

MATHEMATICAL ECONOMIC ANALYSIS

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Office Hours: MTh 9:30-12:30; by appointment

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Course Objective

This course is concerned with the construction of macroeconomic theories that can explain and predict variations in aggregative (economy-wide) variables such as GNP, the general price level, interest rates, growth rates, and the exchange rate. The course material and class organization stress the development of the tools and background necessary for your field courses and for the pursuit of independent research.

Course Organization

Overview

This course is concerned with developing the basic mathematical tools needed for advanced study in economics. Every class is different in background preparation and interests. I will depend on your feedback to set the class pace and the depth of coverage of certain topics, so be sure to speak up.

Topics include the following.

- Sets and methods of proof.
- Sets in the theory of choice.
- Sets in the theory of knowledge.
- Functions and economic models.
- Linear models and matrix algebra.
- Comparative static analysis of linear models.
- Differential calculus.
- Comparative static analysis of non-linear models.
- Univariate and multivariate optimization.
- Comparative dynamic analysis.
- Some computer applications of these mathematical methods.

Course Prerequisites

The official prerequisite for this course is two semesters of calculus. More realistically, I assume you remember basic differential calculus from the first semester and a little bit about integration. Admission to the Ph.D. program in Economics is strongly recommended: this course is taught at a level appropriate to highly committed first-year PhD students.

I also consider a commitment to upholding the [Academic Integrity Code for American University](#) to be prerequisite to participation in this course.

If you feel you may have violated this code of ethics, please talk with me immediately. In cases where there has been a violation of the code of ethics, it will be far better if you contact me, rather than vice versa. I understand the pressure that you may experience in graduate school, and I will try to help you recover from self-reported mistakes.

Course Resources

This class will use the **Blackboard** courseInfo software. Look there for the syllabus, lecture notes, and homework. We will also use a listserv mailing list. For this course, you must subscribe to the class email list, econ-705-L. (Refer to the [subscription instructions](#).) I recommend that you use your AU account to subscribe: you can always set your AU account to forward mail to your commercial account. All students are expected to monitor their course email, which may contain homework problems, reading assignments, and grade reports. All students are expected to adhere to **basic email etiquette**: be respectful, quote appropriately, and do not use HTML. (To repeat: please **turn off HTML formatting of your email**. I filter HTML messages as spam and may not receive them.)

Software

You should expect to use the following applications.

- [Scientific Notebook](#)
- **Python** 2.6.2, with [NumPy](#) 1.3.

We may also use [Matplotlib](#) or **SciPy**

Submit algebraic homeworks as Scientific Notebook (.tex) files. (I also accept **LaTeX** format, if you know what you're doing.)

Scientific Notebook is available on campus in the labs, or you can purchase a one semester license at very low cost. I have arranged for SN to be available free on campus as an EagleNet application. It is also available at a very attractive **student price**, including an inexpensive single semester license. Scientific Notebook includes a tutorial, which you should complete during the first week of class.

Grading

Grading will be based on the total points earned on homework (15 percent of points possible), a midterm exam (35 percent of points possible), and a cumulative final exam (50 percent of points possible).

Exams

Exams presume a thorough knowledge of the graded and ungraded homework assignments given throughout the semester. Exams are taken without the aid of textbooks or of notes of any kind, and no collaboration will be allowed on exams. There is no "extra credit". I offer no makeup exams. (Exams may be missed with a doctor's excuse; the grade will then be calculated from the remaining exams.)

MIDTERM EXAMINATION: 13 October 2009

FINAL EXAMINATION: you will find the date of our final examination on the [final exam schedule](#). (The AU schedule of classes *always* determines the date and time of the final, so please check your schedule of classes.)

Homework

Homework must be submitted in an approved file format. (Formats are discussed in the [Software](#) section of this syllabus.) Homework will occasionally cover new material or extensions not covered in class, and mastery of this material will be assumed in all classes subsequent to its assignment.

All homework should be typed and submitted to my teaching assistant George Panterov at econ705@gmail.com. Always copy (cc:) me on any email to my teaching assistant, including these assignment submissions. Be sure to include your last name, the assignment number, and the course number in the *subject line* of your email. (For example: LastName HW#1, Econ 705.)

My TA grades the homework. You may request supplementary comments from the TA, but do not request grade changes. My TA is not authorized to make grade changes. If you wish to contest a homework grade, you may submit your homework to me for regrading of the entire assignment. It is only fair to note that although I instruct my TA to be quite generous in grading, I do not feel so constrained.

Homework is not always "required" in the sense of being collected and graded; even so, it is preparatory for subsequent classes and exams. In addition, homework will occasionally cover new material or extensions not treated in class, and mastery of this material will be assumed in all classes subsequent to its assignment.

Ongoing study groups are highly recommended. Study groups are an excellent means of mastering the course material. They are also a core part of the experience of graduate education. Besides, they are fun.

Caution!

I encourage you to discuss the homework problem sets with others, but there are strict terms for such collaboration. In accord with the canons of academic honesty, you must cite all of your collaborators at the front of your submitted solutions (in writing, on the assignment). Also, you must write up solutions on your own. **To repeat: your write-up of any problem solution must be entirely your own.** The use of pre-packaged sources of solutions to the assigned problems is not permitted. You may neither copy solutions nor provide solutions to be copied. Plagiarism, cheating, and other anti-intellectual behavior will be dealt with severely and can lead to dismissal from the university.

Topics and Readings

This is not a textbook based course, but we will draw fairly directly on several chapters of the following textbooks: [simon.blume-1994-math4econ], [stachurski-2009-econdyn], and [corbae.stinchcombe.zeman-2009-intro2math]. (Be sure to see my [errata](#).)

In addition, I have requested that some additional texts be put on reserve in the University Library. I will assign small amounts of required reading from some of these texts. Aside from this required reading, the texts are “recommended reading” only if you are interested in pursuing specific topics beyond the scope of this course. These books include the following: [sen-1970-ccsw], [dhrymes-2000-math4trix], [carter-2001-foundations], [klein-2001-mathmethods], [chiang.wainwright-2005-fundamental], [fuentes-1999-mathmethods], [hoy-2001-math4econ], [velleman-2006-how2prove2e], and Jim Hefferon's free online [Linear Algebra](#).

Caution!

I consider any marking, underlining, or writing in pencil, pen, or highlighter on any library materials to be defacement of university property, a violation of academic integrity, and grounds for a one grade reduction in your final grade. Please treat all library materials as precious intergenerational resources that you are privileged to share.

The reading list below is intended to expose you to some useful materials for this course. It is by no means meant to be exhaustive nor to discourage additional reading. The number of classes designated below for each topic is intended only as a rough guide: class interest and preparation will determine how quickly we get through the topics.

Most of the articles for this course are available online, especially through JSTOR. Some articles may be found on Electronic Reserve.

New articles may be added to the readings during the course. The suggested timing of topics and extent coverage is very tentative and will be revised as the semester progresses.

Why Use Math in Economics?

Week 0 (Background)

Required

Simon and Blume ch.1

Recommended

Klein ch.1; Chiang ch. 1; Hoy ch. 1;

The Structure of Economic Models

Week 0

Required

Chiang ch. 2,3;

Recommended

n.a.

Functions: Exponents, Logarithms, and Polynomials

Week 0 (Background)

Required

Simon and Blume ch.2,5; Appendix A2, A3

Recommended

n.a.

Functions: Trigonometry and Complex Numbers

Week 0 (Background)

Required

Simon and Blume ch.2,5; Appendix A2, A3;

Recommended

Dhrymes ch. 1.1

Calculus Basics

Week 0 (Background)

Required

Simon and Blume ch.2-4

Recommended

n.a.

Introduction to Programming

Week 0 (Background)

Required

[stachurski-2009-econdyn] chapter 2;

Recommended

http://www.rexx.com/~dkuhlman/python_101/python_101.html

Sets and Logic

Week 1-2

Required

[corbae.stinchcombe.zeman-2009-intro2math] ch.1; Velleman ch.1,2; Simon and Blume appendix A1;

[stachurski-2009-econdyn] appendix A.1.1

Recommended

Velleman ch.3; de la Fuente 1; Carter 1.1; Klein ch.2; Hoy ch. 2;

Relations

Weeks 3-4

Required

[sen-1970-ccsw] ch. 1*; [corbae.stinchcombe.zeman-2009-intro2math] ch.2;

Recommended

Velleman ch.4; Carter 1.2., 1.6; Klein ch.2; de la Fuente 1;

Introduction to Real Analysis

Week 4

Required

Simon and Blume 12, 29 [stachurski-2009-econdyn] appendix A.2, chapter 3 [corbae.stinchcombe.zeman-2009-intro2math] ch.3, 4.1;

Recommended

Carter 1.3, 2.1; de la Fuente 2;

Sequences

Week 5

Required:

[stachurski-2009-econdyn] chapter 4.1 [simon.blume-1994-math4econ] ch.12; [corbae.stinchcombe.zeman-2009-intro2math] ch.4;

Recommended:

[klein-2001-mathmethods] ch.13;

Continuity

Week 5

Required

Simon and Blume 12,29; Carter 2.3;

Recommended

Chiang ch. 6; Klein ch.6;

Functions

Week 6

Required

Velleman ch.5; Carter 2.1; [stachurski-2009-econdyn] appendix A.1.2;

Recommended

Klein ch.2; Chiang 2,3; de la Fuente 1;

Exponents and Logarithms

Week 6

Required

Simon and Blume ch.5

Recommended

Carter 2.2; Klein ch.3; Klein ch.7; Chiang ch. 10.1-10.4;

Functions on Vector Spaces

Week 7

Required

Simon and Blume 10,11;

Recommended

n.a.

An Introduction to Matrix Algebra

Week 8

Required

Simon and Blume ch. 8,9,10,11,26; Dhrymes ch. 1;

Recommended

Simon and Blume ch. 26,27,28,12; Klein ch.4,5; Carter 3.1, 3.5; Chiang ch. 4;

Markov Chains

Week 9

Required

[stachurski-2009-econdyn] chapter 4

Recommended

n.a.

The Comparative Statics of Linear Models

Week 10

Required

Simon and Blume 6,7,8,9,26; Klein ch.4,5;

Recommended

Chiang ch. 5;

Continuity and Differentiability

Week 11

Required

Simon and Blume 13.4,17; Carter 4.1, 4.2, 4.3;

Recommended

Klein ch. 6,7,9; Chiang ch. 6;

The Comparative Statics of Non-Linear Models

Week 11

Required

Simon and Blume 9 (determinants and inverses), 15 (optional);

Recommended

Carter 4.5; Klein ch. 6,7,8; Chiang ch. 6,7,8;

Quadratic Forms

Week 12

Required

Simon and Blume 16

Recommended

n.a.

Multivariate Optimization

Week 13

Required

Simon and Blume 17, 18, 19; Carter 5.1, 5.2, 5.3;

Recommended

Klein ch.9,10,11; Chiang ch. 9,11,12,21;

Dynamic Optimization

Week 14

Required

[[stachurski-2009-econdyn](#)] chapter 5 handout

Recommended

Klein ch.15;

EMERGENCY PREPAREDNESS

American University has asked that all syllabi include the following text, which contains information about emergency preparedness in the event of a communicable disease epidemic.

In the event of a declared pandemic (influenza or other communicable disease), American University will implement a plan for meeting the needs of all members of the university community. Should the university be required to close for a period of time, we are committed to ensuring that all aspects of our educational programs will be delivered to our students. These may include altering and extending the duration of the traditional term schedule to complete essential instruction in the traditional format and/or use of distance instructional methods. Specific strategies will vary from class to class, depending on the format of the course and the timing of the emergency. Faculty will communicate class-specific information to students via AU e-mail and Blackboard, while students must inform their faculty immediately of any absence due to illness. Students are responsible for checking their AU e-mail regularly and keeping themselves informed of emergencies. In the event of a declared pandemic or other emergency, students should refer to the AU Web site (<http://www.prepared.american.edu>) and the AU information line at (202)885-1100 for general university-wide information, as well as contact their faculty and/or respective dean's office for course and school/ college-specific information.