Economic Modelling 36 (2014) 37–43

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/ecmod

Purchasing power parity for 15 Latin American countries: Panel SURKSS test with a Fourier function

Huizhen He [a,b], Ming Che Chou [c], Tsangyao Chang [d,*]

[a] School of Economics of Sichuan University, Sichuan, China
[b] Department of Investment & Insurance of Zhejiang Financial College, Zhejiang, China
[c] Department of Tourism, Shih-Hsin University, Taipei, Taiwan
[d] Department of Finance, Feng Chia University, Taichung, Taiwan

ARTICLE INFO

Article history:
Accepted 10 September 2013

JEL classification:
C23
F31

Keywords:
Purchasing power parity
Panel SURKSS test with a Fourier function
Latin American countries

ABSTRACT

This study applies Panel SURKSS test with a Fourier function to investigate the properties of long-run purchasing power parity (PPP) in fifteen Latin American countries over the period of December 1994 to February 2010. The empirical results from the univariate unit root and panel-based unit root tests indicate that PPP does not hold for these fifteen countries under study. However, results from the Panel SURKSS test with a Fourier function indicate that PPP is valid for these fifteen countries, with the exception of Honduras. Our results highlight the importance of incorporating both nonlinearities and structural breaks when testing the validity of long-run PPP. These results have important policy implications for these fifteen Latin American countries under study.

1. Introduction

During much of the past few decades, a plethora of studies has centered on the investigation of the stationarity of the real exchange rate (O'Connell, 1998; Papell, 1997; Taylor and Sarno, 2001). The results from such studies are not only valuable for empirical researchers and policy makers, but they have also unveiled extremely important implications in international finance. To be more to the point, a non-stationary real exchange rate indicates that any long-run relationship between the nominal exchange rate and domestic and foreign prices is virtually non-existent, therefore invalidating the theory of purchasing power parity (hereafter, PPP). In this event, PPP cannot be used to determine the equilibrium exchange rate; what's more, the invalidation of PPP disqualifies any monetary approach to determining the exchange rate since that would necessitate that PPP holds true.[1]

Empirical evidence of PPP on the stationarity of the real exchange rate is abundant, but unfortunately, thus far, the consensus has not yet reached. For details about previous studies, see the work of MacDonald and Taylor (1992), Taylor (1995), Rogoff (1996), Taylor and Sarno (1998), Sarno and Taylor (2002), Taylor and Taylor (2004), and Lothian and Taylor (2000, 2008) who have provided in-depth information on the theoretical and empirical aspects of PPP and the real exchange rate.

Recently, there is a growing consensus that real exchange rate exhibits nonlinearities and, consequently, conventional unit root tests,

[1] According to Holmes (2001) and Sarno (2005), PPP is important to policymakers for several reasons. First, it can be used to predict the exchange rate and determine whether a currency is over- or undervalued, which is particularly important for less developed countries and countries experiencing large differences between domestic and foreign inflation rates. Secondly, the notion of PPP is used as the foundation on which many theories of exchange rate determination are built. Consequently, the validity is important to policymakers in developing countries who base their adjustments on PPP. Thirdly, from a theoretical perspective, if PPP is not a valid long-run international parity condition, this casts doubts on the predictions of open-economy macroeconomics, which are based on the assumption of long-run PPP. Indeed, the implications of open-economy dynamic models are sensitive to the presence or absence of a unit root in the real exchange rate. Finally, estimates of PPP exchange rates are often used for practical purposes, such as determining the degree of misalignment of the nominal exchange rate and the appropriate policy response, the setting of exchange rate parities, and the international comparison of national income levels.

* Corresponding author. Tel.: +886 4 24517250x4150.
E-mail addresses: hehzh@126.com (H. He), choumc@cc.shu.edu.tw (M.C. Chou), tychang@fcu.edu.tw (T. Chang).

0264-9993/$ – see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.econmod.2013.09.012

such as the Augmented Dickey Fuller (ADF) test, have low power in detecting mean reversion of exchange rate. To be sure, a number of studies have provided solid empirical evidence for the non-linear and/or asymmetric adjustment of the exchange rate in developed countries (Baum et al., 2001; Taylor and Sarno, 2001), in the G7 countries (Kilian and Taylor, 2003), in the Middle East (Sarno and Taylor, 2002), in Asian economies (Enders and Chumrusphonlert, 2004), in African countries (Chang et al., 2011), as well as in ten Latin American Integration Association countries (Chang et al., 2010). It is important to note, nevertheless, that under no circumstance does the finding of non-linear adjustment necessarily signifies the existence of non-linear mean reversion or stationarity. Thus, it is essential that stationary tests based on a non-linear framework be applied.[2]

More recently, it has been reported that conventional unit root tests not only fail to consider information across regions, thereby leading to less efficient estimations, but also have lower power when compared with near-unit-root but stationary alternatives (Choi and Chue, 2007; Im et al., 2003; Levin et al., 2002; Maddala and Wu, 1999; Pesaran, 2007; Taylor and Sarno, 1998) It is not surprising that these factors have induced considerable doubt on many of the earlier findings, which are based on a unit root in real exchange rate. In order to increase the power in testing for a unit root, many researchers have employed panel data. Levin et al. (2002) and Im et al. (2003), for instance, have developed the asymptotic theory and the finite-sample properties of ADF tests for use with panel data. These two tests have significantly improved power even in relatively small panels, but the problem inherent to both is cross-sectional dependence. Zellner (1962) put forth a straightforward approach to handle cross-sectional dependence across countries, and this is to estimate equations using the seemingly unrelated regression (SUR) estimator. Furthermore, O'Connell (1998) demonstrated that size distortions can be avoided without a significant loss of power by basing the panel-based test on SUR estimations instead of OLS estimations.

Taylor and Sarno (1998) and Breuer et al. (2001) have shown that the "all-or-nothing" nature of the tests has not been fully addressed by recent methodological refinements to the Levin et al. (2002) test. Although Im et al. (2003), Maddala and Wu (1999) and Taylor and Sarno (1998) developed tests that permit the autoregressive parameters to differ across panel members under the stationary alternative, they are not informative in terms of the number of series that are stationary processes when the null hypothesis is rejected. The reason is simple: they are not joint tests of the null hypothesis. In this regards, Breuer et al. (2001) claim that, by analogy to a simple regression, when an F-statistic rejects the null that a vector of coefficients is equal to zero, it is not necessarily true that each coefficient is nonzero. Likewise, when the unit-root null hypothesis is rejected, it may very well not be justified to assume that all series in the panel are stationary. In contrast to those panel-based unit root tests that are joint tests of a unit root for all members of a panel and that are incapable of determining the mix of I(0) and I(1) series in a panel setting, Panel Seemingly Unrelated Regression Augmented Dickey–Fuller tests (hereafter, Panel SURADF) investigate a separate unit-root null hypothesis for each and every individual panel member. In doing so, they clearly identify how many and which series in the panel are stationary processes.

[2] A number of studies have also provided solid empirical evidence for the non-linear and/or asymmetric adjustment of the exchange rate. Reasons for the asymmetric adjustment are the presence of transactions costs that inhibit international goods arbitrage and official intervention in the foreign exchange market may be such that nominal exchange rate movements are asymmetric (see, Taylor and Peel (2000); Taylor (2004); Juvenal and Taylor (2008)). Kilian and Taylor (2003) also suggest that nonlinearity may arise from the heterogeneity of opinion in the foreign exchange market concerning the equilibrium level of the nominal exchange rate: as the nominal rate takes on more extreme values, a great degree of consensus develops concerning the appropriate direction of exchange rate moves, and traders act as accordingly.

Perron (1989) argued that if there is a structural break, the power to reject a unit root decreases when the stationary alternative is true and the structural break is ignored. Meanwhile, structural changes present in the data generating process, but have been neglected, sway the analysis toward accepting the null hypothesis of a unit root. The general method to account for breaks is to approximate them using dummy variables. However, this approach has several undesirable consequences. First, one has to know the exact number and location of the breaks. These are not usually known and therefore need to be estimated. This in turn introduces an undesirable pre-selection bias (see Maddala and Kim, 1998). Second, current available tests account only for one to two breaks. Third, the use of dummies suggests sharp and sudden changes in the trend or level. However, for low frequency data it is more likely that structural changes take the form of large swings which cannot be captured well using only dummies. Breaks should therefore be approximated as smooth and gradual processes (see Leybourne et al., 1998). These arguments motivate the use of a recently developed set of unit root and stationary tests that avoid this problem. Both Becker et al. (2004, 2006) and Enders and Lee (2012) develop tests which model any structural break of an unknown form as a smooth process via means of Flexible Fourier transforms. Several authors, including Gallant (1981), Becker et al. (2004) and Enders and Lee (2012), and Pascalau (2010), show that a Fourier approximation can often capture the behavior of an unknown function even if the function itself is not periodic. The authors argue that their testing framework requires only the specification of the proper frequency in the estimating equations. By reducing the number of estimated parameters, they ensure that the tests have good size and power irrespective of the time or shape of the break. Hence, this empirical study applies Panel SURKSS test, which are the Kapetanios et al. (2003, hereafter, KSS) tests based on the panel estimation method of seemingly unrelated regressions (SUR), with a Fourier function to test the validity of PPP for fifteen Latin American countries. As we know, these countries share some characteristics as high inflation, nominal shocks, and trade openness which might have led to quicker adjustment in relative prices and contributed for PPP to hold. This empirical study contributes to field of empirical research by determining whether PPP holds true for these fifteen Latin American countries. Precisely, what we find here is that long-run PPP holds true for most of these fifteen Latin American countries under study, with the exception of Honduras.

The plan of this paper is organized as follows. Section 2 presents the data used in our study. Section 3 first outlines the methodology we employ, then discusses the empirical findings, and some economic and policy implications are also present in this section. Finally, Section 4 reviews the conclusions we draw.

2. Data

The monthly end-of-period nominal exchange rate and CPIs in this empirical analysis are obtained from the Datastream International. Among a sample of these 15 Latin American countries includes Argentina, Bolivia, Brazil, Chile, Columbia, Costa Rica, Domanic, Ecuador, Haiti, Honduras, Mexico, Paraguay, Peru, Uruguay, and Venezuela. The sample period is from 1994:M12 to 2010:M2. Each of the series starts and ends with the date of the earliest data available on the database. The real exchange rate series of a country at time t is defined as $(S_t \times P_t^{US})/P_t^H$, where S_t is the nominal exchange rate of home country per dollar, and P_t^{US} and P_t^H denote the consumer price indices (CPI 2005 = 100) of home country and the USA respectively. Each of the consumer price index and nominal exchange rate series was transformed into natural logarithms before the econometric analysis. Testing for PPP against the USA is based on the argument that internal foreign exchange markets are mostly dollar dominated. A summary of the statistics is given in Table 1. Our Jarque–Bera test results indicate that, but for that of Honduras/USD, for all other 14 country