Asymptotic estimation theory of change-point problems for time series regression models and its applications

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Abstract

It is important to detect the structural change in the trend of time series model. This paper addresses the problem of estimating change point in the trend of time series regression models with circular ARMA residuals. First we show the asymptotics of the likelihood ratio between contiguous hypotheses. Next we construct the maximum likelihood estimator (MLE) and Bayes estimator (BE) for unknown parameters including change point. Then it is shown that the proposed BE is asymptotically efficient, and that MLE is not so generally. Numerical studies and the applications are also given.

AMS subject classifications: 62M10, 62M15, 62N99

Keywords: Change point, time series regression, asymptotic efficiency, Bayes estimator, maximum likelihood estimator.

1 Introduction

The change point problem for serially correlated data has been extensively studied in the literature. References on various time series models with change-point can be found in the book of Csörgő and Horvath (1997) and the review paper of Kokoszka and Leipus (2000).

Focusing on a change point in the mean of linear process, Bai (1994) derived the limiting distribution of a consistent change-point estimator by least squares method. Later Kokoszka and Leipus (1998) studied the consistency of CUSUM type estimators of mean shift for dependent observations. Their results include long-memory processes. For a spectral parameter change in Gaussian stationary process, Picard (1985) addressed the problem of testing and estimation. Giraitis and Leipus (1990,1992) generalized Picard's results to the case when the process concerned is possibly non-Gaussian.

For a structural change in regression model, a number of authors studied the testing and estimation of change point. It is important to detect the structural change in economic time series because parameter instability is common in this field. For testing structural changes in regression models with long-memory errors, Hidalgo and Robinson (1996) explored a testing procedure with