Int. Fin. Markets, Inst. and Money 19 (2009) 692–711

Contents lists available at ScienceDirect

Journal of International Financial Markets, Institutions & Money

journal homepage: www.elsevier.com/locate/intfin

The confusing time-series behaviour of real exchange rates: Are asymmetries important?

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ARTICLE INFO

Article history:
Received 23 September 2008
Accepted 17 December 2008
Available online 25 December 2008

JEL classification:
C22
F31

Keywords:
Real exchange rates
Non-linear
ESTR
Asymmetry

ABSTRACT

Evidence regarding the time-series properties of real exchange rates is mixed. There is evidence that such rates exhibit both non-stationary and stationary behaviour. The current dominant belief is that rates are non-linear stationary, however, this is not accepted without question. This paper re-examines the time-series properties of five US dollar real exchange rates and argues that the confusing time-series properties arise largely as each series examined exhibits periods of non-stationary and stationary behaviour such that the sample over which any empirical exercise is conducted is of importance. However, extending a typical non-linear model used within the literature to allow for asymmetries improves the models ability to fit the data. Therefore, our results suggest that modelling asymmetries between positive and negative real exchange rate deviations is of importance, whereas extant research has typically rules out asymmetry. Indeed a forecasting exercise conducted over a 1-year horizon is particularly supportive of this model. Such a finding is of importance not only for academics but also finance practitioners involved in trading and portfolio management and finance managers who act in the foreign exchange market for goods market trading. It remains for future research to theoretically motivate the asymmetries found here.

1. Introduction

The behaviour of real exchange rates remains a hot topic within the empirical finance literature, largely because of a significant number of papers supporting and rejecting real exchange rate sta-

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doi:10.1016/j.intfin.2008.12.002

tionarity. Recent research has focussed upon the belief that real exchange rates are stationarity but exhibit non-linear dynamics in the process of mean reversion. In particular, the belief is that for small deviations from mean (equilibrium) value real exchange rates are non-stationary due to the presence of market frictions, transaction costs and other costs of international goods market and financial arbitrage, while larger deviations do exhibit mean reversion. Two popular such models are the band TAR model of Obstfeld and Taylor (1997) and the restricted ESTAR model of Taylor et al. (2001) both of which model the inner and outer regimes according to different autoregressive processes. Moreover, however, there are a variety of other models all claiming to accurately describe the dynamics of international real exchange rates, for which examples include the modified LSTAR model (Sollis et al., 2002), the non-linear trend-stationary model (Sollis, 2005), the multiple-regime STAR model (Bec et al., 2004) and the fractionally-integrated STAR model (Smallwood, 2005). Whilst, more recent further evidence supporting non-linear reversion is proved by Paya et al. (2003), Chortareas and Kapetanios (2004) and Paya and Peel (2007).

However, despite this evidence there is not yet a consensus regarding the behaviour of real exchange rates. On the one hand several papers maintain that real exchange rates are non-stationary (for example, Engel, 2000; Cuddington and Liang, 2000; Arghyrou and Gregoriou, 2007). On the other hand, whilst the above non-linear models may provide a reasonable in-sample fit for a selection of real exchange rates they have limited forecasting power (see, in particular, Rapach and Wohar, 2006).[1]

The present paper, therefore, re-examines the behaviour of five major real exchange rate series, all against the US dollar, and aims to show that the confusing empirical behaviour of real exchange rate series largely arises because most real exchange rate series exhibit both random walk and stationary behaviour that changes over time, such that different sample periods will produce different empirical results. Nonetheless, the results from this paper suggest that accounting for asymmetries within real exchange rates may be important for understanding their movements and to obtain improved forecasts. This latter point being particularly important for both market traders and finance managers whereby improved forecasting power can facilitate trading and hedging strategies.

More specifically, we estimate an asymmetric version of the popular ESTR model and show that each of the real exchange rate series exhibit some form of asymmetry as well as non-linearity in the process of mean reversion. Furthermore, this model typically provides for improved forecasts over alternate linear and non-linear models at the 1-year horizon, although as a note of caution it is arguable that this model is not able to explain the dynamics of all five series (notably for Canada), such that there is no 'one-size-fits-all' model as a different model maybe required to capture the individual nuances of different rates. The remainder of the paper is organised as follows: Section 2 presents a brief background to the real exchange rate debate and some current literature; Section 3 introduces the data and conducts the linear and non-linear tests previously examined within the literature; Section 4 considers a revised version of the ESTR model that allows for asymmetries with real exchange rate dynamics; Section 5 presents a discussion of our results and considers a forecasting exercise; Section 6 summarises and concludes.

2. Background and brief review

Theoretical discussion of real exchange rate dynamics centres around two possible behaviours. First, the theory of PPP states that the exchange rate between two countries should be such that the two national price levels, if expressed in a common currency at the prevailing rate, should equate. Hence, the purchasing power of a unit of either currency is identical. As such, any deviations from PPP should be short-lived and exhibit reversion. Defining the real exchange rate as the measure of deviation from PPP, then its time-series properties should be characterised by stationarity. More explicitly, if PPP held continuously then the real exchange rate would be a constant, however, while we would not expect that to hold in the real world there is a common belief that PPP nevertheless acts as an anchor for

[1] Such a conclusion could point to inherent temporal instabilities in the real exchange rate data, such that any one set of estimates could be sample specific or subject to a White (2000) type data-snooping argument.