

Helsinki GSE 2019-20

Course on Learning and Macroeconomics

Contents and Reading

Seppo Honkapohja, Aalto University School of Business
(email: seppo.honkapohja@aalto.fi)

Overview

The course analyses expectations and learning in dynamic stochastic macroeconomics. We develop techniques for solving for rational expectations equilibrium (REE) and examine whether economic agents endowed imperfect knowledge but following statistical learning schemes will over time converge to REE. Cases where learning can lead to non-REE learning dynamics and dynamic paths of temporary equilibria are also considered. The approach has yielded important implications for different aspects of macroeconomic policy. Monetary policy has in particular been studied. A range of other applications are also discussed.

Course structure and requirements:

- (i) 12 hours of lectures with dates: November 21, 22, 26, 27 and 28, 2019.
- (ii) problem set with 7 problems: written answers to 4 problems must be returned to earn credit,
- (iii) course paper: on a chosen topic from a list of three.

Evaluation weights: final exam 50%, solved problem sets 20% and course paper 30%.

Contents and reading:

Recent survey articles give overviews of the subject:

Evans, G.W. and S. Honkapohja, “Learning and Macroeconomics”, *Annual Review of Economics*, Vol.1, 2009.

Evans, G.W. and S. Honkapohja, “Learning as a Rational Foundation for Macroeconomics and Finance”, Chapter 2 in *Rethinking Expectations: The Way Forward for Macroeconomics*, Frydman R. and E.S. Phelps (Eds.), Princeton University Press.

Woodford M. “Macroeconomic Analysis without the Rational Expectations Hypothesis”, *Annual Review of Economics*, Vol.5, 2013.

Branch, W.A. and B. McGough (2018), “Heterogenous Expectations and Micro-foundations in Macroeconomics”, forthcoming in Handbook of Computational Economics.

Monograph for the course:

Evans, G.W. and S. Honkapohja (2001), *Learning and Expectations in Macroeconomics*, Princeton University Press.

Below it is referred to as GE-SH book. The web site for the book contains errata, problem sets and other supplements, see <https://pages.uoregon.edu/gevans/book.htm>.

Recent surveys and overviews are listed above.

Reading list:

(* = required)

1. Introduction to expectations and learning. Tools for convergence analysis.

A. Basic concepts, behavioral rules, cobweb market model, Convergence of least squares learning to REE in the cobweb model.

* GE-SH book, chapters 1, 2.

Evans and Honkapohja survey papers: 2009 (section 2.2 and 2.2.1), 2013 (sections 1 and 2.1).

B. Recursive algorithms and E-stability. Learning stability in (univariate) linear models.

* GE-SH book, chapters 4, 8. (For technical background: chapter 6 and section 7.3.)

C. Nonlinear models: overlapping generations models, sunspot equilibria.

* GE-SH book, chapters 3.4 and 7.2, 11-12.

Evans, G.W. and S. Honkapohja (2003), “Existence of Adaptively Stable Sunspot Equilibria Near an Indeterminate Steady State”, *Journal of Economic Theory*, 111, 125 - 134.

2. Determinacy and learning stability in multivariate linear models.

A. Determinacy and learning stability in multivariate linear models.

* GE-SH book, Chapter 10.

McCallum, B.T. (2007), “E-Stability vis-a-vis Determinacy Results for a Broad Class of Linear Rational Expectations Models”, *Journal of Economic Dynamics and Control*, 31, 1376-1391.

Bullard, J. and S. Eusepi (2014), “When Does Determinacy imply Expectational Stability?”, *International Economic Review*, 55, 1-22.

B. Learning and the planning horizon: Euler-equation learning vs. Infinite-horizon learning.

* Honkapohja S., G.W. Evans, and K. Mitra (2013), “Notes on Agents’ Behavioral Rules Under Adaptive Learning and Recent Studies of Monetary Policy”, in Sargent, T.J. and Vilmunen, J. (eds.), *Macroeconomics at the Service of Public Policy*, Oxford University Press, 2013, Chapter 4, 63-79.

Evans and Honkapohja survey 2013 (section 2.4.1).

Branch, W.A., G.W. Evans, and B. McGough (2013), “Finite Horizon Learning”, in Sargent, T.J. and Vilmunen, J. (eds.), *Macroeconomics at the Service of Public Policy*, Oxford University Press, 2013, Chapter 8, 141-163.

Evans, G.W., S. Honkapohja and K. Mitra (2009), “Anticipated Fiscal Policy and Adaptive Learning”, *Journal of Monetary Economics*, 56, 930-953.

C. Applications: the RBC model and extensions to increasing returns.

Farmer, R.E. (1999), *Macroeconomics of Self-fulfilling Prophecies*, MIT Press, 2nd edition, chapters 5 and 7.

Farmer, R.E. and J.-T. Guo (1994), “Real Business Cycles and the Animal Spirits Hypothesis”, *Journal of Economic Theory*, 63, 42-72.

Duffy, J. and W. Xiao (2007), “Instability of Sunspot Equilibria in Real Business Cycle Models under Adaptive Learning”, *Journal of Monetary Economics*, 54, 879-903.

Eusepi, S. and P. Preston (2011), “Expectations, Learning and Business Cycle Fluctuations”, *American Economic Review*, 101, 2844-2872.

* Evans, G.W., S. Honkapohja and K. Mitra (2013), “Policy Change and Learning in the RBC Model”, *Journal of Economic Dynamics and Control*, 2013, 37, 1947-1971.

3. Further aspects of learning dynamics.

A. Gradient algorithms, heterogeneous learning.

* GE-SH book, Sections 3.2, 3.4-3.5, 7.2.

Evans, G.W., S. Honkapohja and N. Williams (2010), “Generalized Stochastic Gradient Learning”, *International Economic Review*, 51, 237-262.

* Honkapohja, S. and K. Mitra (2006), “Learning Stability in Economies with Heterogeneous Agents”, *Review of Economic Dynamics*, 9, 284-309.

Branch and McGough survey.

B. Constant gain algorithms, structural change and misspecification.

* GE-SH book, Sections 3.3, 3.6, 14.1-14.3. (technical background: Sections 7.4-7.5.)

Branch and McGough survey.

Brock, W.A. and C. Hommes (1997), “A Rational Route to Randomness”, *Econometrica*, 65, 1059-1095.

Branch, W.A. (2006), “Restricted Perceptions Equilibria and Learning in Macroeconomics”, pp.135-160 in *Post Walrasian Macroeconomics* (ed. by D. Colander), Cambridge UK: Cambridge University Press. Manuscript available at

<http://www.socsci.uci.edu/~wbranch/>.

Adam, K. (2007), “Experimental Evidence on the Persistence of Output and Inflation”, *Economic Journal*, 117, 603-636.

Branch, W.A. and G.W. Evans (2006), “Intrinsic Heterogeneity in Expectations Formation”, *Journal of Economic Theory*, 127, 264-295.

Bullard, J., G.W. Evans and S. Honkapohja (2010), “A Model of Near-Rational Exuberance”, *Macroeconomic Dynamics*, 14, 166-188.

4. Learning and monetary policy.

A. Background on New Keynesian models.

Clarida, R., J. Gali and M. Gertler (1999), “The Science of Monetary Policy: A New Keynesian Perspective”, *Journal of Economic Literature*, 37, 1661-1707.

Woodford, M. (2003), *Interest and Prices, Foundations of a Theory of Monetary Policy*, Princeton University Press, especially Chapters 1, 3 and 4.

Gali, J. (2008), *Monetary Policy, Inflation and the Business Cycle*, Princeton University Press, Chapters 3-5.

B. Determinacy and stability under learning of interest rate rules in the New Keynesian model. Implementation of optimal monetary policy.

* Evans, G.W. and S. Honkapohja (2007), “Expectations, Learning and Monetary Policy: An Overview of Recent Developments”, in *Monetary Policy under Uncertainty and Learning*, Eds. Schmidt-Hebbel, Klaus and Carl E. Walsh, Bank of Chile, Santiago, 2009, 27-76. (Available at BoC web site).

Evans and Honkapohja survey paper 2013 (section 2.5).

* Eusepi, S. and B. Preston (2018), “The Science of Monetary Policy: An Imperfect Knowledge Perspective”, *Journal of Economic Literature*, 56, 3–59, Sections 1-6.

Bullard, J. and K. Mitra (2002), “Learning About Monetary Policy Rules”, *Journal of Monetary Economics*, 49, 1105-1129.

Evans, G.W. and S. Honkapohja (2003), “Expectations and the Stability Problem for Optimal Monetary Policies”, *Review of Economic Studies*, 2003, 70, 807-824.

Evans, G.W. and S. Honkapohja (2006), “Monetary Policy, Expectations and Commitment”, *Scandinavian Journal of Economics*, 108, 15-38.

Gaspar, V., F. Smets and D. Vestin (2010), “Inflation Expectations, Adaptive Learning and Optimal Monetary Policy”, *Handbook of Monetary Economics vol.3, Elsevier, 1055-1095*.

Honkapohja, S. and K. Mitra (2004), “Are Non-Fundamental Equilibria Learnable in Models of Monetary Policy?”, *Journal of Monetary Economics*, 51, 1743-1770.

Preston, B. (2005), “Learning about Monetary Policy when Long-Horizon Forecasts Matter”, *International Journal of Central Banking*, 1(2), 81-126.

Evans, G.W. and B. McGough (2007), “Monetary Policy, Indeterminacy and Learning”, *Journal of Economic Dynamics and Control*, 29, 1809-1840.

C. Learning by the policy-maker. Applied and empirical research on learning and monetary policy.

Eusepi, S. and B. Preston (2018), Sections 7-9.

Honkapohja, S. and K. Mitra (2005), “Performance of Monetary Policy with Internal Central Bank Forecasting”, *Journal of Economic Dynamics and Control*, 29, 627-658.

Gaspar, V., F. Smets and D. Vestin (2006), “Monetary Policy over Time”, *Macroeconomic Dynamics*, 10, 207-229.

Milani, F. (2007), “Expectations, Learning and Macroeconomic Persistence”, *Journal of Monetary Economics*, 54, 2065-2082.

Orphanides, A. and J.C. Williams (2007), “Robust Monetary Policy with Imperfect Knowledge”, *Journal of Monetary Economics*, 54, 1406-1435.

5. Macroeconomic policy in exceptional times

A. Hyperinflations.

Sargent, T.J. and N. Wallace (1973), “Rational Expectations and the Dynamics of Hyperinflation”, *International Economic Review*, 14, 328-350.

Evans, G.W., S. Honkapohja and R. Marimon (2001), “Convergence in Monetary Inflation Models with Heterogeneous Learning Rules”, *Macroeconomic Dynamics*, 5, 1-31.

* Marcet, A. and J.P. Nicolini (2003), “Recurrent Hyperinflations and Learning”, *American Economic Review*, 93, 1476-1498.

Adam, K., G.W. Evans and S. Honkapohja (2007), “Are Hyperinflation Paths Learnable?”, *Journal of Economic Dynamics and Control*, 30, 2725-2748.

B. Liquidity traps, stagnation and policy reaction.

Benhabib, J., S. Schmitt-Grohe and M. Uribe (2001), “The Perils of Taylor Rules”, *Journal of Economic Theory*, 96, 40-69.

* Evans, G.W., E. Guse and S. Honkapohja (2007), “Liquidity Traps, Learning and Stagnation”, *European Economic Review*, 52, 1438-1463.

* Benhabib J., G.W. Evans and S. Honkapohja (2014), “Liquidity Traps, Expectation Dynamics: Fiscal Stimulus or Fiscal Austerity?”, *Journal of Economic Dynamics and Control*, 45, 220-238.

Evans, G.W. and B. McGough (2018), “Interest-Rate Pegs in New Keynesian Models”, *Journal of Money, Credit and Banking*, 50, 939-965.

Honkapohja, S. and K. Mitra (2018), “Price Level Targeting with Evolving Credibility”, *Journal of Monetary Economics* 2019 (forthcoming).

6. Final discussion: other current topics.

(Preliminary)

A. Finance, asset pricing and exchanges rates: Adam, Marcet & Nicolini, Adam, Kuang and Marcet, Kasa IER 2004, Markiewicz IER 2012

B. Behavioral approaches, experiments: Hommes book, Arifovic, Malmendier QJE

C. Empirical research on learning: Adam EJ 2007, Branch 2007,

D. DSGE models with learning: Slobodyan & Wouters 2012a,b, Lansing et al 2018

D. Related approaches: natural expectations, rational inattention.