Econ 373: Time Series Econometrics
Spring 2004

Time: TR 2:35-3:50PM
Classroom: Calhoun 209

Instructor: Mototsugu Shintani
Office: CL 102A Office hour: R 4:00-5:00PM
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Course Objectives: The goal of this course is to introduce basic time series models and to provide tools for empirical work with time series data. It starts by introducing univariate stationary ARMA models and progresses to multivariate models, nonstationary models and nonlinear models. Applied aspect of time series analysis is emphasized in the course. Both time domain and frequency domain methods will be covered.

Prerequisites: The equivalent of Econ 307, 309 or above is required. Students should be familiar with basic concepts of econometrics including probability theory, linear algebra, OLS, GLS and maximum likelihood. Econ 370 is not required but the knowledge of nonparametric method is advantageous. Students need to have a knowledge of a statistical software (e.g. Eviews, STATA, TSP, RATS) or a programming language (e.g. GAUSS, Matlab) before start working on the empirical research paper. If you like to choose one to learn, I recommend GAUSS as it is most popular software among econometricians.

Textbook: James D. Hamilton, *Time Series Analysis* (1994, Princeton University Press)

Other Recommended Textbooks:
Fumio Hayashi, *Econometrics* (2000, Princeton University Press)
Walter Enders, *Applied Econometric Time Series, 2nd Edition* (2004, John Wiley and Sons)

Choice of Final Exam or Term Paper: Each student should **either** (i) take final exam (May 3, Mon, 3:00PM) **or** (ii) write an empirical research paper. The paper should be submitted by the day of the final exam and there is no extension of the submission due date. The paper must be an applied paper that uses the time series tools learned in the course (or described in course outline). If a student has decided to choose the option of research paper, the student must submit a one-page research proposal and the topic should be approved by the instructor by the end of February.

Method of Grading:

Attendance and participation	30 points
One assignment	20 points
Class presentation	20 points
Final exam / term paper	30 points

Course Outline

0. Introduction
- 0.1. Classical regression model with serial correlation
- 0.2. Trend model
- 0.3. Stationarity

PART I: STATIONARY MODELS

1. Univariate models
- 1.1. Linear processes
- 1.2. AR model, MA model and ARMA model
- 1.3. Autocorrelation functions and impulse response functions
- 1.4. OLS and ML estimation
- 1.5. Model selection and prediction

2. Multivariate models
- 2.1. VAR models and estimation
- 2.2. Granger causality test
- 2.3. Triangular identification, impulse response functions and variance decomposition
- 2.4. Identified (structural) VAR models

3. Spectral Analysis
- 3.1. Spectral density
- 3.2. Nonparametric spectrum estimation and long-run variance

PART II: NONSTATIONARY MODELS AND NONLINEAR MODELS

4. Nonstationary models
- 4.1. Unit root tests
- 4.2. Cointegration (1): single equation method
- 4.3. Cointegration (2): system method
- 4.4. Long-memory models

5. Nonlinear models
- 5.1. TAR/STAR models
- 5.2. ARCH/GARCH models
- 5.3. Regime switching models
- 5.4. Dynamic factor models

References

0. Introduction

- Hamilton, chapters 8 and 16

1. Univariate models

- Hamilton, chapters 3, 4 and 5

[Theory]

- Phillips, P. C. B. and V. Solo, (1992), "Asymptotics for linear processes." *Annals of Statistics* 20(2), 971-1001.

2. Multivariate models

- Hamilton, chapter 11

[Theory]

- Lutkepohl, H. (1990) "Asymptotic distributions of impulse response functions and forecast error variance decompositions of vector autoregressive models," *Review of Economics and Statistics* 72: 116-125.

[Application]

- Sims, C. A. (1980) "Comparison of interwar and postwar business cycles: monetarism reconsidered." *American Economic Review* 70(2): 250-257.
- Blanchard, O. J. and D. Quah (1989) "The dynamic effects of aggregate demand and supply disturbances," *American Economic Review* 79: 655-673.
- Leeper, E. M., C. A. Sims and T. Zha (1996) "What does monetary policy do?" *Brookings Papers on Economic Activity* 2, 1-63.

3. Spectral Analysis

- Hamilton, chapter 6

[Theory]

- Berk, K. (1974) "Consistent autoregressive spectral estimates," *Annals of Statistics* 2, 489-502.
- Robinson, P. M. and C. Velasco (1997) "Autocorrelation-robust inference," in: G. S. Maddala and C. R. Rao, eds., *Handbook of Statistics*, Vol. 15 (North-Holland, Amsterdam) 267-298.
- Newey, W. K. and K. D. West (1987) "A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix," *Econometrica* 55(3): 703-708.
- Andrews, D. W. K. (1991) "Heteroskedasticity and autocorrelation consistent covariance matrix estimation," *Econometrica* 59(3), 817-858.

4. Nonstationary models

- Hamilton, chapters 15, 17-20

[Theory]

- Phillips, P. C. B. (1987) "Time series regression with a unit root," *Econometrica* 55(2), 277-301.
- Elliott, G, T.J. Rothenberg, and J.H. Stock (1996) "Efficient tests for an autoregressive unit root," *Econometrica* 64(4) 813-836.
- Engle, R. F. and C. W. J. Granger, (1987) "Cointegration and error correction: representation, estimation, and testing," *Econometrica* 55(2), 251-276.

- Johansen, S. (1988) "Statistical analysis of cointegration vectors," *Journal of Economic Dynamics and Control* 12(2/3), 231-254.
- Shintani, M. (2001) "A simple cointegrating rank test without vector autoregression," *Journal of Econometrics*; 105(2), 337-362.

[Application]

- Nelson, C. R. and C. I. Plosser (1982) "Trends and random walks in macroeconomic time series," *Journal of Monetary Economics* 10: 139-162.

5. Nonlinear models

- Hamilton, chapters 21 and 22