Macroeconomics III

Professors: Emircan Yurdagul and Felix Wellschmied

UC3M

August 30, 2016

Dates. Tuesday and Thursday 16:15 to 17:45, and Friday 18:30-20:00. Final Exam: TBA.

Objective. The objective of the course is to introduce the modeling of heterogeneous agents economies, learn about economies with incomplete markets and uninsurable risk. The typical agent in our analysis will be a household or a worker, though we will devote some attention also to studying the behavior of firms and governments in similar settings.

In the first part of the course, the student will familiarize with a few highly influential models of incomplete markets. Workers face idiosyncratic risk and, crucially, have no access to a full set of Arrow-Debreu securities to insure against the risk. Students will learn how to characterize the stationary equilibrium in these economies and review some of the numerical methods used to solve heterogeneous agents economies with incomplete markets. Computational efficiency is key in solving this class of models. The second part of the course presents various alternatives to solve this class of model. It also discusses how the model can be brought to the data. Finally the course studies the behavior of these models in the presence of aggregate risk.

Requirements. The course requires some basic knowledge of: (1) dynamic programming, (2) measure theory, (3) Markov chains, and (4) the use of Matlab. There are several references to refresh the basics of dynamic programming: a simple one is Chapter 3 in Ljungqvist and Sargent (2004) but the most complete source is Stokey and Lucas (1996). Its first chapter is a very easy help. For measure theory you can check Stokey and Lucas (1996, chapter 7) For Markov chains, a good reference is Ljungqvist and Sargent (2004, chapter 2). A very comprehensive treatment can be found in Stokey and Lucas (1996, chapter 8). A good reference for numerical methods is Heer and Maussner (2009).

Homework. Some of the homeworks will be computer based. It is recommended that you do the computer-based problem sets in pairs.

Grading. The final grade on the course will be based on:

1. Midterm (40%).
2. A final exam (60%).

Part I. The neoclassical growth model with heterogeneous agents.

1. Introduction
2. Theoretical Framework
   - The neoclassical stochastic growth model: recursive formulation.
     Brock and Mirman (1972) and Stokey and Lucas (1996, chapter 1).
   - The heterogeneous agents model in steady state.
     Huggett (1993) and Aiyagari (1994). For a textbook exposition see Ljungqvist and Sargent (2004, chapters 16 and 17).
3. Data
   - Stylized facts on inequality.
     Budria Rodriguez, Diaz-Gimenez, Quadrini, and Rios-Rull (2002), Krueger, Perri, Pistaferri, and Violante (2010) and Heathcote, Perri, and Violante (2010).
   - The importance of uninsurable idiosyncratic shocks and precautionary savings.
     Carroll and Samwick (1998), Storesletten, Telmer, and Yaron (2004) and Kaplan and Violante (2010) .

Part II. Numerical methods applied to heterogeneous agents economies.

1. Introduction: basic concepts on numerical solutions.
2. Solving the household problem
   - Value and policy function iteration.
   - Finding the stationary distribution: simulation vs. distribution function iteration.
3. Finding the steady state equilibrium. Aiyagari (1994) and Rios-Rull (1997)

Part III. Firm Dynamics.

1. Basic theory of entry and exit. Hopenhayn (1992)

2. Financial frictions and misallocation. Midrigan and Xu (2014), Buera and Shin (2013), **?**
3. Entrepreneurship and wealth distribution. Quadrini (2000), Cagetti and De Nardi (2006)

Part IV. Models with Default.

1. Theoretical framework
   (a) Household default. Athreya (2002), Chatterjee, Corbae, Nakajima, and Rios-Rull (2007)
   (b) Sovereign default. Arellano (2008), Aguiar and Gopinath (2006), Hatchondo and Martinez (2009), **?**
2. Numerical analysis
   - Approximating AR(1) processes. Tauchen and Hussey (1991), Kopecky and Suen (2010)
   - Discrete search
   - Solving Arellano (2008).

Part V. Being smart in *Matlab*.

1. Understanding the *Matlab* structure.
2. Basic numerical techniques.

Part VI. Revisiting the household problem.

1. Golden section search (Heer and Maussner 2009) Chapter 11.
2. Multigrid (Tsao and Tsitsiklis 1991).
3. Different versions of endogenous grid points (Barillas and Fernandez-Villaverde 2007), (Hintermaier and Koeniger 2010).
4. Projection (Judd 2001).
5. Parallelizing your code.

Part VII. Job search models and law of one price.

1. Wage risk and employment risk: (Low, Meghir, and Pistaferri 2010).

2. Frictional wage dispersion: (Tjaden and Wellschmied 2014).

Part VIII. Life-cycle structure.

1. Aiyagari economy with finite life (Kaplan and Violante 2010).
2. Search model with finite life: (Low, Meghir, and Pistaferri 2010).

Part IX. Parameterization.

1. Calibration and solvers.
2. GMM estimation (Matyas 1999), (Hryshko 2012).
3. Simulated method of moments.

Part X. Heterogeneity and aggregate risk.

1. Aiyagari with aggregate uncertainty: (Smith and Krusell 1998).
2. Investment decisions with aggregate uncertainty: (Khan and Thomas 2003).

References

Aguiar, M., and G. Gopinath (2006): "Defaultable debt, interest rates and the current account," *Journal of International Economics*, 69, 64–83.

Aiyagari, S. R. (1994): "Uninsured Idiosyncratic Risk and Aggregate Saving," *The Quarterly Journal of Economics*, 109(3), 659–684.

Arellano, C. (2008): "Default Risk and Income Fluctuations in Emerging Economies," *American Economic Review*, 98(3), 690–712.

Athreya, K. B. (2002): "Welfare implications of the Bankruptcy Reform Act of 1999," *Journal of Monetary Economics*, 49(8), 1567–1595.

Barillas, F., and J. Fernandez-Villaverde (2007): "A Generalization of the Endogenous Grid Method," *Journal of Economic Dynamics and Control*, 31(8), 2698–2712.

Brock, W. A., and L. J. Mirman (1972): "Optimal economic growth and uncertainty: The discounted case," *Journal of Economic Theory*, 4(3), 479–513.

Budria Rodriguez, S., J. Diaz-Gimenez, V. Quadrini, and J.-V. Rios-Rull (2002): "Updated facts on the U.S. distributions of earnings, income, and wealth," *Quarterly Review*, (Sum), 2–35.

Buera, F. J., and Y. Shin (2011): "Self-insurance vs. self-financing: A welfare analysis of the persistence of shocks," *Journal of Economic Theory*, 146(3), 845–862.

——— (2013): "Financial Frictions and the Persistence of History: A Quantitative Exploration," *Journal of Political Economy*, 121(2), 221 – 272.

Cagetti, M., and M. De Nardi (2006): "Entrepreneurship, Frictions, and Wealth," *Journal of Political Economy*, 114(5), 835–870.

Carroll, C. D., and A. A. Samwick (1998): "How Important Is Precautionary Saving?," *The Review of Economics and Statistics*, 80(3), 410–419.

Chatterjee, S., D. Corbae, M. Nakajima, and J.-V. Rios-Rull (2007): "A Quantitative Theory of Unsecured Consumer Credit with Risk of Default," *Econometrica*, 75(6), 1525–1589.

Chatterjee, S., and B. Eyigungor (2012): "Maturity, Indebtedness, and Default Risk," *American Economic Review*, 102(6), 2674–99.

Hatchondo, J. C., and L. Martinez (2009): "Long-duration bonds and sovereign defaults," *Journal of International Economics*, 79(1), 117–125.

Heathcote, J., F. Perri, and G. L. Violante (2010): "Unequal We Stand: An Empirical Analysis of Economic Inequality in the United States: 1967-2006," *Review of Economic Dynamics*, 13(1), 15–51.

Heer, B., and A. Maussner (2009): *Dynamic General Equilibrium Modeling Computational Methods and Applications*. Springer.

Hintermaier, T., and W. Koeniger (2010): "The method of endogenous gridpoints with occasionally binding constraints among endogenous variables," *Journal of Economic Dynamics and Control*, 34(10), 2074–2088.

Hopenhayn, H. A. (1992): "Entry, Exit, and Firm Dynamics in Long Run Equilibrium," *Econometrica*, 60(5), 1127–50.

Hryshko, D. (2012): "Labor Income Profiles are not Heterogeneous: Evidence from Income Growth Rates," *Quantitative Economics*, 3(2), 177–209.

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

Judd, K. (2001): "Projection Methods for Functional Problems," *NAKE Workshop*.

Kaplan, G., and G. L. Violante (2010): "How Much Consumption Insurance beyond Self-Insurance?," *American Economic Journal: Macroeconomics*, 2(4), 53–87.

Khan, A., and J. K. Thomas (2003): "Nonconvex Factor Adjustments in Equilibrium Business Cycle Models: Do Nonlinearities Matter?," *Journal of Monetary Economics*, 50(2), 331–360.

Kopecky, K., and R. Suen (2010): "Finite State Markov-chain Approximations to Highly Persistent Processes," *Review of Economic Dynamics*, 13(3), 701–714.

Krueger, D., F. Perri, L. Pistaferri, and G. L. Violante (2010): "Cross Sectional Facts for Macroeconomists," *Review of Economic Dynamics*, 13(1), 1–14.

Ljungqvist, L., and T. Sargent (2004): *Recursive Macroeconomic Theory*. MIT Press, second edn.

Low, H., C. Meghir, and L. Pistaferri (2010): "Wage Risk and Employment Risk over the Life Cycle," *American Economic Review*, 100(4), 1432–1467.

Matyas, L. (1999): *Generalized Method of Moments Estimation*. CUP Cambridge.

Midrigan, V., and D. Y. Xu (2014): "Finance and Misallocation: Evidence from Plant-Level Data," *American Economic Review*, 104(2), 422–58.

Quadrini, V. (2000): "Entrepreneurship, Saving and Social Mobility," *Review of Economic Dynamics*, 3(1), 1–40.

Rios-Rull, J.-V. (1997): "Computation of equilibria in heterogeneous agent models," Discussion paper.

Smith, A. A., and P. Krusell (1998): "Income and Wealth Heterogeneity in the Macroeconomy," *Journal of Political Economy*, 106(5), 867–896.

Stokey, N., and R. Lucas (1996): *Recursive methods in economic dynamics*. Harvard Univ. Press, Cambridge, Mass. [u.a.], 4. print edn.

Storesletten, K., C. I. Telmer, and A. Yaron (2004): "Consumption and risk sharing over the life cycle," *Journal of Monetary Economics*, 51(3), 609–633.

Tauchen, G., and R. Hussey (1991): "Quadrature-Based Methods for Obtaining Approximate Solutions to Nonlinear Asset Pricing Models," *Econometrica*, 59(2), 371–96.

Tjaden, V., and F. Wellschmied (2014): "Quantifying the Contribution of Search to Wage Inequality," *American Economic Journal: Macroeconomics*, 6(1), 134–161.

Tsao, C.-S., and J. Tsitsiklis (1991): "An Optimal One-Way Multigrid Algorithm for Discrete Time Stochastic Control," *IEEE Transaction on Automatic Control*, 36(8), 898–914.