Quantitative Macroeconomics, 2023-24, Term III

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Purpose: This course introduces the techniques of modern quantitative macroeconomics to study economies with either (a) household heterogeneity – with a special focus on the life cycle dimension – or (b) firm heterogeneity – with a special focus on firm dynamics. One important aspect of the course is the emphasis on learning how to solve these economies in the computer. To this end, there will problem sets that will guide you to solve the canonical models of Aiyagari (1994) and for the household heterogeneity part, and Hopenhan ad Rogerson (1993) for the firm heterogeneity part.

Material: Students are expected to have an understanding of basic Arrow-Debreu model with uncertainty, OLG models, the one-sector growth model, and real business cycle models covered in Macro I and II. For this course, the main tools you need to understand are: (1) dynamic programming, (2) a little bit of measure theory, and (3) Markov chains. We will cover these material in the initial weeks. A comprehensive treatment can be found in Stokey, Lucas and Prescott (1989).

The course will be mainly based on Lecture Notes and published or unpublished articles. You can find a nice treatment of several topics that we will cover in this course in Recursive Macroeconomic Theory by Lars Ljungqvist and Thomas Sargent (2012). The course will not, however, follow any particular textbook. Regarding numerical methods, easy introductions can be found in (Adda and Cooper, 2003, chapter 3) and (Ljungqvist and Sargent, 2004, chapter 4). In depth coverage of some very useful methods for economists can be found in Marimon and Scott (1999). Judd (1998) is a comprehensive reference. Finally, Heer and Maussner (2009) and Fehr and Kindermann (2018) are recent textbooks also worth looking at.

Requirements: In addition to readings and class participation, your grade will be based on assignments (20%), reading group sessions (10%), and a final (70%). There will be two types of questions: computer-based and paper-and-pencil. Computer-based quetsions have to be solved in (stable) teams of two, but only one copy per team needs to be handed in. Paper-and-pencil questions follow the standard rules: you can work in teams, but every student is responsible for submitting her own solutions. Problem sets will be typically discussed in class on the date of submission.

During the course you will have to do a substantial amount of programming. Students taking a course like this at CEMFI and elsewhere tend to use Julia or Matlab. I assume you are already familiar with Matlab. There will be a voluntary extra session on Julia during the first week.

We reserve 3 sessions to discuss recent papers that relate to the topics covered in the course. Students will have to read the papers in advance, and a few students will be asked to present the papers.

Preliminary Outline

Part I: Building Tools (Lecture Notes I), 3 sessions

1. Dynamic Programming
2. The neoclassical stochastic growth model: recursive formulation of the competitive equilibrium.

   Readings: Brock and Mirman (1972).

Part II: Heterogenous Household Models (Lecture Notes I), 3 sessions

1. What the RA Agent model cannot do?
2. Facts on Inequality
3. The inter-temporal consumption problem
   - The permanent income hypothesis
   - Uncertainty and the random walk
   - Uncertainty and precautionary savings
4. The heterogeneous agents model in steady state.

   Readings on facts: Heathcote, Perri, Violante (2010), Heathcote, Perri, Violante, and Zhang (2023), Kuhn and Rios-Rull (2016).

   Readings on heterogeneous hosuehold models: Deaton (1991), Aiyagari (1994), Huggett (1993).

Part III: Numerical Methods, 3 sessions

1. Solving the household problem
   - Discreet state space, value function iterations
   - Projection methods

- A simple application: policy function iteration w/ piecewise linear approximation

2. Finding the steady state equilibrium.

   - Finding the stationary distribution: Montecarlo simulation
   - Finding the equilibrium prices

3. Accuracy

4. Solving non-linear equations

Part IV: Extensions of the Basic Heterogenous Household Models (Lecture Notes III), 3 sessions

1. Life cycle

2. Endogenous labor

3. Discrete choices with extreme value shocks

4. Outside the Steady State

   Readings: Huggett (1994), Hubberd, Skinner and Zeldes (1995), Storesletten, Telmer, Yaron (2004), Pijoan-Mas (2006), Domeij and Floden (2006), Krusell and Smith (1998), Rios-Rull (1998), Krusell and Smith (2006), Boppart et al. (2018).

Part V: Income Processes (Lecture Notes IV), 2 sessions

1. The standard income process and the evolution of earnings inequality

2. Heterogeneous income profiles

3. Non-linear earnings processes

4. Endogenous earnings

   Readings: Storesletten, Telmer, Yaron (2004), Guvenen (2007, 2009), Guvenen et al. (2021), Arellano et al. (2017), Huggett et al (2011).

Part VI: Wealth Inequality (Lecture Notes V), 2 sessions

1. Some facts
2. Non-linear earnings
3. Heterogenous returns to savings

   Readings: Kuhn and Rios-Rull (2016), Castaneda et al. (2003), De Nardi et al. (2020), Angeletos (2007), Hubmer et al. (2021)

Part VII: Firm Heterogeneity (Lecture Notes VI), 4 sessions

1. Some data
2. Entrepreneurship
3. Firm dynamics
4. Misallocation
5. Financial frictions

   Readings on facts: Bartelsman, Haltiwanger, Scarpetta (2009), Davis, Faberman, Haltiwanger (2006).

   Readings on firm heterogenity and dybamics: Lucas (1978), Hopenhayn (1992), Hopenhayn and Rogerson (1993), Guner, Ventura and Xi (2008), Restuccia and Rogerson (2008), Hsieh and Klenow (2009), Moll (2014), Hopenhayn (2014a, b), Midrigan and Xu (2014), Bento and Restuccia (2019).

Part VIII: Reading Groups, 3 sessions

1. Taxes and Transfers

    1. Daruich, Diego, and Raquel Fernández. 2024. "Universal Basic Income: A Dynamic Assessment." American Economic Review, 114 (1): 38-88.
    2. Ferriere, Axelle, Philipp Grubener, Gaston Navarro, and Oliko Vardishvili (2023): "On the Optimal Design of Transfers and Income-Tax Progressivity," *Journal of Political Economy Macroeconomics* 1(2): 276-333

2. Health

    1. Hosseini, Roozbeh and Kopecky, Karen A. and Zhao, Kai (2021): "How Important Is Health Inequality for Lifetime Earnings Inequality?" FRB Atlanta Working Paper No. 2021-1.
    2. Mahler, Lukas and Minchul Yum (2023): "Lifestyle Behaviors and Wealth-Health Gaps in Germany," Working Paper, University of Southampton.

3. Households

    1. Margherita Borella, Mariacristina De Nardi, and Fang Yang (2023): "Are Marriage-Related Taxes and Social Security Benefits Holding Back Female Labour Supply?" *Review of Economic Studies,* 90, 102–131.
    2. Sang Yoon (Tim) Lee and Ananth Seshadri (2019) "On the Intergenerational Transmission of Economic Status" *Journal of Political Economy* 2019 127:2, 855-921.

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