Centraal Planbureau

VU VRIJE UNIVERSITEIT AMSTERDAM

Centraal Planbureau (CPB): Cross Validation

Practical Case Study:
Real-life Modelling in Econometrics and Data Science

Emma Arussi, Marta Chejduk, Kevin Mai, Tess Scholtus

January 2024

The Research Statement

1. **The replication of the 2019 study** conducted by Coulombe, Stevanovic, Surprenant utilizing the Dutch macroeconomic dataset.

2. The highlight of the influence of employing **different rolling window sizes** for Pseudo-Out-Of-Sample (POOS) and **varying fold sizes** in K-Fold Cross Validations.

3. The comparison the effects of both cross validation methods on **longer forecasting horizons for both AR(p) and Elastic Net models**.

Method

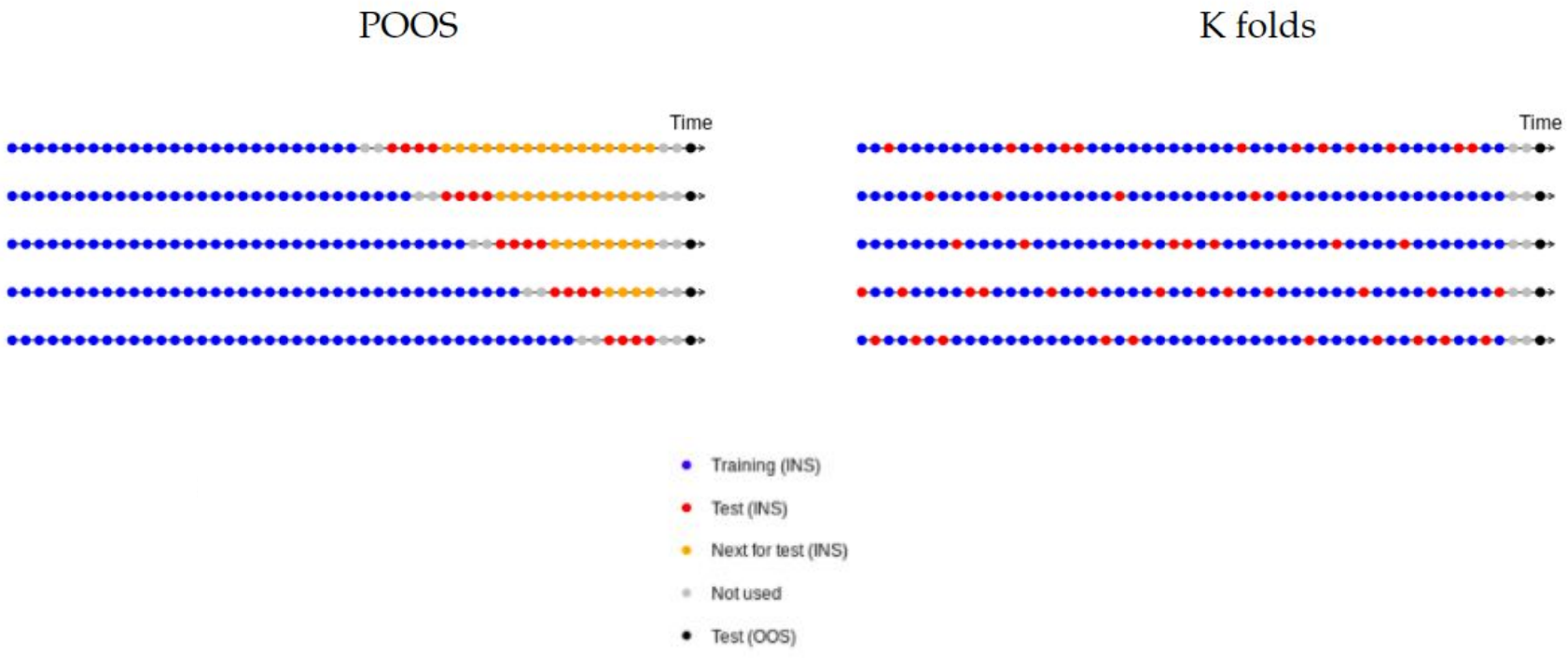
1. Preparation of dataset, clean data for the period 2010-2020, 130 observations and 129 independent variable, variable of interest: Unemployement rate

2. Achieve stationarity, with Augmented-Dicky-Fuller test (log- first difference)

3. Perform cross-validation by K-fold or POOS, applying different strategies, on training set to determine in-sample fit and optimal hyperparameters on 80% training set
   Lag order (p) for AR and alpha/lambda for Enet

4. Evaluate model on test by performing ¨pseudo out of sample¨-rolling forecast on 20% test set

Pseudo-Out-Of-Sample CV versus K-folds CV



The Results: AR(p) cross validation

K-Fold	Best AR Order	Best CV RMSE
5	1	0.0171
10	1	0.0172
20	1	0.0171

Table 1: Summary of k-fold cross-validation results for the AR model.

AR Order (p)	Window Size	Fixed Window	CV RMSE
5	12	TRUE	0.0179
1	36	TRUE	0.0213
Non-stationary	12	FALSE	NA
2	36	FALSE	0.0138

Table 2: Summary of POOS cross-validation results for the AR model

RMSE values for the AR model, compared to the benchmark AR-AIC

The Results: Enet cross validation

Model AR	Order (P)	Forecast RMSE (h=1)	Forecast RMSE (h=3)	Forecast RMSE (h=12)
AIC	AR(3)	0,0427	0,0470	0,0504
Kfold20	AR(1)	0,9523	0,9164	0,9530
POOS ROLL36	AR(2)	1,0000	1,0000	0,9927
POOS FIXED12	AR(5)	1,0291	1,0051	0,9910
Model Enet	**Alpha-Lambda**	**Forecast RMSE (h=1)**	**Forecast RMSE (h=3)**	**Forecast RMSE (h=12)**
Kfold10	0.1-0.008	0,8521	1,0593	1,2077
POOS-ROLL36	1-0.00164	0,8522	1,0489	1,2195
POOS-FIXED12	0.0088-0.0118	1,0393	0,9779	1,1966

Table 8: Forecast Performance AR vs Enet for H=1,3 and 12. RMSE AIC used as benchmark and the numbers below represent the relative, with respect to AR-AIC

RMSE values for the Enet model, compared to the benchmark AR-AIC

Discussion

Aim study: compare model selection POOS CV vs K-fold CV in macroeconomic data

1. Different model selection by POOS-CV and Kfold CV
2. Different model selection dependent on folds chosen (kfold) and choice for window selection (POOS)

Decision in cross-validation method has effect on in- and out of sample model fit

Centraal Planbureau

VU VRIJE UNIVERSITEIT AMSTERDAM

Thank you for your attention!

Questions?