

Macroeconomic Theory I

Economics 608

Tues/Thurs 4:30-6:00

Module 1 (Fall 2017)

Rawls 2082

Purdue University
Krannert School of Management
Department of Economics

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Prerequisites

None

Course Description

The course will introduce the major mathematical tools and the theoretical foundations required for macroeconomic analysis at the graduate level. The course covers the Real Business Cycle (RBC) class of models, though the tools are applicable to the New Keynesian class of models as well. The unifying characteristic of both classes of models, and all models in modern macroeconomic research, is that they are ‘micro-founded’. This means that the equilibrium characterizations of price and welfare effects are derived from the fundamentals of individual preferences, firm technologies, and institutional structures.

This course focuses on deterministic models with homogeneous agents, where the canonical model to be considered is the neoclassical growth model. The course will introduce the mathematical preliminaries (notably dynamic programming), the properties of the deterministic models, and the recursive competitive equilibrium concept. Econ 611 (Module 2) and Econ 612 (Module 3), which are taught by Professor Cathy Zhang and Professor Soojin Kim, respectively, will utilize these basic concepts to study stochastic models with heterogeneous agents (both with and without market frictions), search theory, monetary theory, growth theory, and models with information and commitment frictions.

Altogether, the macroeconomic core courses will provide you the training necessary to analyze how firms and consumers respond in a dynamic setting to market incentives and the effects of macroeconomic policy on wages, interest rates, and welfare.

Learning Outcomes

- Acquire the necessary mathematical tools to be able to analyze micro-founded models of households and firms.
- Use the tools of dynamic programming to characterize the solutions to recursive constrained optimization problems, including the dynamic consumer consumption-savings problem.
- Apply the concept of a recursive competitive equilibrium to a variety of macroeconomic settings.

Course Materials

There is no mandatory course textbook, but the following texts are excellent reference sources. They are both at the Reserve Desk in the Roland G. Parrish Library of Economics and Management (2nd floor of Krannert).

- [SL89] Recursive Methods in Economic Dynamics by Nancy L. Stokey and Robert E. Lucas with Edward C. Prescott (Harvard University Press, Cambridge, Mass., 1989).
- [AC03] Dynamic Economics: Quantitative Methods and Applications by Jerome Adda and Russell Cooper (MIT Press, Cambridge, MA, 2003).

Additional textbook sources include the following (not available at the library):

- [A09] Introduction to Modern Economic Growth by Daron Acemoglu (Princeton University Press, Princeton, NJ, 2009).
- [B97] Topological Spaces by Claude Berge (Dover Publications, Mineola, NY, 1997).
- [M14] Economic Dynamics in Discrete Time by Jianjun Miao (MIT Press, Cambridge, MA, 2014).
- [S96] A First Course in Optimization Theory by Rangarajan K. Sundaram (Cambridge University Press, Cambridge, UK, 1996).

Course materials are found on Blackboard. The following materials supplement the course material:

- [RBM] “Review of Basic Mathematics” by Matthew Hoelle (Purdue manuscript and videos, 2017).
- [NGM] “Neoclassical Growth Model” by Matthew Hoelle (Purdue manuscript and videos, 2017).
- [RA] “A Short Course in Real Analysis” by Matthew Hoelle (Purdue videos and slides, 2016).
- [W06] “Discrete Time Dynamic Programming” by Randall Wright (Penn manuscript, 2006).

Course Calendar (14 lectures)

The course will contain 14 lectures with a Final Exam on Thursday, October 12.

Part 1: Course Introduction

Practice problems: Neoclassical Growth Model, exercises at the end Neoclassical Growth Model notes (with solutions)

Assignments: Syllabus Quiz, Math Quiz, Lecture 1 Quiz, Lecture 2 Quiz, Lecture 3 Quiz, Lecture 4 Quiz

Date	Topic	References	Quizzes Due
August 22 Lecture 1	Course Introduction; Neoclassical Growth Model (Planner's Problem)	RBM, NGM	
August 24 Lecture 2	Neoclassical Growth Model (Equilibrium)	NGM	Syllabus, Math
August 29 Lecture 3	Neoclassical Growth Model: Steady State and Log- linearization	M14 , Chapters 2, 14	
August 31 Lecture 4	Neoclassical Growth Model: Simulation	M14 , Chapters 2, 14	Lectures 1-2

Part 2: Mathematical and Microeconomic Foundations

Practice problems: Welfare Theorems practice problems (with solutions)

Assignments: Real Analysis Quizzes (3 total), Lecture 5 Quiz, Lecture 6 Quiz, Lecture 7 Quiz

Date	Topic	References	Quizzes Due
September 5 Lecture 5	Real Analysis (general metric spaces)	RA , study all slides before class	Real Analysis 1- 3
September 7 Lecture 6	Arrow-Debreu Equilibrium (ADE)	SL89 , Chapter 3	Lecture 3-4
September 12 Lecture 7	Welfare Theorems	SL89 , Section 15.2	

Part 3: Optimization and Equilibrium

Practice problems: Kuhn-Tucker practice problems (with solutions)

Assignments: Lecture 8 Quiz, Lecture 9 Quiz

Date	Topic	References	Quizzes Due
September 14 Lecture 8	Kuhn-Tucker Conditions; Euler Equations	S96 , Chapter 6	Lectures 5-6
September 19 Lecture 9	Sequence of Markets Equilibrium (SME)		

ORAL EXAM: Takes place September 20-22 and covers Parts 1-3 of the class.

Part 4: Dynamic Programming

Practice problems: Dynamic Programming practice problems (with solutions),
 Dynamic Programming exam questions (some solutions)
 Assignments: Lecture 10 Quiz, Lecture 11 Quiz, Lecture 12 Quiz

Date	Topic	References	Quizzes Due
September 21 Lecture 10	Dynamic Programming I: Correspondences	W06 AC03 , Chapter 2 SL89 , Chapter 3 A09 , Chapter 6 M14 , Chapters 6, 7 S96 , Chapter 9 B97 , Chapter 6	Lectures 7-8
September 26 Lecture 11	Dynamic Programming II: Blackwell	W06 AC03 , Chapter 2 SL89 , Chapter 3 A09 , Chapter 6 M14 , Chapters 6, 7	
September 28 Lecture 12	Dynamic Programming III: Benveniste-Scheinkman	W06 AC03 , Chapter 2 SL89 , Chapter 3 A09 , Chapter 6 M14 , Chapters 6, 7	Lecture 9-10

Part 5: Recursive Competitive Equilibrium

Practice problems: Recursive Competitive Equilibrium exam questions (some solutions)

Date	Topic	References	Quizzes Due
October 3 Lecture 13	Recursive Competitive Equilibrium (RCE) and basic extensions	AC03 , Chapter 5 SL89 , Chapter 5	
October 5 Lecture 14	RCE advanced extensions	AC03 , Chapter 5 SL89 , Chapter 5	Lectures 11-12
October 10	FALL BREAK (no class)		
October 12	FINAL EXAM (in class)		

NO CLASS on October 17 (to balance out the fact that M-W classes do not meet on September 4, Labor Day). Module 2 begins October 18.

Methodology

The course will be based on a series of lectures. The lectures are comprehensive, but can be supplemented by the reference texts cited above. The lectures are supported by:

1) Practice problems

The practice problems will not be collected nor graded.

Many of the practice problems include solutions. Students are expected to complete the practice problems, and only use the solutions to assess performance.

There is a strong correlation between student performance on exams and the mastery of the practice problems. In particular, the exam questions (both for Dynamic Programming and Recursive Competitive Equilibrium) contain the old exam questions for Econ 608 (Fall Final Exam and Summer Qualifying Exams) beginning in 2013.

2) Quizzes (called online tests in Blackboard)

There will be numerous quizzes issued on Blackboard throughout the semester. These quizzes are short. The quizzes can be taken an unlimited number of times, with only the highest grade counting toward your overall course grade.

Quizzes are due by 4:30 pm (the beginning of class) on the dates indicated in the Course Calendar.

You are responsible for finding the quizzes in Blackboard and completing them by the due date.

3) Oral exam

During the period from Wednesday, September 20 through Friday, September 22, an oral exam will be given. Students will sign up for a 1-hour time slot and will meet in my office (Rawls 4070) for the exam. The exam is closed notes and closed books. Students will provide oral responses to questions, and will use the whiteboard to show all work.

The oral exam can contain any material covered in Parts 1-3 of the course.

4) Final exam

During the final meeting period (Thursday, October 12), a final exam will be given (closed notes, closed books). The exam will cover all the material covered in the 14 lectures, with emphasis on the material in Parts 4 and 5 of the class. Students are permitted 90 minutes to complete the exam. A make-up exam will not be given.

Assessment

Quizzes (online tests)	20%
Oral exam	30%
Final exam	50%