

Time Series Analysis: Project.

Olivier Wintenberger: `olivier.wintenberger@upmc.fr`

Recommendations: Groups of at most 3 students work on a sufficiently large open dataset of their convenience containing variables of interest.

The project must be done in the R programming language and the results presented in a pdf file.

Preliminary

Subsample the dataset as follows: the 10 most recent data for testing, the rest for training. The 3 first parts of the projects are based on the training set only. The last one ask for a comparison of the predictive power on the test set. The 2 first parts are based on the variable of interest only.

I) Preprocessing

Remove trend, seasonality and outliers on the variable of interest if necessary.

II) Model fitting on the variable of interest

1) MA model

Choose the order of the MA model thanks to an ACF.

Fit the MA model with the chosen order.

Goodness of fit statistics to check whether the residuals are reasonably WN.

2) AR model

Choose the order of the AR model thanks to PACF.

Fit the AR model with the chosen order.

Goodness of fit statistics to check whether the residuals are reasonably WN.

3) ARMA model

Choose the orders of the ARMA model thanks to some information criterion.

Fit the ARMA model with the chosen orders.

Goodness of fit statistics to check whether the residuals are reasonably WN.

4) Model selection and residuals

Choose between AR, MA and ARMA models thanks to the Information criterion.

Goodness of fit statistics to check whether the residuals are gaussian.

5) GARCH model

Fit a GARCH(1,1) model on the residuals.

Test the nullity of the parameter β .

If the test cannot be rejected, fit an ARCH(1) model.

Test the nullity of the parameter α .

Goodness of fit statistics of the chosen model (GARCH(1,1), ARCH(1) or SWN).

6) Prediction intervals for the 10 most recent data

Construct the prediction intervals given by the two steps procedure.

Construct the prediction intervals on the one step estimator for the same ARMA-GARCH model provided by the rugarch package.

III) Training on the variable of interest using covariates

1) Preprocessing

Remove trend, seasonality and outliers on the explanatory variables if necessary.

2) Time varying coefficients

Use a dynamical model with the explanatory variates and some (the order of the AR model) past values of the variable of interest.

3) QLIK

Tune the hyperparameters thanks to the KFAS. Discuss the plausible constant coefficients.

4) Prediction

Use the Kalman's recursion on the tuned dynamical model to produce intervals of prediction for the 10 most recent data.

IV) Conclusion

Compare the 3 different prediction intervals from the two steps procedure, the one step procedure, and the dynamical model. Conclude.