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Purchasing power parity in OECD countries: Evidence from panel unit root

Huseyin Kalyoncu [a,*], Kahraman Kalyoncu [b]

[a] Department of Economics, Nigde University, 51000, Nigde, Turkey
[b] Department of Economics, Middle East Technical University, 06531 Ankara, Turkey

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Abstract

This paper investigates the validity of purchasing power parity (PPP) for 25 OECD countries by using a panel unit-root methodology. The procedure used here is to examine stationarity of real exchange rate. Using ADF unit-root test on single time-series, it is found that real exchange rate of all OECD countries have unit root. This outcome, however, might be due to the generally low power of this test. The aim of this paper is to reconsider this issue by exploiting the extra information provided by the combination of the time-series and cross-sectional data and the subsequent power advantages of panel data unit-root tests. We apply the test advocated by Im et al. [Im, K.S., Pesaran, M.H., Shin, Y., 1997. Testing for unit roots in heterogenous panels. University of Cambridge, Department of Applied Economics]. According to estimation results real exchange rate in OECD countries are stationary and support long-run purchasing power parity.

JEL classification: F31; C22; C23

Keywords: PPP; Panel data unit-root test; Real exchange rate

1. Introduction

The purchasing power parity (PPP) hypothesis is among the most popular research topics in the international macroeconomic literature. PPP suggest that the change in exchange rates between two currencies is determined by the relative prices of two countries. For example, if the US price levels rises by 6% over a year while Turkey's price level rises by 12%, then relative PPP predicts that the dollar will appreciate against the Turkish liras by 6%. The dollars appreciation against the Turkish liras cancels the differential in the inflation rates. Therefore, relative foreign and domestic purchasing powers of both currencies will remain unchanged.

Literature on this doctrine is enormous. Recently researchers have used stationarity and cointegration techniques to test for long-run PPP. Empirical research has not reached a consensus view on whether or not PPP holds. Some of

* Corresponding author. Tel.: +90 388 225 21 45; fax: +90 388 225 20 14.
E-mail address: hkalyoncu@nigde.edu.tr (H. Kalyoncu).

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the studies which tested PPP using cointegration techniques, such as Corbae and Ouliaris (1988), Taylor (1988), Kim (1990), Patel (1990), Layton and Stark (1990), Ardeni and Lubian (1991), Telatar and Kazdaglý (1998), Doganlar (1999) and Narayan (2007) have demonstrated that the long-run PPP does not hold. On the other hand, there are studies such as Kugler and Lenz (1993) and MacDonald (1993) found evidence supporting the validity of PPP.

Using stationarity techniques some researchers, such as Adler and Lehman (1983), Hakkio (1986), Mark (1990), Grilli and Kaminsky (1991), Corbae and Ouliaris (1991), Flynn and Boucher (1993), Bahmanee-Oskoaee (1995,1998), Serletis and Zimonopoulos (1997), Narayan (2005) have demonstrated that real exchange rates contain unit roots and therefore a current change in the real exchange rate is permanent. Nearly all univariate unit-root test concluded that real exchange rates contain unit roots. But some recent studies provides evidence that when structural breaks included for individual countries real exchange rate is stationary, implying support for purchasing power parity. This list includes Marcela et al. (2003) for Mexico, Narayan (2005) for OECD countries, Narayan and Prasad (2005) for 11 middle eastern countries and Narayan (2006a,b) for India.

Recently, panel data unit-root tests have been widely applied to re-examine the stationarity of real exchange rates and hence the long-run purchasing power parity. Using panel unit-root method Wu (1996), Oh (1996), Frankel and Rose (1996), Papell (1997), Lothian (1997), O'Connell (1998), Taylor and Sarno (1998), Papell and Theodoridis (1998), Fleissig and Strauss (2000) and Wu and Wu (2001) find that real exchange rates follow a stationary process. Wu and Chen (1999) fail to reject the unit-root null of real exchange rates using panel unit-root test. Narayan (2006a,b), find that real exchange rates are stationary by applying panel LM unit root with two structural break.

The purpose of this study is to test validity of PPP for 25 OECD countries. This paper is organized as follows. In Section 2, we formally define the analytical framework and econometric methodology. Section 3 describes data and presents empirical result. Section 4 concludes.

2. Analytical framework and econometric methodology

The purchasing power parity tests begin with the calculation of the real exchange rate. The real exchange rate is calculated as follows:

$$\mathrm{RER} = \mathrm{NER}\frac{P^*}{P} \tag{1}$$

where RER is the real exchange rate, NER is the nominal exchange rate and P^* and P are the foreign and domestic prices, respectively. In logarithmic form, the real exchange rate can be represented by:

$$\log(\mathrm{RER}) = \log(\mathrm{NER}) + \log(P^*) - \log(P). \tag{2}$$

Following equation shows the model of mean reverting real exchange rate,

$$\log(\mathrm{RER})_t = \alpha + \beta\log(\mathrm{RER})_{t-1} + \varepsilon_t \tag{3}$$

where α and ε are constant and error term respectively. PPP suggest that real exchange rate series should be stationary. If real exchange rate is stationary this exhibit that any percentage changes in the price level between two countries would be offset by an equal depreciation/appreciation of the nominal exchange rate. If there is a unit-root in the real exchange rate this implies that shocks to the real exchange rate are permanent and PPP does not exist between two countries.

Firstly the stationarity of countries real exchange rate variables is tested by using the Augmented Dickey–Fuller (ADF) unit-root test procedure then panel unit-root tests are applied. In recent years some tests for unit root within panels are developed in the literature. Levin and Lin (1992, 1993), Im et al. (1997), Maddala and Wu (1999), Kao (1999) and Quah (1994) have developed panel unit-root tests. In this study Im, Pesaran and Shin (hereafter IPS) are used. We briefly describe the IPS model:

Suppose that there is a group of N real exchange rates, RER_{it}, which have the following time-series representation:

$$\Delta\mathrm{RER}_{it} = \alpha_i + \beta_i\mathrm{RER}_{it-i} + \sum_{j=1}^{w_{ij}} \delta_{ij}\Delta\mathrm{RER}_{it-j} + \varepsilon_{it}, i = 1,\ldots,N \text{ and } t = 1,\ldots,T. \tag{4}$$