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Econ 104: Introduction to Econometrics

Instructor: John Lazarev (jlazarev@sas.upenn.edu)
PCPSE, Office 633

Zoom Office Hours: Tuesdays and Thursdays 6:00–7:00pm

Lectures: Tuesdays and Thursdays 9:00–10:30am

Recitation Sessions: one hour per week as scheduled

Teaching Assistants: Aaron Mora Melendez (aaronmor@sas.upenn.edu)
Office Hours: Mondays 9:00–10:00am and 2:00–3:00pm

Juan Sagredo (sagju@sas.upenn.edu)
Office Hours: Mondays 12:00–1:00pm and Fridays 9:00–10:00am

Xiaoliang Wang (xlwang@sas.upenn.edu)
Office Hours: Fridays 10:00–11:00am and 12:00–1:00pm

Midterm Exam: Tuesday, March 9

Final Exam: TBD

Course Description This course is designed to introduce students to econometric techniques and their applications in economic analysis and decision making. The main objective of the course is to train the student in (i) handling economic data; (ii) quantitative analyses of economic models with probabilistic tools; (iii) econometric techniques, their application as well as their statistical and practical interpretation; (iv) implementing these techniques on a computer.

The course focuses on practical and conceptual issues involved in the substantive applications of econometric techniques. Estimation and inference procedures are formally analyzed for simple econometric models and illustrated by empirical case studies using real-life data. The course covers linear regression models, simultaneous-equations models, discrete choice models and univariate time series models. Estimation and

inference is conducted using least squares and likelihood based techniques. Students are required to perform several econometric analyses of their own.

Prerequisites: ECON 101 and 103, MATH 104 and either 114 or 115 or with instructor's permission.

Course Text: The required textbook for this course is Stock, James and Mark Watson (2019, 4th Edition): "*Introduction to Econometrics*". Prentice Hall, ISBN-13: 9780134461991.

Statistical Software: We will use the statistical package R via a front-end called RStudio throughout the course. Both programs are free and open source.

Useful Supplementary Textbooks:

- Angrist & Pischke, *Mastering Metrics: The Path from Cause to Effect*
- *Introduction to Econometrics with R*. (Online and Free) <https://www.econometrics-with-r.org/>

Lectures Lectures will be conducted on Zoom. Recordings will be posted. I expect you to complete the assigned readings and problems. During the lectures, we will go over the key concepts and the assigned questions and problems. Come prepared. If you miss, watch the recordings only after you complete the required reading.

To optimize the recordings, I will share with you my whiteboard, turn off my and your video feed, mute your audio feed, and will be monitoring your questions posted on Zoom chat during the recordings. I will try to leave extra time for questions at the end of each lecture.

The discussion module on Canvas is active. You can post there your follow-up questions after each lecture and recitation session. We will also post a stack of slides prepared by the authors of the textbook for each chapter. The slides complement (but not substitute) the textbook. You should review them after you complete the assigned reading.

Recitations Recitations will be devoted to solving assigned *empirical* problems after each chapter of the textbook. You should try to complete these problems on your own first so that you can follow your TA and pay special attention when you are stuck. The only way to master your *R* skills is to keep practicing. Passive learning is not an option here. So, do it yourself first not to fall behind.

To optimize our resources, we will not hold separate "live" recitations for each section every week. Instead, one of the TAs will schedule and record one "live" weekly session, during which they will demonstrate in *R* how the problem can be solved. They will solve these problems in real time and answer your questions

while they are doing that. Again, you are not required to join: a recording and the associated R code will be posted. However, if you attempt to solve the problem on your own in advance and get stuck, these live sessions will give you a chance to ask your questions in person. If you are unable to join “live” recordings, you can meet your TA during their office hours to ask your questions.

Course Requirements and Grading: The overall course grade is based *solely* on your performance on problem sets, class project, and the exams. No extra work can be given, or additional credit assigned, to improve your grade.

- **Problem Sets [12%]:** There will be twelve problem sets, assigned weekly during the semester. Solutions must be submitted electronically on Penn Canvas. Each problem set will be graded on a scale from 0 to 10. However, problems sets are primarily for you to learn: you will receive full credit for problem sets as long as you submit your assignment on time. Each problem set is due by 11:59pm on the due day. If you are late (even 1 minute late), Penn Canvas may not accept it. No excuses for missed assignments/deadlines will be accepted.
- **Class Project [18%]:** Group project (3–6 students). Requirements to be announced in February.
- **Midterm Exam [30%]:** Four problems, 24-hour take home. The lowest problem score will be dropped.
- **Final Exam [40%]:** Five problems, 24-hour take home. The lowest problem score will be dropped.

Your scores on the various assignments will be aggregated at the end of the semester and converted into a letter grade based on a pre-announced scale. I will not assign letter grades to individual assignments. The grades will not be “curved.” Your letter grade will NOT depend on the performance of the rest of the class. I plan to announce the scale after Spring Break.

Missed Assignments: No excuses for missed assignments/deadlines will be accepted.

Departmental Course Policies: All course policies of the Economics Department apply to Econ 104 even if not explicitly listed on this syllabus. See: <https://economics.sas.upenn.edu/undergraduate/course-information/course-policies> for full details.

Approximate Course Outline and Schedule

Lecture	Topic
1/21	Economic Questions: Prediction vs. Causality
1/26	Data Generating Process, Estimated Model, Data, Unit of Observation
1/28	Review of Probability
2/2	Review of Probability
2/4	Review of Statistics
2/9	Review of Statistics
2/11	Linear Regression with One Regressor
2/16	Linear Regression with One Regressor
2/18	Hypothesis Tests and Confidence Intervals
2/23	Heteroskedasticity and Homoskedasticity
2/25	Linear Regression with Multiple Regressors
3/2	Hypothesis Tests and Confidence Intervals in Multiple Regression
3/4	Review Session
3/9	Midterm Exam
3/11	Spring Break (No Class)
3/16	Nonlinear Regression Functions
3/18	Assessing Studies Based on Multiple Regression
3/23	Regression with Panel Data
3/25	Regression with Panel Data
3/30	Engagement Day (No Class)
4/1	Regression with a Binary Dependent Variables
4/6	Instrumental Variables Regression
4/8	Instrumental Variables Regression
4/13	Experiments and Quasi-Experiments
4/15	Prediction with Many Regressors and Big Data
4/20	Prediction with Many Regressors and Big Data
4/22	Time Series
4/27	Time Series
4/29	Review Session
TBD	FINAL EXAM

Empirical Exercises Assigned for Recitation Sessions

Tentative Date of Recording	SW Chapters	Exercise(s) to be discussed
1/22	N/A	Intro to R
1/29	1 and 2	E2.1 , Monte Carlo for LLN and CLT
2/5	3	E3.1
2/15	4	E4.2
2/22	5	E5.1, E5.3
3/1	6	E6.1
3/8	7	E7.1
3/15	8 and 9	E8.2, E9.1
3/22	10	E10.2
4/2	11	E11.2
4/9	12	E12.2
4/16	13 and 14	E14.1
4/23	15	E15.1, E15.2