Hyndman & Khandakar, 2008

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Overview

- Cited over 5000 times on Google Scholar
- Motivation for auto.arima: thousands of time series to analyze
- Practical usage: inexperiences time series users just apply it blindly, and call it the “best” model because it is selected by this algorithm.

Exponential smoothing (Sec. 2)

- A standard method in economic forecasting and business
- May seem ad-hoc until embedded in a dynamic model, i.e., a state space model (SSM) representation, also known as a partially observed Markov process (POMP) or a hidden Markov model (HMM).
- Eqs (2,3,4) violate the usual POMP assumption that Y_n is conditionally independent of all other state and observation variables, given X_n.

Initial values (Sec. 2.4)

- Note that initial values have to be estimated,
- “Most imple- mentations of exponential smoothing use an ad hoc heuristic scheme to estimate x_0. However, with modern computers, there is no reason why we cannot estimate x_0 along with θ, and the resulting forecasts are often substantially better when we do.”

Why AIC? (Sec. 2.5)

- “Obviously, other model selection criteria (such as the BIC) could also be used in a similar manner.”
- Is there anything special about AIC? Not for consistent model selection.

When does model-based fitting by AIC beat alternatives?

- Competition results: “The methodology is particularly good at short term forecasts (up to about 6 periods ahead), and especially for seasonal short-term series (beating all other methods in the competitions for these series)”

On diffuse priors (Sec. 3.1)

- Claim that the likelihood is not defined for nonzero differencing parameters, d and D.
- `arima` attempts to solve this using so-called diffuse priors (Durbin & Koopman, 2001).
- HK prefer unit root tests.
- HK note that differencing may produce poor forecasts, but there's no option for a nonlinear trend with ARMA errors .

Stepwise selection (Sec. 3.2)

- Compares AIC to neighboring models, with +/- 1 lags for one or two model components.
- Reject models close to a unit root or having numerical errors

Comparing exponential smoothing to ARIMA (Sec. 3.3)

- The larger class does not always do better, particularly for seasonal models (there are dauntingly many choices for SARIMA).

Software engineering (Sec. 4)

- S3 classes
- Presumably, high usage reflects good engineering
- Success in competitions can demonstrate strong methodology