

## Interdisciplinary Programmes

Academic year 2019-2020

## Advanced Quantitative Methods

### MINT009 - Spring - 6 ECTS

Tuesday 16h15 - 18h00

## Course Description

This course is a continuation of the quantitative methods sequence for students in the MIA and MDEV programs. It will build on the introductory quantitative methods class by introducing the fundamentals of econometrics. After taking this course, students will be familiar with a wide variety of tools -- such as OLS regressions, instrumental variables, and the basics of panel data techniques -- that are used by social scientists to answer real world questions. There will be an emphasis on understanding the assumptions behind common techniques; developing skills to read and understand quantitative academic papers; and analyzing interesting data sets using statistical software (Stata).

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### > PROFESSOR

[Rahul Mukherjee](#)

[Office hours](#)

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### > ASSISTANT

[Seoni Han](#)

[Office hours](#)

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## Syllabus

**Course outline:** This course is an introduction to the collection of statistical tools and techniques that social scientists refer to as “econometrics”. The basic techniques were developed by statisticians in widely varying fields such as economics, biology, and political science. Even though the textbook (see below) is written from an economist’s point of view, the main technical issues are similar across different disciplines. Thus we will apply the core concepts to data sets and questions from a wider range of social sciences.

The course consists of a weekly class and a review session. The review session will be conducted by Seoni Han ([seoni.han@graduateinstitute.ch](mailto:seoni.han@graduateinstitute.ch)). I will cover theory and some of their applications in class. The review session will be used by Seoni to review any math techniques that we use, cover problems encountered in the lectures and written assignments, as well as to develop statistical computing skills.

**Prerequisites:** The course assumes prior knowledge of statistics at the level of the introductory Statistics for MIA/MDEV programs at IHEID, and high school algebra. Additional mathematical tools,

like the barest minimum of matrix algebra required to understand some of the statistical concepts, will be covered by Seoni during the first few review sessions. If you would like to learn the basics of linear algebra before the class starts, consult the reference provided in the book list below. This is purely optional.

**Books:** The main textbook will be Wooldridge, J. (2012), *Introductory Econometrics: A Modern Approach, 5<sup>th</sup> edition*. You can also use the 4<sup>th</sup> edition, which is very similar. Note that there are more recent editions up to the 7<sup>th</sup> edition available.

A useful and slightly more advanced reference is *Johnston, J. and J. Dinardo (1997), *Econometric Methods, 4<sup>th</sup> edition**. Background statistical material can be found in *Agresti, A. and B. Finlay *Statistical Methods for the Social Sciences (2009), 4<sup>th</sup> edition**. A more advanced reference for the underlying statistics can be found in *Hogg et al. (2012), *Introduction to Mathematical Statistics, 7<sup>th</sup> edition**. For the basics of linear algebra, you can consult your review session notes and chapter 2 of *Lipschutz, S. and M. Lipson (2013), *Linear Algebra (Schaum's Outlines Series, any edition 3<sup>rd</sup> onwards)**.

Two very interesting books if you feel that you are getting interested in the subject of causal inference are: *Angrist and Pischke (2014), *Mastering 'Metrics: The Path from Cause to Effect**; and *Mostly Harmless Econometrics*, by the same authors. The latter is a more advanced treatment.

**Other materials:** The lectures will be taught from slides, which will be e-mailed to you each week before the class, the second week onwards. I may assign additional materials (such as methodological papers from political science and economics) from other sources where required. These sources will be mentioned on the slides for the relevant week as the class progresses, and will either be available at the library, online, or will be e-mailed to you.

**Software:** Stata, a statistical software package used by researchers in the social sciences, will be used in this class as a complement to theory. For a list of computing sites in IHEID that have Stata, consult the Computer User Booklet provided by the IT department. You will be expected to develop a level of comfort in using Stata in order to complete your assignments satisfactorily.

**Grades:** The final grade on the course will be a weighted average of **three graded homework assignments** (total 30%), weekly problem sets (total 10%), and two exams: a **midterm** (27.5%) and a **final** (32.5%).

*Homework assignments:* There will be three assignments each worth 10%. Students should form groups of up to 4 persons (I might change this number depending on class enrolment) to work on the assignments and submit only one final copy of a particular assignment for the entire group. You should e-mail Seoni about the composition of your group **by the end of the second week of class** so that she can record and attribute grades properly. Answers to the assignments, legible and stapled, must be submitted in hard copy and any computer programs used should be e-mailed to Seoni. If you are not confident about your handwriting, please type up your assignment.

**Assignments will be due at the beginning of class on the date mentioned on the course schedule.** Late problem sets will **not** be accepted. Grades for these problem sets will be converted to a 6 point scale, the details of which will be explained to you later.

*Weekly problem sets:* These will be assigned by Seoni on a weekly basis. They will be graded check-plus or check-minus. These are meant to make sure you are keeping up with the material and need to be handed in individually (not in a group as the HW) during the review session. More details from Seoni will follow.

*Exams:* Both exams will be closed-book (i.e. you will **not** be allowed to have study materials with you). You will be allowed the use of calculators. Since each topic builds on the previous, I am labelling

the final exam cumulative, but it will place much more weight on material covered after the midterm. I will provide you more information about this later.

**Office hours:** I will hold regular office hours, but you can drop by only with an appointment using this link: <https://rahulmukherjee.youcanbook.me/>. This is to minimize waiting time for students and to allocate time fairly across students. Of course, if you have an appointment booked and there is no one booked right after you, you are free to stay longer to ask questions. If you feel you are lagging behind at any time during the course, you should make use of the office hours. A recurring pattern from last years has been that my office hours are practically empty till the week before the exam. Don't wait till the end to ask questions and get feedback.

**Midterm feedback and evaluation of the course:** I will have a brief general session right after the midterm to get feedback and evaluation from you about how the course is proceeding.

**Course outline:** Below is a tentative course outline. It is very likely to be revised as the course progresses to include or exclude topics depending on our progress.

Date	Readings/Assignment	Topics
Week 1		
Class 1	Selected topics from Agresti and Finlay chapters 4-8; Woolridge chapter 2	Course introduction; simple regression model
	<b>No review this week</b>	
Week 2		
Class 2	Woolridge chapter 2, 3	Simple regression model (continued); Multiple regression analysis (estimation)
Review Session 1	Review of week 1 and 2 material; review of basic probability and statistics and introduction to matrices; introduction to linear algebra	
Week 3		
Class 3	Woolridge chapter 3	Multiple regression analysis (estimation, continued)
Review Session 2	Review of week 3 material	
Week 4		
Class 4	Woolridge chapter 4	Multiple regression analysis (inference)
Review Session 3	Review of week 4 material	
Week 5		
Class 5	Woolridge chapter 4 <b>Problem set 1</b> due (worth 10%)	Multiple regression analysis (inference, continued)
Review Session 4	Review of week 5 material	
Week 6		
Class 6	Woolridge chapter 4, 5	Multiple regression analysis (testing more complicated hypotheses; rough idea of asymptotic properties)
Review Session 5	Review of week 6 material	
Week 7		
Class 7	Woolridge chapter 6, 7	Multiple regression analysis

		(further issues, qualitative variables)
Review Session 6	Review of week 7 material	
Week 8		
Class 8	<b>Midterm</b> on material covered <b>during weeks 1 to 6</b> , worth <u>27.5%</u>	
Review Session 7	Review session (if required)	
Week 9		
	<b>NO CLASS (Easter Break)</b>	
	No review session this week	
Week 10		
Class 9	Woolridge chapters 8, 9	Basic idea of heteroscedasticity; Multiple regression analysis (specification and data issues)
Review Session 8	Review of week 8 material	
Week 11		
Class 10	Woolridge chapters 9, 13	Multiple regression analysis (specification and data issues continued); Methods for panel data
Review Session 9	Review of week 9 material	
Week 12		
Class 11	Woolridge chapters 13, 14	Methods for panel data continued
Review Session 10	Review of week 12 material	
Week 13		
Class 12	Woolridge chapter 17 Woolridge chapter 15	Limited dependent variables; Instrumental variables
Review Session 11	Review of week 13 material	
Week 14		
Class 13	Woolridge chapter 15 <b>Problem set 3</b> due (worth <u>10%</u> )	Instrumental variables continued
Review Session 12	Review of week 14 material	
Week 15		
	<b>Tentative final exam date</b> Final exam on material covered during weeks 1 to 6 and 9 to 14 (see grades section before), worth 32.5%	