

## Computational Finance and FinTech – Exercises 4

**Exercise 1.** Load the data from the file `hprice.xls` into a data frame. The file contains data on  $N = 546$  houses sold in Windsor, Canada. The dependent variable  $Y$  is the sales price of the house in Canadian dollars. The explanatory variables included in this data set are:

- the lot size of the property (in square feet)
- the number of bedrooms
- the number of bathrooms
- the number of storeys (excluding the basement)
- A dummy variable = 1 if house has a driveway (= 0 otherwise)
- A dummy variable = 1 if house has a recreation room
- A dummy variable = 1 if house has a basement
- A dummy variable = 1 if house has gas central heating
- A dummy variable = 1 if house has air conditioning
- The size of garage (number of cars it will hold)
- A dummy variable = 1 if house is in a desirable neighbourhood

Conduct a simple regression of `saleprice` on `#bedroom` and conduct a multiple regression of `saleprice` on `lot size`, `# bedroom`, `# bath` and `# stories`.

- What are the coefficients associated with the number of bedrooms in each regression? Can you explain why they are different?
- What is the  $R^2$  in the multiple regression? What is the interpretation?
- Are all coefficients statistically significant? Explain!

Use the data in `dax_and_spx.csv` in the following exercises. This data set contains one year of daily DAX and S&P500 index values.

**Exercise 2.** The goal of this exercise is to analyse the linear relationship between the DAX and the S&P 500.

Load the data set into a `DataFrame` and add columns with the log returns and create a scatter plot. Perform a linear regression of the DAX log-returns on the S&P log-returns. Comment on the ability of the model to forecast DAX returns. Is the model statistically significant?

**Exercise 3.** The goal of this exercise is to fit a GARCH model to the DAX and forecast DAX volatilities.

Load the data set into a **DataFrame** and add columns with the log returns and create a scatter plot. Fit a GARCH model on the DAX returns. What do the parameters of the GARCH model tell you about the variability in the DAX volatility? Next, forecast daily volatilities for 100 days and produce a plot of both the historical and the forecasted volatility. It should look similar to this:

