Dynamic Methods in Macroeconomics

Lectures: 25 hours
Excercises: 3x2 hours
Prerequisites: Macroeconomic theory

Description

The aim of the course is to provide a solid overview of recursive methods and familiarize students with their use in macroeconomics. The course focuses mainly on discrete time dynamic programming and its economic applications. A brief sketch on continuous time optimization models will be given. The course covers numerical methods for solving dynamic optimization problems.

Main Text books

N. Stokey and R. Lucas with E. Prescott. Recursive methods in economic dynamics. Harvard University Press, 1989. (SLP)
L. Ljungqvist and T. Sargent. Recursive macroeconomic theory. MIT Press, 2000. (LS)

Course Requirements and Exams

Final grade consists of exam and exercise points. Exercises are not mandatory for passing the course but the exercise points determine 25 % of the final grade.

Preliminary course outline

I Theory of dynamic programming

1. Introduction to dynamic programming
Example: optimal growth
Sequential formulation vs. recursive formulation
Idea of solving
Material: SLP chapter 2

2. Mathematical background
Normed vector spaces
Correspondences
Contraction mapping theorem, Blackwell's theorem
Material: SLP chapter 3

3. Principle of optimality
Formal analysis of the dynamic programming problem
Bellman equation, one-shot deviation principle
Solving by value function iteration and policy iteration
Euler equations
Material: SLP chapter 4

4. Stochastic dynamic programming
Introduction to Markov processes
Principle of optimality for stochastic problems
Necessary and sufficient optimality conditions
Principle of certainty equivalence
Material: SLP chapters 8 and 9, LS chapters 1 and 2

II Applications

5. Growth (different variants), investment, inventory, etc.
Material: SLP chapter 5, LS chapter 11

6. Competitive storage
Material: Deaton, A., and G. Laroque, On the Behaviour of Commodity Prices, Review of Economics Studies, 59, 1992

7. Job search and optimal stopping
Material: J. J. McCall, Economics of Information and Job Search, The Quarterly Journal of Economics, 84(1), 1970, SLP 10, LS chapter 5 (pp. 81—94)

8. Self-Enforcing Contracts
Thomas, J., and T. Worrall. Self-Enforcing Wage Contracts, Review of Economic Studies, 55 (4), 1988

II Numerical dynamic programming

8. Numerical methods
Numerical optimization
Function approximation
Introduction to Matlab
Material: LS chapter 3

9. Practical dynamic programming
Dynamic programming algorithm
Implementing value function and policy iterations
Introduction to CompEcon/Matlab
Material: LS chapter 3

III Continuous Time Models

10. Bellman equation for continuous time models
Pontryagin's maximum principle
Economic growth in continuous time, Tobin's q
D. Acemoglu. Introduction to Modern Economic Growth. 2007 (Section 7.3)

11. Application: Kiyotaki-Wright model in continuous time
Material: Kiyotaki, N., and R. Wright, A Search-Theoretic Approach to Monetary Economics, American Economic Review, 83(3), 1993