Nonparametric transfer function models: A polynomial spline approach

Jun Liu and Jing Wang

Department of Finance and Quantitative Analysis, Georgia Southern University

Department of Mathematics, Statistics, and Computer Science, University of Illinois at Chicago

E-Mail: TBP

Abstract: In this paper, we propose a polynomial splines-based method to model nonlinear relationship between input and output time series. The functional form of the underlying relationship (the transfer function) is unknown but smooth. The noise is serially correlated and assumed to follow a parametric AR model. The transfer function is modeled using polynomial splines and estimated jointly with the AR parameters. By modeling the transfer function nonparametrically, the model is flexible and can be applied on highly nonlinear relationship of unknown functional forms; by modeling the noise explicitly, the correlation in the data is removed so the transfer function can be estimated more efficiently. Additionally, the estimated AR parameters can be used to improve the forecasting performance. Compared with existing local polynomial-based approaches, the proposed polynomial splines-based estimator is much less computationally intensive, more importantly, it can be easily extended to model non-stationary noise. The estimation procedures are introduced and the asymptotic properties of the estimators are discussed. The finite-sample properties of the estimators are studied through simulations and one real example.