Series 1

Introduction to Computational Finance

Return no later than March 3th, 2020

Report

Each student is expected to give back a personal work consisting of a report in *PDF* format presenting his/her results and answering the questions of each exercise, as well as the script (*R*) used to generate the presented results. Both report and script have to be uploaded on Moodle (Serie1).

Installing R

R is a free software we shall use in the course. It allows computing statistics, fitting data efficiently, and producing nice plots. Please get familiarized with its functionalities using any of the many tutorials available online. There are two of them:

- `www.nceas.ucsb.edu/files/scicomp/Dloads/RProgramming/BestFirstRTutorial.pdf`
- `http://www.ats.ucla.edu/stat/r/`

Computing returns

The following series describes the value of a portfolio at the end of each month:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
101	102	103	104	105	106	107	108	109	110	111	112

The initial value of the portfolio being 100, the annual return is 12%.

- Compute monthly returns
- Compute the annual return from the monthly returns. Compare it to the sum of the monthly returns. Which calculation leads to the correct result, i.e. annual return of 12%.
- Compute the average monthly return and the average of the monthly returns !

Portfolio of Microsoft and Starbucks stock

Consider the case where you purchase 10 shares of each Microsoft and Starbucks stock at the end of month $t-1$ at prices $P_{msft,t-1} = \$85$ and $P_{sbux,t-1} = \$30$.

- Compute the initial value of the portfolio.
- Compute the portfolio shares α_{msft} and α_{sbux}.

Consider now that at the end of month t, the prices are $P_{msft,t} = \$90$ and $P_{sbux,t} = \$28$.

- Compute the one-period return of Microsoft and Stabuck stocks.
- Finally, compute the return of the portfolio and its value at the end of month t.

Two random variables

Let X and Y denote two random variables. Their bivariate distribution is described by the following table:

		Y		
		0	1	$P(X)$
X	0	0.2	0	0.2
	1	0.1	0.1	0.2
	2	0.0	0.2	0.2
	3	0.3	0.1	0.4
	$P(Y)$	0.6	0.4	1.0

Compute $E[X]$, $E[X|Y=0]$ and $Var[X|Y=0]$.

Wiki-culture

Describe what a *stock* is. Same for a *bond*.