Empirical Finance

Module 4, 2018-19

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Course information

Course Website: my.nes.ru

Instructor's Office Hours: by previous appointment

Class Time: *Mondays from 7 to 10pm* from March 4 to April 15, 2019; check the schedule for exceptions from the rule.

Seminar Dates: March 16, 30, April 6, and April 13.

Room Number: Marriot Courtyard, Voznesensky Per. 7

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Course description

This course gives you practical tools to analyze financial data, estimate financial models and use them in applications. We start with downloading real-world data, computing returns and variances of individual assets as well as portfolios. We then estimate two types of asset pricing models that you know from your Investments course, the CAPM and multi-factor models. You will be taught how to perform an event study analysis, to study the performance of mutual funds and to test whether certain investment strategies (e.g., technical trading rules) can "beat the market". These three applications, among others, can be framed as tests of the efficient markets hypothesis. But they are valuable techniques in themselves to test for the possibility of making profits out of certain types of information. Finally, the course gives you an introduction to the field of volatility modeling. This is not only useful for option pricing but also has applications in portfolio and risk management.

The programming language of choice for this course is R. There are at least three reasons for this: First, it is free (so you will be able to use it wherever you work) and, second, it has many contributors who have created libraries with code for financial applications. Third, you can both work with data and perform analytical computations equally well in R. The course includes three homework problem sets where you can display the skills that you have acquired in the course. It is essential that you install the program and work with data starting from the first week of the course.

Course requirements, grading, and attendance policies

Requirements: Financial Markets and Instruments, Financial Econometrics, Investments.

The course grade is composed of grades for

- three home assignments in groups of up to two persons (10% for the first, 20% for the second, and 20% for the third),
- a final exam (50%).

Homework assignments will be given on March 4 (due March 17), March 18 (due March 31) and on March 25 (due April 7). Seminars will take place on March 16, 30, April 6, and April 13. The deadlines are at 9pm one day after the seminar. So you need to come prepared to the seminar, with a preliminary solution of the homework assignment, and can get help during the seminar. Homework submitted after the deadline will get a grade of zero. There will be also a final seminar on April 13.

Course contents

Week	Scheduled Date	Topic	Chapters
1	March 4	Basic analysis of financial data using R – Downloading price data – Computing returns of individual securities and portfolios over different horizons – Tools for visualizing data – Risk measures for individual securities and portfolios	A 1-3, 4.1-4.3, Appendix A
2	March 11	Estimating asset pricing models – CAPM – Multi-factor models	CLM 5-6; A 5.1-5.4; S 5
3	March 18	Measuring mutual fund performance	A 6; LeSourd 2, 3
4	March 25	Event study methodology	CLM 4; A 5.5
5	April 1	Tests of the Efficient Markets Hypothesis – Introduction – Random-walk tests – Time series forecasting – Technical trading rules	CLM 1.5, 2; A 1.6; S 2.3, 6
6	April 8	Volatility modeling – Recap of ARIMA modeling of time series – ARCH and GARCH models	S 3.3; Brooks 8
7	April 15	Guest speaker and Review.	

(CLM = Campbell, Lo, MacKinley, A = Ang, S = Sollis; see Course material below)

Description of course methodology

The course will be taught by a combination of lectures with many programming examples, practical problems to be solved as homework, and seminars where these and other problems are solved and discussed.

Sample tasks for course evaluation

1. (from Sollis, Chapter 6)
   Download daily data on the level of the FTSE 100 stock market index for the period 02/01/98-31/12/07, for example from Yahoo! Finance, and apply the technical trading rules MA(1,50) and MA(5,150) over this period.
   a. Compute the sample mean return associated with the buy and sell signals ($\hat{\mu}_b$and $\hat{\mu}_s$) and with a buy-and-hold strategy ($\hat{\mu}$).
   b. Test for the statistical significance of $\hat{\mu}_b$and $\hat{\mu}_s$ relative to $\hat{\mu}$, and the statistical significance of $\hat{\mu}_b - \hat{\mu}_b$ using t-tests.
   c. Critically discuss what your empirical results suggest about the informational efficiency of the UK stock market.

2. (adapted from Brooks, Chapter 8)
   Consider the following GARCH(1,1) model
   $$y_t = \mu + u_t \ , u_t \sim N(0, \sigma_t^2)$$
   $$\sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1} + \beta \sigma_{t-1}^2$$
   a. If y_t is a daily stock return series, what range of values are likely for the coefficients μ, α_0, α_1 and β?
   b. Suppose that the researcher had estimated the above GARCH model for a series of returns on a stock index and obtained the following parameter estimates: $\hat{\mu}$ = 0.0023, $\hat{\alpha}_0$ = 0.0172, $\hat{\alpha}_1$ = 0.1251, and $\hat{\beta}$ = 0.9811. If the researcher has data available up to and including time T, write down a set of equations in σ_t^2 and u_t^2 and their lagged values, which could be employed to produce one-, two-, and three-step-ahead forecasts for the conditional variance of y_t .
   c. Suppose now that the coefficient estimate of β for this model is 0.98 instead. By re-considering the forecast expressions you derived in part (b), explain what would happen to the forecasts in this case.

Course material

Required textbooks and material

- Ang, Clifford S., Analyzing Financial Data and Implementing Financial Models Using R, Springer, 2015.
- Regenstein, Jonathan K., Reproducible Finance with R, CRC Press, 2019.

Additional material

- Brooks, Chris, Introductory Econometrics for Finance, Cambridge University Press, 2008.
- Campbell John Y., Andrew W. Lo, and A. Craig MacKinlay, The Econometrics of Financial Markets, Princeton University Press, 1997.

- Le Sourd, Véronique (2007), Performance Measurement for Traditional Investment: Literature Survey, Chapters 2 and 3. Link
- Sollis, Robert, Empirical Finance for Finance and Banking, Wiley, 2012.
- Additional references can be indicated during the course.

Academic integrity policy

Cheating, plagiarism, and any other violations of academic ethics are not tolerated at NES.