

Assignment 1: Forecasting apartment prices

Many countries have numerous data sets available online. This facilitates the use of data for many purposes. Also for private individuals.

In this assignment we shall consider apartment prices in 2800 Kgs. Lyngby. The data is downloaded from Realkreditrådet (<http://www.realkreditraadet.dk/Statistikker/Boligmarkedsstatistik/Data.aspx>).

The file `apartment_prices.csv` contains 3 columns:

- 1: The `quarter` that the observation is from.
- 2: The `quarter` converted to a continuous variable (`time`).
- 3: The `price` in DKK per square meter.

You should not use the observations from 2015 and 2016 for estimations - only for comparisons.

Question 1.1: Plot the apartment price as a function of time.

Question 1.2: Does the global mean value and standard deviation of the prices give a reasonable representation of the data? (The answer should be elaborated.)

Question 1.3: Let us consider a model for all the data.

Formulate a GLM model in form of a simple linear regression model for all the data. Estimate the model parameters and plot your fit. Would this model be useful for making predictions of future apartment prices?

Question 1.4: Now we will consider methods which considers data more locally. Use **simple exponential smoothing** with $\lambda = 0.8$ to predict the apartment prices for all of 2015 and 2016Q1. Plot the estimates along the entire series and make a table with the predictions. Comment on the results.

Question 1.5: Use a **local linear** trend model to **predict the apartment prices for 2015 and 2016Q1**. State the uncertainty of the predictions. Plot the estimates along the **entire series** and make a table with the predictions. Again use $\lambda = 0.8$. Comment on the results.

(Hint: Consult the example in Sec. 3.6 of the lecture notes).

Question 1.6: Find an optimal value of the forgetting factor for use in the local trend model suggested in the previous question. **(Optimize 1-step predictions. And disregard the first 20 1-step predictions as burn in period.)**

Optional add-on: What is the optimal value if only using data prior to 2005?

Question 1.7: Comment on the results. **Which model do you prefer? Do you trust the forecasts? Do you have ideas for extending the forecast method?**

Note: Simple exponential smoothing does not include a measure of uncertainty. However it can be established through a local constant trend model.