



Measuring the persistence of deviations from purchasing power parity with a fractionally integrated STAR model

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Abstract

Empirically, elements of both fractional long memory and threshold non-linearity are present in the real exchange rates of the G-7 countries against the US, notably in the EU countries. Estimated half lives of deviations from PPP using median unbiased corrections to conventional linear autoregressive models corroborate existing evidence related to the PPP paradox as half lives range from at least four years to an infinite number of years. In contrast, for each EU country, accounting for threshold non-linearity results in estimated half lives that can be less than three years even with the allowance for fractional long memory.

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1. Introduction

International macroeconomists are now intimately aware of the purchasing power parity (PPP) paradox, the inability to theoretically reconcile empirically volatile and persistent real exchange rates. The puzzle, as initially elucidated by Rogoff (1996), points to slow mean reversion in the real exchange rate with half lives of deviations from PPP of at least 3–5 years.

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In the presence of financial shocks, sticky prices and wages can theoretically generate deviations from PPP with half lives that are only a fraction of these estimates. Even more confounding is recent evidence that suggests the measured half lives based on autoregressive models may be downward biased. In fact, Murray and Papell (2002, 2005) present evidence that shows the half lives could be infinite once the downward bias is corrected.

A large literature has been devoted to the PPP puzzle, largely in an attempt to revive the theory. Recently, the theoretical literature has attempted to incorporate habit persistence and additional rigidities such as asset market frictions to produce more persistent real exchange rates with limited success (c.f. Chari et al., 2002). Empirically, others have considered the extent to which time and sectoral aggregation may produce a bias in estimated half lives. For example, Imbs et al. (2005) argue that half lives of deviations from PPP are significantly reduced when one accounts for heterogeneous dynamics in a panel context, while Chen and Engel (2005) argue that, among other issues, small sample bias still remains in Imbs et al.'s estimates. When corrected, the PPP puzzle remains firmly in place.

Alternatively, researchers have attempted to reconcile both the demonstrably long half lives and the empirical finding of a unit root in the real exchange rate by using various time series models that deviate from the standard linear autoregressive paradigm. At least two plausible alternatives have arisen. On one hand, researchers have questioned the assumption of an integer order of integration for the real exchange rate and have argued that a fractional order of integration may be present (Diebold et al., 1991; Cheung and Lai, 1993, 2001; Achy, 2003). On the other hand, a number of researchers have found threshold non-linear mean reversion in the real exchange rate and have argued that previous estimates of half lives based on autoregressive linear specifications are biased upward (Baum et al., 2001; Taylor et al., 2001; Paya et al., 2003).

It is thus clear that there has been considerable interest in determining the extent to which fractional long memory or threshold non-linearity are present in the dynamics associated with PPP. Yet little is known about the relative importance of these two modeling procedures and the implications for tests related to PPP. More generally, the dichotomous modeling approach in the PPP literature highlights the emerging debate among researchers employing macroeconomic techniques. The possibility of confusing regime switching models and other general forms of non-linearity with fractional integration and vice-versa is now established in the literature (Diebold and Inoue, 2001; Kramer and Sibbertsen, 2002). It would thus be of interest to consider an encompassing modeling technique that allowed for non-linear dynamics and fractional long memory simultaneously to determine their relative importance.

A parametric non-linear model that has received extensive attention in the PPP literature is the exponential smooth transition autoregressive (ESTAR) model, which allows for smooth transitions between regimes. In this paper, I employ an encompassing model and testing procedure applied to the post-Bretton Woods real exchange rates of the G-7 countries vis-à-vis the United States that allow for both fractional long memory and ESTAR non-linearity. There is evidence of both ESTAR non-linearity with fractional long memory for each of the EU countries in my sample, especially for the euro-zone subset. There is little evidence of either ESTAR non-linearity or mean reversion for the real exchange rates of Canada or Japan. Median unbiased estimates of half lives based on linear autoregressive models reconfirm the existing paradox, with half lives ranging from a minimum of four years to an infinite number of years. In contrast, the use of generalized impulse response functions for estimated fractionally integrated non-linear models for the EU countries reveals that the half lives can be less than three years in duration. The results show that the use of fractional integration coupled with threshold non-linearity could be an important avenue for studying the PPP paradox.

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