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A test of purchasing power parity based on the largest principal component of real exchange rates of the main OECD economies

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Abstract

A unit root test is used to reject non-stationarity of the largest principal component of nine OECD bilateral real exchange rates over the recent float. Hence, support for purchasing power parity (PPP) over this period is obtained using a standard classical hypothesis test.

Keywords: Exchange rates; Purchasing power parity; Unity root tests; Principal components

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1. Introduction and overview

This paper provides fresh evidence that real exchange rates during the post-Smithsonian float are mean-reverting. Using classical test procedures, we find that the largest principal component (henceforth, LPC) of nine bilateral real rates is stationary, giving support to the hypothesis of long-run purchasing power parity (henceforth, PPP). Previous work has only been able to find in favour of PPP during the recent float by either restricting interest to certain currencies over certain sub-periods or by using non-standard approaches such as Bayesian analysis, imposing auxiliary assumptions, or taking PPP as the null hypothesis. While all of these approaches have their merits, it is of interest to show that statistical support for PPP among the world's most important trading nations over the recent float can be gained by means of a single, simple, classical hypothesis test.

The PPP hypothesis has generated a plethora of empirical papers. Most of these test for the stationarity of real exchange rates. There is a concensus that annual data from the last century strongly supports the hypothesis (see, for example, Edison and Kloveland, 1987; Abuaf and Jorion, 1990; and Frankel, 1985). There is less agreement about the performance of PPP over

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the current float, however. For example, Hakkio (1984) finds that all of the bilateral rates in his sample are non-stationary and argues that the volatility and persistence in exchange rates since 1972 may well be too great to allow the rejection of non-stationarity of real rates. Corbae and Ouliaris (1988), in finding that relative prices and exchange rates are not cointegrated, come to similar conclusions. The findings of Huizinga (1987), Kaminsky (1987) and Enders (1988), however, are more ambiguous.[1]

Most investigators agree that the ambiguous support for PPP given by data from the recent float arises because the tests used have low power (see, for example, Hakkio, 1984). There is, however, another reason. Stationarity tests are typically applied on a currency-by-currency basis, giving a sequence of tests. Even if PPP does hold globally, the chance that all tests within the sequence will reject non-stationarity is very small. To take an extreme example, suppose there are eight statistically independent[2] and stationary real rates in the sample and a test of stationarity applied to any one of the rates has a power of 0.8. Even if PPP did hold, the probability that all eight tests would reject non-stationarity and hence give unambiguous support to PPP is 0.17.[3]

A more powerful test would seem to rest on a multivariate analysis that yields a single test statistic whose null is that one or more rates in the sample is non-stationary and whose alternative is PPP. Abuaf and Jorion (1990) adopt a hybrid multivariate procedure. They impose the restriction that all currencies in their sample have identical largest autoregressive (AR) roots. They then estimate a stacked system of univariate AR equations by GLS and find that non-stationarity can be roundly rejected over the recent float. They do not, however, provide any justification for the largest root restriction, which appears to be driving their results.

This paper adopts a genuine multivariate approach that places no prior restrictions on the VAR. We extract the largest variance principal component from a large number of bilateral real exchange rates. Testing the stationarity of this component amounts to testing a null hypothesis of at least one common trend in the data against an alternative of joint covariance stationarity (PPP) of *all* our currencies. By means of a standard Dickey–Fuller t-test we find that the largest variance principal component of nine bilateral real exchange rates is stationary and conclude that PPP holds for the countries in our sample.

2. Theory

Our test uses the common trends framework of Stock and Watson (1988). Let y_t be an $n \times 1$ vector of random variables, which may be integrated of up to order one. Stock and Watson (SW) show that each element of y_t may be written as a linear combination of $k \leq n$

[1] Adopting a Bayesian perspective, Whitt (1992), estimates posterior odds ratios that favour stationarity of five bilateral real exchange rates.

[2] This assumption is, of course, highly unrealistic. In practice, the exchange rates and associated test statistics will be highly correlated.

[3] Most noted in this respect is the paper of Ardeni and Lubian (1991) who execute stationarity tests for each of the ten bilateral real rates that exist between the United Kingdom, the United States, France, Canada and Italy and fail to reach a definitive conclusion on the validity of PPP over the recent float.