

Advanced Techniques in Macroeconomics II: Heterogeneous Agent Economies

2021-22 Academic Year
Master of Research in Economics, Finance and Management

Description of the subject

Advanced Techniques in Macroeconomics II	Code: 32707
Total credits: 3 ECTS	Workload: 75 hours
Type of subject: Optative	Term: 1st
Department of Economics and Business	
Teaching team: Edouard Schaal	

2. Teaching guide

□ Objective

This course is an introduction to the topic of heterogeneous agents (households, firms) in macroeconomics. The course will be structured around some of the key frameworks in the literature: i) we will start with the classic Bewley-Huggett-Aiyagari with incomplete market and heterogeneous households, ii) for heterogeneous firms, we will cover models in the family of Hopenhayn (1992) and finally iii) the life cycle model of Storesletten, Telmer and Yaron (2004). A strong emphasis will be put on the numerical aspects. We will review some of the state-of-the-art resolution methods that people use nowadays to solve and simulate this class of models. Time permitting, the last part of the course will open up on some recent topics and debates in the literature.

□ Contents

1. **Heterogeneous Households: Bewley-Huggett-Aiyagari models.**
Model definition. Distribution invariants.
2. **Aggregate Uncertainty in Heterogeneous-agent Economies.**
Transitional dynamics. Krusell and Smith (1998). Reiter (2009). Boppart, Krusell and Mitman (2018). Le Grand and Ragot (2018).
3. **Heterogeneous Firms.**
Hopenhayn (1992). Kahn and Thomas (2008). Winberry (2018)
4. **Life-Cycle Economies.**
Storesletten, Telmer and Yaron (2004).
5. **Topics in Heterogeneous-agent Economies.**
Time permitting: Wealthy Hand-to-Mouth (Kaplan, Violante and Weidner, 2014). HANK (Kaplan, Moll and Violante, 2018).

• Teaching methodology

Approach and general organization of the subject

This course is a natural follow-up to “Advanced Techniques in Macroeconomics I” which is a prerequisite. Despite a still important emphasis on numerical methods, this course will be more focused on applications and their economic content, and slightly less on techniques. The core of the course revolves around the modelling and numerical challenges that typically arise in heterogeneous agent economies (e.g., modelling and simulating time-varying distributions, aggregate uncertainty, etc.). Time permitting, the course will open up to current open questions and debates in the literature.

As in “Advanced Techniques in Macroeconomics I”, students will have to learn how to write computer programs to implement the techniques discussed in class. MATLAB will be the language used in class but students may use whichever language they like (Fortran, C, Python, Julia).

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:

- (20%) A short final exam, about the theoretical concepts and algorithms covered during lectures.
- (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).
- (20%) Time permitting: possibly a 10-15 min presentation of a paper covering a recent topic in heterogeneous agent modeling towards the end of the course.

□ **Textbook and References**

My slides are the main resource for this course. They will be regularly posted on Box. They build on a previous course taught at NYU from 2012-2016 and lectures notes by Davide Debortoli and Gianluca Violante.

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

Algan, Y., Allais, O., & Den Haan, W. J. (2008). Solving heterogeneous-agent models with parameterized cross-sectional distributions. *Journal of Economic Dynamics and Control*, 32(3), 875-908.

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

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). Assessing the accuracy of the aggregate law of motion in models with heterogeneous agents. *Journal of Economic Dynamics and Control*, 34(1), 79-99.

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.

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.

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

Terry, S. J. (2017). Alternative methods for solving heterogeneous firm models. *Journal of Money, Credit and Banking*, 49(6), 1081-1111.

Winberry, T. (2018). A toolbox for solving and estimating heterogeneous agent macro models. *Quantitative Economics*, Vol. 9, Issue 3 Nov. 2018

References for specific **applications** are:

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

Cooper, R. W., & Haltiwanger, J. C. (2006). On the nature of capital adjustment costs. *The*

Review of Economic Studies, 73(3), 611-633.

Davis, S. J., Haltiwanger, J., & Schuh, S. (1996). Job creation and job destruction.

De Nardi, M., French, E., & Jones, J. B. (2010). Why do the elderly save? The role of medical expenses. *Journal of Political Economy*, 118(1), 39-75.

Domeij, D., & Heathcote, J. (2004). On the distributional effects of reducing capital taxes. *International economic review*, 45(2), 523-554.

Evans, D. S. (1987). Tests of alternative theories of firm growth. *Journal of political economy*, 95(4), 657-674.

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.

Favilukis, J., Ludvigson, S. C., & Van Nieuwerburgh, S. (2017). The macroeconomic effects of housing wealth, housing finance, and limited risk sharing in general equilibrium. *Journal of Political Economy*, 125(1), 140-223.

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

Floden, M., & Lindé, J. (2001). Idiosyncratic risk in the United States and Sweden: Is there a role for government insurance?. *Review of Economic dynamics*, 4(2), 406-437.

Glover, A., Heathcote, J., Krueger, D., & Ríos-Rull, J. V. (2011). *Intergenerational redistribution in the great recession* (No. w16924). National Bureau of Economic Research.

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

Hopenhayn, H., & Rogerson, R. (1993). Job turnover and policy evaluation: A general equilibrium analysis. *Journal of political Economy*, 101(5), 915-938.

Hsieh, C. T., & Klenow, P. J. (2009). Misallocation and manufacturing TFP in China and India. *The Quarterly journal of economics*, 124(4), 1403-1448.

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

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

Klette, T. J., & Kortum, S. (2004). Innovating firms and aggregate innovation. *Journal of political economy*, 112(5), 986-1018.

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

Kubler, F., & Schmedders, K. (2015). Life-cycle portfolio choice, the wealth distribution and asset prices. *Swiss Finance Institute Research Paper*, (10-21).

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

Le Grand, F., & Ragot, X. (2017). Optimal Fiscal Policy with Heterogeneous Agents and Aggregate Shocks, working paper.

- Lucas Jr, R. E. (1978). On the size distribution of business firms. *The Bell Journal of Economics*, 508-523.
- Luttmer, E. G. (2011). On the mechanics of firm growth. *The Review of Economic Studies*, 78(3), 1042-1068.
- Mortensen, D. and C. A. Pissarides, (1994) “Job Creation and Job Destruction in the Theory of Unemployment”, *Review of Economic Studies*, vol. 61(3), 397-415.
- Ríos-Rull, J. V. (1996). Life-cycle economies and aggregate fluctuations. *The Review of Economic Studies*, 63(3), 465-489.
- Restuccia, D., & Rogerson, R. (2008). Policy distortions and aggregate productivity with heterogeneous establishments. *Review of Economic dynamics*, 11(4), 707-720.
- Smets, F. and R. Wouters, (2007). “Shocks and Frictions in US Business Cycles: A Bayesian DSGE Approach”, *American Economic Review*, American Economic Association, 97(3), 586-606.
- 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.
- Storesletten, Kjetil, Christopher I. Telmer, and Amir Yaron. “Consumption and risk sharing over the life cycle.” *Journal of Monetary Economics* 51.3 (2004): 609-633.
- Winberry, T. (forthcoming). Lumpy investment, business cycles, and stimulus policy. *American Economic Review*.

Reading list for Lecture 5 “Topics in Heterogeneous-agent Economies”

- Auclert, A. (2019). Monetary policy and the redistribution channel. *American Economic Review*, 109(6), 2333-67.
- Bayer, C., Lütticke, R., Pham-Dao, L., & Tjaden, V. (2019). Precautionary savings, illiquid assets, and the aggregate consequences of shocks to household income risk. *Econometrica*, 87(1), 255-290.
- Benhabib, J., Bisin, A., & Luo, M. (2017). Earnings inequality and other determinants of wealth inequality. *American Economic Review*, 107(5), 593-97.
- Debortoli, D., & Galí, J. (2017). Monetary policy with heterogeneous agents: Insights from TANK models. *Manuscript, September*.
- Fagereng, A., Guiso, L., Malacrino, D., & Pistaferri, L. (forthcoming). *Heterogeneity and persistence in returns to wealth*. *Econometrica*.
- 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.
- McKay, A., E. Nakamura, and J. Steinsson (2016) “The Power of Forward Guidance Revisited”, *American Economic Review*, 106(10): 3133-58.

Werning, I. (2015). *Incomplete markets and aggregate demand* (No. w21448). National Bureau of Economic Research.