



# PART 2

CONCEPTUAL FRAMEWORK AND  
METHODOLOGICAL SUMMARY FOR  
PPP COMPILATION

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# Conceptual Framework and Methodological Summary for PPP Compilation

## 2.1 CONCEPTUAL FRAMEWORK

A detailed description of the ICP methodology can be found in the *ICP 2003-2006 Handbook* (World Bank, 2006). Below is a summary of the basic concepts and definitions used in international comparison. Special emphasis has been placed on the concept of exchange rates and purchasing power parities (PPPs) and their use in economic analysis as well as their limitations.

### 2.1.1 EXCHANGE RATES

Although exchange rates provide the simplest method of converting different currencies to a common basis, the results are generally misleading. Exchange rates change abruptly and vary substantially over time. Most economic comparisons that use exchange rates show a poor relationship between the data and the actual situations that they are trying to compare. It has been suggested that smoothed exchange rates might provide better comparisons, but experience shows that smoothing does not solve the problem and such comparisons remain flawed.

### 2.1.2 PURCHASING POWER PARITIES

A PPP for a specific good or service between two countries, A and B, is a ratio that measures the number of units of country A's currency needed in country A to purchase the same quantity of the specific good or service as one unit of country B's currency will purchase in country B. PPPs can be expressed in the currency of either country.

Using PPPs allows for the comparison of real values in the country's economy as adjusted through a common set of international (or regional) average prices. PPPs can therefore be seen as the average price ratios in participating countries. This removes the distortion caused by different price levels that exist between countries for similar goods and services.

Let us assume that a consumer in country A wants to buy in foreign country B the same good that he uses in his own country—a cup of tea, which costs in 1,000 francs in country A and 2 dinars in

## PPP as a Theory of Exchange Rate Determination

Purchasing power parity was originally developed as a theory of exchange rate determination. Today it is primarily used to compare living standards across countries.

From the perspective of exchange rate determination, PPP is a useful reminder that monetary policy has no long-term impact on real exchange rates. Thus, countries with different inflation rates should expect their bilateral exchange rate to adjust to offset these differentials in the long run. The exchange rate, however, can deviate persistently from its PPP value in response to real shocks.

To compare living standards across countries, PPP exchange rates are constructed by comparing the national prices for a large basket of goods and services. These rates are used to translate different countries into a common currency to measure the purchasing power of per capita income in different countries. A PPP exchange rate constructed in this manner is not, however, an accurate measure of the equilibrium value of the market-determined exchange rate.

country B. In this case the PPP is equal to 500. Although the cup of tea in this example is a single product, the aim of the ICP is to assess prices among many countries for a broad range of goods and services, including consumer products and capital and government expenditures, which together make up GDP.

Once PPPs are available for countries and their aggregates are expressed in these terms, it is possible to do comparisons of GDPs, GDPs per capita, relative price levels and, because of the weight-related data used in the calculations, expenditure patterns and structures within economies. These results may differ significantly with comparisons based purely on a common exchange rate, as these may not accurately reflect the actual differences between economies.

### 2.1.3 PRICE LEVEL INDICES

In practice, PPP indices are mainly used to derive international volume indices to deflate ratios of values in national currencies. They have the same dimensions as exchange rates and may be directly compared with the latter. Dividing a PPP index by the corresponding exchange rate yields a price level index (PLI). A PLI shows the average percentage by which the prices of goods and services in country B, when converted into country A's currency at the current exchange rate, exceed or fall below the prices of the same goods and services in country A. A PLI is usually measured in percentages. A PLI of 100 indicates that price levels are the same. Values higher and lower than 100 indicate more expensive and cheaper prices respectively. The PLI shows which economies are cheaper and which are more expensive when currencies are converted using market exchange rates. PLIs are generally low in poor countries.

Such information is useful for individuals or institutional units moving from one country to another or engaged in economic activities within both countries. PLIs reflect the common experience of travelers who find many (but not all) of the goods and services in some countries relatively cheap compared to similar products at home.

PPPs between any pair of countries change slowly with relative inflation, whereas market exchange rates can change quickly. As a result, sudden changes in PLIs are due mainly to changes in market exchange rates.

## 2.2 METHODOLOGICAL SUMMARY FOR PPP COMPILATION

The methodology used in the compilation of PPPs is explained in detail in the *ICP 2003-2006 Handbook* (World Bank, 2006). The actual implementation of 2005 ICP-Africa, however, showed its individual specifics as the region responded to its own challenges.

Generally, PPPs are calculated for all components of GDP. At the most aggregated level, GDP is divided into household consumption, government consumption, gross fixed capital formation, changes in inventories including acquisitions less disposal of valuables, and balance of exports and imports. For 2005 ICP-Africa, these aggregates were further divided into 26 categories, 61 groups, 126 classes and 155 basic headings. The *ICP 2003-06 Handbook* defines a basic heading as 'the smallest aggregate for which expenditure data are available'. Appendix C presents the complete structure of GDP in the form used in the 2005 ICP-Africa.

Appendix D explains the detailed computational procedures of how the PPPs were computed. A hierarchical approach was used in the computation of the PPPs. At the most detailed level, PPPs were computed for each basic heading. The country-product-dummy (CPD) method (a regression method with dummy variables) was used to estimate PPPs at the basic heading level. For some basic headings like disposals of valuables, collecting the required data to compute PPPs was not possible. In such cases, price data collected from another basic heading (or group of basic headings) were used (see Appendix E for the list of reference PPPs).

At higher levels, individual basic heading PPPs were then aggregated (using weights for each basic heading from the national accounts) to produce PPPs and price-adjusted real quantities for each expenditure category up to the GDP, using the relevant basic heading PPPs. The Iklé method described in Appendix D was used to obtain the PPPs at higher levels.

### 2.2.1. ICP DATA REQUIREMENTS

Two sets of data are required to compute PPPs. The first set is composed of estimates of GDP compiled following the expenditure approach and the *System of National Accounts 1993* (SNA93), with its components allocated to 155 basic headings. The usefulness of the comparisons depends upon the consistency of national accounts data among the economies being compared.

Several SNA93 classifications were used for ICP purposes. The most important are those relating to expenditure. In particular, the Classification of Individual Consumption by Purpose (COICOP) provides a good framework for dividing individual consumption expenditure by households into 110 basic headings.

Similarly, the Classification of the Functions of Government (COFOG) provides the framework for government expenditures (individual and collective). The other large component of GDP, gross fixed capital formation (GFCF), is classified by type of asset on which expenditures are incurred, such as construction and equipment.

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In a several participating countries, national accounts were compiled using the production approach, meaning that the expenditure estimates required for ICP purposes were not available. In such cases, the basic headings were computed using alternate data sources (household surveys, supply and use tables, or commodity flow).

The second set of data is comprised of price data collected through surveys. ICP price data requirements for multilateral comparisons include the following:

- Products and services in the item list must (i) be comparable and representative of national expenditure pattern, (ii) represent all the components of the aggregate (consumption or the entire GDP) being compared and (iii) match on the features that affect prices (outlet type, quality of service and the like).
- National annual average prices are required in PPP computations. To that end, the survey should include the entire country (prices collected from a national sample of outlets) and during the entire year of reference.

For 2005 ICP-Africa, the first point was addressed in a participative and iterative process used to elaborate the product list using the structured product description (SPD) approach and is described in section 2.2.3 below. In all countries the household item survey had national coverage, and data were collected monthly for a year.

## **2.2.2 NATIONAL ACCOUNTS DATA**

### *2.2.2.1 Compilation*

During the 2005 ICP-Africa exercise, obtaining comparable data on GDP expenditure was a challenge. The global ICP required estimates of expenditure for more than 150 components of GDP; for Africa more than 200 components were distinguished. As indicated earlier, the reliability of intercountry comparisons requires that the scope of GDP be consistent across countries.

The compilation of national accounts was a major statistical undertaking for all countries. It brought together much of the detailed work of national statistics offices in an integrated and coherent way. A number of countries used SNA93, but many others continued to use outdated systems based on the 1968 SNA.

For 2005 ICP-Africa, the AfDB developed a methodology to obtain countries' estimates of GDP expenditure on a common basis that reflected SNA93 definitions. This methodology was developed through an iterative and participatory process involving the

countries and subregional organizations under the coordination of the AfDB.

Countries were encouraged to (i) adjust their overall estimates of GDP expenditure to a common basis that reflected SNA93 definitions; (ii) prepare a breakdown of GDP into seven broad expenditure categories and, in particular, distinguish individual and collective consumption expenditure by government; and (iii) further divide these seven categories into approximately 200 detailed expenditure categories. This required using various data sources. The results of these exercises were then examined at a series of subregional and regional workshops with the objective of further improving comparability.

### *2.2.2.2 Validation*

Data validation was developed in a hierarchical and participatory manner. All participating regional member countries (RMCs) and subregional organizations were involved under the supervision of the AfDB.

In the first stage, RMCs at different phases of implementing SNA93 used various methods to decompose their expenditure aggregates for the reference year 2005. Bridge tables were then established between the national accounts classifications used in national accounts compilation and the ICP-Africa classification requirements. RMCs that were advanced in implementing SNA93 used the 'bottom-up' approach to fulfill the ICP-Africa requirements, while less advanced RMCs used either the 'top-down' approach or a hybrid of the two approaches.

A series of subregional workshops were held in 2006 to come up with comparisons at the subregional level with regard to household final consumption expenditure. The most important aspect of validation was to make comparisons of the contributions of each basic heading to GDP. Any significant differences that could not be explained were referred to the RMCs for verification. Expenditure patterns among different groupings of RMCs within the subregional organizations were also compared. Checks like these helped to identify a number of problems that had to be corrected by the RMCs.

The last regional workshop was organized in July 2007 to address the comparability of country national accounts data. Countries were asked to review their national accounts expenditure estimates, address identified inconsistencies, and provide revised estimates to correct data errors or errors of interpretation. They were also requested to provide explanations for estimates that appeared to be atypical. Countries then resubmitted the results of these reviews to AfDB for re-examination.

### 2.2.3. PRICE SURVEY DATA

The quality of ICP comparisons depends on the prices of individual items. Price data had to be collected for identical goods from all participating countries, a process that involved intensive preparatory work at both the regional and country levels. The main survey was the main household consumption item survey including pharmaceuticals, housing, health and private education. Other surveys included construction, equipment prices and government consumption surveys.

#### 2.2.3.1 Main household consumption item survey

The first task was to define an all-Africa list of products that were comparable across countries and representative of national expenditure patterns. To that end, country visits and various workshops were organized to bring countries together to prepare that list. The product list was defined with the input of all participating countries using the SPDs as required by the global ICP program. In total, as indicated in Table 1, 1,016 products grouped into 110 basic headings were defined for subsequent pricing. Given the diversity of the continent, some variation in the geographic representativity of individual products occurred, but, taken as a whole, the selection was deemed to adequately represent the consumption patterns of all participating countries.

The SPD approach consisted of developing a product list through an iterative and participatory process. An SPD defines a family of products and is composed of price determining characteristics (type of outlets, package type, labeling, unit of measure, and the like). Each characteristic has several mutually exclusive specifications, and a product is specified by a combination of those specifications. SPDs follow common structures across broad groups of products, thus ensuring a comprehensive and systematic

approach to the definition of products. The SPD approach ensures comparability and facilitates a common understanding—across languages, cultures, institutions and individuals—of the products to be priced.

Following the preparation of the SPDs, AfDB statisticians made country visits to review the specifications with national statisticians, collect information on the nature of products and ensure that all price determining characteristics and related specifications had been considered. Upon completion of the country visits, the AfDB regional coordination team finalized the SPDs. The final SPDs were used to derive product specifications in the form of pre-filled SPDs that were submitted to countries for review. For each product, countries were requested to make specification changes when necessary. The revised specifications were collated to derive the draft regional product list and specifications, which was sent to countries to examine and ensure that their representative products were included. Countries met to finalize the regional list, which was used for price collection.

The two criteria that were used in the selection of products and that have been pursued in the development of the regional product list with the SPD approach are *comparability* and *representativity* of the products. Both are important but may sometimes conflict.

A representative product is one that the consumer prefers. It may account for a significant proportion of the expenditures within a basic heading. Basic headings were so large, however, that no single product could account for a large proportion of the total expenditures. The composition of any given basic heading in terms of product varied from country to country. The selection sought

**Table 1.** Individual Consumption Expenditure by Households: Number of Basic Headings and Products, 2005

Category	Number of Basic Headings	Number of Products
Food and nonalcoholic beverages	29	356
Alcoholic beverages, tobacco and narcotics	5	41
Clothing and footwear	5	128
Housing, water, electricity, gas and other fuels	7	12
Furnishings, household equipment and maintenance	13	104
Health	7	158
Transport	13	55
Communication	3	19
Recreation and culture	13	49
Education	1	9
Restaurants and hotels	2	51
Miscellaneous goods and services and net purchases abroad	12	34
<b>Total individual consumption expenditure by households</b>	<b>110</b>	<b>1,016</b>

products that were the most representative among the participating countries.

Comparability is a relationship between two products or among products in different countries. Products are said to be comparable if (i) their physical and economic characteristics are identical or (ii) they are sufficiently similar that consumers are indifferent among

them. In practice, the characteristics of products may differ, and slight differences may be tolerated, provided that they are not important to the consumers. One way to achieve comparability is to make the descriptions of the products as precise as possible so that the price collectors in different countries price virtually identical and sufficiently similar products.

**Table 1a.** ICP Price Collection Centers for Selected Countries by Locality, 2005

COUNTRY	Rural	Urban	Total
Angola	12	37	49
Benin	11	12	23
Botswana	40	34	74
Burkina Faso	13	13	26
Burundi	0	7	7
Cameroon	10	12	22
Cape Verde	3	9	12
Congo	14	6	20
Congo, Democratic Republic	10	10	20
Côte d'Ivoire	9	19	28
Egypt	22	44	66
Ethiopia	11	62	73
Equatorial Guinea	8	8	16
Ghana	11	20	31
Guinea	9	14	23
Guinea-Bissau	7	8	15
Kenya	10	25	35
Lesotho	70	43	113
Liberia	0	7	7
Malawi	36	10	46
Mali	8	9	17
Mauritania	5	13	18
Mauritius	8	4	12
Morocco	7	8	15
Mozambique	5	5	10
Namibia	0	10	10
Niger	7	8	15
Nigeria	23	26	49
São Tomé and Príncipe	7	8	15
Senegal	2	5	7
Sierra Leone	11	10	21
South Africa	0	50	50
Swaziland	14	21	35
Tanzania	36	61	97
Gambia, The	12	10	22
Togo	5	6	11
Tunisia	23	24	47
Uganda	8	5	13
Zambia	12	55	67
Zimbabwe	32	88	120

To prepare for price collections, a series of regional and subregional workshops and training programs were conducted to enhance staff skills and to ensure that countries were properly equipped. Funding was provided to purchase necessary equipment and hire temporary staff. National price statisticians were trained in new data validation techniques that ensured consistency of data across countries.

The ICP price collections were conducted in parallel with existing consumer price index (CPI) collection activities. The ICP coverage in terms of products and outlets was larger than the CPI coverage to reflect the specific requirements of the ICP program. Table 1a below provides an overview of the number of rural and urban data collection centers in different countries. As the table shows, data in Liberia and Namibia were collected in only seven and ten centers, respectively, and only in urban areas. Zimbabwe and Lesotho had the highest number of centers: 120 and 113, respectively. In total 1,357 centers contributed to the price data collection. Approximately 60 percent were in urban areas, and 40 percent were in rural areas.

Surveys to collect data on main household consumption items, education, health, housing and pharmaceutical products were designed to provide national coverage and included both urban and rural areas. Most countries used a stratification based on administrative areas. Outlets were selected through a two-stage purposive sampling approach. First, the administrative center of an administrative area and – when feasible – one or more adjacent rural areas were chosen as primary sampling units. Second, outlets were selected within each primary sampling unit on the basis of a pre-survey. For most countries, data collection was conducted from May-June 2005 until June 2006.

#### 2.2.3.2 Main household consumption data validation

One of the major pillars of data quality is data editing and validation, which must be carried out at both national and regional levels. At the national level, individual price observations were edited and checked to identify extreme values and outliers. To that end, 2005 ICP-Africa used the Semper, an integrated application developed by the AfDB for editing ICP price data. The Semper checks the surveys' constants (product codes, name, quantity, unit of measurement and other product characteristics), converts the observed quantity to the reference quantity if necessary and identifies errors and outliers using graphical tables.

At the regional level, the following tools were used to ensure comparison of average prices for the same product in different countries:

- Quaranta tables were used to convert estimated national averages into a common unit of currency using exchange rate or PPP or both and to screen them for possible errors. Those errors were examined through regional consistency of the individual national averages.
- Dikhanov tables can be used at different levels of aggregation. CPD residuals and their standard errors at different levels (overall, product and country) were used to identify extreme values and errors. CPD computations can be done at the basic heading, class or GDP levels.

In its ICP Toolpack, the World Bank proposed Quaranta and Dikhanov tables. Quaranta tables were also computed at the regional level using ELFA, an application developed by the AfDB.



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Intra- and intercountry data validations were conducted by national and regional ICP-Africa teams through country visits, retreats and subregional and regional workshops. In addition to those validations, consistency (over time) analyses were carried out because data were collected during a one-year period.

### 2.2.3.3 Other surveys

Estimates of government final consumption expenditure and gross fixed capital formation, including construction and civil engineering, machinery and equipment, and housing, were carried out as well.

**Government final consumption expenditure:** For purposes of 2005 ICP-Africa, participating countries were required to provide the annual government compensation of employees in a cross-section of occupations in general public services, public health services and public education services. Participating countries were expected to collect data for a basket of 'representative' occupations selected by the global office: 13 positions in health, 5 in education and 26 in public administration.

**Construction and civil engineering:** This is a particularly difficult area because of the variety of projects and techniques in different parts of the world, even within the same region. Historically, two alternatives have been used to price such projects. The first is to price the inputs (wages for the labor; materials used in construction, such as bricks, timber, and steel; and the cost of hiring equipment). The second is based on construction experts' pricing of standard models for different types of construction projects, such as housing, bridges, roads and factories. The main advantage of the latter approach is that overhead and productivity differences between countries are taken into account; the disadvantage is that it is much more costly to implement.

A new method was introduced in the 2005 ICP round. In practice, it falls between the input and model-based approaches. Called the 'basket of construction components' approach, it involves pricing identifiable, complete, installed components, including materials and labor plus the cost of hiring any capital equipment used. The product list focused on components (such as window frames) that are significant in the total cost and then identified the major elements of each. Because the type of inputs and the mix between labor and equipment differed between countries, this approach accounted for such variations. The ICP Global Office selected 23 components that represented the principal types of construction activities around the world. Twelve basic construction inputs such as labor, equipment rental costs and selected materials were also priced. While this approach allowed for productivity differences at the individual component level, an underlying assumption was

that the profit margins for managing the overall project were identical (proportionally) between countries. All ICP regions priced these global specifications.

**Machinery and equipment:** Pricing the goods underlying investment expenditures on equipment goods (plant and machinery) was another problematic area in both the regional and the ring<sup>4</sup> comparisons. The pricing approach was similar to the SPD approach used for consumption goods and services, although each region developed its own specifications for consumption products. A major difference for equipment goods was that the ICP Global Office staff not only prepared the respective SPDs on a worldwide basis but also developed the product specifications and identified at least two manufacturers and two model numbers for most products. Countries were asked to provide prices for the first of these two specifications for each product, provided that the model specified was available and in common use in the country. If not, the second model was to be priced. If more than one model could be priced on this basis, then countries were asked to do so. When exact product matches could not be found, each country was asked to price a model that broadly met the specifications and was commonly used in the country.

For national accounts estimates of consumer expenditures on rented and owner-occupied dwellings (imputed) benchmark and the 2005 updates were collected. The physical indicators on the number of characteristics of dwellings were used to produce directly comparable real expenditures on dwellings. In some instances reference PPPs were used for actual rentals in cases where no prices were collected. These reference PPPs were based on prices of other basic headings.

Regional workshops with the sole purpose of validating the other national accounts components (construction and civil engineering, machinery and equipment, compensation of employees and housing) were held mostly in 2007.

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4 A ring comparison includes selected countries that in addition to the global comparison, collected data on a global list of products used to link the different ICP regions.