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Real exchange rates and time-varying trade costs

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A B S T R A C T

This paper re-examines the empirical modeling of Purchasing Power Parity (PPP) deviations in the presence of commodity market frictions. First, we show that a specific type of smooth transition models can closely approximate the functional form of the theoretical adjustment mechanism derived by Dumas (1992) [Dynamic Equilibrium and the Real Exchange Rate in a Spatially Separated World, Review of Financial Studies,5:2153–180] for the case of constant as well as changing trade costs. Second, we develop, for the first time, an empirical model of the real exchange rate which allows for changes in the degree of market integration. By employing a long span of data on the Dollar-Sterling real exchange rate and a micro-founded proxy for trade frictions, we provide novel evidence of a significant relationship between the persistence of the real exchange rate and the level of trade costs. This finding suggests that both the difficulty of detecting PPP and the extend of Rogoff's puzzle vary over time with the degree of trade restrictiveness. Finally, we highlight policy repercussions of our results.

1. Introduction

In the early 1990s, two decades after the break down of the Bretton-Woods system and the inception of floating exchange rates, the consensus view in international macroeconomics was that Purchasing Power Parity (PPP) did not hold to any meaningful degree. The hypothesis that the real exchange rate contained a unit root or that there was no long-run relationship between the nominal exchange rate and the aggregate domestic and foreign price levels could not be rejected. The lack of

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evidence supporting PPP led researchers to focus on the identification of potential pitfalls concerning the empirical approaches employed till then as well as to provide theoretical justifications for the observed behavior of real exchange rates.

As noted by Frankel (1986), the tests typically employed during the 1980s to investigate whether real exchange rates are stationary may have had low power when applied to small spans of data during the floating rate period. Following Frankel a number of researchers provided support for the hypothesis by employing longer spans of data, panel unit root tests and Monte Carlo techniques (Abuaf and Jorion, 1990; Frankel and Rose, 1996; Lothian and Taylor, 1996). Even though these studies provided evidence that real exchange rates mean revert in the long run, the implied half life of deviations from PPP ranged from three to five years. The fact that real shocks cannot account for such a high degree of persistence gave rise to Rogoff's (1996) PPP puzzle.

Perhaps the most important explanation of Rogoff's (1996) puzzle is provided by theoretical models which demonstrate how transactions costs or the sunk costs of international arbitrage induce nonlinear but mean reverting adjustment of the real exchange rate (see, e.g., Dumas, 1992; Sercu et al., 1995; O'Connell and Wei, 2002; Berka, 2005).[1] In his seminal paper Dumas (1992) summarized this position as follows:

> "Linear equations are unlikely clearly to identify a process such as the one for ln p …in which long-run behavior is very different from short-term behavior, since reversion manifests itself only when deviation from parity has become wide enough."[2]
> Dumas (1992, p. 171)

This theoretical work on the properties of the real exchange rate process has motivated numerous empirical applications utilizing nonlinear econometric models. The most widely used family of models is the Smooth Transition Autoregressive (STAR) of Granger and Tërasvirta (1993) and Teräsvirta (1994) (for a survey see Sarno and Taylor, 2002; Pavlidis et al., 2009). The appealing feature of these models is that they allow both the speed of mean reversion to increase with the size of the deviation from the equilibrium and the transition between high and low persistence regimes to occur smoothly and symmetrically. Moreover, the findings of the empirical literature support the presence of STAR nonlinearity for various real exchange rate series (Michael et al., 1997; Taylor et al., 2001; Kilian and Taylor, 2003). The impulse response functions derived from the estimated models suggest that large shocks mean revert much faster in the nonlinear models than the ones previously reported for linear models, for which the speed of mean reversion is independent of the size of the shock. These results appear to provide a framework for solving Rogoff's (1996) puzzle.

The present paper aims to provide further insights regarding the behavior of PPP deviations by extending the nonlinear framework of analysis in two directions. First, we argue that no formal direct link has so far been established between the economic models with trade costs and the nonlinear econometric framework adopted in empirical applications. This deficiency can clearly result in sub-optimal empirical model specifications. We bridge the gap between theory and empirical modeling by employing the spatial economy model of Dumas (1992) to determine the theoretical functional form of the PPP adjustment mechanism and, in turn, investigate the ability of STAR models to approximate it. Interestingly, our findings illustrate that a relatively neglected STAR type model, the Quadratic Logistic STAR (QLSTAR), can approximate very accurately the theoretical Data Generating Process (DGP).

The second contribution of the paper is to relax the assumption of constant trade costs and to formally examine the effect of time-varying trade costs on the nonlinear analysis of real exchange rates. Our approach is motivated by a simple argument that dates at least to Friedman and Schwartz (1982, pp. 290–292) but has been widely ignored in the nonlinear PPP literature: trade frictions vary over time, which induces changes in the degree of market integration and the range of PPP

[1] Trade costs can exhibit significant economic magnitudes and can play an essential role in addressing several major puzzles in international economics (Obstfeld and Rogoff, 2000; Anderson and van Wincoop, 2004).

[2] ln p denotes the logarithm of the real exchange rate.