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Syllabus ¶

ECON/FIN250a: Forecasting in Finance and Economics: Fall 2018 ¶

Key information ¶

Instructor ¶

- Blake LeBaron
- blebaron@brandeis.edu
- <http://www.brandeis.edu/~blebaron>
- Sachar 204, 736-2258
- Office hours: Tuesday, 2-3, Wednesday 12:30-1:30.

TA ¶

- Lingyi Kong
- konglingyi@brandeis.edu
- Office hours:

Times: ¶

Class Times: Monday/Wednesday 11AM-12:20PM

Detailed information ¶

Course Description ¶

This course covers the basics of forecasting and time series analysis as used in finance, economics, and business. Basics time series topics will include linear regression, ARMA models, trend modeling, seasonal adjustments, and volatility modeling. This course will develop all of these using the R programming language and tools such as R-studio and the forecast package.

Learning Goals ¶

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1. Basic problems, issues and limitations in forecasting
 2. Basic forecasting and filtering tools
 3. Analysis of time varying volatility
 4. Formulating a well defined forecasting process in example applications
 5. Understand out of sample limitations in most forecasting solutions
 6. Utilize several different locations for retrieving time series information
 7. Be able to apply the open source language, R for forecasting and time series

Prerequisites: ¶

1. ECON 213a (equivalent to most undergrad 1 semester classes in econometrics)
 1. Random variables, expectations, PDF's, CDF's
 2. Linear regression (Ordinary least squares)
2. Basic calculus (about 1 semester, undergrad level)
3. Basic matrix algebra will be useful too.
4. Rudimentary knowledge of Excel.
5. Useful, but not required:
 1. FIN201a, Financial Theory (or FIN203a, or Bus71, or Econ171)
 2. Some computer skills are useful, but not required.

This course is designed for 2nd year IBS masters students (MA, MSF, MBA). PhD students may also find some of the content useful as well.

Course Materials: ¶

Required Readings: ¶

1. (SL) Schmueli and Lichtendahl, *Practical Time Series Forecasting with R*, Second Edition, Axelrod Publishers. [Textbook Website](#)
2. (HA) Hyndman and Athanasopoulos, *Forecasting Principles and Practice: Second Edition*, available online. [Book](#)
3. In many cases we will be using class notes extensively too.

Optional books: ¶

1. Singh and Allen, *R in Finance and Economics: A Beginner's Guide*, World Scientific, 2017.
2. Tsay, *An Introduction to Analysis of Financial Data With R*, Wiley.
3. Lander, *R for Everyone*, Addison-Wesley.
4. Diebold, *Elements of Forecasting*, fourth edition. (this book is available online for free download) [Book](#)

Optional online lectures: ¶

1. **DataCamp**: Introduction to R
2. **DataCamp**: Forecasting Using R (Hyndman)

Blogs ¶

1. [Forecasting](#)
2. [Diebold](#)

Required Software ¶

Both of these are open source

1. R and R-Studio will be used for all projects
2. We will use the forecast package for R extensively we will use the current version, 8.2.

[Forecast package](#)

Grading: Subject to change ¶

Grades will be based on:

1. Problem sets (10%)
2. Midterm exams (40%)
 1. Midterm 1: Wednesday, October 10th
 2. Midterm 2: Wednesday, November 28th
3. Group project (20%)
4. Final exam (30%), TBA in the Dec 13–20 range

Rules and responsibilities ¶

Communications ¶

You are responsible for all announcements and materials in class. Also, much of the information in class will be sent over Latte and the class website.

Rules specific to ECON/FIN250a ¶

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- Exams
 - Your own work.
 - Closed book (no notes).
 - No laptops, no cell phones, no calculators, no pda's.
 - Problem sets
 - Hand in your own work.
 - Can talk and assist each other.
 - Use all resources.
 - Group projects
 - Own work for the group.
 - Hand in one writeup per group.
 - Laptops: Please bring to class if you want to.

Academic Integrity ¶

You are expected to be honest in all of your academic work. Please consult Brandeis University Rights and Responsibilities for all policies and procedures related to academic integrity. Students may be required to submit work to TurnItIn.com software to verify originality. Allegations of alleged academic dishonesty will be forwarded to the Director of Academic Integrity. Sanctions for academic dishonesty can include failing grades and/or suspension from the university. Citation and research assistance can be found at LTS – Library guides.

Work Load ¶

Success in this four- credit course is based on the expectation that students will spend a minimum of 9 hours of study time per week in preparation for class (readings,papers, discussion sections, preparation for exams, etc.)

Disability Statement ¶

If you are a student with a documented disability on record at Brandeis University and wish to have a reasonable accommodation made for you in this class, please see me immediately. o

Fall calendar dates ¶

- Wednesday, Aug 29: First class
- Monday, September 3: No class (holiday)
- Thursday, September 6, Brandeis Monday

- Mon/Tue, Sept 10/11: No class (holiday)
- Wed, Sept 19: No class (holiday)
- Mon, Sept 24: No class (holiday)
- Tuesday, Sept 25: Brandeis Monday
- Monday, Oct 1: No class (holiday)
- Wednesday, October 24th: Module 2 Wed classes start
- Monday October 29th, no module 2 classes
- Wed–Friday, Nov 21–23: No class (holiday)
- Monday, December 10: Last class

Course Outline ¶

1. Introduction
2. Forecasting philosophy, (SL) chapter 1
3. R introduction
 1. Loading R and R–studio
 2. Getting R packages
 3. Lander, chapters 1–4
4. Statistics basics and review:
 1. Random variables
 2. Hypothesis tests
 3. Regression (more R)
5. Forecasting preliminaries
 1. Time series data and visualization, (SL) chapter 2, (HA) chapter 2.1–2.5, 2.7–2.9
 2. Performance evaluation and objectives, (SL) chapter 3, (HA) chapter 3.1, 3.3, 3.4, 3.5
 3. Forecasting tools (overview), (SL) chapter 4
6. Smoothing, and filtering, (SL) chapter 5
 1. Simple exponential filters
 2. Trends and seasonalities with filters
 3. Examples: Gasoline demand, U.S. unemployment
7. Time series/econometric methods
 1. Regression (seasonality and trend), (SL) chapter 6
 2. ARMA/ARMAX models, (SL) chapter 7

3. Unit root testing
 4. Examples: U.S. GDP, Inflation
 1. Seasonal patterns in U.S. GDP
 2. Longer range forecasts: 1 year
 5. Questions and issues about detrending and long range forecasts
8. Cointegration
1. Spurious regressions
 2. Error correction models
 3. Example: U.S. consumption and personal income
 4. Example: Pairs trading
9. Financial forecasts: Volatility modeling
1. Filters, risk-metrics, VaR
 2. GARCH/ARCH models
 3. Realized volatility
 4. Risk control strategies
 5. Changing covariances
10. Financial forecasts: Directional forecasts
1. Long range value forecasts/mean reversion
 2. Trend following and momentum
 3. Technical analysis
 4. High/Low range analysis (Stochastics)
11. Advanced topics
1. Social media and forecasting (“Now Casting”)
 1. US auto sales and Google searches
 2. Advanced seasonal forecasting
 1. US auto sales with seasonal patterns/
one year ahead forecasts
 2. Machine learning and time series
 1. Neural networks, (SL) chapter 9
 2. Kernel ridge regression

3. Forecast combinations: Bagging, bootstrap

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