

Original article

Gaussian estimation of continuous time diffusions of UK
interest rates

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Abstract

This paper estimates stochastic differential equation models for the interest rate dynamics of the United Kingdom bond market using Gaussian estimation econometric methods and monthly data over the period 1970–2010 using a range of maturities. Gaussian estimates of single and two equation models indicate that there is a relationship between the level of rates and the volatility of rates across the maturities. In addition, there is some evidence of feedback effects.

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Keywords: Gaussian estimation; CKLS; CIRSR; Term structure; Feedback effect

1. Introduction

The estimation of stochastic differential equation models in economics and more recently in finance with discrete data has been a major area of research. In econometrics pioneering work by Bergstrom [1–3] on the estimation of stochastic differential equations with discrete data have had major applications over the last thirty years. “See Bergstrom and Nowman [4] for a recent overview and application to the UK economy”. In finance a major application has been on modelling interest rate dynamics in the fixed income markets. An important contribution using time series data and econometric methods was provided by Chan et al. [7] (CKLS, hereafter) who developed a general interest rate model and found a strong relationship between the level of rates and volatility of rates for the US bond market (see, for example, Tse [17] and Hiraki and Takezawa [11]). An alternative approach to estimating nonlinear single factor models using a discrete approximation was proposed by Nowman [12] based on the exact discrete model that was suggested and explored in Phillips [16]. Nowman [12] used the Gaussian estimation econometric methods of Bergstrom [2,3] (see also Bergstrom and Nowman [4]). These Gaussian estimation methods were applicable to general linear continuous time models and Nowman [12] extended their applicability to nonlinear interest rate models involving heteroscedasticity. Recent examples include Episcopos [10] and Nowman [15]. Nowman [14] considered two factor Chan et al. [7] and Cox et al. [8] (CIRSR, hereafter) interest rate models with feedback effects which are important in the general theory of the term structure of interest rates and considered the Gaussian estimation of them (see Nowman [13] for the non-feedback case).

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