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Purchasing Power Parities: developing methods and computations practices in 2014 CIS ICP

Abstract. Purchasing Power Parities (PPP) represent a unique tool for macroeconomic analysis. The Global International Comparison Program is arranged based on a regional principle. CIS countries form one of the regions. While linking the regional comparison (CIS ICP) results to the global ones, one should bear in mind that Russia participates also in the EU/OECD regional comparison. In previous comparison cycles the issue of linking regional CIS and EU/OECD comparisons was being resolved using the direct linear recalculation method, which ensures fixity of the results, but does not correspond to the common methodology of international comparisons. Within the most recent cycle of CIS ICP which was conducted using 2014 data (2014 CIS ICP), a qualitatively better method was elaborated and used to link regional results – a “partially-multilateral comparison” method (PMC method). This experience is described in the article.

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Purchasing Power Parities (PPP) represent a unique tool for macroeconomic analysis. However, the scope of work needed to carry out PPPs calculation is very large: it is necessary to coordinate item lists (goods and services), collect primary price data (including budget statistics and data on housing), validate data, get national annual average prices, compile data using the detailed structure of GDP expenditures, carry out calculations of PPPs. These steps usually take at least three years and are called a cycle of comparison.

Global and regional comparisons

Global comparison based on purchasing power parities where many countries participate are undertaken under the auspices of the UN. This activity is called the “International Comparison Program” (ICP). Two recent large scale comparison cycles were carried out in accordance with the UN decision using data for 2005 and 2011.¹ The World Bank acted as the Global Coordinator of the program. The Global ICP is organized by regions: there are six main regions of the world, of which five are composed on the geography principle: Asia (except Western Asia), Africa, Western Asia, Latin America and CIS, and one is done on an institutional principle: this is the group of countries coordinated by the OECD and Eurostat. There are several reasons why ICP is organized by regions: these are organizational, administrative, and financial reasons. In theory, countries of the same region form a more homogeneous group with better accuracy of the comparison results.²

Following the decision taken by the UN Statistical Commission, the next round, after 2011, of global ICP was to be conducted using data for 2017. However, following the decision of the Economic Council of the CIS, in the CIS region the regional comparison cycle has been conducted on the basis of data from 2014 (the CIS ICP 2014). CIS-STAT acts a Regional Coordinator.

In June 2017, CIS-STAT issued a statistical publication “2014 International Comparison of CIS Countries GDP Based on Purchasing Power Parities”. This publication presents results of a three year-long effort of the national statistical offices of CIS countries and CIS-STAT on computing PPPs and conducting PPP based comparisons.

A separate important issue of global comparisons is linking regional comparisons to obtain a single set of global indicators.

To link regional results within the 2005 ICP, a special inter-regional comparison – “ring” comparison – was carried out: an additional comparison for a small sample of countries from each region. Each “ring” country participated in two separate multilateral programs: the first program covered countries of the region which the “ring” country belonged to; the second one covered all the “ring” countries. These two programs were organized and conducted separately. The applied methodology was not to calculate direct global inter-country parities, but to calculate multilateral inter-regional parities (it was a totally new approach in the theory and practice of international comparisons) with their further linking with regional parities. In

¹ ICP cycles based on 1985 and 1993 data strictly speaking were not global, as they did not cover all regions of the world.

² Although in practice this is not entirely true. For example, rather different countries participate in the comparisons coordinated by the OECD and Eurostat.

this case, regions were seen as “super-countries” with several price observations in each “super-country”.

However, some conceptual and technical problems were detected in the “ring” comparison of 2005 ICP. First of all, the ring comparison, based on a small sample of countries, provided neither the reliability nor equal representativity of the inter-regional item list and price data for all regions. Thus the ring comparison was substituted by the Global Core List (GCL) approach within the 2011 ICP; all participating countries collected data for the GCL items. Multilateral inter-regional BH PPPs were computed on the basis of the global products basket and price data from all countries.

How should one include CIS data into the 2017 Global ICP? To be able to answer this question we should consider attentively the experience of the 2005 ICP and the 2011 ICP, as well as linking the regional comparison ICP CIS 2014 and the OECD/EU comparison on the basis of 2014 data.

The results of multilateral comparisons are usually invariant relative to base country and base currency. However the transparent and understandable (for broad circle of users) presentation of the results needs special efforts for the selection/definition of these terms. The concept of numéraire currency is very important for the international comparisons based on PPPs. The numéraire currency is a currency towards which the purchasing power parities of the participating countries are being computed. National currency of one of participating countries may be the numéraire currency (e.g. Euro of one country in the euro area or U.S. dollar) or artificial conventional currency (e.g. OECD dollar in OECD comparison or “Purchasing power standard, PPS = Euro at EU average price level”³ – in Eurostat comparison).

In the ICP for CIS 2005 and 2011 the Russian ruble was used as numéraire currency. As a result the purchasing power parities for the national currencies of the participating countries were published towards Russian ruble. Hence, the comparison based GDP estimates (total, per capita, by components, etc.) were also published in Russian rubles on the basis of PPPs. In order to expand the field for comparison, it would be interesting to compute PPPs of the national currencies of CIS countries towards one of the most common world currencies, such as the U.S. dollar, or the Euro. Thanks to the participation of CIS countries in the global comparison cycles, PPPs of their national currencies were obtained towards the Russian ruble (within regional CIS comparisons) and then towards the U.S. dollar (using PPP of Russian ruble to U.S. dollar obtained within OECD comparison).

However a comprehensive and an adequate-- from the methodological point of view-- computation of the PPPs of the national CIS currencies towards the U.S. dollar is possible only if CIS countries participate in a comparison where the USA is also a participating country. Similarly, it is possible to obtain adequate PPP estimates for the CIS currencies towards Euro only if CIS countries participate in the Eurostat comparison.

Participation in a multilateral comparison assumes that national statistical offices collect price data in accordance with a unified approved item list and present data on GDP

³ At present 19 EU countries (euro area countries) use the Euro as a common national currency. However it does not mean that price levels are the same in all euro area countries. In this regard, to present PPPs Eurostat uses an artificial neutral numéraire currency “Purchasing power standard, PPS” = Euro at EU average price level.

expenditures in accordance with harmonized classification, and then a calculation is done on the basis of the common array of data collected by all comparison participating countries.

The USA and euro area countries participate in the regional comparison for the joint group of EU/OECD countries. This work is commonly called “Eurostat/OECD comparison” (or “EU/OECD comparison”) and is coordinated by the OECD Statistics Directorate and Eurostat. To emphasize the role of OECD in computing purchasing power parities of the CIS currencies towards the U.S. dollar⁴, here we call this work an “OECD/EU comparison”.

So far, out of the CIS countries only Russia has an opportunity to interact with OECD on a practical basis, to provide item price data and data on GDP structure, and, as a result, obtain a direct transparent PPP estimate of the Russian ruble towards the U.S. dollar. Thanks to the parallel participation in two comparisons – the CIS ICP and OECD/EU – Russia may be used as a “bridge country” in order to link these comparisons. Therefore there is an opportunity to recalculate the ICP CIS results using U.S. dollars as a numéraire currency, which means obtaining PPP estimates of the national CIS currencies towards the U.S. dollar and compute the GDP estimates of CIS countries in U.S. dollars on the basis of purchasing power parities. This approach was also used in the global comparison cycles of 2005 and 2011, which allowed CIS countries to avoid the extra efforts to undertake the linking procedures used at that time. However such indirect estimating of PPPs of CIS currencies in respect to the U.S. dollar via a bridge country contradicts the key concept of a multilateral comparison, which is a direct comparison of each country with all the rest, and linking countries via a bridge country may raise questions both from the methodological and organizational points of view.

Fixity principle

Speaking of linking regional and global comparisons, it should be emphasized that usually one of the requirements is the adherence to the principle of fixity. This requirement is very important if regional comparisons are used for making official decisions. For example, Eurostat uses PPP based GDP estimate for calculating the size of financial assistance from EU to less developed regions within EU. In this regard, the principle of fixity is applied to the EU countries comparison within OECD/EU comparison (i.e. the PPPs of EU countries are impacted only by EU countries data). However, first of all this is a requirement of administrative and organizational nature and it is to a lesser extent related to statistical requirements (economic homogeneity of countries and accuracy of comparisons).

Computation of PPPs in multilateral comparison is based on computing averages for all countries participating in comparison.⁵ It is clear that when multilateral comparisons are linked it is impossible to achieve strict fixity (absolute fixing) of regional comparisons; when the number of countries whose data are used in computations is changed (expanded) averages are also changed to a certain extent. So the fixity principle is often applied non-strictly; as a rule it is assumed that country ranking by per capita GDP (PPP based) shall be maintained. The

⁴ OECD/EU comparison is a single program of multilateral comparisons. So if a PPP towards the U.S. dollar has been obtained, computation of a PPP towards the Euro becomes a mere arithmetic procedure (scaling).

⁵ Bilateral Fisher PPPs are averaged by the EKS method (presently the official ICP method) or national prices are recalculated to a common currency at a common price level are averaged by the Geary-Khamis method (the method used in the first rounds of the ICP).

ranking of countries by decreased (increased) per capita GDP (PPP based) resulted in each group (region) should be maintained between these countries within a broader set of countries after aggregating this group of countries with others.

PPP estimates for CIS currencies towards the U.S. dollar were obtained for all three CIS comparisons using data for 2005, 2011, and 2014. Different methodological approaches could be used. Within the 2005 and 2011 cycles, the simplest approach was applied to link CIS ICP and OECD/EU comparisons using a direct recalculation via a bridge country (linear recalculation). From the methodological point of view this was not a multilateral comparison of CIS countries with OECD/EU countries, but obtaining an indirect estimate. Within the 2014 comparison a much more sound methodological approach was used, which is a partially-multilateral comparison of CIS countries and OECD/ EU countries. This approach was called a partially-multilateral comparison of CIS and OECD/EU countries (partially-multilateral comparison method, PMC) because at the first stage of computations the bridge country is used that participates simultaneously in different regional comparisons (that country being Russia).

We will describe the two solutions that enable linking regional comparisons.

Linear recalculation using a bridge country data

Linking CIS and OECD/EU comparisons using direct recalculation on the basis of Russia's results in the OECD/EU comparison is a simple procedure. The PPP estimate for each country's currency towards the Russian ruble obtained within the CIS comparison are recalculated towards the U.S. dollar using the respective PPPs of the Russian ruble to the U.S. dollar obtained within OECD/EU comparison. The role of Russia as a bridge country is very clear here.

$$(1) \text{ PPP}(NC_{CIS-m} / \$_{EU/OECD}) = \text{PPP}(NC_{CIS-m} / RUB) * \text{PPP}(RUB / \$_{EU/OECD})$$

$PPP(NC_{CIS-m} / \$_{EU/OECD})$ – purchasing power parity of the national currency of the country *m* from the CIS region towards OECD/EU dollar

$PPP(NC_{CIS-m} / RUB)$ – purchasing power parity of the national currency of the country *m* from the CIS region towards the Russian ruble obtained within the CIS comparison

$PPP(RUB / \$_{EU/OECD})$ – purchasing power parity of the Russian ruble towards OECD/EU dollar, obtained within the OECD/EU comparison

It is clear, that a direct linear recalculation provides fixity of CIS comparison results. For countries participating in OECD/EU comparison (including Russia as a participant of OECD comparison) results are not changed at all, and for other CIS countries they are just rescaled proportionally which maintains all relations between these countries results.

The main advantage of linking two regional comparisons using direct linear recalculation is the simplicity of the procedure while maintaining fixity for Russian results within OECD/EU comparison. These reasons played the key role during the first two CIS ICP cycles (2005 and 2011), when there were many other problems to solve and restricted resources did not

encourage additional work on linking on the basis of adequate methodology of the multilateral approach.

The main drawback of direct linear recalculation is the violation of the concept of multilateral comparison, which is inevitable for such approach. Use of a bridge country imposes all the peculiarities of the statistics (and economics) of the bridge country to other countries' results. As a result one may not exclude that the PPP estimates for these countries could be biased.

The only way to avoid these disadvantages is to conduct multilateral comparisons, i.e. to carry out an integrated calculation on the basis of data collected in accordance with a single item list by national statistical offices of all the countries participating in the comparison. As it was mentioned, in order to obtain adequate--from the methodological point of view--multilateral PPP estimates of the CIS currencies towards the U.S. dollar (or the Euro) it is necessary to integrate within a single calculation data on prices and GDP structure of the CIS and OECD/EU countries. Item lists (product baskets) used in the CIS and OECD/EU comparisons are quite similar. Unfortunately, due to organizational matters a full scale participation of CIS countries (with the exception of Russia⁶) in the multilateral OECD/EU comparison has not been possible up to now. One of the key restrictions for the majority of CIS countries to participate in OECD comparisons is the OECD and EU regulations that prohibit the disclosure of item price data to any non-member OECD/EU country. In this regard, as there is no possibility to include CIS countries into the OECD/EU comparisons on a comprehensive multilateral basis, in order to obtain more adequate multilateral PPPs of the CIS currencies towards the U.S. dollar, CIS-STAT within the CIS ICP 2014 used the partially-multilateral comparison approach that allowed us to substantially eliminate the shortcomings of direct linking via a bridge country (linear recalculation).

Partially-multilateral comparison (PMC method)

Linking the CIS and OECD/EU comparisons is a multistage procedure. Following the negotiations with the OECD and further agreement with Eurostat it was decided to link CIS and OECD/EU data starting from the basic headings level. This made it possible to avoid the issue of disclosing the OECD/EU item price data to CIS countries. This compromise solution appeared to be well-balanced and acceptable for all parties.

At the first stage estimates of PPPs of the CIS currencies towards U.S. dollar are obtained at the basic headings level:

$$(2) \text{ PPP}_{BH-k}(NC_{CIS-m} / \$_{EU/OECD}) = \text{ PPP}_{BH-k}(NC_{CIS-m} / RUB) * \text{ PPP}_{BH-k}(RUB / \$_{EU/OECD})$$

$\text{ PPP}_{BH-k}(NC_{CIS-m} / \$_{EU/OECD})$ – purchasing power parity of the national currency of the country m from the CIS region towards OECD/EU dollar for the basic heading k

$\text{ PPP}_{BH-k}(NC_{CIS-m} / RUB)$ – purchasing power parity of the national currency of the country m from the CIS region towards Russian ruble for the basic heading k

⁶ Some time ago, Russia got the opportunity to participate in OECD comparison on an experimental basis, which was then transformed into regular participation.

$PPP_{BH-k} (RUB / \$_{EU/OECD})$ – purchasing power parity of the Russian ruble towards OECD/EU dollar for the basic heading k

The first step presented in (2) is a simple calculation following the linear recalculation procedure. However, next steps are performed in full compliance with the concept of multilateral comparisons.

At the second stage, on the basis of the combined data from basic headings from CIS and OECD/EU countries the EKS method is used to compute intermediate aggregated PPPs of each CIS (and OECD/EU) country's currency towards the dollar.

Actually, the results computed at this stage are already PPP estimates towards the dollar obtained on the basis of the multilateral comparison of CIS and OECD/EU countries. However these estimates cannot be considered final because it is necessary to maintain fixity for the countries participating in OECD/EU comparison (including Russia as participant of OECD comparison). For this purpose out of final results, one part of the values (for countries participating in OECD/EU comparison including Russia) are brought back to the values obtained within the initial regional OECD/EU comparison (i.e. are strictly fixed), and another part of values (for CIS countries) are modified proportionally.

Briefly speaking, one can say that PPPs from the OECD/EU comparison and also from the expanded OECD/EU/CIS comparison are scaled to the level of OECD/EU=1⁷, and PPPs for OECD/EU countries obtained within the expanded OECD/EU/CIS comparison are replaced with the PPPs from the initial OECD/SU comparison.

Technically this procedure may be described (as one of the options⁸) which are given below in the formulae (3) – (6):

$$(3) \quad PPP^{EU/OECD\sim} = \underset{n}{\text{GEOMEAN}} \{PPP_{EU/OECD-n}^{\sim}\}$$

$PPP^{EU/OECD\sim}$ – the geometric mean of the respective interim PPP estimates for all countries (n) of the OECD/EU region

$$(4) \quad PPP^{EU/OECDfixed} = \underset{n}{\text{GEOMEAN}} \{PPP_{EU/OECD-n}\}$$

$PPP^{EU/OECDfixed}$ – the geometric mean of the respective PPP estimates for all countries (n) obtained via official OECD/EU comparison

⁷ It should be mentioned that scaling does not change the inter-country ratios – this is only another form of a (more neutral) presentation.

⁸ Such approach is described, for example, in “EUROSTAT-OECD Methodological manual on purchasing power parities (PPPs), 2012”

$$(5) \text{FixCoef} = \text{PPP}^{\text{EU/OECDfixed}} / \text{PPP}^{\text{EU/OECD}\sim}$$

FixCoef – fixity coefficient for the results obtained via official OECD/EU comparison

$$(6) \text{PPP}(\text{NC}_{\text{CIS-}m} / \$_{\text{EU/OECD}}) = \text{FixCoef} * \text{PPP}\sim(\text{NC}_{\text{CIS-}m} / \$_{\text{EU/OECD}})$$

PPP~(NC_{CIS-*m*} / \$_{EU/OECD}) – purchasing power parity estimate for the country *m* from the CIS region obtained via partially-multilateral comparison of the joint group of CIS and OECD/EU countries, without applying fixity principle to the official OECD/EU comparison results

PPP(NC_{CIS-*m*} / \$_{EU/OECD}) – purchasing power parity estimate for the country *m* from the CIS region obtained via partially-multilateral comparison of the joint group of CIS and OECD/EU countries, with applying fixity principle to the official OECD/EU comparison results

As a result, the PPP estimates for the countries participating in the OECD/EU comparison (including Russia) remain unchanged. Simultaneous calculations demonstrated that for countries participating in the CIS comparison, the ranking achieved in the CIS comparison also is maintained in the aggregated final results for OECD/EU/CIS. Thus the fixity principle in a broad sense is maintained for all countries of the combined multilateral comparison: for the OECD/EU countries (absolutely strictly) and for CIS countries (by ranking).

Comparisons in the OECD/EU region are done usually towards a conditional currency (“OECD/EU dollar”); however there is users’ demand for the PPPs estimates towards the U.S. dollar⁹. Therefore, CIS-STAT publishes results towards the U.S. dollar as the numéraire currency computed on the basis of the following formula:

$$(7) \text{PPP}(\text{NC}_{\text{CIS-}m} / \text{USD}) = \text{PPP}(\text{NC}_{\text{CIS-}m} / \$_{\text{EU/OECD}}) / \text{PPP}(\text{USD} / \$_{\text{EU/OECD}})$$

PPP(USD / \$_{EU/OECD}) – purchasing power parity of the U.S. dollar towards OECD dollar obtained via official OECD/EU comparison

Uniqueness of results

An important condition of a correct use of PPP based comparisons is the uniqueness of results. Comparison results are used in various macro-economic calculations, including very important ones where statistical ambiguities are unacceptable. However, as it was mentioned above, the nature of multilateral PPP calculations inevitably predetermines the likelihood of obtaining different results depending on which range of countries are involved in the comparison. Based on experience, one can say that qualitative differences do not occur, and the use of a wider range of countries makes it possible to obtain more reliable results.

In order to exclude ambiguity in comparison results, the PPP estimates of CIS currencies towards the Russian ruble are considered interim, and CIS-STAT does not publish them. The

⁹ OECD publishes two types of PPPs: towards OECD/EU dollar and the U.S. dollar.

only official set of ICP CIS 2014 data are estimates obtained via partially-multilateral comparison OECD/EU/CIS.

PPP based comparison in the CIS region in 2014

| Country | Currency | PPP, units of national currency for one US dollar | GDP (PPP based), billion US dollars | Per capita GDP (PPP based), US dollars | Per capita GDP volume index, USA =100 |
|-------------------|-------------------|---|-------------------------------------|--|---------------------------------------|
| Azerbaijan | Azerbaijani manat | 0.37 | 160.3 | 17,022 | 31.2 |
| Armenia | Armenian dram | 167.13 | 28.9 | 9,587 | 17.6 |
| Belarus | Belarusian ruble | 4,530.27 | 177.9 | 18,773 | 34.5 |
| Kazakhstan | Kazakhstan tenge | 93.48 | 424.4 | 24,549 | 45.1 |
| Kyrgyzstan | Kirghiz som | 16.24 | 24.7 | 4,421 | 8.1 |
| Moldova | Moldovan leu | 5.14 | 21.8 | 6,130 | 11.3 |
| Russia | Russian ruble | 21.28 | 3,722.0 | 25,477 | 46.8 |
| Tajikistan | Tajik somonie | 1.67 | 27.2 | 3,299 | 6.1 |

Detailed data are presented in the CIS-STAT publication mentioned above. In order to obtain a PPP of any currency towards the Russian ruble in accordance with the published results, one may just divide the PPP of this currency towards dollar by the Rub/dollar PPP.

Being Regional Coordinator of ICP CIS, the CIS-STAT makes consistent efforts to develop calculations of the PPPs of the CIS currencies for a wide range of countries on the basis of the multilateral comparison methodology. In the framework of ICP CIS 2014 estimates were for the first time obtained with the help of the partially-multilateral approach. This was an important step in the further development of common work on including CIS countries into the international comparisons on the multilateral basis.