Course Assessment

There will be 50% for each of the two class exams. Both exams will be of the open book type. I will also from time to time, distribute problem sets, which will not be graded, but which are useful to ensure that you are following the material.

Course Description

This course is part of the graduate econometrics sequence and is a sequel to EC820 and is a companion course with EC821 on the econometrics of cross section and panel data. The EC822 course can be taken before or after EC821; the only prerequisite is EC820.

The EC822 course is concerned with the application of econometric methodology to time series data for estimation and hypothesis testing in dynamic economic models. The temporal dependencies in such data and the formulation of dynamic economic models combine to present some unique problems and consequently require the application of specialized methods. The econometric methodology presented in this course will be illustrated and motivated by problems in macroeconomics, monetary economics and finance.

Course Notes

You can download some notes and chapters I have written on selected topics for the course. These notes are from a monograph I am preparing and are copyrighted. Some additional information may be given from time to time on the course web page.
Textbooks

The main text for the course is:

James D Hamilton, "Time Series Analysis", Princeton University Press, 1994. This is the most up to date and comprehensive text on the subject matter of this course. However, Hamilton is encyclopedic in nature and is particularly good as a reference book for practicing econometricians and for graduate students doing research dissertations in time series econometrics. Unfortunately, it is not necessarily the ideal book for studying the subject for the first time. Therefore the course notes I have prepared will form a major part of the reading for the course, and should hopefully prove more accessible than some of the sections in Hamilton.

Given its price, I do not expect every student to buy Hamilton. I would recommend groups of two or three students buying a copy between them to help defray cost.

I will also refer to specific parts of G S Maddala and In-Moo Kim, “Unit Roots, Cointegration and Structural Change”, Cambridge University Press, 1998. This book has some excellent material in places.

Some other useful texts are:

Andrew C. Harvey, "Econometric Analysis of Time Series", MIT Press, second edition, 1989. This book is an excellent introduction for much of the material concerning stationary processes, but has very limited coverage of recent research on topics such as unit roots, cointegration and ARCH.


Course Outline

1. Dynamics (2 classes).
   How do dynamic models arise in econometric work? Some useful techniques involving the use of lag operators and the solution of linear difference equations. Basic results on the issues involving econometric estimators being applied to time series regressions with non i.i.d. disturbances. Intuition on possible problems arising from regression between non stationary variables. (Baillie ch 1).

   Strong and weak stationarity. Various definitions of white noise. The Wold decomposition. The population autocovariance and autocorrelation functions. Parametric models including Autoregressive (AR), Moving Average (MA), and Autoregressive Moving Average (ARMA) models. Seasonal ARMA models. Prediction from ARMA models. Derivation of expectations generating schemes; adaptive, extrapolative and rational expectations. (Hamilton, ch 3, 4; Baillie ch 3).

   Sample estimates of the autocovariance and autocorrelation functions. Partial autocorrelations. Examples of autocorrelations of actual economic and financial time series. Initial ideas on non stationarity and unit roots. Subjective decision making concerning whether to difference data and to impose unit roots. The Box-Jenkins modeling philosophy.

   Population autocovariance matrices. Vector version of the Wold decomposition. Vector Autoregressions (VARs), vector ARMA processes, Dynamic Reduced Forms, Autoregressive Final Form, Granger causality and strong exogeneity. Impulse response analysis and application in macroeconomics. (Hamilton ch 10, 11; Baillie course notes).

   Asymptotic results for the regression model with autocorrelation and/or heteroskedasticity. Quasi Maximum Likelihood Estimation (QMLE). (Hamilton ch 8, Harvey ch 2, 6).
   Application of Wald, Likelihood Ratio (LR) and Lagrange Multiplier (LM) Score Tests to testing for serial correlation, heteroskedasticity and for omitted variables. (Harvey ch 5).

Properties of the ARCH(q) model and the generalized ARCH, or GARCH(p,q) models. Integrated GARCH, Exponential ARCH, Non linear ARCH, Long memory ARCH, FIGARCH processes, ARCH in Mean and Multivariate GARCH models. Estimation of GARCH models, the use of QMLE. (Hamilton, ch 21; Baillie ch 9).

7. **Spectral Analysis (2 classes).**

   Analysis in the frequency domain. The autocovariance generating function. The spectral density function as the Fourier transform of the autocorrelation function. Spectral densities of various ARMA models. Estimation of spectral densities by use of spectral windows Linear filter theory. The implication of using linear filters for seasonal adjustment; the Hodrick-Prescott filter. (Hamilton ch 6).

8. **Unit Roots (4 classes).**

   Difference stationary and trend stationary processes. Integrated processes, Functional Central Limit Theorem (FCLT), Brownian Motion, or Wiener Processes. Dickey Fuller tests and Augmented Dickey Fuller (ADF) tests for a unit root. The Phillips Perron and KPSS tests. Applications to economic and financial market data. Martingales and asset pricing models. "How big" is the unit root in GNP? Very brief discussion of fractional differencing and long memory models. (Hamilton ch 15, 16, 17, 18; selected parts of Maddala and Kim).

9. **Cointegration (3 classes).**

   Spurious regression phenomenon and regression on time trends. Regression with I(1) variables. Granger's Representation theorem. Error Correction model and the relationship with VARs. Johansen's test for multiple cointegrating factors in a VAR. Campbell and Shiller's applications for present value models. The uses of cointegration in macroeconomics. (Hamilton ch 19, 20, Harvey ch8; selected parts of Maddala and Kim).