Econ 8240

Quantitative Macro

Mon 4.00-6.50pm

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Course Description: This class follows from what you learn about Macro in the first year. The goal of this course is to (1) introduce the basics tools of modern quantitative macroeconomics, and (2) help students to start working on quantitative macro. Applications include models with rich heterogeneity across agents and firms, aggregate fluctuations, and transitional dynamics. **This course will require intensive computational work by students.** Some knowledge of computer programming will be useful. If you do not know how to program you will need to work harder. You are free to use whatever programming language you like. I recommend Julia or Python.

Text(s): We will use several lecture notes available online. However, a good reference that covers most of the material is:

- "Dynamic General Equilibrium Modeling: Computational Methods and Applications," by Burkhard Heer and Alfred Maussner.
- "Applied Computational Economics and Finance," by Mario J. Miranda and Paul L. Fackler.
- "Economic Dynamics: Theory and Computation," by John Stachurski.

Assignments and Collaboration Policy

- **Independent work:** Each is expected to complete each assignment independently.
- **Collaborative verification:** Classmates can compare their solutions, check for discrepancies, and discuss who is making the mistake when answers differ. This process is designed to strengthen understanding by forcing each student to explain their reasoning clearly.
- **Learning benefit:** Collaboration is meant to serve as a check on your own reasoning and as an opportunity to learn from your partner's approach. Explaining your solution to someone else and debating differences are among the most effective ways to deepen comprehension and catch misunderstandings.

- **AI help:** Use AI as a 24/7 tutor. You are responsible for your submission and should be able to explain the code.

Grade Distribution: Your grade will be based on:

- Homework assignments: 60% of the grade.
- In-class presentation of assignments: 20% of the grade.
- Final project: 20% of the grade.

Attendance is expected at each class.

Detailed description of the plan starts on the next page.

Week	Content
#1, 8/24	**Introduction and deterministic growth model** • Why do we do quantitative macroeconomics? • Programming tips. • Bisection and Newton methods. • Deterministic Growth Model. • Extended Path Method. • Assignment: HW1 distributed.
#2, 8/31	**Stochastic growth model** • Discrete-State-Space Dynamic Programming Problem. • Value function iteration with discretization. • Ways to speed-up the algorithm • Greenwood, Hercowitz, and Huffman (1988). • Computing the model's statistics • HW1 due. Assignment: HW2 distributed.
9/7	No class. Labor day.
#3, 9/14	**Households heterogeneity in macroeconomics** • Motivation: Krueger, Mitman, and Perri (2016). • Macro-micro facts: Kuhn and Rios-Rull (2016). • Data sets. SFC. • Discretization of income processes. • HW2 due and HW3 distributed.
#4, 9/21	**The income-fluctuation problem** • Policy function iteration. 5 alternative methods. • Non-iterative methods. • Accuracy. • Numerical integration. • HW3 due. Assignment: HW4 distributed.
#5, 9/28	**Sovereign default models** • Setup: Arellano (2008) and Aguiar and Gopinath (2006). • Methods matter: Hatchondo, Martinez, and Sapriza (2010). • Discrete choice: Dvorkin, Sánchez, Sapriza, and Yurdagul (2021). • HW4 due. Assignment: HW5 distributed.
10/5	No class. Fall Break.

#6, 10/12	**Stationary Distribution, GE, and applications** • Monte Carlo and the invariant density function. • Rios-Rull: "Computation of Equilibria in Het Agent Models" • Applications: Kaplan and Violante (2021) • HW5 due. Assignment: HW6 distributed.
#7, 10/19	**Consumer Finance** • Parallel Computing • Livshits, MacGee, and Tertilt (2007), Chatterjee, Corbae, Nakajima, and Ríos-Rull (2007). • Athreya, Mustre-del Río, and Sánchez (2019), Braxton, Chikhale, Herkenhoff, and Phillips (2024). • HW6 due. Assignment: HW7 distributed.
#8, 10/26	**Idiosyncratic and aggregate risk** • "MIT shocks". Transitions. IRF. • Boppart, Krusell, and Mitman (2018). • GE with Aggregate Fluctuations. • Krusell and Smith. (1998). • Sequence-Space Jacobian Method. • Auclert, Bardóczy, Rognlie, and Straub (2021). • Birinci, Karahan, Mercan, and See (2022) • HW7 due. Assignment: HW8 distributed.
#9, 11/2	**Firms Heterogeneity in Macroeconomics** • Facts: Cabral and Mata (2003), Sterk, Sedláček, and Pugsley (2021). • Midrigan and Xu (2014). • Setup: Hopenhayn (1992), Hopenhayn and Rogerson (1993). • Applications: Hopenhayn et al. (2022), Karahan et al. (2019). • HW8 due. Assignment: HW9 distributed.
#10, 11/9	**Firms, Finance, and Default** • Hennessy and Whited (2005). • Hennessy and Whited (2007). • Gomes and Schmid (2010). • Clementi and Palazzo (2016). • e Castro et al. (2021). • HW9 due. Assignment: HW10 distributed.

#11, 11/16	**Intro to solving continuous-time models** • Numerical Differentiation. • Manuelli and Sánchez (2019). • Rules for *3-week final project* discussed. • Presentation Tips. • HW10 due. Assignment: Prepare a *Final Project proposal*.
#11, 11/23	**Final projects proposals** • 20' presentation by each group about the final project's proposal. • Assignment: Continue working on *Final Project*.
#12, 11/30	**Meetings about final project** • 30' meeting with each group about progress with the final project. • Assignment: Continue working on *Final Project*.
# 13. 12/7	**Final project presentations**
# 14. 12/14	**Submit final project**

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