

Macroeconomic Theory I

Economics 608

Tues/Thurs 4:30-6:00

Module 1 (Fall 2016)

Rawls 2079

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:

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

The following practice problems are essential for course success:

- [NGM] contain 12 practice problems at the end of the chapter.
- [WT] Welfare Theorems Practice Problems (with solutions).
- [K-T] Kuhn-Tucker Practice Problems (with solutions).
- [DP] Dynamic Programming Practice Problems (with solutions).
- [RCE] Recursive Competitive Equilibrium Practice Problems.

Course structure (14 lectures)

The course will contain 14 lectures with a Final Exam taking place during the final meeting period (Thursday, October 13).

Date	Topic	References
August 23 Lecture 1	Course Introduction; Neoclassical Growth Model (Planner's Problem)	NGM
August 25 Lecture 2	Neoclassical Growth Model (Continuous time)	A09 , Chapter 7
August 30 Lecture 3	Neoclassical Growth Model (Equilibrium)	NGM
September 1 Lecture 4	Real Analysis (general metric spaces)	RA , study all slides before class WT
September 6 Lecture 5	Arrow-Debreu Equilibrium (ADE)	SL89 , Chapter 3 WT
September 8 Lecture 6	Welfare Theorems	SL89 , Section 15.2 WT
September 12 – September 15	ORAL EXAM (outside of class)	
September 13 Lecture 7	Kuhn-Tucker Conditions; Euler Equations	S96 , Chapter 6 K-T
September 15 Lecture 8	Sequence of Markets Equilibrium (SME)	K-T
September 20 Lecture 9	Dynamic Programming I: Correspondences	W06 AC03 , Chapter 2 SL89 , Chapter 3 A09 , Chapter 6 M14 , Chapters 6, 7 S96 , Chapter 9 B97 , Chapter 6 DP

September 22 Lecture 10	Dynamic Programming II: Blackwell	W06 AC03 , Chapter 2 SL89 , Chapter 3 A09 , Chapter 6 M14 , Chapters 6, 7 DP
September 27 Lecture 11	Dynamic Programming III: Benveniste-Scheinkman	W06 AC03 , Chapter 2 SL89 , Chapter 3 A09 , Chapter 6 M14 , Chapters 6, 7 DP
September 29 Lecture 12	Recursive Competitive Equilibrium (RCE) and basic extensions	AC03 , Chapter 5 SL89 , Chapter 5 RCE
October 4 Lecture 13	RCE advanced extensions	AC03 , Chapter 5 SL89 , Chapter 5 RCE
October 6 Lecture 14	Neoclassical growth model: steady state, log-linearization, and simulation	M14 , Chapters 2, 14
October 11	FALL BREAK (no class)	
October 13	FINAL EXAM (in class)	

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.

The practice problems [**WT**], [**K-T**], and [**DP**] include solutions. Students are expected to complete the practice problems, and only use the solutions to assess performance.

The practice problems at the end of the [**NGM**] notes are taken from Master's level course material.

The practice problems [**RCE**] contain numerous exam-type questions that explore applications of the RCE concept.

2) *Online tests*

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

You are responsible for finding the tests on Blackboard and completing them. All tests must be completed prior to the Final Exam. Solutions to the online tests will not be provided.

3) *Oral exam*

During the period from Monday, September 12 through Thursday, September 15, 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 will contain three parts:

- (i) Solve neoclassical growth model problems (any practice problems at the end of [NGM] may be asked).
- (ii) From [RA], be able to define important concepts and state and prove important results. Any online test questions may also be asked.
Definitions: open, closed, bounded, compact, connected, complete, convergent, Cauchy, continuous, differentiable.
Results: Bolzano-Weierstrass, Heine-Borel, Extreme Value Theorem, Intermediate Value Theorem, Mean Value Theorem, Inverse Function Theorem.
- (iii) From [WT], be able to state and prove ADE existence, First Basic Welfare Theorem, and Second Basic Welfare Theorem. Any online test questions and any practice problems from [WT] may also be asked.

4) *Final exam*

During the final meeting period (Thursday, October 13), 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 covered since the oral exam (the final 8 lectures). Students are permitted 90 minutes to complete the exam. A make-up exam will not be given.

Solutions for the final exams from the previous 4 years of Econ 608 (2012-2015) can be found on Blackboard.

Assessment

Online tests	20%
Oral exam	30%
Final exam	50%