Econ 712 - Macroeconomic Theory

Instructor: Rody Manuelli
TA: Kyoung Jin Choi
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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 traditional 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. There will be Review sessions on days to be determined. 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 a midterm exam that will cover the first half of the course and several homework problems. The second half of the course will be taught by Prof. Steven Durlauf.

I encourage you to work in groups when solving homework problems. 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 11:00 AM 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 you may want to check the course's homepage on Internet. The address is http://www.ssc.wisc.edu/~manuelli/712/712f06.htm. At this location you will find lecture notes, homework problems and a lot of other fun stuff.

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 can be accessed at the following Internet address (http://www.ssc.wisc.edu/~manuelli/712/712f07.htm).

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. This book should be available at the bookstore and will be used in Econ 714.

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 at the Helen C. White Library.

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
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  - Office: Social Science 6443
  - Phone number: 262-4894
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  - Office hours: Wednesdays 1:00 - 2:30, or by appointment.
- Discussion Sessions
  - Friday 8:50-9:40: 6314 Social Science
  - Friday 11:00 - 11:50: 6116 Social Science
  - Note: Subject to capacity constraints, you may come to either session. The material covered will be the same

Important Dates

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

- First Half Exam (Tentative): Saturday October 20th from 9:00 to 12:00.

1.5 Grievance Procedure

The Department of Economics has developed a grievance procedure through which you may register comments or complaints about a course, an instructor, or a teaching assistant. The Department continues to provide a course evaluation each semester in every class. If you wish to make anonymous complaints to an instructor or teaching assistant, the appropriate vehicle is the course evaluation. If you have a disagreement with an instructor or a teaching assistant, we strongly encourage you to try to resolve the dispute with him or her directly. The grievance procedure is designed for situations where neither of these channels is appropriate. If you wish to file a grievance, you should go to room 7114 Social Science and request a Course Comment Sheet. When completing the comment sheet, you will need to provide a detailed statement that describes what aspects

of the course you find unsatisfactory. You will need to sign the sheet and provide your student identification number, your address, and a phone where you can be reached. The Department plans to investigate comments fully and will respond in writing to complaints.

Your name, address, phone number, and student ID number will not be revealed to the instructor or teaching assistant involved and will be treated as confidential. The Department needs this information, because it may become necessary for a commenting student to have a meeting with the department chair or a nominee to gather additional information. A name and address are necessary for providing a written response.

2 Econ 712: 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.

   The basic reference that I will use is the set of lecture notes entitled Notes on Discrete Time Dynamic Models: The Growth Model, which can be downloaded (it is a pdf file, so you will need the (free) Adobe Acrobat reader) at http://www.ssc.wisc.edu/~manuelli/712/712f07.htm

   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.
  - Manuelli, R (2007) **Notes on Discrete Time Dynamic Models: The Growth Model**.
  - Stokey, N.L. and R. E. Lucas (1989), **Recursive Methods in Economic Dynamics**, Harvard University Press.
  - Cass, D. (1965), "Optimum Growth in an Aggregative Model of Capital Accumulation", **Review of Economic Studies**, Vol 32, pp 233-240.
  - Brock, W. A. and L. J. Mirman (1972), "Optimal Economic Growth and Uncertainty: The Discounted Case", **Journal of Economic Theory**, Vol. 4, pp 479-513.
  - Sargent, T.J. (1987), **Macroeconomic Theory**, Academic Press.
  - Barro, R and X. Sala-i-Martin (1995), **Economic Growth**, McGraw Hill

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

- Manuelli, R (2007) **Notes on Discrete Time Dynamic Models: The Growth Model**.
- Ljungqvist, L. and T. Sargent, **Recursive Macroeconomic Theory**, chapters 7 and 9.
- McGrattan, E. and J. A. Schmitz, (1998), "Explaining Cross-Country Income Differences," Federal Reserve Bank of Minneapolis Staff Report 250, July. (http://research.mpls.frb.fed.us/research/sr/)
- Stokey, N.L. and R. E. Lucas (1989), **Recursive Methods in Economic Dynamics**, Harvard University Press.
- Cass, D. (1965), "Optimum Growth in an Aggregative Model of Capital Accumulation", **Review of Economic Studies**, Vol 32, pp 233-240.
- Brock, W. A. and L. J. Mirman (1972), "Optimal Economic Growth and Uncertainty: The Discounted Case", **Journal of Economic Theory**, Vol. 4, pp 479-513.
- Presscott, E. C. and R. J. Mehra (1980), "Recursive Competitive Equilibrium: The Case of Homogeneous Households", **Econometrica**, Vol. 48, No. 6, September.
- Sargent, T.J. (1987), **Macroeconomic Theory**, Academic Press.
- Barro, R and X. Sala-i-Martin (1995), **Economic Growth**, McGraw Hill

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.
  - Ljungqvist, L. and T. Sargent, **Recursive Macroeconomic Theory**, chapters 7 and 10.
  - Sargent, T. J. (1987), **Dynamic Macroeconomic Theory**, chapter 3, Harvard University Press.
  - Lucas, R. E. Jr (1978), "Asset Prices in an Exchange Economy", **Econometrica**, Vol. 46, pp 1429-1445.
  - Brock, W. A. (1982), "Asset Prices in a Production Economy", in J. J. McCall (ed) **The Economics of Information and Uncertainty**, University of Chicago Press.
  - Barro, R. E. (1974), "Are Government Bonds Net Wealth?", **Journal of Political Economy**, Vol 82, No. 6, pp 1095-1117.

- Mehra, R. J. and E. C. Prescott (1985), "The Equity Premium: A Puzzle", **Journal of Monetary Economics**, Vol. 15, No. 2, pp 335-359.
- Hansen, L. E. and K. J. Singleton (1983), "Stochastic Consumption, Risk Aversion, and the Temporal Behavior of Asset Returns", **Journal of Political Economy**, Vol. 91, No. 2, pp 249-265.
- Modigliani, F. and M. H. Miller (1958), "The Cost of Capital, Corporation Finance, and the Theory of Investment", **American Economic Review**, Vol. 48, No. 3, pp 261-297.
- Stiglitz, J. E. (1969), "A Reexamination of the Modigliani Miller Theorem", **American Economic Review**, Vol. 59, No. 5, pp 784-793.

5. Search Models.

- A Labor market model.
- General equilibrium search models.
- Coordination problems.
- Matching Models.
  - Ljungqvist, L. and T. Sargent, **Recursive Macroeconomic Theory**, chapters 5 and 19.
  - Sargent, T. J. (1987), **Dynamic Macroeconomic Theory**, chapter 2, Harvard University Press.
  - Lucas, R. E. and E. C. Prescott (1974), "Equilibrium Search and Unemployment", **Journal of Economic Theory**, Vol. 7, pp 188-209.
  - Jovanovic, B. (1979), "Job Matching and the Theory of Turnover", **Journal of Political Economy**, Vol. 87, No. 5, pp 972-990.
  - Diamond, P. A. (1981), "Mobility Costs, Frictional Unemployment, and Efficiency", **Journal of Political Economy**, Vol. 89, No. 4, pp 798-812.
  - Diamond, P. A. (1982), "Aggregate Demand Management in Search Equilibrium", **Journal of Political Economy**, Vol. 90, pp 881-894, October.
  - Pissarides, C (1990), **Equilibrium Unemployment Theory**, Basil Blackwell.

6. Monetary Models. (if we have time)

- Cash-in-Advance
- Money-in-the-Utility Theories.
- Monetary and Fiscal Policy

- Exchange Rates
  - Sargent, T. J. (1987), **Dynamic Macroeconomic Theory**, chapter 4, 5, and 6. Harvard University Press.
  - Ljungqvist, L. and T. Sargent, **Recursive Macroeconomic Theory**, chapters 17 and 18.
  - Burnside, C. M. Eichenbaum and S. Rebelo, (2003), "Exchange Rates and Fiscal Sustainability," working paper.