Rsiopred: An R package for forecasting by exponential smoothing with model selection by a fuzzy multicriteria approach

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Exponential smoothing is one of the oldest, most widely used and most successful forecasting procedures (Goodwin 2010). Its potential applicability has recently been even increased with the introduction of a complete modeling framework incorporating innovations state space models, likelihood calculation, prediction intervals and procedures for model selection (Ord et al. 1997; Bermúdez et al. 2007; Hyndman et al. 2008; Vercher et al. 2012). In R, some basic models of exponential smoothing are available through the HoltWinters() function in the stats package, and the function ets() from the forecast package provides a larger set of models and optimization possibilities (see also the CRAN Task View for Time Series Analysis).

We present the package Rsiopred, which implements the SIOPRED forecasting procedure (Bermúdez et al. 2006, 2008). The procedure is based on a model that works with three components: mean level, damped trend and seasonality factors. The seasonal effects can be modeled using either additive or multiplicative forms. Our methodology unifies the phases of estimation and model selection just into an optimization framework which permits the identification of robust forecasts. Although the incorporation of the initial values as decision variables of the optimization problem increases the dimension of the related non-linear programming problems, the use of suitable optimization tools in the estimation analysis has been very fruitful, providing accurate forecasts.

A very important part of the method is the non-linear solver used. In its original version, SIOPRED uses a proprietary solver (Frontline Systems Inc.). Rsiopred implements, besides the possibility to use this proprietary solver, interfaces to available solvers in R, namely Rsolnp,ipoptr, and Rdonlp2. Various performance issues are tackled by the use of C++ code together with Rcpp. We analyze performance of the different solvers and the ex-post forecasts for some real time series datasets in order to illustrate our approach.

References