Penn World Table 7.0: Are the Data Seriously Flawed?

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Abstract

*Penn World Table* (PWT) 7.0 is the newest PWT data set, based in part on benchmarked prices collected in 2005. In theory the data in PWT 7.0 should be more accurate than the data in PWT 6.3 since 1996 and similar in earlier years. I show that PWT 7.0 GDP/capita and price data for 1970 to 1996 deviate substantially from prior PWT data that are benchmarked to prices across countries for those years. I conclude that overall the PWT 7.0 data are much less accurate than the data in PWT 6.2 and 6.3.

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The Penn World Table (PWT) is a set of multi-country data that measure economic activity using a uniform set of prices for goods and services. These prices are based on surveys undertaken in 1970, 1975, 1980, 1985, 1990, 1996, and 2005. PWT 7.0, the latest version, includes data for 189 countries for up to 60 years. Since PWT 7.0 is the first version to use price data from the 2005 International Comparison Program (ICP), its data since 1996 should be better than the data in PWT 6.3.

But an examination of the data in PWT 7.0 reveals that they differ substantially from the data in PWT 6.3 for the entire period from 1950 to 2007. Since the data for 1970 to 1996 in PWT 6.3 were supposedly created from benchmarked prices for those years, the data modifications in PWT 7.0 are completely unexpected. Two questions immediately arise: Are the data in PWT 7.0 an improvement over the data in PWT 6.3? And more importantly, are the data valid in either of these versions?

Johnson, Larson, Papageorgiou, and Subramanian’s [2009] evaluated the methodology used to create PWT 6.1 and 6.2 and determined that it is flawed. Based on my review of the last five versions of the PWT, I conclude that 1) this flawed methodology is still being used, 2) the data in PWT 7.0 are seriously flawed, and 3) the data in PWT 6.2 and 6.3 are less flawed. In the rest of this paper I present GDP/capita and relative price data from various versions of the PWT that support these conclusions.

**GDP/capita and Price Indices: PWT 7.0 vs. PWT 6.3**

Figure 1 presents GDP/capita data from PWT 7.0 and 6.3 for the UK and the Philippines from the rgdpch series. Since these two countries participated in all of the price benchmarking studies between 1970 and 1996 [Heston, Summers, and Aten, 2008], their data should be among the most reliable for high and low income countries.
The economic data in PWT 6.3 between 1970 and 1996 are based on benchmarked prices, while the data prior to 1970 and after 1996 are projections. The economic data in PWT 7.0 have a similar basis, but after 1996 they are based on price data from ICP 2005. In theory the GDP/capita data from 1950 to 1996 should be similar in PWT 6.3 and 7.0 and should diverge after 1996. Instead Figure 1 shows that the level of GDP/capita in PWT 7.0 is higher in the UK and much lower in the Philippines throughout the entire 1950 to 2007 period. In the Philippines GDP/capita is about 40% lower, even during the period corresponding to earlier price benchmarking studies. How could this happen?

Johnson, et. al. [2009] observe that the data in PWT are created by applying the price indices in the most recent benchmarked year to the data in the National Accounts and then projecting this adjusted data backward and forward using unadjusted National Accounts data.
They observe that in the creation of PWT 6.1, the benchmarked price information prior to 1996 was almost entirely discarded.

Such an approach could explain the pattern of changes in the GDP/capita data between PWT 6.3 and 7.0. The changes in relative prices in the ICP 2005 would change PWT 6.3’s estimates of GDP/capita in 2005 and then the National Accounts data would create a similar growth projection backward to 1950 in both data sets. Neither set of data would be valid except in the benchmarked year, which would be 1996 for PWT 6.3 and 2005 for PWT 7.0.

While this description of the basic PWT price adjustment methodology appears to be correct, additional adjustments were made in each version. The creators of the PWT data were concerned that their adjustment methodology would substantially alter the historic data in each version of the PWT, so they implemented a “consistentizacion” procedure to reduce the magnitude of these changes [Heston, Summers, and Aten, 2008]. To reduce changes between PWT 6.1 and PWT 5.6, in PWT 6.1 they created 1996 prices by applying a 2/3 weight to benchmarked 1996 prices and a 1/3 weight to the prices projected forward from 1985 to 1996 in PWT 5.6. They created the prices for 1985 in PWT 5.6 using a different “consistentizacion” procedure. These prices are the average of five price estimates: benchmarked prices in 1985 and forward and backward projections to 1985 from benchmarked prices in 1970, 1975, 1980, and 1990. So the prices for the entire historic period in PWT 6.1 are based about 2/3 on 1996 benchmarked prices and about 1/3 on the benchmarked prices for five earlier years.

If the methodology for creating PWT prices has not changed since PWT 6.1, then the data in PWT 7.0 are based 2/3 on the 2005 price benchmarks and 1/3 on the prices in 1996 in PWT 6.3. But given the huge changes in the GDP/capita data in the Philippines between PWT
6.3 and 7.0, it is possible that the data in PWT 7.0 are based entirely on the 2005 price benchmarks.

Figure 2 shows the ratio of the price indices $\pi/p$ for 61 countries in 1996 in PWT 6.3 and in PWT 7.0. These two indices measure prices for investment ($\pi$) and for GDP ($p$) relative to the U.S. price for GDP. In theory these ratios should be the same in PWT 6.3 and 7.0, since both should be based on benchmarked prices in 1996. In PWT 6.3 this ratio is 2-3 times higher in low-income countries than in high-income countries. This relationship is consistent with earlier versions of the PWT, in which investment goods in low-income countries had higher average prices than goods in other sectors of the economy [Summers and Heston, 1991]. In stark contrast, the ratio $\pi/p$ for 1996 in PWT 7.0 is invariant across countries. Implicitly in PWT 7.0 the 2005 estimates for these price indices became the primary basis for the indices in 1996, abandoning the very different price information in earlier benchmarking studies.

**Figure 2**

*Ratio of the Price Indices $\pi/p$ Across Countries in 1996*
The validity of the PWT 7.0 data is also in doubt for 2005. ICP 2005 included a comprehensive price survey, but many of the products were not representative for low-income countries and prices often were not collected in rural areas. Deaton and Heston [2010] judge that ICP 2005 overstates price levels \( (p) \) in lower-income countries to a greater degree than earlier benchmarking studies. This higher value for \( p \) in PWT 7.0 reduced the \( \pi/p \) ratio in low-income countries.

II. Validity of the Various Versions of the PWT

The analysis so far suggests that the prices in PWT 6.3 are more similar to actual benchmarked prices than the prices in PWT 7.0. Even though the methodology for creating prices has been conceptually flawed for a long time, the substantial change in the price indices in ICP 2005 appears to have created much greater bias in the PWT 7.0 data than it had in earlier versions of the PWT.

The “consistentization” procedure in PWT 5.6 in effect created economic data that are based on the average of the prices in the benchmarking studies performed from 1970 to 1990. So a simple estimate of the relative bias in the more recent versions of the PWT is the deviation in their average price data for the 1970-90 period compared to the average price data in PWT 5.6.

The data on GDP/capita and relative prices in Figures 1 and 2 indicate that the bias problem is concentrated in the low-income countries. Only two low-income countries, the Philippines and Kenya participated in all the price benchmarking studies, so these countries are the best candidates for evaluating the bias in the different versions of the PWT.

Figure 3 shows the ratio \( \pi/p \) for PWT 5.6, 6.2, 6.3, and 7.0 for the Philippines for 1950 to 2009. This ratio is calculated from the data for \( \pi \) and \( p \) in each data set [Heston, Summers, and Aten, 2011, 2009, 2006, undated]. The patterns in the figure show that for the period 1970
to 1990, the price data in PWT 6.2 and 6.3 are relatively consistent with the price data in PWT 5.6, while the price data in PWT 7.0 clearly are not. Since the price indices in PWT 5.6 only match historic benchmarked prices on average and not by year, it is not clear whether PWT 6.2 or 6.3 data are more consistent with the 1970-90 benchmarking studies.

**Figure 3**

**Ratio pi/p for the Philippines in Different Versions of the Penn World Table**

![Graph showing pi/p ratio for the Philippines](image)

Price indices in the Philippines between PWT 5.6 and PWT 6.2 and 6.3 are not consistent for the period 1950 to 1970. Given the PWT methodology for projecting prices backward prior to 1970, it is not clear why price ratios that were similar in 1970 are not similar prior to 1970.

Figure 4 shows the same pi/p ratios for Kenya. Overall the variation in the price ratios between the various versions of the PWT is similar to the pattern observed for the Philippines.
The ratios in PWT 6.2, and 6.3 are consistent with PWT 5.6 over the 1970-90 period, while the ratios in PWT 7.0 clearly are not. Again it is not clear why the data for 1950 to 1970 changed between PWT 5.6 and PWT 6.2 and 6.3.

This review provides strong evidence that the data in PWT 7.0 deviate substantially from the benchmarked price data over the period 1970-2000. Data in PWT 6.2 and 6.3 appear to be considerably more consistent with the benchmarked data. PWT 6.2 and 6.3 data prior to 1970 and after 2000 appear to be less reliable. Even though the same flawed methodology apparently was used to create the data in PWT 6.2, 6.3, and 7.0, the data in PWT 6.2 and 6.3 are less biased because the relative prices in the benchmarking study in 1996 did not change as much relative to earlier years as they did in 2005.

Figure 4

Ratio $p_i/p$ for Kenya in Different Versions of the Penn World Table
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