

Economic Forecasting Using Forecast Combination

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INTRODUCTION

Economic forecasting helps to reveal future economic performance and evaluate the impacts of economic policies. However, the fluctuation of an economic indicator is related to plenty of factors. Therefore, to capture this fluctuation it is necessary to use a large number of predictors .

In 2003, James Stock and Mark Watson introduced a method to forecast output growth and inflation using many predictors. They first build individual model for each predictor, and then combine the forecasting result of each predictor with different combination methods. After comparison, they concluded that simple combination, such as taking average, outperforms other methods in terms of forecast accuracy.

RESAERCH PURPOSE

This project aims to improve Stock and Watson's forecasts by using a new method called "AFTER". Unlike simple combination, suggested by Stock and Watson, "AFTER" considers the past performance of each individual models (Zou and Yang 2004). In order to prove "AFTER" outperforms simple combination, we forecast real GDP growth, CPI inflation and employment growth with the same data used by Stock and Watson(2003), then evaluate the forecast accuracy in terms of mean square forecasting errors (MSFE).

DATA

The data set and transformation ways are same as the one used by Stock and Watson (2003). The data includes quarterly series over 1959-1999 of 43 original economic indicators in US. After data transformation of each indicator there are 71 time series in total.



METHOD

Build Individual Models

We build individual model using the method introduced by Stock and Watson (2003). Suppose X_t is an explanatory variable at time t , and Y_{t+h} is the response variable at time $t+h$ (h -step ahead forecast). So the individual model corresponding to each predictive indicator is a linear model:

$$Y_{t+h} = \beta_0 + \beta_{11}Y_t + \beta_{12}Y_{t-1} + \dots + \beta_{1n}Y_{t-n} + \beta_{21}X_t + \beta_{22}X_{t-1} + \dots + \beta_{2n}X_{t-n} + \varepsilon_{t+h} \quad (1)$$

where n is the number of lag terms. We set n to be 5 and h to be 2, 4 and 8.

Select Individual Models

We select individual models through "Pseudo Out-of-Sample" forecasting. The idea is to forecast $(j+h)$ th period using the data through j th periods, then forecast $(j+h+1)$ th period using the data through $(j+1)$ th period and so on. To select the lag terms, we use backward AIC selection starting with the full model (1).

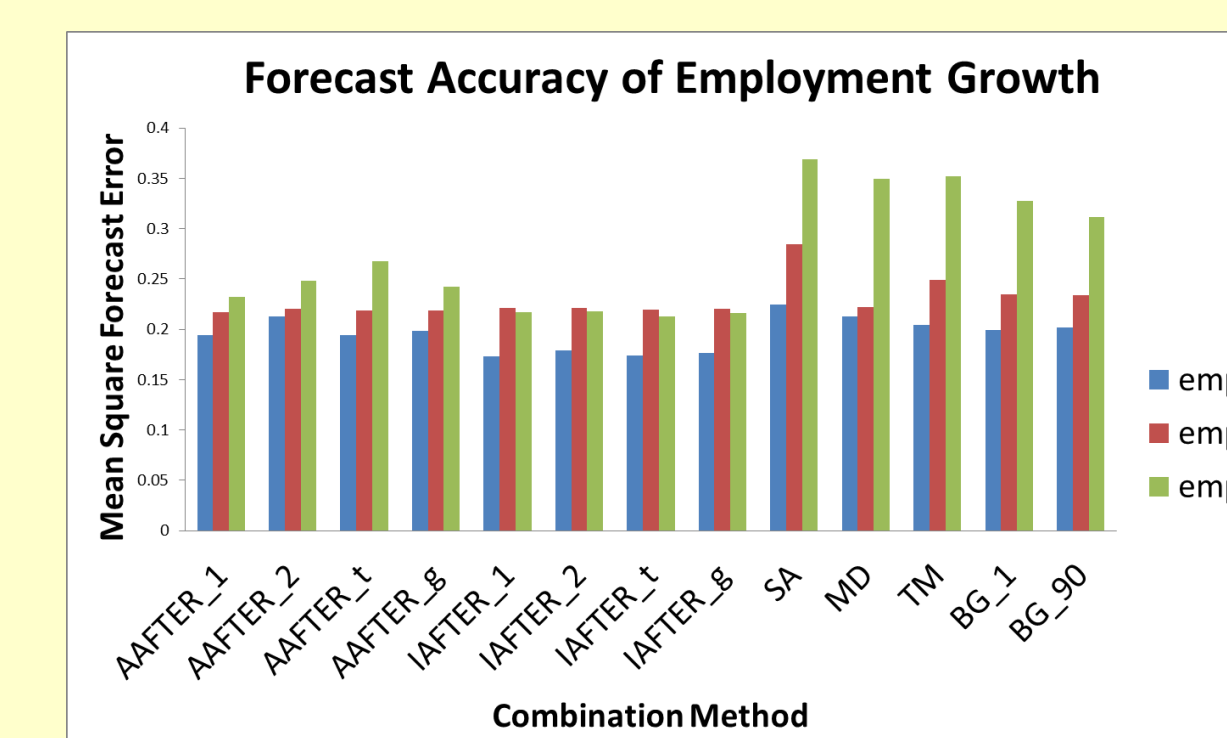
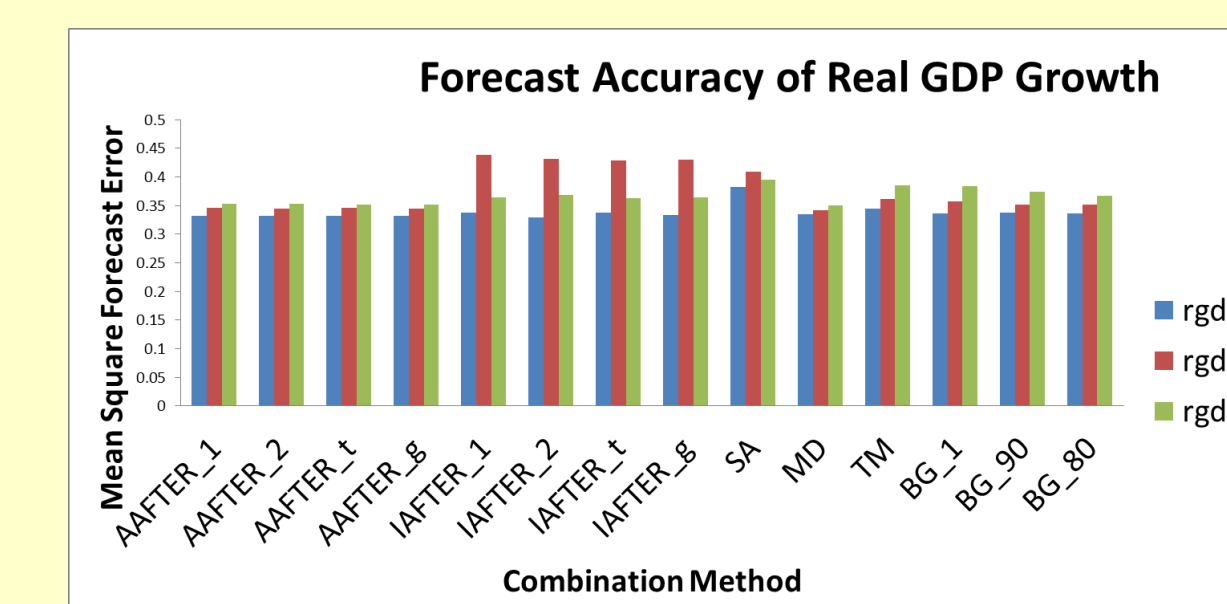
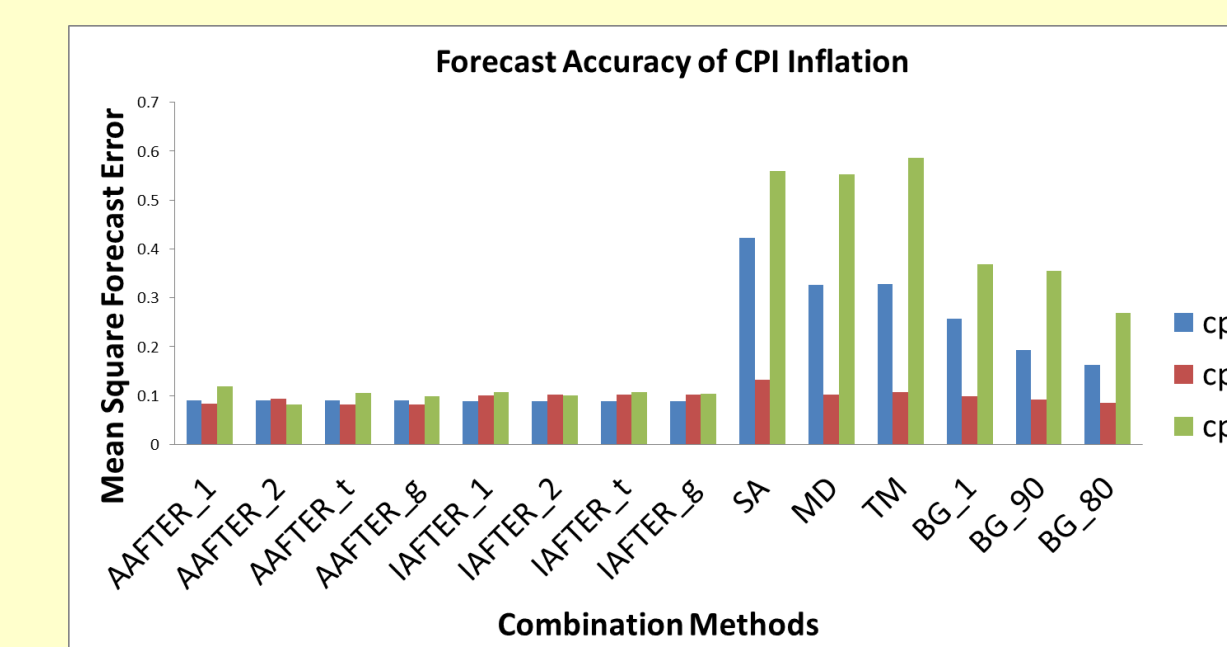
Combine Individual Models

With the purpose to compare "AFTER" with other combination methods, we include three simple combination: simple mean(SA), median(MD), trimmed mean(TM), and "BG", a method introduced by Bates and Granger (1969). "BG" minimizes the mean squared errors of combined forecasts by using relative variance and covariance to weight individual models.

Different from simple combination, "AFTER" updates the weights of individual forecasts after each additional observation, and puts more weight on better-performing forecasts. (Zou and Yang 2004) Here we introduce two versions of "AFTER": "Adaption AFTER" and "Improvement AFTER". "Adaption AFTER" combines the forecasts resulted from AIC selection, and "Improvement AFTER" combine the forecasts resulted from "LASSO", a selection method for high-dimensional data.

RESULT

The graphs below compare the accuracy of different forecast combination with respect to CPI inflation, GDP growth and employment growth . Lower mean squared forecast error(MSFE)implies better forecasting. For each response variable, we do 2-step,4-step,and 8 step –ahead forecasting. For example, the green bars in the first graph present 8-step-ahead forecasting of CPI inflation.



CONCLUSION

Based on forecast accuracy, "AFTER" is an effective combination method. Although it has similar performance to simple combination when predicting real GDP growth, it outperforms simple combination when predicting CPI inflation and employment growth. Therefore, economists can consider using "AFTER" to forecast the growth rate of economic indicators.