Forecasting seasonal time series data. A Bayesian model averaging approach

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Abstract. A Bayesian periodic autoregressive (PAR) model is presented for the prediction of quarterly and monthly time series data. The model admits one structural break in the periodic trend function, where the occurrence of a break, the corresponding break point and also the autoregressive lag order are treated as unknown quantities. Instead of resorting to a model selection approach by choosing one single model for prediction a forecasting approach based on Bayesian model averaging (BMA) is presented. As analytical expressions for the required marginal posterior predictive distributions of the multistep forecasts $y_{T+k},\ k = 1...K$, do not exist a Markov Chain Monte Carlo approach based on data augmentation is presented in order to generate random drawings from these distributions. By using the model posterior probabilities as weights a model averaged posterior predictive distribution can be computed. The forecasting performance of this BMA approach is then compared with classical seasonal time series models on the basis of several prediction criteria. In an empirical analysis of regional disparities the presented Bayesian approach is then used to forecast the monthly unemployment rate differentials of German federal states and their national counterpart.

Keywords. Bayesian model averaging; Data augmentation; Forecasting; Monthly unemployment rates; Periodic autoregressive processes