Econometric Analysis

Fall 2007
Jin-Lung Lin

Course: 1 semesters, 3 hours per lecture.
Hours: Thu. 6:10pm-9:00pm
Office Hours: Wed. 16:00-17:00, Room A406

Econometric Analysis is the first-year graduate course in econometrics. Though it is scheduled as one-semester course, I am teaching it as if it were the first semester of an one-year course with the second semester on time series analysis. All exciting and important topics on financial econometrics will be taught then. So, consider this course as preparatory one.

As students may have only limited exposure to econometrics, I shall allocate parts of the course reviewing basic econometrics as is covered in J. Stock and M. Watson, **Introduction to Econometrics**, 2nd ed. Boston: Addison Wesley, 2007.

The textbook I adopted is:

William H. Green, **Econometric Analysis**, 6th ed., 2008 New Jersey: Prentice Hall

This is a popular textbook for first year graduate econometrics though it is written in handbook format intended for one year. I only teach those parts on basic econometric theory without any coverage on time series analysis which is left to next semester.

One can never really master econometrics without getting his/her hand dirty. Real data using some statistic or statistic package is considered as an essential part of this course. For this, I shall teach and ask students to learn and use *R*, a powerful statistical and yet free package. It can be downloaded from

http://www.r-project.org.

A good free book on R:
John Verzani (2002), Simple R

PDF and a browsable HTML version files are available at
www.r-project.org and *http://wiener.math.csi.cuny.edu/Statistics/R/simpleR/*

I shall give empirical data analysis during the lecturing and give computer-related home work. Hopefully, this course could achieve two goals: equip the students with the ability to *read* data and lay the foundation for further research on econometric theory.

Course evaluation: midterm (30%), final (40%), homework and class attendance (30%).

1 Topics

1. Using *R*
   one lecture
2. Review of matrix theory (Appendix A)
   one lecture
3. Review of probability and distribution theory (Appendix B)
   one lecture
4. Estimation and inference (Appendix C)
   one lecture
5. Large sample distribution theory (Appendix D)
   one lecture
6. Linear regression model and least squares (Chaps. 2,3)
   one lecture
7. Statistical properties of the least squares estimator (chap 4)
   one half lecture
8. Inference and prediction (chap 5)
   one half lecture
9. Functional form and structural change (chap 6)
   one lecture
10. Specification analysis and model selection (chap 7)
    one lecture
11. Generalized regression model (chap 8)
    one lecture
12. Model for panel data (chap. 9)
    one lecture
13. Instrumental variables estimation (chap 12)
    one lecture
14. Maximum likelihood estimation (chap. 482)
    one lecture
15. Series correlation; model with lagged variables (chaps 19,20)
    one lecture

2 A Brief Guide to R

2.1 What is R?

- R is a objected-oriented language and environment for statistical computing and graphics.
- R is a GNU project which is similar to the S language and environment which was developed at Bell Laboratories by John Chambers and colleagues.
- R can be considered as a different implementation of S. There are some important differences, but much code written for S runs unaltered under R.
- R provides a wide variety of statistical (linear and nonlinear modelling, classical statistical tests, time-series analysis, classification, clustering, ...) and graphical techniques, and is highly extensible. The S language is often the vehicle of choice for research in statistical methodology, and R provides an Open Source route to participation in that activity.

2.2 Why using R?

- R is free (GNU) with source codes.
- R runs on a wide variety of UNIX platforms and similar systems (including FreeBSD and Linux), Windows and MacOS.
- R is fast and can embed the Fortran or C compiler codes easily.
- R is actively maintained by the core team and the applications accumulate at an amazing fast rates, including all possible topics in econometrics, statistics and other fields.
- R can produce publication-quality plots including mathematical symbols and formulae where needed and the user retains full control.

2.3 Available econometric packages in R

Contributed Packages Mentioned in this Paper and Why

(indicates package is included by default)*

bayesm	Bayesian statistics for marketing analysis. Many useful codes on Gibbs and MCMC
car	Regression tests and robust standard errors
sem	Two stage least squares
MASS	Robust regression, ordered logit/probit
lmtest	Breusch-Pagan and Breusch-Godfrey tests
sandwich (and zoo)	Heteroskedasticity and autocorrelation robust covariance
tseries	Garch, ARIMA, and other time series functions
MNP	Multinomial probit via MCMC
Hmisc	LaTeX export
xtable	Alternative LaTeX export
systemfit	SUR and 2SLS on systems of equations
fracdiff	Fractionally integrated ARIMA models
survival	Tobit and censored regression
nlme	Nonlinear fixed and random effects models
nnet	Multinomial logit/probit
pls	Partial least squares, principal component regression
ts*	Time series manipulation functions
nls*	Nonlinear least squares
foreign*	Loading and saving data from other programs
urca	unit root and cointegration analysis
MCMCpack	Collected packages for MCMC
dse	synamic system estimation, State space, Kalman Filter, multivariate time series.
spatial	spatial statistics
zoo	required in order to have the sandwich package

2.4 Rmetrics:rare free lunch for financial economists

- Rmetrics is the premier open source solution for financial market analysis and valuation of financial instruments and is embedded in R.
- Included packages
  - fBasics - Markets, Basic Statistics, Date and Time,
  - fCalendar - management of dates, time, and calendars.
  - fSeries - The Dynamical Process Behind Financial Markets,
  - fMultivar - deals mainly with multivariate aspects of time series analysis including neural network modelling with feedforward networks.
  - fExtremes - Beyond the Sample, Dealing with Extreme Values,
  - fOptions - The Valuation of Options.
  - fBonds
  - fPortfolio.