Class Content

The primary objective of this course is to offer exposure to several modern topics in macroeconometrics. These include, primarily, time series analysis and simultaneous equations models. Although these models are often applied to aggregate time series data, they may also be appropriate for some microeconometric applications. For example, empirical work in labor economics with microdata sets pays considerable attention to issues of simultaneous equations identification and estimation. Also the analysis of individual markets with time series data should employ appropriate time series methods. In addition, it is recognized that panel data analysis involves a temporal dimension, and as a result some time series topics are beginning to appear in these models.

The first section of the course will cover topics in time series, with particular emphasis on problems of inference when variables are nonstationary. Traditionally, regressions with time series have ignored the issue of nonstationarity, proceeding as though the well-established properties of standard estimators hold even in the nonstationary environment. This complacency was upset by simulation studies by Granger and Newbold and analytical work by Phillips establishing that regression estimators and test statistics do not have standard distributions in models with nonstationary or integrated variables. At the same time Engle and Granger provided the framework of cointegration for modeling relations among integrated time series, and established the connection between cointegration and the dynamic error correction models that Hendry and his disciples had pioneered. Following the seminal work by Engle and Granger, published fifteen years ago, there has been a flowering of research extending their ideas and applying these methods to a variety of estimation problems. During this section of the course you will be introduced to the statistical foundations, tests, and estimation procedures appropriate for work with integrated time series.

The second section of the course will cover systems of equations, beginning with the seemingly unrelated regressions model with some useful applications. Then we will move on to identification and estimation of simultaneous equations models.

Evaluation

There will be one examination in this course at midterm, counting towards 25% of your course grade. There will also be some problem sets and computer exercises counting another 20% of the final grade. There will be no final exam, but we will reserve the final exam period for some student presentations. The remaining 55% of your grade will be based on your individual project (30%) and a class presentation of an article on econometric methodology (25%), both described below.

The Economics Department will make reasonable accommodations for persons with documented disabilities. Students must notify their instructors no later than January 26, and provide documentation of the disability obtained from the Disabilities Services office located in Willard Hall, Room 322.
Individual Projects
You will each be responsible for an individual term project on an econometrics topic of interest to you. Your choice of topic should be related to the general areas described above (simultaneous equations problems or time series methods). Ideally your project should have both a theoretical or analytical component and an application, and the project should encompass a topic in econometrics that goes beyond what we cover in class. To make this assignment more concrete, an example of an appropriate project could involve allowing for structural breaks in tests of nonstationarity (unit roots). Although we will cover unit root testing in some depth, we will probably not cover this particular extension. There is a theoretical literature in which these tests are developed, and the analytical component of the project would present the statistical foundations behind these tests. Then the tests could be applied to one or more time series of interest as the applied component.

To assure that your project is appropriate, you should prepare a proposal describing (1) the econometric procedure you will investigate, (2) some key references to the relevant econometric theory, (3) the data set or model to which you plan to apply the procedure, and (4) the data sources. One or two pages should suffice for this proposal, and it should be submitted to me by February 14. Your final project is due on Thursday, April 25.

Computer Projects and Problem Sets
To get some practical experience with some of the econometric methods discussed in the course, you will complete several computer projects using EViews, which is available on our Economics Network. These projects are designed to give you some experience applying the procedures that are discussed in class. You will be asked to submit relevant output and answers to exercises requiring some interpretation of the output.

I will design several problem sets that require you to extend the mathematical presentation from class into new areas. Collaboration on the computer exercises and problem sets is acceptable, as long as you inform me about this in advance.

Article Presentation
In keeping with the seminar format, each student will be responsible for a presentation to the class of an article on econometric methodology. I have listed below a number of articles that would be appropriate for student presentations. Each of these is related to the major topics of the course, and presentations will be scheduled to fit with the course sequence. I am open to suggestions for other articles for presentation, as long as these fit within the major themes of the course. During the first two weeks of the class, you are urged to look over the titles below and examine any articles that sound interesting to you. I will match presenters with articles during the first week of February, and give you a schedule of presentations the following week. The tentative order of the presentations is given in the topical outline below.

Given the weight attached to this assignment (25%), you can see that considerable effort is expected to go into this presentation. You may want to read a few related papers and/or the complementary pages in Maddala and Kim, and it may be appropriate in some cases to supplement the article with an empirical illustration, and/or a demonstration for the class of how the methods in the article can be implemented with EViews or some other software. It should be possible to combine the topic for
presentation with your individual project for some obvious complementarities.

Prior to the presentation all students are urged to read the either article or the corresponding pages from the text by Maddala and Kim. You can obtain the articles from me, or some can be printed from JSTOR accessible through the library’s Webcat. In the past students have found it particularly useful if handouts presenting the main points of the presentation, e.g., copies of the slides or overheads, were made available for the group.

Articles for Student Presentations


Granger, C.W.J. and P. Newbold, "Spurious Regressions in Econometrics," Journal of Econometrics 2 (1974), 111-120. A cautionary tale about regressions with integrated series, this is the first of several papers that have shown how spurious regressions can arise in a variety of situations.


Kwiatkowski, Denis, et al. (KPSS) "Testing the Null Hypothesis of Stationarity Against the Alternative of a Unit Root," *Journal of Econometrics* 54 (1992) 159-178. Presents a test that reverses the null and alternative hypotheses from those of the Dickey-Fuller approach.

Maddala, G. S. and Shaowen Wu, “A Comparative Study of Unit Root Tests with Panel Data and a New Simple Test,” *Oxford Bulletin of Economics and Statistics* Special Issue, 61 (1999) 631-652. One strategy for increasing the power of unit root tests is to combine several related time series into a pooled regression. A number of strategies for testing unit roots in panel data sets have been developed in recent years, and this paper provides a lucid review of the issues involved.

Nelson, Charles R., and Heejoon Kang, “Pitfalls in the Use of Time as an Explanatory Variable in Regression,” *Journal of Business and Economic Statistics* 2 (1984) 73-82. The traditional practice in regression analysis with trended variables is to control for deterministic trends. This article shows what happens under such treatment if the variables actually have stochastic trends.


Schwert, G.W., "Tests for Unit Roots: A Monte Carlo Investigation," *Journal of Business and Economic Statistics* 7 (1989) 147-59. One of the first Monte Carlo investigations of the comparative properties of several unit root tests. This paper is also an good introduction to the Monte Carlo method.

Stock, J.H., and M.W. Watson,"A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems," *Econometrica* 61 (1993) 783-820. Consistent with the title, the authors present a least-squares based approach to estimating cointegrating relations that can be used with systems involving I(1), I(2), or higher orders of integration.
Texts

Topics, Reading Assignments, and Student Article Presentations

I. Statistical Inference with Integrated Variables.
A. Basic concepts and statistical foundations.
   Harris, chapters 1, 2.
   Maddala and Kim, chapters 1, 2 and 3.1-3.2.
   Greene, Sections 18.1-18.3

B. Unit root tests.
   Harris, chapter 3
   Maddala and Kim, chapters 3, 4.
Student presentations:
   Pantula, et al. (1994); Maddala and Kim, 4.2 and 4.3
   Kwiatkowski, et al. (1992); Maddala and Kim, 4.5
   Maddala and Wu (1999); Maddala and Kim, 4.9
   Schwert (1989); Maddala and Kim, 4.2
Computer exercise: unit root testing

C. Testing and Estimation of Cointegrating Relations.
   Harris, chapters 4, 5.
   Maddala and Kim, chapters 5, 6.
Student Presentations:
   Phillips and Loretan (1991); Maddala and Kim, 5.4
   King, et al. (1991)
Computer exercise: cointegration testing and estimation

Midterm Examination

D. Properties of regression estimators and test statistics in models with integrated variables.
Student Presentation:
   Campbell and Perron (1991); Maddala and Kim, chapter 7
Granger and Newbold (1974)

E. Extensions; Student presentations
   ARCH models: Engle, Lilien, Robins (1987); Greene, 17.4
   Seasonal unit roots: Hylleberg, et al. (1990); Maddala and Kim, 12.1-12.3
   Unit roots and structural breaks: Perron (1989); Maddala and Kim, 13.1-13.7
   Higher order systems: Stock and Watson (1993); Maddala and Kim, chapter 11.

I. Systems of Equations and Simultaneous Equations Models
   A. Seemingly Unrelated Regressions; the translog cost model.
      Greene, Sections 15.4-15.6
      Computer exercise: estimating the translog model.
   
   B. Identification
      Greene, Sections 16.1-16.3
      Student presentation:
      Johansen and Juselius (1994); Maddala and Kim, 5.6

   C. Estimation.
      Greene, Sections 16.4-16.7
      Student Presentation:
      Engle, Hendry and Richard (1983)

   D. Specification tests; Student Presentation:
      Hausman (1978); Greene, Section 16.8
      Computer exercise: simultaneous equations estimation.


(Final Exam Period - reserved for additional student presentations: Tuesday, May 7, 1:30-4:00 p.m.)
Additional References

Our texts contain numerous references to additional literature. In addition to these, the following references are included for further reading, with an emphasis on time series econometrics.

Banerjee, Anindya, Juan Dolado, John Galbraith, and David Hendry, *Cointegration, Error Correction and the Econometric Analysis of Non-Stationary Data*. Oxford: Oxford University Press (1993). A textbook covering both theoretical and practical issues in unit root testing and cointegration. This text is a level above Enders’ text in theoretical rigor, but not as demanding and Hamilton’s text.


Handbook of Econometrics, volumes 1-4, Amsterdam: North Holland. Of particular relevance to our topics on time series are two chapters in volume 4: Chapter 46 by James Stock, "Unit Roots, Structural Breaks, and Trends" and Chapter 47 by Mark Watson, "Vector Autoregression and Cointegration." These chapters update earlier surveys of these topics with numerous references to theoretical and applied papers.

Harvey, Andrew, Forecasting, Structural Time Series Models and the Kalman Filter. Cambridge: Cambridge University Press (1989). Harvey promotes the use of state space models, estimated by the Kalman filter, as an approach to capturing stochastic trends and short term fluctuations characteristic of economic time series. This is an alternative to the Box-Jenkins and Dickey-Fuller approaches emphasized in the class.

Johansen, Soren, Likelihood-Based Inference in Cointegrated Vector Autoregressive Models, Oxford: Oxford University Press (1995). This is a comprehensive presentation of Johansen's maximum likelihood approach to modeling, estimating, and testing systems of cointegrating relations.


Journal of Econometrics volume 80, No. 2 (1997) is a special issue on cointegration and dynamics in econometrics. Especially recommended are Li and Maddala's article on bootstrapping of cointegrating regressions, and Entorf's paper on spurious regressions in a panel data model.

Journal of Economic Dynamics and Control volume 12 (June-Sept. 1988) is a special issue containing some early and important papers on unit roots and cointegration.

Journal of Economic Surveys volume 12, no. 5 (December 1998) A special issue of surveys on practical issues in unit root testing and cointegration. The article by Haldrup is a fairly intelligible paper on I(2) modeling.


Oxford Bulletin of Economics and Statistics volume 48 no. 3 (1986) is a special issue containing early papers on cointegration and error correction models.


Oxford Bulletin of Economics and Statistics Volume 61, No. 4 (Supplement 1999) is a special issue on panel unit root and cointegration. The article by Maddala and Wu is a particularly useful review of the various unit root tests that have been proposed.

The first of this pair of articles presents the test of a unit root against the stationary alternative with change in mean or change in trend slope. The second applies the test to the Nelson-Plosser data.


Zellner, Arnold, and Franz Palm, "Time Series Analysis and Simultaneous Equation Econometric Models," Journal of Econometrics, vol 2 (1974), 17-54. Shows the correspondence between structural econometric models (SEM) and various time series models, and employs this correspondence to design tests of the underlying SEM.