Universidad Carlos III de Madrid
Department of Economics

Master in Economic Analysis (Ph.D.), 1st year
Macroeconomics II

Second Semester 2020-2021

Professor: Matthias Kredler
Office: 15.2.10
Email: mkredler@eco.uc3m.es
Teaching Assistant (TA): Fernando Riveiro

Aim: This course has three major aims:

1. get you acquainted with the non-stochastic and stochastic versions of the neoclassical growth model and the consumption-savings problem, two of the main workhorses of modern macroeconomics,

2. get you acquainted with *Dynamic Programming*, a powerful tool for solving dynamic optimization problems,

3. get you acquainted with a set of models that are important in modern macroeconomic theory (cyclical fluctuations; the New-Keynesian model, and the search-and-matching model).

Readings: Apart from typed lecture notes provided on my website, you may consider the following sources (if you feel you need more material): We will cover material from the first six chapters of *Recursive Methods in Economic Dynamics* by Stokey, Lucas, with Prescott (SLP), Harvard University Press (1989). These six chapters cover non-stochastic dynamic programming problems. As math supplements to Stokey, Lucas, with Prescott, you may find it helpful to consult *A First Course in Optimization Theory*, by R. Sundaram, Cambridge University Press (1996). Another good reference is *Recursive Macroeconomic Theory* by Lars Ljungqvist and Thomas Sargent (LS), MIT Press (2004). For the part of the New Keynesian model, the reference is *Monetary Policy, Inflation, and the Business Cycle* by Jordi Galí, Princeton University Press (2008).
Grading: Assignments (20%), midterm exam (30%), final exam (50%).

Please check my web page `www.eco.uc3m.es/mkredler` for announcements, problem sets etc.

Course Outline

1. Dynamic Programming under Certainty
   (a) Bellman Equations: The recursive approach to finite-horizon and infinite-horizon problems (Sundaram ch. 11)
      i. Mathematical Preliminaries: Metric Spaces, The Banach Fixed-Point Theorem, Berge's Maximum Theorem (SLP ch. 3, Sundaram ch. 12)
      ii. Basic results: Bellman's Principle of Optimality, Blackwell's Sufficient Conditions, properties of value and policy functions (SLP ch. 4-5, Sundaram ch. 12)
   (b) Applications:
      i. Consumption-savings model
      ii. Neo-classical growth model (LS ch. 11)
      iii. McCall search model
   (c) Comparison to the Lagrangian approach: Euler equations and transversality conditions
2. Dynamic Programming under Uncertainty
   (a) Stochastic version of one-sector growth model and consumption-savings problem
   (b) History-contingent formulation: Euler Equations in general stochastic environments.
   (c) Recursive Competitive Equilibrium (LS ch. 12)
3. Continuous-time dynamic programming
   (a) The Hamiltonian-Jacobi-Bellman (HJB) equation and Euler Equations
   (b) Connection to Pontryagin's Maximum Principle

(c) Introducing Uncertainty: Poisson Processes

4. Solving dynamic stochastic general equilibrium (DSGE) models with an application to the real-business-cycle (RBC) model

   (a) Real-business-cycle (RBC) model

   (b) Solving dynamic stochastic general-equilibrium (DSGE) models by linearization: The method of undetermined coefficients

   (c) Connection to vector auto-regressions (VARs)

   (d) Blanchard & Kahn's stability conditions

   (e) Computation by *Dynare*

5. Monetary policy: The New-Keynesian Model (Galí, Ch. 3 and 4)

   (a) Setup

   (b) Nominal rigidities: Calvo pricing

   (c) New-Keynesian Phillips Curve and Dynamic IS Curve

   (d) Analysis of monetary policy: The Taylor Principle

6. Search-and-matching: The Mortensen-Pissarides model (LS ch. 26.3)

   (a) Matching functions

   (b) Nash Bargaining

   (c) Stationary equilibrium: job-creation curve and wage curve

   (d) Efficiency: The Hosios condition

   (e) Determinants of unemployment and policy analysis