

Universidad Carlos III de Madrid  
Department of Economics

Master in Economic Analysis (Ph.D.), 1st year  
Macroeconomics II  
Second Semester 2018-2019

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**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:** 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). There will also be a set of lecture notes by Nezh Guner, referred to below as NG, and my own lecture notes on continuous-time material. 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](http://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 (NG ch. 6.1-6.2, Sundaram ch. 11)
    - i. Mathematical Preliminaries: Metric Spaces, The Banach Fixed-Point Theorem, Berge's Maximum Theorem (NG ch. 7, SLP ch. 3, Sundaram ch. 12)
    - ii. Basic results: Bellman's Principle of Optimality, Blackwell's Sufficient Conditions, properties of value and policy functions (NG ch. 8-10, SLP ch. 4-5, Sundaram ch. 12)
  - (b) Applications:
    - i. Consumption-savings model
    - ii. Neo-classical growth model (NG ch. 6.2, LS ch. 11)
    - iii. McCall search model
  - (c) Comparison to the Lagrangian approach: Euler equations and transversality conditions
2. Dynamic Programming under Uncertainty (NG, Chapter 12).
  - (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 (NG ch. 12.6, LS ch. 12)
3. Continuous-time dynamic programming (own lecture notes)
  - (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