EC 320: Econometrics

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Office hours : M 9-10am, 3-4pm / T 4-5pm / W 9-10am, 3-4pm / Th 10-11am, 4-5pm / F 1-2pm

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Learning in times of a global pandemic

The times are weird. We are collectively experiencing a virus outbreak unlike anything we have experienced before. We are faced with the challenge to adjust and adapt to new lifestyles, and this involves new learning methods. As you know, the University of Oregon has decided to transfer all classes to online to contain the spread, and do our part in flattening the curve.

Your learning and education are my priority, and I will do my best to maintain a supportive learning environment, wherein you can continue to grow and make progress towards your degree. At the same time, I want to acknowledge that these are stressful times, and that the attention and time that you will be able to dedicate to this class will vary with factors that are exterior to your control as things continue to shift. I intend to the extent that it is possible to hold space for everyone to express their needs and receive the flexibility that they need to meet deadlines and learning goals.

Organizational aspects

Below are a few organizational points that the shift to online classes entail.

- While we are operating under remote instruction, Canvas will be our main resource and method of communication. I will upload lecture slides to Canvas along with pre-recorded lectures. You may watch the lectures at any time that is convenient for you but I suggest that you watch them on the days that face-to-face class would be taking place. You are responsible for all of the material in the slides and recorded lectures.
- This class has an important computational component that is generally taught in discussion sections. Instead, you will have access to tutorial videos on the use of statistical programs (R). These weekly videos will be uploaded to Canvas every Thursday, and you should plan on watching, understanding, and replicating them.
- Office hours will be held remotely, using Zoom or Skype. A sign-up sheet will be made available and will be shared with the class. Sign up for an office hour at least 12 hours ahead of time.
- Assignments will be uploaded and exams will be administered through Canvas. The nature of the assignments is structured to reflect the online nature of the class.

Access to a computer is therefore essential. The first video tutorial will show you how to set up Skype/Zoom, and how to install R on your machines. If you will not have access to a computer please get in touch with me before the term begins.

Please keep in mind that all of these organization aspects are subject to change as we continue to adjust to the fast-moving reality. I will however strive to communicate any changes ahead of time, and work to minimize any extra time or labor cost to you as students. If any questions, doubts, or concerns occur to you, please feel free to write to me or schedule a virtual office hour.

Learning outcomes

"Econometrics is by no means the same as economic statistics. Nor is it identical with what we call general economic theory, although a considerable portion of this theory has a defininitely quantitative character. Nor should econometrics be taken as synonomous with the application of mathematics to economics. Experience has shown that each of these three viewpoints, that of statistics, economic theory, and mathematics, is a necessary, but not by itself a sufficient, condition for a real understanding of the quantitative relations in modern economic life. It is the unification of all three that is powerful. And it is this unification that constitutes econometrics." Ragnar Frisch, Econometrica, (1933), 1, pp. 1-2.

Lectures are designed to give you a basic understanding of econometric modelling. After an initial review of statistical concepts, you will be introduced to regressions, the central tool of econometric analysis. A regression can be estimated using different methods and algorithm, and we shall focus on one of those : Ordinary Least Squares (OLS). As we cover these concepts, you will be introduced both to the intuition and theory behind them, as well as to the computational tools that can help you implement a regression. Assignments in this class are an opportunity for you to think through the material and autonomously apply it to real world empirical question.

At the end of this class you will be able to

- Define the fundamental econometric problem
- Understand a linear regression
- Estimate an OLS regression (manually and computationally), and identify the conditions for OLS validity
- Interpret the results of a regression, and evaluate their validity
- Apply OLS estimation to problems of your choosing to answer a question of your own

Learning tools

Readings

The recommended textbook for this class is Introductory Econometrics by Christopher Douhgerty (5th or older editions). This textbook is not mandatory : you can chose to have it as an additional resource, but not having it will not hamper your ability to complete assignments and exams. Additional assigned readings might be assigned as we go, and if so will be made available on Canvas.

Lectures

During lectures, I will introduce new concepts, explain econometric logic, and provide examples, case studies, and thought experiments. I will be using slides to accompany the lecture. Lectures will be posted to Canvas on Mondays at 12pm and Wednesdays at 12pm. They will be available on Canvas for the duration of the course for you to return if needed. While the option exists,

I am choosing not to monitor viewership. I want however to emphasize the importance of not falling behind : I do expect and strongly encourage you to watch the lectures within a day from their publication, so that you do not fall behind.

Assignments

No one likes busy work. Assignments are designed for you to put your knowledge to work and grapple with thought experiments and real-life problems. Each assignment allows you to measure your progress and take stock of all that you have learnt. Assignments will take different

forms (see below). Not all assignments will be mandatory, and you will be able to choose how much extra-work you want to seek. Summer terms are fast and getting back on the saddle can be hard once one falls. So, I encourage you to seize assignments as a self-evaluation tool.

Office hours

GEs will hold a total of 6 office hours per week. A sign-up log will be made available for you to book 15-20 min slots with the GE of your choice during their office hours. Sign-ups will close 12 hours prior to the office hour in question. A detailed email will be sent about this prior to the beginning of the term.
In addition to these hours, I will set aside 2 hours per week for meetings. These meetings will not be held at a fixed time, but will be appointment based. If you are unable to meet with the two GEs, or require to meet with me personally, you can email me and we can schedule a time for a video-conference.

Recommended readings

If you want to go further, below is a short list of books I recommend as summer readings:

Learning assignments

Ongoing

Pre-lecture online quizzes [100 points + 20 points of extra credit]

There will be a total of 12 online quizzes that will be available on Canvas at 2pm and will be due at 2pm the following day. These short quizzes will cover the previous session material. Out of the 12 quizzes you will be expected to complete a minimum of 10. Any additional quizzes will count toward extra-credits. The solutions to the quizzes will be made public at 2pm on the day after publication.
Quiz publication dates:

1. April 1st
2. April 6th
3. April 8th
4. April 13th
5. April 15th
6. April 20th
7. April 22nd
8. April 27th
9. May 6th
10. May 11th
11. May 13th
12. May 18th

3 replication exercises [/60]

Every week, you will have access to a new tutorial for econometric programming in R. You will have to replicate 3 of these sessions. Tutorials will be posted on thursdays, and you will have until the following Tuesday at 2pm to complete the replication. While you have control over which tutorials to replicate, make sure you plan this well, so you don't find yourself with 0 replication at the end of the term. Replication exercise guidelines will be given at the end of each tutorial.

Due Friday of week 1 : Survey and letter of introduction [10 points of extra credit]

Due end of week 6 : Mid-term analytical project [60 points]

One of this course's goals is to help you engage with news and commentaries on the U.S. and world economy. Your learning and mastery of the notions and concepts are incomplete until you confront them with current economic dynamics and facts. The basic idea of this assignment is :

1. Go out and find a piece of news written about research that presents a causal relationship (examples : "Spending time on social media causes depression", "New speed bump in street reduces accident") :
    - Candidate sources: NPR's syndicated programs (RadioLab, TED Talks, Marketplace), Blog-post style news (HuffPo, BuzzFeed), Newspapers sections on "lifestyle"
2. Send me a link to the article you want to research by end of week 3, also reach out to me if you fail to find anything.
    - If I get an assignment written about an article that does not have a causality claim, it will most likely get a failing grade.
3. Analyze the article: Explain the article and its causal claim, describe the approach (and if possible the regression model) employed to derive the causality, and explain your critique of that claim in terms of what we have learned in class. Does the causality seem convincing to you? Is the approach sound and valid given what we have learned? What can be wrong with the claim?
4. Offer improvements upon the method employed for the analysis if you can think of any, or something that would make the claim more convincing to you.
5. Project should be turned in in writing by end of week 6. Length can vary, but you should aim for somewhere between 2 and 3 pages double spaced. This exercise will expose you to

   two important skills in the academic and professional world: critical thinking and evaluation of causal claims. It is intentionally flexible in the format and content for you to tailor it to your own interests and style, and to try and enjoy it!

   No extensions will be granted beyond the Friday of week 6 at 11:59pm. If you foresee an issue that will prevent you from meeting the deadline, let me know as soon as possible. An unexcused delay will result in a failing grade.

Due end of week 10 : End of term project [120 points]

The project will be due at the end of week 10, but you are strongly encouraged to work and plan ahead to avoid a stressful finals week.

This is an ambitious project. You will be asked to do the following :

- Step 1: Identify a data set that you want to work with: throughout the term, you will be exposed to different datasets, R has a library of built in datasets, and both me and the TAs can provide you with additional data sources that fit your interest. I highly recommend having your dataset figured out by the end of week 5 if possible.
- Step 2: Think about a question involving a causal relationship that you want to investigate using the data you chose
- Step 3: Analyse the data : describe the structure of the data, run your regression model and generate result tables
- Step 4 : Write your project. The write up must consist of 5 parts :
  - Introduction where you present your research question, why it matters, and the reason that you chose it.
  - Data section where you describe the data that you are going to use, including source, variables, means, etc.
  - Analytical section where you present your regression model, and the regression results. This section should also contain inference from the model, including hypothesis testing on the parameters of interest
  - Discussion section where you discuss the implications of your results, and the confidence you have in them
  - A conclusion summing up your results, and opening on some follow-up research question.

No extensions will be granted beyond the Friday of week 10 at 11:59pm. If you foresee an issue that will prevent you from meeting the deadline, let me know as soon as possible. An unexcused delay will result in a failing grade.

Grading rubrics for the midterm and final projects will be made public a week before submission is due.

Finals Week : Final [150 points]

Yes, the final will be comprehensive and cover everything from the beginning of the course. This is purposeful: it will help you to learn and retain the material of the course better. The final will be administered through Canvas on Monday, June 8th from 10:15am to 11:45am. It will be an open-book MCQ test, with negative points for wrong guesses. The final is to be taken individually by each student. Evidence of academic misconduct during an exam will likely result in a failing grade for the entire course.

No make-up final will be given for any reason. Let me know as soon as possible if you cannot make it to the final.
An unexcused absence from the final exam will likely result in a failing grade for the course. If you know that you will not be able to take the final or meet the deadlines you should seriously reconsider taking this course in this term. Note that multiple lectures of EC 320 are offered in every term: Fall, Winter, Spring, and Summer.

Re-grade requests

If you notice an arithmetic mistake in totaling the number of points on a problem set or midterm, simply point this out to me as soon as possible, and the correction will be made. For any other reconsideration of a grade on an assignment, you must submit a formal re-grade request explaining why you believe your answer(s) should be given more points. This request must be made in writing and given to me no later than two days after the assignment grade is returned. Note that the entire midterm will be subject to re-grading, so overall you may gain or lose points if you request a re-grade. There will never be a re-grade for any quiz.

Course Agreements

Online communication etiquette

All of our interactions will be on-line based. This behoves us to think about rules of engagement that we want to uphold so everyone is treated with respect and dignity.

Time : Allow for time of latency : if I or a GE does not return your emails immediately, assume that we are doing our best to get back to you in the shortest delays - do not follow-up on an unanswered email unless 24 hours have elapsed.

Tone : Be intentional with the language and writing tone that you use when addressing the instructional team or your classmates. These are hard times for all of us, and we should treat each other with kindness.

Environment : When having a video-call with a member of the instructional team, or one of your classmates, make sure you are an environment that is quiet and safe of any triggers to the person on the other end of the line.

Radical honesty

Life happens. Even to the best of us. We have all, at one point or the other, hit the snooze button one too many times. This is your learning experience, and I trust you to make the best decisions for it to work best for you. If for any reason you are unable to meet an assignment deadline, or face difficulties meeting the course expectations, or your own, I encourage you to talk to me with transparency for us to find solutions together.

University policies

Below are links and resources on university policies relevant to the class and to instructor-student relations. Please take the time to review these policies and get in touch with me if you have any remaining uncertainties.

Sexual violence and survivor support	**safe.uoregon.edu**
Diversity & inclusion	**inclusion.uoregon.edu**
Academic integrity	**integrity.uoregon.edu**
Accessibility and special accomodations	**aec.uoregon.edu**

Schedule and weekly learning goals

The schedule is tentative and subject to change. The learning goals below should be viewed as the key concepts you should grasp after each week, and also as a study guide. The applications in the second half of the semester tend to build on the concepts in the first half of the semester though, so it is still important to at least review those concepts throughout the semester.

Week 1, 03/30 - 04/03: Introduction to Econometrics

- Day 1: Introduction
  - what is econometrics? why study econometrics? what is the difference between correlation and causation? what is R?
- Day 2: Statistics Review I
  - what is a random variable? what is the difference between a continuous and a discrete variable? what is an expected value, a variance, a standard deviation? how to measure correlation?

Week 2, 04/06 - 04/10: Introduction to Econometrics (cont'd)

- Day 3: Statistics Review II
  - What is an estimator? what are its desirable properties? how to test hypotheses about an estimator?
- Day 4: The fundamental econometric problem
  - What do we mean by ceteris paribus ("all things equal") ? How to estimate causal effects in the absence of selection? what is selection bias? how do randomized control trials address selection bias?

Week 3, 04/13 - 04/17: Introduction to linear regressions

- Day 5: The intuition
  - What is a regression? what is a linear regression? why do we use regression "models"?
- Day 6 : Choosing a model
  - What are some of the common problems a regression can suffer from? what is an omitted variable bias? how to specify the "right" model?

Week 4, 04/20 - 04/24: Estimating simple linear regressions

- Day 7 : Introduction to OLS
  - What is OLS? How does OLS minimize the regression residuals?
- Day 8 : OLS Assumptions
  - When is OLS a good algorithm for estimating a regression ? What assumptions are required for unbiasedness, efficiency and consistency?

Week 5, 04/27 - 05/01: Inference from simple linear regressions

- Day 9 : Approaches to inference
  - What is OLS? How does OLS minimize the regression residuals?
- Day 10 : Milestone : Applying what we have learned
  - In this class you will be presented with news articles asserting causal relations and apply the tools from previous sessions to evaluate the claim. This is in preparation for your midterm project

Week 6, 05/04 - 05/08: Multiple regressions and **Midterm project due**

- Day 11 : Estimating a multiple regression
  - How can we apply OLS to multiple regressions? what changes, what stays the same?
- Day 12 : Inference from multiple regressions
  - How can we test multivariate hypotheses?

Week 7, 05/11 - 05/15: Categorical and interaction variables

- Day 13 : Categorial variables
  - What are they ? how and when to include them in a regression model? what are the costs of including categorical variables? and how to interpret their associated coefficients?
- Day 14 : Interaction variables
  - What are they ? how and when to include them in a regression model? what are the costs of including categorical variables? and how to interpret their associated coefficients?

Week 8, 05/18 - 05/22: Nonlinear regressions

- Day 15: Nonlinear relations
- Day 16: Estimating and interpreting nonlinear regression

Week 9, 05/25 - 05/29:

- Dates saved in case of unexpected events, slower progress. If not will cover additional content from textbook.

Week 10, 06/01 - 06/05: Discussion, review and **Final project due**

- Day 19 : Final project open forum
  - This is an opportunity for all those who want to talk about their final project, present their question, and the direction of their research, to receive feedback from me and from other students before the submission deadline. Sign-up will be available closer to the date
- Day 20 : Final review

Week 11, 06/08 - 06/12: Final Exam