EC 709: Advanced Econometrics II

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(Office Hour: Monday 11:00-12:30, Thursday 2:00-3:30; Room 407)

Overview: This half of EC 709 focuses on macroeconometrics, the quantitative analysis of dynamic economic relationships in a general equilibrium environment. We concentrate on econometric methods that form the backbone of empirical macroeconomics. The topics covered include the generalized method of moments (including the simulated method of moments, indirect inference, and efficient method of moments), structural vector autoregression for dynamic causal effects, and likelihood-based analysis of dynamic stochastic general equilibrium (DSGE) models. If time permits, we will also consider methods for high-dimensional macroeconomic data, such as factor analysis, and tools for modeling the conditional distribution, such as quantile regression methods.

We start with a quick overview of the literature that will provide a background for our analysis and connect various topics into an integrated body of knowledge. We then discuss the methods in detail, heavily using empirical applications. The focus is on concepts and practical aspects rather than technical analysis and proofs. Our main goal is to familiarize students with critical econometric tools to be used in their own empirical research.

Requirements: There are four problem sets and a close-book exam. The problem sets contain both theoretical and empirical questions. Students are encouraged to collaborate on the problem sets but must turn in their own copy. The three problem sets account for 20% of the final grade, and the final exam accounts for 70%. Class participation (i.e., attending lectures on time and participating in discussions) accounts for the remaining 10%.

References We will use a set of lecture notes that I developed for this course. The following books are helpful references to supplement the notes.

• Canova, F. (2007): Methods for Applied Macroeconomic Research, Princeton University Press.
• Hayashi, F. (2000): Econometrics, Princeton University Press.
• Herbst, E. and F. Schorfheide (2015): Bayesian Estimation of DSGE Models, PUP.

TOPICS

1 GMM Part 1: Estimation and Inference

This part reviews the essential concepts related to GMM estimation and inference. We discuss global and local identification, inference in well-identified models, testing parametric restrictions in well-identified models, and model diagnostics.

2 GMM Part 2: Empirical Applications

This part of the lecture considers two empirical applications: on estimating a monetary policy rule and on estimating the coefficient of relative risk aversion. We use these two applications as a platform to examine the assumptions made, the main estimation steps, the issue of small sample size, as well as the effect of weak identification. The students are encouraged to replicate the empirical results independently.

References

[1] Clarida, R., Galí, J. and Gertler, M. (2000): "Monetary Policy Rules And Macroeconomic Stability: Evidence And Some Theory," *The Quarterly Journal of Economics*, 115, 147-180.

[2] Hansen, L.P., (1982), "Large Sample Properties of Generalized Methods of Moments Estimators," *Econometrica*, 50, 1029-1054.

[3] Hansen, L.P. and Singleton, K.J., (1982): "Generalized Instrumental Variables Estimation of Nonlinear Rational Expectations Models," *Econometrica*, 50, 1269-1286.

[4] —— (1984), "Errata: Generalized Instrumental Variables Estimation of Nonlinear Rational Expectations Models," *Econometrica*, 52, 267-268.

3 GMM Part 3: Topics

We focus on three topics chosen based on their empirical importance: the most important factors affecting the finite sample performance of the GMM estimator, the issue of how to conduct inference robust to weak identification, and the construction of optimal instruments in conditional models.

References

[1] Bound, J., Jaeger, D.A. and Baker, R.M. (1995), "Problem with Instrumental Variables Estimation When the Correlation Between the Instruments and the Endogenous Explanatory Variable is Weak", *Journal of the American Statistical Association*, 90, pp. 443-450. (weak identification)

[2] Burnside, C. and Eichenbaum, M. (1996), "Small-Sample Properties of GMM-Based Wald Tests", *Journal of Business and Economic Statistics*, 14, pp. 294-308.

[3] Stock, J.H. and Wright, J.H. (2000), "GMM with Weak Identification", *Econometrica*, 68, 1055-1096.

[4] Stock, J. H., Wright, J.H. and Yogo, M. (2002), "A Survey of Weak Instruments and Weak Identification in Generalized Method of Moments," *Journal of Business & Economic Statistics*, Volume 20 , pp. 518-529.

4 Simulated Method of Moments (SMM)

We discuss three extensions of the GMM estimator, each using an economic model as a simulation mechanism to compute moments – the simulated method of moments, indirect inference, and the efficient method of moments.We highlight their connections with the standard GMM estimator while emphasizing their applications in practice.

References

[1] Duffie, D., and Singleton, K. (1993), "Simulated Moments Estimation of Markov Models of Asset Prices," *Econometrica*, Vol. 61, 1993, 929-952.

[2] Gallant, A.R. and Tauchen, G. (2001), "Efficient Method of Moments," manuscript, Duke University.

[3] Lee, B. and Ingram, B. (1991), "Simulation Estimation of Time Series Models," *Journal of Econometrics* 47, 197-205.

[4] McFadden, D. (1989), "A Method of Simulated Moments of Estimation for Discrete Response Models without Numerical Integration," *Econometrica*, 57, 995-1026.

[5] Pakes, A. and Pollard, D. (1989). "Simulation and the Asymptotics of Optimization Estimators," *Econometrica*, 57, 1027-1057.

[6] Smith, A.A. (1993), "Estimating Nonlinear Time Series Models Using Simulated Vector Autoregressions," *Journal of Applied Econometrics* 8, S63–S84

5 Structural Vector Autoregression (SVAR) for Dynamic Causal Effects

We discuss Structural Vector Autoregression as a framework for business cycle analysis and dynamic causal effect analysis. The topics include the structural moving average model, the structural VAR representation, identification, impulse response, variance decomposition, the relation between SVAR and DSGE models, and recent developments including identification based on high-frequency data and external instruments.

References

[1] Christiano, L., Eichenbaum, M. and Vigfusson, R. (2006), "Assessing structural VARs." in: Acemoglu, D., Rogoff, K. and Woodford, M. (Eds.), *NBER Macroeconomics Annual*.

[2] Fernandez-Villaverde, J., Rubio-Ramirez, J., Sargent, T., Watson, M., (2007). "ABCs (and Ds) of understanding VARs." *American Economic Review* 97 (3), 1021–1026.

[3] Ramey, V.A. (2016): "Macroeconomic Shocks and Their Propagation," Handbook of Macroeconomics, In: Taylor, J.B., Uhlig, H. (Eds.), Handbook of Macroeconomics, Chapter 2, Vol 2, 71-162.

[4] Watson, M. (1994), "Vector Autoregressions and Cointegration", *Handbook of Econometrics*, Volume 4, Engle and McFadden (eds.), Elsevier, New York.

6 Estimating DSGE Models: Introduction

We present the basic tools for the estimation of linearized DSGE models, including model solution algorithms, the state space representation, and the Kalman filter for the likelihood.

References

[1] Herbst, E. and F. Schorfheide (2015): Bayesian Estimation of DSGE Models, Princeton University Press.

7 DSGE Models: Bayesian Computation and Inference

We discuss the estimation of DSGE models from a Bayesian perspective, covering the estimation, inference and model diagnostics.

References

[1] An, S. and Schorfheide, F. (2007), "Bayesian analysis of DSGE models". *Econometric Reviews*, 26, 113-172.

[2] Smets, F, and Wouters, R. (2007), "Shocks and Frictions in US Business Cycles: A Bayesian DSGE Approach," *American Economic Review*, vol 97, no. 3, 586-606.

[3] Herbst, E. and F. Schorfheide (2015): Bayesian Estimation of DSGE Models, Princeton University Press.