Economics Bulletin

Volume 31, Issue 2

Purchasing power parity hypothesis among the main trading partners of Turkey

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Abstract

In this study, we employ that panel unit root tests can be arranged in groups by cross-section dependence or independence, heterogeneous or homogenous unit roots to examine the validity of the purchasing power parity (PPP) hypothesis in Turkey, among trading partners. Using monthly observations of the period from January 2003 to December 2010 in a panel date framework of currencies of the eight largest-trading partner countries of Turkey, we find that panel unit root tests are not rejected the mean-reversion of real exchange rates. Thus, the empirical results give significant support for the purchasing power parity holds in Turkey among trading partners.

Citation: Giray Gozgor, (2011) "Purchasing power parity hypothesis among the main trading partners of Turkey", *Economics Bulletin*, Vol. 31 no.2 pp. 1432-1438.
Submitted: Feb 01 2011. **Published:** May 15, 2011.

1. INTRODUCTION

To determine the exchange rates under floating exchange rates important for policy makers and theoretical considerations. Floating exchange rates are based on the collapsing of Bretton Woods System in 1973 and became a risk factor as the result of the transition to floating exchange rate regime. All the same, Turkey has shifted to floating exchange rates regime as a consequence of the financial crisis in February 2001. One of the main critical issues that to determine exchange rates, whether they are mean-reverting in the long run and the purchasing power parity (PPP) holds.

There is a widespread literature to examine the relation between real exchange rates and PPP. Froot and Rogoff (1995), Rogoff (1996), Taylor and Sarno (1998), Sarno and Taylor (2002), Killian and Taylor (2003), and Taylor (2006) show that the theoretical background and empirical evidences of PPP-real exchange rates relationship. Some of these studies employ panel unit root tests; others propose alternative tests that emphasize a nonlinear stationary process.[1]

Some papers focus on developing countries such as Central-Eastern Asia countries, Central-Eastern Europe or Transition countries; such as Sarno (2000), Alba and Park (2003), Breitung and Candelon (2005), Bahmani-Oskooee et al. (2008), Chortareas and Kapetanios (2009), Telatar and Hasanov (2009) and Christidou and Panagiotidis (2010).

In this paper, we investigate whether real exchange rates in Turkey among trading partners are mean-reverting or not. We apply some front-page panel unit root tests to eight exchange rates which are defined against Turkish Lira (TL). We suggest that such approach could also provide valuable insight for further investigation of this phenomenon in Turkey.

The outline of this study is as follows: Second section explains the data and the methodology, the third section presents the empirical findings and final section concludes.

2. DATA AND METHODOLOGY

In this section, we define the real exchange rates as a panel framework from nominal exchange rates of Swiss Franc (CHF), Euro (EUR), Great Britain Pound (GBP), Iranian Rial (IRR), Chinese Renminbi (RMB), Romanian Leu (RON), Russian Ruble (RUB) and United States Dollar (USD) against Turkish Lira (TL). We use 768 observations the period from January 2003 to December 2010, and the frequency of data is monthly. The related real exchange rates are determined since they are the currencies of largest trading partners of Turkey except Iraq, according to volume of trade data.[2] Volume of trade statistics are provided from Turkish Statistical Institute and year of 2010 is taken as basis. Data of the nominal exchange rates used for this study come from Central Bank of the Republic of Turkey, Central Bank of Russian Federation, Federal Reserve Board and National Bank of Romania. Data of consumer price indexes are provided from International Monetary Fund Statistics and National Bureau of Statistics and all of them define as (2005=100).

Nominal exchange rates are converted into real exchange rates by using the consumer prices indices. Real exchange rates are constructed defining relative prices as the ratio of each country's CPI to Turkey CPI, and we employ the method as follows:

$$log(RER) = log(NER) + \log(P^*) - \log(P)$$

[1] Sarno (2005), Alba and Pappell (2007) and Lothian and Taylor (2008) have briefly introduced a review of literature.

[2] Consumer price index and nominal exchange rate of Iraq are not suitable in this panel framework because of having many outliers.

Where RER is the real exchange rate, NER is the nominal exchange rate and P^* and P are the foreign and domestic prices, respectively.

And we define the following equation which shows the model of mean-reverting real exchange rate,

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

α and ε are constant and error term respectively. PPP suggests that real exchange rate series should be stationary. If there is a unit-root in the real exchange rate, this implies that shocks to the real exchange rates are permanent and PPP does not exist between two countries.

The classical unit root tests of the real exchange rates such as Dickey and Fuller (1979) are subject to some criticism that is occurred from the low power of these tests in small samples, in order to define PPP relationship. Consequently, panel unit root tests have begun to be widely used in literature. In this study, we employ panel unit root tests can be arranged in groups by cross section dependence or independence, heterogeneous or homogenous unit roots which are defined by Maddala and Wu (1999), Breitung (2000), Hadri (2000), Choi (2001), Levin et al. (2002), Im et al. (2003).

To define these approaches, we consider a following AR (1) process for panel data: (Quantitative micro software, 2009: 395-401)

$$y_{it} = \rho_i y_{it-1} + X_{it}\delta_i + \varepsilon_{it}$$

Where $i = 1, 2, ...N$ cross-section units or series that are observed over periods $t = 1, 2, ...T_i$ X_{it} present the exogenous variables in the model, including any fixed effects or individual trends, ρ_i are the autoregressive coefficients, and the errors ε_{it} are assumed to be mutually independent idiosyncratic disturbance. If $|\rho_i| < 1$, y_i said to be weakly (trend) stationary. On the other hand, if $|\rho_i| = 1$ then y_i contains a unit root.

For purposes of testing, there are two natural assumptions that we can make about the ρ_i. First, one can assume that the persistence parameters are common across cross-sections so that $\rho_i = \rho$ for all i; Levin et al. (2002), Breitung (2000), and Hadri (2000) tests all employ this assumption. Alternatively, one can allow ρ_i varying freely across cross sections. The Im et al. (2003), Fisher-ADF and Fisher-PP tests are defined by Maddala and Wu (1999) and Choi (2001) are of this form.

Levin et al. (2002), Breitung (2000) and Hadri (2000) tests all assume that there is a common unit root process so that ρ_i is identical across cross-sections. The first two tests employ a null hypothesis of a unit root while the Hadri (2000) test uses a null of no unit root. Levin et al. (2002) and Breitung (2000) both consider the following basic ADF specification:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j-1}^{p_i} \beta_{ij} \Delta y_{it-j} + X'_{it}\delta + \varepsilon_{it}$$

Where we assume a common $\alpha = \rho - 1$ but allow the lag order for the difference terms, ρ_i to vary across cross-sections. The null and alternative hypotheses for the tests may be

written as H_0: $\alpha = 0$ H_1: $\alpha < 0$ so under the null hypothesis, there is a unit root, while under the alternative, there is no unit root.

The Im et al. (2003), the Fisher-ADF and Fisher-PP tests all allow for individual unit root processes so that may ρ_i vary across cross-sections. The tests are all characterized by the combining of individual unit root tests to derive a panel-specific result. Im et al. (2003) begin by specifying a separate ADF regression for each cross section:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j-1}^{p_i} \beta_{ij} \Delta y_{it-j} + X'_{it}\delta + \varepsilon_{it}$$

$H_{0:}\alpha = 0$ for all i while the alternative hypothesis is given by $H_1 \begin{cases} \alpha_i = 0 for \ldots i = 1, 2, N_1 \\ \alpha_i < 0 for \ldots i = N+1, N+2, \ldots . N \end{cases}$

(Where they may be reordered as necessary) which i may be interpreted as a non-zero fraction of the individual processes is stationary.

This alternative approaches to panel unit root tests use Fisher's (1932) results to derive tests that combine the p-values from individual unit root tests. This idea has been proposed by Maddala and Wu (1999) and by Choi (2001).

3. EMPIRICAL RESULTS

We apply panel unit root tests which are defined by Maddala and Wu (1999), Breitung (2000), Hadri (2000), Choi (2001), Levin et al. (2002) and Im et al. (2003) to mentioned real exchange rates. We employ the panel unit root tests on the level of variable. Trend is accompanied in the empirical analysis, because in the recent studies, a time trend is included in the panel unit root tests. According to Sabate et al. (2003), allowing for a trend in the panel unit root tests is equivalent to accept the existence of factors with a systematic influence on the real exchange rate due to Harrod-Balassa-Samuelson (HBS) effect and introduces a demand-side bias in favor of non-traded goods. Another argument for inclusion of time trend is motivated by the non-stationary of real exchange rates for traded goods because of menu costs or pricing-to-market strategies. Therefore, the panel unit root tests including constant and trend are employed and results can be shown in table 1 as follows:

Table 1: Results of Panel Unit Root Tests

Cross Section Independence	**Cross Section Independence**
Homogenous Unit Roots	**Trend and Constant**
Hadri (2000) HC Z-stat	5.387* (0.0000)
Levin et al. (2002) t-stat	-2.535* (0.0056)
Breitung (2000) t-stat	-4.413* (0.0000)
Heterogeneous Unit Root	**Trend and Constant**
Im et al. (2003) W-stat	-3.445* (0.0003)
Cross Section Dependence	**Cross Section Dependence**
Heterogeneous Unit Roots	**Trend and Constant**
Maddala and Wu (1999) ADF-Fisher Chi-square	36.739* (0.0023)
Choi (2001) ADF-Choi Z-stat	-3.492* (0.0002)
Maddala and Wu (1999) PP-Fisher Chi-square	30.484** (0.0156)
Choi (2001) PP-Choi Z-stat	-2.771* (0.0028)

All panel unit root tests have a null hypothesis that to test of non-stationary real exchange rates, except that Hadri (2000) is stationary.

All panel unit root tests are defined by Barlett kernel and Newey-West (1994) bandwidth, except that Hadri (2000) is defined by quadratic-spectral kernel and Andrews (1991) bandwidth selection.

Hadri (2000) assumes that the unit root test uses heteroskedasticity consistent.

The optimal number of lags is chosen by Akaike Information Criterion (AIC).

Probabilities for Fisher tests are computed using an asymptotic chi-square distribution. All other tests assume an asymptotic normality.

The p-value is in parentheses, ** and * denote the rejection of the null hypothesis at 5% and 1% significance, respectively.

We find that the results of panel unit root tests strongly support to stationary of real exchange rates except Hadri (2000). However, Hadri (2000) panel unit root test experiences significant size distortion in the presence of autocorrelation when there is no unit root. According to Hlouskova and Wagner (2006), the Hadri (2000) panel unit test appears to over-reject the null of stationarity and may yield results that directly contradict those obtained using alternative test statistics.

4. CONCLUSION

The evidence concludes that real exchange rates of Turkey among the main trading partners give significant support for the PPP hypothesis existence of both cross-sectional dependence and independence in panel unit root tests except the rejection of the null hypothesis of Hadri (2000). Empirical findings imply that the real exchange rates of Turkey among the main trading partners can be described as mean-reverting and support long-run purchasing power parity.

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