APPLIED TIME SERIES ECONOMETRICS
(ECON 797W: Spring 2011, UMass Amherst)

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Classes: Monday 6:15-8:45pm in W-22 Machmer
Instructor Office Hours: Tuesday 1:00-3:00pm, or by appointment
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About the course: This course will introduce students to the basic techniques of time series econometric analysis and encourage them to apply some of these techniques to answer questions in heterodox macro/PE. The material that will be discussed in the course can be divided into two parts: (a) analysis of stationary time series processes (both univariate and vector processes), and (b) analysis of non-stationary time series processes (both univariate and vector processes).

Textbook: The following textbook will be used to organize discussion of the material: *Applied Econometric Time Series (Third Edition)*, by Walter Enders, 2010 [Publisher: John Wiley & Sons].

Supplementary Textbooks The following textbooks can be used for reference:

- *Econometrics*, by Fumio Hayashi, 2000 [Publisher: Princeton University Press]

Statistical Packages: We will work with two popular statistical packages in this course: R and STATA. The following links can be used to familiarize oneself with these packages for time series analysis:
For R: http://www.stat.pitt.edu/stoffer/tsa2/R\_time\_series\_quick\_fix.htm

For STATA: http://archive.nyu.edu/bitstream/2451/29569/2/Brief\%20Introduction\%20to\%20Stata\%2010\%20Time\%20Analysis.pdf

Grading: A total of 200 points will be divided between 5 take-home assignments and a research paper as follows:

Take-home assignments: The 5 take-home assignments will be worth a total of 100 points, with each contributing 20 points. The assignments will be handed out in class and will be due in about 7-10 days; they will involve solving end-of-chapter problems, with every assignment (other than the first) including a data exercise. Data exercises can be completed using R or STATA. Details of tutorial sessions to help familiarize students with R and/or STATA will be announced in class.

Research paper: The research paper will be worth 100 points and will involve either (a) replicating the results of an existing paper, and critically extending it further if possible, or (b) presenting original research. Typically the paper will be chosen by the student in consultation with the instructor and should have the following characteristics: (1) the paper must analyze a heterodox macro/PE question, and (2) the paper must use time series econometric analysis. (I have provided a small list of recent heterodox macro/PE papers that have used time series econometric analysis; students can choose a paper from this list or from any other appropriate source).

Tentative schedule: The tentative schedule for the course is as follows:

- **Week 1-2**: Introduction to time series analysis and Difference Equations (Chapter 1 of the textbook): after revising basic concepts from probability and statistics (random variable, probability density/mass function, expectation, variance, covariance, etc.), the first two weeks will help familiarize us with two of the basic building blocks of time series econometrics, deterministic difference equations and lag operators.

- **Week 3-5**: Stationary Time Series Models (Chapter 2 of the textbook): moving from the analysis of deterministic to stochastic difference equations will equip us with the tools to understand the widely
used class of stationary time series models, the ARMA(p,q) model; here we will also go over basic notions of time series analysis and familiarize ourselves with the Box-Jenkins modeling strategy.

- **Week 6-8:** Models with Trends (Chapter 4 of the textbook): time series with trends, both deterministic (time trend) and stochastic (unit roots), are non-stationary random variables and require a whole new approach of analysis and statistical inference; this part of the course will introduce the basic issues involved in analyzing time series with trends (e.g., why do standard methods of inference, using \( t \) and \( F \) tests, completely break down when there is a unit root non-stationary regressor? how do we test for the presence of unit roots?)

- **Week 9-11:** Vector Time Series Models (Chapter 5 of the textbook): having studied univariate time series models in some detail, we will now move to the study of vector processes; in this part of the course we will study one of the widely used tools of *dynamic* macroeconomic analysis, vector autoregressions (VARs) and its three specific techniques - impulse response functions, variance decomposition and Granger causality.

- **Week 12-14:** Cointegration and Error Correction (Chapter 6 of the textbook): this part of the course will familiarize us with techniques used to study cointegrated random variables (i.e., unit root non-stationary random variables, a linear combinations which becomes stationary) and help answer questions like: How do we test for cointegration? what “meaning” can be attached to the notion of “cointegrated variables”? What is an error correction representation of a cointegrated system? How to carry out statistical inference on cointegrating vectors?

**References**


