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Nonlinear adjustment, purchasing power parity and the role of nominal exchange rates and prices

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ABSTRACT

Although the literature on purchasing power parity (PPP) is rich in controversy, the relative contribution of prices and nominal exchange rates to real exchange rate movements which restore PPP disequilibria has rarely been put under any close scrutiny. This paper as a first step applies a cointegrated VAR framework to test for stationary real exchange rates and linear adjustments in prices and nominal exchange rates. As a second step, ESTR error correction models are fitted to test whether nonlinear error correctional behaviour characterizes the data. The results clearly indicate that the nominal exchange rate is responsible for the nonlinear mean reverting behaviour in real exchange rates and also mainly drives overall adjustment. Applying dynamic stochastic simulations based on the estimated models, this study also confirms recent results that the half-life times of real exchange rate shocks are significantly smaller than the consensus benchmark of 3–5 years.

1. Introduction

While purchasing power parity has been the subject of numerous studies, it nevertheless remains a controversial research area in economics.[1] Although the overall evidence suggests that purchasing power parity is relevant to some extent in the long run, many researchers have rejected it because they find evidence of a unit root in the real exchange rate. In particular, the high degree of persistence in real exchange rates and the dynamics of real exchange rate adjustments mean that some puzzles

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[1] For an overview of the literature on purchasing power parity see Sarno and Taylor (2003) and Sarno (2005).

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remain to be solved. For a long time, the mixed empirical evidence on PPP was attributed mainly to the argument that, owing to the very low adjustment to PPP, the sample for the recent floating period was too short to detect a statistically significant mean reversion (Froot & Rogoff, 1995; Juselius & MacDonald, 2004). From a theoretical point of view, slow adjustment to PPP can be explained, for example, by inter-temporal smoothing or cross-country wealth distribution (Cheung & Lai, 1998; Rogoff, 1996). However, the recent findings by some authors (Kilian & Taylor, 2003; Taylor, Peel, & Sarno, 2001) that major real exchange rates can well be characterized by nonlinear mean reverting processes offer another explanation for the failure to reject the unit root hypothesis for real exchange rates based on linear models: adjustment increases with the degree of deviation from PPP, so standard univariate unit root tests have very low statistical power in rejecting a false null hypothesis (Taylor et al., 2001).[2]

In fact, most studies that have reported a very low degree of adjustment base their analysis on a linear framework (Sarno, Taylor, & Chowdhury, 2004). However, although the empirical evidence suggests that real exchange rates show nonlinear mean reverting behaviour, the question of whether exchange rates or prices are mainly responsible for such adjustment during the present floating period has not yet been closely examined in this context. Even in a linear framework, only a small number of studies deal with the question of whether nominal exchange rates or prices are mainly responsible for real exchange rate adjustment to PPP. This is surprising, considering that sluggish price adjustment is also highlighted in the literature as an explanation for PPP deviations (Cheung, Lai, & Bergman, 2004; Rogoff, 1996). In addition, traditional international macroeconomic models of the nominal exchange rate, such as the monetary approach, as well as "new" open economy models, rely on the assumption that purchasing power parity is at least valid in the long run (Taylor et al., 2001). Hence, they implicitly assume that the nominal exchange rate adjusts to PPP deviations.

This study is the first to fit a nonlinear error correction model which links exchange rates and prices to deviations from PPP for the post-Bretton Woods period on a monthly basis. The main aim is to shed some light on the speed and pattern of adjustment by dissecting the role of nominal exchange rates and prices. To tackle this issue, the remainder of the paper is organized as follows: Section 2 summarizes the empirical literature on price and nominal exchange rate adjustment as well as that on nonlinear mean reverting behaviour in real exchange rates, and points out the contribution this study makes to the literature. Section 3 describes the empirical framework used, and presents the results. As the initial stage of the analysis, a cointegration analysis is applied to test for PPP and mean reverting behaviour in a linear framework. The ESTR models applied thereafter also allow for nonlinear error correction behaviour to PPP deviations both for nominal exchange rates and for prices. Finally, the half-life times of shocks to real exchange rates is calculated based on the previous results by applying dynamic stochastic simulations. Section 4 concludes.

2. Literature review

Although the empirical record on PPP is enormous, the contribution of nominal exchange rates and prices to the adjustment process has been considered in only a minor number of studies. In an early paper, Wei and Parsley (1995) study the deviation from purchasing power parity in 12 tradable sectors of 91 OECD countries pairs, based on annual data for the recent float period. They find evidence that nominal exchange rate stability in terms of low volatility produces a faster rate of convergence towards purchasing power parity. Another interesting result pointed out by the authors is that countries with large deviations from PPP show a faster convergence, which indicates nonlinearity in the rate of mean reversion.[3] Analyzing multilateral real exchange rates from 93 countries, Goldfajn and Valdes (1996) find evidence that prices as well as exchange rates adjust to disequilibria in terms of probability, with the latter case occurring more frequently. They also point out that fixed exchange rate regimes are

[2] In a recent study, Frömmel, Kruse, Menkhoff, and Sibbertsen (2011) showed that unit root tests against nonlinear alternatives exhibited a limited ability to identify the precise form of nonlinearity.

[3] The authors formally test for nonlinearity by adding a term of the initial deviation squared to the regression.