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Linking Basic Heading PPPs across Regions

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Linking Basic Heading PPPs across Regions

Discussion Paper

A. Overview

The purpose of this paper is to provide an overview of the issues regarding the choice of methods to link basic heading PPPs across regions. The 2005 ICP results were prepared in stages. First, the world was divided into regions, each of which separately determined the products to be priced for household consumption. While the regions developed their own set of products for household consumption basic headings, global specifications were used for machinery and equipment, construction, government compensation, and dwellings. For both the regional and global lists, the emphasis was on choosing the method to estimate the basic heading PPPs that would produce the best set of regional PPPs. For example, three of the regions made productivity adjustments to PPPs for government compensation. PPPs for housing actual and imputed rents were based on rental rates in some regions and the quantity method in others. While each region's choice of methods improved the quality of their comparisons, it made for a more difficult second stage which was linking the regional PPPs into a global comparison.

The data sources used to estimate the linking factors differed across the basic headings. A "ring list" of products, that was a composite of the regional lists and covered most of the consumption basic headings, was developed and priced by a subset of countries within each region. These "ring" countries submitted prices for the regional list, and also for the ring list which contained nearly a thousand products. The ring prices and the PPPs from the regional comparisons were used to compute between region PPPs that were scalars to calibrate the regional results to a global numeraire. This method ensured that fixity was maintained; in other words, the relative volumes between countries within a region remained the same after the regional results were calibrated to the global level.

This same method was also used for the basic headings where all regions priced the same set of global products, in other words, computing scalars to calibrate the regional PPPs to a global numeraire. However, since the methods differed by region, especially for government compensation, the comparability between countries in different regions was compromised.

For the 2011 ICP, the ring concept has been expanded. Instead of a subset of the countries pricing a ring list of 1,000 products for consumption, a smaller "global core" will be priced by all countries. The analysis of the 2005 ring data showed that the choice of countries contributed more to the variability in the PPPs than did the choice or number of products priced; in other words, it would be better to price fewer items, but by more countries. Each region determined a subset of the global core its countries would price. However, some countries may choose to price the entire core. In addition,

global specifications for housing rents, government compensation, machinery and equipment, and construction will again be used. It is also likely that at least some regions will need to make productivity adjustments to some basic heading PPPs. A final twist is that there will be at least two countries that will be pricing the global core, but will not be part of a regional comparison.

Background material for this discussion includes Chapter 14 of the ICP Handbook, and Chapters 4 “Computation of Basic Heading Purchasing Power Parities within and between Regions” and 8 “Linking the Regions” from the ICP Book. In addition, the Heston Paper, “Productivity Adjustments as a Special Case of a General Regional Linking Problem” is referenced.

The discussion starts with a review of the methodology used to link basic heading PPPs in the 2005 ICP. A variant of this method proposed by Sergeev is then reviewed. The TAG will be asked to consider these two methods with a recommendation for 2011.

The paper concludes with a brief review of two other methods, first that used by the Eurostat-OECD because it may be a solution for those countries not part of a regional comparison, or could be used in conjunction with the final method to be discussed. The fourth method is that proposed by Heston to deal with the problem with comparability when some but not all regions used productivity adjustments. This method should also be considered for those basic headings where all countries will be pricing the same global list.

B. 2005 Method to Link Basic Headings across Regions

As proposed by Diewert, in 2005, basic heading linking factors were obtained by converting the ring country prices in each region to those of a regional numeraire country using PPPs from the regional comparison. This resulted in 5 sets of regional prices. One region was chosen as the numeraire and between region PPPs were computed using the CPD. The price matrix included the individual average prices for each ring country. The resulting between region PPPs multiplied by the within region PPPs converted each country to the global numeraire and maintained within region fixity. Tables 1-3 in Chapter 14 of the ICP Handbook provide a worked example and follow.

Table 1 shows ring prices for three regions, 10 countries and 10 products. The within region PPPs for each country with 1.00 shown for the regional numeraire are in the bottom line of the table.

Table 2 contains the ring prices after they have been converted to the currency of the regional numeraire using the within region PPPs.

Table 3 shows the between region PPPs based on the price matrix shown in table 2. Note that the representativity coding was used in the example; therefore, table 3 shows the results from both the CPD and CPRD.

Table 1. Original Price Data

Product	Region I				Region II			Region III		
	A	B	C	D	E	F	G	H	I	J
1	2*	100		25*	20*	600*		6*	60	
2	5*		12*			900*	450		100	240
3	6*	270	15*			1000*	400	14*	150	200*
4		320	70		180	5000		24		320
5	8*	280		120*	120	2000*	500	20		360
6		210*	60		100		350*	12*	100	
7			50*	140*				40	240	260*
8		120*	12*	100	80	800*		16	50*	
9	2			10*	25	1500	150*			
10					40*		260*		70*	200*
Within-region PPPs	1	30	5	13	1	30	6	1	7	16

Table 2. Prices Deflated by Within-Region PPPs

Product	Region I				Region II			Region III		
	A	B	C	D	E	F	G	H	I	J
1	2*	3.33		1.92*	20*	20*		6*	8.57	
2	5*		2.4*			30*	75		14.29	15
3	6*	9	3*			33.33*	66.67	14*	21.43	12.5*
4		10.67	14		180	166.67		24		20
5	8*	9.33		9.23*	120	66.67*	83.33	20		22.5
6		7*	12		100		58.33*	12*	14.29	
7			10*	10.77*				40	34.29	16.29
8		4*	2.4*	7.69	80	26.67*		16	7.14*	
9	2			0.77*	25	50	25*			
10					40*		43.33*		10*	12.5*

Table 3. Estimated between-region basic heading PPPs

Estimated between-region basic heading PPPs: Data from Table 2					
Method	Regional coefficients (PPP)			Representativity coefficients	
	I	II	III	Rep	Unrep
CPRD	1	10.56	2.23	1	1.79
CPD	1	11.54	2.67	--	--

A variant of the 2005 method

The between region PPPs are computed from the price matrix shown in table 2. Note that the price matrices shown in tables 1 and 2 show different numbers of countries in each region. For the 2005 ICP between region estimation of PPPs, Africa contained 6 ring countries, Asia and Eurostat-OECD 4 and the remaining regions had 2 countries each. When the core list is used to estimate the between region PPPs, there will be 50 countries in the African region and as few as 10 in some other regions. As Sergeev pointed out, regions with a greater number of linking countries may exert a larger influence on the results. On the other hand, the African region is large and diverse and exhibits a large variation in prices. The price matrix may also be sparse for some basic headings.

Sergeev's suggestion is to compute the geo mean of the product prices across countries--each product will have one price regardless of the number of countries in the region. Table 4 shows the geo mean of the product prices from the price matrix in table 2 and the resulting within region PPPs. The use of geo means has pluses and minuses. When there is only one regional average price for each product in a region, equal weight is given to each region in the estimation of between region PPPs. However, the ICP Handbook and also Rao in Chapter 4 point out that the use of geometric average prices results in a loss of information and degrees of freedom.

Table 4 Regional mean prices and between-region PPPs

(The asterisks indicate that the products are deemed to be representative of the region.)

Product	Regional average prices in regional numeraire currency			Ratios of regional average prices : i.e., between-region PPPs for individual products		
	I	II	III	II / I	III / I	II / III
1	2.34*	20*	7.17*	8.55	3.06	2.79
2	3.46*	47.43*	14.64	13.71	4.23	3.24
3	5.45*	47.14*	15.54*	8.65	2.85	3.03
4	12.22	173.21	21.91	14.17	1.79	7.91
5	8.83*	87.36	21.21	9.89	2.40	4.12
6	9.17*	76.38*	13.09*	8.33	1.43	5.83
7	10.38*	-	28.14	-	2.71	-
8	4.20*	46.19*	10.69*	11.00	2.53	4.32
9	1.24*	31.50	-	25.40	-	-
10	-	41.63*	11.18*	-	-	3.72
CPD PPPs geo means				11.52	2.66	4.33
<i>(CPD PPPs : individual prices)</i>				<i>11.54</i>	<i>2.67</i>	<i>4.32</i>
CPRD PPPs geo means				10.35	2.29	4.53
<i>(CPRD PPPs : individual prices)</i>				<i>10.56</i>	<i>2.23</i>	<i>4.74</i>

A most critical issue is how the importance/representative coding would be considered when using geo means.

When using individual country prices, the **representative or importance** classification is carried forward for each item in each country even after it has been converted to the regional currency. This is critical because not every item will be important in every country. When the geo mean is used to estimate between region PPPs, it will be necessary to determine whether it is important (or representative). In the worked example, a product is representative for the region if it was classified as representative by at least half of the countries.

The fact that the core list provides items comparable across the world means that many will not be important in every country. Therefore, it is crucial that the importance classification be done well and its use optimized in the global calculations.

There are many unknowns. First, it is not known whether the countries can consistently apply the “importance” classification. This has implications about the choice of method to compute global basic heading PPPs.

Another unknown is how much of the core list is actually priced. One would expect the within region matrix would be more complete than the global matrix, but we do not know the degree. A third unknown is the affect the core list will have on the regional results.

A related issue that the use of the core list means that there are two sets of PPPs between countries within a region; one based on the regional prices and the other on the core prices. The degree to which these will differ will depend upon two things; one the amount of overlap between the core and regional lists, and the fact that the mix of countries in the multilateral comparison differs between the regional and global aggregations. One would expect the importance classification to be somewhat consistent for countries within a region as well. These are issues to be dealt with in the data validation stage, the subject of another discussion paper.

Given these issues and the unknowns about the use of the core list and the important-less important classification, the recommendation is that the between region PPPs be computed using the full price matrix of country prices rather than the geo means. It is also recommended that the CPRD using representativity as a dummy variable be used rather than using the weighted CPD.

C. Eurostat-OECD Method.

The Eurostat-OECD comparison starts with the estimation of PPPs for the member EU countries. Once these are established, a wider group of countries is brought into the comparison, but in a way to ensure fixity for the first group of countries. A key point about this method is that all countries price basically the same set of specifications. PPPs are first computed for each group of countries. Then multilateral PPPs for all countries are computed without the constraint of fixity. These unconstrained PPPs are adjusted so that, within each region, they become proportional to the respective within region PPPs as shown in the following table.

Country	Region	Within-region PPPs	Unconstrained PPPs for all 10 countries	1 st adjust regions I and II	2 nd adjust region II	1st adjust region III	2 nd adjust region III
A	I	1	1	1			
B	I	30	28.568	30			
C	I	5	3.794	5			
D	I	13	11.67	13			
	<i>GM</i>	<i>6.645</i>	<i>5.858</i>	<i>6.645</i>			
<hr/>							
E	II	1	9.479	10.754 (1)	10.496 (1)		
F	II	30	274.413	322.611 (30)	314.885 (30)		
G	II	6	54.804	64.522 (6)	62.997 (6)		
	<i>GM</i>	<i>5.646</i>	<i>52.239</i>	<i>60.718</i>	<i>59.264</i>		
<hr/>							
H	III	1	2.074			2.353 (1)	2.187 (1)
I	III	7	12.847			16.472 (7)	15,314 (7)
J	III	16	30.132			37.648 (16)	35.001 (16)
	<i>GM</i>	<i>4.820</i>	<i>9.294</i>			<i>11.342</i>	<i>10.545</i>

This method is shown as an option for those countries not part of a region. They can be brought into the global comparison without them having any affect on the regional or global comparisons. It could also be used in conjunction with the final method considered below.

D. Linking Basic Headings using global lists.

As stated above, some regions will be adjusting compensation basic headings for productivity while other will not. The issue is how to link these basic headings. The Heston proposal for compensation is to make a separate computation of each compensation basic heading PPP using the matrix of 180 countries times the set of employee compensations for each country. The outcome would be a set of 180 PPPs for each compensation basic heading. A set of capital and labor coefficients would be estimated for each of the 180 countries and used to make productivity adjustments across all countries. This set of unconstrained PPPs could be used by each region to adjust their regional PPPs to retain fixity. Even though regional PPPs may have been computed differently, they will be linked following consistent methodology.

This method of computing global basic heading PPPs could also be used for the quantity method used for housing, and the machinery and equipment, and construction basic headings based on a global list.

It is recommended this process be used for the compensation and dwelling basic headings. It is also recommended it be used as part of the data validation for the other headings where there is a global list, specifically, machinery and equipment, and construction. A final point is that the use of the core list for household consumption allows the estimation of a set of global PPPs for those basic headings as well. It is recommended this be done for data validation purposes.

What to do with Core Prices not used in the Regional Comparisons?

Once the core list was developed, each region determined a subset that would also be used in their regional comparison. It is likely that there will be core products that end up being priced by only one country which means it will not enter into the regional comparison. The question is whether this price should be used in the estimation of between region basic heading PPPs. The answer should be yes if the product was to be part of the regional comparison, and it should be subject to the data validation exercise. This will increase the number of overlapping products.

A related question is what to do if a country submits prices for the entire core list in addition to the regional prices? As before, they will not affect the regional comparisons. However, their impact on the global estimation will depend on the method.

- Between region PPPs. The extra prices for one country would bias the between region PPPs because it would be over represented.
- Global PPPs. The extra prices would improve the link between that country and all others and have an impact, but less, on the PPPs between other countries through the indirect PPPs.

Further use of these data will be to examine the sensitivity of affect of the extra prices on the global PPPs. A closing point, however, is that the ICP is based on comparability which goes beyond defining the products to be priced. The comparability concept also applies to the balance across countries of the number of products priced by basic heading.

E. Summary

The steps to validate the prices and PPPs need to be carefully defined. This leads to another recommendation which is that the global office needs to have the regional national average prices and basic heading PPPs when validating the core prices to be able to evaluate the relationship between the regional and core data sets. It will be essential that regions and countries stick to the time schedule because it seems prudent that the validation of the regional prices remain open until the core prices and PPPs have been validated.