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Asymmetry dynamics in real exchange rates: New results on East Asian currencies

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ABSTRACT

This paper provides new evidence on the purchasing power parity (PPP) hypothesis in six East Asian countries. Based on nonlinear unit root tests, we discovered that the results are broadly consistent with the fact that real exchange rates (RERs) follow a nonlinear mean reversion process. We presented new evidence that the adjustment towards the PPP parity is asymmetric (LSTAR process) above and below the equilibrium value in all but one case — the Malaysian ringgit (MYR). The empirical results suggest that it is important that the conventional tests of PPP be amended to take account of asymmetries in the adjustment process in RERs.

1. Introduction

The purchasing power parity (PPP) hypothesis postulates that national price levels expressed in a common currency should be equal. PPP may be tested by carrying out nonstationarity tests on the real exchange rate (RER) since the latter can be interpreted as a measure of deviation from PPP. While the RER may be subjected to short-run variation, a necessary condition for PPP to hold in the long-run is that the RER be covariance stationary; it thus has a tendency to revert to a stable equilibrium level over time. In fact, nonstationarity of the RER implies invalidity of long-run PPP as the divergence of purchasing power across the countries considered (expressed in the same currency) would become theoretically infinite.

As to whether long-run PPP holds or not has important economic implications. First, the degree of persistence in the RER can be used to infer the principal impulses driving exchange rate movements. Precisely, if the RER is highly persistent, then the shocks are likely to be supply-side, whereas if there is little persistence, then the shocks may principally be aggregate demand-based (Rogoff, 1996). Second, since the RER is commonly regarded as one measure of international competitiveness, it reflects an important policy-relevant variable, particularly in emerging market economies where exports have been the principal source of economic growth. In fact, because the export base in emerging market economies is hardly diversified, these countries are particularly vulnerable to increased competition. 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

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exchange rate parities, and the international comparison of national income levels. These practical applications of the PPP concept and the quality of policy advice depend on the validity of the parity condition (see Taylor & Taylor, 2004).

Although there has been debate over the validity of long-run PPP, recent studies using nonlinear econometric methods–so called STAR (smooth transition autoregressive) models–have provided fairly convincing evidence that deviations from PPP dissipate over time[1] (Liew, Chong, & Lim, 2003; Micheal, Nobay, & Peel, 1997; Sarno, 2000a; Sarno & Taylor, 2002; Taylor, Peel, & Sarno, 2001). This implies that the RER is a stationary process with a unique long-run equilibrium level. The evidence presented in these studies has motivated us to adopt nonlinear econometric methods to model the currencies of the East Asian currencies that were severely affected by the 1997 Asian financial crisis.

Recent literature appears to support PPP as a valid long-run equilibrium condition, at least in industrialized economies (see the surveys of Sarno & Taylor, 2002; Sarno & Ibrahim, 2003). Meanwhile, conclusions on the validity of long-run PPP for East Asian economies are mixed depending on the empirical methodology, numeraire currency, and time horizon used in the analysis (see Wu, Tsai, & Chen, 2004; Bahmani-Oskooee, 1993; Liew et al., 2003; Enders & Chumrusphonlert, 2004, among others). Evidence supporting the theory of PPP for these counties is mixed. The fact that the empirical evidence has not reached a consensus on whether PPP is upheld in these countries makes this an interesting topic for further investigations.[2] The main objective of this study is to examine the mean-reverting behavior of real U.S. dollar exchange rates for the six Asian countries (Asian-6: Malaysia, Indonesia, the Philippines, Thailand, South Korea and Singapore) using an extended sample period which goes beyond the 1997 Asian financial crisis and 2000–2002 global economic slowdown periods. All of these countries followed export-oriented strategies and are involved in active exchange rate policies. In the aftermath of the 1997 currency crisis, Korea, Indonesia and Singapore shifted to pure float while Thailand and the Philippines shifted to manage float. Malaysia adopted pegged exchange rate regime after her decision to implement exchange rate and capital controls (Coudert & Dubert, 2005).

Specifically the following questions are addressed: Are Asian RERs mean-reverting? Is the adjustment towards PPP of symmetric or asymmetric nature—that is, does the speed of adjustment vary according to whether a currency is over- or under-valued? Has the sharp fall in the currencies due to the 1997 crisis significantly affected the long-run dynamics of these currencies? Majority of existing work is based on linear tests. Unlike earlier attempts, we first tested for linearity based on the procedure suggested by Luukkonen, Saikkonen, and Teräsvirta (1988) and then adopted the sequential tests due to Teräsvirta and Anderson (1993) to determine the appropriate STAR model. Hence, we did not rule out asymmetry adjustment behavior of RER as in past research. In what follows, we opted on the method proposed by Granger and Teräsvirta (1993) to test the null hypothesis of nonstationarity against the alternative hypothesis of stationarity in the presence of STAR-type nonlinearity. Another contribution of this research is that it uses a much longer time period that started in the 1960s and early 1970s. Additionally, East Asia provides an interesting case study given the varied practices of intervention and exchange rate regimes over the sampling priod. Consequently, our results are likely to be more informative with regard to PPP across different exchange rate regimes.

To anticipate the results, we find that deviations from PPP follow a nonlinear mean-reverting process. As further contribution to the literature, we demonstrate that, with exception of the Malaysian ringgit, adjustment towards PPP is found to be of *asymmetric* fashion. This finding is noteworthy as most of the existing studies on RERs have assumed that the exchange rate behaves in a symmetric fashion to both positive and negative shocks (Bahmani-Oskooee, Kutan, & Zhou, 2008; Liew, Baharumshah, & Chong, 2004).[3] Hence, like other macroeconomic variables (e.g., inflation, real interest rate and output), we indentify asymmetries in RERs. We conduct formal statistical tests to show the asymmetric adjustment in the Asian RERs.

The rest of the paper is organized as follows. In Section 2, we discuss and review the literature on nonlinearities in exchange rates. Section 3 provides a brief description of the linearity test and nonlinear unit root tests and the selection of appropriate STAR models.[4] The description of the data is discussed in Section 4. The empirical results are presented in Section 5. The final section concludes this study.

2. Nonlinear real exchange rate behavior: theory and evidence

The present study is motivated by a number of studies that explain the slow convergence to PPP (e.g., Dixit, 1989; Dumas, 1992; Sercu, Uppal, & Hulle, 1995; Chari, Kehoe, & McGrattan, 2000, among others). According to these studies, nonlinear exchange rate adjustment is induced by transaction costs and monopolistic pricing. Such costs create a certain band where adjustment becomes too costly to be undertaken by arbitrageurs and has provided the theoretical foundation for nonlinear RER behavior. While these models are shown to be globally stable (i.e., mean reverting), this nonlinear process has the property of exhibiting near unit root behavior for small deviations from PPP. According to these authors, small deviations from PPP are left uncorrected if they are not

[1] Another strand of literature that has investigated the nonlinear behavior of exchange rates used the threshold models (Enders & Dibooglu, 2001; Leon & Najarian, 2005) to capture nonlinearities and jump behavior in RERs.

[2] The interest for this concept of equilibrium is that its validity as an exchange rate benchmark. For an application of nonlinear approach in the developing economies using real effective exchange rate (REER) approach, see Bahmani-Oskooee et al. (2008).

[3] Liew et al. (2004) and Bahmani-Oskooee et al. (2008) relied on the procedure introduced by Kapetanios et al. (2003, KSS). This test is based on a null of a unit root against an alternative of a nonlinear stationary. The KSS test is based on ESTAR formulation and hence it assumes that the adjustment is symmetric. That is positive deviations from PPP are corrected in the same manner as negative deviations. All in all, the two studies reveal that nonlinear unit root tests provide more support for PPP. It is worth mentioning that Holmes and Wang (2006) and Enders and Chumrusphonlert (2004) applied threshold cointegration to show that asymmetric exchange rate adjustments are responsible for nonlinearities in the Asian countries.

[4] The details of the linearity test are found in Luukkonen et al. (1988), Teräsvirta and Anderson (1993) and Teräsvirta (1994). Meanwhile, for the nonlinear unit root test applied in this study, Granger and Teräsvirta (1993) and Sarno (2001) may be referred to for details.