



Application of PPP exchange rates for the measurement and analysis of regional and global inequality and poverty

D.S. Prasada Rao

The University of Queensland, Brisbane, Australia – d.rao@uq.edu.au

Abstract

Purchasing power parity (PPP) exchange rates from the International Comparison Program (ICP) are widely used for cross-country comparisons of price levels, real incomes and standards of living. The focus of this paper is on the role of PPP exchange rates in the measurement of regional and global inequality and the estimation of poverty incidence using \$1/day and \$2/day international poverty lines. The statistical methodology for the measurement of global and regional inequality and poverty is described. Estimates of global inequality and poverty based on the 2011 ICP along with an analysis of the trends in inequality and poverty over the last two decades are presented. Based on the major revisions to estimates of global inequality and poverty induced by the release of ICP estimates for the last two benchmarks in 2005 and 2011, the paper advocates an increase in frequency for the future conduct of ICP and suggests the implementation of a rolling-benchmark approach similar to that used by the OECD-Eurostat.

Keywords: PPPs; regional/global inequality; poverty.

1. Introduction

The last two decades have witnessed spectacular growth performance from China and India, the two most populous economies of the world. Several African countries and countries from other regions have posted significant improvements in growth rates. At the same time there is evidence to suggest that inequality within countries and global inequality has been increasing over time. The general speculation is that increased globalization may be responsible for rapid growth in many developing economies which may have led to a reduction in inequality between countries and yet may have increased inequality within these economies. Growth in real per capita gross domestic product (GDP) adjusted for changes in inequality in the distribution of income has been a long accepted indicator of change in economic welfare in an economy (Sen, 1976). In addition to the measurement of growth and inequality, monitoring poverty at the national, regional and global level has been a major task undertaken by the World Bank and other development agencies. These efforts are in recognition of the first Millennium Development Goals (MDG) of halving global poverty. The World Bank regularly publishes estimates of absolute poverty based on \$1/day and \$2/day international poverty lines.

Implementation of these ideas and the measurement of real income, inequality and poverty are straightforward within the context of a single country. Comparisons of real incomes, inequality and welfare at a regional or at the global level require suitable measures for converting national income aggregates in national currency units into a common currency unit. It has long been established that market exchange rates are not suitable for this purpose (World Bank, 2013) as they do not reflect the differences in purchasing power of currencies, instead the exchange rates reflect the market demand for the respective currencies. Recognition of this deficiency of the market exchange rates has led to the establishment of the International Comparison Program (ICP) under the auspices of the UN Statistical Commission and undertaken in cooperation with regional agencies such as the African and Asian Development Banks, Eurostat and the OECD. Details of the ICP, its governance structure and the framework that underpins the compilation of PPPs within the Program, are well documented in *Measuring the Real Size of the World Economy -The Framework, Methodology, and Results of the International Comparison* (World Bank, 2013), which is also referred to as the ICP book. The ICP has been the main source of data on PPPs over the last four decades. The recently completed 2005 and 2011 rounds of the ICP have covered 141 and 199 countries respectively, thus the ICP is now considered as

a global statistical program. Estimates of PPPs and real incomes published by the World Bank (see World Bank, 2008 and 2014 reports on the 2005 and 2011 rounds of the ICP) are widely used by researchers and analysts around the world and by the economists and statisticians at the World Bank to measure global inequality and poverty. The main objective of this paper is to describe the role of PPPs in the measurement of global and regional inequality and poverty.

2. PPP Exchange Rates and Measurement of Regional and Global Inequality

Three different measures are used in assessing regional and global inequality (Milanovic, 2005). The first measure is inter-country inequality (Concept 1) where inequality between countries is measured by treating each country as a single entity and use real per capita GDP as representative level for the country. The second measure is international inequality (Concept 2) which is computed as a population-weighted measure where per capita income in each country is weighted by the population size of the country. The third measure is global inequality (Concept 3) where inequality is computed using incomes of all individuals in the world. Global inequality treats the whole world as a single entity.

Empirical estimation of these three measures requires data on per capita incomes in all the countries where incomes are adjusted for currency and price level differences. PPP exchange rates from the ICP are used for converting real per capita GDP or consumption into real values which are used in the computation of the inequality measures. Statistical methods used in the modelling income distributions are explained in detail in Chotikpanich et al (2007, 2012). Standard measures such as the Gini coefficient, Theil's measure and the standard deviation of logarithms of incomes are used in inequality measurement.

Computation of global inequality is undertaken in two steps. In the first step, distributions of income in various countries are modelled and estimated. This step is usually data intensive. However, recent work reported in Chotikapanich et al (2007, 2012) has developed a method based on the generalized method of moments (GMM) technique to fit flexible income distributions using limited aggregate data in the form of income shares of decile and ventile groups. In the second step, the global distribution is obtained as a population-weighted average of country-specific distributions.

Warner et al (2015) make use of real per capita incomes based on PPPs from ICP in compiling measure of global inequality Their study also examines the sensitivity of inequality measures to the choice of different PPP measures for the years 1993, 2000 and 2005. Table 1 shows the estimates of inequality based on the three concepts of inequality and data drawn from the World Development Indicators, 2008 (World Bank, 2008). All the three measures show a lower level of global inequality in 2005 compared to that in 1993. These trends are similar for both Gini and Theil's measures. Decomposition of Theil inequality measure into within and between country inequality provides some evidence to support that globalization of the world economy has led to a reduction in between country inequality, which is largely due to strong growth rates in China and India, but at the same time has shown an increase in within country inequality. This is consistent with literature in this area which argues that in the initial phases of globalization inequality within countries is likely to increase. Theil's between country inequality in 1993 was 0.7189 accounting for 71 percent of global inequality declining to 0.5388 in 2005 accounting for 65 percent. In contrast, within-country inequality accounted for 29 percent in 1993 increasing to 37 percent in 2005.

Table 1. Global Inequality over time

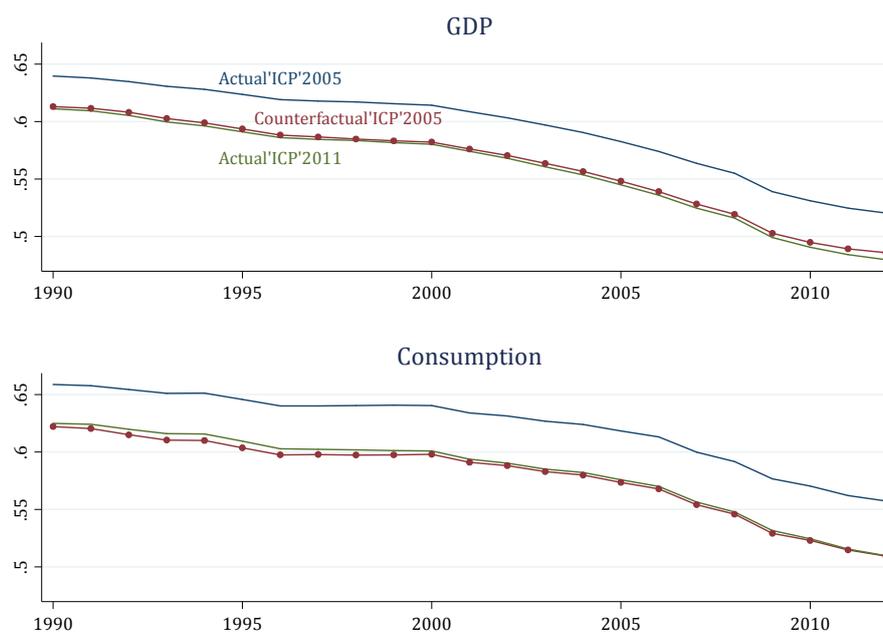
	1993	2000	2005
Concept 1			
Gini	0.5246	0.5365	0.5245
Theil's L	0.2368	0.2524	0.2402
Concept 2			
Gini	0.6448	0.6649	0.6624

	1993	2000	2005
Theil's L	0.7189	0.6396	0.5388
Concept 3			
Gini	0.7084	0.6925	0.6672
Theil's L	1.0193	0.9465	0.8514
Within	0.3004 (29%)	0.3069 (32%)	0.3126 (37%)
Between	0.7189 (71%)	0.6396 (68%)	0.5388 (63%)

Source: Table 4, Warner et al (2015).

Trends in inequality and sensitivity of international inequality (Concept 2) to different PPP measures is further examined in Inklaar and Rao (2014). Following the release of estimates of PPP exchange rates at the conclusion of the 2011 ICP, Inklaar and Rao (2014) examine the sensitivity of inequality estimates to the use of extrapolated PPPs from the 2005 and 2011 ICP and offer a reconciled set of PPPs after making adjusting for differences in sampling and aggregation methods used in these two rounds. The following figure shows trends in inequality based on three sets of PPPs.

Figure 1. International inequality in income and consumption per capita, population-weighted Gini coefficient, 1990-2012



Source: Figure 3, Page 30. Inklaar and Rao (2014)

The Inklaar and Rao (2014) study shows that population-weighted Gini measure of inequality shows a steady decline irrespective of which set of PPPs are used. However, the choice of PPP measure affects the level of inequality. Typically, PPPs based on ICP 2011 and on the counterfactual for 2005 result in a lower magnitude for the Gini compared to the measured based on PPPs from 2005 ICP.

In conclusion of this section it may be noted that the studies of Milanovic (2005), Deaton (2010), Chotikapanich et al (2007, 2012) and Warner et al (2015) demonstrate the important role played by PPP exchange rates in the measurement of regional and global inequality.

3. PPP exchange rates and global poverty measurement

Ever since the adoption of the Millennium Development Goals (MDGs) by the United Nations in 2000 with the goal to “halve, between 1990 and 2015, the proportion of people whose income is less than \$1/day”, estimation and publication of the number of poor under \$1/day and \$2/day has been a major task undertaken by the World Bank. Estimates of global poor and poverty counts by region and at the national level based on international poverty lines have been regularly published in various issues of the World Development Indicators.

A critical element in the determination of the poverty line and in the subsequent estimation of global poverty is the use of PPP exchange rates. In fact the concept of \$1/day poverty line originated in 1985 and it was anchored on the poverty lines of a group of world’s poorest countries. PPP exchange rates for the consumption component of GDP were used in converting national poverty lines in the poorest countries into US dollars and the average was found to be \$1.01 in 1985 thus leading to the notion of a 1\$/day international poverty line. The poverty incidence was estimated to be approximately 1.8 billion.

PPPs from ICP Benchmark Comparisons and Global Poverty Estimates

How does one update the international poverty lines when PPPs from new benchmarks become available? This is a problem that has attracted considerable attention (see Deaton, 2010 and, more recently, Jolliffe and Prydz). Essentially the exercise of setting international poverty lines is undertaken whenever a new set of PPPs become available. For example, after the completion of the 1993 ICP, the new international poverty line for 1993 was found to be \$1.08 which resulted an estimate of 1.304 billion global poor. Similarly, after the release of the 2005 ICP results, the international poverty line was recalculated to be \$1.25 per day and the estimate of global poverty in 2005 was found to be 1.374 billion people.

The recent release of 2011 ICP estimates of PPP exchange rates has led to a discussion and recalibration of the poverty line to be used in 2011. After proper calibration of the international poverty line based on PPP exchange rates from 2011 ICP and the poverty lines of the poorest countries, Jolliffe and Prydz (2015) obtain \$1.82 as the international poverty line. Given the sensitivity of the international poverty line to the 15 poorest countries in the world, Jolliffe and Prydz advocate a more robust approach based on poverty lines of 32 low income countries and find the corresponding international poverty line to be \$1.92 per day. Their estimates of the number of poor in 2011 range from 1.038 billion based on \$1.82 poverty line to 1.158 billion based on \$1.92 poverty line.

The following Table 2 shows poverty estimates by region based on PPPs from the ICP benchmarks in 1993, 2005 and 2011. Poverty incidence is declining over time in all the regions including Africa.

Table 2. Poverty by region based on PPPs from 1993, 2005 and 2011 ICP Benchmarks
(Headcount ratios)

Region	1993 \$1.08	2005 \$1.25	2011 \$1.82	2011 \$1.92
East Asia & Pacific	25.2	16.8	13.2	14.8
Europe & Central Asia	3.5	3.7	0.9	1.1
Latin America & Caribbean	15.3	8.2	5.8	6.3
Middle East & N. Africa	1.9	3.6	0.6	0.8
South Asia	42.4	40.3	21.3	25.0
Sub-Saharan Africa	49.7	50.9	44.2	46.8
Total Percentage in Poverty	28.2	25.2	14.9	16.7
Total millions in poverty	1,350	1,374	1,038	1,158

Source: Deaton (2010) and Joliffe and Prydz (2015)

Extrapolation of PPPs for non-benchmark years

The PPP exchange rates from ICP benchmarks are compiled roughly every five years. This means that poverty estimates for years in between benchmarks years have to be based on interpolation of PPPs and estimates for years outside benchmarks have to rely on extrapolations. The World Bank estimates of poverty are anchored on extrapolations provided in the World Development Indicators where the extrapolations are purely based on adjustments to PPPs based on movements in relative inflation rates. This approach has led to significant problems in the past. For example, Chen and Ravallion (2010) had to make significant upward adjustments to poverty estimates after the release of 2005 ICP. Similarly, the recent release of PPPs from 2011 ICP has led to a debate regarding the differences in PPPs from 2011 ICP and extrapolations from 2005 to 2011. While the inconsistency between benchmarks and extrapolations is widely acknowledged it is important to explore the possibility alternative methods of extrapolation.

Purchasing power parity exchange Rates for the measurement of global poverty

The use of PPPs for the consumption aggregate from the ICP has attracted some criticism and the comment that PPP exchange rates from ICP are not ideal for the purpose of global poverty measurement. First, the PPP exchange rates from ICP are computed using national accounts expenditure weights and these weights may differ significantly from the budget shares of people around the poverty line. This issue was explored by Deaton and Dupriez (2011) and their conclusion was that the effect of the weights on the PPPs is insignificant. Second, PPPs exchange rates from ICP rely on prices of goods and services that are not representative of the consumption of the poor. This issue was explored in ADB (2008) where special price surveys were conducted to collect prices of goods and services consumed by the poor. The main conclusion of that study was that the use of price data relevant for the poor can influence PPP estimates.

4. Conclusion

The PPP exchange rate estimates produced by the ICP are critical to the study of inequality and poverty at the regional and global level. Estimates of inequality and poverty are sensitive to the PPP exchange rates used and as a result it is necessary to carefully choose the right source and set of PPPs. The current practice of conducting ICP once every five years poses significant challenges in terms of extrapolations and in maintaining space-time consistency in PPP estimates. A more frequent compilation of PPPs based on a methodology similar to that used by the Eurostat in producing annual estimates of PPPs is likely to produce more reliable estimates of inequality and poverty on annual basis.

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