Economics 575

Econometrics Topics: Applied Time Series Analysis and Forecasting

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Information

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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 (e.g. ordinary least squares, F-tests, hetersceasticity, collinearity, omitted variable bias)

Introduction:

This course offers one of several possible continuations from a standard econometrics course (e.g. Econ 570). In particular, we focus entirely on time series data that we observe in the macro-economy and financial markets, including interest rates, exchange rates, GDP, asset market returns, option prices, the unemployment rate, investment, and so on. Although a standard econometrics course very briefly touches upon "serial correlation", the topic is vast since time series data permits unique models (e.g. seasonal patterns, business cycles, growth and trend), inference (e.g. testing if growth is stable over time), and problems associated with data properties (e.g. one person's labor supply cannot "explode" because hours in one week are bounded, but hyper-inflation does occur and prices can explode). We pay particular attention to modeling and forecasting business cycles and long run growth in macroeconomic data, and volatility and risk in financial data.

The course begins by estimating the serial correlation coefficient, testing for white noise, and introducing the standard linear ARMA model for time series (Autoregressive Moving Average). We study properties of the ARMA model, how to estimate unknown parameters, how to measure goodness-of-fit, and how to perform and evaluate out-of-sample forecasts. We study sophisticated forecast techniques that are required when we only have one sample of data: rolling-window methods of forecasting. We then introduce more structure by allowing for seasonality and trend, and again build forecast models for these traits. We proceed to model, test and control for "non-stationarity" (e.g. trend, stochastic breaks : this allow us to model growth and shifts in growth) and introduce the ARIMA model, unit roots and tests for unit roots (i.e. we will test whether growth is more stable then the level data itself). Our next challenge is to model and forecast volatility by studying the GARCH class of models (Generalized Autoregressive Conditional Heteroscedasticy). Finally, we build models for multiple time series at once (e.g. GDP and consumption and investment), study problems with co-movements of such data ("cointegration"), build models of causality and test for causal patterns (e.g. do past money supply changes influence future real income changes?), and again study forecast techniques.

Course Information
Homework assignments, answer keys and announcements will be posted on the course web-site. Check the web-site each week for updates.

Required Test Book
"Elements of Forecasting" (4th edition), or latest by F.X. Diebold.

Software - Eviews
We will use Eviews ("Econometric Views") a major time series software with command prompt (instantaneous commands, one-by-one) and programmable interface (for writing and storing code to run more detailed programs). Students must obtain EV Eviews IEWS on their own: 30% of the course grade will be based on time series econometric software use. Eviews is available from the manufacturer at Eviews.com. A student version costs about $40.

Visit www.eviews.com/eviews6/eviews6s/evstud6.html.

In principle any recent version of Eviews is appropriate, although I will only provide documentation for Eviews 6 or 7.

Final Project
A forecast project worth 20% of the course grade is due on the last day of lecture. Details of the project will be discussed after the midterm exam, and a two-page project proposal is due two weeks after the midterm. In general each student works alone to collect one time series variable (e.g. annual unemployment percent change in Venezuela from 1960-2000), model its structure, and produce and evaluate out-of-sample forecasts. Students are graded on the proposal, how well they write and present the model and final results, and on the challenges of the data and project (plain data is easier to model so grading will be harsher; volatile data, data with trend and seasonal traits are harder to model, so grading is a bit lighter: choose a challenging series!). A project that is simply thrown together at the last minute will be given a "zero" with no exception. In general the project will not be much different than a self-guided homework or two. The total score will be deducted by 25% for each day that it is late (unless you have a provable medical emergency).

Course Structure
There will be 2 tests (*one midterm* = 20% *and one final* = 30%), occasional mathematical assignments and data analysis exercises (*worth* 30% *of the final grade*), and a final project (*worth 20%).*

Under no circumstances will late homework assignments be accepted, including legal/medical emergencies and school sanctioned events. Students can, however, turn homework in early. Homework cannot be emailed (I will delete the email without even reading the attached homework), cannot be placed in my mail box (it will be thrown out), nor placed under the door of my office (it will be thrown away). There are no exceptions.

In case of emergencies or school sanctioned events, with a valid excuse (i.e. written proof) students may have their homework grade re-weighted.

Quiz Policy
I hold the right to give pop quizzes at any time, unannounced (hence, "pop"). I will never announce them, so do not ask. In the past I have given anywhere from 0 to 4 quizzes, each worth one homework assignment.

Tentative Lecture Schedule

Week	**Topic**
1	Serial correlation and Q-tests of white noise
2-4	ARMA model and the Box-Jenkins method
5	Seasonality
	Nonstationary time series
6-7	Trend and forecasting
8-9	Unit Roots and forecasting
10-12	GARCH models of volatility
12-14	Multivariate models: cointegration and causation