1 Outline

The purpose of this course is to familiarize you with the techniques and models of aggregate dynamic economics. In this course we will spend a fair amount of time developing techniques for dynamic analysis and applying the results to the study of basic macroeconomic questions. The emphasis will be on the development of formal dynamic models, and in working out the implications that theory has for econometric practice. Since the purpose is to help you work with models and to develop skills that will let you use models to discuss economic issues the course will be of necessity “narrow.” That is, I will not cover a lot of topics, but I will try to cover them deeply. If you want a “broad survey” of the state of macro, this course is not for you.

1.1 Prerequisites

Even though we will discuss the basic material in class, it is absolutely necessary that you are familiar with basic notions of calculus, optimization and probability and statistics. This is a graduate course in economics.

1.2 Course Organization

Unfortunately, given the size of the class, all the sessions will be lecture style: I do most of the talking and you do most of the listening. However, I encourage you to read the assigned material ahead of schedule and to ask questions in class. Quite often I will ask for your ideas and your intuition. I
welcome your comments and questions. I really mean that. My experience is that questions help to present the material in a more illuminating manner. Don’t be shy.

There will be extra Review Sessions on days to be determined, if there is demand. These sessions are a good opportunity to ask more technical questions and to discuss exercises. In addition, some topics, will be mostly discussed in the review sessions.

There will be two exams. The first, will cover my half of the course and the second Professor Shin’s half.

Homework problems are important. If you are comfortable with them, you will not have any problems with the material. In solving homework problems I encourage you to work in groups. However, I expect you to turn in your own version of the answer. If your handwriting is not very good, please plan to type your homework. Even if you turn in all \( N \) homework problems, only \( N - 1 \) will be counted toward your grade. The homework with the lowest grade will be automatically dropped. The homework is due at the beginning of the lecture (or earlier). Late assignments will not be accepted.

Although I plan to make all major announcements/revisions to the schedule in class, I will assume that you all have an email account. There will be an email mailing list for the course which I will use for announcements about meetings, homework and other academic and administrative stuff. Email will be an “official” form of communication in this course. You should feel free to send me email with questions or concerns.

In addition, I will upload to Blackboard all the relevant materials.

1.3 Basic Materials

We will be using a variety of different sources. Initially, I will base my lectures on a set of notes (Notes on Discrete Time Dynamic Models: The Growth Model) that are available online. I will try to upload class notes before each lecture.

For the next topics we will use a combination of chapters from several books. The “major” book (and one that I strongly recommend) is Recursive Macroeconomic Theory by Lars Ljungqvist and Thomas Sargent.

There are other books that cover similar material. Among them, the better ones are Dynamic Macroeconomic Theory by Thomas Sargent, Harvard University Press (on reserve) and Macroeconomic Theory (by
T. Sargent) which deals with some basic stuff on stochastic models that is related to what we will cover.

At some point —starting with asset pricing— we will be using some notions of dynamic programming. The basic ideas will be covered in the discussion sessions by the TA. The required material is in the relevant chapters of Dynamic Macroeconomic Theory and Recursive Macroeconomic Theory.

If you would like to develop more expertise in dynamic problems as applied to macro, the best reference is the book by Nancy Stokey and Robert Lucas Recursive Methods in Economic Dynamics. This book, as well as the other books recommended for the course, will be on reserve. I will try to upload a copy of the class notes/slides that I will use in class at least a day before each lecture.

1.4 Norms and Expectations

I expect you to come to class and I will assume that you are aware of everything discussed in class, including announcements, changes in the schedule and so on. Please plan ahead and make sure that a classmate will get you copies of notes, handouts and any other material handed out in class. I will use email to announce major changes to the schedule. Please make sure that you check your email regularly

Administrative Details

- **Instructor**: Rody Manuelli (email: manuelli@wustl.edu)
  - Office: Seigle Hall 332.
  - email address: manuelli@wustl.edu
  - Office hours: Wednesdays 8:30-10 AM, or by appointment.

- **Instructional Assistant**: Chao, Ke
  - Office: Seigle 352
  - Office hours: Monday 3-5

- **Discussion Session**: Fridays 12Noon-1PM
Important Dates

Even though it is subject to change keep in mind the following important date.

• First Exam (Tentative): Wednesday October 18th from 5:00 to 8:00 PM.
2 Econ 501: Tentative Course Outline

(Version 1.0)

1. Introduction: Dynamic Optimization.

- Convex analysis
- Kuhn-Tucker theorem
- Necessary and sufficient conditions.
- Finite and infinite horizons
- Application: Two period economy.

Since some (most?) of this material has been covered in the math camp, we will rush through the basic ideas (and notation) as described in the set of lecture notes entitled Notes on Discrete Time Dynamic Models: The Growth Model, which can be downloaded from Blackboard.

Although adequate for the level of this course, the presentation falls short of what is required for serious research in dynamic economic theory. The following books are excellent treatments of the basic mathematical techniques at a level that is appropriate for graduate level studies.

A good source of “applied” (this means kind of sloppy) discussion of dynamic programming is in Bertsekas, D. (1987), Dynamic Programming: Deterministic and Stochastic Models, Prentice Hall. This book has an economic/operations research approach. Another brief introduction with economic applications is Sargent, T. (1987), Dynamic Macroeconomic Theory, Harvard University Press. For those of you who do not want to waste time and want to learn the hard stuff right on I suggest you read Stokey, N. L. and R. E. Lucas (with the collaboration of E. Prescott) (1989), Recursive Method in Dynamic Economics. It contains a fairly serious treatment of dynamic optimization (basically using an approach called dynamic programming) both deterministic and stochastic.

The analysis of Euler equations –and especially the linear quadratic case– is presented rather thoroughly in Sargent, T. J. (1987), Macroeconomic Theory.
In the first part of this course we will not be dealing with continuous time models. However, these are quite common in macroeconomics and it is a good investment to learn the techniques. A simple treatment that deals with the bare bones of a macro model is Blanchard, O. J. and S. Fischer (1987), Lectures in Macroeconomics, MIT Press. An alternative is Turnovsky, S. J. Methods of Macroeconomic Dynamics which also deals with stochastic models in continuous time. A user friendly (but still not very rigorous) book is Kamien, M. and N. L. Schwartz (1981) Dynamic Optimization: The Calculus of Variation and Optimal Control in Management and Economics, North Holland. Finally, for those interested in serious stuff I recommend Fleming, W. H. and R. W. Rishel (1975), Deterministic and Stochastic Optimal Control, Springer-Verlag.

For some topics (asset pricing, search) you will need to learn some basic ideas about dynamic programming. I will not cover this technique in class. The topic will be covered in the TA sections. A good (and simple) presentation can be found in both Dynamic Macroeconomic Theory and Recursive Macroeconomic Theory.

2. The Growth Model: A Planner’s Perspective.

- The one sector growth model.
- Steady state analysis.
- Dynamic paths.
- Tax and spending policies.
- Temporary and permanent shocks.
  - Acemoglu, D (2009), Modern Economic Growth, Princeton University Press, 2009, Chapters 5 and 6
3. The Growth Model: Competitive Equilibrium and the Planner’s Solution.

- Equivalence of the planner solution and the competitive equilibrium.
- Sequential budget constraints.
- The impact of budget deficits.
- The effect of alternative spending policies.
- Population growth
- Heterogeneous agents

- Acemoglu, D (2009), Modern Economic Growth, Princeton University Press, 2009, Chapters 5 and 6


4. Consumption and Asset Prices.

  • Consumption and income.
  • The permanent income theory of consumption.
  • Prices of state contingent commodities.
  • Stocks, bonds and derivatives.
  • Modigliani-Miller theorem.
  • Government debt and the Ricardian proposition.


5. Search and Matching Models.

- A Labor market model.
- General equilibrium search models.
- Coordination problems.
- Matching Models.


6. Monetary Models. (if we have time)

* Cash-in-Advance
* Monetary and Fiscal Policy
* Exchange Rates

