Determinants of the implied shadow exchange rates from a target zone

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Abstract

The paper provides a continuous-time model of the dynamic behavior of exchange rates and interest rates when exchange rates are managed within a target zone with the possibility of realignments. In the case of a realignment the exchange rate jumps to a shadow exchange rate. The timing of realignments is modelled by a Cox process with an intensity that depends on the location of the exchange rate in the target zone band as well as the distance to the shadow exchange rate. We set up an approximate maximum likelihood estimation approach and provide parameter estimates for six ERM target zones. Moreover, in the empirical analysis we filter out the shadow exchange rates and investigate which fundamental macroeconomic factors are able to explain the short-run and long-run behavior of the filtered shadow exchange rates. © 2001 Elsevier Science B.V. All rights reserved.

1. Introduction

The paper investigates the behavior of exchange rates and interest rates within a target zone by analyzing empirically the Exchange Rate Mechanism

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(ERM) within the European Monetary System during the period from March 1979 to June 1997. The target zones within the European Monetary System provide an interesting and unique case for examining issues concerning how monetary policy affects the behavior of exchange rates, interest rates, and other important macroeconomic variables. In particular, the exchange rate regime experienced some stable and unstable periods. Thus, at several occasions there were 'speculative attacks' on a number of currencies which eventually lead to the de facto suspension of the target zone regime in August 1993 where the bands were extended to thirty percent for most of the currencies involved.

It remains an open question whether the unstable periods of the ERM within the European Monetary System were caused by macroeconomic variables and exchange rates being fundamentally misaligned or whether the speculative attacks were basically driven by agents suddenly changing beliefs with respect to the sustainability of a given target zone (see, e.g., Obstfeld, 1996; Velasco, 1996).

We use a two step procedure in order to analyze how the behavior of the exchange rates and interest rates within the ERM can be explained by fundamental macroeconomic factors. In the first step, we present and estimate a bilateral continuous time model where the exchange rate jumps to a shadow exchange rate whenever a realignment happens. The shadow exchange rate can be thought of as the natural, or fundamental, level of the exchange rate *if* there was no target zone regime. An important feature of the modelling is that we can filter out the shadow exchange rate from the continuous time empirical analysis. In the second step, we investigate whether basic macroeconomic variables can explain the short-run and long-run movements of the filtered shadow exchange rates.

The continuous time target zone model shares some basic ideas with the model in Christensen et al. (1998) in the sense that it allows for realignments described by a Poisson process with a stochastic intensity; a so-called Cox process. Basically, the exchange rate is restricted to move within a band and can only leave the band by a realignment jump. The intensity for a realignment depends on the position of the exchange rate within the band and the distance to the shadow exchange rate. We will assume 'uncovered interest rate parity' in order to filter out the shadow exchange rate.[1,2] The target zone model in this paper mainly differs from the model in Christensen et al. (1998) by the functional form of the drift and volatility of the managed exchange rate as well as the realignment intensity.

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[1] In an appendix available from the authors by request, we demonstrate the consistency of 'uncovered interest rate parity' with a specific equilibrium pricing structure in the economy and describe briefly how the model is used for pricing exchange rate contingent claims.

[2] The filtering of the shadow exchange rate differs from the simple linear filter in Flood et al. (1991) and Flood and Rose (1995) especially due to the formal model of a non-credible target zone used in this paper.