1 Basic Information About The Course (First Half)

Instructors: Rody Manuelli, (email: manuelli@wustl.edu) and Costas Azariadis

Time and Location: T: 4-6:30 PM Seigle 103.

Office Hours: Wednesday 9:30-11 or by appointment.

Coverage: This syllabus corresponds to the first half (approximately seven weeks) of the course.

Textbooks: The lectures are divided in two parts. During the first couple of weeks we will briefly develop some results on dynamic stochastic optimization. The dynamic stochastic optimization material will be covered at the level of chapters 3 and 4 of the book *Investment Under Uncertainty (IUU)* by Avinash Dixit and Robert Pyndick, Princeton, 1994. Pretty much the same material is covered in the relevant chapters of *The Economics of Inaction* by Nancy Stokey (Princeton University Press, 2009). I will follow some notes (available online) that discuss the basic math results.

Given the emphasis on applications, I will not go into the derivations of the basic mathematical results, and I will state them without proof. I will follow a set of notes that extract the most useful results from several sources.

A. Optimal Control


B. Stochastic Calculus and Optimization

*Brownian Motion and Stochastic Flow Systems (BMSF)*, J. Michael Harrison, Krieger 1990


Truth in Advertising Statement:
This course emphasizes applications of optimal control and stochastic calculus to economics. The lectures will be self-contained. Since I do not know much about this subject there will be some rough spots. Moreover, since I will emphasize applications more than basic results, I will not go over most proofs.

Grading: I will assign homework problems and the grade will be the average grade in those problems with the last problem set receiving greater weight. Details will be discussed in class.

2 Topics (First Half)

This is a list of all possible topics. Given the time limits it is impossible to cover them all. I expect we will be able to discuss 1-8. A (*) indicates a paper that we will probably cover.

1. Background Material. IUU, chapters 1 and 2. (I will not cover this material. It is your responsibility to read the relevant chapters)

   - Stochastic Processes and Brownian Motion: Basic Results.
   - Stochastic Integration and Ito’s Lemma: Definitions and Results.
   - Stochastic Differential Equations and the Feynman-Kac Theorem.
   - Notes on Optimal Stopping and Smooth Pasting.
   - In addition, the material is covered in IUU. chapter 3, SCT (several chapters), as well as the other references. (Almost every book listed covers this topic. See, in particular, the appendix in BMSF.)

3. Options: Real and Financial. IUU (chapters, 5, 6, and 7), EI (chapters 4 and 5). Additional readings:
4. **Options: Strategic Exercise.**


5. **Neoclassical Investment**


6. **Consumption Dynamics**

7. The Impact of Fixed Costs on Consumption and Portfolios


8. Macro Models with Financial Sectors

- ———— and ————-, (2016),“Macro, Money and Finance: A Continuous Time Approach,” working paper (June) (*)


9. Capital Structure and Industry Equilibrium


10. Principal Agent Models


• Philippon, T. and Y. Sannikov, 2007, “Real Options in a Dynamic Agency Model, with Applications to Financial Development, IPOs, and Business Risk,” NBER working paper No 13584. (*)


11. Strategic Experimentation.


12. Search Models (to be completed)


13. Asset Pricing:

• Arbitrage Pricing: Market Price of Risk. Class Notes: Asset Pricing I.
• General Equilibrium: Lucas’ Tree Model. Class Notes: Asset Pricing II.
• General Equilibrium: Non-standard Preferences:
• Fixed Income Pricing: