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TESTING AND MODELLING FOR THE STRUCTURAL CHANGE IN COVARIANCE MATRIX TIME SERIES WITH MULTIPLICATIVE FORM

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Abstract: We first construct a new generalized Hausman test for detecting the structural change in a multiplicative form of covariance matrix time series model. This generalized Hausman test is asymptotically pivotal, and has nontrivial power in detecting a broad class of alternatives. Moreover, we propose a new semiparametric covariance matrix time series model. The proposed model has a time-varying long-run component that takes the structural change into account, and a BEKK-type short-run component that captures the temporal dependence. We propose a two-step estimation procedure to estimate this semiparametric model, and establish the asymptotics of the related estimators. Finally, the importance of the generalized Hausman test and the semiparametric model is illustrated by means of simulations and an application to realized covariance matrix data.

Key words and phrases: Covariance matrix time series model, profiled quasi maximum likelihood estimation, realized covariance matrix, semiparametric time series model, structural change testing.

1. Introduction

Matrix-variate observations are often encountered in statistical applications with structured information. An important example is the realized covariance (RCOV) matrix, which is calculated from intraday high-frequency returns and enhances the prediction ability for the covariance matrix of the underlying multivariate process (see, e.g., Barndorff-Nielsen and Shephard (2002, 2004) and Andersen et al. (2003)). Because modelling and forecasting a covariance matrix are fundamental in asset pricing, portfolio selection, and risk management, it is necessary to study the dynamics of the RCOV matrix.

The non-ignorable structured feature of the RCOV matrix is its positive definiteness. To preserve this feature, many covariance matrix time series models have been proposed based on the Wishart or matrix-F innovation distribu-

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