

Problem Set 1

Financial Econometrics 2ST119

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Instructions

- In order to answer the following problems, you have to write and submit a report as well as the R code. You are strongly recommended to work in groups.
- The data set can be found in the R package "FE".

Part 1: Statistical Properties of Asset Returns

A. Distributional properties of Dow Jones index returns

Use the data sets "DJ_d" (Dow Jones daily) and "DJ_w" (Dow Jones weekly) containing daily and weekly observations of the Dow Jones index.

1. Plot the series of log returns and compute descriptive statistics. Which distributional properties do you find? Do you find differences between daily and weekly data?
2. Evaluate the empirical distributions of the index log returns using quantile-quantile plots (QQ-plots). Test the empirical distribution against
 - (a) a normal distribution (with same mean and variance),
 - (b) alternative t_n -distributions with n degrees of freedom.

Interpret your findings for daily and weekly data.

3. Compute a χ^2 -goodness-of-fit test against
 - (a) a normal distribution,

- (b) a t_n -distribution with n degrees of freedom,
- (c) a mixture of normal distributions with mixture probability α and variance σ_2^2 .

Test the distribution of log returns against alternative theoretical distributions. Which theoretical distribution provides the best fit to the data? Do you find differences between daily and monthly data?

B. Dynamical properties of financial return series

Use the data set "index_d" (Index Daily.dat) containing daily data of international stock indexes.

1. Generate log returns. Compute the empirical autocorrelations and partial autocorrelations. Do you find evidence for significant autocorrelations in the individual index return series?
2. Compute the Ljung-Box test with respect to 10, 50 and 100 lags. By using the 0.01, 0.05 and 0.1 quantile of the χ^2 -distribution with suitable degrees of freedom, interpret your results.
3. Compute the (pairwise) cross-autocorrelations between the individual return series. Do you find evidence for lead-lag relationships?
4. Generate squared log returns. Analyze their dynamical properties. What do you find?

Part 2: Asset Return Predictability and Market Efficiency

A. Testing for asset return predictability

Use the data sets "DJ_d" (Dow Jones daily) and "DJ_w" (Dow Jones weekly) containing daily and weekly observations of the Dow Jones index. In the following, you have to test for asset return predictability based on autocorrelation functions, Ljung-Box statistics as well as variance ratio tests.

Investigate the following issues:

1. Do you find significant evidence for asset return predictability on the daily and weekly level?

2. What about the asset return predictability of two-day and two-week returns? What about the higher aggregated returns?
3. Divide the sample into appropriate sub-periods and analyze whether you find evidence of an increasing market efficiency over time.

Draw overall conclusions regarding asset return predictability based on this analysis.

B. Testing for Return Predictability in Size Portfolios

Use the data set "portcap_m" containing monthly returns of different U.S. stock portfolios built based on market capitalization. Using (cross-)autocorrelation functions, Ljung-Box statistics as well as variance ratio tests based on the complete time series as well as appropriate sub-periods you have to investigate the following issues:

1. Is there a relationship between market capitalization and asset return predictability and does it also hold for higher aggregated returns?
2. Is this relationship stable over time?
3. Are there significant cross-autocorrelations between different size portfolios?
4. Can you confirm the results of Campbell/Lo/MacKinlay (1997) that high-cap stocks lead small-cap stocks? How stable is this result over time?