DAY-BY-DAY CLASS SCHEDULE, SLIDES AND NOTES

THE SOLOW GROWTH MODEL

Class 1: Tuesday, August 22
1. Course introduction (slides here)
2. The Solow Growth Model (my hand-written notes here)
   readings: Krusell lecture notes, chapter 2

OPTIMAL GROWTH MODEL WITH FINITE HORIZON

Class 2: Thursday, August 22
Optimal Growth Model with finite horizon (my hand-written notes here)
1. Assumptions and setup
2. Using Kuhn-Tucker method
3. Deriving the Euler Equation

Readings: Krusell lecture notes, chapter 3 (pp. 11-15)
SLP, chapter chapter 2 (pp. 9-11)

Class 3: Tuesday, August 29
Optimal Growth Model with finite horizon (cont.) (my hand-written notes here)
1. Existence and uniqueness of the slotion to EE;
   Sufficiency of EE + terminal condition
2. Solving for the optimal consumption and capital paths:
   - Numerical method ("shooting algorythm")
   - Analytical approach (solving backwards)
     (works only for particular functional forms of u(c) and f(k))

OPTIMAL GROWTH MODEL WITH INFINITE HORIZON - SEQUENTIAL FORMULATION

Class 4: Thursday, August 31
Optimal Growth Model with infinite horizon (my hand-written notes here)
1. Solving finite optimal growth model with linear technology
2. Infinite horizon models: economic interpretation,
   technical advantages and possible problems
3. Transversality condition (TC): "terminal condition" in the infinite horizon models
4. (EE + TC) are the necessary and sufficient conditions for the maximum!

Readings: Krusell lecture notes, chapter 3 (pp. 15-25)
SLP, chapter 4 (pp.97-99)

Recitation on 08/31: proving sufficiency of (EE+TC)
(Latchezar's hand-written notes here)

Class 5: Tuesday, September 5 (my hand-written notes here)
Optimal Growth Model with infinite horizon (cont.)

1. Solving infinite horizon model (as a lim of finite horizon solution)
2. Connection between TVC and No-Ponzi Game (NPG) condition
3. Recursive formulation of the Optimal Growth Model with infinite horizon
   (Deriving Bellman Equation)

Readings: Krusell's notes, pp. 20-22 (NPG) and pp. 25-27 (Recursive formulation)
SLP, chapter 2, pp. 12-14
LS, chapter 3, pp. 85-87

OPTIMAL GROWTH MODEL WITH INFINITE HORIZON - RECURSIVE FORMULATION

Class 6: Thursday, September 7 (my hand-written notes here)
Optimal Growth Model with infinite horizon - RECURSIVE FORMULATION
1. Connection between the sequential and recursive furmulations
2. Properties of the value function
3. Solving the Bellman equation

Readings: Krusell's notes, pp. 27-29

Class 7: Tuesday, September 12 (my hand-written notes here)
Optimal Growth Model with infinite horizon - RECURSIVE FORMULATION
Solving the Bellman Equation
1. Justification for using iterative methods
2. Guess and Verify methods (for the value function)

Class 8: Thursday, September 14 (my hand-written notes here)
1. Deriving Euler Equation for the recursive problem
2. Guess and Verify method for the policy function
3. Monotonicity of g(k) and c(k)
4. Other properties of g(k) (existence of the unique stable steady state)

Readings: Krusell's notes, pp. 33-35, 39-42; LS, pp.91-92

Recitation: Thursday, September 14 (Notes here)
1. Proof of Blackwell sufficient conditions
2. Proof of the strict concavity of the value function

COMPETITIVE EQUILIBRIUM - SEQUENTIAL FORMULATION

Class 9: Tuesday, September 19 (my hand-written notes here)
1. Summary of the tools learnt in Classes 1-8
2. Introduction to competitive equilibrium
   - Optimal growth problem = the Social Planner's problem
   - The general structure of the competitive equilibrium
   - Types of competitive equilibria
     (sequential and recursive, time-0 trading and sequential trading)
3. The competitive equilibrium of the neoclassical growth model with time-0 trade
   (Arrow-Debreu setup) - description of the environment

Readings: Krusell's notes, pp.51-53, 56

Class 10: Thursday, September 21 (my hand-written notes here)
The competitive equilibrium of the neoclassical growth model with time-0 trade
- environment: economic agents, trading arrangement and commodity space
- the setup of the consumers' problem
- the setup of the producers' problem
- the definition of a competitive equilibrium
Readings: Krusell's notes, pp.56-57

Class 11: Tuesday, September 26 (my hand-written notes here)
Solving for competitive equilibrium of the neoclassical growth model with time-0 trade
- solving consumer's problem
- solving firms' problem
- assumption on utility and production function necessary to eliminate the corner solutions

Class 12: Thursday, September 28 (my hand-written notes here)
1. Welfare properties of time-0 trade competitive equilibrium
2. Competitive equilibrium with sequential trade: setup, solution and welfare properties
3. Recursive competitive equilibrium: the general approach
Readings: Krusell's notes, pp. 58-60, LS, pp. 196-197

COMPETITIVE EQUILIBRIUM - RECURSIVE FORMULATION

Class 13: Tuesday, October 3 (my hand-written notes here)
Recursive competitive equilibrium (RCE)
1. The general approach to difining a RCE
2. RCE in a neoclassical growth model
Readings: LS, pp. 196-197, Krusell's notes, pp. 60-62

Class 14: Thursday, October 5 (my hand-written notes here)
Recursive competitive equilibrium (RCE)
1. RCE in a neoclassical growth model: definition and discussion;
   Comparison of the definition on mine and Krusell's notes
2. Choosing the aggregate state variables in the the economy with heterogeneous consumers
3. Welfare properties of a RCE

Class 15: Tuesday, October 10 (my hand-written notes here)
1. Welfare properties of a RCE (cont.)
2. Connection between PO and CE in the models with representative agents
3. Solving for competitive equilibria:
   - numerical algorithm for finding a sequential competitive equilibrium

Class 16: Thursday, October 12 (my hand-written notes here)

1. Solving for competitive equilibria:
   - numerical algorithm for finding a recursive competitive equilibrium
2. Discussion of the models with heterogeneous agents
3. Solution of the HW7
4. Answering your questions

Thursday, October 12: Midterm Exam (6pm-8pm C139 PC)

DYNAMIC MODELS WITH UNCERTAINTY: Complete markets

Class 17: Tuesday, October 17 (my hand-written notes here)
1. Uncertainty in macroeconomic models:
   - summary of the questions we are going to address in the remaining part of the course
2. Insurance in endowment economy with uncertainty:
   - environment
   - some examples

Readings: LS, Chapter 8, pp.208-209

Class 18: Thursday, October 19 (my hand-written notes here)
Insurance in endowment economy with uncertainty
1. Environment and the "richness" of allowed types of uncertainty
2. Social Planner's problem: FULL INSURANCE
3. Arrow-Debreu time-0 trade competitive equilibrium: commodity space

Readings: LS, Ch.8, pp. 208-214

Class 19: Tuesday, October 24 (my hand-written notes here)
Arrow-Debreu time-0 trade competitive equilibrium with uncertainty and complete markets
1. Setup
2. Properties of the competitive equilibrium:
   - full insurance
   - welfare theorems
3. Example: log utility and no aggregate uncertainty

Readings: LS, Ch.8, pp 213-219

Class 20: Thursday, October 26 (my hand-written notes here)
Arrow-Debreu time-0 trade competitive equilibrium with uncertainty and complete markets
1. Example: log utility and no aggregate uncertainty
   - i.i.d. case;
   - price kernel for any stochastic process
2. Asset pricing:
   - general case;
   - pricing redundant assets
3. Complete vs incomplete markets

Readings: LS, pp. 217-223

Class 21: Tuesday, October 31 (my hand-written notes here)
Complete markets in sequential-trade economy
Use the properties of A-D time-0 CE to to think about the set of assets
which should be traded in a sequential equilibrium in order to achieve full insurance:
- one-period contingent claims
- history-dependent wealth
- borrowing constraint?
Readings: LS, pp. 221-225

Class 22: Thursday, November 2 (my hand-written notes here)
Complete markets in sequential-trade economy
1. The setup:
   - trading one-period state-contingent claims
   - natural borrowing limit
2. Properties:
   - full insurance
   - equivalence with Arrow-Dabreu time-0 competitive equilibrium (finish next time)
Readings: LS, pp. 226-230

Class 23: Tuesday, November 7 (my hand-written notes here)
Complete markets
1. Equivalence of A-D time-0 competitive equilibrium and
   the secuential trade competitive equilibrium in the complete market economies
2. Application of asset prices: **EQUITY PREMIUM PUZZLE**
   - motivation and methodology
Readings:
  equivalence: LS, pp. 228-230
  equity premium puzzle: 1) Krusell notes (Chapter 9, pp. 153-156 for review, 156-157)
                         2) read introduction of Mehra and Prescott (JME 1985): link to the paper

Class 24: Thursday, November 9 (my hand-written notes here)
EQUITY PREMIUM PUZZLE (Mehra and Prescott 1985)
1. Pricing the risk-free bond and equity (the Lucas tree) in the complete markets
   representative agent endowment economy with aggregate uncertainty.
2. Computing the average risk-free and equity returns using their prices
Readings:
1) Section 3 of Mehra and Prescott (JME 1985): link to the paper
   Krusell notes (Chapter 9, pp.157-160)
2) Krusell notes, Chatpter 6, pp. 69-71 and LS, chapter 2, pp. 29-34 for more info
   on Markov processes and invariant distribution

Recitation: Thursday, November 9 (my hand-written notes here)
SIMULATING MARKOV PROCESSES
1. Drawing random variables using the Probability Integral Transform.
2. Simulating Markov Processes.

3. Importance sampling.

Class 25: Tuesday, November 14 (my hand-written notes here)
EQUITY PREMIUM PUZZLE (Mehra and Prescott 1985)
1. Uniqueness of the equilibrium prices
2. Calibration in Mehra and Prescott
3. "Resolutions" of the equity premium puzzle
Reading: Krusell notes (Chapter 9, pp. 160-163)
Mehra and Prescott (1985), Sections 4 and 5

Class 26: Thursday, November 16 (my hand-written notes here)
Recursive Competitive Equilibrium of Endowment Economy with Complete Markets
1. Why do we want to set it up recursively?
2. "Suggestive properties" of A-D time-0 CE and Sequential CE:
- prices are stationary w.r.t. current state;
- constraint set is stationary w.r.t. current state and current wealth;
- optimal consumption and portfolio can be expressed as functions of current state and current wealth;
- indirect utility is stationary w.r.t. current state and current wealth;
=> (a,s) is a sufficient set of state variables.
3. Recursive competitive equilibrium: definition and properties
(Note: the last part of 2 and 3 will be covered in the recitation on 11/16)
Readings: LS, chapter 8, pp. 230-234

REAL BUSINESS CYCLE MODEL

Class 27: Tuesday, November 28 (my hand-written notes here)
1. Motivation and Historical perspective
2. "Identifying" business cycles: H-P filter
3. Business cycle stylized facts
4. Stochastic neoclassical growth model: recursive setup of the planning problem
5. Some notes on *discretizing the AR(1) process*
Readings: 1-3: Krusell notes, Chapter 11, pp. 181-186
4: Krusell notes, Chapter 6, pp. 76-78
5: browse for Tauchen algorithm if you would like to know more details

Class 28: Thursday, November 30 (my hand-written notes here)
1. Solving the planning problem in the stochastic neoclassical growth model
- value function iterations: one more state variable => add a loop
- guess and verify: works only for some u(c), technology and shocks' processes
2. Adding labor/leisure choice: very easy!
3. Social planner's problem and competitive equilibrium: which one to use?

Class 29: Tuesday, December 5 (my hand-written notes here)
1. Recursive competitive equilibrium with uncertainty in the production function
- setup

- solution methods

2. Calibration of the RBC model: general approach and parameterization

Class 30: Thursday, December 7 (my hand-written notes here)

1. RBC model: calibration and results
2. Course review