Testing the purchasing power parity in pooled systems of error correction models

Helmut Herwartz[a,*], Hans-Eggert Reimers[b,1]

[a]*Institute of Statistics and Econometrics, Humboldt-University Berlin, Spandauer Str. 1, D-10178 Berlin, Germany*
[b]*Hochschule Wismar, University of Technique, Business and Design, Postfach 1210, D-23952 Wismar, Germany*

Abstract

Using panel time series data from 18 main industrial economies we test the purchasing power parity (PPP) for the post-Bretton Woods era. As base currencies, we use alternatively the Deutsche mark (DEM), the Japanese yen (JPY), and the US dollar (USD). We employ error correction models for single countries and on the level of pooled equations. Critical values for the applied likelihood ratio tests are estimated by means of the wild bootstrap which copes with heteroskedastic error distributions and contemporaneous cross equation error correlation. To assess the robustness of our results tests of PPP are performed recursively. We find that the PPP provides an accurate description of exchange rate dynamics if the DEM or the JPY are used as base currencies. Specified towards the USD, we reject the economic model. It turns out that this overall conclusion is not invariant with respect to the investigated sample period. © 2002 Elsevier Science B.V. All rights reserved.

1. Introduction

The purchasing power parity (PPP) postulates a stable long-run relationship between the exchange rate of two currencies and the price levels of the involved economies. To test the economic model, mainly two directions of empirical research have been followed recently, unit root testing of real exchange rates and cointegration analysis. For comprehensive surveys of the empirical literature on PPP the reader may consult Froot and Rogoff (1995), Rogoff (1996) or Edison et al. (1997).

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[*] Corresponding author. Tel.: +49-30-2093-5725; fax: +49-30-2093-5712.
E-mail address: helmut@wiwi.hu-berlin.de (H. Herwartz).
[1] Tel.: +49-3841-753601

In the last two decades numerous empirical studies address the issue if real exchange rates are stationary or driven by a stochastic trend. Based on single real exchange rates observed during the post-Bretton Woods era, PPP is mostly rejected (Papell, 1997). Applying panel unit root tests (Levin and Lin, 1992), for instance, Abuaf and Jorion (1990), Frankel and Rose (1996), Jorion and Sweeney (1996) uncover (at least slow) mean reversion of real exchange rates thereby confirming PPP. The results of other studies, among them Hakkio (1984), O'Connell (1998) or Papell (1997), are at odds with the economic model. A particular issue in implementing panel unit root tests is to take contemporaneous correlation between real exchanges rates into account which arises when specifying a pooled system towards a particular base currency (O'Connell, 1998). Mostly feasible GLS procedures are used to incorporate cross-sectional correlation in panel unit root testing. In general, critical values of such tests have to be simulated where the simulation design depends on the particular pooled system and a priori restrictions. Such cross equation restrictions may concern the stationary autoregressive dynamics of the test regression or the parameter governing mean reversion under the alternative hypothesis of stationary real exchange rates. Koedijk et al. (1998) point out that there is little intuition behind the belief that validity of and convergence towards PPP is homogeneous across any set of currencies, as e.g. the Deutsche mark (DEM), US dollar (USD) and Dutch guilder.

This paper is more in the second tradition outlined above, the cointegration approach (Cheung and Lai, 1993; Corbae and Ouliaris, 1991; Edison et al., 1997). Dynamic vector autoregressive model specifications, however, may suffer from a large dimension of the assumed parameter space. Therefore, we employ single equation error correction models (ECMs) to investigate the PPP model towards the most important international currencies, namely, the DEM, the Japanese Yen (JPY) and the USD. From an economic point of view, single equations ECMs are particularly convenient for PPP modeling since they allow for different speeds of adjustments to the long-run equilibrium (Flores et al., 1999; Koedijk et al., 1998). Under a few assumptions such an approach allows efficient inference by means of OLS procedures (Boswijk, 1993) since it is asymptotically equivalent to (higher dimensional) full information maximum likelihood (ML) methods. The likelihood principle, in particular, the likelihood ratio (LR) test, is easily implemented to infer on linear restrictions implied by PPP.

On the level of pooled ECMs, simple aggregates of LR statistics lose their pivotal property due to cross equation error correlation. As recently shown by Herwartz and Neumann (2000), critical values for cross-sectional aggregates of LR statistics can be obtained by a particular resampling scheme, namely, the wild bootstrap. An intrinsic feature of this method is that it does not require any parametric specification of cross equation correlation and, moreover, also copes with heteroskedasticity of error distributions which might affect the performance of LR or unit root tests in small samples. Summarizing, we regard the adopted econometric framework as highly convenient to test PPP in at least three respects: asymptotic efficiency, feasibility and robustness against heteroskedasticity. When testing a particular null hypothesis on the pooled level, we do not impose any further cross equation restriction. Thus, we regard the empirical model as being both informative with respect to particular aspects of cross country homogeneity (PPP) and feasible to capture country specific features (error correction, short run dynamics).