

Outliers in PWT8.0

Outliers of relative price levels of GDP^e

To gauge the plausibility of the price levels of GDP^e (i.e. the PPP for GDP^e divided by the exchange rate), we evaluate a number of criteria. In general, GDP^e price levels can fluctuate because of exchange rate movements and because of changes in a country's PPP. As discussed in the document 'Exchange Rates in PWT80', we use the UN's preferred exchange rate series, which includes estimated rates whenever there are large swings in exchange rates not matched by domestic price swings. We extend this estimation for a number of countries where this also seems warranted based on similar criteria (see below). In addition, part of the time series for a number of countries have been labeled an outlier. This document describes the indicators and criteria that have been used to flag observations as 'suspect' and then which observations have been labeled as 'outliers'.

Criteria

Note that observations on GDP^e price levels in PWT8.0 are based on a) *benchmark* price comparisons, b) *interpolations* between benchmark comparisons or c) *extrapolations* from later or earlier benchmarks. The first criterion is that observations based on benchmark price comparisons or interpolations between benchmarks are trusted. This criterion provides a point of reference for the extrapolated data, rather than an argument all benchmark or interpolated prices are perfect. There is one exception to this and that is the PPP data for Zimbabwe in 2005. Due to the hyperinflation plaguing that country in this period, the PPP estimates are deemed so problematic that the World Bank itself no longer reports these data. This is also supported by comparing the extrapolated price level from the 1996 comparison 0.15 (USA=1) to the ICP 2005 benchmark estimate of over 1.60.

For the second criterion, we rely on earlier editions of PWT, namely 6.1 and 5.6. PWT 5.6 was based on the 1985 benchmark and expanded the set of countries covered by using cost-of-living post-adjustment factors from (amongst others) the United Nations. PWT 6.1 did the same for 1996. It is typically unclear what type of detailed information those post-adjustment factors are based and to what extent an individual country's post-adjustment factor corresponds to its PPP, yet it provides another point of reference.

The third criterion is the predicted price level from a Penn effect regression. The log of GDP per capita (converted using the nominal exchange rate) is regressed on the log price level (PPP divided by the exchange rate) for the set of benchmark and interpolated observations. The extrapolated price level is then compared with the predicted price level.

Approach

The benchmark observations all fall between 15% and 185% of the US price level and interpolated observations fall in only a slightly wider range of 12% to

205%.¹ If an extrapolated observation falls outside these bounds, this is cause for concern, as such high or low price levels are never observed in actual price comparisons or for observations constrained by earlier and later benchmark comparisons. This approach flagged observations in eleven countries. For the second and third criterion, the rule of thumb was that if both indicated that the extrapolated price level was twice as high as indicated by the earlier PWT estimate or the predicted price level, this was cause for further investigation. Based on these criteria, a number of countries were investigated. This led to the decisions listed in the table below.

Outliers of relative price levels of GDP^o

PWT8.0 is the first version of PWT to also include a price level of GDP^o, so accounting for price differences of exports and imports. As a result, there is less experience or history to guide decisions on what constitutes an improbably high or low price level. Furthermore, the price level of GDP^o could be based on benchmark, interpolated or extrapolated prices for consumption and investment and benchmark or extrapolated prices for exports and imports and any combination thereof. We are thus more reluctant to label a price level of GDP^o as an outlier.

One feature of the GDP^o calculation is that it could be negative, as PPP-converted imports are subtracted from the sum of PPP-converted consumption, investment and exports. This is a rare occurrence, affecting only Bermuda. The negative observations for Bermuda are labeled as outliers, including some of the other years (see the table below).

Table: outlier decisions

Country	Issue	Decision
Argentina	GDP ^e price levels of up to 6 times the US level for 1950-1966	Exchange rates for these years replaced by estimated rates
Bermuda	After 2005, the GDP ^e price level exceeds the maximum of 205% for 'benchmark or interpolated' observations. However, the last benchmark, in 1996, was already 184% and the maximum price level in Bermuda is 211%. GDP ^o price levels are already high in the benchmark year 1996, at 354% of the US. However, for the period 1998-2004, the GDP ^o price level is mostly negative and in one year 170% of the US level.	No changes were made based on GDP ^e price levels. Based on GDP ^o price levels, the 1998-2004 period is labeled as an outlier
Bolivia	GDP ^e price levels of up to 11 times the US for 1950-1955	Exchange rates for these years replaced by estimated rates

¹ Note that we normalize the US GDP^e price level to 1 in each year to compare price levels over the years.

Brunei	Between 1985 and 1986, GDP ^e /capita drops from 245% to 146% of the US level and during the entire 1970-1985 period, GDP ^e /capita is 200 to 450% of the US level. The Brunei economy depends on oil exports for about half of its GDP. In 1986, oil prices, hence exports, hence nominal GDP dropped substantially without a similar fall in prices for consumption or investment. Extrapolating backwards implies very high GDP ^e /capita levels and very low GDP ^e price levels (3% in 1970).	The 1970-1985 period is labeled as an outlier
Burundi	Large discrepancy with earlier estimates for 1996 (PWT6.1) and 1985 (PWT5.6), showing GDP ^e price levels that are twice as high as in those versions. Before 2000, the price level was between 50 and 500% higher than predicted from Penn effect regressions, compared with little difference in the benchmark year, 2005.	The 1960-1999 period is labeled as an outlier
Congo, DR	For 1963-1968 and 1972-1994, very high inflation (average annual GDP deflator increases of 49% in the first period and 179% in the second period) and an exchange rate that was frequently out of step with these swings led to GDP ^e price levels of more than 150% of the US level, while the 2005 benchmark level was 57%.	Exchange rates for these years replaced by estimated rates
El Salvador	Rapid inflation in the late 1980s and early 1990s combined with a fixed exchange rate led to GDP ^e price levels of up to 280% of the US level.	The 1986-2010 period is labeled as an outlier
Equatorial Guinea	Exchange rate and price movements are often disconnected. Experiments with different estimation periods show little success in finding a starting and ending point that smooth out the large price level swings. At the same time, the results are not so far out of the realm of plausibility to warrant removing much of the observations for this country: the high price levels in 1996 compared with PWT6.1 are easier to swallow given the high GDP ^e price levels in 2005. Of course, the economy is much richer in 2005 than in 1996, but how	No changes were made

	much of the high GDP ^e price levels are due to the difficulty of keeping track of such a rapidly growing economy and how much is due to mismeasurement is hard to establish.	
Gambia	The period 1972-1985 shows persistent differences between domestic price movements and exchange rate movements, leading to implausibly high GDP ^e price levels.	Exchange rates for these years replaced by estimated rates
Guinea-Bissau	After 1995, the GDP ^e price level varies between 48 and 63%, while between 1960 and 1995, the GDP ^e price level varies between 83 and 240% of the US level. This is also far out of line with predicted price levels from Penn effect regressions (which are around 40%) and non-benchmark estimates for 1985 from PWT5.6 (28%).	The 1960-1995 period is labeled as an outlier
Israel	For 1950-1953, exchange rates from the IMF International Financial Statistics imply price levels that are two to four times the US level.	Exchange rates for these years replaced by estimated rates
Mozambique	Between 1973 and 1991, prices increased rapidly and the exchange rate increased at, on average, an even faster rate. This led to GDP ^e price levels of 350% of the US in the 1960s.	The 1960-1991 period is labeled as an outlier
Sao Tome and Principe	For 1970-1976, GDP ^e price levels peak at 180% of the US level during this period and price and exchange rate movements go in opposite directions.	Exchange rates for these years replaced by estimated rates
Saudi Arabia	In 1973, GDP ^e price levels increased from 30% to 330% of the US level, dropping to 70% in 1974 and remaining at similar levels throughout the period.	No changes were made
Viet Nam	For 1970-1979, an implausibly high exchange rate is shown from what the UN indicates is an 'unknown source'.	Exchange rates for these years replaced by estimated rates. Lower GDP ^e price level in the early 1980s were left 'as is'.