

Quality Assurance Framework and Enhanced Data Validation Procedures for ICP Price Surveys

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Abstract

The International Comparison Program (ICP) is a worldwide statistical initiative designed to estimate Purchasing Power Parities (PPPs) that can be used as currency converters to compare the performance of economies around the world. The ICP conducts surveys every five/six years to collect price and expenditure data for all goods and services that make up the Gross Domestic Product (GDP) in order to calculate the PPPs. To ensure the quality of PPP data, the ICP puts much effort into harmonizing and standardizing practices across countries and regions; effort goes into ensuring that countries use the same methodology and comparable data collection procedures. Being a multilateral comparison, the ICP does not only require correct and reliable price data, but also comparable data. To ensure correctness, reliability and comparability, the validation process is carried out at both the intra-country and the inter-country levels and requires close cooperation and collaboration between participating countries, Regional Coordinating Agencies and the ICP Global Office. The ICP Global Office holds bi-annual meetings with Regional Coordinating Agencies to discuss methodology and processes, while the Regional Coordinating Agencies organize frequent meetings, training sessions and validation workshops for participating countries to ensure consistency of methodology, comparability of prices and soundness of results. The ICP Book and the ICP Operational Guide were developed as reference materials to ensure a common understanding and use of the overall ICP methodology. For the assessment and improvement of the quality of ICP data and processes, the ICP Global Office prepared the ICP Quality Assurance Framework. The Framework is structured to evaluate the quality of the ICP in terms of: (1) processes at the country, regional and global level; and (2) input data (prices and expenditures) and output data (PPPs, price level indices and volume measures).

Key Words: International Comparison Program, PPPs, Prices, National Accounts

1. Background

In order to improve the quality of the ICP data in the 2005 round, considerable efforts went into harmonizing and standardizing methods and practices across countries and regions. The ICP Global Office (GO) held coordination meetings regularly with Regional Coordinating Agencies (RCAs) to discuss methodology and processes. Similarly, RCAs organized regular regional workshops and training sessions for National Coordinating Agencies (NCAs) to ensure that countries used the same methodology and comparable data collection procedures, and to build country capacity in the areas of prices, National Accounts expenditures, and PPPs. The GO prepared the ICP Handbook and the ICP Operational Manual to ensure a common understanding and use of the methodology, and substantial effort went into the preparation of specifications for the products to be priced.

Efforts to improve the quality of ICP data continued in the 2011 round. ICP validation procedures were standardized and strengthened across the regions. The GO prepared the ICP Book and the ICP Operational Guide as reference materials to ensure a common understanding and to promote transparency of ICP methodology and processes. Software tools were developed to facilitate the collection, validation and processing of ICP data and results. For the assessment and improvement of the quality of ICP data and processes, the GO prepared the ICP Quality Assurance Framework (ICP-QAF).

2. ICP Quality Assurance Framework

The ICP-QAF was developed to evaluate the quality of the 2011 ICP round in terms of: (1) processes at the country, regional and global levels; and (2) input data (prices and expenditures) and output data (PPPs, price level indices and volume measures). It was derived from the International Monetary Fund Data Quality Assessment Framework (IMF-DQAF). The IMF-DQAF brings together best practices and internationally accepted concepts and definitions in statistics. It provides a structure for assessing data quality by comparing country statistical practices with best practices.

The IMF-DQAF was developed for specific macroeconomic data sets, such as national accounts and consumer prices, which are typically compiled by a single country. The ICP, however, has three levels of operation involving the GO at the global level, RCAs at the regional level and NCAs at the country level. Moreover, the ICP utilizes various input data (prices and expenditures) and produces an array of output data (PPPs, price level indices and volume measures), whose quality is directly linked to the quality of the processes of data collection, compilation, validation and computation. Thus, the adaptation of the IMF-DQAF to the ICP had to recognize and accommodate these complex ICP processes and its various input and output data.

Similar to the IMF-DQAF, the ICP-QAF is organized in a cascading structure with four levels: (1) *Dimensions*; (2) *Elements*; (3) *Focal issues*; and (4) *Key points*, as shown in the illustrative table below.

Cascading Structure of the ICP-QAF		
Level 1: Dimensions	1.0	PREREQUISITES OF QUALITY
Level 2: Elements	1.1	The legal and institutional environment
Level 3: Focal issues	1.1.1	The primary responsibility for collecting, processing, and disseminating ICP statistics is clearly established by law or other formal provision.
Level 4: Key points	•	A law or other formal provision assigns primary responsibility to an agency to perform the functions of GO/RCA/NCA for the collection, processing, and dissemination of ICP statistics. Such a provision could be a resolution of the UN Statistical Commission, a memorandum of understanding, or a statistical law.

Source: ICP Global Office (2011) "ICP Quality Assurance Framework", World Bank, Washington, DC

The dimensions of quality are six¹:

- a) *Prerequisites of quality*: this dimension includes “pointers-to-quality” that comprise institutional preconditions for the quality of statistics. The focus is primarily on the agencies responsible for collecting, processing, submission, and disseminating ICP statistics, namely the agencies performing the functions of GO, RCAs or NCAs.
- b) *Assurances of integrity*: this dimension assesses the adherence to the principle of objectivity in the collection, compilation, submission, and dissemination of statistics as well as the professionalism in statistical policies and practices, transparency and ethical standards. Again the focus is on the agencies performing the functions of GO, RCAs or NCAs.
- c) *Methodological soundness*: this dimension assesses whether the methodological basis for the production of statistics is sound and whether this can be attained by following internationally accepted standards, guidelines, or good practices. It is necessarily a data specific dimension, reflecting different methodologies for different sets of data.
- d) *Accuracy and reliability*: this dimension covers the idea that statistical outputs sufficiently portray the reality of the economy. It is also data specific, reflecting the sources used and their processing.
- e) *Serviceability*: this dimension assesses whether statistics are disseminated with an appropriate periodicity in a timely fashion, are consistent internally and with other major data sets, and follow a regular revision policy.
- f) *Accessibility*: this dimension relates to the need for data and metadata to be presented in a clear and understandable manner on an easily available and impartial basis, that metadata are up-to-date and pertinent, and that a prompt and knowledgeable support service is available.

To operationalize this ICP-QAF, the GO prepared three checklists to help assess the quality of the ICP processes, data and metadata:

- a) *The NCA Checklist*: This checklist is filled by the NCA and helps assess the ICP national data and metadata produced by countries, as well as the quality of the ICP processes at the country level. It is available in four languages: Arabic, English, French, and Spanish.
- b) *The RCA Checklist*: This checklist is filled by the RCA and helps assess the ICP regional data, metadata, and results produced by RCAs, as well as the quality of the ICP processes at the regional level.
- c) *The GO Checklist*: This checklist is filled by the GO and helps assess the ICP global data, metadata, and results produced by the GO, as well as the quality of the ICP processes at the global level.

3. Enhanced Price Data Validation Procedures

Household Consumption price data collected under the ICP undergoes a dynamic cycle of data validation at three different levels (country, regional, and global). The cycle starts with the intra-country validation which is mainly performed by the NCAs, after which the data proceeds to an inter-country validation process conducted by the RCAs in collaboration with the NCAs, whereas the global validation represents the last stage and is carried out by the GO in collaboration with the RCAs. The validation process is iterative, and each validation stage is repeated until the benefits of further validation activities are deemed marginal and thus not worth pursuing.

¹ ICP Global Office (2011) “ICP Quality Assurance Framework”, World Bank, Washington, DC.

The validation process is initiated with the intra-country validation at the country level. Once the price data is collected and compiled, the individual price observations and metadata are first checked for errors and discrepancies; NCAs have to ensure the validity of the item codes, the observed quantities, the units of measurement and many other details. Based on their knowledge of the region, NCAs make certain that sub-national prices - received from different areas of the same country - are correct and valid. Large differences may be entirely appropriate despite their amplitude; in any case, realistic average prices have to be the end result. After data has been collected and checked for successive quarters, temporal comparison analysis is then performed by the NCAs to locate and treat price inconsistencies and make sure that prices are temporally plausible. Prices can be compared temporally either between ICP rounds or between price collection periods within an ICP round. The intra-country data validation is accompanied with the verification of the importance classification; NCAs are required to classify all items as “important” or “not important” depending on the availability and importance of items in each country. The importance classification is expected to reflect the significance of the expenditure share of the item within its Basic Heading (BH) and allows for the computation of BH PPPs under the weighted CPD method.

Intra-country data validation is conducted by constructing and examining diagnostic tables for average prices, which display average price results and highlight critical values of the Min/Max ratio and high coefficients of variation for each item. The data validation process then examines diagnostic tables for individual price observations, which display the individual price observations as well as results of price deviation and T-Value tests. Although deviation limits are already set by RCAs, they are flexible and can be adjusted by national price experts according to the nature of the item and their knowledge of the range of variation for each item. Higher limits can be set during the early stages of the intra-country validation, which then can be lowered as the validation progresses. After ensuring that all the steps were successfully conducted and that the data is validated, the NCA submits data and metadata to the RCA.

Although the intra-country validation can be carried out entirely by the NCAs without the assistance or the intervention of the RCA, the RCA can provide a valuable second opinion on dubious cases. In the Western Asia region for example, in addition to several training sessions that were conducted to train NCAs on data entry and validation techniques to ensure the reliability of prices, some country missions were also conducted by the Western Asia RCA. The missions provided technical assistance to support the NCAs in treating some erroneous values. Field visits to some outlets were conducted to ensure that the same specifications are consistently priced across the country and across the region.

Following the initial data validation at the national level, the data is then submitted to the RCA for further validation. Country data is first screened for possible outliers at the national level, after which inter-country validation is conducted by the RCA to compare price data across the different countries of the region. This validation assesses whether price collectors in different countries have consistently priced products that are comparable between countries according to the specified product descriptions – in other words, they have all interpreted the item specifications in the same way – and whether the prices they have reported are correct. Inter-country editing looks for extreme values among the average prices and discrepancies in the metadata provided by NCAs for the same item within a BH. In order to do so, the average prices, which are expressed in national currencies, have to be converted into a common currency. The main tools used for inter-country validation are the Quaranta and Dikhanov diagnostic tables. In the Quaranta tables, both exchange rates and PPPs are used in validation to convert the average prices to a common currency, and both the exchange rate converted average prices and the PPP converted average prices are used to derive standardized price ratios. The standardized price ratios based on exchange rate converted prices are called “Exchange Rate-Ratios” and the standardized price ratios based on PPP converted prices are called “PPP-Ratios”.

Before any in-depth analysis, an initial validation is conducted using Exchange Rate-Ratios to compare the data under one currency and check for potential outliers. These outliers can be due to extreme errors commonly related to quantity, units of measurement, or simple typing mistakes. The RCA then checks the metadata underlying the average prices, and ensures that survey frames are comparable across countries.

After the initial data and metadata validation is completed and all extreme values are fixed or discarded, the actual inter-country validation is tackled using the Quaranta and Dikhanov diagnostic tables. PPP-Ratios are examined and the Price Level Index (PLI) is validated. PLI is defined as the ratio of the BH PPP to the Exchange Rate and is expressed as a percentage. At first, the RCA checks the plausibility of the BH PLIs, and checks for extreme average coefficients of variation (CV) at BH level; these indicators can be found in the first two summary sheets of the Quaranta table and provide the RCA with a general assessment of the data. Afterwards, RCAs review each BH thoroughly, where BH tables are checked for high country values of coefficients of variation and where importance classification of BH items is verified. Item tables are then systematically checked for high CVs, high/low Exchange Rate-Ratios, and high/low PPP-ratios. In the Western Asia region, this stage was performed closely with participating countries during the regional workshops; NCA teams actively participated in the inter-country validation sessions to better understand the validation process and enhance the quality of national data. During these sessions, countries would take note of price discrepancies and correct what turns out to be wrong, or they would provide justification should the outliers be correct. These validation steps carried out at BH level are repeated at aggregated levels to verify PPP results for these aggregated levels.

A temporal analysis was also carried out during the inter-country validation, mostly between price collection periods of the 2011 round. Although this could have been easily created by NCAs, the Western Asia RCA put together a temporal analysis table that compiles and compares, for every country, quarterly average prices collected in 2011. This table allowed countries to keep track of their quarterly data during the validation sessions of the annual average prices and helped them locate and define the causes of their price discrepancies in a fast and efficient way.

As previously mentioned, the inter-country validation is an iterative process, and RCAs go through as many validation cycles as necessary to validate the data. However, if some extreme outliers remain after the previously mentioned validation steps, RCAs can delete them after consulting with the relevant NCAs. Once NCAs and RCAs formally approve the price data to be inter-country validated, the data and metadata are submitted to the GO.

The global validation is the third and last validation stage and it is carried out by the GO. This stage begins with an analysis of the regional validation tables in order to ensure a similar approach to data validation across regions, with special emphasis on the importance classification as it ensures the validity of the PPPs calculated using the weighted CPD method. The Global Core List (GCL) items are common to all the regions and are used to link the regional PPPs to create the global set of PPPs. Therefore, the GO conducts a thorough validation of the GCL item prices from both regional and global perspectives. Once these preliminary global validation steps are completed, the GO initiates the validation of the global PPPs by checking the Paasche-Laspeyres Spreads (PLS) at each aggregation level. Direct and indirect PPPs are then checked at each aggregation level before concluding the global validation with the evaluation of the validity and plausibility of the referenced PPPs. Implausible results are communicated to the RCAs who would examine them again with the NCAs. Extreme results that remain after this validation are then deleted by the GO in consultation with the corresponding RCAs. After the completion of all the global validation steps, PPP results for the 2011 ICP round are considered final and ready for publishing.

The survey for Household Consumption is the main survey of the ICP; however, countries conduct special surveys for other GDP aggregates namely Housing, Private Education, Government

Compensation of Employees, Machinery and Equipment, and Construction. The data quality for these surveys affects the quality of the resulting PPPs at GDP level; thus, their data quality should be ensured in order to bring the PPPs at GDP level closest to reality. In validating the data of these special surveys, the validation process is conducted similarly to the validation of Household Consumption data at the three levels (country, regional, and global). However, an initial in-depth customized validation process is conducted for each survey due to the specificity of its data. In the Western Asia region, the special validation process for each special survey was developed with an illustrative and easy-to-follow manual, which was documented and shared with countries to ensure that data quality is enhanced consistently across countries before it is further scrutinized at the RCA level.

4. Conclusions

The 2011 round of the ICP improved price data validation procedures at country, regional, and global levels. The round strengthened the collaboration and coordination between the GO, the RCAs and NCAs, through various meetings and workshops, to ensure a seamless and timely data validation process. Software tools were developed to facilitate the collection, validation and processing of ICP data and results.

To improve the transparency of the ICP, detailed documentation was prepared and disseminated. Operational materials including data and metadata collection and validation forms and guidelines were prepared and circulated to countries, and capacity-building materials including the ICP Book and the ICP Operational Guide were produced. These materials are available on the ICP website at: www.worldbank.org/data/icp.

The ICP Quality Assessment Framework and its checklists were prepared to provide a sound basis and tool to evaluate the quality of ICP data and processes at country, regional, and global levels.

These materials, instruments and tools serve to improve the quality of ICP data and constitute a major investment of the 2011 round, which can be built on and used in future rounds of the ICP.

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