

Economics 821
Time Series Econometrics
Class Syllabus

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Class time and location: MW 9-10:15, Carney 11

Course Description

The goal of this graduate level course is to provide Ph.D. students with an understanding of statistical techniques for the empirical analysis and forecasting of time series in macroeconomics and, to a lesser extent, finance. Although the focus of the course is primarily applied, I will also place some emphasis on the theoretical foundations of the techniques analyzed.

The grade for the course will be based on three problem sets (60%) and a take-home exam (40%). The problem sets will require you to learn basic programming in (preferably) Matlab or any other matrix-based programming language, such as Gauss or Ox.

Textbooks

- **Required:** Hamilton, J.D. (1994): *Time Series Analysis*, Princeton University Press
- **Recommended for part of the course (Forecasting):** Granger, C.W.J., Newbold, P. (1986): *Forecasting Economic Time Series*, Academic Press (2nd edition)

- **Other useful books:**

Theoretical:

Hayashi, F. (2000): *Econometrics*, Princeton University Press

Davidson, J. (2000): *Econometric Theory*, Blackwell Publishers

White, H. (2000): *Asymptotic Theory for Econometricians*, Academic Press

Applied:

Enders, W. (2003): *Applied Econometric Time Series*, Wiley

Favero, C. (2001): *Applied Macroeconometrics*, Oxford University Press

Since some of the recent developments in time series are not covered in the book, I will also rely on journal articles, which are listed in the course outline below. You are only required to read the articles that I will discuss in class (denoted by a '*'). The remaining articles are for your reference, if you want to deepen your understanding of certain topics.

Course outline

1. Univariate Time Series

(a) Models of the conditional mean

i. Stationary time series

- **ARMA models**

*Hamilton, Chapters 1-3, 5

- **State space models: the Kalman filter**

*Hamilton, Chapter 13

Hamilton, J.D. (1985): "Uncovering Financial Market Expectations of Inflation", *Journal of Political Economy*, 93, 1224-1241

Watson, M.W. (1989): "Recursive Solution Methods for Dynamic Linear Rational Expectations Models", *Journal of Econometrics*, 41, 65-89

- **Non linear models: TAR, SETAR, Markov switching**

*Hamilton, Chapter 22

Franses, P.H., van Dijk, D. (2000): *Non-linear time series models in empirical finance*, Cambridge University Press

Hamilton, J. D. (1989): "A New Approach to the Economic Analysis of Nonstationary Time Series and the Business Cycle", *Econometrica*, 57, 357-384

*Kim, C.-J., Nelson, C.R. (1998): "Business Cycle Turning Points, a New Coincident Index, and Tests of Duration Dependence Based on a Dynamic Factor Model with Regime-Switching", *Review of Economics and Statistics*, 80, 188-201

Teräsvirta, T., Tjøstheim, D., Granger, C.W.J. (1994): "Aspects of Modelling Non-linear Time Series", *Handbook of Econometrics*, vol. IV, Chapter 48 (downloadable from

<http://www.elsevier.com/hes/books/02/menu02.htm>)

ii. Non-stationary time series

- **Tests for structural breaks**

Andrews, D.W.K., Ploberger, W. (1994): "Optimal Tests When a Nuisance Parameter is Present Only Under the Alternative", *Econometrica*, 62, 1383-1414

Bai, J. (1997): "Estimating Multiple Breaks One at a Time", *Econometric Theory*, 13, 315-352

Bai, J., Perron, P. (1998): "Estimating and Testing Linear Models with Multiple Structural Changes", *Econometrica*, 66, 47-78

*Hansen, B. (2001): "The New Econometrics of Structural Change: Dating Breaks in U.S. Labor Productivity", *Journal of Economic Perspectives*, 15, 117-128

- **Random walks and unit root testing**

*Hamilton, Chapters 15, 17

Elliott, G., Rothemberg, T.J., Stock, J.H. (1996): "Efficient Tests for an Autoregressive Unit Root", *Econometrica*, 64, 813-836

Stock, J.H. (1994): "Unit Roots and Trend Breaks", *Handbook of Econometrics*, vol. IV, Chapter 46 (downloadable from <http://www.elsevier.com/hes/books/02/menu02.htm>)

(b) **Models of the conditional variance**

- **ARCH/GARCH**

*Hamilton, Chapter 21

Bollerslev, T., Engle, R.F., Nelson, D.B. (1994): "ARCH Models", *Handbook of Econometrics*, vol. IV, Chapter 49 (downloadable from <http://www.elsevier.com/hes/books/02/menu02.htm>)

Engle, R.F. (1982): "Autoregressive Conditional Heteroskedasticity with Estimates of the Variance of U.K. Inflation", *Econometrica*, 50, 987-1008

Bollerslev, T. (1986): "Generalized Autoregressive Conditional Heteroskedasticity", *Journal of Econometrics*, 31, 307-327

2. Multivariate Time Series

(a) **Stationary time series**

- **VAR, Structural VAR, impulse-response functions**

These topics will be covered by Gianni Amisano, who is a visiting scholar from University of Brescia, Italy

- **Granger causality**

*Hamilton, Chapter 11.2

Granger, C.W.J. (1969): "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods", *Econometrica*, 37, 424-438

(b) **Non-stationary time series**

- **Spurious regressions**

*Hamilton, Chapters 18.3

Granger, C.W.J., Newbold, P. (1974): "Spurious Regressions in Econometrics", *Journal of Econometrics*, 2, 111-120

- **Cointegration**

*Hamilton, Chapter 19

Engle, R.F., Granger, C.W.J. (1987): "Co-Integration and Error Correction: Representation, Estimation and Testing", *Econometrica*, 55, 251-276

*Watson, M.W. (1994): "Vector Autoregressions and Cointegration", *Handbook of Econometrics*, vol. IV, Chapter 47, sections 1 and 2 (downloadable from <http://www.elsevier.com/hes/books/02/menu02.htm>)

3. Elements of forecasting

- **Forecasting with regression models**

*Hamilton, Chapter 4

Granger-Newbold, Chapter 6

- **Model selection and information criteria**

*Granger, C.W.J., King, M.L., White, H. (1995): "Comments on the Testing of Economic Theories and the Use of Model Selection Criteria", *Journal of Econometrics*, 67, 173-187

- **Forecast evaluation and Combination**

Granger-Newbold, Chapter 9

*Diebold, F.X., Lopez, J.A. (1996): "Forecast Evaluation and Combination", in *The Handbook of Statistics*, Volume 14: Statistical Methods in Finance, eds. G.S. Maddala and C.R. Rao, 241-268. Amsterdam: North-Holland. (working paper version downloadable at: <http://www.ssc.upenn.edu/~fdiebold/papers/paper9/paeva.pdf>)

Granger, C. W. J. (1999): *Empirical Modeling in Economics: Specification and Evaluation*, Cambridge University Press, New York

White, H. (2000): "A Reality Check for Data Snooping", *Econometrica*, 68, 1097-1126

- **Forecasting with many predictors: data-reduction methods**

Hoover, K. D., Perez, S. J. (1999): "Data Mining Reconsidered: Encompassing and the General-to-Specific Approach to Specification Search", *Econometrics Journal*, 2, 167-191

Litterman, R. B. (1986): "Forecasting with Bayesian Vector Autoregressions - Five Years of Experience", *Journal of Business and Economic Statistics*, 4, 25-38

Stock, J. H., Watson, M. W. (2002): "Macroeconomic Forecasting Using Diffusion Indexes", *Journal of Business and Economic Statistics*, 20, 147-162

4. Special topics (time permitting)

- **Bootstrap techniques**
- **GMM and weak instruments**