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Long memory and nonlinear mean reversion in Japanese yen-based real exchange rates

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Abstract

The extraordinary difficulty in uncovering parity reversion in yen-based real exchange rates has often been ascribed to a missing trend variable. This study identifies an alternative explanation and shows that the puzzling behavior of real yen rates may stem from long-memory dynamics, which undermine unit-root tests in their ability to detect mean reversion. The long-memory findings are consistent with the long swings in yen exchange rates during the current float. Further analysis also reveals evidence of non-monotonic reversion toward parity. © 2001 Elsevier Science Ltd. All rights reserved.

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1. Introduction

Although significant short-run departures from purchasing power parity (PPP) have been widely reported, many economists maintain the view that PPP will prevail in the long run. The recent float experience has not always been reassuring, however, weakening belief and inducing shifts in sentiment. Early studies in the 1980s commonly failed to find parity reversion in real exchange rates during the post-Bretton Woods period (see the extensive reviews by Froot and Rogoff, 1995; Rogoff, 1996, and the studies cited therein). The widespread failure to detect parity reversion seri-

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ously challenged the faith in PPP. Only until the 1990s did many studies begin to unveil supportive evidence of reverting dynamics under the current float (Abuaf and Jorion, 1990; Frankel and Rose, 1996; Lothian, 1990; Lothian and Taylor, 1996; Oh, 1996; Papell, 1997; Sarno and Taylor, 1998; Taylor and Sarno, 1998; Wu, 1996).

The apparent revival of the empirical relevance of PPP has been typically attributed to the improved statistical power attained through using efficient testing procedures and/or longer sample series available for the current float (Lothian and Taylor, 1997). This generic explanation in terms of purely statistical power, however, says little about one of the stylized facts of floating exchange rates, namely, that it is notably much harder to detect PPP reversion when particular currencies — such as the US dollar and the Japanese yen — are employed as the numeraire currency (Jorion and Sweeney, 1996; Koedijk et al., 1998; Papell, 1997; Papell and Theodoridis, 1998a,b; Wei and Parsley, 1995).

This study analyzes specifically the dynamics of yen-based real exchange rates during the current float. Researchers have been confronted with comparable, if not greater, difficulty in detecting PPP reversion in real yen rates as opposed to real dollar rates (Cheung and Lai, 1998; Koedijk et al., 1998; Papell and Theodoridis, 1998b), except for long historical data (Lothian, 1990). Although the difficulty in uncovering PPP may be partly reduced by including a linear trend variable, it remains generally hard to find strong evidence of mean reversion among yen-based real exchange rates. The inclusion of a time trend seems at variance with the standard version of long-run PPP. It has, however, been rationalized as capturing the Balassa–Samuelson effect of productivity growth.

A missing trend variable, this study shows, may not be the key explanation for the behavior of yen-based real exchange rates over the current float. There are more intriguing and pertinent dynamics that are responsible for the usual difficulty in detecting PPP reversion in real yen rates. These are long-memory dynamics, and they can confound unit-root tests and undermine their ability to distinguish between the high-frequency and low-frequency dynamics. This study demonstrates that when the long-memory dynamics are properly accounted for in statistical tests based on fractional time series models, strong evidence of mean reversion can be uncovered in real yen rates.

The finding of long-memory dynamics may be symptomatic of long-swing dynamics. Yen exchange rates are buffeted by notably large appreciations and depreciations over an extended period of time during both the 1980s and the 1990s (see Fig. 1). Lothian (1998) points out the potential implications of long currency swings for PPP analysis. In studying closely the behavior of dollar exchange rates, the author observes that there can be more behind the story of PPP re-emergence. The exceptional difficulty in uncovering parity reversion may be ascribable to specific US economic events. The substantial dollar appreciation and depreciation between 1980 and 1987, in particular, make it unusually hard for researchers to separate statistically the long-run from the short-run dynamics and identify mean reversion (the long swings in the dollar have earlier been noted by Engle and Hamilton, 1990). Given the limited time span of the current float data, the impact of the long swings on statistical tests can be especially significant. This poses an important challenge for