

Seminar in Econometrics Eco517
Spring 2004

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SYLLABUS

Class hours: Wednesdays and Fridays 10:45-12:00
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Course Objectives

This course is mainly concerned with the estimation of nonlinear models with a special focus on (but not limited to) stationary time-series. In the first part of this course, we study extensively the Generalized Method of Moments (GMM). GMM includes as special case maximum likelihood, instrumental variable, and ordinary least squares estimations (under some conditions) and is therefore of special interest. We study in depth under which conditions the estimator is actually consistent and asymptotically normal. In some models however, moments are not directly available and need to be computed via simulations. Simulated methods permit to estimate models that otherwise could not be treated. Examples of applications can be found both in the cross-section literature (multinomial probit) and in the time-series literature (diffusion process). In the second part of this course, we turn our attention on the estimation of several nonlinear models frequently applied in macroeconomics and finance: the Structural Change, Threshold and the Markov-switching models. We discuss the delicate problem of testing for the presence of nonlinearity. Finally, we consider nonstationary processes and testing for unit root both in the context of linear and nonlinear models.

By the end of this course, the students should be able to study the properties of a given model (Markov, mixing), to check identification conditions and to derive the asymptotic properties of their estimators. In presence of nonlinearity, they should be able to select the model that fits the data best.

Grading

There will be several required problem sets (15%), the presentation of a journal article in class (15%), an in-class midterm exam (35%) and a term paper (35%). The purpose of the paper is to help you to get started with your research. The paper can be theoretical but should include an application on real data or some simulations. It should use some of the material seen in class. The term paper will be due on May 17. The midterm will be on Friday, April 16. Further details will be given in class.

Required book: Hamilton, J. (1994) *Time Series Analysis*, Princeton University Press.

Course Outline and Bibliography

1 - Stationarity and Mixing properties

Definitions. General conditions to establish geometric ergodicity and beta-mixing properties. Examples: AR, Threshold and GARCH models.

Carrasco, M. and X. Chen (2002) "Mixing and Moment Properties of Various GARCH and Stochastic Volatility Models", *Econometric Theory*, Vol. 18, No. 1.

Davidson, J. (1994) *Stochastic Limit Theory*, Oxford University Press.

Hamilton, chapter 7.

Tong, H. (1990) *Non-linear Time Series*, Oxford University Press (appendix 1).

2 - Generalized Method of Moments

Asymptotic properties of the estimator. Estimation of the covariance matrix. Specification testing.

Andrews, D. (1991) "Heteroskedasticity and Autocorrelation Consistent Covariance matrix Estimation", *Econometrica* 59 (3) 817-858.

Hamilton, Chapter 14.

Hansen, L.P. (1982) "Large Sample Properties of Generalized Method of Moments Estimators", *Econometrica*, 50 (4), 1029-1054.

Hansen, L.P. and K.J. Singleton (1982) "Generalized Instrumental Variables Estimation of Non-linear Rational Expectations Models", *Econometrica*, 50, 5, 1269-1286.

Newey, W. (1985) "Generalized Method of Moments Specification Testing", *Journal of Econometrics*, 29, 229-256.

Newey, W. and D. McFadden (1994) "Large Sample Estimation and Hypothesis Testing", in *Handbook of Econometrics*, Chapter 36, Volume IV. Ed. by R.F. Engle and D.L. McFadden.

Newey, W. and K. West (1987) "A Simple, Positive Semi-definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix", *Econometrica*, 55, 703-708.

Ogaki, M. (1993) "Generalized Method of Moments: Econometric Applications", in *Handbook of Statistics*, Vol.11, eds. Maddala-Rao-Vinod, 455-488.

Wooldridge, J. (1994) "Estimation and Inference for Dependent Processes", in *Handbook of Econometrics*, Chapter 45, Volume IV. Ed. by R.F. Engle and D.L. McFadden.

3 – Wald, Lagrange Multiplier, and Likelihood Ratio tests

Heteroskedasticity-robust tests. Asymptotic distribution under a local alternative.

Hamilton, p.142-145, p.428-30.

Newey, W. and D. McFadden (1994).

Wooldridge, J. (1994).

4 –Methods of simulated moments

Carrasco, M. and J. P. Florens (2002) “Simulation Based Method of Moments and Efficiency”, *Journal of Business & Economic Statistics*, Vol. 20, No. 4, 482-492.

Duffie, D. and K. Singleton (1993) “Simulated Moments Estimation of Markov Models of Asset Prices”, *Econometrica*, 61, 4, 929-952.

Gallant, R. and G. Tauchen (1996) “Which Moments to match”, *Econometric Theory*, 657-681.

Gourieroux, C., A. Monfort (1991) “Simulation based Inference in Models with Heterogeneity”, *Annales d’Economie et de Statistique*, N. 20/21.

Gourieroux, C., A. Monfort (1996) *Simulation based econometric methods*. Core Lecture, Oxford University Press.

Gourieroux, C., A. Monfort, and E. Renault (1993) “Indirect Inference”, *Journal of Applied Econometrics*, 8, S85-S118.

McFadden (1989) “A method of simulated moments for estimation of discrete response models without numerical integration”, *Econometrica*, 995-1026.

Pakes, A. and D. Pollard (1989) “Simulation and the asymptotics of optimization estimators”, *Econometrica*, 1027-1057.

Tauchen, G. (1997) “New Minimum Chi-Square Methods in Empirical Finance”, in *Advances in Economics and Econometrics, Seventh World Congress*, Eds: D. Kreps and K. Walis, Cambridge University Press.

5 – GMM when there is a continuum of moment conditions

Ill-posed problems. Application to the efficient estimation of mixture models and financial models.

Carrasco, M. and J. P. Florens (2000) “Generalization of GMM to a Continuum of Moment Conditions”, *Econometric Theory*, 16, 797-834.

Carrasco, M. and J.-P. Florens (2001) “Efficient GMM Estimation Using the Empirical Characteristic Function”, mimeo.

Carrasco, M., M. Chernov, J. P. Florens, and E. Ghysels (2002) “Estimating diffusion with a continuum of moment conditions”, mimeo.

Carrasco, M., J.-P. Florens and E. Renault (2002) “Linear Inverse Problems in Structural Econometrics”, forthcoming in *Handbook of Econometrics*, Vol. 6.

6 - Structural Change and Threshold models

These models can be used as an alternative to the Markov-switching model although their properties are very different. Testing for non linearity in these models is delicate because of a nuisance parameter that is present only under the alternative.

Andrews, D. (1993) “Tests for Parameter Instability and Structural Change with Unknown Change Point”, *Econometrica*, 61 (4), 821-856.

Andrews, D. and W. Ploberger (1994) “Optimal Tests When a Nuisance Parameter Is Present Only Under the Alternative”, *Econometrica*, 62(6), 1183-1414.

Carrasco, M. (2002) "Misspecified Structural Change, Threshold or Markov-Switching Models", *Journal of Econometrics*, Vol. 109, No.2, 239-273.

Ghysels, E., A. Guay, and A. Hall (1997) "Predictive tests for structural change with unknown breakpoint", *Journal of Econometrics*, 82, 209-233.

Ghysels, E. and A. Hall (1990) "A test for structural stability of Euler conditions parameters estimated via generalized method of moments estimator", *International Economic Review*, 31, 355-364.

Hansen, B. (1996) "Inference when a Nuisance Parameter Is Not Identified under the Null Hypothesis", *Econometrica*, 64 (2), 413-430.

7 - Markov-Switching Model

This model is useful to fit data that are subject to cycles. Properties of the model. Estimation using the EM algorithm.

Cecchetti, S., P.S. Lam, and N. Mark (1990) "Mean Reversion in Equilibrium Asset Prices", *The American Economic Review*, 80(3), 398-418.

Garcia, R. and P. Perron (1996) "An Analysis of the Real Interest Rate under Regime Shifts", *Review of Economics and Statistics*, 78(1), 11-125.

Hamilton, J. (1989) "A New Approach to the Economic Analysis of Nonstationary Time-Series and the Business Cycle", *Econometrica*, 57(2), 357-84.

Hamilton, J. (1993) "Estimation, Inference and Forecasting of Time Series Subject to Changes in Regime", *Handbook of Statistics*, eds. Maddala-Rao-Vinod, 11, 231-260.

Hamilton, Chapter 22.

8 - Unit-root and Cointegration

Difference between unit root and trend stationary processes.

Tests of the null of unit-root versus stationary alternative: Dickey-Fuller tests, augmented Dickey-Fuller tests. Tests of the null of stationarity against unit root: Park's test, Bierens and Guo test, KPSS. Basic notions on cointegration.

Hamilton, Chapters 17, 19.

Kwiatkowski, D., P.C.B. Phillips, P. Schmidt, and Y. Shin (1992) "Testing the null hypothesis of stationarity against the alternative of a unit-root", *Journal of Econometrics*, 54, 159-178.

Ogaki, M. (1993) "Unit Roots in Macroeconomics: A survey", *Monetary and Economic Studies*, Vol. 11, 131-155.

Park, J. and P.C.B. Phillips (2001) "Nonlinear Regressions with Integrated Time Series", *Econometrica*, 69, 117-161.

9 - Testing for unit roots in presence of breaks in the trend

Banerjee, A., R. Lumsdaine, and J. Stock (1992) "Recursive and Sequential Tests of the Unit-Root and Trend-Break Hypotheses: Theory and International Evidence", *Journal of Business & Economic Statistics*, Vol. 10, 271-287.

- Perron, P. (1989) "The great crash, the oil price shock, and the unit root hypothesis", *Econometrica*, Vol. 57, 1361-1401.
- Perron, P. (1990) "Testing for a Unit Root in a Time Series With a Changing Mean", *Journal of Business & Economic Statistics*, Vol. 8, 153-162.
- Zivot, E. and D. Andrews (1992) "Further Evidence on the Great Crash, the Oil Price Shock and the Unit Root Hypothesis", *Journal of Business & Economic Statistics*, Vol. 10, 251-270.

10 - Threshold cointegration - Application to the real exchange rate

The Dickey-Fuller tests and other standard unit-root tests fail to reject the null hypothesis of a unit-root for the real exchange rate. This suggests that the purchasing power parity (PPP) among countries does not hold. However, recent research shows that the real exchange rate should be modeled by a three-regime threshold model and explains why the traditional unit-root tests lack of power.

- Balke, N. S. and T. B. Fomby (1997) "Threshold Cointegration", *International Economic Review*, 38, 627-645
- Bec, F., M. Ben Salem, and M. Carrasco (2003) "Tests for unit-root versus Threshold specification with an application to the PPP", forthcoming in *Journal of Business & Economic Statistics*, <http://www.econ.rochester.edu/Faculty/CarrascoPapers/ppp17.pdf>
- Obstfeld, M. and A. Taylor (1997) "Nonlinear Aspects of Goods-Market Arbitrage and Adjustment: Heckscher's Commodity Points Revisited", *Journal of the Japanese and International Economies*, 11, 441-479.
- Taylor, A. (2001) "Potential Pitfalls for the PPP Puzzle? Sampling and Specification Biases in Mean-Reversion Tests of the LOOP", *Econometrica*, 69, 473-498.
- Taylor, M, D. Peel, and L. Sarno (2001) "Non-linear mean reversion in real exchanges rates: Towards a solution to the purchasing power parity puzzles", *International Economic Review*, 42, no. 4, 1015-1042. www.cepr.org/pubs/dps/DP2658.asp.

Ressources

Where to find data?

- U of Rochester library:
<http://www.lib.rochester.edu/mgt/datastat.htm>
- Journal of Applied Econometrics:
<http://qed.econ.queensu.ca:80/jae>

Where to find codes in GAUSS?

- <http://www.aptech.com/links.html>
- <http://gurukul.ucc.american.edu/econ/gaussres/GAUSSIDX.HTM>

Where to ask questions about GAUSS?

- gopher://mundo.eco.utexas.edu/1m/mailling/gaussians.archive