CHAPTER 16

Government Services: Productivity Adjustments

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This chapter addresses questions about how the International Comparison Program (ICP) measures the output flowing from expenditures that are not directly purchased by final users. These are often referred to as nonpriced or comparison-resistant services. In the ICP literature, the main headings are "individual government expenditures for education and health" and "collective expenditures provided by governments or nongovernmental organizations" (NGOs). Annex A to this chapter sets out the way in which these basic headings were priced in the 2005 round of the ICP in the context of all basic headings under government. Chapter 11 in this volume discusses the government basic headings in more detail, especially the distinction between individual and collective government expenditures.

Individual government expenditures for health and education fall into two categories: (1) benefits and reimbursements and (2) production of services. Purchasing power parities (PPPs) for benefits and services are based on prices, as described in chapter 11. PPPs for the production of health and education services are based on input costs as measured by compensation of employees, intermediate consumption, and other categories shown in the table in annex A. The comparison-resistant services include collective government expenditures and actual household expenditures on education and health by both households and government. The purpose of this chapter is (1) to explain how some of the PPPs for three basic headings for compensation of employees were in some cases adjusted for productivity, (2) to describe the pros and cons of such adjustments and their effects, and (3) to offer suggestions for improvement.

The first section of this chapter summarizes how the estimation was carried out in the 2005 ICP round within each region. Where output is not market-priced, PPPs can be derived for the labor inputs in these expenditure headings by comparing salaries for different skill and occupational employment categories based on international standard definitions. Using these salary comparisons as the equivalent of PPPs and then dividing expenditures by the PPP provides indirect quantity comparisons of these services. However, the method can produce improbable volumes for low-salary

countries such as Tajikistan, Republic of Yemen, and Cambodia. The reason in part is that salaries are lower in lower-income countries because personnel are accompanied by less capital and are therefore producing less output than in higher-income countries. Lower productivity also results because supervisors are under little pressure to use staff efficiently when their salaries are so low and the value of their output is so hard to measure, which is true of government and education especially. This problem was recognized early on in the ICP's work when there were fewer countries, but it was even more evident in the 2005 ICP round when the range of salaries across the 146 countries was much larger.

In the report on the 1975 ICP, Kravis, Heston, and Summers (1982) devote chapter 5 to these comparison-resistant services. Two points from this chapter are noted here. The first point, covered in the second section of this chapter, deals with evidence on whether the PPPs for priced services can be used to approximate the PPPs for comparison-resistant services. The third section of this chapter discusses some of the methods considered to deal with this problem in the early ICP rounds. The fourth section then deals with how the regions were linked in the 2005 ICP round and considers whether the linking could have taken into account the different methods used in the regions. The chapter concludes with a discussion of an alternative for improving comparability across regions that might be considered for the 2011 ICP.

Treatment of Comparison-Resistant Services in the 2005 ICP Round

In preparation for the 2005 ICP, countries in the European Union (represented by its national statistical office, Eurostat) and the Organisation for Economic Co-operation and Development (OECD) had lengthy discussions on how to compare nonpriced services. They decided on compensation of employees. These discussions were informed by earlier experience in linking associated countries to the Eurostat-OECD comparison.[1] In the end, the Eurostat-OECD countries agreed to base PPPs for comparison-resistant services in 2005 on salary comparisons, stratified by type of occupation and skill. Because the Commonwealth of Independent States (CIS) was linked to the Eurostat-OECD region through the Russian Federation, 50 countries were already committed to basing PPPs on salary comparisons. In view of this constraint on the global comparison, it was decided initially to follow the same procedure in the other regions. Chapter 15 of this volume describes the occupations for which salaries were obtained and the overall framework for data collection.

The Final 2005 Approach

In the 2005 round, the publication schedule for the South America region was ahead of that for other regions; it followed the method used by the Eurostat-OECD comparison. However, the review of the salary information for the Asia-Pacific region revealed that the initial results, even after extensive validation of the data, did not appear to yield plausible value measures. In particular, the indirect quantities for poor countries such as the Lao People's Democratic Republic for headings such as collective government services greatly exceeded those for Hong Kong SAR, China, or Singapore. Similarly, in Western Asia the initial results produced volumes of comparison-resistant services for the Republic of Yemen that were much larger than those for its oil-rich neighbors.

The Asia-Pacific region was the first to introduce productivity adjustments for the headings of publicly provided education, health, and collective government services. This method is described in appendix D of the final report of the 2005 ICP (World Bank 2008).[2] A Cobb-Douglas production function was used to adjust for productivity differences across countries in a manner similar to that used in 1975 ICP round for education, health, and collective government services,

as described in the next section.[3] Following the notation in the final report (World Bank 2008, appendix D), output Y is a function of labor L and capital K. The labor and capital coefficients are α and $(1 - \alpha)$. The constant returns to scale production function is given as

$$Y = cL^{\alpha}K^{1-\alpha}. \tag{16.1}$$

The productivity adjustment involves estimation of the relationship of output per worker to accompanying inputs, in this case labor. Equation (16.1) may then be rewritten as

$$\frac{Y}{L} = c\left(\frac{K}{L}\right)^{1-\alpha}. \tag{16.2}$$

The value of α is unknown, but, according to appendix D of the 2005 ICP report, "similarly empirical studies have found values of α to be in the range of 0.5 to 0.7 for low- to high-income economies, respectively" (World Bank 2008, 180).

Assuming these values hold across the 2005 ICP countries, then grouping countries into low, medium, and high income, combined with their capital output levels, allows estimation of their labor productivity.

Because data were not initially requested from countries, there was no information on capital stock or labor specific to education, health, or collective government services on which to fall back. It was heroically assumed that L was the population aged 15–64, which implied that labor force participation rates for that age cohort were the same across the wide range of 2005 countries. The next data problem was K, the capital stock information; it was available for some countries in Asia, but only a few in Africa and Western Asia. Again, a very strong assumption had to be made: for the few countries available, the range of capital output ratios, from 2.5 to 3.5, applied to all countries. Because these values rose from low- to medium- to high-income countries, the values of 2.5, 3.0, and 3.5 were assigned to those countries, respectively.

The next problem was to group countries in the Asia-Pacific, Western Asia, and Africa regions into the three income groups. The initial groupings were proposed in regional meetings, and typically agreement was reached without change. Thus each country had an assumed capital output ratio and value of $(1 - \alpha)$, the inputs necessary to estimate equation (16.2). In application of the assumed values, the country-specific value of c, obtained from an initial Gini-Éltetö-Köves-Szulc (GEKS) gross domestic product (GDP) aggregation, was substituted into (16.2) for each country in the regional comparison.[4] This method provided an adjusted estimate of output per worker that might lead to moving countries into a different income group and performing another iteration—see table 16.1 for a noniterative illustration that includes seven countries (or economies) in Africa, the Asia-Pacific, and Western Asia where a productivity adjustment was implemented. It also includes four countries that made no adjustment of salaries when estimating the PPP for staff in converting health, education, and collective government expenditures to volumes of output. These countries are Russia, which took part in both the Eurostat-OECD and CIS regional comparisons, and the Kyrgyz Republic, which took part only in the CIS comparison, along with Bolivia and Chile.

In table 16.1, the selected countries are assigned per capita GDP (PCGDP) groups in column (1). The per worker GDP from 2005 is given in column (2), which uses the International Labour Organization (ILO) labor force measure (L) as the denominator. Column (3) uses the proportion of population aged 15–64. The ILO measure is a census, not employment, number, but it does illustrate differences in reported participation rates among countries. The difference between columns (2) and (3) is low in the Lao PDR and very high in the Republic of Yemen, where reportedly few women are said to be in the labor force. Applying the "aged 15–64" labor definition

TABLE 16.1 Simplified Illustration of 2005 ICP Productivity Adjustment

international dollars as determined by PPPs

Selected country or economy	PCGDP group (1)	GDP/*L*, ILO (2)	GDP/*L*, 15–64 (3)	GDP/*L*, HK = 100 (4)	Adj. for *K*/*L*, HK = 100 (5)	PCGDP, HK = 100 (6)	PA, all countries (7)
No productivity adjustment							
Bolivia	Low	7,990	6,063	12.5	13.6	10.2	9.3
Chile	Medium	29,494	18,369	37.8	40.3	34.3	32.3
Kyrgyz Republic	Low	3,908	2,743	5.7	6.1	4.8	4.3
Russian Federation	Medium	22,823	16,658	34.3	36.6	33.3	31.2
Productivity adjustment							
China	Low	6,892	5,752	11.9	12.9	11.4	11.4
Hong Kong SAR, China	High	68,785	48,535	100.0	100.0	100.0	100.0
India	Low	5,393	3,326	6.9	7.4	6.0	6.0
Lao PDR	Low	3,744	3,246	6.7	7.3	5.0	5.0
Nepal	Low	2,661	1,891	3.9	4.2	3.0	3.0
South Africa	Medium	23,425	13,116	27.0	28.8	23.7	23.7
Yemen, Rep.	Low	9,647	4,512	9.3	10.1	6.4	6.4

Source: ICP 2005.
Note: PCGDP = per capita gross domestic product; ILO = International Labour Organization; *L* = labor; HK = Hong Kong SAR, China; *K* = capital; PA = productivity adjustment.

used in the 2005 ICP for productivity adjustments, GDP per worker level, with HK (Hong Kong SAR) equal to 100, appears in column (4). Hong Kong SAR, China was taken as the high-income economy in the Asia-Pacific for which no productivity adjustment was made.

The GDP per worker figure in column (4), when adjusted for the capital per worker group of each country, yields column (5) with HK = 100. Column (6) provides the per capita GDP of each country, with HK = 100, based on the 2005 ICP. Column (7) shows the per capita GDP adjusted for productivity (PA) for the first four countries for which no adjustment was done. For the last seven countries, the 2005 ICP numbers from column (6) are repeated. For the group of four countries, the adjustment for capital ranges from 6.6 to 8.8 percent in terms of GDP per capita. Applying a productivity adjustment to all countries would have the effect of changing the relative positions of poor and middle-income countries with respect to each other, but would have little effect on the range from poor to rich countries. The larger effect for low- and medium-income countries is between countries with and without a productivity adjustment. This effect is also clear in column (5). For Nepal, the Republic of Yemen, the Kyrgyz Republic, India, and Lao PDR, the volume of the three compensation headings would be under 10 percent of what they would have been with no adjustment; for Bolivia and China between 10 and 15 percent; and for Chile, Russia, and South Africa between 25 and 40 percent.

Effects of Productivity Adjustments on the Global Comparison

These adjustments are clearly large. One cannot infer from column (5) the effect on GDP per capita of the countries. This depends on their actual salary PPPs and expenditure shares of the compensation

headings. In gauging the impact on global comparisons, the exact aggregation procedure makes a difference within and between regions.[5] However, some insight may be gained from looking at the 2005 ICP report, in particular tables 3–6, which provide 19 subaggregates of exchange rate and PPP converted per capita and total expenditures (World Bank 2008). From these subaggregates, three aggregates of PPP-converted and one aggregate of exchange rate–converted expenditures were calculated:

1. HECG1 = education, health, and collective government expenditures
2. HECG2 = 1 above from national accounts (the same as exchange rate–converted) expenditures
3. Domestic absorption (DA) = GDP minus the balance of exports and imports and changes in inventories. This is used to avoid problems with negative expenditures and can be derived two ways, as shown in 4 and 5.
4. PPP-converted domestic absorption (DA1) = GDP – exports + imports – changes in inventories = actual consumption + gross domestic fixed capital formation + collective government
5. DA2 = sum of 13 headings of actual consumption + collective government + gross fixed capital formation (sum of four components).

The table in annex B makes clear that the groupings HECG1 and HECG2 combine both private and public expenditures on health and education. HECG1 and HECG2 are shares of comparison-resistant services to domestic absorption using PPP conversions from the 2005 ICP round and shares at national prices. Table 16.2 compares the ratios of PPP-converted shares to shares at national prices. Countries are grouped by size of the ratio and region. The average ratio is quite large; the share at PPPs is 2.46 times larger than national shares, which are in turn 19.2 percent of GDP across the 146 countries. As discussed later in this chapter, this somewhat overstates the effect of the PPPs used to convert comparison-resistant services. But first, the striking differences across the regions in table 16.2 must be noted. The CIS and Asia-Pacific regions have average ratios well over 3.0; Africa is also high. Western Asia and South America are similar and still near 2.0, whereas half of the Eurostat-OECD countries, largely high-income, are below 1.5, with many less than 1.1. A noticeable split is apparent in Western Asia, with four of the Gulf countries comparable to their well-off Eurostat-OECD counterparts.

TABLE 16.2 Distribution by Region of Ratios of PPP-Converted Shares of Domestic Absorption of Public Expenditures on Education, Health, and Collective Government Wages and Salaries to Exchange Rate–Converted Shares

Ratio	Africa	Asia-Pacific	CIS (over domestic absorption)	Eurostat-OECD	South America	Western Asia	Total countries
1.0–1.5	4			25	1	4	34
1.5–2.0	9	3		8	7		27
2.0–3.0	18	8	2	11	2	5	46
3.0–4.0	12	7	6	1		1	27
> 4.0	5	5	2				12
Total countries	48	23	10	45	10	10	146
Average ratio	2.77	3.25	3.60	1.69	1.85	2.10	2.46

Source: ICP 2005.

TABLE 16.3 Distribution by Region of Ratios of Sum of GEKS Components (C + I + G) to GEKS

Ratio	Africa	Asia-Pacific	CIS (over domestic absorption)	Eurostat-OECD	South America	Western Asia	Total countries
0.95–1.05				14			14
1.05–1.1 0				13		4	17
1.10–1.15	7	9		6	7	1	30
1.15–1.20	9	8	4	9	2	3	35
1.20–1.25	14	3	4	2	1	1	25
>1.25	18	3	2	1		1	25
Total countries	48	23	10	45	10	10	146
Average ratio	0.997	1.144	1.092	1.010	1.019	1.061	1.043

Source: ICP 2005.
Note: GEKS = Gini-Éltetö-Köves-Szulc; C = actual final consumption; I = investment or capital formation; G = government.

These ratios can be misleadingly high because the denominator shares in national currencies must sum to 1.0, but not the numerator shares. The ratio of DA2 to DA1 in table 16.3 illustrates the nonadditive character of indexes such as the GEKS. As can be seen, the average of these ratios tended to be greater than 1.0 in the 2005 ICP, with the CIS and Asia-Pacific regions greater than 1.2, the Eurostat-OECD region less than 1.1, and the remaining regions between 1.1 and 1.2. But 25 countries have ratios greater than 1.25, and the ratio can approach 2.0 such as for The Gambia, with five countries exceeding 1.5. The country information underlying tables 16.2 and 16.3 is provided in the annex B table. The ratios greater than 1.0 in table 16.3 are the effect of the comparison-resistant services shown in table 16.2.

The main conclusion from tables 16.2 and 16.3 is that the estimates for comparison-resistant services in 2005 produced large increases in PPP-converted shares for low-income countries, even in regions in which productivity adjustments were made such as the Asia-Pacific. In regions with lower-income countries but in which no productivity adjustments were made, such as the CIS, it appears that there were even larger increases in shares of PPP-converted comparison-resistant services compared with shares at national prices. For these reasons, efforts are under way to improve the methods that will be used in the 2011 ICP, and the general outline of an improved approach to treatment of education has been recommended for all regions, although the final form of this method is not yet available. This chapter now turns to the question of whether guidance for the 2011 ICP round can be gained from experiences in rounds of the ICP before 2005.

Experiments with Priced and Nonpriced Services

The report by Kravis, Heston, and Summers (1982) on the third round of the ICP in 1975 compared the PPPs of priced services such as shoe repair, haircuts, and dry cleaning with nonpriced services, based on the 16 countries in the 1970 ICP, Phase II. Of the 151 basic expenditure headings, 10 were comparison-resistant services and 21 were priced services comprising, respectively, 11 and 16 percent of total expenditures on GDP. The definition of *priced services* includes all services in individual household consumption for which prices were collected for given specifications. The

concept of service items usually involves the final purchaser consuming the service at the point of sale, either an establishment such as a restaurant or an automobile repair shop, a medical facility, or, in their place of residence, say, furnace repair. The service price includes the cost of labor, equipment, and parts. The distinction between services and commodities is not clear in many instances, but the broad split has shown up in predictable PPP differences in countries moving across the per capita GDP spectrum.

The relationships between the price level of priced services (P_p) and market-priced commodities (P_C) and per capita GDP (all indexed to US = 100) in logs from Kravis, Heston, and Summers (1982, 137), with standard errors of the coefficients in parentheses, are

$$\ln P_p = 2.351\ (.321) + .414\ (.090)\ \ln \text{PCGDP}; \quad R^2 = .57; \text{RMSE} = .322; \ n = 16 \tag{16.3}$$

and

$$\ln P_C = 3.317\ (.128) + .266\ (.036)\ \ln \text{PCGDP}; \quad R^2 = .78; \text{RMSE} = .129; \ n = 16. \tag{16.4}$$

To illustrate the meaning of equations (16.3) and (16.4), consider country A with a per capita GDP that is 90 percent of the U.S. GDP and country B with a per capita GDP that is 5 percent of the U.S. GDP. The price level of priced services for country A will be 3.3 times that of country B, whereas for commodities the multiple between country A and B is only 2.2. It follows that the ratio of PPPs of priced services to PPPs of commodities rises with per capita GDP. One explanation for this relationship is the Balassa-Samuelson effect (Balassa 1964; Samuelson 1964). It is based on the nontradability of most priced and nonpriced services and the assumption that productivity in services grows more slowly than commodities.[6] Labor is usually mobile within countries so that wage rates for similar skills will be comparable, whether in the production of traded commodities or nontraded services.[7]

But it also turns out that the PPP for nonpriced services rises more rapidly with per capita GDP than for priced services, so that the ratio of price levels for comparison-resistant to priced services also rises with GDP. The average ratio of prices for comparison-resistant services to market services for Kenya and India, the lowest of the 16 countries in 1970, was 32.5, and for France and Germany, the countries just below the United States (at 100 by definition), 86.5. As will be discussed shortly, the 2005 ICP results for 146 countries display a similar relationship.

How does one explain this relationship? Is there less physical capital per worker in the education, health, and collective services than in other services? Does physical capital per worker rise more rapidly in these nonpriced services than in priced services? Or, as is more likely, are both effects evident? And is labor monitoring less in low-wage countries compared with high-wage countries? If so, it would lead to larger productivity differences between priced and nonpriced services in low-wage countries. The data needed to answer these questions are not available. However, because the 2005 ICP exhibited a similar relationship, it is worth noting the adjustments considered for the 1975 ICP.

Kravis, Heston, and Summers (1982) made some illustrative and informative calculations that took into account the relative importance of the comparison-resistant services in expenditures. Equal productivity PPPs based on salary comparisons were replaced by the PPPs for priced services, and the PPPs for all other basic headings were used in separate Geary-Khamis (GK) aggregations. The effects on per capita income for the averages of the first and second quartiles of the 16 countries for 1970 are as follows. If the published GDP per capita of the first quartile average (Kenya, India, the Philippines, and Republic of Korea) is 100, then, using the PPPs of priced services, the index is 87—that is, if staff in education, health, and collective government services were only as productive as labor in priced services in their countries, the per capita GDP of the lowest quartile would be

only 87 percent compared with using the equal productivity assumption. For the next poorest quartile (Colombia, Malaysia, Islamic Republic of Iran, and Hungary), the comparable result is 95 percent, or a 5 percent reduction in per capita GDP.

Labor mobility is subject to some constraints, including premiums in larger organizations, but, in general, workers can move between commodity and service sectors so that similar skills tend to receive similar pay. It is then plausible to believe that market-priced service PPPs might be a reasonable approximation of the PPP for nonpriced services. Kravis, Heston, and Summers (1982, 140) conclude that the "results for middle and high-income countries are insensitive to the treatment of comparison resistant services. More is at stake for the low-income countries."

As a result of these findings, several modifications of the equal productivity assumption were introduced in the 1975 ICP round for the different headings of comparison-resistant services, which are discussed in the next section.[8]

How did these results hold up for the 2005 ICP? First, these results cannot be compared directly with those in the 2005 ICP because researchers had access only to a set of 129 basic headings of expenditures and PPPs—a data set with less detail than that in the 2005 ICP report. Furthermore, these PPPs already embodied the productivity adjustment used for the Africa, Asia-Pacific, and Western Asia regions, so the comparison was not as clear as that for the 1970 ICP. The comparisons reported in table 16.4 use only two EKS aggregations over the 128 basic headings of domestic absorption, which is GDP less the net foreign balance and net expenditures of residents abroad. Domestic absorption was used because the net foreign balance and net expenditures of residents abroad have never been handled satisfactorily in the history of the ICP, and because DA is a meaningful measure of the bundle of goods and services that countries distribute among various basic headings of expenditures.[9]

Table 16.4 is based on two EKS aggregations of the 2005 ICP basic headings. The first is similar to that in the final report except that the aggregation is over all countries and fixity is not observed.[10] The second uses the same aggregation, but substitutes the PPPs for priced services for each country for compensation payments for collective government and publicly provided education and health care. This table summarizes the results by region. The table in annex C provides the basic headings used for priced and nonpriced services.

Table 16.4 presents the distribution of countries within each region by the ratio of the PPP or the DA of the second aggregation (using priced services) to the first aggregation. If the ratio for

TABLE 16.4 Distribution by Region of Ratio of PPP for Domestic Absorption Using PPP for Priced Services to PPP for Domestic Absorption in ICP 2005, Both Aggregated by EKS over All Countries

Ratio	Africa	Asia-Pacific	CIS	Eurostat-OECD	South America	Western Asia	Total
0.95–1.05				14			14
1.05–1.15	6	9		19	5	5	44
1.15–1.25	23	11	8	11	5	5	63
1.25–1.35	17	3	1	1			22
> 1.35	2		1				3
Total	48	23	10	45	10	10	146
Average ratio	1.24	1.18	1.23	1.10	1.15	1.13	1.17

Source: ICP 2005.
Note: EKS = Éltetö, Köves, and Szulc.

a country is greater than 1.0, the corresponding estimate of DA per capita relative to the United States will be smaller using the PPP for priced services. The use of priced services PPPs would produce smaller estimates of per capita DA for most countries; the average is 17 percent for all 146 countries. The pattern by region is plausible. The difference is smallest in the Eurostat-OECD countries and highest in the CIS countries in which no productivity adjustment was made and in Africa where the base comparison already includes a productivity adjustment. In general, the pattern in table 16.4 is consistent with the Kravis, Heston, and Summers results of a generation earlier, when the biggest effect of this substitution was on lower-income countries and regions.

One conclusion of this chapter is that the use of the PPP for priced services is a possible fallback should problems arise with other methods, or as a useful validation tool. It has the advantage of being simple and transparent to implement. It assumes that the relationship between productivity in collective government services and in publicly provided education and health services is similar across countries. However, because some such assumption is involved in most approaches, perhaps it is not a major limitation. This approach also depends on good estimates of the PPPs for priced services, which are difficult to specify, leading to less than robust results. In fact, the inability of countries to collect enough priced service items led Kravis, Heston, and Summers (1982) to use alternative methods in the 1975 ICP round. When the OECD considered using priced services in the late 1980s, the proposal was abandoned because of data limitations.

Was the coverage of priced services adequate enough in the 2005 ICP to justify a recommendation for use of the PPP for priced services as an alternative treatment of comparison-resistant services? More research is required to answer this question. Such research might include looking into (1) the sensitivity of the results to alternative bundles of priced services; (2) the implicit volume comparisons for these services relative to alternative estimates; and (3) whether the use of priced services might be combined with other methods.

Other Methods for Dealing with Nonpriced Services Up to the 1975 Round

The previous section examined the approach used in the 2005 ICP for comparison-resistant services and the possible use of the PPPs of priced services. This section considers some other approaches from previous ICPs. This discussion is not exhaustive because of space constraints and because Sergeev (1998) has provided an excellent summary of methods used in the early rounds of the ICP and especially those developed from 1975 to 1998 for comparing nonpriced expenditure basic headings for the Eurostat-OECD comparisons. Some of these methods were used only to link countries in Eastern and Western Europe for which Sergeev provides interesting illustrations. Here the focus is on some of the methods considered in Kravis, Heston, and Summers (1982).

Health Personnel

Because there had been criticism of the treatment of services in the 1970 ICP, more data were requested for the 1975 ICP in the health field, including numbers of medical personnel by type, stock of health capital, and directly priced physician services. Various studies were consulted, and the passing rates of medical students on a standard test were compiled for the 32 of the 34 ICP countries in 1975 that had medical schools (Kravis, Heston, and Summers 1982, 152). Many checks were carried out on the method eventually adopted, but here three main points on the treatment of health are especially relevant for future ICP considerations.

First, it is extremely useful to collect as much quantity, quality, and direct price and wage information as possible for health services. To illustrate, the 1970 ICP used only direct quantity comparisons for medical personnel, which is analogous to 2005 in that equal productivity of personnel was assumed. Initially, the 2005 ICP was going to assume equal productivity as well, but the quantities were to be derived indirectly by dividing expenditures on personnel by PPPs estimated from salary comparisons. Certainly, one would like to obtain comparable results by these two approaches because both make the same assumptions about productivity. However, this is possible only when both salary and direct quantity information are collected. The same principle would apply to other expenditure groupings, including education, collective government services, construction, and dwelling services.

Second, in the health field many directly priced medical services purchased by households are used in the ICP, such as physician visits, X-rays, and lab tests. These can be directly compared with the PPPs derived from salary comparisons of hospital personnel or the PPPs derived from expenditures and quantities of medical personnel. Furthermore, the 1975 ICP also used direct quantities consumed by households such as hospital bed-days and measures such as number of physicians or nurses per person, which are slightly closer to output. Measures of output of medical services would be ideal, but the results of the research under way are unlikely to be operational for the 2011 ICP comparisons.

Third, the use of crude production functions to better approximate medical output requires some heroic assumptions, but even Cobb-Douglas functions provide a useful framework for comparisons. In the 1975 ICP, the attempt to collect information on the stock of medical capital was not a great success in that only 8 of the 34 countries could provide estimates. However, the range of countries included low-, middle-, and high-income. Health capital was broken into hospitals and all the rest. These observations were stylized into adjustment factors for health personnel to approximate equivalence in the productivity of dentists, nurses, and physicians in the 1975 ICP. For countries with less than 30 percent of U.S. per capita GDP, the divisor for personnel was 1.30, and for countries between 30 and 50 percent, it was 1.15 (Kravis, Heston, and Summers 1982, 143).

The 1975 approach was similar to that used for some regions in the 2005 ICP except that the latter used capital per worker for the whole economy across all publicly provided comparison-resistant services, including hospitals. Kravis, Heston, and Summers (1982) used hospital capital and hospital bed-days in a production function that produced adjustment factors similar to those for personnel, and so the same adjustment was made for hospital bed-days as just described. In addition, the adjustments covered all medical personnel whether or not they were employed in hospitals or were providing market-priced services. One important conclusion of the 1975 ICP treatment of health was that the direct price measures of the PPPs of health services, such as doctor visits, rise with per capita income much faster than the PPPs measured indirectly by dividing expenditures by labor input, about which more follows.

Education

Capital stock measures for education were harder to obtain in the 1975 ICP because only three countries supplied data. Furthermore, the role of physical capital in producing educational services was more ambiguous than in health services. For these reasons, no adjustment was attempted for capital by Kravis, Heston, and Summers (1982). Cross-country studies based on common tests in local languages conducted around 1970 revealed that "the home variables were relatively less important and the school inputs (relating to inputs such as teachers and library facilities) more important in explaining school performance in developing countries than in developed countries"

(Kravis, Heston, and Summers 1982, 156). However, the state of the art of cross-country testing methodology did not appear robust enough in 1975 to be used as a tool in making volume comparisons across countries.

As with health, both direct quantity and price data were collected for education, including the number of students and teachers at the primary and secondary levels. Salary data for teachers for five levels of teacher education were collected as well; a Country Product Dummy (CPD) was run to provide estimates of relative salaries across ICP countries adjusted for the relative education level of teachers. These direct PPPs based on salaries were then compared with indirect measures derived from dividing expenditures by teacher quantities. As for medical personnel, there is a systematic relationship between direct and indirect PPPs and per capita income. Because the latter rises faster than the former, the ratio of direct to indirect PPPs declines as per capita GDPs rise. Based on this relationship, a downward adjustment was made to the direct quantity estimates, which decreased from 80 percent for the lowest of four per capita income groups, 32 percent for the second, and 12 percent for the third, all relative to the top group of per capita income (Kravis, Heston, and Summers 1982, 159).

These adjusted teacher quantities represent the inputs to education and for want of any other measure would also represent the output. Another output measure is the number of students taught, but many problems are associated with the pupil measure as well. What is the relationship of class size to educational output? The number of pupils registered, the most typical figure available, is not necessarily the number who are attending and eventually graduating. In the end, the square root of the product of the adjusted quantity of teachers and the number of pupils was taken as the output of primary and secondary education. No adjustment was made for third-level education. Also, in the 1975 ICP, administrative expenses on education were excluded from the total education expenditures when dividing by the above quantity of numbers of teachers and pupils to derive indirect PPPs. Finally, the method to be adopted by the Eurostat-OECD countries in their 2011 comparisons uses test information to make an adjustment (in fact, small) to the measure of output, the number of primary and secondary students.

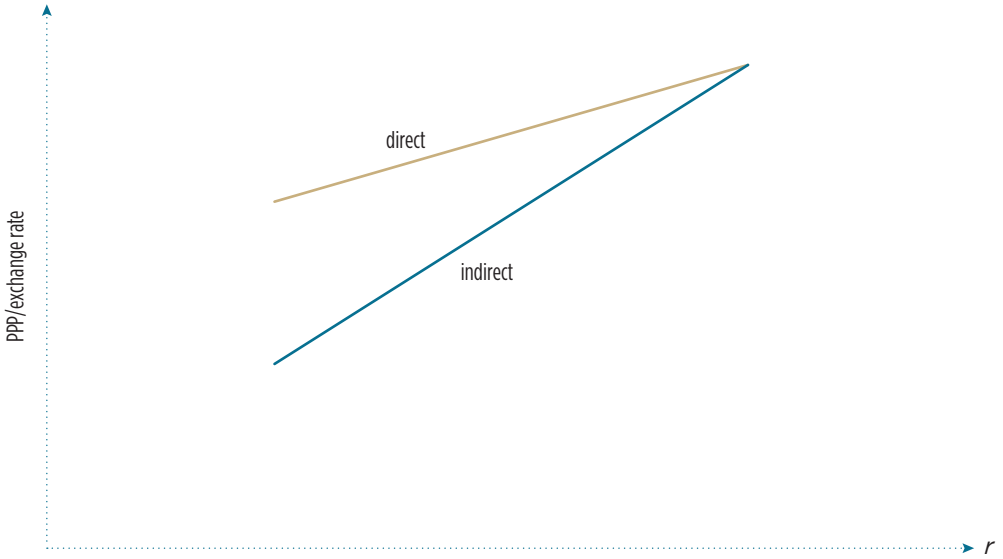
The method used for the Eurostat-OECD countries for 2011 may prove more difficult when extended to 180 countries in 2011. Although this approach is along the lines of the ICP approach before 2005, Kravis, Heston, and Summers (1982) found, based on their experience, that information on the salaries of teachers and their average years of training would also be useful. There is every reason to believe that quantity measures of students in primary and secondary education may overstate the output of the education sector for low-income countries, with the degree of overstatement declining with per capita income.

Collective Government Expenditures on Personnel

As for the 1970 ICP, a questionnaire was distributed in 1975 to countries to obtain information on capital in government. However, the response was not sufficient to form a basis for any adjustment. Eventually, it was decided to use the same adjustment factors used for health personnel—that is, a 30 percent adjustment for the lowest group of countries and 15 percent for the next group, with per capita GDPs of between 30 and 50 percent that of the United States.

The principal conclusion to emerge from the review in this section is summarized in figure 16.1 (figure 5-1 in Kravis, Heston, and Summers 1982). The horizontal axis, *r*, is the per capita GDP of a country relative to that of the United States, and the vertical axis is the price level of comparison-resistant services. The direct price level measure at lower incomes begins at a higher point than the price level indirectly measured by dividing expenditures by quantities or a

FIGURE 16.1 Relationship of Direct and Indirect PPP Estimates to Per Capita GDP



Source: Kravis, Heston, and Summers 1982.

price level estimated from salary comparisons. However, the direct measure rises more slowly with incomes, so that at moderately high incomes both measures yield comparable estimates of the price level. This pattern also appears in other difficult-to-measure sectors such as imputed rents for homeowners. When rents are measured directly, holding constant amenities of housing, they are higher than when measured by the quantity approach in which only a few elements of quality are captured. If, as Kravis, Heston, and Summers (1982) conclude, figure 16.1 captures a general phenomenon, then it provides strong support for collecting as much information as available for hard-to-compare expenditure headings.

Linking Issues for Regions in 2005

This chapter has covered the 2005 ICP procedures within each region, but not the linking of regions. The problem of linking regions first arose in the context of whether all expenditure groups should be linked through the 18 Ring countries that had agreed to undertake pricing of a large number of shop items (see chapters 1 and 8 for an explanation of the Ring and linking concepts). However, common questionnaires were used for areas such as housing and government salaries. Would it then be more appropriate to use data from all countries for linking or just the Ring countries? Because Ring countries did not appear likely to supply better-quality data for housing or salaries in some regions, an agreement was reached in the Global Office to use data for all countries. The Eurostat-OECD region was one exception to this pattern because the decision to use data from all countries instead of just the Ring was made after the Ring country protocol was adopted. South America was another exception because for budgetary reasons it was the first region to complete its work, and its salary classification was not comparable, so only the Ring countries, Brazil and Chile, were used for linking.

TABLE 16.5 Estimated Salary Differences across Regions in Education, Health, and Collective Government Services

	Coefficient	Anti-log	Standard error	*t*-value
Intercept	10.65	42,183.00	0.0905	117.72
Africa	−2.65	7.04	0.0972	−27.31
Asia-Pacific	−2.28	10.18	0.1029	−22.31
South America	−1.57	20.78	0.1208	−13
Western Asia	−1.71	18.14	0.1149	−14.86
Eurostat-OECD	0	100		
n = 75	R^2 = .400	Coeff. var. = 12.697	RMSE = 1.081	ln_wage mean = 8.514

Source: ICP 2005.
Note: RMSE = root mean square error. No CIS countries were in the data set.

The data available to the Global Office included wage data for 75 countries. For each country, there were data on the job and the occupational grouping (administration, defense, education, and health). In addition, a simple grouping by skill designation was assigned to each job, and, of course, countries were assigned to their region. Early estimates suggested that because of the spotty, variable character of the salary observations, it was best to omit defense from the estimation, thereby reducing the number of salary observations from 1,876 to 1,730. Several of these variables were collinear so that, for example, a CPD could not be estimated for a region and individual countries and for a job and occupational grouping or skill level. Table 16.5 provides the results of a CPD regression in which only regional and sectoral coefficients are estimated, but the latter are not shown.[11] Because country variation is not taken into account in table 16.5, the explained variance is fairly low. All of the coefficients are significant, and the rank of the regions is plausible. The second column of table 16.5 shows the anti-log of the regional coefficients in the table as a percentage of the Eurostat-OECD countries. Roughly speaking, salaries for comparable occupations are 14 times higher in the Eurostat-OECD countries than in Africa, and at least five times higher in the other regions. If expenditures were converted by these PPPs, they would greatly raise the estimated quantities of these comparison-resistant services. Again, no CIS countries were in the data set, although wages in several of these countries were quite low compared with those of the Eurostat-OECD countries (the salary data were not adjusted for calculation of the regional parameters used for linking, or, put another way, the between-region PPPs were not adjusted for productivity).

When the equation allows for individual country coefficients instead of regions, the explained variance is, of course, much higher (R^2 = .97). With the United Kingdom as the base (the nine Eurostat-OECD countries in the regression average 98 percent of the United Kingdom), Bolivia is only 5 percent of the United Kingdom, and many countries in Africa are even lower. Table 16.5 reinforces the need to follow up the initial steps taken in the 2005 ICP to make some adjustment for productivity.

A Proposal for Linking in 2011 and Conclusions

The linking issue was important for comparison-resistant services in the 2005 ICP because the productivity adjustment was made in three of the six regions, leading to likely noncomparability. For a country like Bolivia or Tajikistan where no productivity adjustment was made, per capita

incomes would be less comparable with similar countries in Africa, the Asia-Pacific, or Western Asia. The issue is further complicated because the actual aggregation to the global level in 2005 was not carried out using the 146 countries individually; rather, it was carried out using five regional aggregates, the CIS included with the Eurostat-OECD. It was not possible in the end to obtain satisfactory regional adjustment factors to improve on a simple Ring country comparison.[12] As a consequence, a lack of comparability of low- and middle-income countries across different regions remains in the final 2005 ICP report. A somewhat different approach is explored here that uses as much salary information as is available to the Global Office and makes a rough allowance for productivity differentials across the regions based on the human and physical capital stock.

Estimates of Productivity by Country

Using the 2005 data, this section illustrates an alternative method of linking based on individual country productivity adjustments relying on a Cobb-Douglas production function across all the regions. Physical capital K_p and labor force estimates L are from the Penn World Table (PWT), and human capital estimates K_h are from the Barro-Lee data set.[13] The education measure is the average number of years of primary and secondary school completed. In equations (16.5) and (16.6), the dependent variable is the log of $\frac{GDP}{L}$, and in the first equation only $\frac{K_p}{L}$ is on the right side, whereas K_h is also included in the second equation:

$$(16.5) \qquad \ln \frac{GDP}{L} = 4.56 + .704 \ln \frac{K_p}{L}; \quad R^2 = .799; \; n = 106$$

$$(16.6) \qquad \ln \frac{GDP}{L} = 4.87 + .552 \ln \frac{K_p}{L} + .455 * \ln K_h; \quad R^2 = .786; \; n = 87.$$

All the coefficients are significant, but for K_h only at the 5 percent level. The first equation covers more countries, which makes it preferable for the illustration that follows. In addition, when the ratio of the estimated to actual value is taken, the standard deviation is significantly larger for the equation including K_h (.0827 versus .065). Thus the specification or data problems associated with including human capital in the productivity equation require more research to justify inclusion.

A Productivity Adjustment

The direction of productivity adjustment across countries is clear. The method adopted in the Asia-Pacific region is one that certainly moves in the right direction in that most agree that output per government, health, or education worker is likely to increase with more capital per worker. The approach suggested here is illustrated for the 2005 ICP research data set. The following estimates were made.

First, output per worker estimates were based on estimating equation (16.5) for the 106 countries in the PWT data set. These estimates were extended to the remaining countries based on the relationship of the estimated log of output per worker for the 106 countries to per capita GDP from an initial GEKS estimate. This estimating equation had an R^2 of .465 with sensible coefficients, although if this method were adopted in the future one would want a tighter estimating equation. Applying the equation coefficients to the per capita GDPs of the remaining 40 countries yielded estimates of the log of output per worker. Another limitation on this illustration is that these estimates refer to the whole economy, not labor in comparison-resistant services.

Second, these output per worker estimates were used to obtain adjustment factors that ranged from 1 to 4, going from high- to low-income countries. The admittedly very rough groupings were as follows: output per worker greater than US$40,000 was assigned 1.0; $30,000–40,000, 1.2; $20,000–30,000, 1.5; $15,000–20,000, 2.0; $10,000–15,000, 2.5; $5,000–10,000, 3.3; and under $5,000, 4.0. These factors were used to adjust the parities obtained from wage comparisons to obtain new input parities for the compensation headings of comparison resistant-services.[14]

Third, aggregations were run using unadjusted and adjusted compensation figures to gauge the impact on the results. Although this step might eventually prove to be an effective adjustment for individual countries, that is not the purpose of the present exercise. It is already agreed that the Eurostat-OECD and CIS countries will not make any adjustment within their regions for the 2011 ICP round. One reason is that these regions are already moving toward quantity comparisons for education services and exploring possibilities for the health sector.

The purpose of this exercise is to propose a method that would allow regions to retain whatever method they choose for the regional exercise while at the same time linking the regions in a way that would permit the adjustment across regions to improve comparability. The results of this exercise are reported in table 16.6. Two aggregation methods have been used, both producing similar results. One is the GEKS method and the other a weighted CPD, labeled CPDW. The share of each region of global domestic absorption is calculated with and without adjustment for each of the two methods. These shares are simply obtained by adding up the total GDP of each country in a region and dividing by the global total. The total DA (world) is also provided for each method. As can be seen, without the productivity adjustment the world total is larger than with the adjustment because less output of these services is attributed to many of the lower-income countries.[15]

But more important, the shares of each region are also substantially affected. The Eurostat-OECD share goes up because few of its countries are affected by the adjustment, while the shares of all the other regions go down—Africa by more than 5 percent. The effect is larger for GEKS than for CPDW. These effects are similar to what would result if one used the PPP for nonpriced services for the compensation headings of comparison-resistant services—that is, the regional pattern of table 16.6 is similar to that of the priced service exercise summarized in table 16.4 where the effect would be strongest for Africa and less so for South America and Western Asia. However, it is clear that the variation in the PPP for nonpriced services is subject to more error than even the rough productivity adjustment of table 16.6.

TABLE 16.6 Estimated Effect of Productivity across 146 ICP 2005 Countries by Region—Share of Global Domestic Absorption

Region	GEKS, no adjustment	GEKS, adjustment	CPDW, no adjustment	CPDW, adjustment
Africa	0.0313	0.028	0.0309	0.0288
Asia-Pacific	0.2384	0.2196	0.2371	0.2250
CIS	0.0421	0.0390	0.0400	0.0380
Eurostat-OECD	0.6236	0.6529	0.6271	0.6471
South America	0.0509	0.0468	0.0510	0.0476
Western Asia	0.0138	0.0133	0.0139	0.0136
World (US$ billions)	60,071	55,202	60,085	55,249

Source: Penn World Tables.
Note: GEKS = Gini-Éltetö-Köves-Szulc; CPDW = Country Product Dummy-Weighted.

How would this proposal improve the global comparisons? The adjusted shares provide a regional total that can be distributed among the countries in a region in the same way as the regional comparison. But this approach has a cost in that comparability across basic heading parities is reduced. However, because greater interest centers on aggregate comparisons across countries, the type of adjustment in table 16.6, which provides a more complete picture, has a major advantage. The effects of the productivity adjustment are systematic across regions, and therefore attributing adjusted shares to each region will improve the comparability of total DA and GDP per capita across the regions more than carrying out an adjustment in some regions but not others.

In summary, this general method is likely to be useful for improving the comparability of comparison-resistant service volumes across countries when regions adopt different methods as appears likely in 2011 for collective government, health, and perhaps education and dwelling services. Dwelling services are explored in more detail in chapter 12. The other principal conclusion of this chapter relevant to the 2011 ICP is implicit in figure 16.1: indirectly estimated price levels tend to be systematically lower compared with direct price comparisons for low-income countries. In view of the heterogeneity of available national statistical bases, there is no simple solution to this problem, but there is a simple message. In much the same way that expenditure surveys and commodity flow tables are used as checks on each other in national accounts, collecting more information on the headache headings in the ICP can provide similarly useful checks on PPP and volume estimates.

The major suggestions for moving forward to the 2011 ICP are to (1) carry out productivity adjustments where needed, depending on the methods used in each region; (2) adjust estimated regional PPPs for linking for productivity; (3) determine labor and capital data requirements for regional and national adjustments; and (4) collect as much auxiliary data as possible about health, government, and education. Such data would include numbers of employees stratified by skill and occupation, pupils, and hospital bed-days.

ANNEX A

Summary of the Components of Individual Consumption by Households and Government for Health and Education: Their Role in the Estimation of PPPs

This annex illustrates the context in which productivity adjustments were made in the 2005 ICP for the basic headings for compensation of employees. The accompanying table shows the detailed headings of concern in this chapter and makes clear that some health and education expenditures are part of the individual consumption of households, including partial or full payment for visits to doctors and dentists, some lab services, and some tuition payments to private and public educational institutions. Many education, health, and collective government expenditures are for purchases of supplies and maintenance and depreciation of buildings and equipment. For these basic headings, reference PPPs—PPPs usually based on direct prices collected for other basic headings—are used. In the 2005 ICP, the PPPs for the three compensation lines shown in the following table were based on direct comparisons of salaries and benefits in cash and in kind for selected occupations, some specific and a few common to education, health, and collective government services. Compensation of government employees appears in the actual consumption of households and in collective services.

As the following table shows, a category such as health is made up of a combination of household and government individual expenditures for which PPPs are computed using prices for some aggregates and compensation of employees for other aggregates. All enter into the overall PPP for health. The same is true to a lesser extent for education. As noted in the table, the reference PPP for hospitals is based on the PPP for government purchases of health services and as such is heavily based on compensation-derived PPPs.

Finally, it should be noted that the term *comparison-resistant* services has usually referred to all the headings in the table, both private and collective expenditures.

A. Health goods and services

Individual consumption by households for health (1)	Basis for PPPs (2)	Individual consumption by government for health (3)	Basis for PPPs (4)
Health		Health benefits and reimbursements	
Medical products, appliances, and equipment	Prices	*Medical products, appliances, and equipment*	Col. (2) prices
Outpatient services	Prices	*Outpatient services*	Col. (2) prices
Hospital services	Reference	*Hospital services*	Reference
		Production of health services by government	
		Compensation of employees	Salaries of health-related occupations
		Intermediate consumption	Reference
		Operating surplus	Reference
		Net taxes	Reference
		Receipts from sales	Reference

B. Education

Individual consumption by households for education	Basis for PPPs	Individual consumption by government for education	Basis for PPPs
Education	PPPs from private education	**Education benefits and reimbursement**	Col. (2) prices
		Production of education services	
		Compensation of employees	Salaries of education-related occupations
		Intermediate consumption	Reference
		Operating surplus	Reference
		Net taxes	Reference
		Receipts from sales	Reference

C. Collective consumption expenditure by government

		Production of collective services for general government	Basis for PPPs
		Compensation of employees	Compensation of employees by occupation for general government
		Intermediate consumption	Reference
		Operating surplus	Reference
		Net taxes	Reference
		Receipts from sales	Reference

Source: ICP 2005.

ANNEX B

Effects of Productivity Adjustments on the Global Comparison in International Dollars (PPP or Exchange Rate)

	PCDA (1)	PCSumDA (2)	Ratio of PCsumDA to PCDA (3)	EKS (%) HECG/DA (5)	% Nat cur HECG/DA (6)	Col. (5)/ col. (6) (7)	Real health + Ed + C gov exp (8)
Bangladesh	1,295	1,414	1.09	36.4	10.5	3.49	472
Bhutan	3,901	5,159	1.32	57.1	17.2	3.33	2,229
Brunei Darussalam	35,733	35,145	0.98	63.0	37.2	1.69	22,497
Cambodia	1,459	2,053	1.41	85.1	15.2	5.60	1,242
China	3,986	4,657	1.17	49.1	16.7	2.93	1,956
Hong Kong SAR, China	32,338	32,627	1.01	29.8	17.3	1.72	9,647
Macao SAR, China	28,200	22,786	0.81	25.1	16.4	1.53	7,079
Taiwan, China	25,360	30,261	1.19	54.6	22.1	2.47	13,854
Fiji	4,822	5,848	1.21	49.7	15.9	3.14	2,398
India	2,141	2,489	1.16	51.7	14.8	3.50	1,106
Indonesia	3,170	3,244	1.02	33.4	11.2	2.98	1,059
Iran, Islamic Rep.	10,496	11,228	1.07	46.7	16.2	2.89	4,901
Lao PDR	1,856	2,572	1.39	76.4	16.3	4.69	1,418
Malaysia	10,259	10,212	1.00	39.7	17.0	2.34	4,073
Maldives	4,531	7,624	1.68	100.4	21.5	4.67	4,549
Mongolia	2,672	3,583	1.34	73.6	14.2	5.17	1,967
Nepal	1,135	1,372	1.21	55.2	14.7	3.76	626
Pakistan	2,437	2,943	1.21	52.8	14.4	3.65	1,286
Philippines	2,972	3,089	1.04	43.2	14.6	2.95	1,284
Singapore	33,543	33,033	0.98	35.0	20.5	1.71	11,732
Sri Lanka	3,583	3,699	1.03	34.4	9.9	3.48	1,233
Thailand	6,887	7,750	1.13	46.3	17.7	2.61	3,187
Vietnam	2,163	3,180	1.47	85.3	16.3	5.23	1,844
Asia-Pacific	11,781,385	13,481,449	1.14	48.3	16.3	2.96	5,691,615
Argentina	10,749	10,648	0.99	33.7	19.6	1.72	3,625
Bolivia	3,575	4,115	1.15	60.3	22.2	2.71	2,154
Brazil	8,401	8,875	1.06	45.9	27.8	1.65	3,857
Chile	11,607	10,846	0.93	29.4	20.3	1.45	3,411
Colombia	6,314	6,767	1.07	44.2	24.3	1.82	2,792
Ecuador	6,559	6,398	0.98	34.1	17.3	1.96	2,234

(*continued*)

	PCDA (1)	PCSumDA (2)	Ratio of PCsumDA to PCDA (3)	EKS (%) HECG/DA (5)	% Nat cur HECG/DA (6)	Col. (5)/ col. (6) (7)	Real health + Ed + C gov exp (8)
Paraguay	3,952	4,018	1.02	30.6	14.1	2.17	1,209
Peru	6,294	5,969	0.95	30.2	19.3	1.56	1,903
Uruguay	9,112	9,107	1.00	34.7	20.4	1.70	3,159
Venezuela, RB	8,779	7,748	0.88	32.8	19.5	1.68	2,883
South America	2,985,901	3,042,959	1.02	40.7	24.5	1.66	1,215,767
Albania	5,949	6,599	1.11	36.8	11.2	3.28	2,188
Australia	33,442	33,790	1.01	30.3	23.1	1.31	10,130
Austria	32,291	32,058	0.99	26.3	20.3	1.29	8,492
Belgium	30,745	31,211	1.02	29.8	24.0	1.24	9,147
Bosnia and Herzegovina	7,657	8,971	1.17	39.4	18.2	2.17	3,016
Bulgaria	9,924	11,191	1.13	47.4	18.1	2.62	4,704
Canada	33,745	33,901	1.00	25.8	21.4	1.20	8,710
Croatia	13,963	15,138	1.08	37.5	21.1	1.78	5,240
Cyprus	25,046	24,778	0.99	26.9	20.8	1.29	6,744
Czech Republic	19,890	21,167	1.06	39.2	23.1	1.70	7,798
Denmark	31,367	32204	1.03	29.1	23.2	1.26	9,133
Estonia	17,313	17886	1.03	36.6	16.9	2.16	6,335
Finland	28,388	28555	1.01	28.8	21.9	1.31	8,183
France	29,954	30356	1.01	28.7	22.0	1.30	8,611
Germany	28,787	29349	1.02	27.4	21.6	1.27	7,884
Greece	27,131	26766	0.99	29.7	20.2	1.47	8,056
Hungary	17,133	18417	1.07	39.4	22.4	1.76	6,752
Iceland	42,464	43262	1.02	27.8	21.7	1.28	11,787
Ireland	32,107	32417	1.01	26.1	19.1	1.37	8,377
Israel	23,790	25204	1.06	40.9	28.8	1.42	9,733
Japan	29,796	30567	1.03	30.3	20.0	1.51	9,034
Korea, Rep.	20,954	21510	1.03	30.7	19.6	1.57	6,431
Latvia	14,230	15434	1.08	42.0	17.5	2.39	5,970
Lithuania	14,637	15747	1.08	40.8	17.9	2.28	5,973
Luxembourg	51,504	52155	1.01	21.2	20.1	1.05	10,899
Macedonia, FYR	7,886	8,773	1.11	41.5	18.0	2.30	3,274
Malta	21,194	21,805	1.03	33.5	21.0	1.60	7,101
Mexico	11,436	11,543	1.01	32.3	16.3	1.97	3,688
Montenegro	8,468	10,071	1.19	57.7	26.5	2.17	4,883
Netherlands	31,638	32,414	1.02	30.5	23.6	1.29	9,665
New Zealand	25,105	24,828	0.99	28.1	19.4	1.45	7,048
Norway	36,837	37,611	1.02	29.0	22.3	1.30	10,695

	PCDA (1)	PCSumDA (2)	Ratio of PCsumDA to PCDA (3)	EKS (%) HECG/DA (5)	% Nat cur HECG/DA (6)	Col. (5)/ col. (6) (7)	Real health + Ed + C gov exp (8)
Poland	13,600	15,154	1.11	39.3	20.1	1.96	5,348
Portugal	21,527	21,515	1.00	29.7	23.2	1.28	6,399
Romania	9,847	10,761	1.09	43.4	18.5	2.35	4,273
Serbia	9,379	9,745	1.04	35.9	15.1	2.38	3,368
Slovak Republic	16,328	17,834	1.09	39.6	19.6	2.02	6,468
Slovenia	23,115	23,144	1.00	29.4	21.0	1.40	6,794
Spain	28,649	28,254	0.99	26.9	18.6	1.45	7,701
Sweden	28,972	30,530	1.05	33.5	24.4	1.38	9,720
Switzerland	32,286	33,022	1.02	26.1	20.6	1.27	8,418
Turkey	8,119	8,284	1.02	28.5	14.0	2.04	2,316
United Kingdom	32,915	32,760	1.00	25.7	19.8	1.30	8,462
United States	44,081	43,957	1.00	28.4	28.4	1.00	12,521
Eurostat-OECD	35,269,786	35,625,954	1.01	29.0	23.4	1.24	10,227,966
Armenia	4,104	5,282	1.29	49.6	12.6	3.93	2,035
Azerbaijan	4,487	4,746	1.06	41.7	12.0	3.47	1,872
Belarus	8,519	10,937	1.28	55.4	20.9	2.65	4,716
Georgia	3,767	4,925	1.31	55.0	17.4	3.17	2,073
Kazakhstan	8,367	10,900	1.30	63.4	18.0	3.52	5,307
Kyrgyz Republic	1,816	2,930	1.61	75.7	15.5	4.89	1,374
Moldova	2,700	4,753	1.76	77.7	14.3	5.42	2,099
Tajikistan	1,476	2,734	1.85	104.0	12.9	8.05	1,535
Ukraine	5,568	7,570	1.36	63.1	20.0	3.16	3,516
CIS	2,162,344	2,360,383	1.09	45.6	19.0	2.40	985,287
Angola	3,019	2,333	0.77	30.7	22.2	1.39	928
Benin	1,423	1,496	1.05	37.2	13.5	2.76	530
Botswana	11,244	8,195	0.73	36.6	29.2	1.25	4,111
Burkina Faso	1,194	1,232	1.03	41.9	20.7	2.03	500
Burundi	418	529	1.26	69.8	17.2	4.06	292
Cameroon	1,994	1,782	0.89	29.0	11.6	2.51	578
Cape Verde	3,401	4,254	1.25	44.1	15.8	2.80	1,501
Central African Republic	700	698	1.00	30.6	10.9	2.82	214
Chad	1,680	1988	1.18	77.7	9.1	8.56	1306
Comoros	1,138	1266	1.11	52.8	13.8	3.83	601
Congo, Dem. Rep.	262	258	0.98	41.9	13.9	3.02	110
Congo, Rep.	2,817	2,161	0.77	44.1	20.9	2.12	1,243
Côte d'Ivoire	1,515	1,332	0.88	31.1	17.7	1.76	471
Djibouti	1,959	2,063	1.05	46.8	26.5	1.77	918

(*continued*)

	PCDA (1)	PCSumDA (2)	Ratio of PCsumDA to PCDA (3)	EKS (%) HECG/DA (5)	% Nat cur HECG/DA (6)	Col. (5)/ col. (6) (7)	Real health + Ed + C gov exp (8)
Egypt, Arab Rep.	5,003	5,690	1.14	55.5	16.6	3.34	2,774
Equatorial Guinea	9,553	6,048	0.63	22.5	8.2	2.74	2,147
Ethiopia	611	561	0.92	25.3	14.4	1.76	155
Gabon	10,565	8,482	0.80	39.5	19.1	2.07	4,176
Gambia, The	811	1,598	1.97	152.6	37.4	4.08	1,237
Ghana	1,300	1,430	1.10	40.3	14.1	2.85	524
Guinea	948	1,023	1.08	48.0	15.8	3.03	455
Guinea-Bissau	622	771	1.24	64.4	20.5	3.15	400
Kenya	1,418	1,709	1.20	58.1	23.2	2.50	825
Lesotho	1,795	2,802	1.56	83.0	20.0	4.15	1,490
Liberia	407	552	1.36	82.0	22.8	3.60	334
Madagascar	1,034	1,360	1.32	73.5	19.1	3.85	760
Malawi	725	935	1.29	62.0	22.8	2.72	449
Mauritania	2,040	2,330	1.14	45.5	13.8	3.30	929
Mauritius	10,429	11,618	1.11	43.1	17.7	2.43	4,497
Morocco	3,669	3,586	0.98	31.1	21.3	1.46	1,142
Mozambique	780	778	1.00	37.4	16.2	2.31	291
Namibia	4,646	5,546	1.19	61.4	29.4	2.09	2,853
Niger	644	667	1.04	41.6	16.9	2.46	268
Nigeria	1,773	1,368	0.77	18.4	10.6	1.74	326
Rwanda	851	1,023	1.20	61.2	17.7	3.46	521
São Tomé and Príncipe	1,681	1,997	1.19	53.6	14.9	3.61	901
Senegal	1,783	1,790	1.00	34.9	15.1	2.31	622
Sierra Leone	858	1,328	1.55	97.5	30.2	3.23	836
South Africa	8,476	8,859	1.05	45.3	26.0	1.74	3,842
Sudan	2,342	1,947	0.83	17.0	8.0	2.12	399
Swaziland	4,455	4,867	1.09	54.6	19.7	2.77	2,431
Tanzania	1,048	816	0.78	17.0	7.7	2.22	178
Togo	995	1,141	1.15	45.3	13.9	3.25	451
Tunisia	6,456	6,279	0.97	30.8	17.5	1.77	1,991
Uganda	1,033	982	0.95	29.1	19.6	1.49	301
Zambia	1,244	1,435	1.15	40.6	21.4	1.90	505
Zimbabwe	552	683	1.24	64.2	11.0	5.85	354
Africa	1,821,701	1,816,152	1.00	39.8	18.9	2.11	725,704
Bahrain	23,095	23,008	1.00	31.4	22.8	1.38	7,249
Iraq	3,175	4,385	1.38	95.8	41.5	2.31	3,043

	PCDA (1)	PCSumDA (2)	Ratio of PCsumDA to PCDA (3)	EKS (%) HECG/DA (5)	% Nat cur HECG/DA (6)	Col. (5)/ col. (6) (7)	Real health + Ed + C gov exp (8)
Jordan	5,219	6,778	1.30	52.9	20.1	2.63	2,762
Kuwait	33,031	29,994	0.91	28.1	26.1	1.08	9,297
Lebanon	11,431	14,861	1.30	59.3	27.2	2.18	6,783
Oman	168,94	16,935	1.00	38.3	28.5	1.34	6,475
Qatar	50,248	52,753	1.05	26.7	20.5	1.30	13,438
Saudi Arabia	16,573	15,716	0.95	39.1	32.8	1.19	6,479
Syrian Arab Republic	4,013	4,849	1.21	53.0	17.9	2.96	2,127
Yemen, Rep.	2,226	2,538	1.14	47.9	15.3	3.13	1,066
Western Asia	844,324	896,140	1.06	46.4	26.8	1.73	391,800
World	548,65,442	57,223,036	1.04	35.1			19,238,139

Note: PCDA = per capita domestic absorption; PCSumDA = per capita domestic absorption from sum of 13 basic headings of actual consumption plus collective government plus gross fixed capital formation; HECG = health, education, collective government; EKS (%) HECG/DA = ratio of HECG PPP expenditures to domestic absorption; column (6) is same as column (5) except DA based on exchange rates; full caption of column (8) is real health, education, and collective government expenditures.

ANNEX C

Priced and Nonpriced Services, ICP 2005

Priced commodities		Priced services	
110111.1	Rice	110314.1	Cleaning and repair of clothing
110111.2	Other cereals and flour	110322.1	Repair and hire of footwear
110111.3	Bread	110410	Actual and imputed rentals for housing
110111.4	Other bakery products	110430	Maintenance and repair of the dwelling
110111.5	Pasta products	110440	Water supply and miscellaneous services relating to the dwelling
110112.1	Beef and veal	110442	Miscellaneous services relating to the dwelling
110112.2	Pork	110451	Electricity
110112.3	Lamb, mutton, and goat	110452	Gas
110112.4	Poultry	110453	Other fuels
110112.5	Other meats and preparations	110513	Repair of furniture, furnishings, and floor coverings
110113.1	Fresh or frozen fish and seafood	110533	Repair of household appliances
110113.2	Preserved fish and seafood	110562.1	Domestic services
110114.1	Fresh milk	110562.2	Household services
110114.2	Preserved milk and milk products	110621	Medical services
110114.3	Cheese	110622	Dental services
110114.4	Eggs and egg-based products	110623	Paramedical services
110115.1	Butter and margarine	110630	Hospital services
110115.3	Other edible oils and fats	110723	Maintenance and repair of personal transport equipment
110116.1	Fresh or chilled fruit	110724	Other services in respect of personal transport equipment
110116.2	Frozen, preserved, or processed fruits	110731	Passenger transport by railway
110117.1	Fresh or chilled vegetables	110732	Passenger transport by road
110117.2	Fresh or chilled potatoes	110733	Passenger transport by air
110117.3	Frozen or preserved vegetables	110734	Passenger transport by sea and inland waterway
110118.1	Sugar	110735	Combined passenger transport
110118.2	Jams, marmalades, and honey	110736	Other purchased transport services
110118.3	Confectionery, chocolate, and ice cream	110810	Postal services
110119	Food products n.e.c.	110830	Telephone and telefax services
110121	Coffee, tea, and cocoa	110915	Repair of audiovisual, photographic, and information-processing equipment
110122	Mineral waters, soft drinks, fruit and vegetable juices	110935	Veterinary and other services for pets
110211.1	Spirits	110941	Recreational and sporting services

Priced commodities		Priced services	
110212.1	Wine	110942	Cultural services
110213.1	Beer	110943	Games of chance
110220	Tobacco	110960	Package holidays
110311.1	Clothing materials and accessories	111000	Education
110312.1	Garments	111110	Catering services
110321.1	Footwear	111120	Accommodation services
110511	Furniture and furnishings	111211	Hairdressing salons and personal grooming establishments
110512	Carpets and other floor coverings	111220	Prostitution
110520	Household textiles	111240	Social protection
110531	Major household appliances whether electric or not	111250	Insurance
110532	Small electric household appliances	111261	FISIM
110540	Glassware, tableware, and household utensils	111262	Other financial services n.e.c
110551	Major tools and equipment	111270	Other services n.e.c.
110552	Small tools and miscellaneous accessories	*Nonpriced services as in the first two sections of annex A on education and health services*	
110561	Nondurable household goods	130221	Compensation of employees
110611	Pharmaceutical products	130222	Intermediate consumption
110612	Other medical products	130223	Gross operating surplus
110711	Motor cars	130421	Compensation of employees
110712	Motorcycles	130422	Intermediate consumption
110713	Bicycles	130423	Gross operating surplus
110722	Fuels and lubricants for personal transport equipment	130424	Net taxes on production
110820	Telephone and telefax equipment	140111	Compensation of employees
110911	Audiovisual, photographic, and information processing equipment	140112	Intermediate consumption
110914	Recording media	140113	Gross operating surplus
110921	Major durables for outdoor and indoor recreation	140114	Net taxes on production
110931	Other recreational items and equipment	140115	Receipts from sales
110933	Gardens and pets		
110950	Newspapers, books, and stationery		
111212	Appliances, articles, and products for personal care		
111231	Jewelry, clocks, and watches		
111232	Other personal effects		

Source: ICP.
Note: n.e.c. = not elsewhere classified.

NOTES

1. This experience is summarized in Sergeev (1998) and so is not covered here.
2. The preliminary report of the Asian Development Bank (2007, appendix D) describes this method and provides some quantitative illustrations of the effects of the adjustments. The final report on the ADB website provides an abbreviated description.
3. The 1975 ICP used a small sample of countries with estimates of health capital to obtain adjustment factors, and the 2005 ICP used estimates of capital per worker for the whole economy. Another difference between the two rounds is that the 2005 ICP applied the adjustment factor to salaries and then used the salaries to obtain indirect quantities. The 1975 ICP adjusted quantities to obtain indirect PPPs.
4. In this chapter, EKS, the aggregation method found in the 2005 ICP report, is used interchangeably with GEKS, an increasingly popular abbreviation that acknowledges that the method originated with statistician Corrado Gini.
5. For example, the effect within a region would depend on whether the GEKS or Iklé-Dikhanov-Balk (IDB) method—the harmonically share-weighted Gheary-Kharmis (GK) method—was used. In the global comparison, it would depend on whether EKS was performed on the regions or on individual countries.
6. The Balassa-Samuelson effect is based on the fact that commodities are largely tradable, whereas services, especially comparison-resistant services, are largely nontradable. See Heston, Summers, and Nuxoll (1994), where this effect is tested and where alternative explanations are also cited.
7. The tradable-nontradable distinction is not as tidy as it is made to appear. Consumers are tourists, but they also travel to seek health care in other countries. Likewise, construction companies seek projects outside their home countries. Both are some examples of how loose the distinction can be.
8. In the 1990s, when Eurostat-OECD began to make comparisons for nonmember countries, especially in Eastern Europe and the former Soviet Union, some experiments were made using priced services PPPs for comparison-resistant services. However, as in many rounds of the ICP, the number of observations on priced services was not considered adequate.
9. Foreign trade can be handled properly by estimating export and import PPPs separately. Because this estimation involves additional price comparisons, typically the ICP has converted the net foreign balance by a common conversion factor. The exchange rate was used in the 2005 ICP, and the PPP for domestic absorption was used in some earlier ICPs. Use of the exchange rate is not base country–invariant and has an asymmetric effect for countries with price levels below the exchange rate as to whether they are running a trade deficit or surplus.
10. According to OECD, *fixity* refers to "the practice of fixing the results of an International Comparison Programme (ICP) aggregation for a country group when the country group is compared with a larger group. For example, the relation of France and Italy as given by Geary-Khamis or EKS for the 15 EU countries would be fixed so that within OECD, the France-Italy relationship would be preserved" (http://stats.oecd.org/glossary/detail.asp?ID=5527). Even when fixity is observed, an aggregation across the five ICP regions (CIS is included with the Eurostat-OECD comparison) produces results different from an aggregation of the 146 individual countries.
11. The ranking of types of employment is not particularly meaningful because administration, for example, may have been mainly lower-level employees, whereas education has mainly higher levels in the particular mix of occupations sampled within the broad groupings of administration, health, and education.

12. It was possible to estimate from a CPD equation coefficients for the regions. However, these estimates were based on wage comparisons for different occupations, much like the regional comparisons, and simply reproduced what had been found within regions—that is, based on wage and salary comparisons, indirect quantity estimates for low-income regions would be implausibly large.
13. The labor force data are available at http://pwt.econ.upenn.edu. The physical capital series is preliminary and not yet posted on the web. Country studies of China, India, and Indonesia were used to supplement the PWT estimates. For the Barro-Lee data set, see http://www.cid.harvard.edu/ciddata/ciddata.html. This chapter was being written as the Barro-Lee data set was being updated, and so it was not yet clear whether the new data would have broader coverage and more explanatory power. The India and Indonesia estimates are based on Eng (2008), and the China estimate is based on Wu (2009).
14. For the Eurostat-OECD, CIS, and South America regions, the basic heading compensation parities were from the research input of the 2005 ICP. For the Africa, Asia-Pacific, and Western Asia regions, where the research input compensation parities have already been adjusted, the wage-estimating equations discussed in the text were used to derive parities based on the United Kingdom. These could in turn be put on a U.S. base. Some countries in these three regions were not in the wage equation and so had to be estimated by a short-cut equation based on per capita income—a method that should be improved.
15. This exercise used only the three compensation headings in the table in annex A for collective consumption and government purchases of individual health and education services. Because the PPP for public purchases of health services was partially used for household purchases of hospital services, table 16.6 provides a more complete comparison than if only household purchases of hospital services had also been included.

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