

Econ 606: Graduate Macroeconomics (II)

Georgetown University

Jinhui Bai

SPRING 2009

Last Update: December 10, 2008

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Time and Location: T, Th 4:15 - 5:30pm, ICC 116.

Instructor Office Hours: Thursday 10:00am - 12:00pm or by appointment, ICC 557.

TA Office Hours: Thursday 1:00pm - 2pm, .Location TBD.

TA Recitation Session: Monday 7:40-8:55pm, ICC 119. TA will go over the answers to the homework assignment.

Course Description:

The goal of the course is to introduce students to the dynamic stochastic general equilibrium (DSGE) models. The course will teach students the key aspects of dynamic programming and the formulation and solution of *Sequential Competitive Equilibrium* and *Recursive Competitive Equilibrium* (or sometimes called *Stationary Markov Equilibrium*). We will apply these techniques and equilibrium concepts to a variety of topics, including growth, business cycles, labor market, asset pricing, wealth distribution, fiscal policy and monetary policy.

We will emphasize basic computational methods of dynamic programming and competitive equilibrium. Several homework will involve using the standard programming languages (e.g., MATLAB or GAUSS) to compute solutions to dynamic programming problems and the recursive competitive equilibrium. An introduction to MATLAB will be given at an appropriate time.

After completing the course, students should be able to understand the basic language of the modern dynamic macroeconomics.

Recommended Textbooks:

(a) Ljungqvist, L., Sargent, T., 2004. *Recursive Macroeconomic Theory*, Second Edition, MIT Press. The solution to the problems in the *LS* book is freely available on the internet (<http://pages.stern.nyu.edu/~svnieuwe/pdfs/masterex.pdf>). The MATLAB programs for selected models in the *LS* book is freely available on the link “<ftp://zia.stanford.edu/pub/sargent/webdocs/mitbook>”.

(b) Stokey, N., Lucas, R.E., Jr., with E. Prescott, 1989. *Recursive Methods in Economic Dynamics*, Harvard University Press.

These two books will be referred to as *LS* and *SLP*, respectively.

Other Useful References:

- [1] Acemoglu, Daron, 2008. Introduction to Modern Economic Growth. Princeton University Press.
- [2] Bewley, Truman F., 2007. General Equilibrium, Overlapping Generations Models, and Optimal Growth Theory. Harvard University Press.
- [3] Cooley, Thomas F., 1995. Frontiers of Business Cycle Research. Princeton, NJ: Princeton University Press.
- [4] Lucas, Robert E, Jr., 1987. Models of Business Cycles. Basil Blackwell.
- [5] Romer, D., 2006. Advanced Macroeconomics. Third Edition, McGraw-Hill.

Course Website: Georgetown University Blackboard (<http://campus.georgetown.edu>). I will post class announcement, lecture notes (slides), problem sets, answers to problem sets, and additional readings to the website.

Grading and Exams: There will be weekly assignments, a midterm exam and a final. They will count toward the grade as follows.

Assignments	Midterm	Final
20%	30%	50%

There will be around 10 Problem sets for the course. The assignments are due in class before the lecture at the announced date (typically Thursday). Homework assignments will be graded according to the following scale: $\checkmark+$, \checkmark , $\checkmark-$, 0. Late problem sets will receive a grade of **zero**. To allow for the possibility of unexpected emergency, I will drop one lowest homework score in calculating your final grade. Group discussion in solving the homework assignments is strongly encouraged, but each student is expected to write his/her own answers and in his/her own words.

The midterm exam is currently scheduled to be in class on **March 5, 2009** (Thursday). The final exam will take place at 4:00-6:00pm on **May 5, 2009** (Tuesday). The final exam is cumulative. Both exams will be *open-book and open-notes*.

Additional Readings: In addition to readings from the textbook, readings from academic publications will occasionally be posted to the course web site whenever necessary. Because the lectures cover only the key points of each topic, reading and studying the textbook and the assigned papers in a timely fashion is an essential part of the course.

Course Outline

The lecture is planned to cover Parts I - V below. Parts VI - VIII will be covered only if we have extra time. The schedule is subject to change.

I. Stochastic Growth Model and Discrete-time Optimization Methods

1. Finite-Period Deterministic Problem

- (a) Sequential method (Lagrange): Kuhn-Tucker and difference equations
- (b) Principle of Optimality and recursive method (dynamic programming)

2. Infinite-Period Deterministic Problem

- (a) Sequential method (Lagrange)
- (b) Principle of Optimality and recursive method (dynamic programming)
- (c) Existence and uniqueness: Contraction Mapping and Blackwell's sufficient condition
- (d) Solution methods for dynamic programming
- (e) Link Infinite-period and Finite-Period problem

3. Approximation Methods

- (a) Two Euler-equation-based methods: Shooting Algorithm and (log) linearization
- (b) A value-function based method: Discrete state value function iteration

4. Markov process and stochastic dynamic programming

- (a) Representation of uncertainty: event tree and probability space
- (b) Markov process
- (c) Sequential versus recursive methods

5. Approximation Methods again

- (a) A Euler-equation-based method: linearization around deterministic steady state
- (b) A value-function based method: Discrete state value function iteration

6. Continuous-time dynamic programming versus optimal control

Readings: *LS* Chapter 2, 3, 4; *SLP* Chapter 2 - 6, 9, 10.

II. Business Cycle Theory

- 1. Business cycle definition and facts
- 2. Real business cycle theory
- 3. Welfare costs of business cycles

Readings: Lucas (1987), Kydland and Prescott (1990)

III. Labor Search Model

- 1. Basic model
- 2. Computational method

Readings: *LS* Chapter 6.1-6.4.

IV. Dynamic Stochastic General Equilibrium (DSGE) with Complete Markets

1. Pure exchange economy: Formulation

- (a) DSGE with complete commodity markets: Date-zero trading
- (b) DSGE with complete asset markets: sequential competitive equilibrium
- (c) DSGE with complete asset markets: recursive competitive equilibrium
- (d) Allocation equivalence of three equilibrium concepts
- (e) Welfare properties: First and Second Welfare Theorem

2. Pure exchange economy: Characterization

- (a) Consumption correlation
- (b) Asset Pricing for one-period security
- (c) Asset pricing for long-lived securities: Lucas (1978) asset pricing model
- (d) Quantitative evaluation: Mehra-Prescott (1985) equity premium puzzle

3. Production economy: Formulation and Characterization

- (a) DSGE with complete commodity markets: Date-zero trading
- (b) DSGE with complete asset markets: sequential competitive equilibrium
- (c) DSGE with complete asset markets: recursive competitive equilibrium
- (d) Allocation equivalence of three equilibrium concepts
- (e) Welfare properties: First and Second Welfare Theorem

Readings: *LS* Chapter 8, 12, 13.

V. DSGE with Incomplete Asset Markets

1. Two-Period models

- (a) Exchange Economy
- (b) Production economy with a representative neoclassical firm
- (c) Positive and normative properties of incomplete market equilibrium
- (d) Two-Period incomplete market economy with Malinvaud (1973) idiosyncratic risk

2. Infinite-Horizon model with Idiosyncratic Labor Income Risk: Bewley Economies

- (a) Storage economy: Imrohoroglu (1989)
- (b) Pure exchange economy: Huggett (1993)
- (c) Neoclassical growth model: Aiyagari (1994), Huggett (1997), Krusell and Smith (1998)

Readings: *LS* Chapter 16, 17.

VI. Overlapping-Generations (OLG) Models

1. Samuelson (1958) pure-exchange economy
2. Diamond (1965) growth model

Readings: *LS* Chapter 9.

VII. Optimal Fiscal Policy with Commitment

1. Ricardian equivalence with lump-sum and history-dependent distortionary taxation
2. Chamley-Judd optimal taxation result
3. Brief introduction to optimal taxation in the Bewley models: Aiyagari and McGrattan (1998), Heathcote (2005)

Readings: *LS* Chapter 10, 11, 15.

VIII. Monetary competitive equilibrium model

1. Hahn problem in a finite-period economy
2. Bewley-Townsend Model
3. Sidrauski Money-in-the-Utility and Shopping Time Model
4. Lucas-Stokey (1987) Cash-Credit Goods model
5. Monetary Growth model with cash-in-advance constraint: Cooley-Hansen (1989)

Readings: *LS* Chapter 24, 25; Nakajima and Polemarchakis (2005)

References

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- [2] Aiyagari, R., McGrattan, E., 1998. The optimum quantity of debt. *Journal of Monetary Economics* 42, 447-469.
- [3] Bassetto, M., Kocherlakota, N., 2004. On the irrelevance of government debt when taxes are distortionary. *Journal of Monetary Economics* 51, 299-304.
- [4] Bewley, T., 1977. The permanent income hypothesis: A theoretical formulation. *Journal of Economic Theory* 16, 252-292.
- [5] Bewley, T., 1980. The optimum quantity of money, in *Models of Monetary Economics*, ed. by John Kareken, Neil Wallace, Minneapolis, Minnesota.
- [6] Bewley, T., 1983. A difficulty with the optimum quantity of money, *Econometrica*, 51, 1485-1504.
- [7] Bewley, T., 1986. Stationary monetary equilibrium with a continuum of independently fluctuating consumers, in: Hildenbrand, W., Mas-Colell, A. (Eds.), *Contributions to Mathematical Economics in Honor of Gerard Debreu*. North-Holland, pp. 79-102.

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- [11] Geanakoplos, J. and H. Polemarchakis, 1986, Existence, regularity, and constrained suboptimality of competitive allocations when the asset market is incomplete, in: W.P. Heller, R.M. Ross and D.A. Starrett, eds., *Uncertainty, information and communication, essays in honor of Kenneth J. Arrow*, Vol. III (Cambridge University Press, Cambridge).
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- [13] Hansen, Gary D., 1985. Indivisible labor and the business cycles. *Journal of Monetary Economics* 16, 309-327.
- [14] Heathcote, J., 2005. Fiscal Policy with Heterogeneous Agents and Incomplete Markets. *Review of Economic Studies* 72, 161-188.
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- [18] Imrohoroglu, A., 1992. The welfare cost of inflation under imperfect insurance. *Journal of Economic Dynamics and Control* 16, 79-91.
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- [22] Lucas, R.E., Jr., Stokey, N.L., 1987. Money and interest in a cash-in-advance economy. *Econometrica* 55, 491-513.
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