Structural Macroeconometrics

Econ. 2713
Spring 2010

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Office Hours: M 1-2, FR 10-11, in 4506 WWPH

Texts

Available at Pitt Book Center:

DeJong, David N. with Chetan Dave. *Structural Macroeconometrics*, 2007. Princeton: Princeton University Press.

Textbook Web Site: http://www.pitt.edu/~dejong/text.htm

Course Web Site: http://www.pitt.edu/~dejong/ECON2713.htm

On Reserve:

Cooley, Thomas F. and Prescott, Edward E. (1995) "Economic Growth and Business Cycles", *Frontiers of Business Cycle Research*, T. Cooley, Ed., Princeton U. Press: Princeton.

Ljungqvist, Lars and Thomas J. Sargent. *Recursive Macroeconomic Theory*, 2nd Ed. 2004. Cambridge: MIT Press.

Judd, Kenneth L. *Numerical Methods in Economics*. 1998. Cambridge: MIT Press.

Stokey, Nancy L. and Robert E. Lucas. *Recursive Methods in Economic Dynamics.* 1989. Cambridge: Harvard University Press.

Textbook references in the syllabus are denoted in **bold type: DD, CP, LS, KJ, SL.**

Overview

The focus of the course is on the empirical implementation of dynamic stochastic general equilibrium (DSGE) models. The course is organized around the following empirical exercise. Beginning with a model environment, a non-linear expectational system of difference equations is derived using Bellman's Principle of Optimality. The system is then approximated (using linear and non-linear representations), taking the form of a state-space representation. Appropriate data are then identified and aligned with their theoretical counterparts (often by removing trends and isolating cycles). Finally, the likelihood function associated with the state-space representation is evaluated using a filtering procedure.

In class, tools needed to conduct this exercise will be demonstrated through an example application to a

simple asset-pricing environment. Outside of class, students will be asked to conduct an analogous exercise involving a simple real-business-cycle (RBC) environment. Thus the course relies heavily on the use of examples, and learning-by-doing on the part of students. Example data sets and GAUSS code are provided at the textbook Web Site. For an excellent GAUSS tutorial, consult
http://www.american.edu/econ/notes/gauss.htm

Grades will be based on the completion of exercises involving the RBC model; and an independent project involving the empirical analysis of a DSGE model.

Syllabus

I. Introduction

DD, Chapter 1, Chapter 6.1; Woodford, Michael (2009) "Convergence in Macroeconomics: Elements of the New Synthesis," *American Economic Journal: Macroeconomics* 1:267-279.

II. Example Environments

A. Asset Pricing

DD, Chapter 5.3; Lucas, Robert E. (1978) "Asset Prices in an Exchange Economy," *Econometrica* 46:429-445.

B. Real Business Cycles

DD, Chapter 5.1; CP, Chapter 1.

III. Dynamic Programming

LS, Chapter 3; SL, Chapter 9.

IV. Solution Methods

A. Log-Linear Approximation

DD, Chapter 2; Sims, Christopher A. (2001) "Solving Linear Rational Expectations Models," *Computational Economics* 20:1-20.

B. Perturbation Methods

KJ Chapter 13, 14. Judd, Kenneth L. and S.M. Guu (1997) "Asymptotic Methods for Aggregate Growth Models," *Journal of Economic Dynamics and Control* 21:1025-1042. Schmitt-Grohe, Stephanie, and Martin Uribe (2004) "Solving Dynamic General Equilibrium Models using a Second-Order Approximation to the Policy Function," *Journal of Economic Dynamics and Control* 28:755-775.

C. Value- and Policy-Function Iterations

DD, Chapter 10.3; LS, Chapter 3; KJ, Chapter 12.

D. Endogenous Grid Points

Carroll, Christopher D. (2006) "The Method of Endogenous Gridpoints for Solving Dynamic Stochastic Optimization Problems," *Economics Letters*, pp. 312–320.
Barillas, F. and Jesus Fernandez-Villaverde (2006) "A Generalization of the Endogenous Grid Method," University of Pennsylvania Working Paper. Available online at http://www.econ.upenn.edu/~jesusfv/generalizedegm.pdf

E. Projection Methods

DD, Chapter 10.2; KJ, Chapter 6.

V. Data Alignment

DD, Chapter 3. CP, Chapter 1. Gorodnichenko, Yuriy, and Serena Ng (2007) "Estimation of DSGE Models When the Data are Persistent," University of Michigan Working Paper. Available online at http://www.econ.berkeley.edu/~ygorodni/dsge-gorodnichenko-ng.pdf
Conesa, Juan Carlos, Timothy J. Kehoe and Kim J. Ruhl (2007) "Modeling Great Depressions: The Depression in Finland in the 1990s," Federal Reserve Bank of Minneapolis *Quarterly Review*, November 2007. Available online at http://www.minneapolisfed.org/research/QR/QR3112.pdf
Ireland, Peter and Scott Schuh (2008) "Productivity and Macroeconomic Performance: Interpreting the Past and Predicting the Future with a Two-Sector RBC Model," *Elsevier for the Society of Economic Dynamics* 11(3):473-492.

VI. Likelihood Evaluation

A. State-Space Representations

DeJong, David N., Hariharan Dharmarajan, Roman Liesenfeld, and Jean-Francois Richard (2007) "Efficient Likelihood Evaluation of State-Space Representations," University of Pittsburgh Working Paper. [DDLR], Section 2. Available online at http://www.pitt.edu/~dejong/EIS%20Filter%20Likelihood%20Final.pdf

B. The Kalman Filter

DD, Chapter 4.3.

C. Efficient Importance Sampling

DD, Chapter 9.2, 9.4. Richard, Jean-Francios, and Wei Zhang (2007) "Efficient High-Dimensional Monte Carlo Importance Sampling," *Journal of Econometrics,* forthcoming. Available online at
http://www.econ.pitt.edu/fantin/papers/efficientHD-import-sampling.pdf

D. The Particle Filter

DD, Chapter 11.2; DDLR, Section 3.

E. Adaption

DDLR, Section 3. Pitt, Michael K. and Neil Shephard (1999) "Filtering via Simulation: Auxiliary Particle Filters," *Journal of the American Statistical Association* 94: 590-599.

F. The EIS Filter

DDLR, Section 4.

Suggestions for Further Reading

IV.A. Log-Linear Approximation

Blanchard, Olivier J. and M. Kahn (1980) "The Solution of Linear Difference Models Under Rational Expectations," *Econometrica* 48: 1305-1311.

Klein, Paul (2000) "Using the Generalized Schur Form to Solve a Multivariate Linear Rational Expectations Model," *Journal of Economic Dynamics and Control* 24:1405-1423.

Uhlig, Harald (1999) "A Toolkit for Analyzing Non-linear Dynamic Stochastic Models Easily," in R. Marimon and A. Scott, Eds., *Computational Methods for the Study of Dynamic Economies*, Oxford University Press, New York: 65-78.

IV.B. Perturbation Methods

KJ, Ch. 13-15

IV.C. Value- and Policy-Function Iterations

Santos, Manuel S. and Jesus Vigo-Aguiar (1998) "Analysis of a Dynamic Programming Algorithm Applied to Economic Models," *Econometrica* 66:409-426.

IV. Solution Methods

Aruoba, S. Boragan, Jesus Fernandez-Villaverde, and Juan F. Rubio-Ramirez (2006) "Comparing Solution Methods for Dynamic Equilibrium Economies," *Journal of Economic Dynamics and Control* 30: 2477-2508.

VI.C. Efficient Importance Sampling

Geweke, John (1989) "Bayesian Inference in Econometric Models using Monte Carlo Integration," *Econometrica* 57:1317-1339.

Robert, C.P. and G. Casella (1999) *Monte Carlo Statistical Methods.* New York: Springer Verlag.

VI.D. The Particle Filter

Fernandez-Villaverde, Jesus, and Juan F. Rubio-Ramirez (2005) "Estimating Dynamic Equilibrium Economies: Linear Versus Non-Linear Likelihood," *Journal of Applied Econometrics* 20:891-910.

Fernandez-Villaverde, Jesus, and Juan F. Rubio-Ramirez (2007) "Estimating Macroeconomic Models: A Likelihood Approach," *Review of Economic Studies*, forthcoming. Available online at http://www.restud.com/uploads/papers/10078-2_paper_text.pdf

Gordon, Neil J., D.J. Salmond and A.F.M. Smith (1993) “A Novel Approach to Non-Linear/Non-Gaussian Bayesian State Estimation,” *IEE Proceedings-F* 140(2):107-113.

Kitagawa, Genshiro (1996) “Monte Carlo Filter and Smoother for Non-Gaussian Non-Linear State Space Models,” *Journal of Computational and Graphical Statistics* 5:1-25.

Ristic, Branko, Sanjeev Arulampalam, and Neil Gordon (2004) *Beyond the Kalman Filter*. Boston: Artech House.