Syllabus for Econ 575

Applied Time Series Analysis and Forecasting

Professor Peter Reinhard Hansen

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Lectures: Tue & Thu 09:30-10:45 in Gardner Hall 309.

Office Hours: Wednesdays 4:00-5:00 and Thursdays immediately after class. Initially on zoom: Zoom Meeting ID: 942 4253 9483 Passcode: 575575

In person (eventually): Gardner Hall 300G.

Prerequisites:

Econ 410, 420 and 470 (Intermediate Microeconomics, Macroeconomics, and Econometric). In particular it is assumed the student is familiar with regression model estimation and related hypothesis testing techniques.

Course Objective:

The objective of the course is to introduce you to time series analysis and forecasting methods. By the end of the course you will master empirical time series methods and forecasting techniques.

The orientation of the course is a mix of theoretical and applied econometrics. A theoretical understanding and is critical to understanding the limitations of empirical methods methods and applying them correctly. Empirical applications will serve to illustrate forecasting methods and familiarize you with applied time series analysis and a variety of forecasting techniques.

We will initially focus on regression-based forecasts, which draws on your knowledge from Econ 470. The proceed with time series topics such as: autoregressive and moving average models, exponential smoothing, volatility models (GARCH), and particular aspects related to forecasting.

Course Website:

Assignments, announcements, grades, readings, and other information will be posted on Sakai. It is your responsibility to check Sakai and your UNC email regularly to stay informed regarding course content, exam dates, schedule changes, etc. https://sakai.unc.edu/portal/site/econ575sp2022

Spring 2022 Course Delivery: The ongoing COVID-19 pandemic may require us to change the way this course it taught. Ideally we will meet in person this semester as long as it is safe and practical., but we may have to go remote temporarily.

Textbook

We will use material from multiple sources, primarily the following two textbooks, of which one is available for free online.

- *Introduction to Econometrics* 4th ed. by Stock & Watson (SW)

- *Forecasting in Economics, Business, Finance and Beyond* by Francis X. Diebold. (D) Download: Forecasting from from the author's website.

Review and treatment of regression analysis will be based on SW, and we will proceed with the time series material in SW, chapters 15-17. Then we cover material from D, which will be supplemented with lecture notes and research papers.

Problem Sets Software

A number of homework assignments will be given during the course. You may discuss and exchange ideas about how to solve the assignments, but each student must turn in her own work.

Some assignments may require the use of computer software such as Python, R, Julia, STATA. I plan to use Julia for

Grading Policy

Grades will be based on: a midterm exam (20%) and a final exam (40%). The remaining 40% is based on homework assignments and the forecasting project. Active class participation is also factored into this part of the grade. I expect you to be present and actively participate in all lectures. So make sure to let me know, in advance, if a timing conflict will cause you to miss a lecture.

The midterm will take place in class on **March 1, 2022** (in class), the empirical project is due on **April 7, 2022** (tentatively), and the Final is on **May 3, 2022** at 8:00 A.M (a Tuesday).

Exams are closed-book, but you may bring a sheet with your own notes (one side of a letter-sized sheet of paper for the midterm, both sides for the final exam).

Project: Collecting data, which included the variable to be forecasted (e.g. unemployment rate, inflation, covid cases, sales data) and predictor variables (if any); build a forecasting model; estimate it and evaluate the forecasts (including an out-of-sample evaluation whenever possible). Students are graded on how well the project is written, along with the presentation of the model and final results. Projects that attempt to forecast "challenging time series" may be grade lighter. A project that is simply thrown together at the last minute will receive "zero" credit. Additional

details about the project will given later in the course. The project carries the same weight as three regular homework assignments. Late projects are accepted, but the score is discounted by 25% for each day that it is late (unless you have a documented medical emergency).

Schedule (preliminary)

Week 1-2

Introduction and Review of Basic Linear Regression Analysis

Week 2-3

SW Ch. 15 Time-Series Models: Autoregressive Models

Week 4-5

SW Ch. 16 Distributed Lag Models

Week 5-6

SW Ch 17.1-3. Vector Autoregression.

Week 7-8

SW Ch 17.5. Volatility Clustering

Week 8-10

Forecasting (Diebold)

Week 12-14

Advanced Topics & Project Presentations

Honor Code

All students are expected to follow the guidelines of the UNC honor code. In particular, students are expected to refrain from "lying, cheating, or stealing" in the academic context. If you are unsure about which actions violate the honor code, please see me or consult honor.unc.edu.

Mask Use

During in person lectures, all enrolled students are required to wear a mask covering your mouth and nose at all times in our classroom. If you choose not to wear a mask, or wear it improperly, I will ask you to leave and am instructed to submit a report to the Office of Student Conduct. At that point you will be disenrolled from this course for the protection of our educational community. Students who have an authorized accommodation from Accessibility Resources and Service have an exception. For additional information, see Carolina Together.

Electronics Policy

The use of electronics in class is prohibited unless for participating in class activities.

Acceptable Use Policy

By enrolling as a student in this course, you agree to abide by the University of North Carolina at Chapel Hill policies related to the acceptable use of IT systems and services. You may be asked to participate in online discussions or other online activities that may include personal information about you or other students in the course. The rights and protection of other participants are protected under the UNCChapel Hill Information Technology Acceptable Use Policy, which covers topics related to using digital resources, such as privacy, confidentiality, and intellectual property. Consult the University website "Safe Computing at UNC" for information about the data security policies, updates, and tips on keeping your identity, information, and devices safe.

Accessibility Resources and Services

The University of North Carolina at Chapel Hill facilitates the implementation of reasonable accommodations, including resources and services, for students with disabilities, chronic medical conditions, a temporary disability or pregnancy complications resulting in barriers to fully accessing University courses, programs and activities. Accommodations are determined through the Office of Accessibility Resources and Service (ARS) for individuals with documented qualifying disabilities in accordance with applicable state and federal laws. See the ARS Website for contact information: https://ars.unc.edu or email ars@unc.edu.

Counseling and Psychological Services

CAPS is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services, whether for short or long-term needs. Go to their website: https://caps.unc.edu/ or visit their facilities on the third floor of the Campus Health Services building for a walk-in evaluation to learn more.

Title IX Resources

Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitation, or stalking is encouraged to seek resources on campus or in the community. Reports can be made online to the EOC at https://eoc.unc.edu/report-an-incident/. Please contact the University's Title IX Coordinator, Report and Response Coordinators in the Equal Opportunity and Compliance Office, Counseling and Psychological Services (confidential), or the Gender Violence Services Coordinators (confidential) to discuss your specific needs. Additional resources are available at safe.unc.edu.

Policy on Non-Discrimination

The University is committed to providing an inclusive and welcoming environment for all members of our community and to ensuring that educational and employment decisions are based on individuals' abilities and qualifications. Consistent with this principle and applicable laws, the University's Policy Statement on Non-Discrimination offers access to its educational programs and activities as well as employment terms and conditions without respect to race, color, gender, national origin, age, religion, creed, genetic information, disability, veteran's status, sexual orientation, gender identity or gender expression. Such a policy ensures that only relevant factors are considered and that equitable and consistent standards of conduct and performance are applied. If you are experiencing harassment or discrimination, you can seek assistance and file a report through the Report and Response Coordinators (see contact info at safe.unc.edu) or the Equal Opportunity and Compliance Office, or online to the EOC at https://eoc.unc.edu/report-an-incident/.

Diversity Statement

I value the perspectives of individuals from all backgrounds reflecting the diversity of our students. I broadly define diversity to include race, gender identity, national origin, ethnicity, religion, social

class, age, sexual orientation, political background, and physical and learning ability. I strive to make this classroom an inclusive space for all students. Please let me know if there is anything I can do to improve. I appreciate suggestions.

Undergraduate Testing Center

The College of Arts and Sciences provides a secure, proctored environment in which exams can be taken. The center works with instructors to proctor exams for their undergraduate students who are not registered with ARS and who do not need testing accommodations as provided by ARS. In other words, the Center provides a proctored testing environment for students who are unable to take an exam at the normally scheduled time (with pre-arrangement by your instructor). For more information, visit http://testingcenter.web.unc.edu/.

Learning Center

The UNC Learning Center is a great resource both for students who are struggling in their courses and for those who want to be proactive and develop sound study practices to prevent falling behind. They offer individual consultations, peer tutoring, academic coaching, test prep programming, study skills workshops, and peer study groups. If you think you might benefit from their services, please visit them in SASB North or visit their website to set up an appointment: http://learningcenter.unc.edu.

Writing Center

The Writing Center is located in the Student and Academic Services Building and offers personalized writing consultations as well as a variety of other resources. This could be a wonderful resource to help with your writing assignments in this course (and any assignments in your other courses). You do not need a complete draft of your assignment to visit; they can help you at any stage! You can chat with someone in the writing center or set up as appointment on their website: http://writingcenter.unc.edu.

Grade Appeal Process

If you feel you have been awarded an incorrect grade, please discuss with me. If we cannot resolve the issue, you may talk to our departmental director of undergraduate studies or appeal the grade through a formal university process based on arithmetic/clerical error, arbitrariness,

discrimination, harassment, or personal malice. To learn more, go to the Academic Advising Program website.