ECON 3740: INTRODUCTION TO ECONOMETRICS

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Lecture 1

General information

- The syllabus is the main source of information for the course. Please check the syllabus before asking questions.
- Courselink: http://courselink.uoguelph.ca
- Assignments:
  - ASSN 1 Due Date: Wednesday, Oct.3rd, In-class
  - ASSN 2 Due Date: Monday, Nov. 28th, In-class
- Exams:
  - Midterm: Wednesday, Oct. 10th, In-class
  - Final: Wednesday, Dec. 12nd 2:30pm- 4:30pm, Location TBA
  - *You have a week from now to let me know of any issues with* **the midterm only**

General information continue

- Grades:
  - 10% Each Assignment, 20% Midterm, 20% Group Project, 40% Final Exam
- Book: Jeffrey Wooldridge Introductory Econometrics A Modern Approach 6^{th} edition Nelson
- Office Hours: 1:00-3:00PM Monday and Wednesday, MACK 048
- Email: chaoyi@uoguelph.ca
- TA and Lab Instructor: Anastasia Dimiski
- TA and Lab Instructor Email: adimiski@uoguelph.ca

Term project

- Group number: you will form groups of 3-4 people and each group will turn in one project. (If there is no group available for you by the end of next week, please let me know).
- The paper should consist of **a simple empirical analysis**, and it should be at most **15 pages** long (incl. tables, figures, and bibliography). You can use either *word* or LaTeXto write your essay. Formal requirements will be strictly enforced. a Harvard style is recommended.
- All authors should have **same** contributions to the project formulation and paper preparation
- Project Due Date: Monday, Nov. 28th, In-class. *NO EXTENSION*

Term project schedule suggestion

- Choose your group topic by the end of Sep
- A complete literature review with respect to your topic by the end of Oct
- After literature review, start to work on your topic. This includes
  - Introduction and a short literature review summary.
  - Specification of the econometric model
  - Obtain data
  - Estimation of the econometric model
  - Test Hypothesis
  - Conclusion
- Your first version of the paper should be available in early Nov.
- The final project deadline is Nov. 28th

What is econometrics

- Definition from Jeffrey M. Wooldridge:

  Econometrics is based upon the development of statistical methods for estimating economic relationships, testing economic theories, and evaluating and implementing government and business policy.

- In this course you will play with data and learn to use econometric techniques to quantitatively measure a model and draw inference.

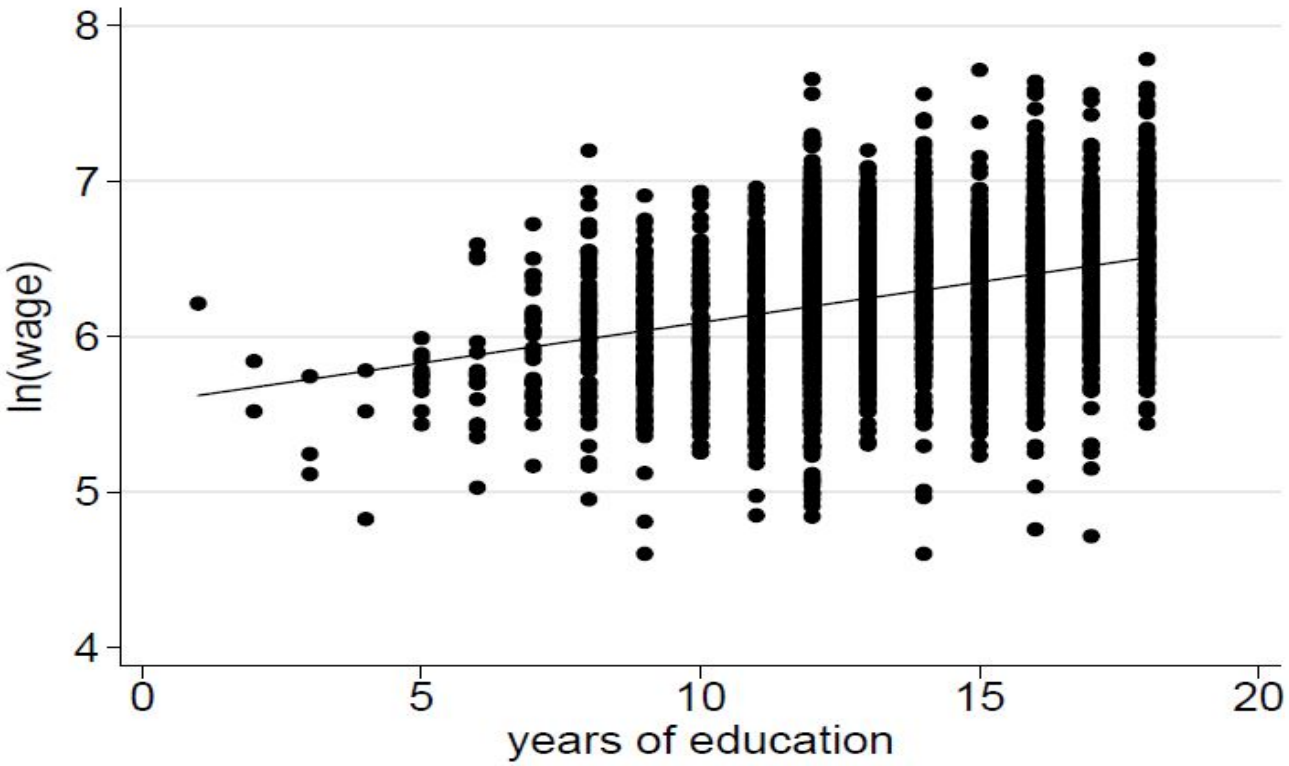
- Focus on the causality

What is econometrics

A wage example

What are the returns to education?

Figure: Average Using data on 3,010 full-time working men in the US we will analyze whether obtaining more years of education increase wages.



Learning outcomes

At the end of this course you should

- have knowledge of regression analysis relevant for analyzing economic data.
- be able to interpret and critically evaluate outcomes of an empirical analysis
- know the theoretical background and assumptions for standard econometric methods
- be able to use Stata/R to perform an empirical analyses
- be able to read and understand journal articles that make use of the methods introduced in this course
- be able to make use of econometric models in your own academic work, for example in your senior year econometrics course.

Course outline

- Topic 1: Course Introduction
- Topic 2: Mathematics and Statistics Review
- Topic 3: The Nature of Econometric and Economic Data (Ch.1)
- Topic 4: The simple Regression Model (Ch.2)
- Topic 5: Carrying Out an Empirical Project (Ch.19)
- Topic 6: Multiple Regression Analysis: Estimation (Ch.3)
- Topic 7: Multi Regression Analysis: Inference (Ch.4)
- Topic 8: Multi Regression Analysis: Further Issue (Ch.6 Ch.7)
- Topic 9: Heteroskedasticity (Ch.8)
- Topic 10: Basic Regression Analysis With Time Series Data (Ch.10 Time permitting))
- Topic 11: More on Specification and Data Problems (Ch.9 Time permitting))

A Review of statistics

- A random variable and its probability distribution
- Measures of the shape of a probability distribution (mean, variance, skewness and kurtosis)
- Two random variables and their joint distribution
  - Joint distribution, marginal distribution, conditional distribution
  - Law of iterated expectations
  - Means, variances and covariances of sums of random variables
- Often used probability distributions in econometrics
  - Normal, Chi-Squared, Student t and F-distributions

A random variable

Definitions:

- **Outcomes** are the mutually exclusive potential results of a random. Examples: Your grade on the exam; the number of days it will snow next week process

- **Random variable** is a numerical summary of a random outcome Examples: The number of days it will snow next week is random and takes on a numerical value (0,1,2,3,4,5,6 or 7).
  - *Discrete random variable*: takes on discrete number of values, like 0,1,2,...
  - *Continuous random variable*: takes on a continuum of possible values

  Question: What is the difference between two mutually exclusive events and two independent events?

Probability distribution of a discrete variable

- Each outcome of a discrete random variable occurs with a certain probability

Definition: A Probability distribution of a discrete random variable is the list of possible values of the variable and the probability that each value will occur.

- Let random variable G be the number of days it will rain in the last week of January

Probability distribution of G								
Outcome	0	1	2	3	4	5	6	7
Probability	0.20	0.25	0.20	0.15	0.10	0.05	0.04	0.01

Cumulative distribution of a discrete random variable

- A cumulative probability distribution is the probability that the random variable is less than or equal to a particular value
- The probability that it will rain less than or equal to g days, $F(g) = P(G < g)$ is the cumulative probability distribution of G evaluated as g
- A cumulative probability distribution is also referred to as a cumulative distribution or a CDF (Cumulative Density Function).

Probability distribution of G								
Outcome	0	1	2	3	4	5	6	7
Probability	0.20	0.25	0.20	0.15	0.10	0.05	0.04	0.01
CDF	0.20	0.45	0.65	0.80	0.90	0.95	0.99	1

Probability distribution of a continuous random variable

- Nov 1^{st} temperature is an example of a continuous random variable
- Let random variable T denote next monday temperature
- Clearly, a probability distribution that lists all values and the probability of each value is not suitable for above case (the space of the values is infinite and uncountable. Temperature can be 10, 10.01, 10.001, 10.0001...)
- Therefore, probabilist use a probability density function (PDF/density) to summarize the probability

Figure: PDF and CDF for Nov 1^{st} Temperature