Carleton University
Econometrics II, ECON 6027

Professor: Lynda Khalaf

Winter 2024

1 Course Objectives

The goal of this course is to familiarize PhD students with a wide range of topics in modern econometrics, focusing on what matters for applying and understanding empirical work.

Prerequisites include a masters-level course in econometrics [for example, the ECON 5027 course at Carleton] that covers the basics on Regression Analysis, Least Squares, Instrumental Variables (IV) and Maximum Likelihood estimation. Matrix Algebra and fundamental statistical principles [for example, the basics, in the Appendix of the course textbook] are assumed known. The course will nevertheless include three full review lectures, covering background material on linear regression and inference, and on several matrix algebra principles and important statistical concepts.

First and second year PhD students may have heterogenous training with regards to masters-level material: the course thus aims to standardize background knowledge and skills before introducing non-linear methods. Within the non-linear class, the Generalized Method of Moments and likelihood-based models for discrete choice and time varying volatility will receive specific attention.

The course exposition is formal and technical, and departs from a recipe-book/tool-kit approach. While the focus is on applicability, theory and principles will be emphasized. These include *standard* asymptotic theory. The course sets the minimum requirement in this field at the PhD level, which may be summarized as *understanding* rather than just *using* econometrics. Detailed lecture notes will be available, to bridge the gap between the required theoretical training, relative to the recommended textbook.

This course is required for **all** PhD students, whether they will choose econometrics as a field or not. Instruction will reflect this fact, while students interested in econometrics as a PhD field can sharpen their knowledge particularly on the theory side. Rigor and notational clarity is expected in assignments, which will be reflected in grading. Writing

skills will also be assessed through the written assignments (see below).[1]

Some knowledge of econometric software is required. Training sessions will be offered on STATA, MATLAB and R. In addition to main econometric methods, software training will also cover optimizing non-standard statistical objective functions, some programming principles and an introduction to simulation-based studies and methods. Equal focus on cross-section and time series principles and applications is maintained.

The course includes assignments using well known data sets and econometric problems of recent interest in economics.

2 Lectures

The course will be offered on-line. Unless indicated otherwise, notes and recorded lectures will be posted on Brightspace on or before Monday 11h30 of each teaching week. The assigned teaching time is Wednesdays 8:35 -11:25. Lectures and training directives are pre-recorded then posted on Brightspace.

Further directives will be posted on Brightspace and regularly updated. Students need to verify Email and announcements on Brightspace all through the semester. Brightspace will be used for the following: all course announcements and email; links to the course slides and pre-recorded lectures; online submission of the assignment in pdf form. Unless an urgent and unanticipated problem emerges, changes to the schedule below will be announced within a week notice.

Regular **on-line Q&A periods** and training sessions are indicated below. Students are encouraged to prepare their formal questions in writing (scanned handwriting is accepted) and sent by Brightspace email or shared during a Q&A session. Unless otherwise indicated, a ZOOM invitation will be sent via Brightspace email within half an hour of the scheduled Q&A period. **The regular Q&A sessions are optional** (replace office hours)**. Students are strongly recommended to attend the training sessions.**

For clarity and to facilitate communications, the following describes Email policy for this course.

- Course related queries should be sent via Brightspace Email. Any other Email communication in any form about this course will not receive any response; this is to make sure all questions are properly received.

- Questions on course material will not be answered on continuous basis. Instead, the objective is to establish a fair, transparent and reliable system. From January

[1] Writing matters in econometrics; many good papers remain unpublished because of poor writing and presentation.

8 to April 3[2], all questions received by Monday noon [that is between Monday pm of the preceding week and Monday am of the current week] will receive a response by Tuesday 5 pm.[3]

- Responses that require proofs, derivations and similar queries will normally not be settled by Email exchange. In fact, except for brief and minor clarifications, most questions will be redirected towards Q&A online meetings with appointments if needed, in view of the nature of the course.

3 Grading Scheme and regulations

- Grades

1. Assignment I (35%). Due February 7, 11h30 (upload on Brightspace, pdf document).
2. Assignment II (35%). Due March 13, 11h30 (upload on Brightspace, pdf document).
3. Assignment III (30%). Due April 20, 11h30 (upload on Brightspace, pdf document).

Failure to submit the assignments on time will result in a grade of zero. The assignments are not designed to be closed-book so it is acceptable to use available resources, to cooperate or to consult (with others or with each other). Group work [groups of up to **two** students only] is allowed; each group has to submit a differentiated assignment. Identical assignments will be treated as a plagiarism case.

4 Important instructions, regulations and academic support

The following are important: (i) instructions for any submitted material for this course including oral presentations, and (ii) references to official information about plagiarism, Carleton University resources, and academic accommodations. Students who need clarifications about the information below are invited to raise the question either by Email or directly at a Q&A session.

[2] There will be no Q&A period after the last day of classes. Please note that April 10 follows a Friday schedule.

[3] Questions of an exceptional urgent nature should be identified as such in the message subject matter, and will be managed depending on the nature of the emergency.

- On the use of Generative Artificial Intelligence tools (e.g. ChatGPT). While you may consult available resources (electronic or not), any *textual and direct* use of generative AI tools to produce any document you submit for this course is considered a violation of academic integrity standards as per the university's statement on Plagiarism (reference provided below). By *textual and direct*, the usual standards on plagiarism apply.

- **Student or professor materials created for this course, including presentations and posted notes, assignments and exams, remain the intellectual property of the author(s). They are intended for personal use and may not be reproduced or redistributed without prior written consent of the author(s).**

- Re-use of (own) work: (i) previously submitted for credit in another course, (ii) conducted for any previous purpose such as a masters paper or thesis, or (iii) is currently performed and intended for another course or for other purposes (*e.g.* current research, material submitted for work outside the university), is **not** considered plagiarism.[4] But you are required to cite such work and seek my permission **before** using it with proper citation. If the work is current and is intended for another course, the permission of the professor in charge of the other course will be required in writing (by official university Email); this also applies to courses taken at the university of Ottawa.

- You are responsible for reading and knowing the information about plagiarism, Carleton University resources, and academic accommodations found at

https://carleton.ca/economics/plagiarism-resources-and-accommodations/

5 Textbook

5.1 Basic Textbook

Hansen B. (2020). *Econometrics*. Electronic version available. https://users.ssc.wisc.edu/~bhansen/econo

Class notes will be available to guide readings. Directives to access available E-resources will be provided. The same author has an introductory textbook that is recommended as a reference. Other reference manuals include the following.

[4] If the work was submitted for work outside the university, it is the responsibility **of the student** to ensure confidentiality rights are respected.

5.2 Reference Manuals (for optional consultation)

1. Davidson R. and J. MacKinnon (2004). *Econometric Theory and Methods.* Oxford University Press. http://qed.econ.queensu.ca/ETM/.

2. Gouriéroux, C. and A. Monfort (1995). *Statistics and Econometric Models*, Volumes 1-2. Cambridge University Press, Cambridge, U.K.

3. Greene W. H. (2018). *Econometric Analysis*, 8th Edition, Pearson.

   http://people.stern.nyu.edu/wgreene/Text/econometricanalysis.htm.

4. Cameron A. C. and Trivedi (2009). *Microeconometrics Using Stata.* Stata Press.

5. Pesaran M. H. (2015). *Time Series and Panel Data Econometrics.* Oxford University Press.

6. Tsay R. S. (2005). *Analysis of Financial Time Series.* John Wiley & Sons.

6 Proposed Course Outline

This outline is tentative. Adjustments may be needed depending on the performance in assignments and or feedback from the class; changes to the schedule below will be announced within a week notice.

1. January 10: *Background unifying training: basic principles, the linear model, asymptotic theory, time series regressions.* Ref: Chapters 2-8. **Q&A: 9h30-11h00.**

2. January 17: *Background unifying training, continued.* **Q&A: 9h30-11h00.**

3. January 24: Exercises and software training session. Details will be provided with a week notice. Q&A: to be announced.

4. January 31: *Background unifying training, continued.* **Q&A: 9h30-11h00.**

5. February 7: **Deadline, assignment 1.** *Likelihood: general principles, inference (hypothesis testing); time series and discrete choice applications.* Time series covers, among others, ARMA and (G)ARCH models. Ref: Chapters 5, 9, some sections of 26. Reference on (G)ARCH models: Tsay (2005), in the above list of reference textbooks. **Q&A: 9h30-11h00.**

6. February 14**:** *Likelihood, continued.* **Q&A: 9h30-11h00.**

7. February 21**:** Carleton University Winter Break. No class.

8. February 28: Exercises and software training session. Details will be provided with a week notice. Q&A: to be announced.

9. March 6*: Likelihood, continued. Optimizing non-linear functions.* **Q&A: 9h30-11h00.**

10. March 13: **Deadline, assignment 2.** *IV regression and GMM.* Ref: Chapters 12 and 13. **Q&A: 9h30-11h00.**

11. March 20: *IV regression and GMM, continued.* **Q&A: 9h30-11h00.**

12. March 27: Exercises and software training. Partly synchronous lecture; details will be provided with a week notice. Q&A: to be announced.

13. April 3: Catch-up lecture. **Q&A: 9h30-11h00.** Note that on April 10, classes follow a Friday schedule, so there will be no class for this course.

14. April 19: **Deadline, assignment 3.**