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Interest rate linkages: a Kalman filter approach to detecting structural change

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Abstract

This paper investigates changes in the causal structure linking of the G-7 short-term rates by estimating time-varying speed of adjustment coefficients in error correction equations using a Kalman filter approach. This technique allows us to detect structural breaks in the causal linkages that generate the cointegrating relations between the series. The testable hypotheses are the US world-wide leadership, the disengagement of UK monetary policy from those pursued in the Eurozone after the collapse of the ERM and the German leadership hypothesis (GLH) within the European Union (EU). The evidence points to a break in the causal linkages between the UK and other EU countries after the third–fourth quarter of 1992. The empirical results are also consistent with a US world-wide leadership and a weak German leadership within the Eurozone.
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1. Introduction

In economic theory convergence between short-term interest rates can be explained taking two different approaches. If interest rates are treated as analogous to other asset prices, then their movements are naturally interpreted as being determined by financial flows in profit-seeking capital markets. This will normally give rise to a set of arbitrage conditions such as uncovered interest rate parity (UIP). Alternatively, they

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can be viewed as policy instruments, with their time paths being determined by a policy objective such as an exchange rate or an inflation target. These two approaches are not necessarily inconsistent, since deviations from interest rate parity may cause the exchange rate to move towards its policy target. As long as its deviations from the target are stationary, so will be those from interest rate parity. Almost all empirical studies have found that the G-7 exchange rates are at most I(1) series. If one then makes the reasonable assumption that any risk premium, which may exist, in the relationship is stationary, the implication of these theories is that interest rates should be cointegrated on a bilateral basis.

In previous empirical papers, interest rate linkages have often been analysed in the context of specific policy frameworks such as the Exchange Rate Mechanism (ERM). For instance, numerous studies have attempted to test the so-called 'German Leadership Hypothesis' (GLH), according to which Germany acts as the dominant player within Europe, and monetary authorities in other ERM countries are unable to deviate from the interest rates path set by the Bundesbank (see Fratianni and von Hagen, 1990; Kirchgassner and Wolters, 1993). Taking this view, co-movements in interest rates arise because of policy convergence. But under pure arbitrage conditions one also expects interest rates to move together in the long run. So the question naturally arises: how is the system affected by a policy regime, and how will it change if there is a regime shift?

In cointegrated models, one can think of changes in the long-run structure as changes either in the long-run relationships themselves (the cointegrating vectors) or in causality links (the loading factors). Specifically, consider a Vector Error Correction Model (VECM) such as,

$$\Delta z_t = \Pi z_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta z_{t-i} + \varepsilon_t \tag{1.1}$$

where the long-run reduced rank matrix Π has been decomposed as $\Pi = \alpha\beta'$, with α being the matrix of loading weights and β the matrix of cointegrating coefficients. A change in the long-run structure of the system could occur through changes either in former or in the latter (see Hendry, 2000 among others).

A simple diagnostic test for structural change is suggested by Hao and Inder (1996), who extend the CUSUM test to the case of non-stationary regressors considering the FM-OLS residuals and replacing the error variance with the long-run variance estimate. Hansen (1992) derives the asymptotic distribution of a LM test for parameter instability against several alternatives in the context of cointegrated regression models. Quintos and Phillips (1993) develop a test for the null of parameter constancy in cointegrated regressions against the alternative that the coefficients follow a random walk. Seo (1998) defines LM test statistics for structural changes in both the cointegrating vector and the vector of adjustment parameters for the cases of both a known and an unknown breakpoint. Hansen and Johansen (1999) suggest graphical procedures to evaluate the constancy of the long-run parameters of cointegrated systems. Barassi et al. (2001b) propose an OLS-based sequential approach to test for a single permanent break in causality in structural cointegrated VARs and compare

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