Syllabus
Solving and Estimating Models with Imperfect Common Knowledge
European University Institute
Spring 2020

Instructor: Leonardo Melosi, Federal Reserve Bank of Chicago and European University Institute

Contacts: leonardo.melosi@eui.eu

Description: A salient feature of economic systems is that information is dispersed across separate decision-makers (Hayek, 1945). In his pioneering work, Phelps (1970) studies the implications of informational isolation and theorizes that an important source of uncertainty for decision-makers is the unknowability of others' minds. Even when observations allow a decision-maker to exactly infer events that affect her decision, these observations may provide little information about the way in which the beliefs of others may have changed, and still less about others' beliefs of others' beliefs.

This is a five-lecture course on macroeconomic models in which rational and optimizing agents have *imperfect common knowledge* in the game theoretic sense and forecast the forecasts of other agents to make their decisions. We will review some of the techniques to linearize and solve this type of models and to take them to time series data using likelihood methods. We will consider models with exogenous signals, endogenous signals, as well as rational inattention models.

Goals: Students will acquire the technical skills to contribute to the empirical macroeconomic literature on imperfect common knowledge.

Exams: There will be a take-home exam and a few *informal* assignments, which will be handed in during class and do NOT have to be returned. These assignments are intended to stimulate interested students to grasp a deeper comprehension of those concepts that the course cannot thoroughly cover due to the time constrain. *The final grade will be only based on the quality of the take-home exam.*

The exam consists in reading the paper on rational inattention by Mackowiack and Wiederholt (2009) and in solving the baseline model of that paper in Matlab (or in other similar software). Students are asked to write a short paper in which they describe and solve this model as well as critically evaluate its predictions (e.g., plotting the impulse response functions). Carefully analyzing what features of the model explains the model's predictions will be a critical factor for the final grade. Ability of concisely conveying results and insights will be rewarded in the final grade. *The paper's length should not exceed 10 pages.*

The submission deadline for the exam is *TBA*. Delayed submissions will be heavily penalized.

Course Outline

1. Preliminary tools

   (a) The Kalman filter
   (b) Solving Rational Expectations models

2. A simple imperfect common knowledge model

   (a) Loglinearization
   (b) Key properties
   (c) Model solution: three methods

3. A model with endogenous signals

   (a) Application: Central bank's communication
   (b) Signaling effects and delphic forward guidance

4. A primer on solving rational inattention models

5. Taking imperfect common knowledge models to the data

Main References:

- Phelps (1970)

- Woodford (2002)

- Sims (2003 and 2010)

- Nimark (2008)

- Mackowiack and Wiederhold (2009)

- Melosi (2014 and 2017)

- Angeletos, Collard, and Dellas (2018)

References

Angeletos, G.-M., F. Collard, and H. Dellas (2018). Business cycle anatomy. NBER Working Paper 24875, National Bureau of Economic Research.

Hayek, F. A. (1945). The use of knowledge in society. *American Economic Review 35*(4), 519–530.

Mackowiak, B. and M. Wiederholt (2009). Optimal sticky prices under rational inattention. *American Economic Review 99*(3), 769–803.

Melosi, L. (2014). Estimating models with dispersed information. *American Economic Journal: Macroeconomics 6*(1), 1–31.

Melosi, L. (2017). Signalling effects of monetary policy. *Review of Economic Studies 84*(2), 853–884.

Nimark, K. (2008). Dynamic Pricing and Imperfect Common Knowledge. *Journal of Monetary Economics 55*(2), 365–382.

Phelps, E. S. (1970). *Microeconomic Foundations of Employment and Inflation Theory.* London:Macmillan.

Sims, C. A. (2003). Implications of rational inattention. *Journal of Monetary Economics 50*(3), 665–690.

Sims, C. A. (2010). Rational inattention and monetary economics. In B. M. Friedman and M. Woodford (Eds.), *Handbook of Monetary Economics*, Volume 3 of *Handbook of Monetary Economics*, Chapter 4, pp. 155–181. Elsevier.

Woodford, M. (2002). Rational inattention and monetary economics. In J. S. Philippe Aghion, Roman Frydman and M. Woodford (Eds.), *Knowledge, Information, and Expectations in Modern Macroeconomics: In Honor of Edmund S. Phelps.*, Handbook of Monetary Economics, pp. 2558. Princeton:Princeton University Press.