Introduction and Overview

EC 320, Set 01

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Prologue

EC320, Set 01 | Introduction and Overview

Motivation

What is the goal of econometrics?

> To learn about the world using **data**.

Why do economists (and others) study econometrics?

> Providing answers to important problems.

Ex.

- Do minimum wage policies reduce poverty?
- Does the death penalty deter violent crime?
- How will global warming affect the economy?
- How responsive are polluter to a carbon tax?
- What explains the gender pay gap?
- Are recessions good for your health?
- Can we forecast the next recession?

Motivation

What is the goal of econometrics?

> To learn about the world using **data**.

Why do economists (and others) study econometrics?

> Providing answers to important problems.

How do you pronounce it?

> **uk · kaa · nuh · meh · truhks**

Motivation

Why should **you** study econometrics?

> Develop skills and learn to use tools that are valued by employers.
> Cultivate a healthy sense of skepticism

IMO[1], of all the courses in a typical economics major, **econometrics is the most translatable** to a job

- Data is the new oil
- Extracting meaningful analysis from is a sought after skill in the job market of 2023

Motivation

Why should **you** study econometrics?

Throughout this course, I will try my best to emphasize why:

- **Why** are we learning this?
- **Why** does this matter with regard to future econometrics courses?
- **Why** is important for answering important problems?
- **Why** does this matter to employers?

Econometrics is built on crucial *fundamentals*. These *fundamentals* is the focus of this class.

uk · kaa · nuh · meh · truhks

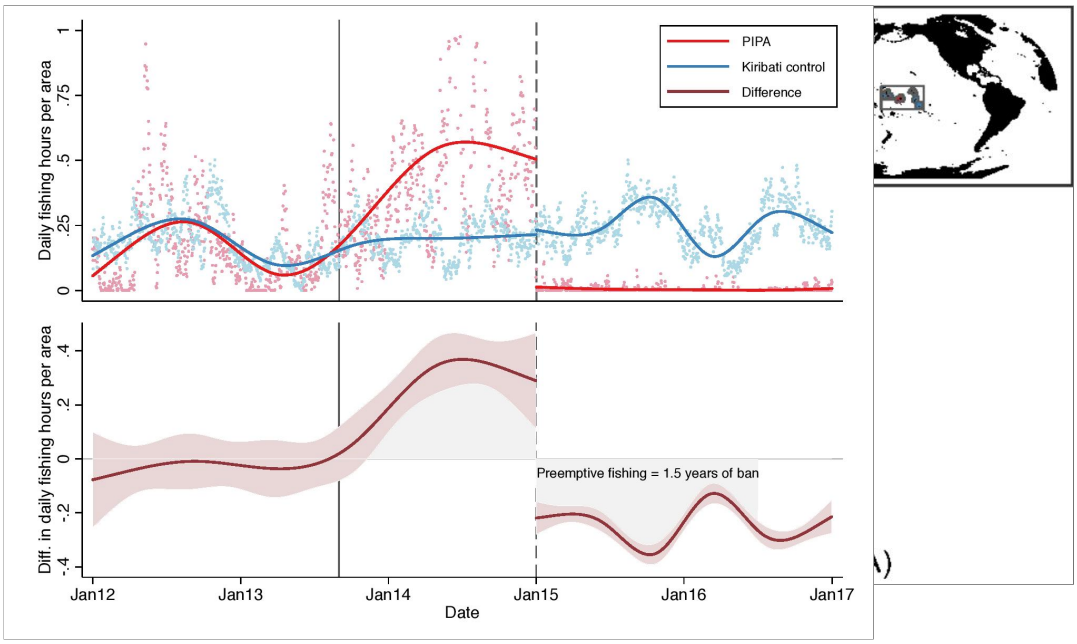
Most econometric inquiry concerns one of **two** distinct goals:

1. **Prediction:** Accurately predict or forecast an outcome given a set of predictors. Given what we know about x, what values do we expect y to take?
2. **Causal identification:** Estimate the effect of an intervention on an outcome. How does y change when we change x?

   In this class, and in **EC 421**, we will focus on the **later**. The **former** is the focus of **EC 422** and **EC 524**

1. Please take this with a grain of salt. I am a single data point. Others may disagree

Causal identification



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Causal identification

Common refrain.[1]

> "Correlation does not necessarily imply causation."

Why might correlation fail to describe a causal relationship?

- Omitted-variables bias
- Selection bias
- Simultaneity
- Reverse causality
- Coincidence

Causal identification

Common refrain.[1]

> "Correlation does not necessarily imply causation."

Correlation may imply causation if we assume *"all else equals"*

- Hold everything fixed

This assumption is fragile in the real world.

Solutions:

- Conduct experiments
- Find a **natural experiment**

Experiments

How can we ensure the all else equals assumption holds?

> Randomization

Randomized Controlled Trails (RCT)

- widely used across many scientific disciplines[1]
- often touted as the of causal identification
- use randomization to ensure all else equals

In 2019, the Nobel Prize winners adapting RCTs to projects in development economics[2]

Experiments

Research question

>

The **all else equals** assumption would require:

- all preexisting correlates with health must be the same across insured and uninsured

What would violate this assumption?

>

Experiments

- Then, assuming the assignment is perfectly random across a large enough sample size, this assumption becomes much more palatable

Oregon Health Insurance Experiment

> The Oregon Health Insurance Experiment is a landmark study of the effect of expanding public health insurance on health care use, health outcomes, financial strain, and well-being of low-income adults... In 2008, the state of Oregon drew names by lottery for its Medicaid program for low-income, uninsured adults, generating just such an opportunity. This ongoing analysis represents a collaborative effort between researchers and the state of Oregon to learn about the costs and benefits of expanding public health insurance.

Natural experiments

> An external, non-experimental factor creates circumstances that resemble a controlled experiment

Real-world events provide opportunity to compare similar groups

With some assumptions, researchers infer the causal relationships examining differences in outcomes between groups

2021 Suez Canal Obstruction. **map**

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Regular article

Distance, trade, and income — The 1967 to 1975 closing of the Suez canal as a natural experiment☆

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Keywords:
Trade
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Growth
Gravity

ABSTRACT

This paper exploits a temporary shock to distance, the closing of the Suez canal in 1967 and its reopening in 1975, to examine the effect of distance on trade and the effect of trade on income. Time series variation in sea distance allows for the inclusion of pair effects which account for static differences in tastes and culture between countries. Distance is found to have a significant impact on trade with an elasticity that is about half as large as estimates from typical cross sectional estimates. Since the shock to trade is exogenous for most countries, predicted trade volume from the shock can be used to identify the effect of trade on income. Trade is found to have a significant impact on income. The time series dimension allows for country fixed effects which control for all long run income differences. Because identification is through changes in sea distance, the effect is coming entirely through trade in goods and not through alternative channels such as technology transfer, tourism, or foreign direct investment.

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Natural experiments

Green paradox

> An outcome in which climate policies instead have the opposite effect.

Carbon taxes: A carbon tax is announced to start at sometime in the future—aimed at reducing carbon emissions
However, for a short amount of time, emissions increase... **Why?** Theory dictates:

- If firms are informed of the policy, they will expect the price of pollution to increase in the future.
- Thus, they have incentive to **pollute more now**

Natural experiments

Blue paradox

- **Recent study** by **Grant McDermott** and coauthors.

  Question: Do commercial fishers preempt fishing bans by increasing their fishing effort before the bans go into effect?
  Motivation:

- Recent conservation seek to preserve habitat and increase fish stocks.
- Policy lever: Restrict fishing activity in marine protected areas.
- Concern: Preemptive behavior could fish stocks.

  Data: Vessel-level data on fishing effort/intensity.

Natural experiments

Blue paradox

Setting

Phoenix Islands Protected Area (PIPA)

- Policy announcement on September 1, 2014
- Implemented 1 January 2015.
- PIPA.
- Outlying Kiribati islands.

Natural experiments

Blue paradox

Result

Natural experiments

Blue paradox

Identification strategy: Differences-in-differences

Measure the causal effect of the fishing ban by comparing fishing effort in treatment and control regions, before-and-after PIPA.

Parallel trends assumption.

> "Define a control region that plausibly exhibits the same trends in fishing effort over PIPA, had the marine reserve never been implemented or anticipated."

Believing this assumption is key to a causal interpretation

Natural experiments

Blue paradox

Result

Natural experiments

Blue paradox

Discussion

Results provide causal evidence that commercial fishers engage in preemptive behavior in response to conservation policy changes.

Results are with economic theory, but that the theory is correct.

- Science **cannot prove** anything.
- Science can *falsify or reject* existing hypotheses or *corroborate* existing evidence.

Natural experiments

Blue paradox

Furthermore, the causal statement rests on a critical assumption.

- Cannot prove that the assumption is true, but can falsify it.
- Failure to falsify $\neg$ assumption is true

1. Medicine, psychology, education, agronomics among many others
2. Duflo, Banerjee, Kremer won the Nobel Prize in Economics in 2019

Number of people who drowned by falling in pool and Nicolas Cage films

EC 320

EC320, Set 01 | Introduction and Overview

In EC 320

We start to build up the fundamentals of causal analysis

But first we need to build up the necessary **Theory**, **Tools**, and **Skills**

This course will focus exclusively on a particular method that is common in statistics in general:

- *Ordinary Least Squares (OLS)* (aka linear regression)

Coursework

Rough weekly outline:

- **01:** Introduction and review
- **02:** The econometric problem
- **03:** SLR estimation
- **04:** SLR assumption
- **05:** SLR inference
- **06:** **Midterm**
- **07:** MLR estimate and inference
- **08:** Transformations
- **09:** Quantitative variables
- **10:** Exogeniety and final review

Final: Tuesday, June 13 @ 2:45

Syllabus

- [link]

Course site

About me

Please call me Andrew

- **Office:** **PLC 523**
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> Metrics

- I love studying econometrics
- My first time teaching EC 320
- **TA'd:** EC 421 (x2), EC 422/522, EC 423/523, EC 424/524
- **Instructed:** EC 330 (x3)

EC320, Set 01 | Introduction and Overview

About me

Please call me Andrew

- **Office:** **PLC 523**
- **Office hours:** XXX
- **Email:** **adickin3@uoregon.edu**

> Grad school

- 4th year Econ PhD student
- Applied topics related to environmental economics
- Causal inference, statistical learning, and data science
- Current focus on air pollution

About me

Please call me Andrew

- **Office:** **PLC 523**
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> Before grad school

- Grew up in San Diego, CA
- Spent childhood/undergrad summers in the San Juan Islands
- Studied economics and math at San Diego State University
- Prior to PhD, researched crime and immigration topics

In EC 320

An applied econometrician[1] needs a solid grasp on (at least) three areas:

1. The underlying **theory** (assumptions, strengths, weaknesses).
2. An ability to load, aggregating, joining, visualizing **large datasets**.
3. **Applying** the theoretical methods to **actual data**.

This course aims to deepen your knowledge in each of these three areas.

- 1: Analytical skills (**Math**)
- 2-3: Computational tools ($\mathbb{R}$)

1. Applied econometrician = Practitioner of econometrics, e.g., analyst, consultant, data scientist.

R

What is R?

To quote the R **project website**[1]

> R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS.

What does that mean?

- **R** was created for the statistical and graphical work required by econometrics–written by statistical programmers
- R has a vibrant, thriving online community. (**stack overflow**)
- Plus it's **free** and **open source**.

Why are we using R?

1. R is **free** and **open source**—saving both you and the university money.

2. Outside of a small group of economists, private- and public-sector employers favor R over `Stata` and most competing softwares.

3. R is very **flexible and powerful**—adaptable to nearly any task, , 'metrics, spatial data analysis, machine learning, web scraping, data cleaning, website building, teaching. I write all my slides, problem sets, and exams in R.

Why are we using R?

4. R imposes **no artificial restrictions** on your amount of observations, variables, memory, or processing power.

5. If you put in the work,[1] you will come away with a **valuable and marketable** tool.

6. I 💖 R

1. Review **wikipedia** definitely requires time and effort.

Getting started with R

R setup for EC 320

Installation

You need to install **2** pieces of software:

- R
- **`Rstudio`**

For explicit instructions for how to install, follow **this tutorial**

Note: R/`Rstudio` installations differ by operating system

R setup for EC 320

R v. Rstudio

- The programming language (ie english, spanish, french etc.)
- The engine, chassis, wheels, etc. of a car
- The Integrated Development Environment (IDE) (ie word processor)
- The dashboard containing various buttons and monitors

R works without Rstudio, but Rstudio doesn't work without R

R

EC320, Set 01 | Introduction and Overview