Introduction to Econometrics

Ivan Medovikov

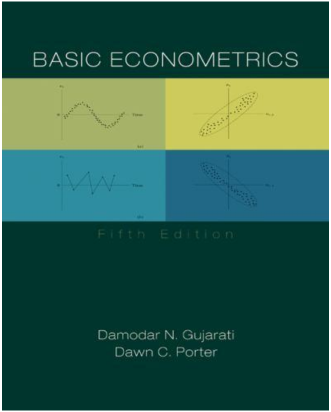
Brock University

September 6, 2012

Course Outline

Required Textbook

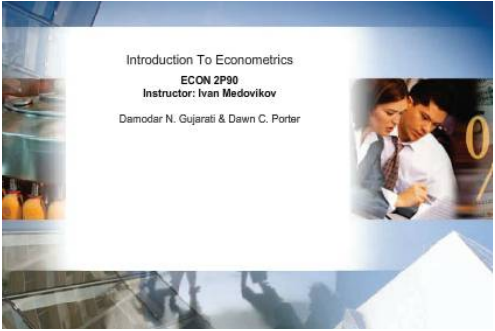
- Gujarati, D., "*Basic Econometrics*", 5th ed., McGraw, 2008.



Course Outline

Custom Edition

- **Much** more affordable custom edition at the Book store



Course Outline

Course Web-Site

- Isaak / Sakai (https://lms.brocku.ca/)

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- Assignments
- Some course materials (notes, examples)
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Labs

- Lab 1: Mondays, 5:00-7:00 pm (MCJ 201)
- Lab 2: Thursdays, 8:00-10:00 pm (MCJ 201)
- Please attend the correct lab

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Course Outline

Required Software

- Gnu Regression, Econometrics and Time-series Library (GRETL)
- Cross-platform, open-source, free
- http://gretl.sourceforge.net/

Course Outline

Evaluation

Midterm I	25%
Midterm II	25%
Final	30%
Assignments	20%

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Midterm I: October 1st (in-class, tentative)

Course Outline

Office Hours

- Office: Plaza Building, Room 429
- Office hours: Mondays, Tuesdays, 11:00 am to 12:30 pm
- Or by appointment

Course Outline

Teaching Assistant

- Jamie Jiang
- Email: course web-site
- Office Hours: TBA

Course Drop Deadline

- November 2, 2012

Introduction

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- Why bother?
  - Data can be **very** valuable
  - Making good decisions

Introduction

economic data $\rightarrow$ ECONOMETRICS $\rightarrow$ answers, decisions

Review of Basic Statistics

Review of Probability

- What is conditional expectation?
- What is a **regression**?

Review of Basic Statistics

What is a Random Event?

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Review of Basic Statistics

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Review of Basic Statistics

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- The likelihood of occurrence
- We can attach probabilities to events using the **relative frequency approach**

$$\text{probability of event} = \frac{\#\text{of ways it can occur}}{\text{total } \# \text{ of possible outcomes}}$$

Review of Basic Statistics

What is Probability?

- For example:
  - $P(\text{"getting one tail"}) = P(A) = \frac{\{HT,TH\}}{\{HT,TH,TT,HH\}} = \frac{2}{4} = \frac{1}{2}$
  - $P(\text{"getting at least one tail"}) = P(B) = \frac{\{HT,TH,TT\}}{\{HT,TH,TT,HH\}} = \frac{3}{4}$
  - $P(\text{"getting two heads"}) = P(C) = \frac{\{HH\}}{\{HT,TH,TT,HH\}} = \frac{1}{4}$

Review of Basic Statistics

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$$Y = \begin{cases} 0 & \text{, if } \{HH\} \\ 1 & \text{, if } \{TH, HT\} \\ 2 & \text{, if } \{TT\} \end{cases}$$

Review of Basic Statistics

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Review of Basic Statistics

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- $P(Y = 1) = P(\{TH, HT\}) = 1/2$
- $P(Y = 2) = P(\{TT\}) = 1/4$

The Joint Probability

- Suppose that $X = \#$ of tails after the *first* coin toss
- We can find joint probability of X and Y
- For example:
  - $P(X = 1, Y = 1) = P(\{TH\}) = 1/4$
  - $P(X = 2, Y = 1) = P(\{TT\}) = 1/4$
  - $P(X = 0, Y = 1) =?$ Why?
  - $P(X = 0, Y = 1) = 0$
- Function $f(x, y) = P(X = x, Y = y)$ is the **joint probability density function**

Review of Basic Statistics

The Conditional Probability Density Function

- What is the $P(Y = 2)$ given that $X = 1$?
- This is the **conditional probability** of Y given known X
- We write this as $P(Y = 2|X = 1)$
- Can find $P(Y = y|X = x) = \dfrac{P(Y = y, X = x)}{P(X = x)}$
- For example,
  $$P(Y = 2|X = 1) = \frac{P(Y = 2, X = 1)}{P(X = 1)} = 0.25/0.5 = 1/2$$

Review of Basic Statistics

Expected Value

- On average, how many tails can we expect?
- In other words, what is the average (mean) of Y?
- We can find expected value (mean) of Y using $f(y)$ as:

$$
\begin{aligned}
\mu_y &= 0 \times P(X=0) + 1 \times P(X=1) + 2 \times P(X=2) \\
&= 0 \times f(0) + 1 \times f(1) + 2 \times f(2) \\
&= 0 \times 1/4 + 1 \times 1/2 + 2 \times 1/2 = 1 \text{ tail}
\end{aligned}
$$

- This is the **unconditional expectation (mean)**, $E[Y]$

Conditional Expected Value

- On average, how many tails can we expect, **given** that we know we had tail on first toss (i.e. $X = 1$)?
- This is the **conditional expectation** of Y, $E[Y|X = 1]$

$$\begin{aligned}\mu_{y|x} &= 0 \times P(Y = 0|X = 1) + 1 \times P(Y = 1|X = 1) \\ &+ 2 \times P(Y = 2|X = 1) \\ &= 0 \times 0 + 1 \times 1/2 + 2 \times 1/2 = 1.5 \text{ tails}\end{aligned}$$

Review of Basic Statistics

The Regression Function

- We treat $E[Y|X = x]$ as a function of x
- This is the **regression function**, or **regression**
- This is the focus of this course

Review of Basic Statistics

The Regression Modelling

- Specifying a model for $E[Y|X = x]$
- Estimating this regression model
- Using the model for forecasting & analysis

Review of Basic Statistics

The Regression Modelling

- $E[\text{sales}|\text{advertising}]$
- $E[\text{house price}|\text{floor area}]$
- $E[\text{human weight}|\text{human height}]$
- Other?