

DSGE Models and the data: Methods and Problems
BSSM, July 2008
Fabio Canova
U-Bern, ICREA-UPF and CEPR

Outline

The course presents a self contained exposition of methods to study DSGE models.

It is assumed that participants are familiar with the following topics:

- (a) Basic RBC and New-keynesian models, both of closed and open economy flavour.
- (b) Working knowledge of Matlab programming language.

The lectures for this course are based on chapters 2, 3, 5, and 7 of my book: *Methods for Applied Macroeconomic Research*, Princeton University, Press, 2007.

Slides of the presentations will be available shortly before the course at the CREI BSSM homepage. No material will be distributed in class.

Sample codes implementing some of the techniques discussed in the lectures will be provided and posted. Practice session will illustrate the mechanics of the codes.

Program

Monday July 7, 2008 Log-linear and second order approximations to solutions of DSGE models.

Tuesday, July 8, 2008: Data treatments and filtering

Wednesday, July 9, 2008: Calibration and evaluation methods

Thursday, July 10, 2008: Structural estimation: GMM and Impulse response matching

Friday, July 11, 2008: Identification issues and other problems

Reading list

Articles with (*) will be discussed in the lecture.

1) Solution and Approximation Methods

- (*) Cooley, T. (1995) (ed.) *Frontiers of Business Cycle Research*, Princeton University Press, Chapters 1-3
- (*) Marimon and Scott (1999) (eds.) *Computational Methods for the Study of Dynamic Economies*, Oxford University Press, Chapters 2-4
- Hansen, L. , Sargent, T. and McGratten, E. (1996) ” Mechanics of Forming and Estimating Dynamic Linear Economies”, in *Handbook of Computational Economics*
- (*) Klein, P. (2000) ” Using the generalized Schur form to solve a multivariate linear rational expectations model”, *Journal of Economic Dynamics and Control*, 24, 1405-1423.
- Uhlig, H. (1999) A methods for Analyzing Nonlinear Dynamic Stochastic Models Easily in Marimon, R. and Scott A. (eds.) *Computational Methods for the Study of Dynamic Economies*, Oxford University Press.
- Blanchard, O. and Kahn, C. (1980), ”The Solution of Difference Equations under Rational Expectations”, *Econometrica*, 48, 1305-1311.
- King, R., Plosser, C. and Rebelo, S. (1988), Appendix to ”Production, Growth and Business Cycle:I The Basic Neoclassical models”, University of Rochester, working paper
- King, R. and Watson, M. (1998), ”The solution of Singular Linear Difference Systems under Rational Expectations”, *International Economic Review*, 39, 1015-1026.
- Schmitt-Grohe, S. and Uribe, M. (2004) ” Solving Dynamic General Equilibrium Models using Second Order Approximation to the Policy function”, *Journal of Economic Dynamics and Control*, 28, 755-775

2) Data treatment, Filtering and stylized facts

- (*) Baxter, M. and King, R., (1999), ”Measuring Business Cycles: Approximate Band-Pass Filters for Economic Time Series”, *Review of Economics and Statistics*, 81, 575-593.
- (*) Canova, F., (1998), ”Detrending and Business Cycle Facts”, *Journal of Monetary Economics*, 41, 475-540.

- Canova, F., (1999), "Reference Cycle and Turning Points: A Sensitivity Analysis to Detrending and Dating Rules", *Economic Journal*, 109, 126-150.
- (*) Christiano, L. and J. Fitzgerald (2003) The Band Pass Filter, *International Economic Review*
- Cogley, T. and Nason, J., (1995), "The Effects of the Hodrick and Prescott Filter on Integrated Time Series", *Journal of Economic Dynamics and Control*, 19, 253-278.
- Hess, G. and Iwata, S. (1997) "Measuring and Comparing Business Cycle Features", *Journal of Business and Economic Statistics*, 15, 432-444.
- (*) Hodrick, R. and Prescott, E. (1997) "Postwar Business Cycles, An Empirical Investigation", *Journal of Money Banking and Credit*, 29, 1-16.
- Harvey, A. and Jaeger, A., (1993), "Detrending, Stylized Facts and the Business Cycles", *Journal of Applied Econometrics*, 8, 231-247.
- King, R. and Rebelo, S., (1993), "Low Frequency Filtering and Real Business Cycles", *Journal of Economic Dynamics and Control*, 17, 207-231.
- (*) Pagan, A. and Harding, D. (2002), "Dissecting the Cycle: A Methodological Investigation", *Journal of Monetary Economics*, 49, 365-381.
- (*) Ravn, M and Uhlig, H. (2002), On adjusting the HP filter for the frequency of Observations, *Review of Economics and Statistics*, 84, 371-375.
- Beveridge, S. and Nelson, C., (1981), "A New Approach to Decomposition of Economic Time Series into Permanent and Transitory Components with Particular Attention to the Measurement of the Business Cycle", *Journal of Monetary Economics*, 7, 151-174.
- Bry G. and Boschen, C. (1971) *Cyclical analysis of time series: Selected Procedures and Computer Programs*, New York, NBER
- King, R. Plosser, C., Stock, J. and Watson, M. (1991) "Stochastic Trends and Economic Fluctuations", *American Economic Review*, 81, 819-840.
- Whelan, K. (2005) New evidence on Balance growth, Stochastic trends, and economic fluctuations, Central Bank of Ireland, manuscript.

3) Calibration and evaluation methods

- Canova, F. (1994) "Statistical Inference in Calibrated Models", *Journal of Applied Econometrics*, 9, S123-S144.

- (*) Canova, F. and Ortega, E. (2000) "Testing Calibrated General Equilibrium Models", in Mariano, R., T. Shuermann and M. Weeks (eds.) *Inference using Simulation Techniques*, Cambridge University Press.
- Canova, F., Finn, M. and Pagan, A. (1994), "Evaluating a Real Business Cycle Model", in C. Hargreaves (ed.), *Nonstationary Time Series Analyses and Cointegration*, Oxford, UK: Oxford University Press.
- Christiano, L. and M. Eichenbaum (1992), "Current Business Cycle Theories and Aggregate Labor Market Fluctuations", *American Economic Review*, 82, 430-450.
- (*) DeJong, D., Ingram, B. and Whiteman, C., (1996), "Beyond Calibration", *Journal of Business and Economic Statistics*, 14, 1-10.
- Diebold, F., Ohanian, L. and Berkowitz, J., (1998), "Dynamics General Equilibrium Economies: A Framework for Comparing Models and Data", *Review of Economic Studies*, 68, 433-451.
- Gregory, A. and Smith, G. (1989), "Calibration as Estimation", *Econometric Reviews*, 9(1), 57-89.
- (*) Gregory, A. and Smith, G. (1993), "Calibration in Macroeconomics", in Maddala, G.S. (ed.), *Handbook of Statistics*, vol. 11, Amsterdam, North Holland.
- Hansen, L. and Heckman, J. (1996) "The Empirical Foundations of Calibration", *Journal of Economic Perspective*, 10, 87-104.
- Kim, K. and Pagan, A. (1994) "The Econometric Analysis of Calibrated Macroeconomic Models", in Pesaran, H. and M. Wickens (eds.), *Handbook of Applied Econometrics*, Vol.I, London: Blackwell Press.
- Kydland, F. and Prescott, E. (1982), "Time To Build and Aggregate Fluctuations", *Econometrica*, 50, 1345-1370 .
- (*) Kydland, F. and Prescott, E. (1996) "The Computational Experiment: An Econometric Tool", *Journal of Economic Perspective*, 10, 69-85.
- Mehra, R. and Prescott, E. (1985), "The Equity Premium: A Puzzle", *Journal of Monetary Economics*, 15, 145-162.
- Pagan, A. and Shannon, (1985), "Sensitivity Analysis for Linearized Computable General Equilibrium Models", in J.Piggott and J. Whalley (eds.) *New Developments in Applied General Equilibrium Analysis*, Cambridge: Cambridge University Press.

- Showen, J. and Whalley, J. (1992), *Applying General Equilibrium*, New York, Cambridge University Press.
- Sims, C (1996) "Macroeconomics and Methodology", *Journal of Economic Perspectives*, 10, 105-120.

4) Structural Estimation: GMM and Impulse response matching

- (*) Hamilton, J., (1994), *Time Series Analysis*, Princeton University Press, Chapter 14.
- (*) Hayashi, F., (2002), *Econometrics*, Princeton University Press, Chapters 3 and 4.
- Hansen, L.P., (1982), "Large Sample Properties of GMM Estimators", *Econometrica*, 50, 1029-1054.
- Hansen, L.P. and Singleton, K., (1982), "Generalized Instrumental Variables Estimation of Nonlinear Rational Expectations Models", *Econometrica*, 50, 1269-1286. (corrigenda, 1984).
- Ogaki, M., (1993), "GMM: Econometric Applications", in G.S. Maddala, C.R. Rao, and H.D. Vinod, eds., *Handbook of Statistics*, vol. 11, Elsevier Science.
- Jones, J.B. (*) Has fiscal policy helped to stabilize the postwar US economy?, *Journal of Monetary Economics*, 2002, 709-746.
- Newey, W. and West, K., (1987), "A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix", *Econometrica*, 55, 703-708.
- Journal of Business and Economic Statistics, Special Issue on Small Sample Properties of GMM estimators, July 1996.
- Gali, J and Gertler, M. (1999), "Inflation Dynamics: A Structural Econometric Analysis", *Journal of Monetary Economics*, 44, 195-222.
- Lee, B. and Ingram, B., (1991), "Simulation Estimation of Time Series Models", *Journal of Econometrics*, 47, 197-205.
- Duffie, D. and Singleton, K., (1993), "Simulated Moments Estimation of Markov Models of Asset Prices", *Econometrica*, 61, 929-952.
- Smith, T., (1993), "Estimation of Nonlinear Time Series Models using simulated VARs", *Journal of Applied Econometrics*, 8, s63-s84.

- Gourieroux, C. and Monfort, A. (1995) "Testing, Encompassing and Simulating Dynamic Econometric Models", *Econometric Theory*, 11, 195-228.
- Dridi, R. , Guay, A. and Renault, E. (2003) "Indirect Inference and Calibration of Dynamic Stochastic General Equilibrium Models", *Journal of Econometrics*, 136, 397-430.
- Stock, J. and Wright, J. (2000), "GMM with weak identification", *Econometrica*, 68, 1055-1096.
- (*) Boivin, J and Giannoni, M. (2006) "Has Monetary Policy become less powerful?", *Review of Economics and Statistics*, 88, 445-462.
- (*) Christiano, L. Eichenbaum, M. and Evans, C. (2005), "Nominal Rigidities and the dynamic effect of a monetary policy shock", *Journal of Political Economy*, 113, 1-46.

5) Identification issues and other problems

- (*) Canova, F. and Sala, L. (2005), "Back to Square one: Identification Issues in DSGE models", available at www.econ.upf.edu/crei/people/canova
- Canova, F. (2007) " How much structure in empirical models?", forthcoming, *Palgrave Handbook of Econometrics II*.
- Canova, F. and Paustian, M (2007) " Measurement with some theory: using sign restrictions to evaluate business cycle models, available at www.crei.cat/people/canova.
- Iskev, N (2007) "How much do we learn from the estimation of DSGE Models? A case study of identification issues in a New Keynesian Business cycle model, University of Michigan manuscript.
- Fukac, M and Pagan, A. (2008) Limited Information Estimation and Evaluation of DSGE models, QUT and UNSW manuscript.
- Fukac, M. and Pagan, A. (2005) Issues in Adopting DSGE models for Policy Decisions, QUT and UNSW, manuscript.