Syllabus for **Economics Forecasting and Big Data**
Rutgers University
Department of Economics

01:220:421
Spring 2018

Contact Details

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Course Details

Lecture: Monday 2:50 PM - 4:10 PM, Murray Hall 208
        Wednesday 2:50 PM - 4:10 PM, Murray Hall 208
Office hours: TBA.
Final exam date: TBA.

Prerequisites: 01:220:320, 01:220:321, and 01:220:322

This course is an **UPPER LEVEL ELECTIVE**.

It is expected that all students will have taken intermediate level courses covering microeconomics and macroeconomics (e.g. 220:320 and 220:321) and an introductory regression class (e.g. 220:322). It will be assumed that all students have a good command of the material taught in these courses. **It is strongly recommended that you have some background knowledge about statistics, probability and linear algebra.**

Textbook

Forecasting: Principles and Practice by R. J. Hyndman and G. Athanasopoulos. ISBN-10 0987507109, ISBN-13 978-0987507105.

This text is an online text and can be found at `https://www.otexts.org/fpp/`. Students who prefer a hard copy of the book can purchase it on amazon.com for 40. The material in the text will cover the first three-quarters of the course. The last part of the course dealing with data reduction techniques and the handling of Big Data will consist of selected readings and lecture notes.

Course Overview

The course is aimed at the student who wishes to have a working knowledge of widely-used forecasting techniques. This is an upper level course and so will be taught at an advanced level. Good understanding of the material taught in the prerequisite courses for this class is essential for doing well in this course. The emphasis of this course will be on techniques that enable the forecaster to come up with good forecasts in a short period of time and reporting those results to a client. This course will focus on the practical aspects of the whole economic forecasting process. That is,

1. Understanding the needs of the client.
2. Decomposing the data into its various components.
3. Constructing forecasts and forecast confidence intervals for the various components using a variety of econometric models.
4. Compiling and reporting your results to the client in a clear and concise way.
5. Dealing with data sets with a large number of potential explanatory variables.
6. Using commonly used statistical and econometric software to make forecasts.

Learning Goals

Students who successfully complete this course should

1. be familiar with the basic concepts of the forecasting problem and be able to articulate them to someone who is not familiar with the forecasting problem.
2. be familiar with the time series issues involved with forecasting economic variables.
3. be able to use econometric software packages to produce forecasts and forecast confidence intervals.
4. be able to communicate forecasting results to a prospective client in a non-technical way.
5. be able to handle high dimensional data sets when producing forecasts.

Assessment

The assessment of this course will be a mix of practical assignments and exams. There will be one midterm exam and a final totaling 60% of the course grade. The other 40% of the course grade will be based on performance in practical forecasting exercises. The breakdown is as follows:

- Two mid-term exams: each 15%

- Final Exam: 35%
- Homework and small forecasting exercises: 20%
- One large programming project: 15%

Course Software

There is no one computer software program that is perfect for all aspects of this course. The textbook uses **R** and the recommended textbook uses both **R** and **Python**. So this course will introduce students this two very powerful statistical software package. Students will also need to use basic spreadsheet programs such as **Excel**. Other econometric software such as **Eviews** will also be used.

Academic integrity

Familiarize yourself with the universitys policy on academic integrity:
http://academicintegrity.rutgers.edu/academic-integrity-policy/
I will not hesitate to enforce the policy at any sign of a violation of it.

Overview of Lectures

1. The Forecasting Problem and Review of Regression Methods

    - The forecasting problem (Chapter 1, Text)
        - data availability and methods
        - short, medium and long run forecasts
        - basic steps in the forecasting process
        - the statistical forecasting perspective
    - Basic Data Analysis (Chapter 2, Text)
        - visualizing the data
        - transforming and adjusting data
    - Reporting and Evaluating Forecasts (Chapter 2, Text)
        - evaluating forecast accuracy
        - forecast diagnostics
        - prediction intervals
    - Review of Regression methods (Chapters 4 and 5, Text)
        - the simple and multiple regression model
        - using regression methods to forecast
        - reporting your results

2. An Introduction to Time Series Methods

- Time series decomposition (Chapter 6, Text)
    - trend component
    - cyclical component
    - seasonal component
    - irregular component
- Moving averages (Chapter 6, Text)
- Seasonal Adjustment (Chapter 6, Text)
- Properties of Time Seires (Chapter 8, Text)
    - stationarity and non-stationarity
    - making time series stationary

3. Time Series Methods

- ARIMA models (Chapter 8, Text)
    - stationary autoregressive (AR) models
    - moving average (MA) models
    - non-seasonal ARIMA models
    - seasonal ARIMA models
- Forecasting with univariate ARIMA models (Chapter 8, Text)
    - estimation and order selection in ARIMA models
    - producing ARIMA forecasts
    - o producing prediction intervals using ARIMA models
- Dynamic time series models (Chapter 9, Text)
    - dynamic univariate models
    - vector autoregressions
    - forecasting with dynamic time series models

4. Data Reduction and Big Data (various readings and notes)

- What is Big Data?
- Variable selection in high dimension data sets
- Principle components
- Factor Models
- leading and coincident forecasting indices
- Factor augmented vector autoregressions
- forecasting using high dimensional data sets

Final Comments

1. It is expected that all students will attend lectures, be up to date with their readings and be prepared to participate fully in class. Please ask questions in class or in office hours if you have any problems or misunderstandings. Do not wait until just before an exam to ask questions.

2. The best way to learn is by doing. The problem sets are designed to get you to practice the material introduced in the lectures. I encourage you to form study groups and work together. However, you should write up the answers yourself. Remember to always acknowledge people that helped you in preparing your assignment.

3. Students must work on the major project individually. No collaboration is allowed for this part of the class.

4. Please be respectful to your fellow classmates during class. The use of cell phones or computers is not allowed during class.