UNIVERSITY OF WATERLOO

Department of Economics
ECON 322: Econometric Analysis 1

Course Outline
(Spring 2022)

Instructor:	Arcila, Andrés
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Lecture Time:	T-Th 11:30 to 12:50
Lecture Location:	RCH 305
Office Hours:	Thursdays 5:00 to 6:00 (online) or by appointment

Course description

This course covers the core topics needed to estimate linear models using ordinary least squares and to interpret estimates for cross-sectional data. Students will learn to interpret the coefficients of linear models for continuous and discrete regressors, to conduct reliable inference for different specifications of the error term, and to determine which model is the most suitable among the class of linear models.

Students will be introduced to a statistical software package and will be required to complete regular computer-based assignments throughout the course that either: (i) simulate the statistical distribution of the least squares estimator under an assumed model; or (ii) estimate the parameters of an assumed model using a sample of data from the real world.

The statistical software package used in this course is R. It runs on Windows, Mac or Linux and can be downloaded for free at https://www.r-project.org/. It is also available in any Arts computer labs. You will be trained to use it in class and in

tutorial sessions. If you have a computer, you should go to the above link and install R before the first tutorial session. It is also recommended, but not required, to install R-Studio, which is also available for free at https://www.rstudio.com/. It is an IDE (Integrated Development Environment) for R. It greatly facilitates the use of R.

Textbook

The students are expected to read the chapters mentioned in the Topics section below. Ideally, the readings should be done before attending the lectures.

- Wooldridge, Jeffrey M., *Introductory Econometrics: A Modern Approach* Sixth Edition, Cengage Learning 2016 **(previous editions can also be used)**

- Heiss, Florian, *Using R for Introductory Econometrics*, CreateSpace 2016 **(It is available online for free at http://www.urfie.net/read.html, or it can be purchased at Amazon.ca)**

Topics

For each topic, some problems are suggested. They are supplementary problems that you may want to try if you need more practice questions. However, specific problems to prepare for the exams are available in Learn.

1. Introduction: (Appendices B and C)
   Overview of important concepts in statistics

   ◇ **Problems from appendix B:** 1, 2, 4, 9, 10
   ◇ **Problems from appendix C:** 1, 6, 7, 8, 11

2. The simple regression model (Chap. 1 and 2)
   Discussion on the different types of data, estimation of models with 1 regressor, and the interpretation of a regression.

   ◇ **Theoretical problems:** 2.1, 2.2, 2.3, 2.5, 2.6, 2.7, 2.8, 2.9
   ◇ **Numerical problems:** C2.1, C2.2, C2.4, C2.6, C2.7, C2.10

3. Multiple regression models (Chap. 3)
   Issues regarding data and model selection.

   ◇ **Theoretical problems:** 3.1, 3.3, 3.4, 3.6, 3.7, 3.12, 3.15, 3.16
   ◇ **Numerical problems:** C3.1, C3.2, C3.6, C3.8, C3.10

4. Inference (Chap. 4))
   Tests of single and multiple linear restrictions

   ◇ **Theoretical problems:** 4.1, 4.2, 4.4, 4.6, 4.8, 4.10, 4.11

   ◇ **Numerical problems:** C4.1, C4.2, C4.3, C4.6, C4.8, C4.12

5. Asymptotic properties of the OLS estimators (Chap. 5)
   Analysis of the properties of the estimators when the sample size increases

   ◇ **Theoretical problems:** 5.2, 5.3, 5.5

   ◇ **Numerical problems:** C5.1, C5.2, C5.4, C5.6

6. Functional forms and forecasting (Chap. 6)
   Discussion on how to choose the functional form, and the forecasting of the dependent variable.

   ◇ **Theoretical problems:** 6.1, 6.3, 6.4, 6.7, 6.10

   ◇ **Numerical problems:** C6.1, C6.2, C6.3, C6.5, C6.8, C6.11, C6.14

7. Regression with dummy variables (Chap. 7)
   Including unquantifiable information in a regression: the qualitative variables

   ◇ **Theoretical problems:** 7.1, 7.2, 7.5, 7.8, 7.9

   ◇ **Numerical problems:** C7.2, C7.4, C7.8, C7.10, C7.12, C7.14, C7.16

8. Generalized linear models: Heteroscedasticity (Chap: 8)
   The properties of OLS with heterogenous error terms, and the weigthed least quares (WLS) method

   ◇ **Theoretical problems:** 8.1, 8.2, 8.3, 8.5, 8.6, 8.8

   ◇ **Numerical problems:** C8.1, C8.5, C8.8, C8.12, C8.14

9. Misspecification (Chap: 9)
   Measurement errors, missing data, and functional form misspecification

   ◇ **Theoretical problems:** 9.1, 9.2, 9.3

   ◇ **Numerical problems:** C9.1, C9.3, C9.8, C9.11, C9.13, C9.14

Evaluation

Topics covered in all exams will be given in class. Practice questions will be provided before each exam, and most of them will be solved in class, for the midterms, or in a special review session for the final. In order to push the students to learn R, questions with R coding can be asked in any exam for up to 15 points out of 100.

Assignments (Weekly (almost)): 25%
Midterm exam (Thursday June 2 in class): 20%
Midterm exam (Thursday July 7 in class): 20%
Final exam (cumulative): 35%

Policy regarding the assignments

At the end of each tutorial, the TA will hand out an assignment. You must hand in it at the beginning of the next tutorial session. Failure to do so without a valid justification, to be approved by the instructor, will result in a grade of 0. You must therefore attend the session you are registered for. For a few assignments, you may be asked to upload it on Learn. In those cases, you must upload it before the deadline specified on Learn.

In all assignments, you have to answer theoretical and computer questions. You must submit the answers to the computer questions using a word processor. Your answers must include the R codes, the output produced by R, any graphs if you are asked to produce them, and a discussion if required. Failure to do so, may result in a grade of 0.

Although you are encouraged to work in groups, you have to submit your own assignments with your own answers. As a result, two or more students submitting identical answers are violating Policy 72 and disciplinary penalties my be imposed under Policy 71 (see below).

The marking scheme is as follows (except for the last assignment): You get 0 if you answer less than 50% of the questions or if you do not hand it in. You get 1 if you answer between 50% and 99% of the questions. You get 2 if you answer all questions.

The last assignment is worth approximately three assignments. You will be asked to answer general questions using new datasets, and to build your own model. For this assignment, you will be evaluated on your ability to apply the different concepts covered in class. The questions and datasets will be available on Learn a few weeks before the due date.

Policy regarding missed midterm exams

If a student provide the proper documents to the instructor within 2 business days of the exam and that the justification is considered valid by the instructor, the weight of the midterm exam is moved to the final exam.

Economics Department Deferred Final Exam Policy
Deferred Final Exam Policy found at
https://uwaterloo.ca/economics/undergraduate/resources-and-policies/deferred-final-exam-policy.

Cross-listed course

Please note that a cross-listed course will count in all respective averages no matter under which rubric it has been taken. For example, a PHIL/PSCI cross-list will count in a Philosophy major average, even if the course was taken under the Political Science rubric.

Academic Integrity

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo are expected to promote honesty, trust, fairness, respect and responsibility. See the UWaterloo Academic Integritity webpage and the Arts Academic Integrity webpage for more information.

Discipline: A student is expected to know what constitutes academic integrity, to avoid committing academic offences, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. When misconduct has been found to have occurred, disciplinary penalties will be imposed under Policy 71 – Student Discipline. For information on categories of offenses and types of penalties, students should refer to Policy 71 - Student Discipline. For typical penalties check Guidelines for the Assessment of Penalties.

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4. When in doubt, please be certain to contact the department's administrative assistant who will provide further assistance.

Appeals: A decision made or penalty imposed under Policy 70 - Student Petitions and Grievances (other than a petition) or Policy 71 - Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 - Student Appeals.

Accommodation for Students with Disabilities

Note for students with disabilities: Note for students with disabilities: The AccessAbility Services office, located on the first floor of the Needles Hall extension (1401), collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the AS office at the beginning of each academic term.

Mental Health Support

All of us need a support system. The faculty and staff in Arts encourage students to seek out mental health supports if they are needed.

On Campus

- Counselling Services: counselling.services@uwaterloo.ca / 519-888-4567 xt 32655

- MATES: one-to-one peer support program offered by Federation of Students (FEDS) and Counselling Services

- Health Services Emergency service: located across the creek form Student Life Centre

Off campus, 24/7

- Good2Talk: Free confidential help line for post-secondary students. Phone: 1-866-925-5454

- Grand River Hospital: Emergency care for mental health crisis. Phone: 519-749-433 ext. 6880

- Here 24/7: Mental Health and Crisis Service Team. Phone: 1-844-437-3247

- OK2BME: set of support services for lesbian, gay, bisexual, transgender or questioning teens in Waterloo. Phone: 519-884-0000 extension 213

Full details can be found online at the Faculty of ARTS website
Download UWaterloo and regional mental health resources (PDF)
Download the WatSafe app to your phone to quickly access mental health support information

Territorial Acknowledgement

We acknowledge that we are living and working on the traditional territory of the Attawandaron (also known as Neutral), Anishinaabe and Haudenosaunee peoples. The University of Waterloo is situated on the Haldimand Tract, the land promised to the Six Nations that includes six miles on each side of the Grand River.