

Purchasing Power Parities and the International Comparison Program: Overview and Basic Fundamentals

Eileen Pantua Capilit
Economic Statistics Consultant
Statistics Division, UN ESCAP

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Objectives:

1. Have a general understanding of
 - ▶ PPPs and ICP
 - ▶ Main uses and applications of PPPs
2. Have better appreciation on:
 - ▶ Basic ICP data requirements
 - ▶ ICP Data collection and validation
 - ▶ PPP estimation and calculations

Key Questions

1. What are PPPs?
2. Why is ICP and PPPs important?
3. How can comparability be achieved
4. What are the ICP Data Requirements
5. How are PPPs calculated?

Presentation Outline

1. Background
2. PPPs and ICPs
3. Uses and applications of PPPs
4. Establishing Comparability: The ICP Essentials
5. ICP Data Requirements
6. ICP Data Collection and Validation
7. Calculating PPP

1. Background

Comparability

ICP and PPPs are all about comparing “like with like”



If there is NO comparability then we have a meaningless number...

Let's have dinner.



RMB 5



RMB 500

What are the key principles implemented in the ICP to achieve comparability?

Collaboration

Transparency
in process

Replication

Collaboration Means... Everyone Matters

National Implementing Agencies

Heads of Agencies,

National Coordinators, Field supervisors,
Statistics/Economic Officers,
Field Officers, Price Collectors, Encoders

Global ICP
Implementing

Regional
Implementing (ADB
for Asia Pacific
Region)



Transparency calls for...

Keeping everyone informed

Involving every party in the process

Proper documentation at all levels

Sharing of critical information to increase levels of understanding

Inclusive discussion and resolution of issues

Replication means...



Everyone across states within economy; economies within region; and regions across the globe, implements ICP in the same way, from product identification to collection to validation and discussions.

2. PPPs and ICPs

The basket of goods and services



What are PPPs?



- ▶ *measure the total amount of goods and services in a single unit of an economy's currency can buy in another economy*
 - Price relatives or ratios of prices between countries
 - Based on relationship of actual prices between countries
 - Market basket of "like" items
 - Weighted by GDP expenditures
 - Both currency converters & price deflators
 - PPP converted GDPs
 - reflect only volume differences between countries
 - generally more consistent over time

What are PPPs?



USD100

XR=6.46

RMB646



USD100

PPP=3.51

RMB351



$$PLI = (PPP/XR) * 100 = 54.33$$

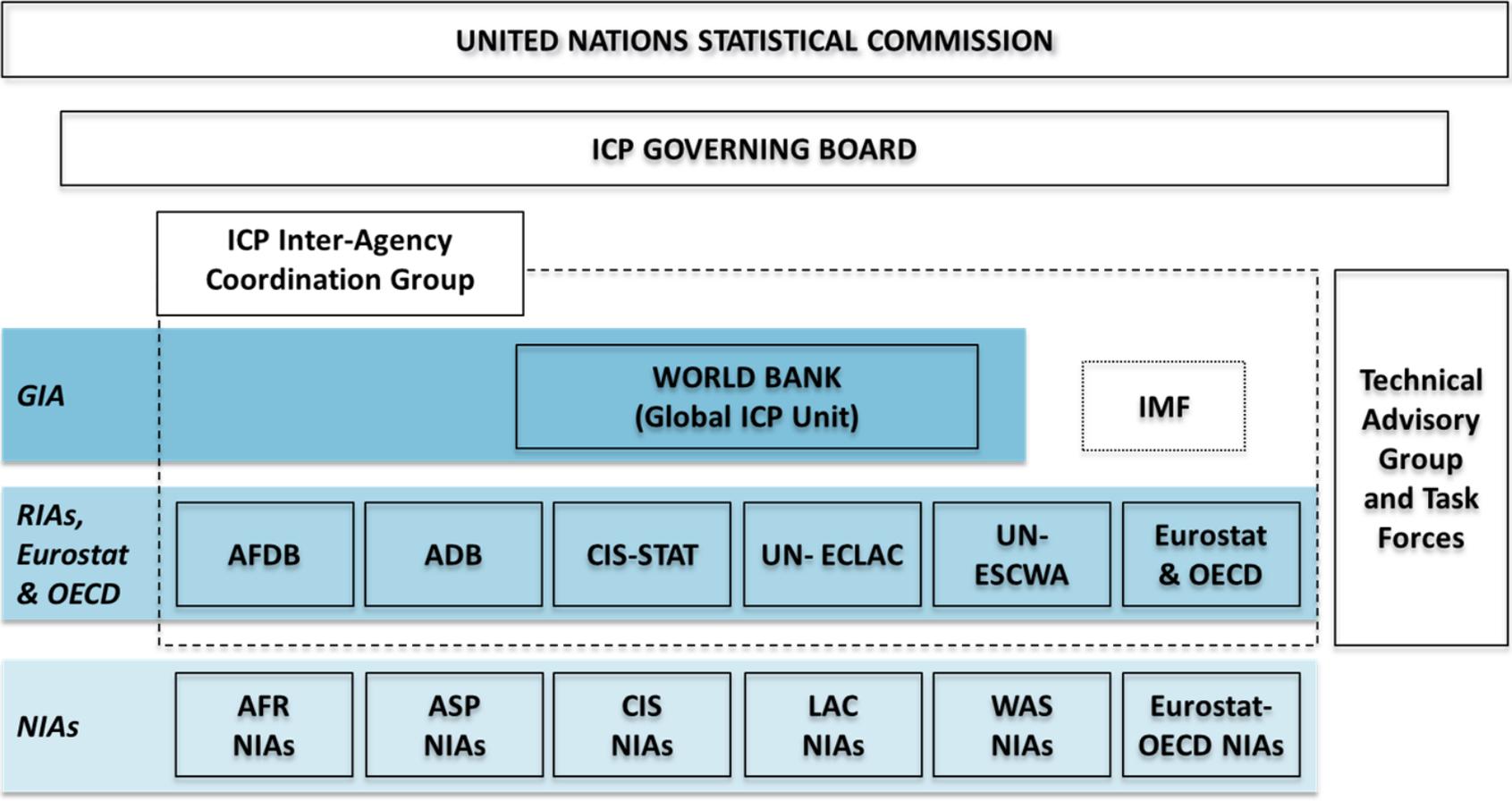
What is ICP

A resource-intensive worldwide statistical initiative led by the World Bank under the auspices of the UNSC and coordinated across the global through RIA

- The ICP produces:
 - PPP adjusted economic aggregates
 - PPP estimates
 - Internationally comparable price level
- Coordinated work on,
 - Global price survey of comparable items within countries, across countries (199 in 2011) and across regions (7)
 - GDP provides the weights to aggregate the PPP



ICP Governance Framework



GIA = Global Implementing Agency, RIA = Regional Implementing Agency, NIA = National Implementing Agency

ICP Research Agenda

- ▶ Building consistent PPP time series
- ▶ improving PPP reliability and quality,
- ▶ addressing difficult to measure areas, such as housing, construction and government services.
- ▶ strengthening the alignment between PPPs and national statistical programs,
- ▶ advocating wider uses and applications of PPPs
- ▶ exploring innovations in technology and new data sources.

3. Uses and Applications of PPPs

Sustainable Development Goals

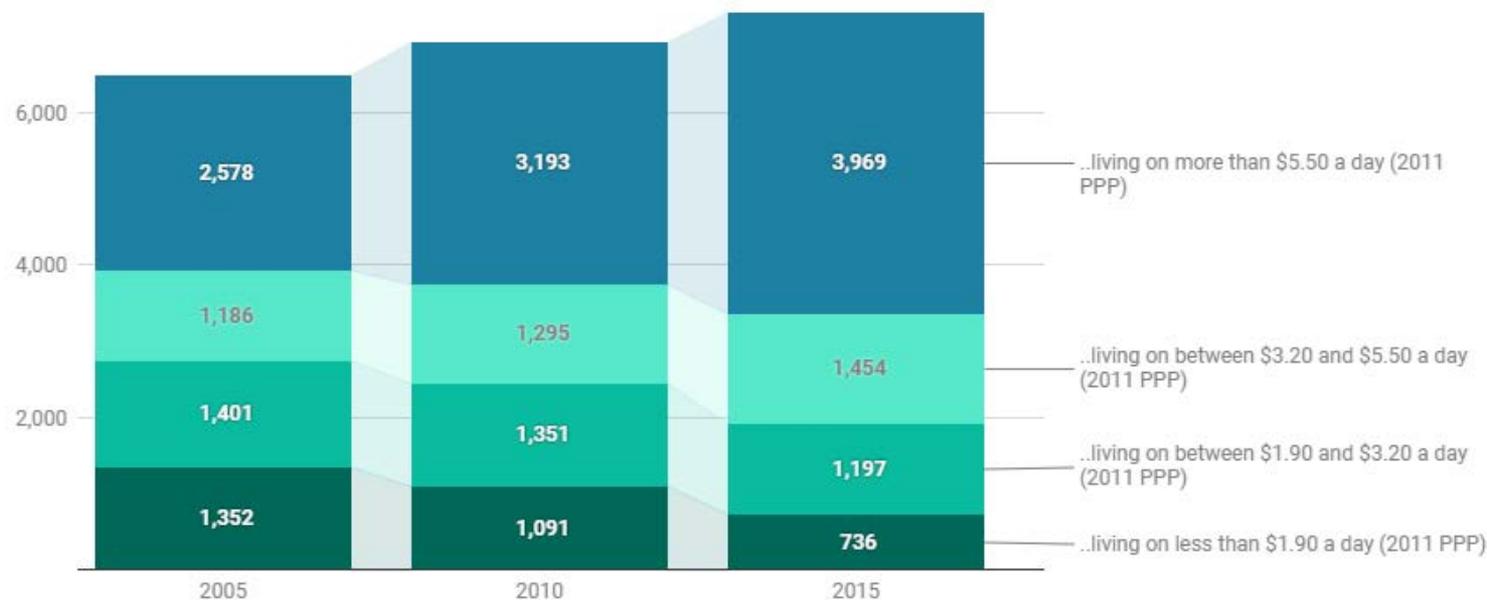
- ▶ *Goal 1: End Poverty in all its forms*
(proportion of the population living below the international poverty line expressed in PPP terms)
- ▶ *Goal 3: Ensure healthy lives and promote well-being for all at all ages*
(uses GDP per capita expressed in PPP terms in the estimation of the maternal mortality ratio)
- ▶ *Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all*
(energy intensity)
- ▶ *Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation*
(CO2 emission in PPP terms, and portion of research and development expenditure in PPP terms)



Fewer people are living in poverty now, despite rising populations..

Goal 1. Eradicate poverty in all its forms by 2030

Global population (millions)

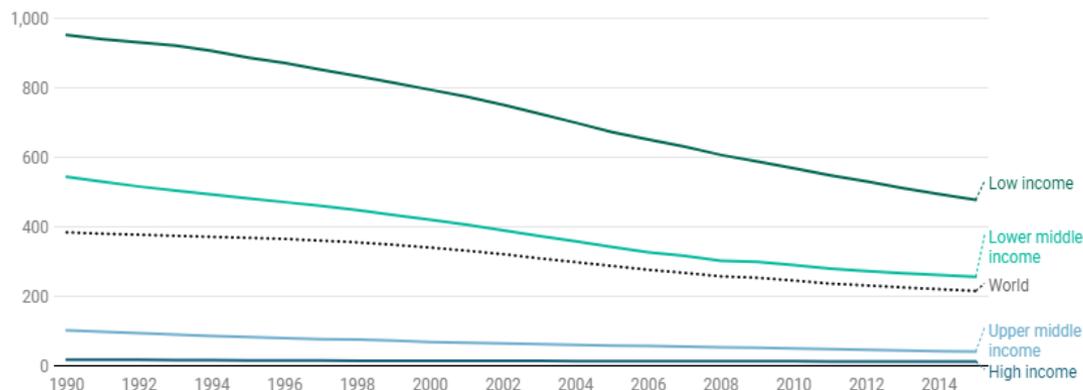


PPPs are used to establish international poverty lines at \$1.90, \$3.20, and \$5.50 a day

Source: PovCalNet

PPPs are utilized in several other official SDG indicators like...

Maternal mortality ratio (modeled estimate, per 100,000 live births)



This modeled indicator uses GDP measured in PPP terms in its calculation

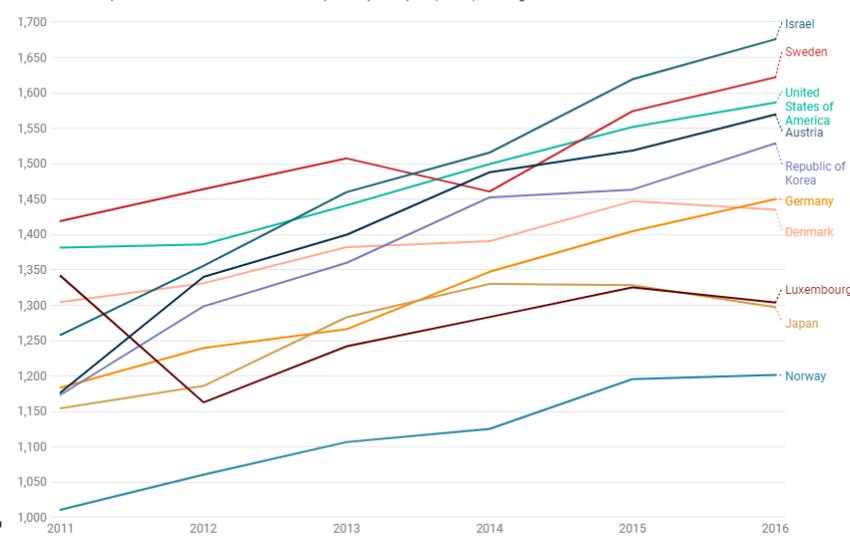
Goal 3. Ensure healthy lives and promote well-being for all at all ages

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Source:

<https://blogs.worldbank.org/opendata/monitoring-sdgs-purchasing-power-parities>

Government Expenditure on Research and Development per capita (SPPP), ten highest countries in 2016.



Source: UNESCO

Who uses PPPs?



- **United Nations Development Program**
 - Human Development Index
 - Inequality-adjusted Human Development Index
 - Gender Development Index



- **United Nations Educational, Scientific and Cultural Organization**
 - The relative value of funding provided annually for education



- **United Nations International Children's Emergency Fund**
 - The number of children living in poverty



- **International Monetary Fund (IMF)**
 - Output and growth of composite groups of economies
 - Quota subscription of member countries



- **The European Commission**
 - Allocation of Structural and Cohesion Funds to implement the growth policy of the European Union



- **The Organisation for Economic Cooperation and Development (OECD)**
 - Aggregation of real GDP and its components for the OECD
 - Research and policy analysis



WORLD BANK GROUP

- Size of the economy
- Poverty rates and international poverty line
- Shared prosperity
- Health systems
- Energy dependency, efficiency and carbon dioxide emissions
- Price levels

Policymakers, academia and think-tanks

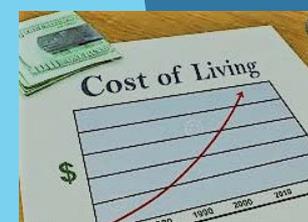
- in analyzing a wide variety of topics including bilateral, regional and global comparisons

Private sector:

- increasingly using PPPs for evaluating cross-country investment costs

Source: World Bank Group, 2018

Key Uses/Applications of PPPs



- Analyze the extent of convergence in real incomes & prices across countries
- Measure levels & trends in inequality in real GDPs between countries & between regions within a country
- Assist in establishing aid policies for less developed countries
- Calculate cost of living adjustments for people assigned to posts in different countries

Why use PPPs?

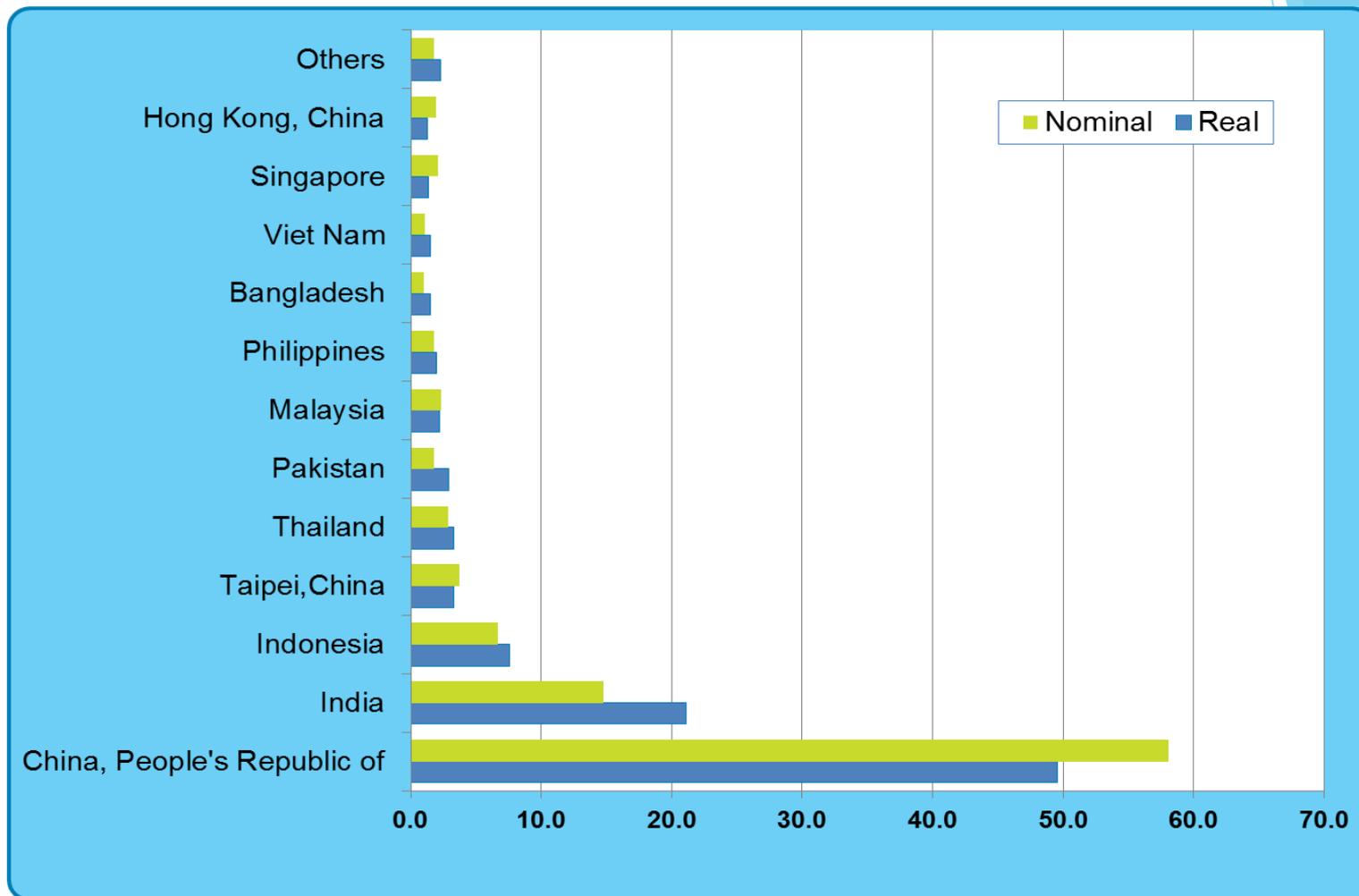


Economy	Purchasing power parity	Exchange rate (LCU per HK dollar)	Price level index (Asia and Pacific = 100)	Nominal GDP (million HK dollars)	Real GDP ² (million HK dollars)
(1)	(3)	(4)	(5)	(6)	(7)
BAN	4.24	9.53	67	1018544	2289582
BHU	3.09	6.00	78	14335	27849
BRU	0.13	0.16	123	129927	159836
CAM	246.65	521.39	72	99865	211102
PRC	0.64	0.83	117	56993942	73709156
FIJ	0.19	0.23	126	29214	35263
HKG	1.00	1.00	152	1936083	1936083
IND	2.77	6.00	70	14509265	31445329
INO	660.35	1126.73	89	6587922	11240667
LAO	451.84	1031.61	66	62744	143253
MAC	0.84	1.03	124	286428	351184
MAL	0.27	0.39	103	2249883	3310259
MLD	1.56	1.88	126	16837	20230
MON	98.35	162.58	92	77173	127577
MYA	43.02	105.08	62	429477	1048928
NEP	4.51	9.51	72	152433	321449
PAK	4.46	11.09	61	1729818	4304442
PHI	3.27	5.56	89	1744357	2969222
SIN	0.16	0.16	153	2067600	2046788
SRI	7.08	14.20	76	460616	924446
TAP	2.77	3.79	111	3621152	4954438
THA	2.26	3.92	88	2838871	4909768
VIE	1228.43	2634.86	71	1055039	2262952
			100	98111525	148749803

Exchange rates would have understated the size of Asia and the Pacific economy by a third

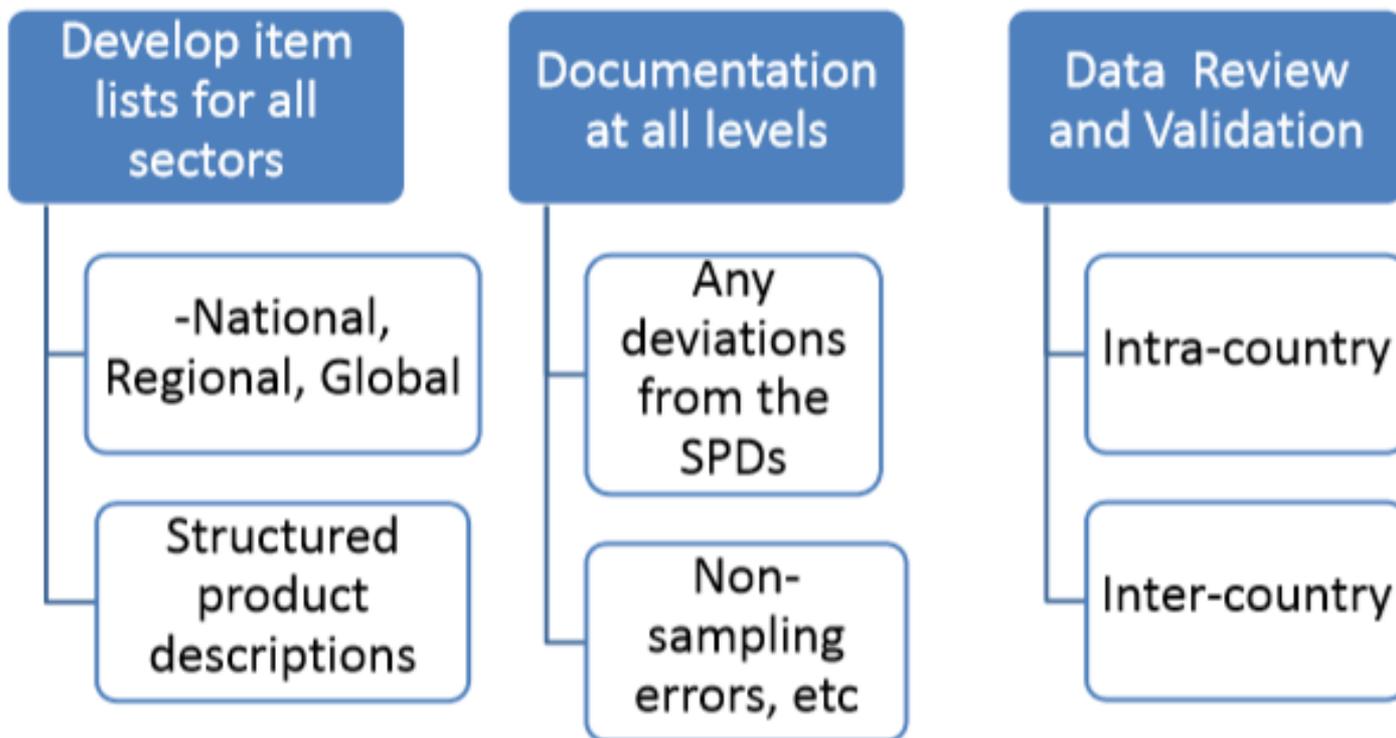
Economy Shares Within the Region

Real and Nominal GDP, 2011



4. Establishing comparability: The ICP essentials

Achieving comparability: Some considerations



Preparation of product list

- Role of item list:
- Item (goods and services) lists are central to the ICP
- They identify the items to be priced
- Enable pricing of comparable items
- Enable pricing of important (representative) products
- Lists includes those for: Global, regional, subregional and national

Product Catalogue for ICP Asia and the Pacific Price Surveys

HOUSEHOLD



Structured Product Descriptions (SPD)

- Structured product descriptions (SPDs) are
 - A generalised way of describing products
 - Characteristics *relevant to price* are described
 - E.g. quantity; packaging; dimensions etc
 - All household final consumption items are described
- SPDs are used
 - Used to identify specific products across countries
 - To improve comparability

SPDs: Example

Structured Product Descriptions

Item Name: Men's T-shirt, short sleeves, WKB
Brand: Well known
Brand stratum: Low
Quantity: 1
Unit of measurement: Piece
Type: Men's regular t-shirt Material: 100 %
cotton Package:
Style: Straight Length:
Sleeve length: Short Lining:
Collar: Round neck
Color: Single color
Pattern: Plain
Size: Adult medium
Exclude: underwear
Specify: Brand

Price Determining Characteristics

- ▶ Set of characteristics that mostly identifies specific item from the “other items”
- ▶ These characteristics determine the price of a specific item
- ▶ If one of the price determining characteristics is not met, the item will be different
- ▶ Usually quantity, packaging, brand, etc.

Comparability is crucial for robust comparisons to be made

- ▶ Products need to be clearly specified to ensure comparability
- ▶ A **tight product specification** is defined by very precise product description to minimize the variation of characteristics of product
- ▶ To achieve comparability, all the characteristics of the products priced across the countries must match the target specifications

5. ICP Data Requirements: Price and national accounts expenditure values

ICP in Asia and the Pacific: Scope and Coverage

- Conceptual Framework: Multilateral Price Indices and 2008 System of National Accounts (ensures comparability of GDP estimates and its components)
- Data Requirements: Prices and Gross Domestic Products Values
- Country coverage: states, regions, districts, counties reflecting annual national averages
- Geographic Coverage: Worldwide 199 country, 7 regions

What is GDP

- measures a country's economic output
- calculated as the market value of all final goods and services produced within a specific period of time by the enterprises resident in the country.
- ICP uses a one-year accounting period for PPP calculation for a given reference year.
- GDP also includes out-of-country production of a resident producer while excluding in-country production by nonresident producers.

Hierarchical Approach to ICP



The Expenditure Classification

- ▶ GDP main aggregates further divided into
 - 28 Categories
 - 63 Groups
 - 126 Classes
 - 155 Basic Headings
 - ▶ the level at which national accounts data are required for the ICP



Understanding basic heading

- Building blocks of the ICP comparison
- Lowest level at which explicit expenditure weights are required
- Consist of a group of similar well-defined products which should be relatively homogeneous
- Can be more heterogeneous than is theoretically desirable
- Provide the framework for editing reported prices
- PPPs are first calculated for basic headings and then aggregated to higher levels

Sample Basic Headings

Code	Basic Headings
<u>Bread and Cereals</u>	
11.01.11.1	Rice
11.01.11.2	Other cereals, flour and other cereal products
11.01.11.3	Bread
11.01.11.4	Other bakery products
11.01.11.5	Pasta products
<u>Meat & Fish</u>	
11.01.12.1	Beef and veal
11.01.12.2	Pork
11.01.12.3	Lamb, mutton and goat
11.01.12.4	Poultry
11.01.12.5	Other meats and meat preparations
11.01.13.1	Fresh, chilled or frozen fish and seafood
11.01.13.2	Preserved or processed fish and seafood

Basic Data Requirements

- a set of national annual prices for a selection of products chosen from a common basket of well-defined goods & services
- a breakdown of final expenditure on GDP by product group (basic heading) according to a common classification
- mid-year resident population
- all data should refer to the year of comparison - e.g. 2011, 2015, 2016, 2017

Price Data



Price Surveys: Annual national average prices

- ▶ Household consumption products
 - Product list: include global and regional list (including sub regional list)
 - ▶ Frequency: monthly (except for selected items)
 - ▶ Observations: minimum 15 quotations per quarter (more for larger economies)
 - ▶ Coverage: national including rural & urban areas
 - ▶ Outlet type: supermarket; dept. store; traditional market etc.
 - ▶ Prices: transaction prices
- ▶ Machinery and equipment
- ▶ Construction
- ▶ Government compensation
- ▶ Rental and dwelling

GDP expenditure values: National Accounts

- ▶ The SNA 93/2008 framework will be used for compiling the 2017 ICP
- ▶ The *expenditure approach* is required for the ICP
- ▶ Coverage should be exhaustive



Basic Data Requirements: GDP Values

- The main aggregates are subsequently broken down into 155 product groups or basic headings and GDP disaggregation is required at this level
- Each of these aggregates must follow the definitions, concepts and classification of SNA 93/2008
- To the extent possible be based on standard international classification structures:
 - COICOP
 - COPNI
 - COFOG
 - CPA/CPC

6. ICP data collection and validation

First establish that ICP Prices are

- ▶ From a set of national average prices for a selection of products chosen from a common basket of well-defined goods & services for a given period
- ▶ These prices MUST be consistent with national accounts (valued at market prices)



And that for prices to be consistent with national accounts then

- ▶ the underlying assumptions to ensure consistency of prices with the national accounts:
 - It should be **NATIONAL AVERAGE PRICE**
 - Coverage: Nationwide (urban and rural)
 - Periodicity: weekly, bi-weekly, Monthly or quarterly prices; semi-annual (depending on variability of items and the)
 - Valuation: At Purchasers' prices; Market prices/purchasers' prices

What and Where to Price?

What to price?

- Items listed in the regional and global price list
- According to exact specifications
- Record any deviations from regional or global specification
- *Record any deviations from national specifications*

Where to price?

- According to specified sample frame
 - Volume seller locations and outlets
 - From all types of outlets based on specifications
 - Representing the entire country/province/state/region and the entire period
- Only from locations and outlets specified in the sample frame.
- Record any deviations and rationale for collecting prices outside of the frame



How many quotations should we have?

IT DEPENDS!

- As many as needed to get a reliable measure of annual average price of an item for a province/region/state and ultimately for the country
- Varies from product to product
 - The more variable the prices are over time and space, the larger the number of observations/quotations to be collected
 - Broader the definition of a product, larger the number of quotations
- Varies from region to region
 - Larger regions need to collect more prices from more locations



Important Note! MUST BE CONSISTENT WITH THE SAMPLING PLAN!

Scope and Coverage, National Accounts

- ▶ GDP at current prices
- ▶ Values at the 155 Basic Headings
 - ▶ Individual Consumption Expenditures by Households
 - ▶ Individual Consumption Expenditures by NPISH
 - ▶ Government Consumption Expenditures
 - ▶ Individual (Health and Education)
 - ▶ Collective
 - ▶ Gross Capital Formation
 - ▶ Changes in Inventories Less Acquisition of Valuables
 - ▶ Balance of Trade

ICP Benchmarks: Scope and Coverage

▶ Household (110 BH)

- ▶ Bi-weekly, weekly, bi-monthly, monthly, and/or quarterly price collection
- ▶ Multiple collection centers
- ▶ 2011: 1,132 items
- ▶ 2017: 972 items*



▶ Machinery and equipment (7 BH):

- ▶ Annual price collection
- ▶ 2011: 190 products
- ▶ 2017: Around 150 products (starting point)*

▶ Construction (3 basic headings):

- ▶ Annual price collection
- ▶ 2011: 58 items (M: 41; E: 10; L:7)
- ▶ 2017: 58 items (M: 32; E: 5; L:18)*



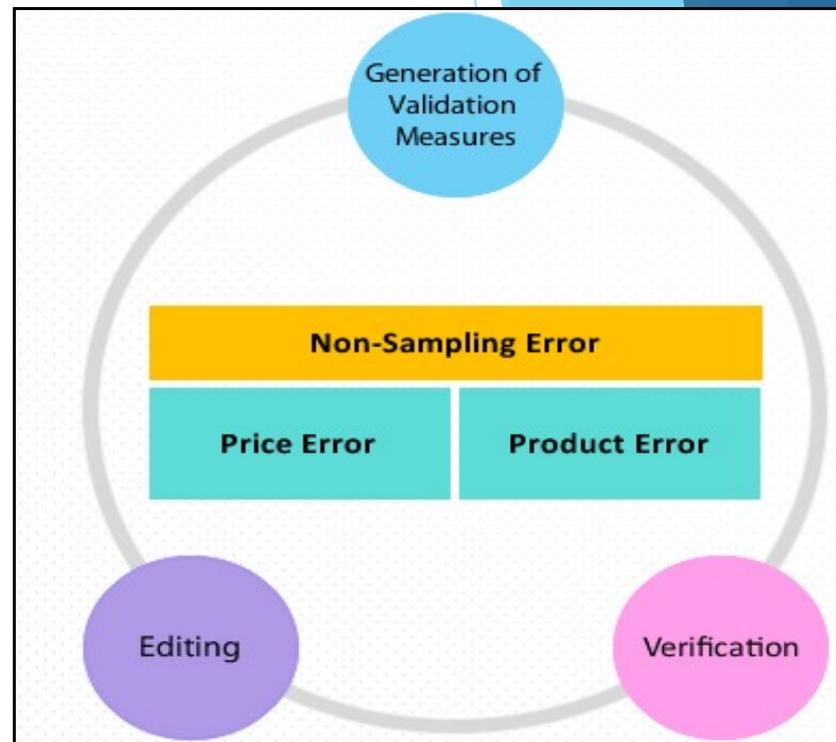
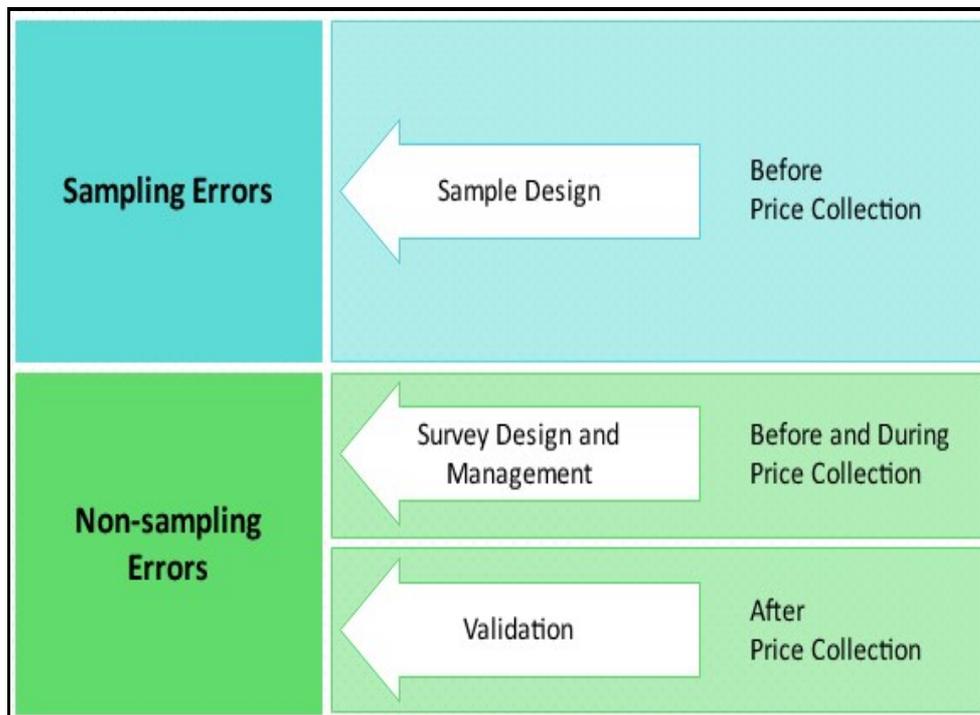
ICP Benchmarks: Scope and Coverage

- ▶ Compensation of employees in government services
 - ▶ Annual price collection
 - ▶ 2011: 44 occupations
 - ▶ 2017: 33 occupations

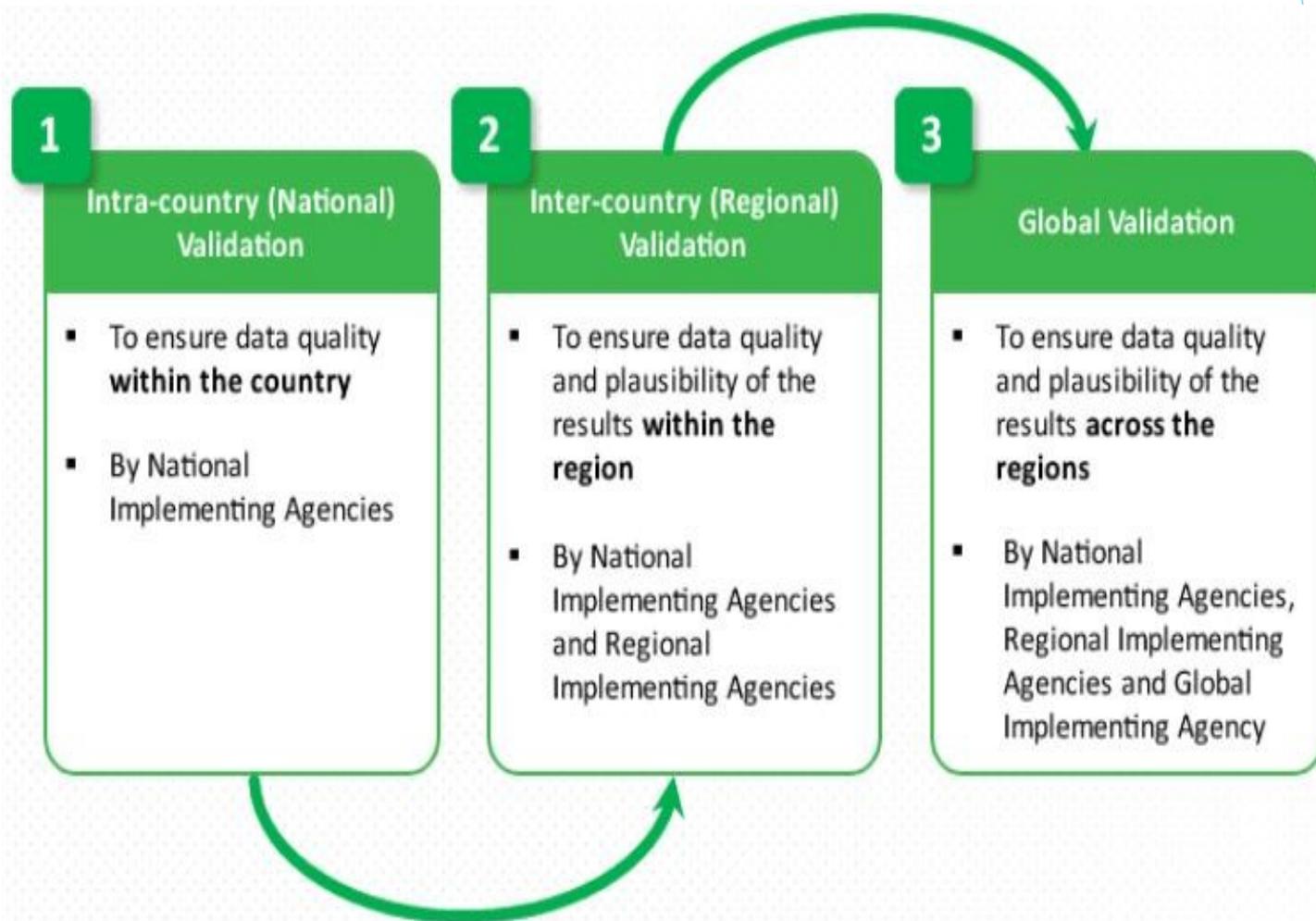


- ▶ Actual and imputed rents:
 - ▶ Annual price collection
 - ▶ Rental Survey
 - ▶ Dwellings

The need for data validation



Stages of data validation



Intra-Country Validation: Parity Within

Involves three validation

Within region/state/district/province

Across region/state/district/province

Across quarters

- ▶ Survey Frame Updates
 - ▶ Geographical coverage (urban/rural, area selection)
 - ▶ Frequency of price collection (including no. of quotations per price collection by item/BH)
- ▶ Summary Statistics by product
 - ▶ Products priced breakdown; number of quotations; summary on relative measures of dispersions (CV, Min/Max Ratios)
- ▶ Summary Statistics by location and by product
 - ▶ Products priced and location breakdown; number of quotations; summary on relative measures of dispersions (CV, Min/Max Ratios)

7. PPP estimation and tools



ICP PPP Estimation: Aggregation Process

Three Stages in Aggregation Process

Computing national annual averages of price observations

Aggregating prices to basic heading level parities

Aggregating basic heading parities to GDP and other sub-aggregates

PPP Calculation: Data Requirements

1

Annual National Average Prices

2

Basic heading PPPs, with country 1 acting as the reference country and its currency as the numeraire

Complete set of basic heading expenditures in national currencies



PPP Calculation: Three Stages

1

Annual National Average Prices
(NIAs)

2

Regional PPPs
(RIA)

Linking regional PPP to calculate
global PPPs

National average prices

Countries participating in the ICP compile detailed breakdown of final expenditures on GDP that cover the whole range of goods and services included in the GDP.

Expenditures are:

- Annual
- Expressed in local currency units
- Compiled by following the ICP classification
- Validated at national, regional and global levels

Elementary PPP

Average prices provided by the countries are used to calculate elementary PPPs, typically at the level of basic headings.

	Country 1	Country 2	Country 3	Missing Average Prices
Item 1 (e.g. white rice)	<avg. price>	<avg. price>	<avg. price>	
Item 2 (e.g. brown rice)	<avg. price>	<avg. price>		
Item 3 (e.g. basmati rice)	<avg. price>		<avg. price>	
	Country 1	Country 2	Country 3	
Basic heading (e.g. rice)	PPP	PPP	PPP	

PPPs are equivalent to *geometric mean* of item level price *ratios* for a country and the reference, or “base”, country IF there are no missing prices.

Since there ARE missing prices, a statistical method to calculate the PPPs is needed.

Elementary PPP Calculation

There are several methods for calculating elementary PPPs.

Unweighted Methods

- Gini-Éltető-Köves-Szulc (GEKS)
- Country Product Dummy (CPD)

Weighted Methods

- Gini-Éltető-Köves-Szulc star (GEKS*)
- Country Product Representativity Dummy (CPRD)
- Weighted Country Product Dummy (CPD-W)

Elementary PPP Calculation: CPD

CPD is a statistical method that is used to derive PPPs by regressing the logarithm of observed prices against a set of *dummy variables* that are defined with respect to the **products priced** and the **participating countries**.

The regression equation for the CPD can be written as:

$$\ln p_{ij}^h = \sum \alpha_j C_j + \sum \beta_i P_i + \varepsilon$$

Where

$i = 1, \dots, M$ products; $j = 2, \dots, N$ countries ; $h = 1, \dots, K$ basic headings
 $\ln p_{ij}^h$ is the natural logarithm of price for product i in country j
 C_j is country dummy which takes the value of 1 when the price is for country j , otherwise zero; C_1 is dropped because country 1 is the base country
 P_i is product dummy which takes the value of 1 for product i , otherwise zero
 ε is an error term



PPP Calculation: Properties of Price and Volume Indices

Base country invariant

- all participating countries are symmetrical so the results are no different to the chosen base country

Commensurability

- All produce results that are invariant to changes in the units of measurement for prices and quantities

Transitivity

- Requires that every indirect parity PPP_{jk} should equal the corresponding direct parity PPP_{jk}

Reference PPPs

Reference PPPs are estimated and used for basic headings for which:

- No prices are collected.
- It is not possible or difficult to obtain reliable price information.



Reference PPPs serve as proxies for the missing PPPs.

There are three types of reference PPPs:

1. Price-based
2. Volume-based Reference PPPs
3. Exchange rate-based Reference PPPs

PPP aggregation

Elementary PPPs are aggregated by using national account expenditures as weights to obtain PPPs for each aggregation level up to GDP.

	Country 1	Country 2	Country 3	Country 1	Country 2	Country 3
BH 1 (e.g. <i>rice</i>)	PPP	PPP	PPP	weight	weight	weight
BH 2 (e.g. <i>cereals</i>)	PPP	PPP	PPP	weight	weight	weight
BH 3 (e.g. <i>bread</i>)	PPP	PPP	PPP	weight	weight	weight

A Matrix of PPPs and Weights



	Country 1	Country 2	Country 3
Aggregate (e.g. <i>bread and cereals</i>)	PPP	PPP	PPP

The aggregation of PPPs is undertaken separately for each level of expenditure up to the level of GDP.

PPP aggregation: Methods

As with the estimation of elementary PPPs, several methods exist to aggregate PPPs.

Additive

Not Additive

No Gerschenkron Effect

GEKS
Gini-Éltető-Köves-Szulc

Minimizes
Gerschenkron Effect

IDB
Iklé-Dikhanov-Balk

Subject to
Gerschenkron Effect

GK
Geary-Khamis

Choosing the method

Selection of the aggregation method depends on the intended use of the estimates.

When comparison of *real expenditures* between the countries has priority.

GEKS

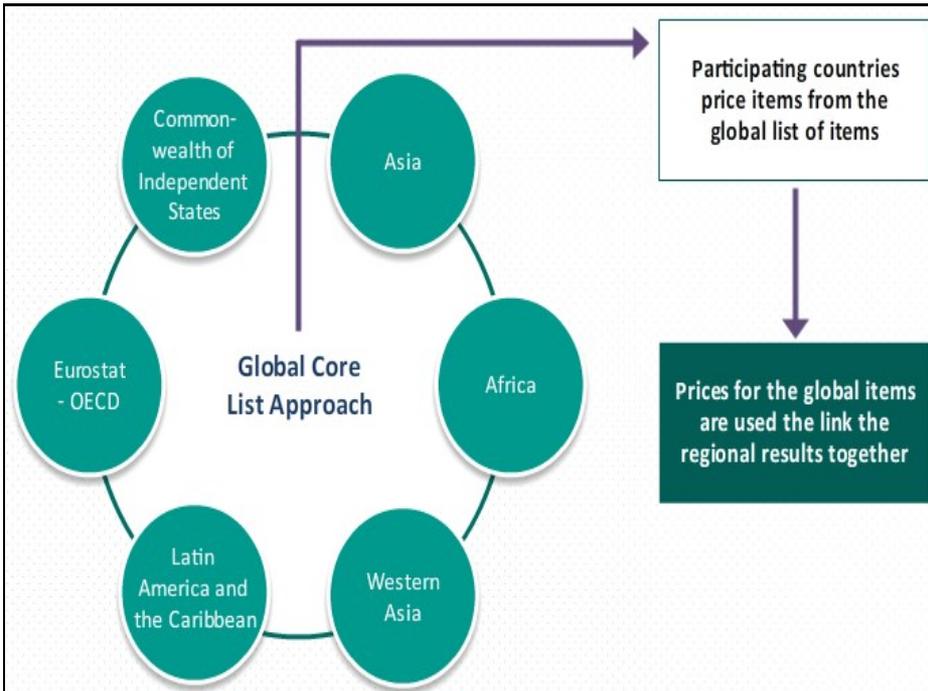
Official ICP Method

When additivity has priority.

IDB

GK

Linking regional PPPs



To calculate the global PPPs (US\$=1) the following inputs are required for each participating countries and regions:

Global core list item prices in local currency

Regional PPPs at the basic heading and aggregate levels following the ICP classification

National accounts expenditures at the basic heading level in local currency

Annual average market exchange rates to the U.S. dollar

The linking is carried out in two stages:

At the basic heading level

At the aggregate level

ICP Tools for all

- World Bank:
 - ICP Toolpack
 - Also developed excel macros for index number calculations including complex estimates of CPD and GEKS
- ADB: has the Asia Pacific Software Suite to:
 - Manage country and regional data for PPP computation
 - Automate the system of survey administration, data collection, data validation, data processing and reporting
 - Country modules were for each component requiring data collection and validation (Household, Compensation of employees, construction, equipment, rental, etc.)

8. In summary...

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The Organisation for Economic Cooperation and Development (OECD)

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WORLD BANK GROUP

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- Shared prosperity
- Health systems
- Energy dependency, efficiency and carbon dioxide emissions
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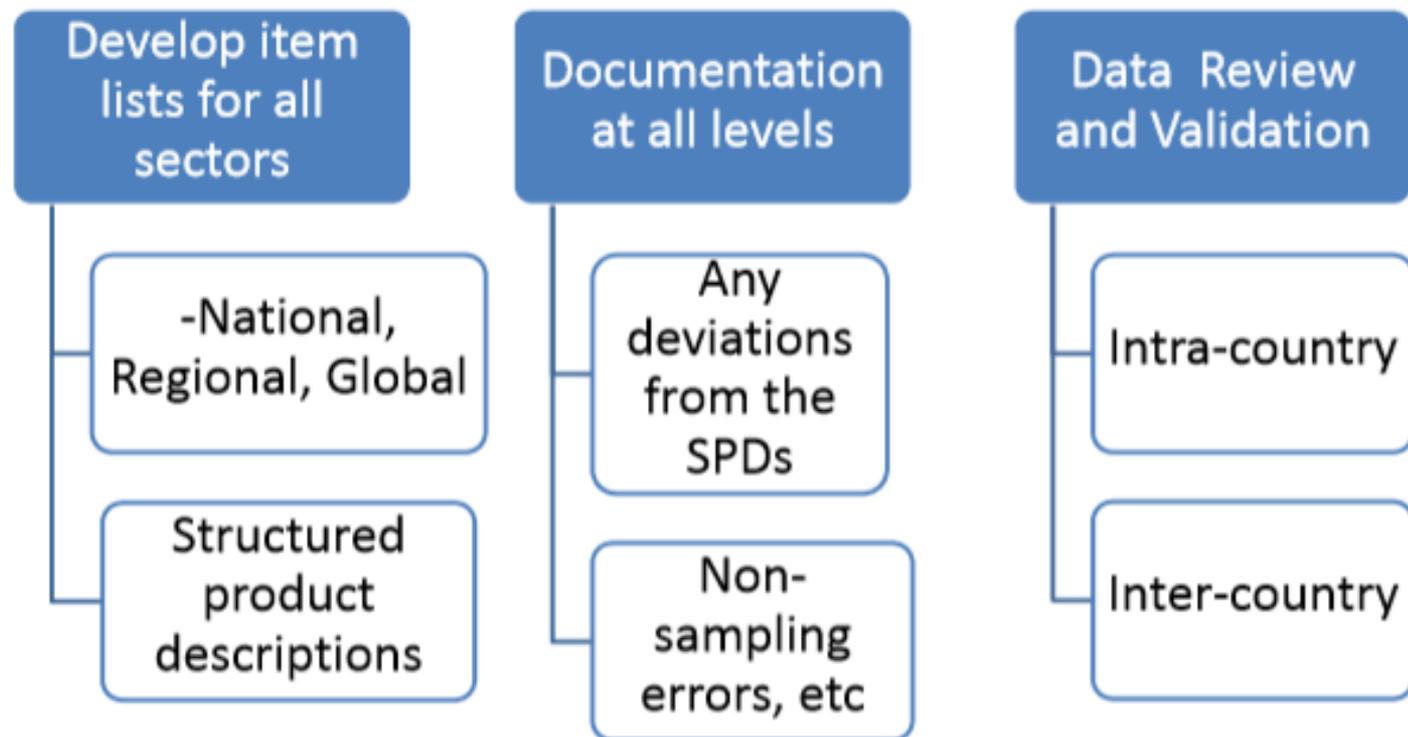
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Source: World Bank Group, 2018



How can comparability be achieved?



What are the ICP Data Requirements

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Linking regional PPP to calculate
global PPPs

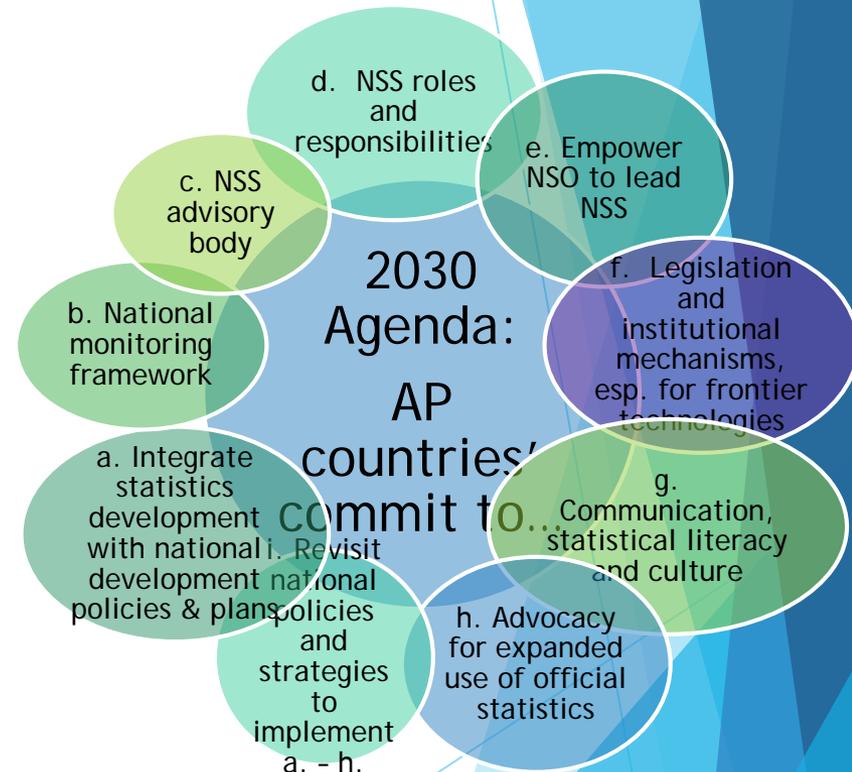
9. Challenges ahead...

Challenges ahead...

The UNSC has recommended the institutionalization of the ICP at all levels

Ensuring that “no one is left behind” necessitates greater collaboration and data integration at all levels

In Asia-Pacific, countries have made nine commitments including to use frontier technologies, big data, new methods to meet targets of the 2030 Agenda and the SDGs



Adherence to the key principles in the ICP process has the potential to achieve positive outcomes.

Collaboration

Transparency
in process

Replication

Emphasizing on transparency

Keeping everyone informed

Involving every party in the process

Proper documentation at all levels

Sharing of critical information to increase levels of understanding

Inclusive discussion and resolution of issues

References

- ▶ Asian Development Bank, 2016 and 2017 presentations
- ▶ PPP eLearning course, World Bank Group, <https://www.worldbank.org/en/programs/icp/brief/e-learning>

Thank you

Eileen Pantua Capilit
Economic Statistics Consultant
Statistics Division, UN ESCAP

Eileen.Capilit@un.org; ecapilit@yahoo.com

Skype ID: e_1002

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