Econometrics – Doctoral School

T0: Introduction to R

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Content of R codes

1. Operations on vectors and matrices
2. Conditioning, loops, defining functions
3. Importing data (`read.csv`, `Quandl`, `quantmod`, `Eurostat`)
4. Converting and plotting data (`ts`, `zoo`, `xts`)
5. Simple vs. compound interest rate

Rates of return / growth rates

Simple rate of return:

$$Y_t = (1 + R_t)Y_{t-1} \leftrightarrow R_t = \frac{Y_t - Y_{t-1}}{Y_{t-1}}$$

Compound interest rate (m is compounding frequency):

$$Y_t = \left(1 + \frac{R_{m,t}}{m}\right)^m Y_{t-1}$$

Continuously compound interest rate:

$$Y_t = \lim_{m\to\infty} \left(1 + \frac{R_{m,t}}{m}\right)^m Y_{t-1} = \exp(r_t)\, Y_{t-1}$$

Logarithmic rate of return:

$$Y_t = \exp(r_t)Y_{t-1} \leftrightarrow r_t = \ln(Y_t/Y_{t-1})$$

Notice: $1 + R = \exp(r) \leftrightarrow r = \ln(1 + R)$

Rates of return / growth rates

Simple returns:

- Ø Easy to calculate for a portfolio of assets: $R_p = \sum_{k=1}^{K} w_k R_k$
- Ø Easy to communicate to non-statisticians
- Ø Not symmetric nor additive…

Log returns:

- Ø Symmetric and additive
- Ø Easy to communicate to statisticians
- Ø Difficult to calculate for a portfolio of assets: $r_p \neq \sum_{k=1}^{K} w_k r_k$

We will work with log returns

Exercises

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0.1

Write an algorithm, which would allow to calculate the roots of the equation:

$$e^x - (x+1)^2 = 0$$

knowing that they are in the interval $< -3{,}3 >$.

[Hint: make two loops with functions `for` and `while`]

0.2

Create a function `invVal(Y,h,R,m)` that will calculate the value of investment Y after h years, given that the annual interest rate is R and compound frequency m.

Use the function to calculate the value of 1000PLN after 1 year for $m = \{1,2,4,\infty\}$ and $R_m = 10\%$.

Exercises

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0.3.

Using the `eurostat` package import to R the annual growth rate of real GDP in Poland (at quarterly frequency). Write a series as a `zoo` object and make a plot. What was the average growth rate over the last 10 years

0.4.

Import daily data for the WIG index from the Internet to R. After converting the series to a `zoo` object, make a panel of figures for

- historic prices
- logarithmic growth rates
- ACF for levels
- ACF for growth rates