Increasing the Efficiency of Price Survey Frameworks in the ICP

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A. Introduction

The International Comparison Program (ICP) has become the world's largest statistical initiative. The ICP is a worldwide statistical program to collect comparative price data and estimate purchasing power parities (PPPs) of the world economies. In order to make cross country comparisons of their economic output and the welfare of their inhabitants, it is necessary to convert the main economic indicators to a common currency. These comparisons are best made using PPPs as currency converters instead of exchange rates. Exchange rates are determined by the flow of international transactions and do not reflect differences in price levels; therefore, may not provide an accurate measure of the real value of a country's output and the standard of living of its residents.

The System of National Accounts, 1993 (SNA93) provides a common international framework for the measurement of economic activities across the world as measured by the Gross Domestic Product (GDP.) The GDP provides the framework for the collection of price statistics and the estimation of PPPs. The GDP expenditures are divided into 155 basic headings which are the level at which PPPs are first computed.

A major use of PPPs is for the estimation of the widely used "dollar-a-day" international poverty threshold which is $1.25 in 2005 international dollars. This threshold is based on PPPs from the household expenditure components of the ICP. Household expenditures make up 110 of the 155 basic headings into which the GDP is divided. This paper focuses on the methodology used to estimate PPPs for the 110 household consumption basic headings with specific attention paid to the use of these data to not only compare economic aggregates across countries but for poverty analysis.

The next section provides an overview of the methodology used to estimate PPPs. Section C describes how the products making up the population for each basic heading are defined. In section D, guidelines used to determine the number of products to select. Section E provides guidelines followed by countries to determine the survey population and sample of outlets where the prices will be selected. The paper concludes with steps taken for the 2011 ICP.

B. Steps to Estimate Purchasing Power Parities

The first step is to divide the household consumption expenditures of the GDP into the well-defined basic headings. For example, the food aggregate contains 29 basic

headings. Rice is a basic heading; beef and veal is a basic heading; and fresh or chilled fruit is a basic heading. The foundation of the PPPs is that they are based on national prices a basket of goods and services that are comparable across countries. In addition to the comparability requirement, the basket to be priced should contain products that are an important part of each country's expenditures within a basic heading.

It is for comparability purposes that the world is divided into six major regions. Each region develops a basket of goods and services that are representative of expenditures of its countries. While this is an efficient way to compare prices between countries within regions, it is also important that countries across regions be compared. For example, PPPs for China and India can be computed between countries within Asia, but not between say Brazil or the US. This linking across regions was achieved in 2005 by selecting a subset of countries within each region to price both their regional list of products, and also a global list which was essentially a composite of the regional lists. This global list was referred to as the ring list and the price collection as the ring survey. The results from the global ring survey are used for the analysis shown in the next sections.

C. Defining the Population of Products within Basic Headings.

The major dilemma faced by every ICP round is how to determine the products to be priced by the different countries. Each country will want to price products that account for a major part of the consumption of its citizens and are representative of its economic structure. However, it is also critical that the products be comparable across countries. For this reason, strict standards were developed for the ICP 2005 to define the products to be priced using Structured Product Descriptions (SPDs) described in the ICP 2005 Handbook. Using the rice basic heading as an example; rice in its generic form is a product. However, it comes in various forms; white and brown rice, long, medium, and short grain, varieties such as basmati, which can be sold under a brand name in a variety of package types and sizes. Quality can enter into the dimension as well by various specified percentages of broken rice. Rice is a fairly simple product compared to other household products such as clothing or non traded services.

The very specific process to describe products within a basic heading as developed for the 2005 ICP was developed to control price differences caused by quality differences. The serious concern is that comparisons of the cost of living between rich and poor countries can be affected by the economic gradient in the quality of products consumed. Rice sold loose with 20 % broken kernels is more likely to be consumed in a poor country while the rich country may more likely consume parboiled rice sold under a brand name. Ravallion, Chen, and Sangraula (2009, p. 178) cite the use of precisely specified definitions of goods and services as an important reason for the large increase in PPPs from previous estimates. Deaton (2010), raises a similar concern that in the attempt to match goods and services precisely across diverse countries for the ring survey, high-end "western" goods and services were priced in poor African countries where if they could even be found, it was only in a few specialty stores in the main city.

The problem could be resolved if each country could provide expenditure weights for every product within a basic heading. However, that is not possible resulting in all prices within a basic heading receiving the same weight regardless of their importance. To overcome this dilemma, the Eurostat-OECD has each country place every product within one of two categories—representative or non representative. A "representative" product is one whose expenditure share is important and whose price is representative of the price level of products in the basic heading. This concept was attempted for the 2005 ICP, but countries were not able to consistently apply the definition. Additional training and emphasis on the concept is being applied to the 2011 prices. Countries are asked to define which products are important; the evaluation of the price levels will be a part of the data validation steps.

If products can be classified as "important" and "representative", then the weighted Country Product Dummy (CPD) method can be used to assign more weight to those products when estimating the basic heading PPPs. The expectation is that the important and representative products have lower prices because they are sold in larger quantities.

Once the detailed product specifications have been prepared; each country will identify those products in each basic heading important to its economy. These are also products similar to those included in the data collection for the Consumer Price Survey (CPI); but because of the more specific descriptions may not be exactly the same products. Products important to country A may not be important in country B or C which will have other products important to them. In order to ensure overlap for the estimation of PPPs, countries are asked to submit prices for products not important for them but important to other countries.

D. The Number of Products to Select within Basic Headings.

Data from the 2005 ring price survey are used to illustrate how to evaluate specificity of the product specifications, the classification into importance or representative, and to determine the number of products that need to be priced within basic headings. This section is based on the ring price survey data to point out the sources of variability inherent in the estimation of basic heading PPPs when the CPD method is used. Table 1 shows the diagnostic variables provided by the CPD regression used to compute basic heading PPPs.

- The main diagnostic is the CPD residuals. Product prices in national currency are converted to the currency of the base country (PPP price) the average of which is the international price. The CPD residual is the ratio of each product's PPP price to the product's international price.
- There are two dimensions to the CPD model, the country dimension and the product dimension. The variability of the residuals for a country provides a measure of the dispersion of price levels for the different products it priced. The product dimension shows the variability in relative prices for each product across countries. Standard deviations are shown for the product and country components.

The product dimension is shown by the residuals across countries. The residuals for long grain rice, prepacked , range from .66 in country E to 1.31 in country D. This means that the price for long grain rice in country E is 66 percent of the international average price for long grain rice. The table is a subset of the matrix that includes the 18 ring countries; the standard deviations shown for each product represent the variability across the 18 countries. The standard deviation for short grain rice; 0.34, suggests that the product specifications are either too loose or that there may be a price error.

The country dimension is shown by the column of residuals by products. Long grain rice, prepacked, is relatively cheap in country E while brown rice is expensive. Country E only priced three items which implies the others were either not available or it only priced products it classified as important. However, brown rice is expensive in country E suggesting that it is not representative of its prices. Country D is the only one that priced every item which suggests it priced both important and less important items. The residuals in country D range from .22 to 1.31 pointing out the need to further classify the prices as important and representative. The variability of relative prices within a country points to the need to have some form of additional weighting to reflect the importance of each.

The standard deviation of the residuals by country can also be used as a guide to determine the number of products to price. Even though the sample of products is not from a random selection, the principles of sampling theory can be used to provide guidelines to determine the number of products to be priced. The goal is to price enough products that the sampling error of the country residuals is within a target level of precision. Rice is a homogeneous product compared to others such as clothing or medical products.

Table 2 shows the standard deviation of the country residuals across products. There is very little variability for electricity rates within a country because the number of providers is limited and rates are often regulated. For that reason, only a small number of prices are needed. The garment basic heading includes children's, women's, and men's clothing; a very heterogeneous set of products. Because of this variability, between 70 and 100 products should be priced by each country. The choice of a number within this range depends on the relative expenditure shares of the basic heading. Where clothing makes up a significant part of the consumption expenditures, then more precision should be sought by pricing more items. However, if expenditures are low, then the smaller number should be priced.

Not every country will be able to price every product. For that reason, the target number of products will have to be increased so that each country can price the minimum number.

E. Defining the Survey Population and the Sample of Outlets.

The target price for each product is the national annual average price which should be the weighted average of quantities sold times the prices. A major concern of poverty researchers was whether the prices collected by the ICP adequately reflected the rural areas where there are large levels of poverty. A related concern was whether the basket of goods reflected what the poor purchase.

Ideally, each country should have a frame or register of all sales outlets along with their volume of sales. The problem is that even though broad measures of size may be available, they may not reflect the sales of individual products. For example, a meat market may also sell fresh vegetables. Most countries use their CPI survey frame and add to it for ICP products not in the CPI or if a larger sample is needed.

In order to provide more information for data analysis about where products were purchased, countries are asked to provide an indicator of outlet type and location to each observed product price. Table three shows the outlet types and the location indicators which are capital city, other urban, and rural. A strong emphasis is being placed on the use of these classifications to provide more information about the data underlying the national annual average price. The goal is that the individual price observations making up the national annual average prices be coded to reflect outlet type and location be made available to researchers to further understand the sources of price variability and whether the products sold differ between urban and rural areas.

The selection of outlets should be proportional so that data are self weighted. That simply means that if supermarkets account for 30 percent of the sales, then 30 percent of the outlets should be of the supermarket type. Basic sampling theory is used to provide guidelines on the outlets to include in the national price surveys. Table 4 shows the number of outlets needed in order to reach desired levels of precision. Where a produce such as rice is a major part of food consumption, the goal should be to have a price with greater precision than for a product of lesser importance.

Since the product descriptions are very precisely defined, one would not expect there to be a great deal of variability. Therefore, a product with a relative standard deviation greater than .30 may be too loosely defined and suggests the definition be reviewed. Table 4 shows target sample sizes by desired precision and relative standard deviations.

F. Summary

While there is a very large set of literature on estimating PPPs and other index numbers, there is very little said about the survey framework. This paper provides an overview of what should be considered when defining the products to be priced, the number of products needed in each basic heading and the size of the price surveys. Greater attention is being paid to the classification of products as important or representative, especially for the core list that will be used to link regions. Since it is a global list, each country will be

pricing products that may be available, but not an important part of what is actually consumed. In these cases, the source of the prices by outlet and location will be critical information.

Table 1 Variability of PPP Prices by Product and Country

	CPD residuals[a]						
	Country A	Country B	Country C	Country D	Country E	Country F	STD DEV
Rice (basic heading)							
Long grain, prepacked	0.95			1.31	0.66	0.69	.25
Long grain, loose		0.88		1.00			.23
Basmati		1.02		1.34	1.16		.28
Medium grain		1.32		0.22		1.45	.22
Short grain	1.05	1.05	1.27	0.39			.34
Brown		0.80	0.55	1.22	1.31	1.00	.29
Basic heading PPP (base not shown)	1.795	853.1	1,047.0	4.801	19.98	319.6	
Standard deviation of residuals[b]	0.05	0.172	0.236	0.285	0.298	0.303	
Relative sampling error[c]	0.035	0.077	0.169	0.117	0.172	0.175	
90 percent confidence interval	±0.058	±0.128	±0.282	±0.195	±0.288	±0.292	

Source: International Comparison Program.

[a] Shown as the ratio of each product price converted to the currency of the base country (PPP price) to the geometric mean of the PPP prices across countries for each product. The geometric mean is the "international price" of each product. The countries shown and residuals are a subset of the 18 countries making up the matrix

[b] Expressed as ratios, the standard deviation of the residuals provides an estimate of the variability of the relative product prices in each country.

[c] Standard deviation divided by the square root of the number of products priced.

Table 2 Examples of Target Numbers of Products to Price

Product	Standard deviation of relative prices	Target number of products to price	Number in 2005 Ring survey
Rice	0.05–0.30	10–15	6
Fresh or chilled fruit	0.19–0.37	10–15	12
Garments	0.24–0.30	70–100	68
Electricity	0.03–0.17	3–5	5
Pharmaceuticals	0.26–0.38	50+	43

Source: International Comparison Program.

Table 3 Outlet Types and Location Indicators

Outlet type	Examples	Capital city, other urban, rural
Large shops	Supermarkets, hypermarkets, department stores	
Medium and small shops	Mini-markets, kiosks, neighborhood shops, grocery stores, convenience stores	
Markets	Open markets, covered markets, wet markets	
Street outlets	Mobile shops, street vendors,	
Bulk and discount stores	Wholesale stores, discount stores	
Specialized stores	Supply stores, hardware stores, furniture stores	
Private service providers	Taxi cabs, hotels, restaurants, private schools, private hospitals	
Public or semi-public service providers	Water suppliers, electric power companies, public schools, public hospitals	
Other kinds of trade	Online (Internet) shopping sites, catalogue orders	

Table 4 Sample Sizes by Target Precision and Relative Standard Deviation, with 10 Percent Significance Level

Target precision (%)	Estimated relative standard deviation: *s/m*				
	0.05	0.1	0.2	0.3	0.4
	number of price observations--outlets				
5	3	10	45	100	176
10	1	3	10	25	100
15		1	5	10	20

REFERENCES (RÉFERENCES)

Chen, Shaohua and Martin Ravallion, 2008, —The Developing World is Poorer thet We Thought, But No Less Successful in the Fight Against Poverty" Policy Research Paper 4703, The World Bank.

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RÉSUMÉ (ABSTRACT)

The foundation of the PPPs coming from the International Comparison Program (ICP) is that they are based on prices for a basket of goods and services that are comparable across countries. In addition to the comparability requirement, the goal is that the basket to be priced includes products representative of individual countries. The tension between comparability and representativity is reviewed by examining the interaction of several factors that affect the reliability of Purchasing Power Parities (PPPs). The first is the specificity of the price-determining characteristics and how that relates to the number of products to be priced. Both depend on the heterogeneity of the product groups, and the amount of overlap of the products across countries. All of these factors have to be considered in the sample design to determine the number and types of outlets to be included in the price collection. A final requirement is that national annual average prices be provided for each product or service.

The paper illustrates the sources of variability inherent in the estimation of PPPs and presents how the understanding of those sources can be used to define the products to be priced, classify them according to their importance, set targets for the number each country should price, and define the scope and coverage of the data collection by outlet types and the rural/urban domains in order to provide national annual average prices.