Recursive Methods

Fall 2005

Instructor: Prof. Emilio Espino
Meetings: Monday, 09:00 – 12:00
Office Hours: By appointment.
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Course description

The purpose of this course is to develop recursive methods as a tool for the study of dynamic economies. We start by covering deterministic and stochastic dynamic optimization using dynamic programming analysis. There we will study the corresponding prototype examples. Then, as much as time permits, we additionally apply these techniques to study competitive economies regarding welfare theorems, existence issues, etc.

The main reference for the course (hereafter, SLP), which we will follow as close as possible:


When considered fundamental, we will add some additional readings to study more recent developments and applications.

Finally, although I consider that the numerical implementation of the analytical methods to be developed in this course is a fundamental step for modern quantitative analysis, those issues are beyond the scope of this class.
1. **Introduction to Recursive Methods (1 week).**

1.1. *The Celebrated Neoclassical One-Sector Optimal Growth Model* as the Leading Example.

1.2. Finite Horizon Problems: Educated Guesses for Closed Form Solutions.
   - SLP Ch. 2.

2. **Mathematical Preliminaries (2 weeks)**


2.2. Complete Metric Spaces and The Contraction Mapping Theorem.

2.3. Continuity and the Maximum Theorem.

   - SLP Ch. 3.

3. **Dynamic Programming I: Bounded Returns (4 weeks)**

   - SLP Ch. 4.5 and 9.5.

   - SLP Ch. 4.1 and 9.1.
3.3. Existence, Uniqueness, Continuity, Concavity and Differentiability of the Value Function.

- SLP Ch. 4.2 and 9.2.


- SLP Ch. 5.1 and 10.1.

4. **Dynamic Programming II: Unbounded Returns.**
   (2 weeks)

4.1 Homogenous Dynamic Programming.


4.2 More on Unbounded Returns.


4.3 Application: The AK Growth Model.

5. **The Power of Recursive Methods: Some Applications.**
   (2 weeks)

5.1 Pareto Optima and Competitive Equilibria: The Fundamental Welfare Theorems.


- SLP Ch. 15.


5.3 Application: Recursive Competitive Equilibrium, Heterogeneous Households and the Recursive Neguishi’s Approach.