Forecasting German key macroeconomic variables using a large dataset

Inske Pirschel*
University of Kiel and Kiel Institute for the World Economy

Maik H. Wolters†
University of Kiel and Kiel Institute for the World Economy

December 5, 2013

Extended Abstract

In this paper, we study the performance of three alternative large scale approaches to forecast key macroeconomic variables. Our dataset for Germany consists of 124 variables in quarterly frequency covering a sample period from 1978 until 2013. While the use of such a large number of time series in the forecasting process enables us to include as much information as possible, forecasting models with large cross-sections also come with the disadvantage to suffer from a dimensionality problem as the number of parameters to be estimated quickly becomes very large. This may result either in overparametrization leading to unstable parameter estimates and inaccurate forecasts or the estimation of the models may simply become infeasible due to the very limited number of observations in typical macroeconomics applications.

The three large scale approaches studied in this paper handle the dimensionality problem of large datasets by aggregating information, yet on different levels. First, we study model averaging techniques where a large number of small forecasting models that contain only very few variables are estimated and the final forecast is computed as a weighted average of the forecasts of all the small models. Aggregation, thus, takes place after the forecasts have been computed. We have implemented equal weighted averaging as well as Bayesian model averaging. For the latter, the weights depend on the marginal density of the individual small forecasting models. Secondly, we study a large Bayesian vector autoregression as developed in Banbura, Giannone and Reichlin, 2010 (Banbura, M., D. Giannone and L. Reichlin, 2010. Large Bayesian Vector Auto Regressions Journal of Applied Econometrics 25: 71-92). Here the number of parameters is reduced via shrinkage to make the estimation feasible. The information from the data is therefore aggregated during the estimation process. Finally, we study different factor models such as a factor augmented autoregression, a factor augmented vector autoregression and a dynamic factor model. With these methods, information from the data is aggregated into a small number of factors prior to the estimation. We compare the forecasts for GDP growth,

*inske.pirschel@ifw-kiel.de
†maik.wolters@ifw-kiel.de

CPI inflation, a short-term interest rate and the unemployment rate obtained with these three large scale approaches to a number of different simple benchmark forecasting models, i.e. a random walk model, a direct and iterative autoregressive model, a small VAR and a small Bayesian VAR containing only our key variables.

Our dataset builds on the dataset used by Schumacher, 2007 (Schumacher, C., 2007. Forecasting German GDP Using Alternative Factor Models Based on Large Datasets Journal of Forecasting 26: 271-302), which we updated to include data through 2013. We compute forecasts one to eight quarters ahead using a recursive as well as a moving-window forecasting scheme. Forecast accuracy of the individual forecasting models is measured in terms of root mean squared forecast errors relative to the random walk forecasting model.

Our main findings from the preliminary estimation and forecasting exercise are as follows. With respect to the prediction of output growth, the three large scale methods as well as all of the remaining benchmark models beat the random walk forecast. The large Bayesian VAR and the model averaging techniques dominate the forecasts obtained by the univariate autoregression for the one quarter ahead forecast, but are just as good for higher horizons. The unrestricted VAR, the small Bayesian VAR and the forecasts obtained by the static and dynamic factor models cannot beat the simple autoregression. While none of the methods could predict the financial crisis of 2008, the large Bayesian VAR is able to capture the timing of trough and the recovery remarkably well.

Regarding inflation, the random walk forecast is again outperformed by all other forecasting methods. However, none of them can beat the simple autoregressions. Out of the three large scale methods, the large Bayesian VAR performs best, at least for short forecasting horizons.

Interest rate forecasts obtained by the three large scale approaches beat the random walk forecast and the univariate autoregressions for horizons of up to three quarters ahead. Among the three large scale approaches the large Bayesian VAR again performs best. The unrestricted VAR and the small BVAR provide less accurate interest rate forecasts than the random walk.

For the unemployment rate the random walk is outperformed by the simple autoregressions, the small Bayesian VAR and the three large scale methods. Forecasts obtained by the large Bayesian VAR and model averaging are also more precise than the simple autoregressions, at least for short horizons. The unrestricted VAR performs worse, while the factor model is just as good.

To sum up, the large scale approaches studied in this paper can provide a picture of current economic dynamics, but have difficulties predicting turning points and recessions. Among the factor models the simple factor augmented autoregression always dominates the two other specifications, while Bayesian model averaging beats equal weighted model averaging. Overall, the large Bayesian VAR shows a very good forecasting performance, especially for short horizons, and is, thus, an efficient method to accurately aggregate the predictive information contained in large macro datasets. The relative performance of the remaining methods however depends heavily on the predicted variable and the respective forecasting horizon.

Keywords: Large Bayesian VAR, Model averaging, Factor models
JEL-Codes: E62, E63, H61, H62, H63