Guide for Incoming MSc Economics Students

1. MICROECONOMICS

Contents:

1. Consumer Theory
2. Decisions under Uncertainty
3. Producer Theory
4. General Equilibrium
5. Introduction to game theory
6. Asymmetric information and contract theory

The material is presented on a formal mathematical level. Results are derived formally but more complicated proofs are not covered in this lecture.

Math Prerequisites: The course requires some familiarity with multivariate calculus, standard mathematical techniques used in formal undergraduate courses and a few more results. Here is a detailed list:

1. Limits, Continuity, Differentiability, Integration of univariate functions, compact sets in R^n, intermediate value theorem.
2. Vector- and Matrix notation. Scalar Products
3. Multivariate Calculus: partial derivative, Young's theorem, Hessian matrix, convex and concave functions, positive and negative (semi-)definite matrices, implicit function theorem, homogeneous functions of any degree
4. (Constrained) Optimization: Lagrangian, Kuhn-Tucker Conditons, Envelope Theorem, Weierstrass' theorem,
5. Probability Theory: Expected Value, Jensen's inequality

Most of these topics also in the maths as statistics course that is available over the summer and if you are not familiar with them it is useful to review them before you get busy during the term. You can find treatments of these topics in

- *Mathematics for Economists* (Pemberton & Rau)
- *Mathematics for Economists* (Simon & Blume)
  This is more advanced than Pemberton & Rau and covers much more than is needed in preparation for this course.

Economics Prerequisites: Students should be familiar with basic microeconomics terminology and definitions of: Elasticities, normal and inferior goods, luxuries and necessities. income expansion paths, Engel curves, utility functions, budget sets, indifference curves, isoquants, price-taking behaviour, Cobb-Douglas and CES utility- and production-functions, Edgeworth-Box. It is expected that you are able to derive solutions to utility maximization problems, cost-minimization problems and profit maximization problems.

Generally the material is presented in a self-contained manner but you are expected to be able to solve the problems mentioned above without difficulty and should review the terminology and basic concepts.

Textbooks you can use to review are for example:

- Microeconomics – Principles and Analysis (Cowell)
- Intermediate Microeconomics (Varian)

Recommended textbooks:

- G. Jehle and P. Reny, Advanced Microeconomic Theory, Addison-Wesley, 2000. (or other editions)

- A. Mas-Colell, M.D. Whinston and J.R. Green, Microeconomic Theory, Oxford University Press, 1995.
  This book is more advanced and comprehensive than Jehle and Reny. In particular the chapters on Game Theory and Asymmetric Information and Contract Theory are better than in Jehle/Reny

Lower level (advanced undergraduate) textbooks:

- H. Gravelle and R. Rees, Microeconomics, 3rd Edition, Financial Times/Prentice-Hall, 2004.

- F. Cowell, Microeconomics: Principles and Analysis, Oxford University Press, 2006.

The following books are advanced readings that cover most topics of this module but are much more comprehensive.

Useful reference if you want to dig deeper into models of consumer behaviour:

- Deaton and J. Muellbauer, Economics and Consumer Behaviour, Cambridge University Press, 1980.

More advanced texts on game theory are:

- D. Fudenberg and J. Tirole, Game Theory, MIT Press, 1991

- M. Osborne and A. Rubinstein, A Course in Game Theory, MIT Press, 1994

Useful textbooks on asymmetric information and contract theory are:

- J.-J. Laffont and D. Martimort, The Theory of Incentives, Princeton University Press, 2002

- B. Salanie, The Economics of Contracts A Primer, 2nd ed, MIT Press, 2005

- P. Bolton and M. Dewatripont, Contract Theory, MIT Press, 200

2. MACROECONOMICS

Pre-requisites:

- see maths & stats

Summer reading:

- Gerogry Mankiw (2006), "The Macroeconomist as Scientist and Engineer", Journal of Economic Perspectives.
  Link: https://scholar.harvard.edu/files/mankiw/files/macroeconomist_as_scientist.pdf
- V.V. Chari and Patrick Kehoe (2006), "Modern Macroeconomics in Practise: How Theory is Shaping Policy", Journal of Economic Perspectives.
  Link: http://www.skchugh.com/images/ChariKehoe_2006JEP_MacroTheoryAndPolicy.pdf
- Nobel Prize lecture Christopher A. Sims
  http://www.nobelprize.org/mediaplayer/index.php?id=1743
- Robert E. Hall (2016), "The Macroeconomics of Persistent Slumps", in John Taylor and Harald Uhlig, eds*., Handbook of Macroeconomics*, *Vol. 2*.
  Link: http://web.stanford.edu/~rehall/HBC010716.pdf

Textbooks:

- *David Romer*, "Advanced Macroeconomics", Third Edition, McGraw-Hill, 2006.
- *Daron Acemoglu*, "Introduction to Modern Economic Growth", Princeton University Press, 2009.

3. ECONOMETRICS

Prerequisites:

It is assumed that students have a working knowledge of basic linear algebra (e.g., linear systems of equations, matrix algebra), multivariate calculus (e.g., partial derivatives, multivariate optimization), elementary probability theory (e.g., joint distributions, conditional expectations, variances and correlations), and statistical inference (e.g., consistency, unbiasedness, confidence intervals, hypothesis testing).

Summer Preparation:

Just make sure you are familiar with the mathematics prerequisites. In particular, students in the past have sometimes struggled with matrix algebra in the beginning of the course. For this you might want to look at the chapter on multivariate regression and the appendix on matrix algebra in

(SW) Stock, J. H. and M. Watson (2011): "Introduction to Econometrics", Pearson, 3rd edition.

(SW) also reviews basic concepts from probability and statistics (see Ch. 2 and 3). For a more detailed review, you may also want to look at the relevant chapters in

Hansen, Bruce E. (2020): "Introduction to Econometrics", University of Wisconsin (available online).

Textbooks:

There is no required textbook for this class. Some recommended supplementary readings include

Wooldridge, J. (2010): "Econometric Analysis of Cross Section and Panel Data", MIT Press, 2nd edition.

Hayashi, Fumio (2000): "Econometrics", Princeton University Press.

Hansen, Bruce E. (2020): "Econometrics", University of Wisconsin (available online).

4. MATHEMATICS AND STATISTICS

The mathematics and statistics refresher course is delivered as an online course ("Maths Camp") and designed as a review. We assume that your prior studies covered the concepts in that course. You will have access to the online platform during the summer prior to the start of the MSc programme.

We strongly encourage you to go through the topics list below as soon as possible and make sure that your prior studies indeed covered them.

1 Overview

Lecturer: Daniel Wilhelm

Teaching Assistant: tba

Summary: This course revises some of the analytical tools most frequently used in economics and econometrics. It has a strong practical focus, aiming at ensuring that all students handle the basic analytical concepts used in the other MSc courses.

On-Campus Review Sessions: In addition to the online course, there will be a few review sessions on campus the week before the exam. The sessions are held by the teaching assistant with a focus on solving exercises.

2 Textbooks

For the mathematical background part of the course we will use

(PR) Pemberton, M. and N. Rau (2011): "Mathematics for Economists: An Introductory Textbook", Manchester University Press (any newer edition is fine, but notice that the numbering of chapters has changed after the 2011 edition)

and we strongly recommend you have it for reference. The statistics part will focus on

(SW) Stock, J. H. and M. Watson (2011): "Introduction to Econometrics", Pearson, 3rd edition

whose chapters on probability and statistics are a concise review of relevant topics for our course. We will also draw some content from

(W) Wooldridge, J. (2010): "Econometric Analysis of Cross Section and Panel Data", MIT Press, 2nd edition.

which will also be used in the core econometrics courses later on. If you like a more detailed review and need to learn some concepts from scratch,

(DS) DeGroot, M. H. and M. J. Schervish (2011): "Probability and Statistics", Pearson, 4th edition.

may be a better option than (SW). If you have a solid background in probability and statistics, there is probably no need to buy (SW) nor (DS).

Optional further reading: For a more formal discussion of unconstrained and con- strained optimisation, see Appendix M.J–M.N of Mas-Colell, Whinston, and Green (1995). Ljungqvist and Sargent (2004) is a great macro textbook that covers dynamic program- ming in more detail and provides lots of economic applications.

3 Topics

1. Mathematical preliminaries
   Sets; Sequences and limits; Open sets and closed sets, compact sets. Required reading: (PR) Ch. 3 and 5
2. One-variable calculus
   Functions; Limits and continuity; Slope and derivatives; Using derivatives to characterise functions; Using derivatives to approximate functions at a point. Required reading: (PR) Ch. 3, 6, 7, 9 and 10.2
3. Integral calculus
   Indefinite integral; Integration rules; Definite integral; The fundamental theorems of calculus; Special integration rules. Required reading: (PR) Ch. 19, 20
4. Matrix algebra
   Matrices and vectors; Matrix operations; Systems of linear equations; Rank of a matrix; Determinant of a matrix; Eigenvalues and eigenvectors; The relationship be- tween the determinant and the eigenvalues and eigenvectors of a matrix; Quadratic forms; Definite matrices.
   Required reading: (PR) Ch. 11 to 13 and 25
5. Calculus of several variables
   Functions of several variables; Partial derivative; The chain rule; Higher order derivatives; Approximation at a point; Turning points; Concavity and convexity; The implicit function theorem; Homogeneous functions.
   Required reading: (PR) Ch. 14 and 15
6. Optimization with several variables
   Unconstrained optimisation; Optimisation with equality constraints; Optimisation with inequality constraints; The general case: optimisation with mixed constraints; The envelope theorem and comparative statics analysis.
   Required reading: (PR) Ch. 16 to 18
7. Introduction to dynamic optimisation in discrete time
   Existence of a solution; Policy function; Brief introduction to difference equations. Required reading: (PR) Ch. 27 and 28
8. Introduction to probability
   Events and probability, simple operations; Conditional probability and the Bayes theorem; Independence.
   Required reading: (SW) Ch. 1 and 2.1; alternatively: (DS) Ch. 1 and 2
9. Random variables
   Single random variables: discrete and continuous random distributions, functions of random variables, moments; Bivariate distributions: marginal distribution, con- ditional distribution, moments, independence, law of iterated expectations; Vectors of random variables; Important

distributions.
Required reading: (SW) Ch. 2.2 to 2.4; alternatively: (DS) Ch. 3 to 5

10. Conditional expectations in econometrics
Properties of conditional expectations; elasticities, partial effects, linear projections. Required reading: (W) Ch. 1 and 2

11. Large samples
Random samples and sample moments; Weak law of large numbers; Central limit theorem; The delta method.
Required reading: (SW) Ch. 2.5 to 2.6 (alternatively: (DS) Ch. 4 and 5) and (W) Ch. 3

12. Estimation and testing
Estimation; Distribution of sample mean in large samples; Confidence intervals; Hypothesis testing.
Required reading: (SW) Ch. 3 (alternatively: (DS) Ch. 6 to 8) and (W) Ch. 3

Assessment

The module is assessed by final exam in early October of the MSc year. Students who fail this exam will be provided with additional support during Term 1 and will be offered a re-sit exam in the following August. Previous years' exams are available for students to practice with.

References

Ljungqvist, L., and T. J. Sargent (2004): Recursive Macroeconomic Theory. MIT Press, 2nd edn.

Mas-Colell, A., M. D. Whinston, and J. R. Green (1995): Microeconomic Theory. Oxford University Press.