EC 744: Economic Dynamics

Prof. Jianjun Miao

Spring 2009

Schedule Thursday 5:30-8:30pm at CAS B20.

Office Hours Wednesday 4:30-6:00pm and Friday 4:30-6:00pm, or by appointment

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Course Overview This course introduces the theory and application of dynamic optimization and equilibrium analysis in discrete time. It aims at providing necessary techniques for graduate students to analyze economic dynamics. The topics focus on analyzing and solving discrete-time dynamic programming problems in economics and finance. We will put more emphasis on applications by solving many economic examples such as consumption/savings, investment, optimal growth, industry dynamics, job search, recursive utility, portfolio choice, and asset pricing. We will also study computational methods because they become important in economics and finance. We will focus on the discrete state space method (value function iteration) and the projection method. The best way to learn computational methods is learning-by-doing. Thus, students are expected to complete a computation project.

Course Web Site The class material (syllabus, lecture notes, announcements, problem sets, additional readings) will be posted on Course Info. In order to access the course web page you can go to http://courseinfo.bu.edu/courses/09sprggrsec744_a1/. You will be asked to login. Use your BU username and Kerberos password. You can also access the web page directly through Student Link (simply click the course button).

Textbooks Teaching will be based mostly on the textbook and my lecture notes. I will produce lecture notes that will be made available on the course web site. The following textbook are required, which can be purchased from internet bookstores such as Amazon or Barnes&Nobel.

- Stokey, N. and R.E. Lucas with E. Prescott, 1989, Recursive Methods in Economic Dynamics, Harvard University Press. (SLP)

The following books are highly recommended. You may find them from internet bookstores.

- Adda, J. and R. Cooper, 2003, Dynamic Economics: Quantitative Methods and Applications, The MIT Press.
- Judd, K., 1998, Numerical Methods in Economics, Cambridge, MA: MIT Press
- Lundquist, Lars and Thomas J. Sargent, 2004, Recursive Macroeconomic Theory, 2nd edition, MIT Press.
- Miranda, M.J. and P.L. Fackler, 2002, Applied Computational Economics and Finance, MIT Press.

Course Requirements and Grades Class attendance is required. There will be homework every two weeks. Students are required to read textbooks before each class, and are expected to actively participate in classes. The final course performance is based on the following weights:

- Class participation and presentation: 20%.

- Homework: 40%.
- Computation project: 40%. Due on May 6.

IMPORTANT It is your responsibility to plan your travel around exams dates. In particular, the date of the final exam is determined by the Registrar and cannot be changed for any reason. All exams are required. If you miss an exam without an acceptable excuse, you will receive a grade of zero. The only exceptions will be for a verified family emergency or for an illness or injury that is confirmed by the University Medical Clinic or other doctor. If you miss an exam for a legitimate reason, you will take a makeup exam.

Academic Conduct It is your responsibility to know and understand the provisions of the CAS Academic Conduct Code (http://www.bu.edu/cas/academics/programs /conductcode.html). Cases of suspected academic misconduct will be referred to the Dean's Office. Any student found guilty of cheating on an exam in this course will receive a minimum penalty of a zero grade for that exam.

COURSE OUTLINE

1 Discrete Time Deterministic Models

SLP Chapters 3-6

1.1 Mathematical Preliminaries

- Metric spaces
- Contraction mapping theorem
- The theorem of the maximum

1.2 Dynamic Programming under Certainty

- Bellman equation
- Euler equation

1.3 Deterministic Dynamics

- Linear system and linear approximation

1.4 Applications

- Growth models
- Consumption-savings problem
- Investment with convex adjustment costs

2 Discrete Time Stochastic Models

SLP Chapters 7-13.

2.1 Mathematical Preliminaries

- Measure theory and integration
- Markov processes

2.2 Stochastic Dynamic Programming

- Bellman equation
- Euler equation
- Policy functions and transition functions

2.3 Convergence of Markov Processes

- Strong convergence
- Weak convergence

2.4 Numerical Methods

- (Log) linear and second-order approximation
- Value function iteration (interpolation)
- Projection method

2.5 Applications

- Optimal growth (RBC)
- Consumption-savings problem
- Bewley model (Aiyagari (1994))
- Firm dynamics (Hopenhayn (1992), Hopenhayn and Rogerson (1994), Gourio and Miao (2008))

- Investment with convex/nonconvex adjustment costs (Cooper and Haltiwanger (2005))
- Recursive utility (Epstein and Zin (1989), Backus et al. (2004))
- Portfolio choice and asset pricing (Chen, Ju and Miao (2008), Ju and Miao (2008))

References

S.R. Aiyagari, Uninsured Idiosyncratic Risk and Aggregate Saving, Quarterly Journal of Economics, 109 (1994) 659-684.

Ang, Andrew, Geert Bekaert, and Jun Liu, Why Stocks May Disappoint, Journal of Financial Economics, v76, n3, 471-508, June, 2005.

Backus, David, Bryan Routledge, and Stanley Zin, 2004, Exotic Preferences for Macroeconomists, NBER Macroeconomic Annual.

Bekaert, Geert, Robert J. Hodrick, and David A. Marshall, 2001, The implications of first-order risk aversion for asset market risk premiums, Journal of Monetary Economics 40, 3-39.

Blanchard, Olivier J. and Charles M. Kahn, 1980, The Solution of Linear Difference Models under Rational Expectations, Econometrica 48, 1305-1311.

Chen, Hui, Nengjiu Ju and Jianjun Miao, 2008, Dynamic Asset Allocation with Ambiguous Predictability, working paper, Boston University.

Cooper, Russell, and John Haltiwanger, 2006, On the nature of capital adjustment costs, *Review of Economic Studies* 73, 611-633.

Epstein, Larry G. and Stanley Zin, 1989, Substitution, Risk Aversion and the Temporal Behavior of Consumption and Asset Returns: A Theoretical Framework, *Econometrica* 57, 937-969.

Gourio, Francois and Jianjun Miao, 2008, Firm Heterogeneity and the Long-Run Effects of Dividend Tax Reform, forthcoming in American Economic Journal: Macroeconomics

Hopenhayn, Hugo A., 1992, Entry, exit, and firm dynamics in long run equilibrium, *Econometrica* 60, 1127-1150.

Hopenhayn, Hugo A., and Richard Rogerson, 1993, Job turnover and policy evaluation: A general equilibrium analysis, *Journal of Political Economy* 101, 915-938.

Ju, Nengjiu and Jianjun Miao, 2007, Learning, Ambiguity, and Asset Returns, working paper, Boston University.

King, Robert G. and Mark W. Watson, 1998, The Solution of Singular Linear Difference Systems Under Rational Expectations, International Economic Review 39, 1015-1026.

Klein, Paul, 2000, Using the Generalized Schur Form to Solve a Multivariate Linear Rational Expectations Model, Journal of Economic Dynamics and Control 24, 1405-1423.

Schmitt-Grohe S. and M. Uribe, 2004, Solving Dynamic General Equilibrium Models Using a Second-Order Approximation to the Policy Function, *Journal of Economic Dynamics and Control* 28, 645-858.

Schedule

	Thursday	
Week 1	01/15	Introduction
Week 2	01/22	Deterministic Theory
Week 3	01/29	Deterministic Theory
Week 4	02/05	Deterministic Application
Week 5	02/12	Stochastic Theory
Week 6	02/19	Stochastic Theory
Week 7	02/26	Stochastic Application
Week 8	03/05	Stationary Distribution
Week 9	**Spring Recess**	
Week 10	03/19	Numerical Method
Week 11	03/26	Numerical Method
Week 12	04/02	Numerical Method
Week 13	04/09	Numerical Applications
Week 14	04/16	Presentation
Week 15	04/23	**No Class**
Week 16	04/30	Presentation
Week 17	05/01-05/04	Study Period
Week 18	05/06	Project Due