Improved PPP Extrapolation Approaches

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Abstract

The International Comparison Program (ICP) is a worldwide statistical initiative designed to estimate Purchasing Power Parities (PPPs) that can be used as currency converters to compare the performance of economies around the world. PPP exchange rates are the currency ratios that compare the cost of identical baskets of goods and services globally. The ICP collects detailed information on price levels in economies worldwide. PPPs enable levels of economic activity in different countries to be compared thereby providing in-depth views of the distribution of resources worldwide. Market exchange rates are often used to make such comparisons but they generally produce distorted results because they are influenced mainly by factors such as international trade in goods and services, interest rates and financial flows between countries. On the other hand, PPPs take into account the actual price levels prevailing in a country by directly comparing them with the prices for similar products in other countries. The ICP conducts surveys every five/six years to collect price and expenditure data for all goods and services that make up the Gross Domestic Product (GDP) in order to calculate the PPPs. PPPs are utilized to adjust the GDP of different countries, initially expressed in each country's national currency, to a common currency so that their volumes of final goods and services purchased can be directly compared. There is a considerable demand for PPPs evidenced by their large and diverse applications by development organizations, governments, corporations, and myriad others. The demand for global statistics has increased and along with it the need for open and timely data. A setback to the current ICP process is the publication lag between benchmark ICPs, which are held every five/six years. As a result, PPPs are extrapolated from the latest ICP benchmark, for example through the Penn World Tables and the World Development Indicators. These publications extrapolate PPPs at high levels (GDP or its main aggregates). The World Bank is exploring new approaches to improve the extrapolation method currently used in the World Development Indicators. This paper describes the proposed improved PPP extrapolation approaches and highlights the issues associated with extrapolating PPPs from a benchmark year to later years and in interpolating between benchmarks.

Keywords: International Comparison Program, PPP time series, Prices, National Accounts

1. Background

The International Comparison Program (ICP) was developed in the 1960s in order to compare the levels of economic activity in different countries. At that time, national accounts had progressed to the point at which many countries were producing annual estimates of expenditure on gross domestic product (GDP). Comparing growth rates of GDP is a trivial exercise because percentage changes do not depend on the currency in which the GDP estimates are expressed. However, before comparing levels of GDP between countries it is necessary to convert each country's GDP from its national currency to a common currency (most commonly the United States dollar ($US)). Even in the 1960s, during the regime of fixed exchange rates around the world, it was obvious that using exchange rates to convert GDP estimates from a national currency to $US was flawed because exchange rates do not take into account the differences in price levels between countries. In the current era of floating exchange rates in so many countries, exchange rates are even less suitable for this purpose because they are influenced by factors such as international trade in goods and services, interest rates and monetary flows rather than the internal price levels of countries. Typically, using exchange rates to convert GDP into a common currency overstates the gap between developed and developing countries because the latter have much lower wage rates than the former. As a result, the costs of their internal services are much lower compared with those in developed countries. The ICP provides a more robust method of converting GDP estimates into a common currency because it collects prices for similar products in all participating countries and compares them in the form of purchasing power parities (PPPs).

The early steps in developing PPPs in the 1960s were based on collecting price data from a very small number of countries. The ICP gradually developed over time, with the 2005 round involving 146 countries from all major regions of the world. The 2011 ICP further expands the country coverage with approximately 190 countries involved, although some of these are providing data only for household final consumption expenditure. One of the downsides of such broad participation is the cost of running a full ICP round, both for the World Bank (the coordinating agency) and the national statistical offices that are providing the price and national accounts data.

On the other hand, the wealth of data available from the 2005 ICP has led to increased interest in international comparisons and so to a requirement for more frequent PPPs. Some methods have been developed to estimate annual PPPs, with the most common ones based on extrapolating the latest benchmark PPP using the rates of change in prices between the USA and each other country in turn. However, such methods are based on some very restrictive assumptions that are unlikely to be realized in the medium term, even if they do happen to hold in the short term.

2. Challenges with estimating PPPs for non-benchmark years

Dalgaard and Sørensen (2002) demonstrated the conceptual problem of trying to maintain consistency across both time (e.g. a consumer price index (CPI)) and space (e.g. PPPs) in an index formula. However, the methods commonly used to extrapolate PPPs from a benchmark year assume a high degree of consistency between a time series and the PPPs from successive ICP benchmarks.

The most common method used to extrapolate PPPs is to use the ratio of the GDP deflator for a country to that of a base country (usually the USA) in each year to extrapolate from the latest benchmark PPP available for GDP; this is often referred to as the "GDP extrapolation method" and is used by the World Bank to construct the PPP time series published in its World Development Indicators. The main reasons for this simple approach are that it is easy to implement and the necessary data are readily available. More robust approaches have not been used to date (at least outside the European Union and OECD countries) because the detailed price data required are either not available or are not classified consistently at a detailed level across the countries involved. One piece of evidence that indicates the shortcomings of these extrapolation procedures is the difficulty experienced in using this type of method to interpolate PPPs between benchmarks. The gaps that appear between the PPPs extrapolated from an earlier benchmark compared with those produced in a later benchmark show that it is a flawed process, even over a relatively short span of years.

Some of the most restrictive types of assumptions involved in extrapolating PPPs using such methods are that the countries concerned have similar types of economies, with similar price levels and they are evolving in a similar way over time. Clearly, such assumptions are not being met when countries such as the USA and India are being compared but they are rarely mentioned when the processes involved in extrapolating PPPs are documented. McCarthy (2012) has identified a variety of assumptions that underlie such extrapolations.

Despite the limitations of the extrapolation procedures, it is important to realize that they will continue to be used because they provide a better means of comparing the levels of economic activity between countries than exchange rates.

3. Overview of current methods

As described above, the most common method to estimate PPPs for non-benchmark years is the GDP extrapolation method. A variation on this approach is to use separate deflators for each of the major components of expenditure on GDP (household final consumption expenditure, government final consumption expenditure, gross fixed capital formation and net trade in goods and services) and aggregate the PPPs for these components to a PPP for GDP. This is the approach used by the Penn World Tables. However, while it is generally the case that the resultant PPPs for GDP are better than those from a simple GDP deflator extrapolation, they still suffer from the restrictive assumptions underlying this type of process.

Another method that has been used is to take a 3-year or a 5-year moving average of exchange rates to extrapolate PPPs from a benchmark. However, while this does smooth out some of the larger fluctuations in exchange rates, it does not overcome the fundamental problem that exchange rates ignore differences in price levels between countries.

Eurostat (the European Union's Statistical Office) produces annual PPPs by collecting prices for household final consumption expenditure on a 3-year rolling program and adjusting them using time series from the Harmonized Index of Consumer Prices (HICP). In effect, prices for approximately one sixth of the household final consumption expenditure products are collected each half year and then adjusted using the HICP time series to a consistent set of prices for each year. Annual PPPs for household final consumption expenditure can then be estimated. The

HICP is critical for this process because the prices collected for the HICP are classified consistently across countries and are available for all the countries involved. The prices for government final consumption expenditure and gross fixed capital formation are collected more frequently than those for household final consumption expenditure. The main difference between this type of procedure and the GDP extrapolation method is that the prices for individual products are being adjusted to a common time (i.e. each year) using prices of directly related products. For example, prices for different types of meat may be extrapolated using the price index for meat. In this regard, it is quite different from the equivalent of using the GDP extrapolation method for household final consumption expenditure, which would be to extrapolate PPPs for total household final consumption expenditure using the HICP index for all goods and services.

Eurostat refers to this method as the "rolling benchmark approach". It has worked effectively for many years in terms of reducing costs (collecting prices for each product only once every three years instead of every year), providing an ongoing program of price collection so that a large number of price collectors do not have to be hired for a short period and in providing reliable annual PPPs for analysts interested in international comparisons.

4. Proposed new approach

The World Bank is exploring a new approach to improve the extrapolation method currently used in the World Development Indicators. The proposed approach involves extrapolating PPPs at the most detailed level - the Basic Heading level. A Basic Heading is the lowest level of disaggregation under the ICP Classification of Final Expenditure on ICP (2008) for which PPPs are computed. The rationale is that extrapolating PPPs at the most detailed level would yield more robust and detailed results than extrapolating PPPs at higher levels using the current methods.

The approach involves two stages. In the first stage, Regional PPPs are extrapolated. In the second stage, the Regional PPPs are linked to produce Global PPPs. The first stage involves the extrapolation of Regional PPPs, as per the following steps:

A1. Extrapolate Basic Heading Regional PPPs to non-benchmark years using the relative price indices of the countries to the Regional numeraire country;

A2. Extrapolate Basic Heading expenditure data (expressed in national currency units) for each country using changes in prices and population;

A3. Pro rate the extrapolated Basic Heading expenditures (from step A2) to the most detailed expenditure aggregates available for each country (e.g. GDP, household final consumption expenditure, gross fixed capital formation, etc.);

A4. Aggregate Basic Heading Regional PPPs using the Gini-Éltetö-Köves-Szulc (GEKS) method to compute Regional PPPs for each level of aggregation up to the GDP;

A5. Deflate the extrapolated expenditures matrix (from Step A3) by the computed Regional PPPs matrix (from Step A4) to obtain the Regional matrix of real expenditures;

A6. Compute country real expenditure shares in the Regional Comparison for each level of aggregation up to the GDP.

Next, the Global PPPs are computed following a similar approach to that used in benchmark exercises. This approach involves the following steps:

B1. Extrapolate inter-regional linking factors at the Basic Heading level. These inter-regional linking factors are inter-regional Basic Heading PPPs expressed in the Regional numeraire countries to the Global numeraire country (USA), thus they can be extrapolated using the relative price indices of the Regional numeraire countries to the Global numeraire country (USA);

B2. Ensure the fixity of Regional Basic Heading PPPs in the Global comparison by multiplying each country's Regional Basic Heading PPPs (from Step A1) by the inter-regional linking factor (from Step B1). The PPPs derived from this step are the Global Basic Heading PPPs;

B3. Aggregate Global Basic Heading PPPs (from Step B2) using GEKS to compute Global PPPs for each level of aggregation up to the GDP;

B4. Deflate the extrapolated expenditures matrix (from Step A3) by the computed Global PPPs matrix (from Step B3) to obtain the Global matrix of real expenditures;

B5. Compute Regional real expenditure totals by summing the country real expenditures in the Global Comparison (from Step B4) for each Region;

B6. Distribute Regional real expenditure totals among the countries in the regions according to the country shares in the Regional Comparison (from Step A6) to ensure the fixity of Regional real expenditures and PPPs for each level of aggregation up to the GDP;

B7. Global PPPs for each country are calculated indirectly by dividing the expenditures expressed in national currency units (from Step A3) by the country real expenditures (from Step B6) for each level of aggregation up to the GDP.

If the quality of PPPs, linking factors, and expenditure data at the Basic Heading level is not very reliable, then this approach can be implemented at higher levels of aggregation under the ICP Classification of Final Expenditure on ICP (i.e. classes, groups, categories, etc.).

The World Bank is currently testing this extrapolation approach for the period 2005-2011, and comparing the extrapolated 2011 results to preliminary 2011 benchmark results, as they are produced by the ICP. The findings from this testing will be reviewed and discussed by the ICP Technical Advisory Group, with the objective of finalizing this new extrapolation method by December 2013.

5. Conclusion

With the 2011 Round of the ICP coming to a close, the World Bank and various stakeholders are contemplating the future of the ICP. An improvement in the extrapolation of PPPs between benchmark years is a crucial element to ensure the sustainability of the ICP, by responding to the increased demand for more frequent and detailed PPPs and improving the use of PPP data.

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