

# The Ring Comparison: Linking the Regions

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Chapters 4, 5, and 6 provide the theoretical basis for the methods used to estimate basic heading purchasing price parities (PPPs), and then aggregate them to the gross domestic product (GDP), first at the regional level (chapter 5) and then at the global level (chapter 6). The method of choice is to first estimate basic heading PPPs at the regional level.<sup>1</sup> It is for comparability purposes that the International Comparison Program (ICP) divides the world into major regions. When each region develops a basket of goods and services that are representative of the expenditures of its countries, it is likely that many of these products will be important to a large number of countries. This approach improves the quality of the price comparisons between countries within regions, but it is also important that countries be compared across regions. For example, the PPPs for China and India can be computed between countries within Asia, but not between those countries and, say, Brazil or the United States.

This situation presents a major dilemma for the ICP. For comparability purposes, each region not only chooses what to price independently of other regions, but also can adopt the PPP estimation methodologies that are best suited for the economic structure and statistical capacity of its countries. The other chapters in this book describe the different methodologies and provide reasons for the choices made. Chapter 1 describes the concepts (e.g., transitivity and base country invariance) and the properties of multilateral comparisons. Although these properties apply to the estimation of PPPs between countries in the same region, it is also essential that they be met for the comparisons of countries in different regions for the global comparison. The estimation process for computing PPPs between countries in different regions must also take into account the fixity concept—that is, the ranking and relative volumes of countries within a region must be preserved. To illustrate, the results for the Asia-Pacific region in the 2005 ICP indicated that the real GDP for China was 2.28 times larger than India's real GDP. The fixity concept means that after the countries are linked to the rest of the world, China's real GDP is still 2.28 times larger than India's.

Chapter 4 describes the theory and methods for the computation of basic heading PPPs within and between regions. It also explains the requirement that two sets of basic heading PPPs be used to link countries across regions. The first set is the *within-region* basic heading PPPs based on region-specific product lists and the estimation methodology specific to each region. The second set is the *multilateral between-region* PPPs based on the national average prices for a global set of products called the Ring list. A subset of countries within each region priced the Ring list in addition to providing prices for their regional basket. Chapter 6 sets out the methodology to aggregate the linked PPPs to the GDP.

This chapter describes the concepts underlying the linking methods used in the 2005 ICP. It outlines the steps taken to create a global list of products out of the regional baskets and the choice of countries to price it. It also reviews the price collection and validation procedures and provides the results. The chapter concludes with lessons learned and recommendations for the 2011 ICP.

## Linking Methods

The bridge method shown in equation (8.1) is a simple way to link two regions and relies on one country pricing both sets of regional baskets (World Bank 2007). If country  $k$  provides the average prices for products in both regions  $A$  and  $B$ , then the PPP between any country  $t$  in region  $B$  and any country  $s$  in region  $A$  can be derived as

$$(8.1) \quad PPP^{s,t} = PPP^{s,k} \cdot PPP^{k,t}$$

where  $PPP^{s,k}$  is the PPP between countries  $s$  and  $k$  based on the prices both countries collected for region  $A$ , and  $PPP^{k,t}$  is the PPP between countries  $k$  and  $t$  based on region  $B$  prices.

The problem is that the PPP between countries  $s$  and  $t$  is dependent on the choice of country  $k$  to provide the linkage and will differ depending on the country chosen to price both regional baskets. The number of alternative PPPs between countries in different regions is the number of countries in the two regions. In the previous ICP round, Japan was used to link the Eurostat–OECD (Organisation for Economic Co-operation and Development) comparison with Asia and Mexico with Latin America. However, this method is arbitrary, depending on the country chosen to price both baskets. Therefore, the goal for the 2005 ICP was to provide a method to link countries across regions that was not dependent on the choice of a single country to conduct the additional price surveys.

For the 2005 ICP, a between-region PPP (Diewert 2004) was defined as a PPP that compares the prices in two regions after the prices in each region have been converted into a common regional currency. As described in chapter 13 of the *ICP 2005 Methodological Handbook* (World Bank 2007) and chapters 4 and 6 of this volume, the basic heading PPP between two countries in different regions can be obtained using a between-region PPP to obtain PPPs between countries in different regions. The PPP between country  $t$  in region  $B$  and country  $s$  in region  $A$  was described in chapter 13 of the *ICP 2005 Methodological Handbook* as

$$(8.2) \quad PPP^{s,t} = PPP^{s,A1} \cdot PPP^{A1,B1} \cdot PPP^{B1,t}$$

$PPP^{s,A1}$  is the *within-region* basic heading PPP between the regional reference country  $A1$ , whose currency is used as the regional numeraire, and country  $s$  as calculated by region  $A$ .  $PPP^{A1,B1}$  is the basic heading PPP between regions  $A$  and  $B$  expressed in terms of the two regional numeraire

currencies—that is, those of the regional reference countries  $AI$  and  $BI$ . This *between-region* PPP in the 2005 ICP was calculated by the Global Office using prices collected in the Ring program.  $PPP^{BI,t}$  is the *within-region* PPP between country  $t$  and the reference country  $BI$  as calculated by region  $B$ .

The goal for the 2005 ICP was to determine a multilateral set of between-region PPPs such as  $PPP^{AI,BI}$  that was not dependent on the choice of a single country to determine the linking and that was invariant to the choice of reference country and numeraire currency in both regions.

The bridge method described in equation (8.1) was used in the 2005 ICP to link countries in the Commonwealth of Independent States (CIS) region because the countries, lacking resources, were unable to furnish the Ring prices. It was also recognized that the price structures of the CIS countries were similar, and so they could be linked using the Russian Federation as the linking country. Equation (8.2) shows the linking method used to link the other regions. The between-region PPPs were based on a subset of countries (the so-called Ring countries) within each region pricing a global set of products in each basic heading. As noted earlier, this global product list was called the Ring list for which Ring prices were obtained. The Ring list was a composite of items priced in each region. The Ring countries first priced their regional list and then the Ring list. Chapters 4 and 6 describe the statistical methods used to link countries across regions. However, for the purposes of this chapter a simple example is shown in figure 8.1 to illustrate the process, which is central to the remainder of this chapter.

Box 1 in figure 8.1 shows the Ring prices for 10 products in a basic heading for countries A–D in region I, E–G in region II, and so forth. The prices shown are in the currency of each country.

The bottom row (box 2) shows the within-region basic heading PPP for each country to its regional base country. Country A is the base for region I, and country E is the base for region II. The purpose of the Ring comparison is to compute the between-region PPPs—that is, for each basic heading the PPP between regions I and II and between regions I and III. Therefore, the next step is to convert the Ring prices in each region into a common regional currency. This is done by dividing the Ring prices for each country by the *respective within-region PPPs*. These “deflated prices” are shown in box 3. The prices for the base countries remain the same.

The matrix in box 3 now contains in effect prices for three regions expressed in three regional currencies. The same Country Product Dummy (CPD) method used to compute within-region basic heading PPPs and described in previous chapters is used to compute the between-region PPPs from the matrix of deflated Ring prices. Box 4 shows the PPP between regions I and II to be 10.56. Region I is the base, and so its PPP equals 1.0.

The between-region PPPs for each basic heading are called linking factors because they are used as scalars to calibrate the within-region PPPs to the base region. Box 5 shows that the global PPP for this basic heading for each country in region II is simply the product of the within-region PPP and 10.56. The global PPP for the regional base country is equal to the linking factor.

The use of a single scalar for each basic heading in each region ensures that the within-region relative volumes and so forth remain the same. Therefore, the fixity property is preserved. Just as important, this method is base country–invariant, and transitivity is ensured. However, these properties are conditional on the choice of countries to price the Ring list.

The use of multiple countries to compute the regional linking factors is a vast improvement over the bridge method, which relies on a single country. However, the Ring concept is still dependent on the choice of countries to price the Ring list—a different set of countries could produce different linking factors. The next section describes how the Ring countries were selected.

**FIGURE 8.1** Linking Factors: A Numerical Example

1	Ring prices—BH	Region I				Region II			Region III
	Product	A	B	C	D	E	F	G	H
	1	2	100		25	20	600		etc.
	2	5		12			900	450	
	3	6	270	15			1,000	400	
	4		320	70		180	5,000		
	5	8	280		120	120	2,000	500	
	6		210	60		100		350	
	7			50	140				
	8		120	12	100	80	800		
	9	2			10	25	1,500	150	
10					40		260		
2	PPPs (within region)	1	30	5	13	1	20	6	

3	Deflated prices	Region I				Region II			Region III
	Product	A	B	C	D	E	F	G	H
	1	2	3		2	20	20		etc.
	2	5		2			30	75	
	3	6	9	3			33	67	
	4		11	14		180	167		
	5	8	9		9	120	67	83	
	6		7	12		100		58	
	7			10	11				
	8		4	2	8	80	27		
	9	2			1	25	50	25	
10					40		43		

4	Regional coefficients (PPPs)			
	Method	I	II	III
	CPD	1	10.56	etc.

Country	Region	PPPs (within region)	Linking factors	Global PPP
A	I	1	1	1
B	I	30	1	30
C	I	5	1	5
D	I	13	1	13
E	II	1	10.56	10.56
F	II	30	10.56	316.80
G	II	6	10.56	63.36
H	III	etc.	etc.	etc.

Base country for region I for the ICP: United States

Base country for the ICP: OECD

Source: ICP 2005.

## Selecting the Ring Countries

Ideally, all countries would have priced the Ring list, but because of resources a sample of 18 countries was chosen to do the additional pricing. The selection of the 18 countries to price the Ring list was purposive rather than random; each country had to meet the following requirements:

- Availability of a wide range of products and services comparable to those in at least two other regions
- Capability of providing prices and expenditure weights for all of the GDP aggregates
- Willing to take on the extra work of pricing the Ring list.

Table 8.1 lists the Ring countries by region. The number of countries in a region differed because Africa has nearly 50 countries, whereas South America and Western Asia each has only 10 countries. Because none of the countries in the CIS region priced the Ring list, that region was linked to the OECD by Russia, which priced both the OECD and CIS lists. This was the bridge method shown in equation (8.1).

The Ring countries were chosen before the regional results became available. Therefore, information about the relative price levels and structures from the regional comparison was not available when making the final selection of countries. The results of the Ring survey are used later in this chapter to evaluate that selection. The next section describes the steps taken to develop the Ring list.

## Developing the Ring List

The Ring list covered only basic headings in the household consumption aggregate of the GDP; it excluded those for health, education, and housing rentals. The Global Office developed global lists and specifications for the health, education, and housing basic headings, as well as those for general government, equipment, and construction. Therefore, it was not necessary to develop a separate Ring list for those basic headings. The same data were used for both the regional and Ring comparisons. The nature of these basic headings made it difficult to prepare the pricing specifications; they required expertise and time not available in every region. Because of the complexity of these basic headings, separate chapters are devoted in this volume to each.

The starting point for developing the Ring list was to merge the product lists from the five ICP regions and the Eurostat-OECD comparison. For simplicity purposes, all are referred to as

**TABLE 8.1** Ring Countries/Economy by 2005 ICP Region

Africa	Asia-Pacific	Eurostat-OECD	South America	Western Asia
Cameroon	Hong Kong SAR, China	Estonia	Brazil	Jordan
Egypt, Arab Rep.	Malaysia	Japan	Chile	Oman
Kenya	Philippines	Slovenia		
Senegal	Sri Lanka	United Kingdom		
South Africa				
Zambia				

Source: World Bank 2008.

regions in the remainder of this chapter. Annex A lists the number of products in each major category by region.

A first review revealed very few exact matches between the regional lists. Even when the same type of product was found in different regions, the price-determining characteristics such as package type and size were defined differently. There were also differences in quality and terminology—for example, some rice was sold loose instead of packaged, and an item called a biscuit in one region was called a cookie in another. Two different approaches, depending on the type of product, were adopted to construct the Ring list. First, the products purchased by households were split into two groups. Group (a) consisted of consumption goods usually purchased in retail outlets such as shops, market stalls, supermarkets, and department stores. Group (b) consisted mostly of services such as transport, communications, health, education, restaurants, and hotels.

The regional product lists for group (a) were then consolidated, resulting in over 5,500 products grouped by cluster within basic headings. The starting point for the group (b) services was the specifications from the Eurostat-OECD comparison. These products were much more difficult to define, and therefore the specifications used in the ongoing Eurostat-OECD region were used as a starting point instead of trying to consolidate those lists from the other regions. The group (b) list contained about 1,000 items and services. Both lists were sent to the regional coordinators and Ring countries, and they simply identified those products and services “as defined” that were available in their respective markets.

Products and services that could only be priced by Ring countries within the same region were eliminated. This review reduced the combined lists from the two groups to about 1,200 items. The next step was to establish targets for the number of Ring products to be priced within each basic heading. The methods described in chapter 7 using the expenditure share, homogeneity of products, and expected relative price variation of products within each basic heading were used to establish target numbers. These targets ranged from 2 for eggs to over 90 for pharmaceutical products.

The next step was to harmonize the product descriptions for the remaining items. This step was a challenge, and the Global Office staff became experts in how the same product was defined across the world. A draft catalog containing the harmonized descriptions and pictures (where available) was sent to the regional coordinators and Ring countries. The regional coordinators brought representatives from the Ring countries together to provide detailed comments about each description, propose changes to the descriptions, add new products, or delete others. They also were asked to identify products that were representative of the patterns of consumption in their country (R), or were available but not representative (A). The purpose of this classification was to identify those products that might be available to be priced but were not usually purchased by the average consumer in his or her country. These products generally have higher prices, and so the classification was to be used in the estimation process. More is said about this process in the section presenting the data analysis results.

The Global Office incorporated the comments, additions, and deletions from the regional coordinators and Ring countries to create an updated Ring list. The distribution of the number of products by basic heading was also reviewed to determine the final number to remain on the list. The draft catalog was updated and sent to the regions and Ring countries for a final review. The Global Office then organized a workshop that included the regional coordinators and selected national experts to finalize the list. This effort resulted in revisions, including the addition of some products and the deletion of others. The end result was a global list of 1,095 household consumption goods and services and the accompanying product specifications. The distribution of the products in this final list is shown in the Ring column in annex A. The number of items in the global lists for general government, construction, and equipment is also shown.

## Collecting the Ring Prices

The process to develop the Ring list did not begin until all regions had finalized their regional specifications. Thus the regional data collection was under way while the Ring list was being developed. However, the main factor affecting the timing of the Ring data collection was the size of the Ring list, which, except for the Eurostat-OECD, exceeded the size of the regional lists. As a result, none of the Ring countries had the capacity to collect the Ring prices until they had completed the regional data collection, which meant that the Ring price collection did not begin until 2006. In addition, resources were not available to support a Ring price collection that covered each country for a full year. The data for the Ring prices were therefore collected only at one point in time and only in the capital city.

The Eurostat-OECD countries typically only collect prices in the capital city and at one point in time for their comparison. These countries use their consumer price index (CPI) and other data to backcast the point-in-time data to an annual average and also to calibrate the capital city prices to the national level. Annex B provides an example of the worksheet that Ring countries were required to submit. The ratio of the capital city average prices to the national level was derived from the regional PPP data collection or other sources. The data for backcasting to 2005 were taken from each country's consumer price index.

## Validating the Ring Prices

The prices collected for the Ring products were subjected to the same stringent diagnostic tests and validation procedures used by each country and region for the regional price data described in detail in chapter 9. This process began with each Ring country validating those prices in the same way in which they validated the prices for the regional comparison. Each country did have the benefit of the information on price levels from their regional data collection, but they had to validate prices for products that were not in that collection and for which they may not have had much prior knowledge.

The data validation for the regional comparisons was conducted independently by each region, whereas the group of 18 Ring countries was treated as a separate region administered by the Global Office. When each country had completed its validation of the Ring prices, it was submitted to the ICP Global Office for the remaining steps of the validation.

The most intensive validation focused on the between-country review of the relative prices of individual products within a basic heading, treating the set of 18 countries as a single region. The first step was to convert each country's prices for each product within a basic heading into a common currency using both the exchange rate and the Ring country basic heading PPPs based on the Ring prices. Because this was the first time product prices from countries representing all regions of the world were compared, this first review was conducted without the benefit of having the within-region results.

Similar to what was found in the regional data validation, the Ring prices validation revealed two kinds of outliers. One was a country price (in the common currency) that differed significantly from the common currency prices for the other countries. For example, short grain rice prices in the common currency were about the same for all of the Ring countries except one whose price was less than the average. The question was whether this price should be included even after country verification. In many cases, after reviews with the regional coordinator such prices were deleted. The other type of outlier was a product outlier. The standard deviation of the deviations of the national prices

from the international average prices for each product within a basic heading was used to identify products for which there was a lack of consistency in the price levels reported by countries. This lack of consistency was generally caused by the product being poorly or loosely defined (see chapter 7) in such a way that comparable products were not being priced. Because there was not sufficient time to redefine these products, they were simply dropped after extensive review.

A main concern arising from this first review was that the basic dilemma of comparability and representativity became a greater problem for the Ring list because of the diversity in the economic size and structure of countries in different regions. The dilemma is that one wants to measure the same goods and services across countries. Ideally, these same goods and services should also be representative of the consumption in each country. The basic concern was whether the Ring list contained too many products common to rich countries but rare and expensive in poor countries. Two questions then evolved: Did each country price the same product? And if a price was submitted, was it representative of the consumption patterns in the region? The reason for classifying products as representative or nonrepresentative was that one would expect representative products to be sold in greater quantities with lower prices than would be observed for nonrepresentative products.

This data validation indicated that the concept of representativity was not consistently applied across the Ring countries. The national price statisticians were not able to agree on a workable definition of representativity that was consistent across countries and regions. Where one would expect representative products to be those with lower prices, the opposite was often true. Because the representativity variable added another source of variability to the results, it was not used to compute the between-region PPPs. As discussed in chapter 7, the representativity concept was used only by the Eurostat-OECD comparison and the CIS region.

Although the analysis just described was useful in determining the prices and products that needed additional review, it was also necessary to compare the price levels between regions because that comparison would be the basis for the between-region PPPs. For example, one would expect price levels to be lower in Africa than what was observed in the Eurostat-OECD countries. Again, the diagnostics just described were used to identify problem prices and products. An additional step was to compare the consistency between regional and Ring results once information from the regional comparisons became available.

The Ring list differed from the regional lists because its products were defined to be comparable between countries in different regions. The question was whether the relative prices at the product level based on the regional and Ring prices should be similar for countries in the same region.

The next stage of the data validation was to evaluate whether relative price levels from the regional comparisons were similar to price levels from the Ring comparison for countries in the same region.

Table 8.2 shows the within-region rankings of Ring countries based on aggregated price level indexes (PLIs) from the regional comparison, then based on the Ring comparison before and after prices were deflated. (These aggregations came from the Dikhanov table as part of the validation, and so were not weighted.) The computations treated the 18 countries as a region with base UK = 1.0 for columns (2)–(5). The main points follow:

- Column (1) shows the within-region rankings of the aggregated PLIs by country from the respective *regional comparisons*. For example, in Africa's regional comparison price levels among the six Ring countries were the highest in South Africa followed by Zambia and the lowest in the Arab Republic of Egypt. In the Eurostat-OECD region, Japan had

**TABLE 8.2** Regional and Ring Price Level Indexes and Their Rankings, ICP 2005

	Regional rank <sup>a</sup> (1)	PLI, Ring (2)	Ring rank (3)	PLI, deflated (4)	Deflated rank (5)
Brazil	2	0.664	1	0.664	1
Chile	1	0.664	2	0.645	2
Jordan	2	0.570	1	0.568	1
Oman	1	0.560	2	0.560	2
Cameroon	4	0.686	1	0.686	2
Senegal	3	0.615	3	0.630	4
Egypt, Arab Rep.	6	0.384	6	0.642	3
Kenya	5	0.550	4	0.730	1
South Africa	1	0.680	2	0.593	5
Zambia	2	0.536	5	0.522	6
United Kingdom	2	1.000	2	1.000	2
Estonia	4	0.700	4	1.022	4
Japan	1	1.165	1	0.975	1
Slovenia	3	0.815	3	1.016	3
Malaysia	2	0.541	2	0.770	2
Hong Kong SAR, China	1	0.672	1	0.672	4
Philippines	3	0.437	4	0.729	3
Sri Lanka	4	0.530	3	0.890	1

Source: The Ring analysis for the 2005 ICP was provided by Imededdine Jerbi, ICP Global Office.

a. The global ranking is the same because of the fixity requirement.

the highest PLI, and Hong Kong SAR, China, had the highest in Asia among the respective Ring countries in those regions. Recall that the principle of fixity requires that these within-region rankings be preserved after each region has been linked.

- Column (2) shows the aggregated PLI for each country based on the Ring prices. The Ring countries were treated as one region, with the United Kingdom as the base. The PLI for Cameroon is exceeded only by those for the Eurostat-OECD countries; it is the largest in the Africa region. The price levels for Africa excluding Egypt were larger than expected, especially compared with those for Asia, which had lower than expected price levels. This finding raised two questions: Did the Ring list adequately represent the products widely consumed in the Africa and Asia-Pacific regions? Or should some countries not have been included in the Ring comparison?
- Column (3) shows the within-region rankings of the PLIs in column (2). Cameroon went from having the fourth-highest PLI among the six African countries in the regional comparison to a first-place ranking based on the Ring prices. Zambia went from having the second-highest PLI in the regional comparison to the fifth highest based on Ring prices. The question is whether the PLIs within the Ring countries were consistent with those from the regional comparisons. Because the product lists were different, some inconsistencies would be expected. In addition, the within-region multilateral PPPs and price level indexes were based on countries not in the 18-country multilateral

Ring computations. However, one would expect the rankings to be somewhat consistent. Although the respective rankings of the PLIs from the regional and Ring prices were not exactly the same in the South America, Western Asia, and Eurostat-OECD regions, they were similar.

- Column (4) shows the aggregated Ring PLIs after the Ring prices for each country were deflated using the basic heading PPPs from the regional comparisons. For example, Hong Kong SAR, China and the United Kingdom were the base countries for the Asia-Pacific and Eurostat-OECD regions, respectively. The Eurostat-OECD region was also the base region as indicated by the  $PLI = 1$  in both columns (2) and (3) for the United Kingdom. The Ring prices in each Asia-Pacific country were transformed into Hong Kong SAR, China prices using the within-region PPPs of each country to Hong Kong SAR, China and so on for the rest of the regions. In theory, the resulting PLIs for each group of countries should be about the same, and they are similar in the South America, Western Asia, and the Eurostat-OECD regions. However, there is considerable variability in the deflated PLIs for the Africa and Asia-Pacific regions.
- Column (5) shows the within-region ranking of the PLIs. Egypt went from the significantly lowest in price level to the third most expensive country among the six African countries. South Africa moved from having the highest PLI to having the fifth highest. In the Asia-Pacific region, Sri Lanka became the most expensive country and Hong Kong SAR, China the cheapest. These are two examples in which the classification of “representative” may have made a considerable difference.

The conclusion of this analysis was that the Ring results for the Eurostat-OECD, Western Asia, and South American countries were consistent with the respective regional comparisons. However, the lack of consistency between the regional and Ring results in Africa and the Asia-Pacific raised the question of whether some countries should be considered outliers. For example, a Ring country should represent the average regional price structure—that is, shares of expenditures by basic heading are similar, as are the price levels. Sergeev (2007) offered another approach to determining whether some countries were possible outliers using coefficients of similarity of price structures. An analysis using this approach revealed that possible outliers were Cameroon, Zambia, and Egypt in Africa, Sri Lanka in the Asia-Pacific, and Japan in the Eurostat-OECD comparison.

As a result of these two sets of analysis, another in-depth review of the product specifications and prices was undertaken to determine whether there was a developed country bias in the product choices and descriptions. In addition, the prices of about 200 products showing the greatest price variability were observed by a team of ICP experts in markets in the United Kingdom, Slovenia, Hong Kong SAR, China, and Malaysia. These market visits generally confirmed that the price collections were consistent across countries and regions.

The final stage of analysis was to compute the linking factors by excluding countries that were possible outliers. This computation provided an evaluation of the effect of the Ring data on the linking factors, but it was not possible to carry out a similar analysis on the regional basic heading PPPs; they had to be used as provided by each region. Recall that a subjective process was used to choose the initial set of Ring countries. Rather than add more subjectivity to the process, all 18 countries were included in the estimation of the final linking factors.

The overall validation of the Ring prices went through four iterations that included the regional coordinators and representatives of some of the Ring countries. Over 11,600 average prices (about seven average product prices per country per basic heading) were submitted for the 1,000-plus Ring products. At the end of the validation, over 2,000 individual product prices were

deleted, or about 20 percent. In addition, about 60 products were deleted when it was not possible to determine whether any of the country prices were plausible.

Although the Ring prices were subjected to detailed scrutiny, the basic heading PPPs from the regional comparisons were taken “as is” because the regional results had already been published. Therefore, it was not possible to review the regional results that were not consistent with those from the Ring countries.

The following analysis provides a look at the basic heading–level PPPs from the Ring comparison first based on the original Ring prices and then based on the Ring prices after they were deflated by the respective within-region PPPs. This analysis will reveal the consistency of the within-region PPPs and Ring PPPs. It takes into account the fact that PPP levels vary considerably across basic headings.

Table 8.3 presents results for three countries and some selected basic headings. The columns labeled “Ring prices” contain the ratios of the basic heading PPP to the aggregated PPP using the Ring prices. The columns labeled “deflated Ring prices” contain the ratios of the Ring basic heading PPPs to the aggregated PPPs after they were deflated, again across the 18 Ring countries treated as a region. In Sri Lanka, for example, the Ring PPP for electricity was 0.15 of the aggregated PPP, but after being deflated using its regional PPPs, electricity moved to 1.27 of the aggregated level. The differences for gas were even larger. Similar or larger differences were shown by the other countries in which a PPP from the Ring prices was considerably below the average PPP, but after deflation by the within-region PPP it became much larger than the average. There were differences in the opposite direction as well.

These diagnostics point out inconsistencies between the Ring and regional data by basic heading and should lead to another review of those data. Thus the within-region PPPs should have been subjected to review as part of the Ring analysis.

The outcome of this analysis was that the variability and lack of consistency were attributed to three factors. First, so that the Ring list would contain products comparable across regions, it contained many products that would not have been widely purchased by consumers in every country. The representativity classification gives more weight to items sold in greater quantities, which are assumed to have lower prices. But as pointed out earlier in this chapter, this classification process was not used. Therefore, if the Ring list contained a large number of nonrepresentative items so that comparable products could be priced, the result would be higher price levels for those countries in which, even though they could price the items, it was likely that those items would be

**TABLE 8.3** Ratio of Basic Heading Ring and Deflated Ring PPPs to Aggregated PPPs, Selected Countries

	Egypt, Arab Rep.		Sri Lanka		Japan	
	Basic heading PPP/aggregated PPP		Basic heading PPP/aggregated PPP		Basic heading PPP/aggregated PPP	
	Ring prices	Deflated Ring prices	Ring prices	Deflated Ring prices	Ring prices	Deflated Ring prices
Bread	0.83	3.76	0.07	0.91	1.45	0.44
Electricity	0.65	0.93	0.15	1.27	0.04	0.04
Gas	0.85	0.97	1.89	5.46	2.10	0.35
Therapeutic appliances	0.50	5.00	0.34	0.03	0.56	1.51

Sources: ICP 2011 and data analysis by Imededdine Jerbi, ICP Global Office.

available only in specialty shops and as a result more expensive. This outcome would lower the real expenditures of those countries compared with those in the Eurostat-OECD comparison. Second, even though the Ring comparison was a vast improvement over the bridge method, the results were still dependent on the choice of countries to price the Ring products. A different set of Ring countries may have provided different results. Third, estimation of the linking factors is dependent on a set of Ring prices that are then deflated by the within-region basic heading PPPs. However, the regions were allowed to publish their results before validation of the Ring prices was complete. There was therefore no opportunity to seek a review of the within-region basic heading PPPs not consistent with the relative prices from the Ring countries.

## Linking Basic Headings Not Included in the Ring Comparison

This section is an overview of how the basic headings not included in the Ring comparison were linked.

### Actual and Imputed Rentals for Housing

Chapters 3, 12, and 17 describe the three methods used in the 2005 ICP to estimate housing PPPs: rental prices, quantity indicators, and relative volumes. PPPs based on rental prices are computed by means of the same methods used for prices in other basic headings. These rental prices are also used to represent owner-occupied housing. Some countries have limited rental markets. Therefore, a method based on the quantity and quality of housing (the quantity method) was used to impute PPPs in the Asia-Pacific and Africa regions. Both of these regions have limited rental markets, pointing to the use of quantity indicators. However, because countries in those regions had difficulties providing housing quantities, the relative volume of household consumption expenditures was used as the reference volume for actual and imputed rentals and to impute PPPs. Rental PPPs were thus neutral because being neutral did not affect the per capita volumes for private household consumption. All other regions were able to use either rental prices or the quantity method or a combination.

All countries, including those in the Africa and Asia-Pacific regions, were requested to submit quantity and quality data to the Global Office. From this set, data on housing quantities for 106 countries were used in a CPD regression to estimate between-region PPPs. This matrix of quantity and quality indicators was too sparse to estimate PPPs at the individual country level. However, it was sufficient to compute the between-region PPPs for the five groups of countries. Chapter 12 on dwelling services contains considerable detail on these different methods. The dilemma is that the use of relative volumes to impute PPPs in Africa and the Asia-Pacific may have overstated the rental PPPs in those countries in which there is considerable informal housing. If so, this overstatement would have lowered the real expenditures in those countries compared with those in the rest of the world.

### Health, Education, and Government Compensation

Chapters 11, 15, and 16 provide background on how government expenditures enter into the estimation of PPPs for health and education. Chapter 16 summarizes the issues on the use of productivity adjustments for the government compensation basic headings. There was no separate

Ring list for government compensation because all countries submitted salary results for the same set of occupations. There was also considerable overlap between the ICP global occupations and those used by the Eurostat-OECD and CIS countries. The main difference was that the regional PPPs for government compensation were adjusted for productivity in the Africa, Asia-Pacific, and Western Asia regions. The adjustments increased the spread of the real expenditures for compensation in countries in those regions. Without those adjustments, the very low salaries in many countries would have resulted in real expenditures at implausibly high levels.

The dilemma was how to link countries in these regions with the rest of the world where no adjustments for productivity were made. One consideration was that there was no need for productivity adjustments in the other regions. However, within each region were countries similar to those in Africa, the Asia-Pacific, and Western Asia where adjustments were made. Compensation data not adjusted for productivity for 75 countries representing all regions were used to compute between-region PPPs. If the linking factors were adjusted for productivity, then the spread between ICP countries and those in the Eurostat-OECD would be increased. Thus care should be taken in making comparisons between, say, India (productivity adjustment) and Tajikistan (no adjustment).

## Equipment and Construction

Global specifications were priced by all countries in the ICP regions and the Ring countries in the Eurostat-OECD region. The same prices were used for both the regional results and the estimation of linking factors.

## Results

This section provides some basic heading regional linking factors from the 2005 ICP and explains how they are related to the global-level PPPs—that is, all countries linked to US = 1.0.

Table 8.4 shows the between-region PPPs or linking factors for a selected set of basic headings and for the GDP. The between-region PPP for the rice basic heading for the Asia-Pacific region was 5.81. The rice basic heading PPP linked to US = 1.0 for each country in the Asia-Pacific region was its within-region PPP multiplied by 5.81. The rice PPPs for China and India (from the Asia-Pacific region with Hong Kong SAR, China = 1.00) were 0.53 and 2.64, respectively. When each was multiplied by 5.81, the global PPPs (US = 1.0) for China and India were 3.08 and 15.34, respectively. Each basic heading linking factor is a regional scalar that, when multiplied by each country's within-region basic heading PPP, becomes the global PPP. Because the linking factor is a scalar, the PPPs between countries within the region remain the same whether they are compared at the global level or the regional level. The PPP for China/India is 0.200 using the regional PPPs (0.53/2.64) or the global PPPs (3.08/15.34).

Equation (8.2) and the example in figure 8.1 both show that the linking factor for each basic heading is also the global PPP for the regional base countries. Hong Kong SAR, China; Brazil; the United Kingdom; South Africa; and Oman were the regional base countries for the estimation of the between-region PPPs for the Asia-Pacific, South America, Eurostat-OECD, Africa, and Western Asia regions. The rice basic heading PPP for Hong Kong SAR, China linked to the United States is 5.81. This relationship holds for every level of aggregation. In other words, the linking factor for the GDP level of aggregation for Africa is the PPP for South Africa linked to US = 1.0. The regional linking factors can be observed for every region and level of aggregation by simply looking at the PPP of the regional base country.

**TABLE 8.4** Linking Factors for Selected Basic Headings: Between-Region Basic Heading PPPs, ICP 2005 (US = 1.0)

Basic heading	Asia-Pacific	South America	Eurostat-OECD	CIS	Africa	Western Asia
1101111 Rice	5.81	1.26	0.65	15.52	4.84	0.23
1101121 Beef and veal	8.12	0.76	0.68	12.13	4.33	0.24
1101131 Fresh or frozen fish and seafood	4.45	1.30	0.46	13.19	3.22	0.14
1103121 Garments	5.84	2.42	0.68	27.62	5.47	0.28
1104111 Actual and imputed rentals for housing	7.96	1.03	0.49	4.57	2.40	0.70
110451 Electricity	9.92	4.29	0.81	9.33	5.65	0.22
110611 Pharmaceutical products	6.83	2.35	0.39	14.75	10.82	0.37
110612 Other medical products	8.29	3.89	0.69	11.81	10.27	0.56
110613 Therapeutic appliances and equipment	6.46	1.89	0.77	30.99	5.61	0.44
110621 Medical Services	3.47	1.39	0.48	4.08	2.60	0.09
110622 Dental services	1.55	0.35	0.39	4.86	0.85	0.10
110623 Paramedical services	2.96	0.77	0.79	4.18	2.24	0.12
110630 Hospital services	2.29	0.51	0.39	2.74	2.03	0.12
110711 Motor cars	11.69	3.16	0.70	27.96	7.76	0.31
110712 Motorcycles	12.18	3.29	0.66	34.14	8.09	0.33
111000 Education	4.39	1.45	0.40	1.53	2.79	0.17
130221 Compensation of employees—health services	1.46	0.19	0.23	0.71	0.72	0.08
130421 Compensation of employees—education services	1.75	0.36	0.45	1.53	1.06	0.11
140111 Compensation of employees—collective services	1.92	0.50	0.50	3.50	1.15	0.10
150110 Metal products and equipment	8.26	3.38	0.68	29.76	6.26	0.39
150120 Transport equipment	5.89	1.94	0.55	21.45	5.45	0.19
150210 Residential buildings	3.60	0.93	0.70	13.67	3.47	0.11
150220 Nonresidential buildings	3.85	0.95	0.85	14.81	3.67	0.12
150230 Civil engineering works	4.95	1.27	0.73	14.59	5.14	0.16
GDP	5.69	1.36	0.65	12.74	3.87	0.23
Coefficient of variation, all basic headings	0.54	0.47	0.36	0.54	0.87	0.60

Source: ICP 2005.

The linking factors for the CIS column are the PPPs of Russia to US = 1.0, with Russia included in the Eurostat-OECD computations. Thus the relative levels of the linking factors for each basic heading in the CIS region are based on Russia.

Table 8.4 also shows the variability in the linking factors across the basic headings compared with the GDP linking factors. The lowest level for all regions is the compensation of employees for

health services. Recall that the within-region PPPs for the Africa, Asia-Pacific, and Western Asia regions were adjusted for productivity, but the linking factors were not adjusted. These linking factors would likely have been larger had they also been adjusted for productivity. Also note that the linking factors are generally lower for services than they are for goods.

The final line in table 8.4 is the coefficient of variation, which measures the average dispersion of the basic heading linking factors around the GDP linking factors. The dispersion of the linking factors was generally greater than those observed for the respective regional comparisons. Perhaps this is to be expected because countries within regions are more alike in price structures, and the linking factors have to bring together every region of the world. On the other hand, it could mean that the variability in the linking factors was the result of the countries selected to price the Ring products—in other words, the selected countries may not have been representative of their respective regions.

The variability in the linking factors was likely also caused by the different methods used across regions. For example, PPPs for dwelling services were computed three different ways. Productivity adjustments were applied to government compensation in three regions, but were not used when estimating linking factors. The Eurostat-OECD and CIS regions applied the representativity concept, but it was not used in the other regions or in the estimation of linking factors.

## Lessons Learned

The following lessons were learned from the Ring comparison in the 2005 ICP. First, the list of Ring products had to contain products comparable across countries in different regions. Not all of these products were representative of purchases in every country. Therefore, unless some way is found to classify products by importance, they all receive equal weight in the estimation of linking factors. A lesson learned, then, was that the process to determine representativity should be simplified. The concept of importance described in chapter 7 will be implemented and also made a part of the data validation exercise.

Second, because Ring countries should represent the regional price and economic structures, they should be selected using the within-region PPP results. In addition, the variability across countries suggests that more countries should submit prices for a global list.

Third, the two-stage estimation of between-region linking factors depends on the within-region PPPs to deflate Ring prices to regional currencies. The data validation of the within-region basic heading PPPs should not be completed until the linking factors have also been finalized. An outlier linking factor may be the cause of the within-region PPP, not the Ring data.

Fourth, Dikhanov (2009) showed that a core list that contained only about 30 percent of the original list of Ring products still provided consistent results. From this finding emerged the method used to link regions in the 2011 ICP. A set of global core products has been developed that will be a subset of every region's regional list. Every country will provide prices for the global core list, thereby fully satisfying the transitivity and invariance properties directly. In addition, data from all countries will be used to estimate the between-region linking factors, which means the linking is not conditional on the choice of countries.

Fifth, although it is important that regions have choices of methodology, too many different methods were used, making the linking process even more difficult. The next section summarizes the actions to be taken for the 2011 ICP to minimize the regional differences.

## The Way Forward

The linking methodology used for the 2005 ICP was a huge improvement over what was used for previous rounds. Much was learned from the Ring exercise, and it is guiding the choice of methods for the 2011 round.

A set of global products was prepared for household consumption items—the so-called core list. Each region decided which elements of the core list would be part of its regional data collection. Thus every country will be pricing a set of global products, and so every country's data will be used to estimate the between-region linking factors. The ICP Global Office developed global specifications for health, education, quantities of housing, government compensation, equipment, and construction; the regional and global lists are the same.

The definition of *representativity* was simplified (it is now called “importance”) to mainly describe products widely consumed. Chapter 7 provides details on the use of the importance concept for the regional and core products.

The validation of the regional and core product prices will proceed in parallel so that inconsistencies across the two lists can be identified and removed.

Finally, regions will be allowed flexibility in how they estimate the within-region PPPs for dwellings (price or quantity methods) and government compensation (with or without productivity adjustments). However, the linking method for dwellings will require that all countries submit the data on housing quantities as described in chapter 12. The global aggregation used for government compensation will incorporate productivity adjustments for all countries in all regions (even if a region's results were not adjusted).

## ANNEX A

## Number of Products in Major Categories, by Region and Ring, ICP 2005

Category	Africa	Asia-Pacific	CIS	Eurostat-OECD	South America	Western Asia	Ring
Food and nonalcoholic beverages	356	223	198	422	147	353	281
Alcoholic beverages and tobacco	41	19	20	72	8	21	30
Clothing and footwear	128	78	104	319	136	162	132
Housing and utilities	21	17	22	64	18	12	35
Furnishings and household equipment	95	85	91	460	77	83	124
Health	144	112	75	244	51	69	162
Transportation	55	65	47	365	33	29	96
Communication	19	19	16	81	8	12	28
Recreation and culture	49	70	79	336	54	59	96
Education	7	7	7	5	10	11	7
Restaurants and hotels	51	25	45	117	14	20	60
Miscellaneous goods and services	34	56	36	136	22	31	44
<i>Total consumption</i>	<i>1,000</i>	<i>776</i>	<i>740</i>	<i>2,621</i>	<i>578</i>	<i>862</i>	<i>1,095</i>
<i>General government</i>	<i>50</i>	<i>50</i>	<i>50</i>	<i>50</i>	<i>50</i>	<i>50</i>	<i>50</i>
<i>Construction</i>	<i>34</i>	<i>34</i>	<i>34</i>	<i>34</i>	<i>34</i>	<i>34</i>	<i>34</i>
<i>Equipment</i>	<i>108</i>	<i>108</i>	<i>108</i>	<i>108</i>	<i>108</i>	<i>108</i>	<i>108</i>

Source: ICP 2005.

## ANNEX B

## Worksheet to Provide Indexes to Backcast Ring Prices to 2005 and from Capital City to National Level

### ICP 2005—Instruction for Submitting Indexes for Ring Country Prices

Please fill out the lowest available level.

Country Name		XXXXXX	Ring Survey Date (Month, 2006)	Reference CPI for the Ring Survey Date (Month, 2006)	Reference CPI (Annual, 2005)	Ratio of Capital to National Prices
N°	Code	Description				
1	100000	<b>GROSS DOMESTIC PRODUCT</b>				
2	110000	<b>FINAL CONSUMPTION EXPENDITURE BY HOUSEHOLDS</b>				
3	110100	<b>FOOD AND NONALCOHOLIC BEVERAGES</b>				
4	110110	<b>Food</b>				
5	110111	<i>Bread and cereals</i>				
6	110111.1	Rice				
7	110111.2	Other cereals, flour, and other cereal products				
8	110111.3	Bread				
9	110111.4	Other bakery products				
10	110111.5	Pasta products				
11	110112	<i>Meat</i>				
12	110112.1	Beef and veal				
13	110112.2	Pork				
14	110112.3	Lamb, mutton, and goat				
15	110112.4	Poultry				
16	110112.5*	Other meats and meat preparations				
17	110113	<i>Fish</i>				
18	110113.1	Fresh, chilled, or frozen fish and seafood				
19	110113.2	Preserved or processed fish and seafood				
20	110114	<i>Milk, cheese, and eggs</i>				
21	110114.1	Fresh milk				
22	110114.2	Preserved milk and other milk products				
23	110114.3	Cheese				

Source: ICP 2005.

## NOTE

1. The five geographic regions were Africa, Asia-Pacific, Commonwealth of Independent States, South America, and Western Asia. The Eurostat-OECD comparison constituted the sixth region.

## REFERENCES

- Diewert, W. E. 2004. "On the Stochastic Approach to Linking the Regions in the ICP." Discussion Paper 04-16, Department of Economics, University of British Columbia, Vancouver.
- Dikhanov, Yuri. 2009. "Efficiency of the Core Product List in International Comparisons." Report prepared for Technical Advisory Group meeting, World Bank, Washington, DC, October 1–2.
- Sergeev, Sergey. 2007. "Use of Coefficients of Similarity of Price Structures in the Ring Comparison." Paper prepared for the Technical Advisory Group, International Comparison Program, World Bank, Washington, DC.
- Vogel, Frederic A. 2009. "Lessons Learned from ICP 2005." Report prepared for Technical Advisory Group meeting, World Bank, Washington, DC, October 1–2.
- World Bank. 2007. *ICP 2005 Methodological Handbook*. <http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/ICPEXT/0,,contentMDK:20126612~pagePK:60002244~piPK:62002388~theSitePK:270065,00.html>.
- . 2008. *Global Purchasing Power Parities and Real Expenditures: 2005 International Comparison Program*. <http://siteresources.worldbank.org/ICPINT/Resources/icp-final.pdf>.

