Econ 575 Econometrics Topics:
Applied Time Series Analysis and Forecasting

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Lectures: Tue & Thu 11:00-12:15.
Office Hours: TBA in GA 300G.

Prerequisites:

Econ 410 and 420 (Intermediate Microeconomics and Macroeconomics); a college level introductory course in statistics that covered probability theory; and a college level course in econometrics. In particular it is assumed the student is familiar with regression model estimation and related hypothesis testing techniques, such as ordinary least squares, F-tests, heteroskedasticity, etc.

Course Outline

The objective of the course is to introduce you to the theory on forecasting and familiarize you with a variety of forecasting techniques. The orientation of the course is applied as well as theoretical. A theoretical understanding of the forecasting problem is critical for understanding forecasting methods and using them effectively. Empirical applications will serve to illustrate forecasting techniques and familiarize you with a variety of forecasting methods.

We will focus on the modeling and forecasting of time series data. Examples of time series data include macroeconomic variables, such as GDP, inflation, rate of unemployment, interest rates, etc. business variables such as sales, demand, etc. and financial variables such as asset returns, exchange rates, financial volatility, etc. You will likely have encountered "serial correlation" in previous econometrics courses, which is a form of serial dependence. Serial dependence is often viewed as "problematic" because it is a violation of classical assumptions such as independence. However in forecasting problems serial dependence is beneficial and often critical for our ability to make interesting forecasts.

Econometric methods that relate to forecasting are rather extensive. In this course we will mainly focus on regression-based forecasts and volatility models, such as GARCH models. We will also cover econometrics topics such as autoregressive and moving average models and other topics that relate to forecasting.

Website

Course website: https://sakai.unc.edu/portal/site/econ575

Textbook

We will use "Forecasting in Economics, Business, Finance and Beyond" by Francis X. Diebold as the main textbook. This book is not yet in print, but is available for free online, and can be downloaded from the course website.

Problem Sets

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 Matlab, Gauss, R, Ox. Matlab is quite popular in Economics/Econometrics/Finance, while R is popular in Statistics. You can obtain Matlab inexpensively from UNC; R is shareware and therefore free online; and Ox can be obtained for free for academic use. Excel and Google Sheets will also be used to illustrate some forecasting techniques.

Grading Policy

Grades will be based on: homework assignments and forecasting projects (40%); a midterm exam (20%); and a final exam (40%).
The midterm will take place in class on March 7, in class, 11:00 AM – 12:15 PM. The first forecasting project (regression-based forecasting) is due 4/4, and the second forecasting project (volatility forecasting) is due 4/25.

Each student must work alone on the projects that involves: Collecting a variable to be forecasted (e.g. annual unemployment rate in Brazil from 1955-2015), as well as predictor variables (if any); build a forecasting model; estimate it and evaluate the forecasts (including an out-of-sample evaluation if 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 projects will given later in the course. Each of the two projects carries the same weight as two 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). 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).

Schedule (preliminary)

Introduction

11/12 An introduction to forecasting and an overview of Econ 575

Dissecting the Forecasting Problem Diebold Chapter 2 and lecture notes

1/17 Object of interest, information set, forecasting horizon

1/19 Loss functions. MSE and LinEx loss (as examples)

Conditional Expectations Lecture notes

1/24 Conditional expectations defined. Properties

1/26 Examples of Conditional Expectation. Normally distributed random variables

Predictive Regression Diebold Chapter 3 and lecture notes

1/31 Least squares, regression with a single predictor

2/2 Regression with multiple predictors. Matrix notation

2/7 Standard errors and autocorrelation

Forecast Uncertainty Diebold Chapter 4

2/9 No class

2/14 Aspects of model and parameter uncertainty.

Trend and Seasonality Diebold Chapter 5

2/16 Deterministic trends

2/21 Seasonality (deterministic)

Autoregression Diebold Chapter 6

2/23 Autocovariance, autocorrelation, white noise

2/28 Autoregressive models

3/2 Forecasting with autoregressive models

Midterm Exam 3/7 In class midterm exam (no class 3/9)

Spring Break (March 11-19)

The Wold Representation Diebold Chapter 7

3/21 Wold representation, approximations, MA

3/23 MA(∞) representation of AR and ARMA

3/24 Friday: Extra Lecture?

Project Break No lectures on 3/28 & 3/30

Heteroskedasticity Diebold Chapter 8

4/4 [Project 1 due] ARCH & GARCH models

4/6 Generalizations, Component GARCH, Estimation

4/11 Empirical application of GARCH

High-Frequency Data Lecture notes

4/13 Brief introduction to high-frequency data, and realized measures

Realized GARCH Models

4/18 GARCH models that incorporates realized measures of volatility

4/20 Empirical Applications

Forecast Evaluation and Comparisons Diebold Chapters 10

4/25 [Project 2 due] Point forecast evaluation

4/27 Diebold-Mariano test