Financial Econometrics
Sogang Universtiy

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Homework 1

Due: September 27, 2022
Note: For Problem #1, write your answers into a Jupyter Notebook file and submit the file.
Total points: 8

1. (2) Using Python, perform the following for the KOSPI index returns during the period 2021:01:02-2021:12:30 (on the basis of daily, closing prices; data available at https://ecos.bok.or.kr/flex/EasySearch.jsp).

   (a) Plot the sample autocorrelation function of the simple returns of the KOSPI index (log-differences of the index). Do they indicate serial correlation?

   (b) Test the null of no serial correlation using the Ljung-Box test at the 5% level. Set the lag length at 10.

2. (3) [1]Suppose that the daily log return of a security follows the model

$$r_t = 0.01 + 0.2r_{t-1} + a_t$$

   where $\{a_t\}$ is a Gaussian white noise series with mean zero and variance 0.02.

   (a) What are the mean and variance of the return series r_t?

   (b) Compute the lag-1 and lag-2 autocorrelations of r_t .

   (c) Assume that $r_{100} = -0.01$, and $r_{99} = 0.02$. Compute the 1- and 2-step ahead forecasts of the return series at the forecast origin $T = 100$. What are the associated standard deviations of the forecast errors?

3. (1) Suppose that r_t is represented by the AR(2) process

$$r_t = 1.1r_{t-1} - 0.4r_{t-2} + a_t,\ a_t \sim WN(0, \sigma^2).$$

   Is this process stationary?

4. (1) Consider the process

$$r_t = 1 + \sum_{j=0}^{\infty} 0.2^j a_{t-j},\ a_t \sim WN(0, \sigma^2).$$

   Is this process stationary?

[1]This is from Chapter 2 of Tsay's book.

5. (1) Find the ACF function of the MA(2) process

$$r_t = a_t + \theta_1 a_{t-1} + \theta_2 a_{t-2},\ a_t \sim WN(0, \sigma^2).$$