This course examines the models and statistical techniques used to study time series data with a special emphasis to applications in macroeconomics. The course has three specific objectives. The first is to equip students who anticipate using time series data in their Ph.D. research with the tools they need for state-of-the-art empirical research. The second objective is to lay out the econometric theory of time series analysis, with an emphasis on recent developments. The third objective is to analyze selected recent works in theoretical macroeconomic modeling with an emphasis on their empirical implications and analysis.

The course is built so that for each topic the econometric tool is presented first, followed by the relevant empirical applications. Among the topics, the course will cover:

i) Time series models with latent variables and applications to leading indicators and the business cycle

ii) Vector Auto-Regressions and impulse responses, with applications to monetary policy analysis and the dynamics of aggregate demand and supply shocks

iii) Modeling and inference in persistent time series, with applications to trends and random walks, and price convergence

iv) Forecasting and structural breaks, and applications to the Phillips curve and the Term Structure as predictors of future GDP growth and inflation dynamics

There will be various problem sets during the course, plus a final research paper.

This course may be used toward minor certification in either Macro or Econometrics (not both).
Preliminary reading list and references

General References:

H is Hayashi, Econometrics, Princeton University Press
Hamilton, Time Series Econometrics, Princeton University Press

Important: this syllabus is preliminary and the contents of the course may change during the semester – please come to classes to keep up with the contents!

Mark your calendars! There will be a special Applied Macro workshop in the afternoon of September 27, and the students taking this course are expected to participate. Please also note that you are invited to attend the following two time series econometrics seminars: Bruce Hansen, on Thursday, September 7, 2006 3:30pm, 327 Social Sciences, and Serena Ng on Thursday, November 2, 2006 3:30pm, 327 Social Sciences. We also have an Applied Macro Lunch group, meeting on Wednesdays 11:40-12:55 in room 120, and you are welcome to participate.
These activities are really part of the course and will help you integrate with the research done in the time-series / applied macro literature! And they will be fun!

- 1. Introduction: An overview of the time series properties of macro data
  - Econometric theory: Correlation and basics of time series
    - Chp 6 Hayashi
  - Application: Description of time series data
    - The Great Moderation: an introduction
    - Stock and Watson, “Has the Business Cycle changed? Evidence and explanations”, mimeo

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1 Hayashi is not among the requested book available at the Duke University Store, as it is a required reference for the first year PhD sequence in Econometrics

Goal: Learn how to estimate Business Cycles (with the Baxter-King filter), interpret data, learn about Great Moderation phenomenon

2. Vector Autoregressions

- Econometric theory: Estimation and inference, Identification and interpretation of Impulse response functions and variance decomposition
  - Chp 6 Hayashi, Hamilton
  - Watson, Vector Autoregressions, Handbook of Econometrics Volume 4, Elsevier
  - L. Kilian (1998), Small Sample Confidence Intervals for IRFs, Review of Economics and Statistics
  - Pesavento and Rossi (2006), Impulse Response Confidence Intervals for Persistent Data: What Have We Learned?, Journal of Economic Dynamics and Control

- Economic applications: monetary policy analysis and productivity shocks
  - J. Fernandez-Villaverde, J. Rubio-Ramirez, T. Sargent, A, B, C’s (and D)’s For Understanding VARS
  - L. Christiano, M. Eichenbaum, Robert Vigfusson, Assessing Structural VARs
  - Chari, Kehoe, McGrattan, A critique of structural VARs using business cycle theory
  - Hall, Inoue, Nason and Rossi, Optimal IRF matching estimation, mimeo

Goal: Estimate VARs and Impulse Responses, IRF confidence bands, estimate structural VARs. Learn about IRF matching estimation techniques.

3. Modeling and inference in persistent time series

- Econometric theory: Univariate tests for unit roots
  - chp. 9 H,
- Elliott, Rothenberg, and Stock (1996), Efficient Tests for Unit Roots, Econometrica (available on JSTOR)
- Ng and Perron (2001), “Lag length selection and the construction of unit root tests with good size and power”, Econometrica (available on JSTOR)

○ Economic applications: Does GDP have a unit root? Does PPP hold?
  - Diebold Rudebusch

○ Goal: Learn to test for unit roots and construct confidence intervals for the largest root, understand the PPP debate

○ Econometric theory: Multivariate tests for unit roots and cointegration
  - chp. 10 H

○ Economic applications: Is the technology driven real business cycle model dead? Continuing the debate…
  - Christiano Eichenbaum and Vigfusson, “What Happens After A Technology Shock?”, mimeo
  - Rossi and Pesavento (2005), ” Do technology shocks drive hours up or down? A little evidence from an agnostic procedure”, Macroeconomic Dynamics 2005

○ Goal: Test for cointegration, understand the Technology Shock debate
- 4. Structural breaks and model selection
  - Econometric theory: tests for structural breaks
    - Rossi, B. (2005), Optimal tests for nested model selection in the presence of underlying parameter instability, Econometric Theory
    - Elliott and Muller (2006), Optimally testing general breaking processes in linear time series models, Review of Economic Studies
    - Giacomini and Rossi (2006), Non-nested model selection in unstable environments, mimeo
  - Economic applications: Empirical evidence on structural breaks and their implications for an analysis of NAIRU, technology and monetary policy shocks
  - Goal: Learn how to test for structural breaks, understand the stability of monetary policy reaction function debate

- 5. Forecasting
  - Econometric theory: tests for equal and absolute predictive ability
- Clements and Hendry
- Christoffersen and Diebold, “Optimal prediction under asymmetric loss”
- H. White (2005), "Forecasting with Nonlinear Models”, table, forthcoming in the Handbook of Forecasting

○ Economic applications: forecasting inflation and GDP growth by using the term structure

○ Goal: Learn how to make and evaluate forecasts

- 6. Structural estimation of Macroeconomic models
  ○ Econometric theory: GMM estimation (with some references to MLE and Bayesian estimation)
    - Hayashi, chp. 3
    - Burnside, Craig, *Craig’s notes on GMM estimation*
    - David De Jong, *Structural Macroeconometrics*
  ○ Economic applications
    - M. Del Negro, F. Schorfheide, F. Smets, R. Wouters (2005), *On the Fit and Forecasting Performance of New-Keynesian Models*
  ○ Goal: Learn how to estimate structural macro models and understand the lack of propagation debate in the 1990s

- 7. Time series models with latent variables (if time permits)
- Econometric theory: Linear models, the Kalman Filter, and Regime Switching models
  - Hamilton
  - Muller and Petalas, Efficient estimation of the parameter path in unstable time series models (mimeo)
  - Kim and Nelson, State space models with regime switching, MIT press
- Economic applications: Leading indicators
  - Marcellino, Handbook of Forecasting
- Goal: Learn how to estimate unobserved components models and regime switching and learn about the literature on Leading Indicators