	-0.9	2.051	0.942	1	0	1
SYC	-10.4	2.162	0.997	1	0	1
TCD	6.9	3.340	0.950	5	0	5
TGO	-10.2	2.537	0.884	6	1	7
TUN	-10.1	2.671	0.918	3	0	3
TZA	-0.9	3.191	0.884	9	1	10
UGA	-9.9	2.678	0.993	9	0	9
ZAF	6.1	2.461	0.996	2	0	2
ZMB	18.2	1.912	0.947	0	0	0
ZWE	-5.5	2.308	0.914	4	0	4
BGD	-7.3	2.552	0.941	5	0	5
BRN	13.2	2.016	0.970	1	0	1
BTN	-19.2	2.950	0.966	3	0	3
CHN	2.6	2.156	0.971	1	0	1
FJI	-27.3	2.142	0.973	1	0	1
HKG	5.6	2.315	0.989	1	0	1
IDN	2.6	2.589	1.000	4	0	4
IND	-2.4	2.872	1.000	7	0	7
KHM	-1.4	3.178	1.000	2	0	2
LAO	-5.9	2.295	1.000	3	0	3
LKA	-7.4	3.352	1.000	9	0	9
MDV	3.4	2.438	1.000	4	0	4
MNG	-1.9	2.743	1.000	4	0	4
MYS	7.2	2.248	1.000	2	0	2
NPL	-34.1	2.390	1.000	2	0	2
PAK	-10.6	3.009	0.987	7	0	7
PHL	-12.0	2.618	1.000	2	0	2
SGP	35.8	3.347	0.989	5	0	5
THA	0.0	2.536	0.976	4	0	4
TWN	14.2	2.308	1.000	1	0	1
VNM	0.1	2.752	1.000	6	0	6
ARM	-7.9	3.155	1.000	5	0	5
AZE	16.7	2.567	1.000	3	0	3
BLR	5.6	2.748	0.993	3	0	3
KAZ	8.6	2.282	0.957	1	0	1
KGZ	-28.7	3.251	1.000	4	0	4
MDA	-27.2	2.206	0.965	2	0	2
RUT	9.2	1.995	0.953	0	0	0
TJK	-23.5	3.649	1.000	8	0	8
UZB	-16.5	3.583	1.000	7	0	7

Table 6: No. of extreme L/P ratios for GDP (contd.)

ICP 2021 (159 countries, free EKS calculation, **Abs. V**, v16.04.24)

	Shares of Net Exports (%)	L/P MAX	L/P MIN	No. of L/P > 2.0	No. of L/P < 0.9	No. of L/P (>2.0; <0.9)
ALB	-13.4	2.146	0.957	1	0	1
AUS	5.4	3.464	0.934	5	0	5
AUT	0.9	3.309	0.973	1	0	1
BEL	1.8	3.606	0.977	3	0	3
BGR	1.8	2.058	0.875	2	1	3
BIH	-11.3	2.233	0.972	1	0	1
CAN	0.0	2.661	0.942	2	0	2
CHE	12.3	5.287	1.000	53	0	53
CHL	-0.8	2.500	0.942	1	0	1
COL	-7.6	2.386	0.936	2	0	2
CRI	1.6	2.012	0.890	1	1	2
CYP	4.0	2.457	0.838	1	1	2
CZE	3.0	2.779	0.911	1	0	1
DEU	5.4	3.575	1.000	3	0	3
DNK	6.7	3.776	1.000	8	0	8
ESP	1.0	3.372	0.890	1	1	2
EST	-1.0	2.783	0.915	1	0	1
FIN	0.0	2.791	0.855	1	1	2
FRA	-1.9	3.090	0.993	1	0	1
GBR	-0.2	3.437	0.846	3	1	4
GRC	-7.8	2.764	0.941	1	0	1
HRV	-2.7	2.475	0.920	1	0	1
HUN	0.2	2.564	0.896	1	1	2
IRL	40.1	7.059	1.000	73	0	73
ISL	-2.0	3.108	0.973	2	0	2
ISR	3.6	2.853	0.934	2	0	2
ITA	2.2	3.143	0.968	2	0	2
JPN	-0.5	3.550	1.000	9	0	9
KOR	3.6	2.658	1.000	1	0	1
LTU	4.5	2.471	0.935	1	0	1
LUX	33.3	4.570	1.000	48	0	48
LVA	-3.2	2.538	0.886	1	1	2
MEX	-1.9	2.036	0.961	1	0	1
MKD	-15.8	2.257	0.957	1	0	1
MLT	17.8	2.570	0.997	1	0	1
MNE	-19.4	2.118	0.968	1	0	1
NLD	11.3	3.492	1.000	4	0	4
NOR	12.9	3.812	1.000	21	0	21
NZL	-3.2	3.306	1.000	10	0	10
POL	3.3	2.214	0.982	1	0	1
PRT	-2.8	2.753	0.894	1	1	2
ROU	-5.7	2.202	0.880	1	1	2
SRB	-8.0	2.139	0.931	1	0	1
SVK	-0.1	2.699	0.870	1	1	2
SVN	5.8	2.877	0.900	1	1	2
SWE	4.7	3.154	0.941	1	0	1
TUR	0.4	2.389	0.950	4	0	4
USA	-3.6	3.974	1.000	15	0	15
ARG	3.1	2.521	0.939	3	0	3
BOL	-3.4	2.527	0.832	4	1	5
BRA	0.1	2.297	0.938	2	0	2
DOM	-9.2	2.857	1.000	6	0	6
ECU	1.0	2.024	0.924	1	0	1
GTM	-14.1	3.027	1.000	1	0	1
HND	-23.5	2.398	0.978	1	0	1
NIC	-13.5	2.622	0.976	4	0	4
PAN	3.4	1.941	0.912	0	0	0
PER	3.0	2.403	0.959	2	0	2
PRY	1.2	2.192	1.000	3	0	3
SLV	-24.2	2.613	1.000	2	0	2
URY	6.5	2.101	0.967	1	0	1
ARE	18.7	2.897	1.000	19	0	19
BHR	19.5	2.161	1.000	2	0	2
EGZ	-7.8	3.276	1.000	6	0	6
IRQ	14.2	2.026	1.000	1	0	1
JOR	-21.0	1.949	0.931	0	0	0
KWT	2.0	2.965	1.000	17	0	17
LBN	-31.2	3.275	1.000	14	0	14
MAS	-9.3	2.472	0.964	1	0	1
MRU	-8.6	2.039	0.960	1	0	1
OMN	11.1	2.426	1.000	5	0	5
PSE	-38.4	2.255	1.000	1	0	1
QAT	24.8	3.845	1.000	32	0	32
SAU	8.4	2.824	1.000	6	0	6
SDO	-4.4	3.177	0.984	5	0	5
SYR	-48.3	7.059	1.000	122	0	122
TUO	-10.1	2.655	0.974	3	0	3
Max	40.1	7.059				
Min	-65.7		0.832			
			Total	920	30	950

Table 7: ICP 2021: Differences in the GDP results by the use of absolute exp. weigths

	Exp. (mio. NC)		Shares of									
AggrL	5th	4th	Net Exports	Free EKS PPPs ($=1)		Free EKS PPPs GDP ($=1)			Volume Index pc (ICP159=100)			Av.
	GDP	Net Exports	(%)	DA	NetExp-XI	Act. Value	Abs. Values	% Diff	Act.V	Abs.Va	% Diff.	Te
AGO	44 541 004	13 811 739	31.0	185.543	631.442	193.103	210.598	9.1	34.9	33.4	-4.5	1
BDI	7 506 400	-1 435 000	-19.1	674.472	1975.951	639.454	718.252	12.3	4.9	4.5	-7.9	0
BEN	9 809 694	-609 893	-6.2	234.520	554.531	228.606	244.621	7.0	17.2	16.8	-2.5	0
BFA	11 317 126	-63 531	-0.6	219.076	554.531	214.287	228.547	6.7	12.5	12.2	-2.2	0
BWA	207 743	-10 256	-4.9	5.143	11.087	5.050	5.333	5.6	83.0	82.0	-1.2	0
CAF	1 431 537	-257 750	-18.0	256.315	554.531	250.281	267.045	6.7	5.5	5.4	-2.2	0
CIV	39 190 371	38 300	0.1	247.326	554.531	242.639	256.819	5.8	30.7	30.3	-1.4	0
CMR	25 141 470	-918 714	-3.7	208.072	554.531	202.653	217.741	7.4	23.8	23.1	-2.9	0
COD	135 923 497	319 717	0.2	962.631	1989.391	945.252	994.361	5.2	7.1	7.1	-0.8	0
COG	8 172 514	1 110 000	13.6	240.610	554.531	238.235	251.545	5.6	30.7	30.3	-1.3	0
COM	558 319	-111 398	-20.0	192.556	415.956	187.668	201.351	7.3	18.9	18.4	-2.7	0
CPV	164 544	-60 271	-36.6	49.068	93.218	49.521	49.885	0.7	29.5	30.6	3.6	1
DJI	609 208	170 548	28.0	92.582	177.721	91.260	100.892	10.6	31.5	29.8	-5.5	0
DZA	22 079 279	60 392	0.3	43.132	135.064	42.151	45.412	7.7	61.9	59.9	-3.2	0
EGY	7 226 500	-560 600	-7.8	4.434	15.645	4.238	4.775	12.7	81.5	75.4	-7.5	0
ETH	5 249 281	-507 357	-9.7	15.230	48.567	14.570	16.264	11.6	15.6	14.6	-6.6	0
GAB	11 208 063	4 252 899	37.9	262.588	554.531	263.336	275.920	4.8	94.9	94.6	-0.4	1
GHA	470 592	-11 993	-2.5	2.278	5.806	2.230	2.374	6.5	33.6	32.9	-2.0	0
GIN	154 656 800	-31 143 700	-20.1	3439.807	9728.774	3258.614	3685.064	13.1	18.3	16.9	-7.8	0
GMB	105 487	-30 447	-28.9	17.106	51.484	15.926	18.590	16.7	13.1	11.7	-10.8	0
GNB	997 023	-126 331	-12.7	228.150	554.531	221.023	239.956	8.6	11.4	11.0	-3.9	0
GNQ	6 803 761	604 119	8.9	235.754	554.531	234.125	244.943	4.6	92.8	92.6	-0.2	0
KEN	12 027 662	-1 099 439	-9.1	45.426	109.638	44.185	47.795	8.2	26.8	25.9	-3.5	0
LBR	621 270	-130 957	-21.1	77.682	165.352	75.531	81.260	7.6	8.3	8.0	-3.0	0
LSO	35 076	-17 219	-49.1	6.827	14.779	6.624	7.183	8.4	12.1	11.7	-3.8	0
MAR	1 274 727	-118 098	-9.3	4.121	8.988	4.035	4.299	6.5	45.4	44.5	-2.0	0
MDG	55 744 386	-4 965 967	-8.9	1281.582	3829.978	1231.952	1376.917	11.8	8.2	7.6	-6.7	0
MLI	12 738 656	-1 080 118	-8.5	224.372	554.531	217.363	235.156	8.2	14.0	13.5	-3.5	0
MOZ	1 058 442	-332 118	-31.4	26.417	65.465	25.175	28.122	11.7	6.8	6.4	-6.7	0
MRT	332 596	-28 586	-8.6	13.229	36.063	12.774	13.979	9.4	29.5	28.1	-4.7	0
MUS	480 511	-46 673	-9.7	17.836	41.692	17.402	18.764	7.8	111.0	107.4	-3.2	0
MWI	9 975 522	-1 649 065	-16.5	316.370	799.650	303.702	333.911	9.9	8.6	8.2	-5.2	0
NAM	181 935	-29 570	-16.3	7.107	14.779	6.980	7.374	5.6	53.8	53.1	-1.2	0
NER	8 270 826	-1 389 510	-16.8	236.836	554.531	228.975	248.963	8.7	7.5	7.2	-4.0	0
NGA	176 075 502	-1 936 176	-1.1	158.102	401.152	154.742	164.799	6.5	27.8	27.3	-2.1	0
RWA	10 929 200	-1 707 000	-15.6	335.419	988.625	318.854	359.598	12.8	13.3	12.3	-7.5	0
SDN	18 703 277	-820 711	-4.4	128.306	370.791	124.582	135.988	9.2	17.2	16.4	-4.5	0
SEN	15 287 932	-3 048 827	-19.9	239.297	554.531	232.055	252.038	8.6	20.4	19.6	-3.9	0
SLE	44 359 564	-10 883 417	-24.5	3633.245	9829.927	3424.932	3897.920	13.8	8.0	7.4	-8.3	0
SOM	7 628	-5 012	-65.7	0.436	1.000	0.409	0.466	13.8	5.7	5.2	-8.3	0
SSD	4 245 061	-54 302	-1.3	139.207	306.355	136.616	143.875	5.3	15.1	15.0	-0.9	0
STP	10 716	-3 035	-28.3	8.883	20.710	8.550	9.327	9.1	29.3	28.0	-4.4	0
SWZ	66 270	-604	-0.9	6.413	14.783	6.290	6.728	6.9	46.1	45.0	-2.4	0
SYC	26 751	-2 784	-10.4	8.999	16.921	8.881	9.238	4.0	147.7	148.3	0.4	0
TCD	8 537 038	588 729	6.9	234.599	554.531	231.771	245.171	5.8	11.2	11.0	-1.4	0
TGO	4 661 118	-477 687	-10.2	217.641	554.531	211.182	229.695	8.8	13.3	12.8	-4.1	0
TUN	130 466	-13 178	-10.1	0.980	2.794	0.943	1.048	11.2	58.9	55.3	-6.2	0
TZA	153 874 086	-1 363 659	-0.9	825.842	2297.764	805.844	877.411	8.9	15.7	15.0	-4.2	0
UGA	153 589 883	-15 238 045	-9.9	1290.416	3587.052	1245.517	1369.436	9.9	14.0	13.3	-5.1	0
ZAF	6 230 743	381 096	6.1	8.033	14.779	7.899	8.285	4.9	69.3	69.0	-0.4	0
ZMB	442 337	80 610	18.2	7.227	20.018	7.230	7.778	7.6	16.4	15.9	-3.2	1
ZWE	36 044	-1 979	-5.5	0.559	1.000	0.552	0.569	3.1	21.3	21.6	1.3	0
BGD	37 509 506	-2 721 153	-7.3	29.817	85.100	28.810	31.586	9.6	39.9	38.0	-4.9	0
BRN	18 822	2 487	13.2	0.574	1.344	0.571	0.601	5.2	390.3	387.3	-0.8	0
BTN	204 664	-39 265	-19.2	21.723	73.940	20.322	23.679	16.5	69.5	62.2	-10.5	0
CHN	114 923 700	2 991 342	2.6	4.310	6.452	4.230	4.387	3.7	100.4	101.2	0.7	0
FJI	8 896	-2 426	-27.3	0.980	2.071	0.959	1.019	6.3	54.2	53.2	-1.8	0
HKG	2 867 622	159 713	5.6	6.458	7.774	6.265	6.457	3.1	322.4	326.8	1.4	0
IDN	16 976 690 800	444 533 794	2.6	5073.518	14308.144	4989.272	5342.209	7.1	65.2	63.5	-2.6	0
IND	227 242 946	-5 478 906	-2.4	22.236	73.918	21.548	23.723	10.1	40.3	38.1	-5.4	0
KHM	110 505 916	-1 540 285	-1.4	1537.753	4098.723	1503.932	1606.675	6.8	23.1	22.5	-2.6	0
LAO	184 982 069	-10 960 088	-5.9	3326.694	9697.916	3221.288	3569.900	10.8	40.9	38.5	-5.9	0
LKA	17 600 190	-1 301 049	-7.4	58.048	198.880	55.578	62.272	12.0	74.6	69.4	-7.0	0
MDV	83 095	2 848	3.4	9.033	15.375	8.887	9.220	3.8	85.9	86.5	0.6	0
MNG	44 702 733	-871 262	-1.9	963.830	2849.289	941.067	1003.088	6.6	75.6	73.4	-2.8	0
MYS	1 548 898	111 973	7.2	1.578	4.143	1.563	1.666	6.6	158.9	155.5	-2.1	0
NPL	4 543 219	-1 550 409	-34.1	36.871	118.134	33.747	40.677	20.5	24.2	20.9	-13.5	0
PAK	61 229 896	-6 475 177	-10.6	47.156	162.625	44.853	51.048	13.8	31.7	29.0	-8.4	0
PHL	19 410 614	-2 325 496	-12.0	20.400	49.255	19.822	21.461	8.3	46.4	44.7	-3.6	0
SGP	569 364	203 635	35.8	0.974	1.344	0.902	0.932	3.4	604.3	610.9	1.1	0
THA	16 188 611	-6 478	0.0	12.168	31.981	11.918	12.752	7.0	101.8	99.2	-2.5	0
TWN	21 663 231	3 074 798	14.2	15.532	28.022	15.220	15.904	4.5	316.7	316.4	-0.1	0
VNM	8 479 666 500	9 761 865	0.1	7412.852	23159.888	7241.360	7814.918	7.9	62.1	60.0	-3.4	0
ARM	6 991 778	-549 344	-7.9	153.096	503.770	147.227	162.542	10.4	83.7	78.4	-6.3	0
AZE	93 203	15 556	16.7	0.481	1.700	0.486	0.531	9.2	99.7	95.1	-4.6	1
BLR	176 879	9 992	5.6	0.727	2.539	0.716	0.782	9.2	138.6	132.3	-4.6	0
KAZ	83 951 588	7 237 564	8.6	138.801	426.030	137.768	148.539	7.8	167.4	161.9	-3.3	0
KGZ	782 854	-224 289	-28.7	21.236	84.641	19.277	23.738	23.1	31.0	26.2	-15.4	0
MDA	242 079	-65 781	-27.2	6.075	17.682	5.711	6.563	14.9	84.6	76.8	-9.3	0
RUT	135 773 769	12 479 579	9.2	25.560	73.646	25.393	27.273	7.4	189.6	184.1	-2.9	0
TJK	101 076	-23 715	-23.5	2.680	11.309	2.450	2.984	21.8	22.0	18.7	-15.0	0
UZB	738 425 246	-121 802 161	-16.5	2740.154	10609.980	2561.255	2988.322	16.7	43.1	38.2	-11.5	0

Table 7: ICP 2021: Differences in the GDP results by the use of absolute exp. weigths (contd.)

AggrL	Exp. (mio. NC) 5th GDP	Exp. (mio. NC) 4th Net Exports	Shares of Net Exports (%)	Free EKS PPPs ($=1) DA	Free EKS PPPs ($=1) NetExp-Xl	Free EKS PPPs GDP ($=1) Act. Value	Free EKS PPPs GDP ($=1) Abs. Values	Free EKS PPPs GDP ($=1) % Diff	Volume Index pc (ICP159=100) Act.V	Volume Index pc (ICP159=100) Abs.Va	Volume Index pc (ICP159=100) % Diff	Av. Te
ALB	1 856 172	-248 720	-13.4	45.640	103.539	44.528	47.577	6.8	77.4	75.6	-2.3	0
AUS	2 206 533	119 118	5.4	1.492	1.331	1.431	1.457	1.8	313.5	323.9	3.3	1
AUT	405 242	3 723	0.9	0.739	0.845	0.727	0.752	3.4	325.1	329.5	1.4	0
BEL	507 930	8 961	1.8	0.766	0.845	0.752	0.778	3.5	304.5	307.6	1.0	0
BGR	138 979	2 540	1.8	0.754	1.654	0.741	0.782	5.4	142.3	140.7	-1.1	0
BIH	39 145	-4 439	-11.3	0.728	1.654	0.712	0.762	7.0	87.8	85.6	-2.5	0
CAN	2 517 123	215	0.0	1.263	1.254	1.246	1.277	2.5	275.9	281.4	2.0	0
CHE	743 330	91 571	12.3	1.107	0.914	1.032	1.063	3.0	432.1	439.3	1.7	1
CHL	240 371 473	-1 832 326	-0.8	465.363	758.955	458.805	475.400	3.6	139.0	140.1	0.8	0
COL	1 192 586 000	-90 505 000	-7.6	1566.699	3744.244	1529.118	1634.488	6.9	81.5	79.5	-2.5	0
CRI	40 326 626	633 560	1.6	348.977	620.785	343.218	357.282	4.1	118.9	119.2	0.3	0
CYP	24 928	987	4.0	0.649	0.845	0.634	0.653	3.1	228.2	235.5	3.2	0
CZE	6 108 717	180 907	3.0	13.162	21.678	12.933	13.481	4.2	230.6	231.1	0.2	0
DEU	3 617 450	195 268	5.4	0.766	0.845	0.743	0.769	3.4	305.6	308.7	1.0	0
DNK	2 550 606	170 729	6.7	6.904	6.288	6.597	6.771	2.6	344.8	351.2	1.8	1
ESP	1 222 290	11 753	1.0	0.631	0.845	0.621	0.642	3.4	217.0	220.2	1.4	0
EST	31 169	-313	-1.0	0.557	0.845	0.550	0.568	3.3	222.4	224.8	1.1	0
FIN	250 923	84	0.0	0.856	0.845	0.845	0.868	2.7	279.9	284.8	1.8	0
FRA	2 502 118	-47 098	-1.9	0.755	0.845	0.750	0.762	1.6	255.3	262.5	2.8	0
GBR	2 284 079	-3 518	-0.2	0.688	0.727	0.679	0.695	2.3	261.9	267.6	2.2	0
GRC	181 500	-14 107	-7.8	0.573	0.845	0.574	0.571	-0.5	155.0	162.8	5.0	1
HRV	58 408	-1 604	-2.7	0.469	0.845	0.463	0.474	2.5	166.6	169.6	1.8	0
HUN	55 198 927	107 099	0.2	161.501	303.127	159.026	166.221	4.5	186.7	186.4	-0.1	0
IRL	434 070	173 949	40.1	0.812	0.845	0.723	0.737	1.9	624.3	640.2	2.5	0
ISL	3 250 399	-65 146	-2.0	147.801	126.951	147.744	144.294	-2.3	308.4	330.0	7.0	1
ISR	1 581 860	56 803	3.6	3.922	3.230	3.781	3.852	1.9	233.2	239.3	2.6	1
ITA	1 822 345	40 687	2.2	0.681	0.845	0.668	0.692	3.5	240.9	243.9	1.3	0
JPN	549 379 200	-2 952 200	-0.5	109.104	109.754	107.927	109.720	1.7	211.8	217.7	2.8	0
KOR	2 080 198 465	73 951 200	3.6	886.944	1143.952	868.663	894.274	2.9	241.6	245.2	1.5	0
LTU	56 478	2 539	4.5	0.462	0.845	0.454	0.474	4.4	231.2	231.1	0.0	0
LUX	72 361	24 099	33.3	0.951	0.845	0.811	0.846	4.4	727.9	741.0	1.8	0
LVA	33 349	-1 051	-3.2	0.505	0.845	0.499	0.516	3.3	185.3	187.2	1.0	0
MEX	26 619 086	-515 362	-1.9	10.829	20.272	10.656	11.102	4.2	102.2	102.4	0.2	0
MKD	729 445	-115 498	-15.8	19.403	52.113	18.659	20.539	10.1	104.5	98.8	-5.5	0
MLT	15 327	2 727	17.8	0.589	0.845	0.562	0.582	3.5	274.6	279.2	1.7	0
MNE	4 955	-959	-19.4	0.380	0.845	0.371	0.399	7.6	112.7	109.3	-3.0	0
NLD	870 587	97 978	11.3	0.794	0.845	0.752	0.775	3.1	344.9	349.8	1.4	0
NOR	4 211 620	544 521	12.9	9.831	8.593	9.098	9.361	2.9	447.0	454.1	1.6	1
NZL	353 054	-11 437	-3.2	1.546	1.414	1.549	1.541	-0.5	232.8	246.0	5.7	0
POL	2 631 302	87 277	3.3	1.869	3.860	1.839	1.935	5.2	195.8	194.2	-0.8	0
PRT	216 053	-6 098	-2.8	0.606	0.845	0.601	0.608	1.2	182.3	188.1	3.2	0
ROU	1 189 090	-67 435	-5.7	1.944	4.161	1.908	2.015	5.6	170.2	168.1	-1.2	0
SRB	6 271 988	-501 370	-8.0	45.705	99.408	44.813	47.368	5.7	106.9	105.6	-1.3	0
SVK	100 256	-80	-0.1	0.538	0.845	0.530	0.549	3.7	181.6	182.9	0.7	0
SVN	52 279	3 053	5.8	0.568	0.845	0.556	0.576	3.7	233.1	235.4	1.0	0
SWE	5 486 558	260 464	4.7	8.718	8.579	8.425	8.658	2.8	326.5	332.0	1.7	0
TUR	7 256 142	29 384	0.4	3.075	8.888	3.007	3.258	8.3	149.7	144.0	-3.9	0
USA	23 594 031	-858 239	-3.6	1.000	1.000	1.000	1.000	0.0	370.7	387.5	4.5	1
ARG	46 282 065	1 429 642	3.1	41.069	97.174	40.401	42.656	5.6	132.1	130.6	-1.2	0
BOL	279 206	-9 411	-3.4	2.619	6.948	2.557	2.767	8.2	47.2	45.5	-3.6	0
BRA	8 827 241	12 333	0.1	2.545	5.404	2.501	2.643	5.7	86.0	84.9	-1.2	0
DOM	5 392 714	-497 719	-9.2	23.499	57.233	22.851	24.644	7.8	110.8	107.2	-3.2	0
ECU	106 166	1 052	1.0	0.469	1.000	0.461	0.486	5.4	67.5	66.8	-1.0	0
GTM	665 568	-93 628	-14.1	3.464	7.749	3.379	3.633	7.5	58.4	56.7	-2.9	0
HND	684 204	-160 473	-23.5	11.337	24.093	11.095	11.790	6.3	31.3	30.8	-1.8	0
NIC	497 524	-66 960	-13.5	11.689	35.236	11.183	12.518	11.9	33.9	31.6	-6.8	0
PAN	67 407	2 325	3.4	0.531	1.000	0.523	0.545	4.1	154.7	155.2	0.3	0
PER	868 149	26 191	3.0	1.848	3.880	1.822	1.913	5.0	73.8	73.3	-0.6	0
PRY	270 633 896	3 333 971	1.2	2750.732	6691.350	2704.696	2868.829	6.1	77.9	76.7	-1.6	0
SLV	29 451	-7 129	-24.2	0.460	1.000	0.448	0.480	7.2	54.4	53.0	-2.7	0
URY	2 674 701	174 710	6.5	28.413	40.990	27.669	28.630	3.5	147.3	148.7	0.9	0
ARE	1 524 744	285 085	18.7	2.557	3.673	2.478	2.567	3.6	343.0	345.9	0.8	0
BHR	14 778	2 879	19.5	0.198	0.376	0.196	0.204	4.1	262.3	263.0	0.3	0
EGZ	7 226 500	-560 600	-7.8	4.117	15.645	3.927	4.477	14.0	87.9	80.4	-8.6	0
IRQ	281 641 285	39 952 720	14.2	562.818	1471.000	563.748	599.473	6.3	63.8	62.6	-1.9	1
JOR	32 033	-6 735	-21.0	0.333	0.708	0.326	0.345	5.7	46.9	46.3	-1.3	0
KWT	42 766	850	2.0	0.205	0.302	0.202	0.209	3.3	254.8	257.7	1.1	0
LBN	192 669 936	-60 141 536	-31.2	4416.086	11200.000	4167.482	4613.582	10.7	43.2	40.6	-5.9	0
MAS	1 274 727	-118 098	-9.3	4.257	8.988	4.175	4.435	6.2	43.9	43.1	-1.8	0
MRU	332 596	-28 586	-8.6	13.386	36.063	12.956	14.151	9.2	29.0	27.7	-4.5	0
OMN	33 910	3 777	11.1	0.197	0.385	0.195	0.205	4.9	200.2	199.3	-0.5	0
PSE	58 526	-22 475	-38.4	1.923	3.232	1.987	1.936	-2.6	29.4	31.5	7.2	1
QAT	654 225	162 083	24.8	2.506	3.650	2.424	2.488	2.6	512.7	521.8	1.8	0
SAU	3 278 085	275 572	8.4	1.967	3.750	1.946	2.026	4.1	257.8	258.6	0.3	0
SDO	18 703 277	-820 711	-4.4	78.473	370.791	75.018	85.960	14.6	28.5	25.9	-9.2	0
SYR	25 936 805	-12 517 413	-48.3	498.627	2150.833	423.146	553.068	30.7	11.9	9.3	-22.1	0
TUO	130 466	-13 178	-10.1	0.926	2.794	0.889	0.995	12.0	62.5	58.2	-6.9	0
		MIN	-65.7				MIN	-2.6		MIN	-22.1	15
		MAX	40.1				MAX	30.7		MAX	7.2	

Tables 8a shows the countries with the VIpc (World=100) differences less than - 5%. Only few countries have the VIpc difference less than -10%: GMB, BTN, NPL, KGZ, TJK, UZB, SYR. These are the countries with very high negative share of "Net exports".

Table 8a: The countries with the VIpc (World=100) differences less than - 5%

ICP 2021: Differences in the GDP results by different treatment of balancing BHs

AggrL	Exp. (mio. NC) 5th GDP	Exp. (mio. NC) 4th Net Exports	Shares of Net Exports (%)	Free EKS PPPs ($=1) DA	Free EKS PPPs ($=1) NetExp-XI	Free EKS PPPs GDP ($=1) Act. Value	Free EKS PPPs GDP ($=1) Abs. Values	Free EKS PPPs GDP ($=1) % Diff	Volume Index pc (ICP159=100) Act.V	Volume Index pc (ICP159=100) Abs.Va	Volume Index pc (ICP159=100) % Diff
BDI	7 506 400	-1 435 000	-19.1	674.472	1975.951	639.454	718.252	12.3	4.9	4.5	-7.9
DJI	609 208	170 548	28.0	92.582	177.721	91.260	100.892	10.6	31.5	29.8	-5.5
EGY	7 226 500	-560 600	-7.8	4.434	15.645	4.238	4.775	12.7	81.5	75.4	-7.5
ETH	5 249 281	-507 357	-9.7	15.230	48.567	14.570	16.264	11.6	15.6	14.6	-6.6
GIN	154 656 800	-31 143 700	-20.1	3439.807	9728.774	3258.614	3685.064	13.1	18.3	16.9	-7.8
GMB	105 487	-30 447	-28.9	17.106	51.484	15.926	18.590	16.7	13.1	11.7	-10.8
MDG	55 744 386	-4 965 967	-8.9	1281.582	3829.978	1231.952	1376.917	11.8	8.2	7.6	-6.7
MOZ	1 058 442	-332 118	-31.4	26.417	65.465	25.175	28.122	11.7	6.8	6.4	-6.7
MWI	9 975 522	-1 649 065	-16.5	316.370	799.650	303.702	333.911	9.9	8.6	8.2	-5.2
RWA	10 929 200	-1 707 000	-15.6	335.419	988.625	318.854	359.598	12.8	13.3	12.3	-7.5
SLE	44 359 564	-10 883 417	-24.5	3633.245	9829.927	3424.932	3897.920	13.8	8.0	7.4	-8.3
SOM	7 628	-5 012	-65.7	0.436	1.000	0.409	0.466	13.8	5.7	5.2	-8.3
TUN	130 466	-13 178	-10.1	0.980	2.794	0.943	1.048	11.2	58.9	55.3	-6.2
UGA	153 589 883	-15 238 045	-9.9	1290.416	3587.052	1245.517	1369.436	9.9	14.0	13.3	-5.1
BTN	204 664	-39 265	-19.2	21.723	73.940	20.322	23.679	16.5	69.5	62.2	-10.5
IND	227 242 946	-5 478 906	-2.4	22.236	73.918	21.548	23.723	10.1	40.3	38.1	-5.4
LAO	184 982 069	-10 960 088	-5.9	3326.694	9697.916	3221.288	3569.900	10.8	40.9	38.5	-5.9
LKA	17 600 190	-1 301 049	-7.4	58.048	198.880	55.578	62.272	12.0	74.6	69.4	-7.0
NPL	4 543 219	-1 550 409	-34.1	36.871	118.134	33.747	40.677	20.5	24.2	20.9	-13.5
PAK	61 229 896	-6 475 177	-10.6	47.156	162.625	44.853	51.048	13.8	31.7	29.0	-8.4
ARM	6 991 778	-549 344	-7.9	153.096	503.770	147.227	162.542	10.4	83.7	78.4	-6.3
KGZ	782 854	-224 289	-28.7	21.236	84.641	19.277	23.738	23.1	31.0	26.2	-15.4
MDA	242 079	-65 781	-27.2	6.075	17.682	5.711	6.563	14.9	84.6	76.8	-9.3
TJK	101 076	-23 715	-23.5	2.680	11.309	2.450	2.984	21.8	22.0	18.7	-15.0
UZB	738 425 246	-121 802 161	-16.5	2740.154	10609.980	2561.255	2988.322	16.7	43.1	38.2	-11.5
MKD	729 445	-115 498	-15.8	19.403	52.113	18.659	20.539	10.1	104.5	98.8	-5.5
NIC	497 524	-66 960	-13.5	11.689	35.236	11.183	12.518	11.9	33.9	31.6	-6.8
EGZ	7 226 500	-560 600	-7.8	4.117	15.645	3.927	4.477	14.0	87.9	80.4	-8.6
LBN	192 669 936	-60 141 536	-31.2	4416.086	11200.000	4167.482	4613.582	10.7	43.2	40.6	-5.9
SDO	18 703 277	-820 711	-4.4	78.473	370.791	75.018	85.960	14.6	28.5	25.9	-9.2
SYR	25 936 805	-12 517 413	-48.3	498.627	2150.833	423.146	553.068	30.7	11.9	9.3	-22.1
TUO	130 466	-13 178	-10.1	0.926	2.794	0.889	0.995	12.0	62.5	58.2	-6.9
		MIN	-65.7				MIN	-2.6		MIN	-22.1

Tables 8b shows the countries with the VIpc (World=100) differences more than + 5%. There are only very few countries with such VIpc difference – GRC, ISL, NZL and surprisingly PSE.

Table 8b: The countries with the VIpc (World=100) differences more than 5%

ICP 2021: Differences in the GDP results by different treatment of balancing BHs

AggrL	Exp. (mio. NC) 5th GDP	Exp. (mio. NC) 4th Net Exports	Shares of Net Exports (%)	Free EKS PPPs ($=1) DA	Free EKS PPPs ($=1) NetExp-XI	Free EKS PPPs GDP ($=1) Act. Value	Free EKS PPPs GDP ($=1) Abs. Values	Free EKS PPPs GDP ($=1) % Diff	Volume Index pc (ICP159=100) Act.V	Volume Index pc (ICP159=100) Abs.Va	Volume Index pc (ICP159=100) % Diff
GRC	181 500	-14 107	-7.8	0.573	0.845	0.574	0.571	-0.5	155.0	162.8	5.0
ISL	3 250 399	-65 146	-2.0	147.801	126.951	147.744	144.294	-2.3	308.4	330.0	7.0
NZL	353 054	-11 437	-3.2	1.546	1.414	1.549	1.541	-0.5	232.8	246.0	5.7
PSE	58 526	-22 475	-38.4	1.923	3.232	1.987	1.936	-2.6	29.4	31.5	7.2
										MAX	7.2

So, the differences in the results between the official and modified methods are remarkable in several cases but generally these are not drastic. Of course, the use of absolute weights is disputable approach[22] but – What is the better approach?

[22] It seems that R. Hill (together with M. Scholz) also attempted to use absolute values for expenditure weights in the experiments for the ICP 2011.

The use of absolute weights in the NA was proposed also in a paper by M. Osterwald-Lenum "Chain Linked Quantity Indices When the Quantity has Been Zero", the 32nd General Conference of the IARIW (Boston, USA, August 5-11, 2012) - http://www.iariw.org/papers/2012/OsterwaldLenumPaper.pdf

III. Is there a rational kernel in the proposed special treatment of BHs with negative expenditure?

The proposal about the use of the absolute expenditure weighs for the PPP calculations is based on several considerations. Simple bilateral L-, P-PPPs are only input data for further treatment (starting from the calculation of Fisher-PPPs). The EKS method has not direct analogues in the economic reality and this method cannot be explained strictly in economic terms. The EKS procedure is rather a formal mathematical approach to obtain transitive results with an equal impact of all countries. It is very difficult to apply intuitive considerations to EKS-PPP which is a complicated capricious conglomerate from direct and indirect PPPs obtained by very different weights and PPP structures. It is better to use meaningful input PPPs for further calculations. Formally correct PPPs are not the main aim but the transformation of meaningless input PPPs into meaningful final results is problematic. The Laspeyres and Paasche PPPs are defined in terms of average values. A Laspeyres PPP is an arithmetic mean (AM) of the relative PPPs, using as expenditure weights of the base country. A Paasche PPP is a harmonic mean (HM) of the relative PPPs, using expenditure weights of the own country. The "true" AM/ HM averages can be calculated on the basis of non-negative weights only. If the aggregated PPPs are defined in terms of average values then one should follow the rules of this concept.

There was in the past the discussions on this point with the OECD with some parallels with the NA practices. The aggregation of positive and negative sub-items is a standard procedure in national accounts. This is, for example, the recalculation from current prices into constant prices by a very simple method:

(III.1) $\sum(Q1*P0) = \sum [(Q1*P1)/(P1/P0)]$

(the time periods 1 and 0 can be replaced by countries A and B).

In this trivial case the price indices are only „collateral product".[23] To obtain the Real Value-Total in this context, we don't need meaningful aggregated price indices. It means, price indices for the total can be outside the range of the price indices of the BHs and the aggregate price indices can be, at all, infinite (e.g., during double deflation) but the volumes (Real values) can be still correct. Therefore the price indices used in NA practice are often not shown. A similar technique is used by the Gerardi method => the use of GM of national prices (= the use of GM of national price structures) as quasi-international prices for the direct calculation of the Volumes.[24]

The ICP attempts to compare produced GDP from the expenditure side. In effect, the presence of "balancing categories" with possible negative expenditure is inevitable. The most problematic point is the BH „Net exports" because many developing countries have very high share of „negative" „Net exports" and the high differences

[23] A similar situation is also between the PPP and Volume Comparisons. See, for example, L. Drechsler and E. Krzeczkowska "*Purchasing power parities in international comparisons: quantity vs. price chan*ges", The Review of Income and Wealth, Journal of the IARIWth, 1982, Series 28. - https://www.roiw.org/1982/253.pdf

[24] D. Gerardi „*Selected problems of inter-country comparisons on the basis of the experience of the EEC*" - The Review of Income and Wealth, Journal of the IARIW, 1982, Series 28, https://www.roiw.org/1982/381.pdf

between Exchange Rate (reference PPPs for „Net exports“[25]) and BH-PPPs from Domestic Absorption. The OECD experts had the opinion that it is possible to ignore the presence negative expenditure during the PPP calculations. The distortion of the average test for L-, P-PPPs in the case of high negative “Net exports” even logical because of high exchange rate, volume of Net exports is relatively low compared to nominal Net exports and thus the inclusion of Net exports reduces less real values than nominal values. Accordingly, PPP for GDP should go down compared to the PPP for the sub-total. OECD experts formulated their opinion as the following: “*By definition, GDP includes only domestic production and therefore the influence of imports should offset. If not, there is an inconsistency. However, the influence of imports is not neutralised in the new model but, on the contrary, import prices influence GDP even twice. "Domestic GDP" already contains imported products and then they are taken into account second time if net exports are recorded positive. Imports should be kept negative exactly to neutralise its effect... GDP excluding net exports is Domestic Absorption (DA). There is a major problem with countries, of which net exports are negative and exchange rates are significantly higher than PPPs for DA, in other words in cheap countries. Most CCs belong to this category. One can conclude that because net exports are negative and their PPPs relatively high (compared to domestic PPPs), **PPPs for total of GDP must be lower than PPPs for DA**. However, in the new model PPPs for GDP exceed PPPs for DA, which is not acceptable*."

The transformation from the GDP by expenditure side to the GDP by production side is obvious. The GDP is domestic absorption (DA) adjusted by Imports (with Minus) and Exports (with Plus). However the correct way for the calculation of PPP for the domestic production without the influence of imported products on the basis of prices collected for the expenditure on GDP is not clear. The problem - In which way it is possible to reflect this correctly from price side by PPP aggregated calculations? - is an open question. The problem concerns not only "Net export" for poor countries but, generally, also other BHs, for example, BHs from "Machinery and equipment" rather for rich countries (see an example in this paper for Sweden and Iceland in Eurostat 1997). The DA (GDP without "Net exports") includes also several negative BHs.

The problem in the aggregation PPP procedures is not the same as in the NA and the argumentation is depended on the method applied[26]. The situation in international comparison are much more complicated than in NA. The task is not the recalculation of an aggregate by prices of another period (country) but the multilateral recalculation in a common currency. The differences by the content and numerical differences for these two tasks are very big taking into account the difference in price and expenditure structures of different ICP countries. The primary bilateral PPPs are only input data for further intricate treatment starting from the calculation of Fisher-PPPs. All usual considerations which are correct for simple methods like the standard recalculation of

[25] The problem of applicability of the XRs as specific PPPs was discussed, for example, in a paper by S. Ahmad (World Bank) „*A Note on the Treatment of Net Foreign Balance in the Calculation of Real Values*“. Vienna Consultation on the ECP (point 8 of the Agenda); Vienna, 1998.

[26] The considerations from NA practice could be applied rather to the G-K method which is based on the calculation of Real Values in average international prices. However the problem is that overall PPPs and average international prices are calculated within a common linear system and the positive solution is guaranteed only if input data are positive. The exclusion of BH with negative values from the main calculation is inevitable by the use of standard G-K method. Excluded BH should be treated in a special way with the introduction of additional hypotheses about reference PPPs and reference weights. Each separation of input data into several parts leads by G-K method to the results which are not base country invariant (this is not only numerical problem but this is sometimes a political problem also). Additionally, it is very difficult to say in general case which results are more realistic: the results obtained by separation of input data or by the use of absolute weights for the PPP calculation.

NA data into constant prices are not valid for more complicated methods[27]. Obviously the ignorance of this problem by the traditional method of the EKS calculation is not a solution. This is possible (in some limits) only due to roughness of the EKS procedure. For example, this is simply impossible for more refined procedures like the GK procedure.

The considerations about the neutralization of the effect of imported products are valid, maybe, for the Paasche PPP only. The present method distorts systematically the rule "***PPPs for total of GDP must be lower than PPPs for DA"*** each time by the calculation of the Laspeyres PPP for the cases: one country has significant negative "net exports" and low price level (PPP << XR)[28] and another country (base country) has significant positive "Net exports". The Laspeyres GDP-PPP (exactly for the same GDP with high share of Import) in this case is inevitable higher then PPP-DA due to using the positive weights of the base country. The present method combines mechanically "neutralized" and "non-neutralized" PPPs for the same country. It is not very logically to use these "non-neutralized" PPPs in the further calculations if the concept about the neutralization *("...PPPs for GDP exceed PPPs for DA, which is not acceptable")* was declared. Usually such pairs of the countries has very high Laspeyres-Paasche Spread (LPS). The reliability of the F-PPPs for the situations with very high LPS is very problematic.

The EKS method has not direct analogues in the economic reality. This method cannot be explained in economic terms - this was the main argument in favour of GK during the earlier phases of ICP. The EKS procedure is rather a formal mathematical approach to obtain mechanically transitive results with equal impact of all countries. It is very difficult to apply intuitive considerations to EKS-PPP which is a complicated capricious conglomerate from direct and indirect PPPs obtained by very different weights and BH-PPP structures. In this case it is better to use meaningful input PPPs for further calculations. If some bilateral PPPs (Paasche or Laspeyres) are meaningless (= 0 or < 0) then all further calculations either impossible or these meaningless PPPs should be replaced by indirect PPPs obtained via third countries.

Intuitive considerations like "*PPP for GDP-Total should go down compared to the PPP for DA by negative Net exports*" are not always valid for final multilateral EKS results. The EKS process may change considerably results relatively intuitive considerations and it is hard to say in general case anything about the size or even direction of possible differences. The respective examples can be found in the actual international comparisons. The EKS-PPPs can be in accordance with this concept for one set of the countries and not for the same countries within the expanded set of the countries. To present the situation clearer, some examples from the Global ICP 2017 are given below. This contains multilateral EKS PPPs as well as calculated bilateral, L-, P-, F-PPPs under the simplification: the GDP is divided in two parts only - the Domestic Absorption (DA) and Net exports. The Table 9 below contains several simplified examples where the countries have very high negative share of “Net exports” or / and very different PLIs for Domestic Absorption (DA), to demonstrate possible distorting

[27] So, the implementation of chain-type indexes using a Fisher formula by BEA/USA led to the hot discussions and to special educating the data users.

[28] In general, if a country has a very significant share of expensive imports (30-50%) then the difference between GDP-PPP and the exchange rate should not be extremely high. Respectively, the price level should be not drastically low. The existence of this effect is an indirect indication also that the problem of Quality adjustments (quality differences between domestic and imported products) were not taken into account properly.

effect of the categories with negative expenditure in the PPP calculations without a special treatment.

Table 9: Several EKS / F-PLI examples from ICP 2017

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	
		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	
		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	
		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

First example: F-PPP between STP and LUX

STP has very high negative "Net export" (~ - 50%) and low PLI for DA = ~ 46% (LUX=100). What sense to calculate HM Paasche PLI with the exotic STP weights = 150% (DA) and – 50% (Net exports)?[29] In effect, Paasche-PLI for STP (LUX =100) was outside the PLIs for underlying categories. Both STP PLIs (LUX=100) for GDP - multilateral EKS as well as bilateral F-PLI - are higher than PLI for DA!

Second example: F-PPP between SDN and CHE

SDN has moderate share of negative "Net export" (~ - 6%) but SDN has very low PLI for DA = ~ 20% (CHE=100). In effect, Paasche-PLI for SDN (CHE =100) was outside the PLI for underlying categories even the share of negative expenditure is relatively small. Both SDN PLIs (CHE=100) for GDP - multilateral EKS as well as bilateral F-PLI - are higher than PLI for DA!

[29] Probably, the use of the Tornqvist-PPPs can soft slightly the problem of negative expenditure weights – at least, numerically. This is valid if one country has high negative share of Net exports but not formthe mcase when both countries have high negative share of Net exports.

Third example: **F-PPPs between NPL and CHE**.
NPL has high negative "Net export" (~ - 33%) and low PLI for DA = ~ 25% (CHE=100). What sense to calculate HM Paasche PLI with the exotic NPL weights = 133% (DA) and – 33% (Net exports)? In effect, Paasche-PLI for STP (LUX =100) was outside the PLIs for underlying categories. Bilateral NPL F-PLI for GDP (CHE=100) was higher than PLI for DA but multilateral EKS NPL GDP PLI was lower than PLI for DA. What PLI is more "true"?

Fourth example: F-PPP between STP and LSO
Both countries (STP and LSO) have high share of negative "Net export" (~ - 50% and ~ - 40%), DA PLI between these counties (LSO=100) = 110% ws close to 100%. In effect, Laspeyres, Paasche and Fisher PLIs for STP (LSO = 100) were higher than the PLI for underlying categories!

It is possible to find similar examples in the ICP 2021. Table 10a contains the figures for the countries with negative Net exports but multilateral GDP-PLI is higher than PLI for DA (CPV and PSE are the most impressive examples).

Table 10a: ICP 2021 Analysis of the PLI differences (PLI-DA > PLI-GDP)
(Countries with negative Net exports)

	Exp. (mio. NC)		Shares of										Free EKS PLIs		PLI
AggrL	5th	4th	Net Exports	Free EKS PPPs ($=1)		Free EKS PPPs GDP ($=1)			Volume Index pc (ICP159=100)			Av.	(World = 100)		Ratio
	GDP	Net Exports	(%)	DA	NetExp-XR	Act. Value	Abs. Values	% Diff.	Act.Val	Abs.Val	% Diff.	Te	DA	GDP	DA / GDI
CPV	164 544	-60 271	-36.6	49.068	93.218	49.521	49.885	0.7	29.5	30.6	3.6	1	78.7	80.8	0.974
SYC	26 751	-2 784	-10.4	8.999	16.921	8.881	9.238	4.0	147.7	148.3	0.4	0	79.5	79.8	0.996
ZWE	36 044	-1 979	-5.5	0.559	1.000	0.552	0.569	3.1	21.3	21.6	1.3	0	83.5	84.0	0.995
CHL	240 371 473	-1 832 326	-0.8	465.363	758.955	458.805	475.400	3.6	139.0	140.1	0.8	0	91.7	92.0	0.997
EST	31 169	-313	-1.0	0.557	0.845	0.550	0.568	3.3	222.4	224.8	1.1	0	98.5	99.0	0.996
FRA	2 502 118	-47 098	-1.9	0.755	0.845	0.750	0.762	1.6	255.3	262.5	2.8	0	133.5	134.9	0.990
GBR	2 284 079	-3 518	-0.2	0.688	0.727	0.679	0.695	2.3	261.9	267.6	2.2	0	141.5	142.2	0.996
GRC	181 500	-14 107	-7.8	0.573	0.845	0.574	0.571	-0.5	155.0	162.8	5.0	1	101.4	103.4	0.981
HRV	58 408	-1 604	-2.7	0.469	0.845	0.463	0.474	2.5	166.6	169.6	1.8	0	82.9	83.3	0.996
ISL	3 250 399	-65 146	-2.0	147.801	126.951	147.744	144.294	-2.3	308.4	330.0	7.0	1	174.1	177.0	0.983
JPN	549 379 200	-2 952 200	-0.5	109.104	109.754	107.927	109.720	1.7	211.8	217.7	2.8	0	148.6	149.6	0.994
LVA	33 349	-1 051	-3.2	0.505	0.845	0.499	0.516	3.3	185.3	187.2	1.0	0	89.3	89.8	0.995
MEX	26 619 086	-515 362	-1.9	10.829	20.272	10.656	11.102	4.2	102.2	102.4	0.2	0	79.9	80.0	0.999
NZL	353 054	-11 437	-3.2	1.546	1.414	1.549	1.541	-0.5	232.8	246.0	5.7	0	163.5	166.6	0.981
PRT	216 053	-6 098	-2.8	0.606	0.845	0.601	0.608	1.2	182.3	188.1	3.2	0	107.1	108.1	0.991
SVK	100 256	-80	-0.1	0.538	0.845	0.530	0.549	3.7	181.6	182.9	0.7	0	95.1	95.3	0.997
USA	23 594 031	-858 239	-3.6	1.000	1.000	1.000	1.000	0.0	370.7	387.5	4.5	0	149.5	152.1	0.983
PSE	58 526	-22 475	-38.4	1.923	3.232	1.987	1.936	-2.6	29.4	31.5	7.2	1	89.0	93.5	0.952

Of course, it is possible to find the examples with the countries which have negative Net exports and multilateral GDP-PLI is remarkable lower than PLI for DA (KGZ and SYR are the most impressive examples[30]) – see Table 10b.

Table 10b: ICP 2021 Analysis of the PLI differences (PLI-DA < PLI-GDP)
(Countries with negative Net exports)

	Exp. (mio. NC)		Shares of										Free EKS PLIs		PLI
AggrL	5th	4th	Net Exports	Free EKS PPPs ($=1)		Free EKS PPPs GDP ($=1)			Volume Index pc (ICP159=100)			Av.	(World = 100)		Ratio
	GDP	Net Exports	(%)	DA	NetExp-XR	Act. Value	Abs. Values	% Diff.	Act.Val	Abs.Val	% Diff.	Te	DA	GDP	DA / GDI
GMB	105 487	-30 447	-28.9	17.106	51.484	15.926	18.590	16.7	13.1	11.7	-10.8	0	49.7	47.1	1.056
BTN	204 664	-39 265	-19.2	21.723	73.940	20.322	23.679	16.5	69.5	62.2	-10.5	0	43.9	41.8	1.051
NPL	4 543 219	-1 550 409	-34.1	36.871	118.134	33.747	40.677	20.5	24.2	20.9	-13.5	0	46.7	43.5	1.074
KGZ	782 854	-224 289	-28.7	21.236	84.641	19.277	23.738	23.1	31.0	26.2	-15.4	0	37.5	34.6	1.083
TJK	101 076	-23 715	-23.5	2.680	11.309	2.450	2.984	21.8	22.0	18.7	-15.0	0	35.4	33.0	1.075
UZB	738 425 246	-121 802 161	-16.5	2740.154	10609.980	2561.255	2988.322	16.7	43.1	38.2	-11.5	0	38.6	36.7	1.052
SYR	25 936 805	-12 517 413	-48.3	498.627	2150.833	423.146	553.068	30.7	11.9	9.3	-22.1	0	34.7	29.9	1.158

These examples show clearly that the simple ignorance of the problem of negative BH expenditure by the EKS procedure is not a solution. The keeping of Imports as negative values during the PPP calculations does not mean that its effect on GDP-PPP will be

[30] One should not forget that these intuitively appropriate EKS results were obtained as GM of numerous bilateral F-PPP many of them were not very reliable (with extreme LPS) – see para. I.

automatically neutralized in the desirable way. The traditional method is inconsistent internally because of a mechanic combination of "neutralized" and "non-neutralized" PPPs. The present method can bring intuitively desirable results (in accordance with a concept) for one set of countries and it can bring non-expected results (within the same concept) for another set of the countries.

Conclusion

An EKS-PPP is a complicated capricious conglomerate from direct and indirect PPPs obtained by very different weights and PPP structures. The real ICP situation with 150-160 very different countries contains a very complicated and not uniform set of bilateral comparisons with very different degree of the reliability. Therefore it is better to calculate the EKS-PPPs on the basis of meaningful reliable bilateral PPPs.

All PPP and structural methods are based on the assumption that price data contains only positive values and expenditure / quantity data – only non-negative values. Therefore the presence of BHs with negative values within an aggregate leads inevitably to some special treatment during the calculations of aggregate PPPs. I. Kravis, R. Summers and A. Heston, University of Pennsylvania "*Comments on D. Gerardi -Selected problems of intercountry comparisons on the basis of the experience of the EEC*" – https://www.roiw.org/1982/381.pdf, page 409:
"All of the commonly considered methods are designed to compare physical volumes. It is not to be expected that without appropriate adjustments they can be routinely applied to net items in the national accounts that are different in character from the physical flows of the other components of final expenditures on GDP."

The present ICP methodology as well as EU-OECD methodology ignore this problem. However the treatment of „balancing" categories with negative nominal values in a standard way is not correct from the theoretical point of view of average price indices. The practice shows that the absence of special treatment of BH with negative nominal values can lead to the „biased" results even at the GDP level. The distortion depends on two factors: the shares of „negative" expenditure and variation of BH-PPPs.

The official EKS methodology should describe clearly: What should be done if some bilateral PPPs (Paasche or Laspeyres) are equal to Zero or have negative values or have extreme LPS? To obtain the plausible results in general case, a modified method was developed. The main idea is the using of absolute nominal values (**for the PPP calculation only**) instead of actual nominal values of expenditure data.[31] This approach is consistent with the theory of the calculation of average indices. The experimental calculations showed that the proposed modification is a practicable procedure. The approach proposed in the present paper is, maybe, the simplest but not necessary the best and further investigations can lead to better solutions.

[31] The proposed modification is applicable for EKS aggregation procedure (see para. II) as well as for GK aggregation procedure (see Annex I).

Annex 1

Treatment of balancing Basic Headings within the Geary - Khamis method[32]

The main idea of the GK method proposed by R. Geary (1958) is the use of international prices which are calculated as average weighted values (the national quantities - physical or imaginary - are used as weights) from national prices revaluated with simultaneously calculating PPPs into a common currency (e.g. International Dollar, PPSs, etc.). In actual comparisons using BH data, inputs into GK are the following: BH-PPPs ('National currency/Numeraire currency') are used as „notional" (fictitious) prices and a set of „notional" (fictitious) BH quantities obtained as ratio of nominal value in national currency to corresponding BH-PPP. The average international prices and PPPs are interdependent being defined by an underlying set of simultaneous linear equations.

Let us have N participating countries and M product groups (BHs). An average „International price" of the ith group (denoted π_i) is the quantity - weighted arithmetic average of the PPP-adjusted national prices of the ith group in the N participating countries. The aggregated purchasing power parity = PPP (denoted f_j) for the jth country for the aggregate in question is equal to the ratio of the total expenditure at international prices to the total expenditure at national prices. These definitions lead to the system of (N+M) lineal equations in (N+M) unknowns (π_i and f_j) which can be modified to the reduced system with (N-1) unknown variables f_j. The Gauss-method with the selection of main elements or an iterative method can be used for solving the reduced system of the equations.

S.H. Khamis (1970 and 1972) proved existence and uniqueness of a positive solution for the Geary system. He demonstrated that meaningful results are guaranteed if non-negative input data is used. Therefore BHs which can have negative nominal values (and correspondingly- negative "notional" quantities) need a special treatment within the GK procedure. "Balancing categories" are usually excluded from the GK-calculations and some special calculations (sometimes very complicated) are made for these categories after the main GK-calculation. Such procedure complicates the general algorithm of GK method and, speaking strictly, the separation of an aggregate into two (or several parts) leads to the non-invariant (relatively to the numeraire country) results.

There is a simple approach to include all categories in general GK-calculation without distortions due to negative expenditure. It is desirable to use the absolute values of indicators w_{ij} and q_{ij} (without sign) instead of their actual values (with signs). In effect, the GK system will produce always positive international prices and PPPs:

$$\text{(A.1)} \qquad \pi_i = \sum_{j=1}^{N} (P_{ij} * f_j) * |q_{ij}| \; / \; \sum_{j=1}^{N} |q_{ij}|; \qquad i = 1,2,...,M$$

$$\text{(A.2)} \qquad f_j = \sum_{i=1}^{M} (\pi_i * |q_{ij}|) \; / \; \sum_{i=1}^{M} (p_{ij} * |q_{ij}|); \qquad j = 1,2,...,N$$

[32] This approach was proposed for the first time by the author of this paper in his Ph.D dissertation „Multilateral methods for international comparisons" (Researcher Institute by the Statistical Office of the USSR), published in Russian in 1982.

Where

P_{ij} is „notional“ price of ith group in the jth country

q_{ij} is „notional“ quantity (weight) for ith group in the jth country;

$Q_i = \sum_{j=1}^{N} | q_{ij} |$ - total quantity of the ith basic heading (sum of absolute quantities),

f_j is the aggregated purchasing power parity[33] „International currency/National currency“ of given aggregate (GDP) for the jth country

$w_{ij} = p_{ij} * |q_{ij}|$ - modified nominal value for ith group in the jth country (in national currency);

$W_j = \sum_{i=1}^{M} p_{ij} * | q_{ij} |$ - modified total value of the aggregate in question for country **j** at national prices,

N - Number of participating countries;

M - Number of basic headings (primary groups),

It seems this approach is not only practicable but also correct from a theoretical point of view of the calculation of „true“ averages. So, international prices are average weighted values from recalculated national prices by help of GDP PPPs with q_{ij}/Q_i as the weights and global PPPs are average weighted values (from individual PPPs „International price/National price“) with the values w_{ij}/W_j as the weights. Any correct average (between maximal and minimal values) can be calculated if the weights are non-negative. In our case the using of absolute values of indicators q_{ij} and w_{ij} in (A.1) and (A.2) gives us the possibility for the calculations of correct average values.

The absolute quantities are used within the GK-method for the calculations of international prices only. The actual quantities (values) based upon fact (with sign) and the international prices calculated by formula (A.1) should be used for calculations of real values and respective volume indices, etc. Consequently the aggregated purchasing power parities f_j (A.2) are used for the calculation of the average international prices only. The standard PPP „International currency/National currency“ (f_j) which should be used for the calculation of Real Values (Volumes) are calculated as the ratio of Real GDPs at international prices to Nominal GDPs at national prices. Of course, this procedure needs an additional explanation for users but the general „gain“ of this modification seems to be preferable.

The ICP uses separate BHs for Exports (non-negative expenditure) and Imports (non-positive expenditure). This circumstance softs slightly the problem of negative expenditure. The weights using in the calculations of average international prices are strictly positive in this case. However this can lead to the problem during the PPP aggregation - Imports can have much higher shares of negative values than shares of Net exports. This is especially problematic for the cases where PPPs for Domestic absorption are very different from XRs (reference PPPs for Exports / Imports).

[33] The inverted values (i.e. 1/PPP) are used in original version of GK method but it is only a technical difference.

There are the proposals to calculated separate PPPs for Exports and Imports on the basis of detailed price data from foreign trade. So, the respective PPPs in the PWT9.0 were obtained on the basis of Unit values from the UN Comtrade Database for Exports / Imports for 185 countries from 1984 to 2011 and from the World Trade Organization's (WTO) Integrated Data Base (IDB).[34]

This approach kept the problem with negative expenditure for Imports and bring additional problem the comparability of detailed price data. The database for foreign trade allow to calculate Unit Values. The Quality adjustment coefficients are obtained not from the comparisons of technical parameters of exported / imported products but by the econometric models. These econometric models are sophisticated but nevertheless they are based on some more or less arbitrary assumptions. The authors of the citied paper indicated this themselves on pages 520-522*: "Khandelwal's estimates exhibit a very strong relationship to country population, and Hallak and Schott's estimates are moderately correlated with population and our estimates (derived from using both the demand and supply side) are uncorrelated with population. The Hallak-Schott quality estimates are very strongly correlated with the manufacturing trade balance, while Khandelwal's and our export quality estimates are only slightly correlated with that balance. Our import quality estimates are not significantly correlated with any of the three variables. Finally, our quality-adjusted terms of trade estimates for these countries are negatively correlated with per capita income and population but are not associated with the manufacturing trade balance.* ***The key lesson we take from these comparisons is that estimates for quality are very sensitive to proxies chosen for important model variables, whether it be population as the proxy for the number of firms or the manufacturing trade balance as a measure of demand****."*

[34] Feenstra,R., J.Romalis. 2014 "*International Prices and Endogenous Quality*." Quarterly Journal of Economics 129 (2): 477–527
https://www.google.at/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwib_7z1scDYAhWSIuwKHZkNAUUQFggzMAE&url=https%3A%2F%2Facademic.oup.com%2Fqje%2Farticle-pdf%2F129%2F2%2F477%2F17092717%2Fqju001.pdf&usg=AOvVaw199X2mM_ZIUhC-cHKhA9w_

Annex 2

Treatment of zero quantities / expenditures in the PPP aggregation procedures based on average geometric quantities

N. Abe and D. S. Prasada Rao proposed to use in the ICP the Fixed Basket Multilateral Walsh Index – see, N. Abe (Hitotsubashi University) and D.S. Prasada Rao (University of Queensland) "*Transitivity, Substitution Bias and the Fixed Basket Multilateral Walsh Index for International Price and Real Expenditure Comparisons*", April 2022

https://www.bing.com/ck/a?!&&p=22b167cd7fce497df034f47db7f2b44abaf6e9eae9e4b5ce09658747633fb7a3JmltdHM9MTczODcxMzYwMA&ptn=3&ver=2&hsh=4&fclid=2167f667-c837-675c-2a94-e340c9ee66e0&psq=Naohito+Abe+(Hitotsubashi+University)+and+D.S.+Prasada+Rao+(The+University+of+Queensland)+%22Transitivity%2c+Substitution+Bias+and+the+Fixed+Basket+Multilateral+&u=a1aHR0cHM6Ly9yaXNrLmllci5oaXQtdS5hYy5qcC9KYXBhbmVzZS8yMDIyLzA0L25laS9kcDIyLTFfcmNlc3IucGRm&ntb=1

This method includes one specific technical point “Treatment of zero "quantities (q) / zero expenditure" because the Walsh method is used the geometric averaging of country’s quantities. The authors considered 3 options - see page 18-19 of the paper. The use of Generalized GM is preferable relatively two other. However, it is not clear that this approach can be justified in practical terms. If one country has very small but actual value of quantity (q) then Generalized GM can be very far from Standard GM - see one imaginary example below:

Example with zero for Country D

	Commodity X		M =>	4
			Z =>	0.25
	Cou A	Cou B	Cou C	Cou D
q	1	5	10	0
I	0	0	0	1
(q^z)M	0.250	0.374	0.445	0.000
GenGM	1.3030			
AM	4.0000			

What would be if Cou D reported very small but actual q?

	Cou A	Cou B	Cou C	Cou D
q	1	5	10	0.1
StandGM	1.4953			
AM	4.0250			

	Cou A	Cou B	Cou C	Cou D
q	1	5	10	0.01
StandGM	0.8409			
AM	4.0025			

	Cou A	Cou B	Cou C	Cou D
q	1	5	10	0.001
StandGM	0.4729			
AM	4.0003			

It is visible that small change done by one country leads to big change of average quantities. Additionally, if one wants to eliminate very small q to calculate "true" GenGM then this expert should decide on critical value for q (0.1, 0.01, 0.001, …) - this depends on commodities and used measuring units.

The authors considered also the alternatives like computing the geometric mean of strictly positive quantities with exponent (1/M) instead of (1/M*) where M* is the number of countries with positive quantities. This is the geometric equivalent of the arithmetic mean of numbers when some of them are zero. Since the expenditure categories with zero expenditures are small, results are not that sensitive. Probably, the version with exponent (1/M) instead of (1/M*) is better. Nevertheless, the technical problem is kept. If a country indicated small realistic value instead of zero then GMs can be very different. For example, if Cou A has q = 9 and Cou B = zero then GM with M=2 is 3. If Country B reports q as 0.1 then GM is ~ 0.95.

The authors did not consider the treatment of negative q / expenditure and therefore focused on the HHC. Obviously the practical use of Walsh method for GDP where several BHs can have very high negative expenditure (e.g. Net export) is even more problematic. If the separate BHs for Exports and Imports are used then the calculation of GM of quantities is unproblematic. However this can lead to the problem during the further aggregation (especially if different PPPs like in PWT are used). Imports have in many cases much higher negative values than Net exports.