Decision Making under Uncertainty

Content: This mini-course is intended to expose students to methods of decision making employed by companies facing uncertainty. These methods recognize the option value of waiting for better conditions and information. Since this option is easiest quantified when a company enjoys a property right over the option we will focus on the case of monopolists, i.e., owners of the right do not face competition. We will quantify uncertainty using the tools of stochastic processes which are based on Brownian motion and are extensively used in modern Economics and Finance. At the end of the mini-course a student will be able to quantify uncertainty and determine the value of a potential project as well as the optimal timing of the investment decision.

Instructor: Stathis Tompaidis, University of Texas at Austin, McCombs School of Business.

Schedule: 8 lectures of 75 minutes each.

Rooms and Times of Lectures: to be determined.

Prerequisites: In order to benefit from this course a student should be familiar with ordinary and partial differential equations.

Assignments: There will be 3 individual assignments to help the students practice their understanding of the material covered in the course. Solutions to the assignments will be provided. The first assignment will be handed out at the end of lecture 2. The second homework assignment will be handed out at the end of lecture 5. The last homework assignment will be handed out at the end of lecture 7.

Textbook: Investment under Uncertainty, by A. K. Dixit and R.S. Pindyck. In addition, notes will be handed out in class.
Detailed List of Topics

Review of Probability Theory and Stochastic Processes

Lecture 1
Random variables and their distributions, conditional expectation, Martingales

Lecture 2
Brownian motion, Ito’s Calculus, Stochastic Differential Equations, Feynman-Kac formula

Real Options

Lecture 3
Dynamic Programming, optimal stopping, smooth pasting, optimal abandonment

Lecture 4
Investment opportunities and investment timing

Lecture 5
Value of a project

Lecture 6
Entry, exit, lay-up and scrapping

Lecture 7
Sequential Investment

Lecture 8
Applications of Real Options: Investing on Highway infrastructure, Real Estate