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Poverty

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USE OF COUNTRY PURCHASING POWER PARITIES FOR INTERNATIONAL COMPARISONS OF POVERTY LEVELS: POTENTIAL AND LIMITATIONS

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Introduction

Individual scholars and expert groups have considered both physical and monetary measures to define a poverty line. Physical measures might be based upon caloric intake, or as considered in India, the number of square meals (thoughtfully defined) in a sample period and the purchase of clothing, with some experts also arguing for an inventory of physical household assets. The attraction of choosing physical measures is that they appear to avoid the necessity of converting currencies across countries to a common measure. However, the survey problems of identifying those below such thresholds, or of choosing equivalent food baskets across space to obtain the same caloric intake, involve problems as knotty as those using monetary measures. In any event, the focus of this paper is on monetary measures of poverty and takes up two interrelated issues of comparing poverty levels: what prices and what expenditure weights should be used when comparing the purchasing power parity (PPP) of currencies, either across or within countries, such as across rural and metropolitan areas.

Section A outlines the usual method of counting those in poverty across different geographic areas, including the limitations of past practice and the potential of modifying current practice using the aggregate PPPs from the International Comparison Programme (ICP) and the Penn

World Table (PWT). An Appendix describes the estimation of PPPs and compares the PWT approach to that of the World Bank. In Section B the nature of the prices that may be specific to sections of the population (such as the very poor, or the rural versus the urban residents) is discussed, including the recent work of Deaton, Friedman and Alata (2004). Section C describes the results of an exercise designed to create more appropriate 'poverty PPPs' than currently published.

Generating Poverty Counts Across Space

There is a voluminous literature on this subject at the national level where this exercise began in the 1960s. Typically, monetary measures of poverty lines have been based on a particular consumption bundle, or as a percent of median consumption in the country. In either case, the poverty count provides a snapshot of the number of persons below the line. This type of poverty count has the great policy advantage that it can change, hopefully going down over time.

Within large countries such as India, which first introduced poverty reduction as a national planning goal, there may be lower poverty lines for rural areas, because some prices in the consumption bundle will be lower than in urban areas. If one wants to create an international poverty line, the problem of converting monetary measures becomes critical.

The factor used to make currencies comparable across countries, whether it is an exchange rate or purchasing power parity, does not change the underlying economic inequalities around the world. However, it does significantly affect the perception of the extent of poverty and the

economic size of countries. At PPPs, the economies of China and India are ranked among the world's top seven, but not so at exchange rates. Similarly, if one took a simple poverty line such as one quarter the world per capita income average, the proportion in poverty was near eighty percent in Asia at 1980 exchange rates, while at PPPs this proportion is closer to fifty percent[1]. Since writing this paper the World Bank has released a draft benchmark purchasing power parity study for 145 countries for 2005. It provides a much larger spread in country incomes than in previous ICP studies, or in the Penn World Table. In 2005 the report shows that 84% of the population was under half the world per capita income average, while at PPPs the proportion drops to sixty-six percent, or two-thirds of the population under the world per capita income average.[2]

What PPPs Should be Used?

The ICP was designed to produce detailed data on prices and expenditures of goods and services that entered into the calculation of countries' gross domestic product (GDP). These so-called benchmark comparison surveys have been undertaken for various years beginning in 1970 through 2005. The surveys enable the calculation of PPPs at various levels of aggregation, from basic heading expenditures such as Food, Transport, Housing, and so forth, to aggregate expenditures such as Consumption, Investment and Government. The OECD countries now undertake their own surveys producing annual PPP comparisons for a number of European countries, while the Penn World Table (PWT) group includes other countries and estimates a time-series going back to 1950. The World Bank has also produced an aggregate PPP for GDP, and is now leading the efforts for a new global ICP benchmark survey with a reference year of 2005.

The ICP concept of consumption differed slightly from the 1964 SNA (System of National Accounts) framework, because it included private consumption expenditures plus those parts of government expenditures on health and education directly consumed by households. In 1993 the SNA adopted this convention and called it Household Actual Final Consumption, distinguishing it from the old SNA concept of Household Final Consumption Expenditures. The OECD countries have all followed suit, and consumption in PWT 6.1 (2002) is equal to Household Actual Final Consumption when possible, although most developing countries still use the old SNA concept. There is a significant political and economic debate in some countries as to whether publicly provided goods and services should be included in the poverty line, and this is also an important research question. In practice, the question of publicly provided services is beyond the scope of this paper. If it were possible to add these services to survey data to obtain actual household final consumption by income or expenditure decile, it would clearly be valuable to calculate both SNA concepts. Hopefully this will become feasible in the 2005 round of the ICP.

In the 2005 World Bank Report, the concepts of actual consumption and household consumption are both presented. It is important to note that some of the differences between the 2005 ICP and earlier rounds is due to comparisons for non-priced government services in administration, health and education.[3] What was done in Africa, Asia and West Asia was to make an adjustment that reduced the GDP of these countries by ten percent or more compared to the treatment in earlier benchmarks or PWT. However, this adjustment does not affect household consumption, which is the focus of this paper. For a fuller discussion of the differences between the 2005 and earlier

studies see Heston (2008). The likely impact of the new ICP numbers on the World Bank poverty lines and counts is discussed in this volume by Martin Ravillion.

Use of the PPP for consumption is clearly more appropriate than the PPP for Gross Domestic Product for converting any common international poverty line into local currencies. Both are available from the benchmark ICP surveys (1970, 1975, 1980, 1985, and 1993), and for a larger number of countries in the World Bank, as well as for intermediate years up to 2002 in PWT. Are there other PPP concepts that should be considered? One alternative would be to use consumption weights specific to the poorer income groups. This is a fairly natural extension of what is done in temporal price indexes where one might estimate a consumer price index for subgroups of the population like the elderly.

In Section B we further discuss the sensitivity of PPPs to consumption weights. Since poverty studies have conversion factors for currencies estimated in different ways, we have included in an Appendix the PWT methodology and a comparison with the World Bank estimates of consumption PPPs.

What Prices Should be Used?

Estimation of Consumption PPPs or some other aggregate PPP, such as Food PPPs, or Housing PPPs, is not easy, even if there is agreement on all the methods to be employed. This is partly because there are multiple layers of items within each basic heading, such as Flour, Meat, Rice and Vegetables within Food, or Household Appliances and Furniture within Housing. One of the key issues involves the common practice of obtaining a national average item price from each

country. For example, the price of one pound of a bag of white Flour[4] within the Food basic heading can be averaged across a number of outlets and several time periods. But when we are focused on a particular population group, namely those in poverty, do national average prices make sense? They probably do in small countries, because most of the evidence suggests that the poor are affected by the lack of capital that constrains them to buy in small quantities, not necessarily that they pay higher prices for the same items. However, in larger countries, there may be significant regional price differences that require more than one poverty line in order to not over-count the poor in some areas and under-count them in others.

Items Consumed by the Poor

Consider an item about which millions of us are experts, haircuts. On a summer day in Beijing circa 2000 one could get a haircut at shops with varying amounts of amenities. Excluding hotels, the charges might range from 10 to 15 yuan in shops down to 1 or 2 yuan for no-overhead service on the street. Most PPP estimates will choose a shop that might be found in a range of other countries. As long as the prices in such shops represent the relative costs of these services in different countries, the comparisons may still be reasonable, even if they do not explicitly price street barbers.

However, the existence of phenomena like street barbers raises some larger questions. If we consider provision of a minimum bundle of necessary goods and services as the basis for determining the cost of a poverty bundle, then what do we do about items like street haircuts that may only be consumed by the poor? Other examples include rice with broken grains that is indifferently sorted and cleaned, inferior grains like *ragi*, in India, second hand clothing or cloth

remnants, and a wide variety of inferior or makeshift housing. The present state of PPP estimation, at best, only represents consumption of goods and services in the relevant expenditure heading that are available in a wide range of countries.

The Prices to the Poor Question

Outlets and items used in the ICP are those thought important in the expenditures of each country, and often the items representing a heading in one country will be different from those in another country. But do the poor pay different prices for the same items than the middle and upper classes? Those in the PPP estimation business are silent on this issue, and if asked, will say we would be glad to have such data if only countries collected them.

In an early study, Kunreuther (1973) set forth a simple model to examine this question, taking into account size of packaging, type of outlet, and inventory costs of large package sizes or bulk purchases. He found that in New Haven the same package size was more expensive in small stores than chain stores, and that price per physical unit declined with increasing package size.[5] The link to poverty occurs in where stores are located, where the poor make purchases and the size of package they purchase. His result was quite clear. The poor purchased in smaller size packages in smaller stores. Why? Chain stores were not in poor neighborhoods and the poor had less access to their own transport to travel to larger stores. The poor interviewed in the Kunreuther study traveled smaller distances than the more affluent, and had less ability to store goods. In addition to the storage constraint, the poor had weekly per capita purchases that were about two-thirds those of the middle class sample interviewed. The poor also made more frequent purchases suggesting that storage and liquidity constraints may have both operated to

produce purchases of smaller size packages.

That was New Haven in 1973. A study in northeast Brazil by Musgrove and Galindo (1988) reported a somewhat different result when they looked at small and large stores in large, medium and small cities. Their study was in 1985 and in an attempt to overcome the effects of the overall rapid inflation in Brazil, they concentrated the survey into two weeks in a month with only (!) a 5.4% price increase. Whereas Kunreuther found that neighborhood stores sold the same size package at a price typically 10 to 15% higher than the chains, Musgrove and Galindo did not find such a consistent pattern, with some items like manioc flour being sold at lower prices by small retailers. Further, they report that for items sold in bulk, like beans or rice, the price per unit was the same whether the size was a cup or a much larger quantity. A limitation of their study was that it relied solely on the response of storeowners. They did not have direct information on where the poor made their purchases or at what prices, a point that Deaton makes even more strongly. However, it does appear that in urban areas of Brazil the poor do not face different prices for the same goods as the rich, in part because many neighborhoods have a wide range of socio-economic groups living in close proximity, which is not to say that lack of capital does not constrain the size of unit that the poor purchase.

Another question is whether we can learn anything from the prices of goods that are thought to be purchased solely by the poor. Examples of such items are day-old bread, inferior grains, used clothing, or street corner haircuts. In the current round of the ICP several items were consistent for pricing across African countries. If the PPPs are similar to other consumption items between countries, then it would suggest that comparisons across countries can be carried out on the basis

of typical items of consumption. However, those purchasing day old bread or used clothing need no proof that they are in poverty to buy these items, so there is only a presumption that they are mainly purchased by the very poor.

V. Rao (2000) dealt with this question in a study of villages in South India and found that, because the poor buy in very small quantities, the price paid per kilogram of basic food items is higher than for the middle classes. For example, a kilo of yellow split peas would cost Rs. 28, and a 100 gram purchase, Rs. 3.50. While poor families in a week may buy grains in sufficient bulk, important commodities like *pulses* may, as in the above example, have a 20% higher unit cost. Similarly cooking oil is often purchased by the poor in 100 gram lots, raising the unit price. In rural areas, there may be little effect of outlets, but Rao found a significant effect of size of purchases on the cost of a given quantity of consumption goods between the very poor and better off villagers.

What of urban areas of India? Anecdotal evidence abounds. Sales of individual cigarettes at small street stalls reveal the same higher costs per unit as a correlate of low income and/or little liquidity.[6] Even when prices per kilogram are similar for larger and smaller size purchases, there is typically in India a valuable gift with the large package[7]. Is there an outlet effect for the same size of purchase such as in New Haven, but which was not systematically evident in northeast Brazil? Certainly the ICP framework has in the past provided no basis for examining this issue.

An exercise carried out by Perling (2002) collated some 2,800 price observations on thirteen commodities and services in rural and urban areas of China, Hong Kong, Thailand, Malaysia and

Singapore. Although the items surveyed comprised more than the Big Mac, they were not statistically rigorous in terms of the sampling framework, and the results are only suggestive of the type of survey that would address some of the issues raised in this section. The table below provides summary results for three items in Perling's study, a durable item, batteries, a perishable, onions, and a service item, haircuts for men. In Table 1 the price level of each item is presented. The base for the comparisons are prices collected in outlets in a middle class area of Chengdu city in China. For Bangkok, the PPP of the Thai Bhat to the Chinese Yuan is divided by the exchange rate and expressed as a percent. For example, the entry of 227 for a kilo of onions in Bangkok means that it costs the Bangkok middle class 2.27 times as much as in Chengdu at exchange rates.

Table 5.1. Price Levels in Selected Asian Markets, Spring 2002
Base = Chengdu (100)

	Batteries	Onions	Haircuts
Bangkok – Middle	79	227	208
Bangkok – Poor	79	306	102
Singapore – Middle	135	500	582
Singapore – Poor	101	312	406
Shanghai - Middle	110	151	160
Shanghai – Poor	84	135	107
Fuli – Rural	59	85	22
Shenzen – Middle	109	164	126
Hong Kong – Middle	118	477	835
Chengdu – Middle	**100**	**100**	**100**

Taken at face value, what would the information in Table 5.1 suggest about the geographical distribution of poverty within a country? As is well known, the poverty count is inversely related to the level of income in states, provinces or any other sub-national unit. This fact is often used to justify policies that promote overall economic growth in a country as the most useful way to reduce poverty. However, it is not inconsistent with that position to also try to

measure the poverty in different regions better than we do. In some cases better measures of the geographic dispersion of poverty may facilitate targeted policies that can supplement income growth in raising the economic, educational, or health status of specific groups. (See for example, Bigman and Fofack, 2000) The numbers for China in Table 5.1 suggest that taking account of price differences within China would reduce the poverty count in rural areas and poorer cities and raise them in better off cities.

A study of the poverty line in the United States by Aten (1996) illustrates another aspect of the regional problem. The notion of a national poverty line has been under review in the United States for a number of years but there remains a lack of consensus on exactly what to do. In the meantime, a number of poor in regions like the Dakotas are over-counted and those in large cities undercounted. In her work Aten, based on Kokoski, Cardiff and Moulton's (1994) study of interarea price differences in the United States, calculated the cost of the national poverty bundle in1987 which was then $5778 per person. This bundle cost $4867 in the North-Central region versus just over $6970 in San Francisco and the New York SMA, hence the likely over-count of those in the North-Central and South Regions compared to most large U.S. cities. While the government may have had political reasons to shy away from sub-national poverty lines, it has certainly not stopped a number of private firms from selling their estimates of how costly it is to live in different parts of the United States.

The Bureau of Labor Statistics (BLS) Approach to Spatial Price Comparisons

ICP price research looked for models in terms of known frameworks for price collection for country consumer price indexes (CPI). CPI methodology typically either averages prices across

outlets in a city and then takes the time-to-time price relative for an item such as Flour (standardized to a unit weight), or takes a price relative at each outlet and averages the relatives across outlets in a city. In either case, information that might have been available on outlet type and average quantity purchased is discarded in the aggregation process. However, in general, price collectors know the location of their outlets, and could easily learn about typical sizes of purchase for items where it is relevant.

The BLS in the United States changed its framework for CPI price collection in a way that at first glance made the problem of using their data to compare prices across space very difficult. There is a sampling frame at which the price collector checks off for each entry level item (ELI) the outlet, the size, the type of package and other information about the volume seller within the ELI as indicated by an outlet employee. Examples of ELIs within the Food and Beverages expenditure group would be Flour, Bread, Milk, Chicken, Bananas, etc. When this framework was adopted by BLS in the 1970s it seemed not to lend itself to place to place comparisons because collectors were not asked to price the same item in different outlets. There is no way of knowing in this framework whether, for example, the type of soft drink priced in supermarkets in Denver is the same as those priced in Chicago.

Kokoski, Moulton and Zieschang (1999) demonstrated that the framework of the CPI lends itself clearly to a hedonic approach. The BLS group began experimenting with the hedonic approach that was also part of early ICP work, namely the Country Product Dummy method (CPD) developed by Robert Summers (1973). The version that Summers used was a very straightforward hedonic regression model akin to those used for temporal studies (Griliches,

1990, Triplett, 1990, Berndt, 1995).

The prices are regressed against the two sets of dummy-variables as given in equation (1) below: one set contains a dummy variable, D_j for each country other than the numeraire country (country 1), and the second set with a dummy for each item specification, $z_{i.}$

$$(1) \quad \ln p_{ij} = \sum_{i=1}^{n} \beta_i z_i + \sum_{j=2}^{m} \alpha_j D_j + \varepsilon_{ij}$$

The country coefficients, the $\alpha_j s$, are the logarithms of the estimated country price levels[8]. The item coefficients, the β_is, are the logarithms of the estimates of the average item price in the currency of the numeraire country (which could also be a regional currency).[9]

The innovation of the BLS group was to apply these regressions to United States metropolitan areas using the entry level item (ELI) characteristics of the consumer price index data, resulting in the calculation of interarea price parities at the level of various expenditure classes or groups. The basic idea was similar to the CPD procedure. The exact same type, brand and size of apple may not be priced in Philadelphia, Los Angeles, Miami, and Alaska, but as long as there is an overlap of apple characteristics across two or more areas, then a price parity for Apples can be obtained for all areas. This framework has been elaborated and a different aggregation used for more recent years by Aten (2006).

The application of this hedonic framework that is proposed for a poverty PPP is set out in (2) below. The subscript *j* may refer to countries as in the CPD method or as in the BLS formulation, *j* may

refer to regions within a country.

$$(2) \quad \ln p_{ikj} = \sum_{i=1}^{n} \beta_i z_i + \sum_{k=1}^{l} \beta_k z_k + \sum_{j=2}^{m} \alpha_j D_j + \varepsilon_{ij}$$

The subscript *(i)* refers to an income related characteristic, such as outlet type or neighborhood: for example, low, average or high income neighborhood, while the (*k)* are item specifications. With this information a simple hedonic regression could tell us whether coefficients for dummy variables in poor neighborhoods were significantly higher than in middle class neighborhoods for different types of items. However, neighborhoods are often not so easily defined, and the poor may make purchases in outlets that are located in higher income neighborhoods, but perhaps it would be possible to broadly identify these differences.

One conclusion is that it would be desirable, in countries with dispersion in prices and incomes across regions, to build up price levels by geographical region and population groups like the poor, perhaps by estimation of hedonic regressions for a number of goods and services. These hedonic equations would explain price *by item characteristics* like size of package, national or local brand and *market characteristics such as* type of outlet, region of the country, rural versus urban location, and within urban areas, poor and other neighborhoods. If the relative importance of different size purchases in rich and poor neighborhoods is known, it could be used to sharpen the PPP estimates for the poor. This would permit regional estimates of price levels, real incomes and hence numbers in poverty.

Estimation of an International Poverty PPP

How is the World Bank poverty line of "a dollar a day" a day estimated? Initially, the poverty line for India in rupees was used as a base, and later poverty lines from other low income countries were included. Based on the benchmark ICP studies, these poverty lines could be converted to the US dollar and to other currencies based on their PPPs. As long as a country has expenditure or income distribution data, it is then possible to develop poverty counts based on this international standard. The dollar a day number proved popular with many users. However, it does not explicitly allow for inflation. In actual applications, the dollar a day line is well over two dollars[10].

As discussed briefly in Section A, the PPP used for an international poverty line should refer to consumption goods and services, which is clearly more appropriate than the PPP for GDP. However, the PPPs from the ICP involve the budget shares of rich and poor countries as weights so the market basket is quite different from that of the poor. Further, in the case of several aggregation methods, the PPP for consumption is affected by the relative prices of investment goods and government services. The purpose of this section is to make a first pass at examining how sensitive the consumption PPPs are to different methods, to different country groups, and to different reference expenditure distributions. Section C will provide actual estimates of various PPPs for 115 countries, followed by a discussion of their strengths and limitations with respect to using them as the basis for converting an international poverty line.

Sensitivity of PPPs to Aggregation Methods

The difference between aggregation methods in international comparisons has been extensively researched (for example, in Balk [2004]). We will highlight two of them. The first is the G-K (Geary-Khamis) method used in PWT, and the other is the CPD (Country Product Dummy) method described earlier with respect to work done by the Bureau of Labor Statistics. The latter is gaining favor in both national and international practice because of its operational flexibility and transparency, as well as some desirable theoretical properties.

Sensitivity of PPPs to Country Groupings

Should all countries be included in the calculation of a world poverty line? That is, should the prices and quantities of consumption goods in high-income countries enter into the aggregation methods at all, and if so, how sensitive are the results to them? In this paper the world refers to the countries for which we have detailed benchmark data, and they are divided into groups based on their GDP per capita in 1996.

Sensitivity of PPPs to Expenditure Weights

The question of what prices should be used if we want to estimate anything other than a national average PPP has been discussed briefly in Section A under two headings: What Prices Should be Used?, and Items Consumed by the Poor. However, we do not have published national average prices paid by the poor versus the wealthy, nor are there any systematic efforts under way to obtain such differentials, assuming they exist. An example of a survey and a framework for the future was outlined in Section A under The Prices to the Poor Question and The BLS Approach. On the other hand, it is possible to obtain expenditure distributions by income groups within

countries, and also differential expenditure groupings by countries across the world, and one can look at the sensitivity of the PPPs to these expenditure weighting choices.

Heston (1986) experimented with the first approach using the expenditure weights of the lowest quintile groups in Malawi, India, Brazil and the United States to represent the expenditure distribution in African, Asian, South American and high-income countries respectively. The major surprise was that the weights made as much difference as indicated in Table 5.2.

Table 5.2. Ratio of Poor to Average PPPs, 1980

Region	Number of 1980 Countries	Ratio (Poor / Average PPP)
Africa	14	.876
Asia	5	1.205
South America	17	1.310
High-Income Countries	19	1.064

What drives the results in the low-income countries is the relative price of food, which is typically high compared to other headings of consumption. This means that for Asia and South America, using a Consumption PPP based upon an expenditure distribution closer to the poverty level would increase the number in poverty.

If we believed the African figures they would suggest the number in poverty in 1980 was substantially overstated, especially compared to Asia and Latin America. Prices of many food items were controlled in Africa in 1980, and while efforts were made to obtain prices of food as a weighted average of ration and free market prices, it is doubtful that this was actually done in many countries. The average ratios in Table 2 cover up a fair amount of country variance, but

there were only 2 of the 14 countries in Africa where the PPP of the poor was higher than of the national average. However, it seems probable that the African PPP for the poor is low because ration prices entered into the estimation with more weight than justified by their quantitative importance. A study carried out by Biru and Ahmad at the World Bank, based on prices collected in a number of African countries for 1985, produced a result similar to that reported above for Asia and South America[11].

An Iterative Approach

An expenditure distribution for those in poverty, either within countries or across countries, departs from the average in obvious ways, such as higher proportion of expenditure on food and other basic necessities. The practical problem of data availability can be resolved by using the two approaches suggested above – within country surveys and across country groupings. But there remains a conceptual issue of simultaneity. We are ultimately seeking a conversion factor appropriate to count those in poverty, but using an existing expenditure survey to group observations means that we are assuming a pre-defined poverty threshold across the observations.

In order to cut through this simultaneity, we develop an iterative procedure as follows: assume an initial distribution of expenditure weights and country groupings, and using the average national prices from the benchmark ICP, estimate a set of initial Consumption PPPs. Then adjust the per capita consumption of each country by the latter, and find a new grouping and distribution of expenditures based on this initial PPP for consumption. Repeat the process, using the same

average national prices, until the groupings are stable and/or the PPPs converge.

Results

The Consumption PPPs reported here refer to 1996 input prices and expenditures and are derived from benchmark comparisons in different parts of the world between 1993 and 1996 involving 115 countries, rich and poor[12]. For presentation purposes, the PPPs have been converted to Price Levels with a price level of 1.00 for the world in the sample. The Price Level is simply the PPP divided by the exchange rate relative to the United States dollar, although any other numeraire country could be used. For example, a price level of 1.66 for the US means that US$1.66 is equivalent to one international dollar. A price level of 0.66 for Tanzania translates into a PPP of 381 Tz shillings at an exchange rate of 580 Tz. Shillings to the US dollar. This reduces the number of decimal places and the need to specify the different currency names for all 115 countries. The list of countries and their 1996 exchange rates used in this paper are in the Appendix.

To examine the sensitivity of consumption price levels, seven different alternative combinations of aggregation and weighting methods are discussed and they are presented schematically in Table 5.3. The Geary-Khamis or GK method has been used in PWT, and the other, the weighted CPD or Country-Product-Dummy method, is similar to the EKS method used in the European Union (Balk [2004], Sergeev [2004], Rao [2002]).

Table 5.3. Alternative Price Levels for Consumption

	GK method		CPD method		Iterative CPD method
	Consumption within GDP	Consumption		Consumption (only low income countries)	
Super-country weights	(1)	(2)			
Share weights		(3)	(4)		
Poverty weights			(5)	(6)	(7)

(1). Consumption Price Level directly from PWT
   a. Geary-Khamis method.
   b. Supercountry weights,[13] a plutocratic weighting scheme.
   c. All 115 countries are included.
   d. Aggregation is over GDP although the Consumption Price Level refers only to Consumption within GDP.

(2). Consumption PWT (supercountry weights)
   a. Same (1) except for: Aggregation is only over Consumption.

(3). Consumption PWT (percentage share weights)
   a. Same as (2) except for: Weights are percentage shares,[14] totaling 100 for every country, a democratic scheme.

(4). CPD method (percentage share weights)
   a. Same as (3) except for: Country-Product-Dummy method instead of Geary-Khamis method.

(5). CPD method (poverty weights)
   a. Same as (4) except for: Countries are grouped by income and their weights are the percentage shares of expenditures of a low-income country within a group.

(6). CPD method (poverty weights, no high-income countries included)
   a. Same as (5) except for: Aggregation is only over the low-income countries in the world, totaling 52 countries.

(7). CPD Iterative approach (poverty weights)
   a. Same as (5) except for: groupings change to reflect the new ordering after the Consumption Price Levels are calculated, and the process is repeated until there is convergence and the groups remain stable.

[1] In practice, PWT uses the nominal GDP modified by a 'super-country-weight' factor to adjust for the fact that the number of countries that participate in PWT changes every benchmark year. Details are in the Appendix.
[1] The EKS system which is commonly used in EU and OECD comparisons is usually run in an unweighted version so that

Luxembourg is given the same weight as Germany. When the G-K system is run with percentage weights, the results are very close to EKS. For comparisons, see Heston, Summers and Aten (2001).

In order to estimate methods (5)-(7), using poverty weights, countries are ordered by their per capita GDP and expressed as a percentage of the United States in 1996 from PWT (labeled ***y***). For example, in this initial ordering, Tanzania is the poorest, with a ***y*** equal to only 1.6. The United States is ranked 114th, with a ***y*** equal to 100. Initial poverty thresholds are set at ***y*** values less than 5, 10, 20 and 40 respectively for income Groups 1-4, while Group 5 countries had ***y*** values greater than 40. Some of the borderline countries were assigned a group depending on their national poverty counts.[15]

The poverty weights used in alternatives (5)-(7) are a set of reference distributions for each group, based on the quintile expenditures of two poor countries: Ethiopia and Guatemala, neither of which participated in the 1996 comparisons[16]. It would clearly be better to have quintile distributions for each country, but using the average expenditures of the poor in a country with a similar income at least provides a starting point with which to contrast the national average distributions. These weights are given in Table 5.4.

Table 5.4. Poverty Weights: Reference Distributions

Expenditure Heading	Country Income Group				
	1	2	3	4	5
Cereals	48.50	34.00	19.60	18.70	15.00
Meat	2.50	5.20	8.00	7.80	7.10
Fish	0.30	0.40	0.50	0.50	0.40
Eggs, Milk	5.50	6.60	7.70	10.00	10.30
Oils	5.60	3.30	1.00	0.80	0.80
Fruit, Vegetables	1.90	8.20	14.50	12.30	9.70
Other Foods	5.50	6.80	8.20	6.50	8.30
Non-Alcoholic Beverages	3.80	2.60	1.40	1.30	1.50
Alcoholic Beverages	0.40	0.40	0.40	0.30	0.40

Expenditure Heading	Country Income Group 1	2	3	4	5
Tobacco	0.20	0.20	0.10	0.10	0.20
Clothing	2.90	3.10	3.40	2.80	2.50
Footwear	1.60	1.70	1.70	1.50	1.40
Rent	6.30	8.70	11.10	10.80	10.60
Fuel	1.00	0.60	0.20	0.30	0.70
Furniture	0.50	0.30	0.10	0.20	0.30
Household Operation	1.40	2.50	3.70	3.80	3.70
Appliances	0.50	0.30	0.20	0.20	0.30
Health	1.80	3.40	4.90	5.70	6.40
Transport Equipment	0.20	0.20	0.20	0.20	0.30
Transport Operation	0.20	0.20	0.20	0.70	1.40
Transport Services	0.50	1.70	2.90	2.80	3.10
Communication	0.20	0.20	0.20	0.50	0.60
Recreation	0.70	0.80	0.80	1.10	1.60
Education	3.60	3.50	3.50	4.20	5.10
Restaurants	1.30	1.40	1.50	1.50	2.50
Other Expenditures	3.90	3.80	3.70	5.40	5.70
Total	100.00	100.00	100.00	100.00	100.00

Figure 5.1 shows a summary of the price level calculations for all countries, with this normalization. That is, the price levels on the y-axis are the averages by income group, and countries in Groups 1-3 average one. There are seven lines corresponding to the seven alternative price levels, although three of them are highlighted and the remaining four are squeezed between alternatives (1) and (7).

Figure 5.1. Alternative Price Levels by Income Group

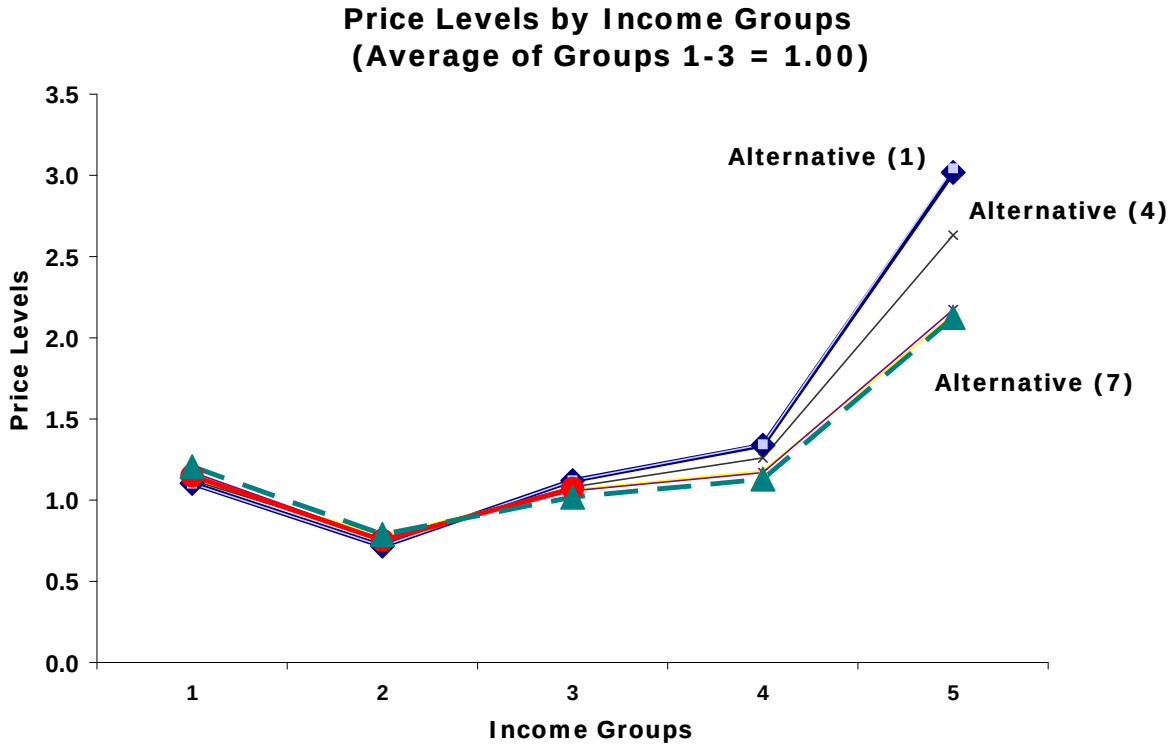

Table 5.5 summarizes the data in Figure 5.1, showing the average price levels by income group for each of the seven alternative calculations. Alternative (0) is the price level of GDP, used in the initial conversion of currencies to international dollars (see also Table 5.2).

<Table 5.5>

Alternative (1) is the price level of consumption from PWT computed with, but not including other expenditures in GDP, while the others are computed only with consumption expenditures. The consumption-only alternatives (2)-(7) tend to be flatter than alternative (1), with slightly higher price levels for Group 1 and lower levels for Group 5. Group 2 countries tend to have the

lowest price levels in all alternatives, lower than those in Group 1, giving the lines their U-shape in Figure 1 and suggesting that the very poorest countries have proportionally higher price levels for consumption than the low-to-middle income countries, and sometimes even lower than middle income countries in Group 3.

Tables 5a and 5b show the detailed results for all countries and are included at the end of the text before the Appendix. Table 4.1 has all the price levels, with the average of the countries equal to one. The average of Group 1-3 countries is also given in order to allow comparisons with alternative (6). That is, the price level of any of the other alternatives must be divided by that factor to normalize on the same average as alternative (6).

Do the Methods Make a Difference?

The difference between using GDP price levels and consumption price levels as shown in Table 5b are significant, as many low-income countries have lower consumption price levels, and the share of consumption is also relatively high. However, the differences between using the consumption component of GDP (Alternative (1)) and only consumption in the GK aggregation method (Alternative (2)) are almost negligible. Alternative (2) increases the range slightly, as the differences occur mostly in the extreme low and high income countries.

Differences between the GK method used in Alternative (3) and the CPD method in Alternative (4), are larger, as expected. They both use the same own-country expenditure share weights but for the majority of the low-income countries, the CPD method results in lower price levels, while for the higher income countries, the CPD leads to higher price levels. The largest of these

differences are for Nigeria (drops from 2.8 to 2.4) and Bahrain (from 1.8 to 1.4) and Switzerland (increases from 2.2 to 2.7), where the average of all countries is 1.0. At higher incomes, the CPD method is closer to Alternative (1) which is GK with own country weights, while the GK method with percentage share weights is closer to the CPD method when representative poverty weights are used in the iterative procedure of alternative (7).

Do Country Groupings Make a Difference?

There is a small difference, to the second decimal place, between using all 115 countries in Alternative (5) and just the Groups 1-3 countries in Alternative (6), other things being equal. The difference is positive for lower price levels and negative for higher price levels, that is, the range of price levels is greater when using just the Groups 1-3 countries. However, we only have 26 consumption headings, and if there were more detailed price and expenditure data for a greater number of headings, the differences might be more pronounced.

Do Expenditure Weights Make a Difference?

There are two sets of comparisons: one between Alternatives (2) and (3): supercountry versus percentage share weights using the GK method, and the other between Alternatives (4) and (5), percentage share weights versus poverty weights using the CPD method. The difference between using plutocratic (supercountry) weights and democratic (percentage share) weights is very large. The spread across countries is much wider with lower price levels for lower income countries and higher price levels for high income countries when using plutocratic weights. The pattern is similar for the second comparison: the spread is wider when using democratic weights versus the representative weights, although smaller than when using plutocratic versus

democratic weights.

This difference in spread can be seen clearly in Table 5.5, if we focus on differences between income Groups 1 and 3. The average price levels for Group 1 are higher than for Group 3 when percentage share weights or poverty share weights are used (Alternatives (3)-(7)), regardless of method. When using plutocratic weights, the Group 3 price levels are slightly higher than the Group 1 levels.

Does Simultaneity Make a Difference?

If the alternative price levels change the relative ranking of countries, then their income groups may change, and hence their representative poverty weight should change as well. In order to verify that these relative changes do not affect the final price level results, we developed an iterative procedure that regroups the countries and recalculates the price levels based on the new income groupings and new poverty weights until the price levels are stable. This occurred after the third iteration, and the difference between the original price levels (Alternative (5)) and these iterated price levels (Alternative (7)) are similar to the differences when the expenditure weights are changed. That is, for Groups 1 and 2, the iterated price levels are on average higher, but for the remaining groups they are lower, so that the spread is wider in Alternative (7).

Do Alternative Price Levels Affect Poverty Counts?

To highlight the difference that the alternative price levels might make to poverty thresholds and counts, we compare the original ordering of countries by per capita GDP relative to the US converted at GDP price levels, with the ordering that would result using Alternative (1). The

consumption expenditures are given in international dollars (available from PWT), and are labeled ***CEX$*** in Table 5b

We normalize on the total consumption expenditures of the US for 1996 of just under $20,000 and apply the same 5, 10, 20 and 40 percent thresholds as in the initial grouping. These are labeled ***cy*** in Table 5b and correspond to expenditure groupings of $1000, $2000, $4000 and $8000 respectively, or approximately $3, $5, $11 and $22 international dollars a day.

The general pattern is that lower income countries have a lower consumption price level and this leads to a higher ***cy*** (with US=100), although not necessarily a higher ***CEX$*** since the latter depends on whether consumption expenditures are a relatively large proportion of GDP. For example, Guinea's price level of GDP is 0.36 but that of consumption is 0.30, and although its total CEX$ drops to $2514 from $2715, its ***cy*** jumps to 12.7 from 9.3, and it would be classified as a Group 3 country instead of a Group 2 country.

Table 5c shows only the countries that switch income groups, between the original and either Alternative (1) or Alternative (7). For example, Zimbabwe, which at GDP price levels is only 9.8 percent of the U.S., at Consumption price levels is over 10 percent, and moves up into group 3 using either alternative measure. Korea has a high consumption price level and drops from nearly 50% of the U.S. GDP to just under 40% when we use the iterative method, Alternative (7), and to 40.8% using Alternative (1). Out of the twenty-five countries that switch groups, sixteen fall into a lower income group using Alternative (7) and ten using Alternative (1), most of them with ***y***s in the 20% to 25% range. Six countries would move to a higher income group

using Alternative (7) and eight using Alternative (1).

Table 5.6. Countries that Switch Income Groups

		Initial		*Alternative*	
		y	(0)	(1)	(7)
1	Armenia	8.2	2	3 higher	2
2	Bolivia	9.0	2	3 higher	2
3	Guinea	9.3	2	3 higher	3 higher
4	Zimbabwe	9.8	2	3 higher	3 higher
5	Sri Lanka	11.0	3	3	2 lower
6	Ecuador	13.2	3	3	2 lower
7	Turkmenistan	15.5	3	2 lower	2 lower
8	Lebanon	16.9	3	4 higher	4 higher
9	Romania	17.1	3	4 higher	4 higher
10	Bulgaria	20.2	3	4 higher	4 higher
11	Kazakhstan	20.1	4	4	3 lower
12	Botswana	20.8	4	3 lower	3 lower
13	Belize	21.2	4	3 lower	3 lower
14	Latvia	21.2	4	3 lower	3 lower
15	St. Lucia	21.5	4	4	3 lower
16	St. Vincent	22.0	4	3 lower	3 lower
17	Dominica	23.6	4	3 lower	3 lower
18	Venezuela	23.7	4	4	3 lower
19	Russia	24.3	4	4	3 lower
20	Thailand	24.3	4	3 lower	3 lower
21	Mauritius	40.4	4	5 higher	5 higher
22	Antigua	44.3	5	4 lower	4 lower
23	Slovania	45.0	5	4 lower	5
24	Bahrain	45.4	5	4 lower	4 lower
25	Korea	49.1	5	5	4 lower

If we look at Table 5b, which has the GDP per capita and the consumption expenditures per capita using Alternative (1), we can see that for some countries the differences underlying Table 5.5 are significant. For example, Turkmenistan has a ***y*** equal to 15.5 percent of the U.S. and a per capita GDP of $4525, but its consumption per capita drops to $1770 and its corresponding ***cy*** to only 8.9 percent of the U.S. Similarly, Botswana goes from a GDP per capita of $6072 and a ***y*** of 20.8 down to a per capita consumption of $2410 and a ***cy*** of 12.1 percent.

Concluding Remarks

This paper has reviewed some of the strengths and limitations of PWT for providing suitable price levels and PPPs for international poverty comparisons. It compared alternative aggregations and weighting methods and suggested several ways in which estimation of PPPs for the poor might be improved in benchmark ICP comparisons.

It seems clear that a consumption-based PPP is preferable to any GDP-based PPP. Both are available from PWT, and the former, labeled Alternative (1) in the paper, will already significantly affect the ordering of countries. However, the weighting used in PWT is more suitable for national income accounting as it tends to assign greater weight to larger economies, which in the 1996 benchmark on which these calculations are based, tend to be the wealthier countries. Both China and India were included in the 2005 benchmark and as a consequence, the difference due to weighting between alternative methods was less. But it appears that use of country shares or poverty shares as the weight are a more appropriate way to go to answer the question about the relative purchasing power of the poor in each country.

Only two aggregation methods were used here and others should be examined. However, previous work has shown that variations of both the GK and CPD are known to be similar to EKS (Sergeev [2003]). An attempt was made here to represent the expenditure distributions of the poor based on household surveys in Guatemala and Ethiopia. Ideally one would like the distribution of expenditures for each country around the likely international poverty line, and then to carry out an iterative procedure such as Deaton (2004) has used for India and Indonesia.

However, even the iterations computed here, using only a rough expenditure distribution for the five low-income groups, suggest a promising line of research.

Improvements to current methods of using average prices and expenditures to estimate country price levels for poverty comparisons can be summarized as:

a) Taking into account the prices paid by the poor into the initial price comparisons when there are geographical concentrations of people, such as in large urban centers of developing countries.
b) Using percentage share weights rather than actual weights for each country (democratic versus plutocratic weights).
c) Adjusting these share weights to reflect expenditures distributions of the very poor, either by using low-income surveys for each country, or an iterative approach that combines representative shares and own country average-income shares. As noted earlier, this will be made easier in the future because of the World Bank effot to classify a large number of household expenditure surveys into the ICP framework.

If direct price surveys are not available, an indirect approach is to use existing surveys to identify the location, outlet and type of neighborhood where prices are collected, and the typical size of purchase. This would improve the underlying price data entering into PPP and subsequently PWT calculations of private consumption that are more appropriate for the poor, both within and between countries. Similarly, expenditure surveys for the poor that are comparable across countries would improve the iterative procedure in that the initial distributions represent individual countries, rather than representative groups of countries.

At present, PWT consumption price levels and the corresponding PPPs used in Alternative (1) provide a basis for conversion of international poverty lines into national currencies that are fairly stable over time. When the final report of the 2005 ICP report has been released and the detailed heading information made available to researchers, it will then be possible to improve upon both PWT and the estimates of this paper. One potential set of information from the new round was to be within-country variation in prices but unfortunately, countries in the different regions did not permit release of this price information.

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[1] These comments and parts of this section are based on Heston (1986).

[2] See http://www.worldbank.org/icp

[3] Typically for non-priced output of government and non-profit organizations, the PPP has been derived from wage comparisons for closely specified occupations. This assumes that productivity of these workers is equal across countries, an assumption that was clearly a gross simplification since the opportunity cost of labor and the capital per worker are higher in more affluent countries. In the 2005 comparison a very rough adjustment was made based on actual or assigned capital per worker in the whole economy for lower income countries. This adjustment has the effect of reducing the output of educational, health and administrative services by 50 to 100% compared to what they were in previous benchmarks.

[4] The size and packaging can be standardized to any other specification, and to other characteristics, depending on the richness of the price collection survey.

[5] In Kunreuther's sample the price per unit over the range of package sizes was from 50% to 75% going from largest to smallest size. The sample of poor and middle class respondents were well aware of the range of sizes available and the differences in price per physical unit even though this

was before mandatory displays of this information in chain stores. In the sample of neighborhood stores, about 20% to 40% stocked the largest package size for each of the 8 items sampled by Kunreuther.

[6] In fact the pricing of an individual cigarette at Rs. 2 can be fairly close to a package of 10, that may cost something over Rs. 15. And panwallas may use a low price of a single cigarette as a loss leader. But informants in Brazil and Egypt suggest that the mark-up or the single cigarette is typically 10-20% above buying a package.

[7] For example a 1 kilogram package of cooking oil may sell for Rs. 55 and a 5 kilogram package at Rs. 225, but the latter will include a plastic bucket valued at Rs. 90 by the seller, but at cost perhaps Rs.50. A significant percentage of larger size consumer items in India are discounted in this tied manner.

[8] The price level is commonly used in the international literature instead of a purchasing power parity and often refers to prices expressed relative to a numeraire country currency, such as the U.S. dollar. The analogue in interarea comparisons is a price expressed relative to one area, or to the average of the areas (as is done in the Euro region).

[9] Chapter 10 of the draft ICP handbook deals extensively with the estimation of basic heading parties using both a weighted (roughly) and unweighted CPD and EKS. In this chapter simulations are developed indicating that the weighted CPD approximates more closely what would be obtained if all prices were available for all products in all countries than other methods.

[10] Some users do not regard a dollar or so a day as helpful because they believe no one could live on $1 or 2 in the United States. Of course, the dollar amount buys 3 or 4 times the amount of goods in a rural area of a poor country than it would in the United States. It might be of interest to note that about the time that the $1 a day poverty line was being discussed, the homeless in Chicago on

average had $5 of spending money a day.

[11] The exercise reported below was based upon 55 of the 60 countries in the 1980 ICP benchmark (Eastern Europe was excluded). Two limitations of this exercise should be mentioned. First, the exercise was not on input prices at the basic heading level of 100 or so categories of consumption, but at the level of major expenditure components, about 10-20 summary categories. These summary category for 1980 had been estimated by the Geary-Khamis (G-K) aggregation method. It is possible that the over-all quantitative effect of alternative weights would differ from those using more detailed headings, but it is not likely that the use of G-K parities would change the qualitative findings. The second limitation of this exercise is that it used representative expenditure weights of a very diverse character. For Africa, the expenditure distribution was of estate workers in Malawi. In Asia, the 3rd decile of rural workers in India; for South America, the lowest quintile in Brazil; and in high income countries, the 1960 expenditure distribution for those in poverty in the United States was used.

[12] Details of how the price and expenditure data are transformed into PPPs at the various levels of aggregation, such as Consumption, Investment, Government, and GDP are beyond the scope of this paper, but a brief summary of the procedures used in PWT are given in the Appendix.

[13] In practice, PWT uses the nominal GDP modified by a 'super-country-weight' factor to adjust for the fact that the number of countries that participate in PWT changes every benchmark year. Details are in the Appendix.

[14] The EKS system which is commonly used in EU and OECD comparisons is usually run in an unweighted version so that Luxembourg is given the same weight as Germany. When the G-K system is run with percentage weights, the results are very close to EKS. For comparisons, see Heston, Summers and Aten (2001).

[15] Bulgaria was assigned to Group 3 and Tunisia and Kazakhstan to Group 4 although their ys are all around 20.

[16] If Guatemala and Ethiopia had participated in the 1996 ICP comparisons, they would be in Groups 3 and 1, respectively. For Group 1, Ethiopia's second quintile was used, for Group 2, the average of Ethiopia's and Guatemala's second quintiles was used. For Groups 3-5, Guatemala's

distributions, from second to fourth quintile were used.

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APPENDIX ON PWT AND OTHER CONVERSION FACTORS FOR POVERTY STUDIES

This section sets out the main differences between PWT and other data sets that might be used for studies of international poverty. We first distinguish between the treatment of benchmark and non-benchmark countries. The method of producing current and constant international price estimates is treated next along with the principal differences between the PPP estimates of the World Bank and PWT. A more detailed version of the materials described in this section is provided in the documentation of PWT 6.1[17] so this discussion will be brief.

Benchmark and Non-Benchmark Countries

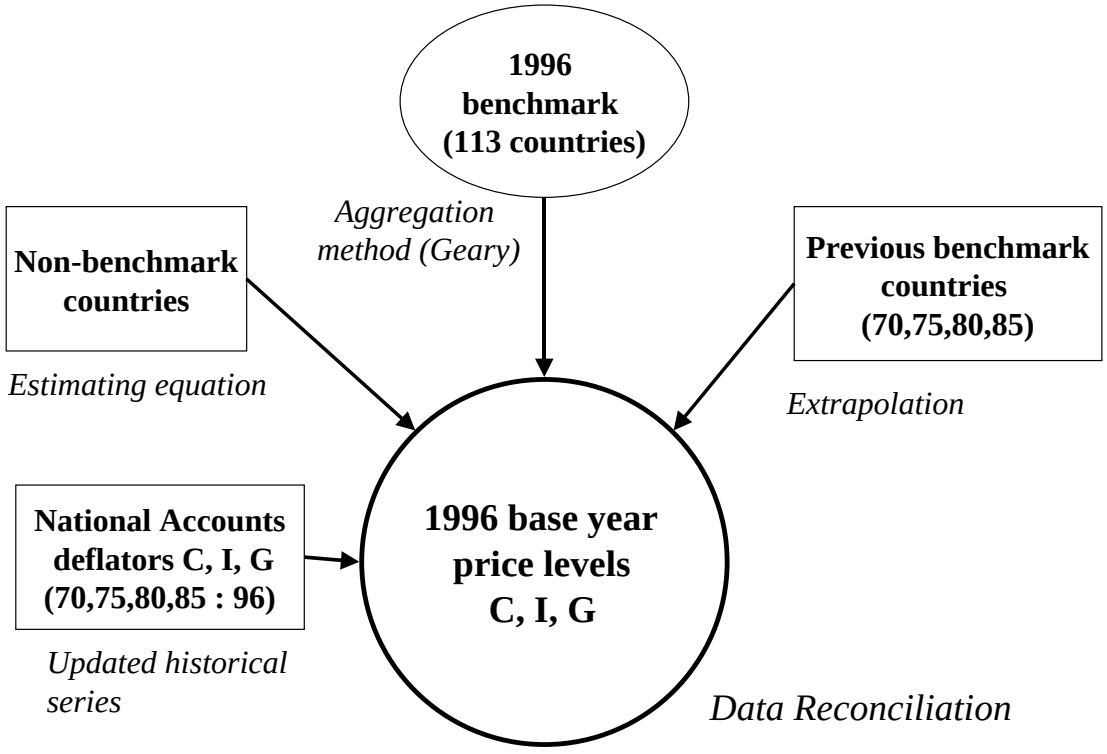
Benchmark ICP comparisons have been carried out for over 100 countries, some for just one year, and some for as many as eight years since 1970, originally at five-year intervals, and now every three years for the OECD countries.[18] Benchmark comparisons typically involve detailed price comparisons representing 150 or more basic headings of expenditure on consumption, capital formation and government. Beginning in 1980 these benchmark comparisons have been organized regionally with various procedures built into the process so that links could be established between countries in different world areas. Some links were provided by countries in both OECD and other groupings, as for example Austria with countries of Eastern Europe, and Japan with the Economic and Social Commission for Asia and the Pacific (ESCAP).

Unfortunately, the last ICP benchmark that represented most of the world regions for a particular date was 1985; it was incorporated in PWT 5.6, with later regional benchmark data. For PWT

6.1, a world comparison was cobbled by using 1996 OECD estimates for member countries plus an equal number of formerly planned economies. Several Latin American countries also made estimates for 1996, and it was possible to update 1993 estimates for the ESCAP countries, Africa, the Middle East and the Caribbean to 1996, for a total of 115 countries, albeit at the level of only 36 headings of expenditure.[19]

Figure 1a illustrates the inputs and procedures used in PWT to obtain the initial 1996 base year price levels (or PPPs) for the three components of GDP: consumption, investment and government.

Figure 5a. Base Year PPPs



First, the ICP benchmark data for the 113 countries are aggregated to the level of C, I, and G using the Geary-Khamis (G-K) method and weights, termed super-country weights, that assign proportional representation of the benchmark countries relative to the world. The World Bank has used a different aggregation method and a different weighting scheme, one that assigns equal weight to each country over all of GDP, so that small countries such as Belize and Luxembourg will have the same importance over all headings as larger countries such as Mexico and Germany. The use of super-country weights in the G-K system provides continuity with previous versions of PWT.

The second step is to estimate the PPP of C, I and G for the non-benchmark countries.[20] In recent versions of PWT these estimates have been made in two stages. First, an estimate of the PPP for Domestic Absorption is made based upon the relationship between various cost of living measures and the PPP for GDP for benchmark countries. The values of these post adjustment indexes for the non-benchmark countries are then used in the estimating equation to obtain their Domestic Absorption. This may be contrasted with the method used by the World Bank, also a short-cut approach, but one that uses an equation involving education and nominal income but no direct information on prices in non-benchmark countries. In addition, the World Bank does not make estimates for C, I, and G, only for GDP, whereas in PWT the component PPPs are estimated again using a relationship derived from the benchmark countries.

The third and final step is to collate the 1996 benchmark PPPs, the non-benchmark PPPs and the PPPs from previous benchmark countries that may or may not be part of the 1996 ICP. When

countries have multiple benchmarks, the relative PPPs of two countries in two benchmarks usually differs from what would be predicted from relative price movements in the two countries. For example, if the GDP deflator in country A rises by 20% between two benchmarks and that of B by 30%, then one would expect the $PPP_{B/A}$ to rise between two benchmarks by about 8.3% [(1 - 1.3/1.2)*100]. In fact the two estimates will differ, often by 5 to 15% or more in either direction.

To deal with this empirical finding we use a reconciliation process[21]. The basic idea is to bring previous benchmark estimates of PPPs to a common year by use of the national accounts deflators. For countries with several benchmarks it is necessary to average the different PPP estimates and this is done by giving more recent estimates somewhat greater weight. The reconciled past and present benchmark PPPs, together with the non-benchmark short-cut PPP estimates, and the national accounts expenditure data, become the inputs to another multilateral aggregation procedure (G-K method, super-country weighting) that will generate the GDP PPPs and international dollar estimates for C, I, and G for the 168 countries in 1996.

It should be noted that these estimates will not necessarily correspond to the initial benchmark comparison for 1996 because both non-benchmark and previous benchmark countries are now included. The World Bank does not attempt this reconciliation process.

PWT Estimates in Other Years

Frequently, international comparisons of poverty, and of wealth, are made at different points in

time. One advantage of PWT as a data source for the PPP for such estimates is that it provides a continuous series from which erratic movements that may occur using benchmark estimates in two different years have in effect been removed.[22] Figure 5b illustrates the procedure to obtain the current and constant price series in PWT over time.

<Figure 2a>

For 1996, we have the set of 168 benchmark, non-benchmark and previous benchmark countries and their component PPPs. For other years, we move the 1996 PPPs backwards and forwards by the changes in the national accounts deflators for each component of each country relative to changes in the United States. These become the input PPPs that, combined with the current price national accounts of each country, permit a new multilateral aggregation (G-K method, super-country weights) for each year. The result is a set of GDP PPPs and international price estimates of C, I and G for the 168 countries for 1950-2000.

Several different constant price measures are provided in PWT. It is not clear that researchers would want to use these in poverty comparisons, so the following discussion is highly condensed. A Laspeyeres type measure is given that takes the real value of the components in each year and moves them backward and forward by the national accounts growth rates of the components. The resulting estimates are summed with the net foreign balance in 1996 prices to obtain the GDP in each year. Because the weights of C, I and G in international prices will not necessarily be the same as those in national prices, the growth rate of GDP In PWT will not be identical to that in national prices. In this PWT differs from most other series and this should be

understood in research making use of the growth rates implicit in PWT. The same is true of the chain index in PWT. The chain index applies the national accounts growth rates to the component shares in international prices, derived from the current year multilateral aggregation, obtaining a growth rate for Domestic Absorption (DA) for each pair of consecutive years.

The main differences between PWT and World Bank PPPs can be summarized as follows:

1. The initial *aggregation method* or price index number formula that is applied to the benchmark countries is not the same: PWT uses the G-K aggregation with plutocratic weights.
2. Estimates for *non-benchmark* countries are made using short-cut methods, but the equations and variables differ: the World Bank uses education and nominal incomes whereas PWT uses information on prices and no education variable.
3. Information on *previous benchmarks* is not used in the World Bank, but is collated and reconciled in PWT.
4. The *current price series*: PWT estimates PPPs and international prices for each component in each year, whereas the World Bank obtains the 1996 GDP PPPs and applies national accounts growth rates to obtain other years.
5. The *constant price series*: PWT's Laspeyres series is based on the growth rate of C, I and G from the national accounts plus the net foreign balance, the World Bank uses GDP growth rates.
6. *Chain series*: PWT provides a chained constant price series using component shares in international prices for each year.
7. *Consumption PPPs*: PWT provides the PPP and the constant and current international

prices for consumption as well as for GDP for all countries and for as many years as there are national accounts series available.

Table 5a. Detailed Price Levels

		GK (1)	GK (2)	GK (3)	CPD (4)	CPD (5)	CPD (6)	CPD (7)
		C in GDP			Just C			
	y	Wts	Wts	%	%	% POV	% POV (1-3)	% POV Iter
Tanzania	1.6	0.66	0.65	0.69	0.63	0.66	***0.91***	0.74
Malawi	2.5	0.44	0.44	0.58	0.52	0.61	***0.84***	0.64
Madagascar	2.7	0.58	0.57	0.67	0.61	0.66	***0.92***	0.72
Yemen	2.7	1.27	1.27	1.37	1.24	1.56	***2.15***	1.48
Mali	2.8	0.45	0.45	0.60	0.52	0.73	***1.00***	0.72
Zambia	2.9	0.70	0.69	0.79	0.73	0.85	***1.17***	0.86
Nigeria	3.2	1.96	1.94	2.77	2.36	2.72	***3.75***	3.02
Sierra Leone	3.2	0.30	0.30	0.61	0.52	0.62	***0.86***	0.67
Tajikistan	3.4	0.26	0.26	0.42	0.35	0.34	***0.47***	0.42
Benin	3.8	0.57	0.57	0.66	0.62	0.75	***1.03***	0.74
Kenya	4.3	0.37	0.37	0.51	0.44	0.55	***0.76***	0.56
Mongolia	4.3	0.54	0.53	0.51	0.48	0.49	***0.67***	0.50
Nepal	4.4	0.27	0.27	0.29	0.26	0.30	***0.42***	0.26
Senegal	5.1	0.54	0.53	0.68	0.61	0.76	***1.05***	0.75
Bangladesh	5.2	0.38	0.37	0.40	0.36	0.39	***0.54***	0.40
Vietnam	5.7	0.31	0.31	0.31	0.28	0.28	***0.39***	0.27
Congo	5.9	0.74	0.74	1.26	1.00	1.33	***1.87***	1.34
Cameroon	6.5	0.45	0.45	0.72	0.61	0.73	***1.03***	0.74
Cote d'Ivoire	6.7	0.50	0.50	0.75	0.67	0.79	***1.10***	0.77
Pakistan	6.7	0.45	0.45	0.43	0.41	0.39	***0.55***	0.43
Azerbaijan	7.0	0.36	0.36	0.52	0.43	0.34	***0.48***	0.49
Moldova	7.8	0.30	0.30	0.44	0.35	0.33	***0.46***	0.42
Armenia	8.2	0.33	0.33	0.51	0.44	0.35	***0.49***	0.50
Kyrgyztan	8.9	0.32	0.32	0.42	0.36	0.36	***0.50***	0.42
Bolivia	9.0	0.62	0.62	0.56	0.57	0.57	***0.80***	0.59
Guinea	9.3	0.30	0.30	0.47	0.40	0.51	***0.72***	0.50
Uzbekistan	9.6	0.35	0.35	0.49	0.40	0.45	***0.63***	0.51
Zimbabwe	9.8	0.33	0.33	0.42	0.41	0.48	***0.68***	0.45
Albania	10.5	0.48	0.47	0.56	0.49	0.42	***0.60***	0.51
Philippines	10.7	0.51	0.51	0.48	0.48	0.46	***0.66***	0.46
Sri Lanka	11.0	0.41	0.41	0.45	0.39	0.36	***0.51***	0.41
Egypt	12.7	0.41	0.41	0.48	0.45	0.52	***0.74***	0.52
Jordan	12.8	0.80	0.80	1.01	0.91	1.01	***1.44***	0.97
Morocco	13.0	0.45	0.45	0.68	0.59	0.66	***0.94***	0.69
Jamaica	13.0	0.99	0.99	1.13	1.03	1.17	***1.66***	1.12
Ecuador	13.2	0.87	0.87	0.76	0.79	0.79	***1.12***	0.78
Indonesia	13.3	0.49	0.48	0.50	0.45	0.52	***0.74***	0.42

		GK (1)	GK (2)	GK (3)	CPD (4)	CPD (5)	CPD (6)	CPD (7)
		C in GDP			Just C			
	y	Wts	Wts	%	%	% POV	% POV (1-3)	% POV Iter
Syria	13.6	1.92	1.92	2.40	2.13	2.74	***3.92***	2.60
Ukraine	15.1	0.34	0.34	0.45	0.37	0.39	***0.56***	0.42
Peru	15.2	0.89	0.89	0.80	0.82	0.84	***1.21***	0.80
Georgia	15.3	0.39	0.39	0.58	0.50	0.38	***0.55***	0.54
Turkmenistan	15.5	0.16	0.16	0.32	0.22	0.21	***0.30***	0.27
Macedonia	15.7	0.81	0.81	0.78	0.77	0.78	***1.12***	0.75
Lebanon	16.9	1.04	1.03	1.65	1.27	1.73	***2.47***	1.37
Romania	17.1	0.40	0.40	0.47	0.41	0.36	***0.52***	0.41
Grenada	17.2	0.89	0.89	1.03	0.90	1.04	***1.49***	1.01
Swaziland	17.7	0.35	0.35	0.53	0.49	0.60	***0.85***	0.55
Fiji	18.1	0.93	0.93	0.90	0.88	0.82	***1.17***	0.83
Iran	18.3	0.59	0.59	0.66	0.61	0.68	***0.97***	0.71
Panama	19.4	0.82	0.81	0.74	0.75	0.76	***1.08***	0.73
Belarus	19.4	0.38	0.38	0.52	0.43	0.44	***0.62***	0.48
Bulgaria	20.2	0.37	0.37	0.37	0.36	0.37	***0.52***	0.35
Tunisia	20.0	0.38	0.38	0.63	0.53	0.66		0.62
Kazakhstan	20.1	0.40	0.40	0.54	0.45	0.45		0.50
Botswana	20.8	0.49	0.49	0.63	0.64	0.68		0.68
Belize	21.2	0.86	0.86	0.94	0.85	0.93		0.82
Latvia	21.2	0.60	0.60	0.75	0.66	0.61		0.66
St. Lucia	21.5	1.04	1.03	1.10	1.01	1.21		1.19
St.Vincent	22.0	0.89	0.89	1.06	0.91	1.08		1.05
Turkey	22.0	0.75	0.75	0.71	0.70	0.66		0.62
Lithuania	22.2	0.55	0.55	0.61	0.55	0.54		0.53
Dominica	23.6	0.98	0.98	1.14	0.99	1.10		1.10
Brazil	23.6	1.18	1.18	1.03	1.11	1.06		1.00
Venezuela	23.7	0.88	0.87	0.79	0.80	0.80		0.71
Thailand	24.3	0.84	0.83	0.81	0.79	0.73		0.74
Russia	24.3	0.64	0.64	0.74	0.67	0.66		0.67
Mexico	25.2	0.80	0.80	0.69	0.76	0.71		0.69
Croatia	25.4	1.01	1.01	1.06	1.06	1.03		1.05
Estonia	25.7	0.66	0.66	0.68	0.64	0.66		0.63
Poland	26.4	0.76	0.76	0.83	0.79	0.70		0.70
Hungary	29.8	0.69	0.69	0.65	0.66	0.63		0.60
Gabon	30.4	0.65	0.65	1.33	1.02	1.34		1.51
Chile	30.7	0.94	0.94	0.83	0.87	0.88		0.85
Uruguay	31.8	1.13	1.13	1.05	1.10	1.03		1.00
Trinidad	32.5	0.85	0.85	0.89	0.89	0.96		0.90
Slovakia	34.2	0.56	0.56	0.60	0.58	0.51		0.54
Argentina	36.6	1.22	1.21	1.05	1.12	1.10		1.03
St. Kitts & Nevis	39.9	1.00	0.99	1.02	0.97	1.10		1.10
Mauritius	40.4	0.39	0.39	0.63	0.53	0.65		0.60
Greece	43.7	1.58	1.58	1.34	1.43	1.29		1.24
Antigua	44.3	1.38	1.37	1.52	1.45	1.52		1.51
Slovania	45.0	1.27	1.27	1.03	1.12	1.09		1.05

		GK (1) C in GDP	GK (2)	GK (3)	CPD (4)	CPD (5)	CPD (6)	CPD (7)
					Just C			
	y	Wts	Wts	%	%	% POV	% POV (1-3)	% POV Iter
Bahrain	45.4	1.12	1.11	1.83	1.36	1.27		1.19
Czech Republic	46.1	0.65	0.65	0.62	0.62	0.60		0.57
Portugal	46.3	1.39	1.39	1.17	1.27	1.14		1.11
Korea	49.1	1.40	1.40	1.34	1.34	1.51		1.45
Barbados	50.0	0.48	0.49	1.02	0.72	1.04		0.73
Spain	53.2	1.69	1.70	1.34	1.52	1.36		1.34
Israel	56.4	1.80	1.81	1.38	1.64	1.54		1.50
Bahamas	56.6	1.30	1.30	1.26	1.26	1.38		1.30
Oman	57.1	0.66	0.66	1.36	0.98	1.11		1.03
New Zealand	60.7	1.75	1.76	1.32	1.59	1.43		1.46
Ireland	63.4	1.88	1.89	1.50	1.70	1.44		1.46
Bermuda	64.4	2.44	2.44	2.65	2.67	2.27		2.45
Finland	66.8	2.31	2.31	1.77	2.09	1.84		1.85
Qatar	68.0	0.79	0.79	1.05	0.92	1.21		0.98
United Kingdom	68.7	1.74	1.75	1.33	1.56	1.38		1.41
France	69.3	2.26	2.27	1.73	2.07	1.81		1.82
Italy	70.1	1.72	1.72	1.39	1.57	1.45		1.41
Sweden	71.5	2.52	2.53	1.93	2.33	2.02		2.06
Belgium	72.3	2.09	2.10	1.58	1.89	1.64		1.66
Germany	72.3	2.25	2.26	1.70	2.07	1.79		1.88
Austria	73.3	2.22	2.23	1.70	2.02	1.72		1.76
Netherlands	73.4	2.04	2.05	1.56	1.87	1.58		1.61
Iceland	73.6	2.01	2.02	1.62	1.81	1.76		1.71
Australia	78.2	1.70	1.71	1.29	1.54	1.33		1.35
Canada	79.1	1.47	1.48	1.09	1.34	1.20		1.24
Japan	82.4	2.61	2.63	2.09	2.41	2.59		2.53
Denmark	82.5	2.44	2.45	1.91	2.21	2.05		2.01
Switzerland	83.8	2.86	2.87	2.23	2.70	2.31		2.39
Singapore	85.4	1.92	1.92	2.19	1.99	1.42		1.51
Norway	85.4	2.52	2.53	1.95	2.30	2.13		2.10
Hong Kong	89.0	1.45	1.46	1.47	1.46	1.38		1.43
USA	*100.0*	1.66	1.67	1.25	1.57	1.32		1.48
Luxembourg	120.4	2.11	2.12	1.59	1.89	1.70		1.75
Average All		**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
Average only Groups 1-3		**0.58**	**0.58**	**0.71**	**0.64**	**0.71**	**1.00**	**0.72**

Table 5b. GDP versus Consumption Alternative (1)

	GDP (Original)				Consumption Alternative (1)			
	PLGDP	GDP$	*y* (US=100)	Income Group	PLC	CEX $	*cy* (US=100)	Income Group
Tanzania	*0.68*	467	1.6	1	*0.66*	403	2.0	1
Malawi	*0.52*	730	2.5	1	*0.44*	689	3.5	1
Madagascar	*0.60*	788	2.7	1	*0.58*	720	3.6	1
Yemen	*0.92*	788	2.7	1	*1.27*	535	2.7	1
Mali	*0.55*	817	2.8	1	*0.45*	703	3.5	1
Zambia	*0.71*	847	2.9	1	*0.70*	660	3.3	1
Nigeria	*2.02*	934	3.2	1	*1.96*	567	2.9	1
Sierra Leone	*0.37*	934	3.2	1	*0.30*	911	4.6	1
Tajikistan	*0.26*	993	3.4	1	*0.26*	664	3.3	1
Benin	*0.59*	1109	3.8	1	*0.57*	995	5.0	1
Kenya	*0.43*	1255	4.3	1	*0.37*	998	5.0	1
Mongolia	*0.56*	1255	4.3	1	*0.54*	799	4.0	1
Nepal	*0.26*	1285	4.4	1	*0.27*	895	4.5	1
Senegal	*0.61*	1489	5.1	2	*0.54*	1236	6.2	2
Bangladesh	*0.36*	1518	5.2	2	*0.38*	1310	6.6	2
Vietnam	*0.32*	1664	5.7	2	*0.31*	1306	6.6	2
Congo	*0.93*	1722	5.9	2	*0.74*	1014	5.1	2
Cameroon	*0.58*	1898	6.5	2	*0.45*	1581	8.0	2
Cote d'Ivoire	*0.65*	1956	6.7	2	*0.50*	1454	7.3	2
Pakistan	*0.41*	1956	6.7	2	*0.45*	1445	7.3	2
Azerbaijan	*0.33*	2044	7	2	*0.36*	1685	8.5	2
Moldova	*0.29*	2277	7.8	2	*0.30*	1599	8.0	2
Armenia	*0.29*	2394	8.2	2	*0.33*	2152	10.8	3
Kyrgyztan	*0.26*	2598	8.9	2	*0.32*	1719	8.7	2
Bolivia	*0.61*	2627	9	2	*0.62*	2029	10.2	3
Guinea	*0.36*	2715	9.3	2	*0.30*	2514	12.7	3
Uzbekistan	*0.35*	2803	9.6	2	*0.35*	1557	7.8	2
Zimbabwe	*0.44*	2861	9.8	2	*0.33*	2061	10.4	3
Albania	*0.45*	3065	10.5	3	*0.48*	2858	14.4	3
Philippines	*0.61*	3124	10.7	3	*0.51*	2349	11.8	3
Sri Lanka	*0.39*	3211	11	3	*0.41*	2392	12.0	3
Egypt	*0.51*	3708	12.7	3	*0.41*	3371	17.0	3
Jordan	*0.68*	3737	12.8	3	*0.80*	2212	11.1	3
Morocco	*0.59*	3795	13	3	*0.45*	3134	15.8	3
Jamaica	*0.94*	3795	13	3	*0.99*	2492	12.5	3
Ecuador	*0.70*	3854	13.2	3	*0.87*	2231	11.2	3
Indonesia	*0.49*	3883	13.3	3	*0.49*	2393	12.0	3
Syria	*1.68*	3970	13.6	3	*1.92*	2817	14.2	3
Ukraine	*0.33*	4408	15.1	3	*0.34*	2487	12.5	3
Peru	*0.95*	4437	15.2	3	*0.89*	3143	15.8	3
Georgia	*0.31*	4467	15.3	3	*0.39*	3320	16.7	3
Turkimenistan	*0.19*	4525	15.5	3	*0.16*	1770	8.9	2
Macedonia	*0.81*	4583	15.7	3	*0.81*	3320	16.7	3
Lebanon	*1.07*	4934	16.9	3	*1.04*	5232	26.3	4
Romania	*0.52*	4992	17.1	3	*0.40*	4140	20.8	4

	GDP (Original)				Consumption Alternative (1)			
	PLGDP	**GDP$**	***y* (US=100)**	**Income Group**	**PLC**	**CEX $**	***cy* (US=100)**	**Income Group**
Grenada	*1.03*	5021	17.2	3	*0.89*	3536	17.8	3
Swaziland	*0.42*	5167	17.7	3	*0.35*	3686	18.6	3
Fiji	*0.86*	5284	18.1	3	*0.93*	3543	17.8	3
Iran	*0.68*	5342	18.3	3	*0.59*	3471	17.5	3
Panama	*0.89*	5664	19.4	3	*0.82*	3285	16.5	3
Belarus	*0.34*	5664	19.4	3	*0.38*	3033	15.3	3
Bulgaria	*0.33*	5897	20.2	3	*0.37*	4040	20.3	4
Tunisia	*0.61*	5839	20	4	*0.38*	4517	22.7	4
Kazakhstan	*0.37*	5868	20.1	4	*0.40*	4110	20.7	4
Botswana	*0.90*	6072	20.8	4	*0.49*	2410	12.1	3
Belize	*0.76*	6189	21.2	4	*0.86*	3735	18.8	3
Latvia	*0.55*	6189	21.2	4	*0.60*	3886	19.6	3
St. Lucia	*1.02*	6277	21.5	4	*1.04*	4614	23.2	4
St. Vincent	*0.64*	6423	22	4	*0.89*	2964	14.9	3
Turkey	*0.75*	6423	22	4	*0.75*	4551	22.9	4
Lithuania	*0.54*	6481	22.2	4	*0.55*	4309	21.7	4
Dominica	*0.78*	6890	23.6	4	*0.98*	3470	17.5	3
Brazil	*1.16*	6890	23.6	4	*1.18*	4377	22.0	4
Venezuela	*0.76*	6919	23.7	4	*0.88*	4074	20.5	4
Thailand	*0.71*	7094	24.3	4	*0.84*	3590	18.1	3
Russia	*0.66*	7094	24.3	4	*0.64*	4538	22.8	4
Mexico	*0.81*	7357	25.2	4	*0.80*	5451	27.4	4
Croatia	*0.99*	7415	25.4	4	*1.01*	4448	22.4	4
Estonia	*0.66*	7503	25.7	4	*0.66*	4476	22.5	4
Poland	*0.80*	7707	26.4	4	*0.76*	5791	29.1	4
Hungary	*0.84*	8700	29.8	4	*0.69*	5651	28.4	4
Gabon	*0.96*	8875	30.4	4	*0.65*	5352	26.9	4
Chile	*0.89*	8963	30.7	4	*0.94*	5517	27.8	4
Uruguay	*1.06*	9284	31.8	4	*1.13*	6462	32.5	4
Trinidad	*0.78*	9488	32.5	4	*0.85*	6019	30.3	4
Slovakia	*0.61*	9984	34.2	4	*0.56*	7011	35.3	4
Argentina	*1.20*	10685	36.6	4	*1.22*	7280	36.6	4
St. Kitts & Nevis	*0.86*	11648	39.9	4	*1.00*	5923	29.8	4
Mauritius	*0.53*	11794	40.4	5	*0.39*	9458	47.6	5
Greece	*1.55*	12758	43.7	5	*1.58*	10144	51.1	5
Antigua	*1.05*	12933	44.3	5	*1.38*	5700	28.7	4
Slovania	*1.19*	13137	45	5	*1.27*	7144	36.0	4
Bahrain	*1.21*	13254	45.4	5	*1.12*	5607	28.2	4
Czech Republic	*0.69*	13458	46.1	5	*0.65*	9325	46.9	5
Portugal	*1.39*	13517	46.3	5	*1.39*	9801	49.3	5
Korea	*1.32*	14334	49.1	5	*1.40*	8096	40.8	5
Barbados	*0.86*	14597	50	5	*0.48*	12084	60.8	5
Spain	*1.66*	15531	53.2	5	*1.69*	10721	54.0	5
Israel	*1.69*	16465	56.4	5	*1.80*	9656	48.6	5
Bahamas	*1.24*	16524	56.6	5	*1.30*	12234	61.6	5
Oman	*0.86*	16670	57.1	5	*0.66*	9713	48.9	5
New Zealand	*1.68*	17721	60.7	5	*1.75*	12075	60.8	5

	GDP (Original)				Consumption Alternative (1)			
	PLGDP	**GDP$**	***y* (US=100)**	**Income Group**	**PLC**	**CEX $**	***cy* (US=100)**	**Income Group**
Ireland	*1.81*	18509	63.4	5	*1.88*	11760	59.2	5
Bermuda	*2.36*	18801	64.4	5	*2.44*	16677	83.9	5
Finland	*2.12*	19502	66.8	5	*2.31*	12611	63.5	5
Qatar	*1.13*	19852	68	5	*0.79*	9942	50.0	5
United Kingdom	*1.67*	20056	68.7	5	*1.74*	15089	75.9	5
France	*2.14*	20231	69.3	5	*2.26*	13707	69.0	5
Italy	*1.74*	20465	70.1	5	*1.72*	14159	71.3	5
Sweden	*2.36*	20874	71.5	5	*2.52*	14084	70.9	5
Belgium	*2.09*	21107	72.3	5	*2.09*	11591	58.3	5
Germany	*2.29*	21107	72.3	5	*2.25*	14625	73.6	5
Austria	*2.23*	21399	73.3	5	*2.22*	14925	75.1	5
Netherlands	*2.05*	21428	73.4	5	*2.04*	13405	67.5	5
Iceland	*2.09*	21487	73.6	5	*2.01*	14728	74.1	5
Australia	*1.65*	22830	78.2	5	*1.70*	15784	79.4	5
Canada	*1.47*	23092	79.1	5	*1.47*	13488	67.9	5
Japan	*2.58*	24056	82.4	5	*2.61*	14637	73.7	5
Denmark	*2.40*	24085	82.5	5	*2.44*	15965	80.4	5
Switzerland	*2.84*	24464	83.8	5	*2.86*	14456	72.8	5
Singapore	*1.66*	24932	85.4	5	*1.92*	8663	43.6	5
Norway	*2.39*	24932	85.4	5	*2.52*	14701	74.0	5
Hong Kong	*1.55*	25983	89	5	*1.45*	17482	88.0	5
USA	*1.66*	*29194*	*100*	*5*	*1.66*	*19867*	*100.0*	*5*
Luxembourg	*2.05*	35149	120.4	5	*2.11*	21047	105.9	5
Average	***1.00***	**9354**	**32.0**		***1.00***	**6071**	**30.6**	

[17] Technical Documentation, About PWT, in http://pwt.econ.upenn.edu.

[18] Actually the European Union countries have been carrying out annual estimates since 1993 where about one third of the underlying items are priced each year, and the remainder updated from the previous years by appropriate time-to-time indexes.

[19] In 1985 there were only 64 countries but a total of 139 basic expenditure headings.

[20] There are also countries for which benchmark results are not available but some studies have been made, notably China and Taiwan. For details see PWT6.1.

[21] This reconciliation process was called 'consistentization' in previous versions of PWT, but Robert Summers has reluctantly given up the term.

[22] The reconciliation process does not remove erratic movements that originate in the national accounts series.