Department of Economics
University of California at Berkeley

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Economics 241B - Econometrics

This course will cover statistical models for the analysis of economic time series data, with applications in macroeconomics and finance. It is intended both for students specializing in econometric theory and for students interested in applying time series methods to economic data. Economics 240A-B (or equivalent) is prerequisite. Economics 241A is *not* required for Economics 241B this semester.

The class will meet Tuesday and Thusday 2-3:30 in 87 Evans. Grading will be based on performance on the (approximately biweekly) problem sets and on two written exams. The first half of the semester (taught by T. Rothenberg) will primarily be devoted to analysis of stationary time series data, while the second half (taught by M. Jansson) will address nonstationarity and nonlinearity/nonnormality/heteroskedasticity in time series.

The principal text for the class is:

- Hamilton, J.D., *Time Series Analysis.* Princeton University Press, 1994 (cited as "Hamilton").

Other (optional) useful references are:

- Harvey, A.C., *Time Series Models, Second Edition.* MIT Press, 1993 (cited as "Harvey").
- Granger, C.W.J. and P. Newbold, *Forecasting Economic Time Series.* Academic Press, 1977 (cited as "Granger and Newbold").
- Sargent, T.J., *Macroeconomic Theory, Second Edition.* Academic Press, 1987 (cited as "Sargent").

More advanced treatments of some of the topics covered can be found in:

- Brockwell, P.J. and R.A. Davis, *Time Series: Theory and Methods, Second Edition.* Springer, 1991
- Davidson, J., *Stochastic Limit Theory.* Oxford University Press, 1994.
- Fuller, W.A., *Introduction to Statistical Time Series, Second Edition.* Wiley, 1996.
- Hannan, E.J., *Multiple Time Series.* Wiley, 1970.
- Harvey, A.C., *Forecasting, Structural Time Series Models and the Kalman Filter.* Cambridge University Press, 1989.
- Tanaka, K., *Time Series Analysis: Nonstationary and Noninvertible Distribution Theory.* Wiley, 1996.
- White, H., *Asymptotic Theory for Econometricians, Second Edition.* Academic Press, 1999.

REFERENCE LIST FOR 241B

1. **Discrete Time Stochastic Processes:** stationarity; stochastic difference equations; Wold decomposition theorem; ARMA, ARMAX, and state-space models; linear projections and forecasting.

   - Hamilton, chapters 1-4.
   - Harvey, chapters 1-2.
   - Granger and Newbold, chapter 1 and sections 4.1-4.4.

2. **Parameter Estimation and Hypothesis Testing:** fitting ARMA models using nonlinear least squares; maximum likelihood estimation via the Kalman filter; GMM estimation; asymptotic inference.

   - Hamilton, chapters 5, 7, 8, 13, and 14.
   - Harvey, chapters 3-4.
   - Granger and Newbold, chapters 3.

3. **Frequency Domain Analysis:** spectra; filters; transforms; nonparametric estimation.

   - Hamilton, chapter 6.
   - Harvey, chapter 6.
   - Granger and Newbold, chapter 2.
   - Sargent, sections 11.4-11.12.

4. **Vector Processes:** vector ARMA processes; Granger-Sims causality; simultaneous equations.

   - Hamilton, chapters 10-11.
   - Harvey, sections 7.1-7.5.
   - Granger and Newbold, chapter 7.

5. **Univariate Nonstationary Time Series:** trend-stationarity; unit roots; functional limit theory; testing for unit roots; testing for stationarity; inference on large autoregressive roots.

   - Hamilton, chapters 15-17.
   - Stock, J.H. (1994), "Unit Roots, Structural Breaks and Trends," in *Handbook of Econometrics, Volume IV,* ed. by R.F. Engle, and D.L. McFadden. New York: North Holland, 2739-2841.

6. **Multivariate Nonstationary Time Series:** spurious regressions; cointegration; estimation and inference; testing for cointegration.

   - Hamilton, chapters 18-20.
   - Watson, M.W. (1994), "Vector Autoregressions and Cointegration," in *Handbook of Econometrics, Volume IV,* ed. by R.F. Engle, and D.L. McFadden. 2843-2915.

7. **Structural Breaks, Conditional Heteroskedasticity and Nonlinear Models.**

   - Hamilton, chapters 21-22.
   - Bollerslev, T., R.F. Engle and D.B. Nelson (1994), "ARCH Models," in *Handbook of Econometrics, Volume IV,* ed. by R.F. Engle, and D.L. McFadden. 2959-3038.