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Departement Ekonomie - Department of Economics

Mathematical Economics for Postgraduate Students 771

2020

Prof DP von Fintel & Dr H Hollander

1 Background

The use of mathematics in economics is often viewed negatively by practitioners, ranging from mild opposition to much deeper skepticism in the underlying epistemology. These skeptics see quantitative methods as a compromised mode of expression that is best done away with.

Sometimes these sorts of sentiments are justified. A great deal of economics nowadays proceeds on the basis that an elegant mathematical proof of something is truth, no matter the empirical evidence for or against the theorem/theory in question.

While a sober assessment of its usefulness as a tool is to be encouraged, much of this sort of disagreeable sentiment is premised on a misunderstanding of the role played by mathematics in economics. The mathematical formulation of an argument is a style of reasoning that lends itself to disciplines, like economics, where evidence plays a central role. Of course, good writing can accomplish the same goal, but this is a rare skill that very few posses. So first and foremost, mathematical formalisms help to communicate ideas succinctly and with clarity that is often more difficult to do any other way.

But a second, perhaps more important role for mathematics, is that it helps us clarify how our conclusions (say over the efficacy of policy) follow from our (often hidden) assumptions. A formal approach to theorising about the economy offers a way of making transparent the underlying assumptions behind received ideas. Indeed, some of the most celebrated advances in economics during the 20th century have embodied exactly this idea.

In the end however, mathematical techniques are nothing but tools. Good economics requires ingenuity as well as creativity in the application of these tools. Although few might aspire to be like the Kenneth Arrow's of the world - brilliant masters of both mathematical formalism and narrative exposition - both manners of communicating the discipline are encouraged. Formal training in mathematical methods is therefore a core competency demanded by our postgraduate coursework degree programmes.

2 Course Contacts

Role	Name	E-mail	Room	Consultation
Lecturer	Prof DP von Fintel	dieter2@sun.ac.za	619A	By appointment
Lecturer	Dr H Hollander	hylton@sun.ac.za	519	By appointment
Tutor	Mr B Rouillard	19994133@sun.ac.za	-	During Tutorials
Postgraduate Administration	Ms C Smit	carina@sun.ac.za	506A	-

3 Course Objectives

- To provide students with a necessary foundation in calculus and linear algebra
- To provide a thorough grounding in unconstrained and constrained optimisation that will be applied in Microeconomics and Macroeconomics theory courses
- To introduce students to Dynamic Theory, which is foundational to advanced courses in Macroeconomics

4 Prescribed Text and Course Resources

- The core text for this course is
  Simon, C.P. and L. Blume, (1994). *Mathematics for Economists,* New York: WW Norton & Company.
- The section on recursive methods will follow:
  - Krussel, P. (2014). *Real Macroeconomic Theory.* Chapter 4, Dynamic Optimization
  - Judd, K. L. (1991). Review: A Review of Recursive Methods in Economic Dynamics. by Stokey, Lucas, and Prescott. *Journal of Economic Literature*, 29(1), 69-77
- The section on linearisation methods will follow:
  - Dejong, D.N. Dave, C. (2007). *Stuctural Macroeconometrics.* Chapter 2, Section 1: Linearization
  - Uhlig, H. (1999). A Toolkit for Analyzing Nonlinear Dynamic Stochastic Models Easily.
- All information, announcements, lecture notes, assignments and tutorials will be posted on SunLearn:
  - `http://learn.sun.ac.za`

5 Course Structure

5.1 Lectures, Tutorials and Problem Sets

Two formal lectures are scheduled for every week of the semester, though we will usually only use one time slot. The default slot is Mondays from 09:00-11:00. At times, we will meet on Fridays from 09:00-11:00. In addition to formal lectures, a weekly tutorial is scheduled on Mondays from 14:00-16:00. This slot will be used to work through problems with the tutor. This course

requires a substantial amount of practice to be able to implement and grasp the theoretical concepts and solve the problems in tests and exams. Students should prioritize the attendance of tutorials and the completion of problem sets. When a chapter is covered in the lectures, a set of problems from the text will be posted on the course website. Problem sets need not be handed in. However, at the beginning of each tutorial a short test will be written on any given subset of the questions that were prescribed in the problem sets. These short tests will constitute your tutorial mark (10% of the final mark).

5.2 Assessment

The final mark for this course will be calculated as follows (please note the relevant dates of assessment):

1. Tutorial mark: 10%
2. Term test: 30% (13 March 2020 from 09:00-11:00; Examinable material: Chapters 12 to 15)
3. Final exam: 60%

Please note the following important information:

- Term test
  - The test will cover material from Chapters 12 to 15
  - Students are not required to submit a medical certificate or provide any other reasons if they miss this test.
- Examination
  - The final exam will consist of three sections.
  - **Students who wrote the test in March** are only required to write the first and second sections, covering Chapters 16-19 and Appendix A4 (50 %) and Chapter 23, Recursive Methods and Linearisation (50%). These students write for 3 hours. Students may not write the third section of the exam if they have attempted to write the test in March.
  - **Students who miss the test in March** are required to write all three sections of the final exam (3 + 2 = 5 hours). This assessment will be completed in one sitting with a short controlled break. The third section will examine the same material as the test in March (Chapter 12 to 15). The paper for this section will only be handed out after the short break.

– **Students who miss both the term test and the examination** will not be awarded the credits for this module, and their results will be recorded as "incomplete". They will not be able to write the supplementary or medical exams, since no mark will be available for the term test. *Students who miss the term test in March therefore face the risk of not completing the module if they fall ill during the main examination period.*

– **Students who miss the examination due to illness** are obliged to present a valid medical certificate to the department, after which they may qualify to write the medical exam. Only students who wrote the term test can qualify for a medical examination. This assessment will take place together with the supplementary exam, and will be scheduled in the same week as all other supplementary exams of the postgraduate programme. The date will be announced in due course.

– **Students who write the first exam may qualify for a supplementary examination**, which will be written in the same week as all other supplementary exams of the postgraduate programme. After the first examination, passes, fails and supplementaries are awarded according to the following classifications:

Final Course Mark (FM)

		$0 \leq \text{FM} < 40$	$40 \leq \text{FM} < 50$	$50 \leq \text{FM} \leq 100$
Exam Mark (EM)	$0 \leq \text{EM} < 40$	Fail	Supplementary	Supplementary
	$40 \leq \text{EM} < 50$	Supplementary	Supplementary	Pass
	$50 \leq \text{EM} \leq 100$	Supplementary	Supplementary	Pass

– **Students who are ill and submit a medical certificate for the first examination** will not receive a mark for any of the assessments completed on the day of the examination. This entails that no mark will be awarded for section 3 of the exam should students have missed the term test. Should this occur, module results will be recorded as "incomplete" and students should register again for the course.

– **Students who miss both the test in March and the exam**, will not be awarded the credits for this module, and results will be recorded as "incomplete" and students should register again for the course in the following academic year. This includes students who are ill during the first exam period.

6 Basic Course Outline

The following times and venues apply, though sometimes lectures and tutorials are interchanged:
Lecture: Monday 09:00-11:00 - Schumann 205
Tutorial: Monday 14:00-16:00 - Schumann 205
Extra: Friday 09:00-11:00 - Schumann 205

Lectures (L)		**Tutorials (T)**		**Other**	
Monday (09:00-11:00)		Monday (14:00-16:00)		Friday (09:00-11:00)	
Background: *Prof DP von Fintel*					
03-Feb	Ch 12: Limits and Open Sets (L)	03-Feb	*	07-Feb	*
10-Feb	Ch 13: Functions of Several Variables (L)	10-Feb	Ch 12 (T)	14-Feb	*
17-Feb	Ch 14: Calculus of Several Variables (L)	17-Feb	Ch 13 (T)	21-Feb	*
24-Feb	Ch 15: Implicit Functions and Derivatives (L)	24-Feb	Ch 14 (T)	28-Feb	*
Optimisation & Integral calculus : *Prof DP von Fintel*					
02-Mar	Ch 16: Quadratic Forms (L)	02-Mar	Ch 15 (T)	06-Mar	*
09-Mar	Ch 17: Unconstrained Optimisation (L)	09-Mar	*	13-Mar	**TERM TEST**
16-Mar	Ch 18: Constrained Optimisation I (L)	16-Mar	Ch 16 & 17 (T)	20-Mar	*
23-Mar	**RECESS**	23-Mar	**RECESS**	27-Mar	**RECESS**
30-Mar	Ch 19: Constrained Optimisation II (L)	30-Mar	*	03-Apr	*
06-Apr	Appendix A4	06-Apr	Ch 18 & 19 (T)	10-Apr	**PUBLIC HOLIDAY**
Introduction to Dynamic Theory: *Dr H Hollander*					
13-Apr	**PUBLIC HOLIDAY**	13-Apr	**RECESS**	17-Apr	Ch 23: Eigenvalues and Eigenvectors (L)
20-Apr	Ch 23: Eigenvalues and Eigenvectors (L)	20-Apr	App A4 (T)	24-Apr	*
27-Apr	**PUBLIC HOLIDAY**	27-Apr	**PUBLIC HOLIDAY**	01-May	**PUBLIC HOLIDAY**
04-May	Recursive Methods	04-May	Ch 23 (T)	08-May	Linearisation
11-May	*	11-May	Recursive Methods & Linearisation (T)	15-May	*

Please monitor the course website and listen for announcements in class regarding the slots with an (*). (L) denotes a formal lecture for a specific date, while (T) indicates a tutorial. The time taken and order of the topics may be adjusted to suit the schedule, but will be timeously communicated to students in class and/or via the course website.