

# **Construction of World Tables of Purchasing Power Parities and Real Incomes Based on Multiple Benchmarks and Auxiliary Information: A State-Space Approach**

*D.S. Prasada Rao, Alicia Rambaldi and H.E. Doran*

The paper presents a new method for the construction of a consistent panel of Purchasing Power Parities (PPPs), and real incomes, using an econometric framework that combines available predictions of PPPs into a single model. The method improves upon the current practice used in the construction of the Penn World Tables, PWT, and similar tables produced by the World Bank as it integrates the various steps involved in the compilation of the Penn World Tables, makes use of all the PPP benchmark data from the various phases of the International Comparison Program, and ensures the model's prediction of the PPP for the reference country is identically one for all time periods. This general econometric model combines two sources of observations of PPP. The first and primary source of data is the ICP and the PPPs for benchmark years constructed by the ICP. The second are the PPP predictions from a model of the national price level (or exchange rate deviation index) which is able to produce predictions for all countries and years. The errors in the regression model are assumed to be spatially correlated across countries. These observations are combined using a state-space formulation so that the problem of obtaining optimum predictions of PPPs, from the available time series and cross sectional information, is treated as one of signal extraction. The smoothed PPP predictions (and standard errors) obtained through the state-space are produced for both ICP- participating and non-participating countries and non-benchmark years. Both sets of PPP observations (ie those based on model predictions as well as the ICP benchmarks) are assumed to suffer from measurement error. More developed countries are assumed to compile both national accounts data and ICP benchmark surveys with less measurement error. Therefore, the covariance structure of the state-space model is heteroskedastic and spatially correlated.

The objective of this paper is to present a number of analytical results to highlight some of the properties and flexibility of the approach. For example, we show that the resulting PPP predictions when the regression predictions are used only for non-benchmark countries in the benchmark years are weighted averages of past observations, and that the PPP estimates from earlier ICP benchmarks are weighted less than the more recent ones. We show how a series of constraints to the general model produce variants that: a) result in PPP predictions that deviate minimally from the available ICP's PPPs (benchmarks); or b) preserve the growth rates in price levels implicit in individual countries' national accounts data. A data set for 141 countries for the period 1970 to 2005 is used to illustrate the flexibility of the method proposed here and to produce a tableau of *PPP* estimates with standard errors for all countries over the period.

*JEL Classification:* C53, C33

*Key words:* Purchasing Power parities, Penn World Tables; State-space models; Spatial autocorrelation; Kalman Filter