Macroeconomic Forecasting via Factor Model and Machine Learning: An Application to Japan[*]

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Abstract

We perform a thorough comparative analysis of factor models and machine learning for forecasting Japanese macroeconomic data. Our main results can be summarized as follows. First, factor models and machine learning perform better than the conventional AR models in many occasions. Second, predictions by machine learning methods are particularly well for medium- to long-term forecast horizons. Third, this success of machine learning mainly depends on the characteristic of its nonlinearity and interaction of variables, suggesting the potential nonlinear structure within the Japanese macroeconomic series. Fourth, when estimating the model from sample period data, recursive scheme is better than rolling scheme for short-term forecast horizon and vice versa for medium- to long-term forecast horizons. Fifth, neural network is helpful for improving the forecast performance, however, deep learning does not necessarily enhance its accuracy. Sixth, composite forecast improves the forecast performance under the environment of factor models and machine learning, and specifically, machine learning methods whose predictor variables are dynamic factors have a decent proportion of forcast power even after controlling for factor models and machine learning separately.

JEL classification: C11, C32, C38, C45, C53.

Keywords: forecast, big data, factor model, machine learning, LASSO, Ridge, Elastic Net, regression tree, ensemble, Bagging, Random Forest, Boosting, Neural Network, forecast combination, Bayesian Model Averaging.