

# Purchasing power parity, price indices, and exchange rate forecasts

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## Abstract

This paper addresses the issue of using aggregate price indices for purchasing power parity (PPP) tests and the fitness of PPP as a model for exchange rate forecasting. Compared with consumer price index (CPI) and wholesale price index (WPI), the price index of traded-goods (TPI) appears to be a more appropriate price index for both PPP tests and exchange rate forecasting. It performs better in the tests and provides superior exchange rate forecasts, both within- and out-of-sample. While the half-life of the estimated deviations from PPP is about two years for the CPI and WPI-based real exchange rates, it is only one year for the TPI-based real exchange rates.

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## 1. Introduction

Purchasing power parity (PPP) has been viewed as a basis for international comparison of income and expenditures, an equilibrium condition, an efficient arbitrage condition in goods or assets, and a theory of exchange rate determination (Officer, 1976; Frenkel, 1976, 1978; Dornbusch, 1987; Isard, 1987; Helmers, 1990; Summers and Heston, 1991). As a basis for international comparison of income and expenditures, PPP establishes a common ground for cross-country comparison by linking currencies of different countries to the same base. In this case, PPP is superimposed

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as an *a priori* condition to convert a country's income or expenditures in local currency to a common unit (Summers and Heston, 1991, p. 329). As a parity or arbitrage condition, PPP relates the equilibrium exchange rate to domestic and foreign prices, but does not imply a direction of causality. As a theory of exchange rate determination, a direction of causality is imposed on the relationship between the equilibrium exchange rate and domestic and foreign prices. For example, the monetarist view of PPP runs from monetary disturbances to price levels to exchange rates. In the latter two views, the validity of PPP must be empirically tested.

PPP has been tested extensively ever since Cassell (1918, 1923) formalized it early in the 20th century. According to Froot and Rogoff (1995, p. 1649), there are three different stages of empirical tests. The first stage includes correlation-type tests in which the null hypothesis is that PPP holds. The second stage involves time series (unit root) tests in which the null hypothesis is that PPP deviations are completely permanent. The third stage consists of cointegration tests in which the null hypothesis is that deviations away from any linear combination of prices and exchange rates are permanent. Stage-one tests typically reject the PPP hypothesis. Supporting evidence has emerged in stage-two and stage-three tests. Most tests, however, do not support PPP. The current consensus in the literature is that the estimated deviations from PPP are persistent and have a half-life of 4–5 years at best. For a survey, see Froot and Rogoff (1995) and the references therein.

For quite a while, researchers have been seeking explanations for these disappointing results. For example, Taylor (2000) pointed out that the slow convergence to PPP typically found in the literature was inconsistent with the real world. He demonstrated that relatively low-frequency data and linear model specifications could contribute to the disappointing results of slow convergence to PPP. On the other hand, Lothian and Taylor (1996) found strong evidence of mean-reverting real exchange rates between the dollar and the sterling and between the franc and the sterling with two centuries of annual data. Using random simulations with artificial data, Lothian and Taylor (1997) also discovered that the probability of rejecting a false null hypothesis was extremely low with 20 or even 50 years of annual data, but became acceptable over long spans. Cumby (1996) found that once the average deviations from absolute Big Mac parity were removed, convergence to relative Big Mac parity was quite rapid. The half-life of the estimated deviations from Big Mac is about one year, which is considerably shorter than what has been found in the literature.

In the literature, PPP tests typically involve aggregate price indices. Taylor (1988) showed that aggregate price indices such as the consumer price index (CPI) and the wholesale price index (WPI) did not correspond to their theoretical counterparts and contained measurement errors. In a more recent study, Sjaastad (1998) examined the properties of the PPP real exchange rate as a proxy for the true real exchange rate, which is defined as the relative price of traded-goods. He found that measurement errors accounted for 75% of the variance in the PPP real exchange rate. In another study, Betton et al. (1995) showed that index-induced errors could bias the outcome of PPP tests. They argued that exchange rates would not behave as predicted by PPP even if the measurement errors could be overcome.

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