Journal of International Money and Finance 29 (2010) 1131–1150

Contents lists available at ScienceDirect

Journal of International Money and Finance

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

Can a real business cycle model without price and wage stickiness explain UK real exchange rate behaviour?☆

David Meenagh [a], Patrick Minford [a,b,*], Eric Nowell [c], Prakriti Sofat [d]

[a] Cardiff University, Colum Drive, Cardiff, Wales CF10 3EU, United Kingdom
[b] CEPR, United Kingdom
[c] Liverpool University, United Kingdom
[d] Barclays Capital, Singapore

JEL classification:
E32
F31
F41

Keywords:
Real exchange rate
Productivity
Real business cycle
Bootstrap
Indirect inference

A B S T R A C T

This paper establishes the ability of a Real Business Cycle model to account for UK real exchange rate behaviour. The model is tested by the method of indirect inference, bootstrapping the errors to generate 95% confidence limits for a time-series representation of the real exchange rate, as well as for various key data moments. The results suggest RBC models can explain real exchange rate movements.

1. Introduction

The continuous strength of the dollar over the 1990s fuelled interest in the relationship between productivity and exchange rates. As US productivity surged in the second half of the 1990s, the dollar began its climb against all the major currencies of the world. This has led to a large body of literature analysing the links between the real exchange rate and productivity. The conventional view of the impact of a productivity shock on an economy is that the real exchange rate will depreciate, in order to permit the extra output to be sold on world markets. However, this is at odds with the empirical

☆ We are grateful for useful comments, without implicating them in our errors, to Laurence Copeland, Sugata Ghosh, David Peel and also to other participants in the Cardiff University economics workshop. This work was supported by the UK Economic and Social Research Council under grant RES-165-25-0020.

* Corresponding author. Cardiff University, Colum Drive, Cardiff, Wales CF10 3EU, United Kingdom.
E-mail address: minfordp@cf.ac.uk (P. Minford).

0261-5606/$ – see front matter © 2010 Elsevier Ltd. All rights reserved.
doi:10.1016/j.jimonfin.2010.02.006

findings of currency appreciation after a productivity spurt (for discussion of the dollar's real appreciation in the 1990s see Tille et al., 2001; Corsetti et al., 2004; Bailey et al., 2001; Schnatz et al., 2003; Meredith, 2001). In this paper we explore the ability of a Real Business Cycle (RBC) model—along the lines of McCallum (1989) and Backus et al. (1994)—to account for the real exchange rate's behaviour, using UK experience as our empirical focus. First, we find that a deterministic productivity growth shock generates a real depreciation in steady state equilibrium but on impact undershoots this substantially and may even create an appreciation, as part of its business cycle effect—with some weak similarities to the type of behaviour found for the dollar in the 1990s. Second, we show that the RBC alone when perturbed by the model shocks found empirically can reproduce the univariate properties of the real exchange rate—by implication there is no necessary case here to add nominal rigidity.

We define the real exchange rate conventionally as the ratio of foreign consumer prices to home consumer prices, converted into a common currency. A large body of evidence (originating with Engel, 1993) finds that the variation of this ratio is almost entirely dominated by the ratio of home-produced relative to foreign-produced traded goods, the terms of trade. A large number of studies have examined movements in the real exchange rate. They find that they exhibit swings away from various definitions of 'purchasing power parity' (PPP) by which is meant the longer-run equilibrium value of Q. Such an equilibrium is akin to the 'natural rate' of output or unemployment in a general equilibrium macroeconomic model and it may move over time for a variety of reasons. Many studies have found definite evidence of reversion to PPP but very slow reversion. More recently studies that have allowed for non-linear adjustment (such that as the real exchange rate moves further away from PPP the pressures of goods market arbitrage become stronger) have found that the speed of reversion is much greater, and becomes of similar order to that for other macro variables such as output and inflation—for an early result of this sort see Michael et al. (1997).

One can think of these studies as final form equations of Q, where unspecified shocks to the economy, from demand and supply, stochastically disturb Q away from some smoothly-moving trend. Macroeconomic models that could in principle produce such a final form range from, on the one hand, models with a high degree of nominal rigidity to, at the other extreme, real business cycle models with no stickiness—henceforth RBC models.

In this paper we explore the ability of an RBC model to account for the behaviour of Q, using UK experience as our empirical focus. Our argument will be that the RBC alone, without price stickiness, can reproduce the univariate properties of Q. We do not rule out the possibility that adding a degree of nominal rigidity could also contribute. However our concern is to establish the basic ability of the flexprice RBC model to provide explanatory power. In this respect we depart from much work which has accounted for real exchange rate movements in terms of price stickiness—originally Dornbusch (1976) and more recently Chari et al. (2002) who tested a sticky-price two-country model of the US and EU by comparing simulated moments with their data counterparts; Le et al. (2009, 2010) examine alternatives with varying degrees of stickiness and find that data variances (including that of the real exchange rate) are better matched with only a small degree of it, even though all versions of these models are strictly rejected by the data overall. Rather to our surprise there is little work examining the flexprice RBC model, only the McCallum and Backus et al. papers cited above; however their empirical tests were rather limited and our aim here is to use econometric tests based on indirect inference that were not in use at that time. Unlike the two papers by Le et al. above, we restrict our formal testing focus to the real exchange rate alone, we use raw data, mostly non-stationary, and our model for the UK as a medium-sized open economy treats rest-of-world consumption and real interest rate as exogenous.

Thus the aim of this paper is to extend the testing of flexprice RBC models for their real exchange rate properties by first using a previously-unused test procedure based on statistical inference and second applying it to unfiltered UK post-war data. The paper is organised as follows. In section 2 we set out the real business cycle model. In section 3 we calibrate the model to UK quarterly data and show the results of a productivity shock. Section 4 establishes the facts of the real exchange rate, Q; it is integrated of order 1 and can be fitted well by an ARIMA process. In section 5 we explain the method of indirect inference and formally test the model statistically on the real exchange rate data. Section 6 we conclude that Q behaviour in fact can be explained using an RBC model with no nominal rigidity.