

THE UNIVERSITY OF CHICAGO
Graduate School of Business
Business 41910-01, Autumn Quarter 2005, Mr. Ruey S. Tsay

COURSE INFORMATION

Title: Time Series Analysis for Forecasting and Model Building

GSB Honor Code: This course requires students to follow the GSB Honor Code and Standards of Scholarship in examinations and homework assignments. The GSB Honor Code requires students to sign the following pledge, "I pledge my honor that I have not violated the Honor Code during this examination," on every examination.

Course Objective:

- To introduce time series analysis for econometric and financial applications
- To discuss time series forecasting
- To gain experience in model building
- To assess the impacts of interventions and outliers
- To understand state-space models and Kalman filter
- To study MCMC methods and their applications in time series analysis
- To discuss unit-root theory, trend-stationarity, testing and applications.

Lecture: Wednesdays 8:30 to 11:30 am, starting September 28

Lecture Notes:

Outline of the lecture and some supplementary material will be posted on the web:
<http://gsbwww.uchicago.edu/fac/ruey.tsay/teaching/uts/>.

Textbook:

No textbook. Some selected reference books are given below:

- *Time Series Analysis*, J. Hamilton, Princeton University Press, 1994.
- *Analysis of Financial Time Series*, 2nd Edition, Ruey S. Tsay, Wiley, 2005.
- *A Course in Time Series Analysis*, ed. Peña, Tiao and Tsay, Wiley, 2001.

- *Time Series Analysis by State Space Methods*, Durbin and Koopman, Oxford University Press, 2001.
- *Time Series Analysis: Forecasting and Control*, Box, Jenkins, and Reinsel, Prentice-Hall, 1994.
- *Time Series: Theory and Methods*, Brockwell and Davis, Springer-Verlag, 1991.

Office hour:

Tuesday: 11:00 am to 12:00 noon or by appointment

My phone number 702-6750. My office: HPC 455. e-mail: ruey.tsay@gsb.uchicago.edu. The best way to reach me is via e-mail

Grading:

The final grade will be based on homework assignments (30%), mid-term (30%), and a final exam (40%).

Special notes:

1. Mid-term: Week 6, November 2, 2005 (9:30 am to 11:30 am)
2. Final Exam: School schedule. Week 11, December 7, 2005 (8:00 am to 11:00 am).
3. No late homework assignments will be accepted. Solutions or discussions will follow after the assignments are handed in.

Computing:

S-plus, R, and SCA package are used intensively in the course. Instructions of these packages will be given when needed. Students can use other packages if preferred.

Course Outline

1. Basic concepts
 - Back-shift or lag operator
 - Dynamic dependence
 - Difference equations
2. Linear Time Series Models
 - Stationarity and invertibility
 - Ergodicity
 - Wold decomposition

- AR, MA and ARMA models
- Non-stationary models
- Seasonal models
- Trend analysis
- Component models
- Aggregation
- Regression models with time series errors

3. Prediction

- Minimum squared error forecasts
- Prediction from ARMA models
- Exponential smoothing
- Combining forecasts
- Forecast evaluation

4. Model Identification and Estimation

- ACF, PACF, EACF
- Information criteria: AIC, BIC, etc.
- Least squares and maximum likelihood estimates
- MCMC methods, e.g. Gibbs sampling

5. Intervention Analysis and Outliers

- Model checking
- Outlier analysis
- Intervention analysis

6. Unit-root theory and applications

- Random walk model
- Dickey-Fuller test
- Other tests

7. Kalman Filter and Its Applications

- State space models
- Relation to ARMA models

- Kalman recursion
 - Applications
8. Nonlinear Time Series Models, if time permits
- Threshold model
 - Markov switching model
 - Nonlinearity tests
9. Dynamic Regression Models, if time permits
- Transfer function model
 - Model building
 - Structural econometric models
10. Nonparametric Methods, if time permits
- Kernel method
 - Local polynomial
 - Neural network

Some important web sites for U.S. data

- Federal Reserve Bank at St. Louis
<http://research.stlouisfed.org/fred2/>
- CRSP data at WRDS of Wharton, U. of Penn.
<http://wrdsx.wharton.upenn.edu>
(account is required)