Advanced Techniques in Macroeconomics II

2022-23 Academic Year
Master of Research in Economics, Finance and Management

1. Description of the subject

- Advanced Techniques in Macroeconomics II
- Total credits: 3 ECTS

Code: 31804
Workload: 75 hours
Term: 1st

- Type of subject: Optative
- Department of Economics and Business
- Teaching team: Davide Debortoli

2. Teaching guide

Objective

This course is the natural continuation of "Advanced Techniques in Macroeconomics I" which is a pre-requisite. The main objective of this course is study advanced global solution methods and their applications. We will start by looking at the projection method. We will then introduce Heterogenous Agent models and look at some of the state-of-the-art methods used to solve and simulate this class of models. Time-permitting, we will also review some recent topics and debates in the literature.

Contents

1. **Projection Methods.**
   Function approximation (linear and cubic splines, Chebyshev polynomials). Collocation. Smolyak quadrature.
   Applications: RBC model, Optimal Fiscal Policy

2. **Basics of Heterogeneous-agent Economies.**
   Model definition and steady state (Bewley-Huggett-Aiyagari).
   Transitional dynamics. Krusell and Smith (1998). Auclert et. al. (2021)

3. **Topics in Heterogeneous-agent Economies.**
   Wealthy Hand-to-Mouth (Kaplan, Violante and Weidner, 2014). HANK (Kaplan, Moll and Violante, 2018).

Teaching methodology

Approach and general organization of the subject

A prerequisite of this course is "Advanced Techniques in Macroeconomics I"

As in that course, lectures will be divided into the following parts: (i) theoretical description of the numerical technique; (ii) application of the technique to a standard model; (iii) application of the technique to specific models (see list above).

Also, students will have to write computer programs to implement the techniques discussed in class using whichever language they like (MATLAB, Fortran, C, Julia, Python, etc.). The programming language used in the course will be MATLAB.

Training activities
Lectures, proposed readings, study and development of computer programs.

Assessment and Grading System

The grade of the course will be determined on the following basis:

- (60%) A series of homeworks, requiring to write computer programs to solve standard problems and models. Homeworks could be performed in small groups (max. 3 people, one solution per group).

- (40%) A class presentation of a paper covering a recent topic in heterogeneous agent modeling.

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Textbook and References

My slides are the main resource for this course. They will be regularly posted on Box.

Important references for the **numerical techniques** covered in class is the book

Other references for **numerical methods for macroeconomic models** are

Algan Y., O. Allais, W. Den Haan and P. Rendal (2014), "Solving and Simulating Models with Heterogeneous Agents and Aggregate Uncertainty", *Handbook of Computational Economics,* Vol. 3, Ch. 6.

Auclert A., B. Bardóczy, M. Rognlie and L. Straub (2019), "Using the Sequence-Space Jacobian to Solve and Estimate Heterogeneous-Agent Models", Working Paper.

Boppart, T., Krusell, P., & Mitman, K. (2018). Exploiting MIT shocks in heterogeneous agent economies: the impulse response as a numerical derivative. Journal of Economic Dynamics and Control, 89, 68-92.

Den Haan, W. J. (2010). Comparison of solutions to the incomplete markets model with aggregate uncertainty. Journal of Economic Dynamics and Control, 34(1), 4-27.

Maliar L. and S. Maliar, (2014). "Numerical Methods for Large Scale Dynamic Economic Models" in: Schmedders, K. and K. Judd (Eds.), Handbook of Computational Economics, Volume 3, Chapter 7, 325-477, Amsterdam: Elsevier Science.

Le Grand, F., & Ragot, X. (2018). A class of tractable incomplete-market models for studying asset returns and risk exposure. European Economic Review, 103, 39-59.

Marcet, A. and G. Lorenzoni, (1998), "Parametrized expectations approach: some practical issues", in R. Marimon and A. Scott (eds), *Computational Methods for the Study of Dynamic Economies*, Oxford University Press.

Reiter, M. (2009). Solving heterogeneous-agent models by projection and perturbation. *Journal of Economic Dynamics and Control*, *33*(3), 649-665.

Winberry, T. (2016). A toolbox for solving and estimating heterogeneous agent macro models. *Quantitative Economics*.

References for specific **applications** are:

Aiyagari, S. R. (1994). Uninsured idiosyncratic risk and aggregate saving. *The Quarterly Journal of Economics*, *109*(3), 659-684.

Fernández-Villaverde, J. , G. Gordon, P. Guerrón-Quintana and J. Rubio-Ramírez (2015). "Nonlinear adventures at the zero lower bound," *Journal of Economic Dynamics and Control*, 57(C), 182-204.

Floden, Martin (2001), The Effectiveness of Government Debt and Transfers as Insurance, *Journal of Monetary Economics*.

Hopenhayn, H. A. (1992). Entry, exit, and firm dynamics in long run equilibrium. *Econometrica: Journal of the Econometric Society*, 1127-1150

Huggett, M. (1993). The risk-free rate in heterogeneous-agent incomplete-insurance economies. *Journal of economic Dynamics and Control*, *17*(5-6), 953-969.

Kaplan, G., Moll, B., & Violante, G. L. (2018). Monetary policy according to HANK. *American Economic Review*, *108*(3), 697-743.

Kaplan, G., Violante, G. L., & Weidner, J. (2014). The Wealthy Hand-to-Mouth. *Brookings Papers on Economic Activity*, *2014*(1), 77-138.

Khan, A., & Thomas, J. K. (2008). Idiosyncratic shocks and the role of nonconvexities in plant and aggregate investment dynamics. *Econometrica*, *76*(2), 395-436.

Krueger, D., and Kubler, F. (2004). "Computing equilibrium in OLG models with stochastic production." Journal of Economic Dynamics and Control 28.7: 1411-1436.

Krusell, P. and A. Smith (1998) "Income and Wealth Heterogeneity in the Macroeconomy", *Journal of Political Economy*, 106, 867–896.

McKay, A., E. Nakamura, and J. Steinsson (2016) "The Power of Forward Guidance Revisited", *American Economic Review*, 106(10): 3133-58.

Storesletten, Kjetil, Chris I. Telmer, and Amir Yaron. "How important are idiosyncratic shocks? Evidence from labor supply." The American Economic Review 91.2 (2001): 413-417.