Modern Empirical Econometrics

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Lot’s of economists don’t work on economicsy topics.

We often answer all sorts of causal questions. Let me show you how.
Causal questions economists answer

- What is the effect of ...
  - legalizing medical marijuana on crime?
  - signing a contract in the beginning (instead of at the end) on lying?
  - legalizing prostitution on rape and sexually transmitted diseases?
  - schooling on earnings?
Impact of education on income

What We Have Found

Average earnings are 24% higher for those with a tertiary education compared to those with only upper secondary and post-secondary non-tertiary education

Date Updated: March 2013

Differences-in-means

• We typically observe differences in means (averages)

• Average earnings people without tertiary education: NZD 100,000

• Average earnings people with tertiary education: NZD 124,000

• Difference in average earnings: NZD 24,000 or 24%
Differences-in-means

• Difference-in-means = Average causal effect + Selection bias

• Difference-in-means:
  • People with tertiary education earn 24,000 more

• Average causal effect:
  • Average effect of education on earnings

• Selection bias:
  • Difference in earnings for other reasons than education → everything else!
Thinking about selection bias

• How would the outcome of the two groups differ in the absence of the treatment?

• What else (besides education) is driving difference in earnings between these two groups?

• Difference-in-means = causal effect + everything else
(made up) mean differences

• People who wear a tie earn on average 20% more. Should you wear a tie to work?

• People who are in a hospital have a 200% greater likelihood of dying in the next year.

• Children who have books at home are 10% more likely to go to university.
Solutions to selection bias - randomization

- We can solve selection bias by randomly assigning treatment.

- Randomly send children to school (treatment group) or not to school (control group).

- Record earnings of treatment and control group ten years later.

- If we have a large enough sample, the only difference between treatment and control group is schooling.
How effective are student tutors compared to professors in tutorial teaching?

Setting

• We look at data from a Dutch business school.

• At this business school, students get randomly assigned different tutors.

• We observe students’
  • grades,
  • grades in future courses,
  • course evaluations,
  • earnings, and
  • job satisfaction.
Randomization check

• If students we have indeed random assignment, we should observe that:

• Students who are taught by professors are similar to those taught by professors.

• Our randomization check confirms that, between the two groups there are...
  • no difference in past GPA
  • no difference in share female
  • no difference in age
Results

• Students who are taught by student tutors (compared to professors)
  • Get the same grades in current and future courses
  • Evaluate the courses somewhat more negatively
  • No difference in earnings or job satisfaction.

➢ At this business school, students are almost as effective as professors in tutorial teaching.

➢ Professors are 4x more expensive than student tutors. Why still use professors for tutorial teaching?
Interpreting the results

• Unproductive professors?

• Teaching might be valuable for students.

• Teaching may help professors improve course material?

• Effect might be different at different institutions.
What is the effect of building a refuse incinerator on housing prices?

**Background:** A rumor that a new incinerator would be built in North Andover started after 1978; construction started in 1981.
Nearinc = 1
Price differences in 1981

Average house prices in 1981

<table>
<thead>
<tr>
<th>Not near</th>
<th>$101,307</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near</td>
<td>$70,619</td>
</tr>
<tr>
<td>Difference</td>
<td>$-30,688</td>
</tr>
</tbody>
</table>

Is this the causal effect of the incinerator on house prices?
Price differences in 1978

<table>
<thead>
<tr>
<th>Location</th>
<th>Before incinerator 1978</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not near</td>
<td>$82,517</td>
</tr>
<tr>
<td>Near</td>
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There was already a difference in 1978!
Difference-in-Difference estimator

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\[ \Delta_{1978} \]

Differences because of other factors (location, house quality, etc.)

\[ \Delta_{1981} \]

Differences because of incinerator and other factors (location, house quality, etc.)

Diff-in-Diff estimator of effect of incinerator:

\[ \Delta_{1981} - \Delta_{1978} = -11,863 \]

It is only valid if difference because of other factors did not change over time.
Example Diff-in-Diff by Marie & Zoelitz (2017)

• What is the effect of smoking marijuana on grades?

• Difficult to run an experiment.

• Instead, look for ”natural experiment”. In Maastricht:
  • Coffeeshops were open to everyone until September 2011
  • From October 2011 they were open only open for Dutch, Germans and Belgians (DGB) and closed for all other nationalities.

• What is the effect of coffee shop closing on grades?
Poster Announcing Application on 1st of October 2011
Diff-in-Diff estimate

- D1: Difference between Dutch/German/Belgian students and other students before coffee shop closing.
  - Difference due to other factors

- D2: Difference between Dutch/German/Belgian students and other students during coffee shop closing.
  - Difference due to other factors + coffee shop closing

- Diff-in-Diff estimate: D2-D1
  - Difference due to coffee shop closing
The performance of students who are no longer legally permitted to buy marijuana increases substantially.

This is evidence for causal effect of restricting access to marijuana on grades.
Interpreting the results

• Some students may have asked friends to buy marijuana for them.
  • Effect is driven by people who were influence by the closure.

• Should the Netherlands ban marijuana sales?
  • Other factors to consider: effect on crime? Effect on other drug consumption?
Things you could do in the classroom

• Introduce the “Difference-in-means= causal effect + everything else” formula

• Ask students to think about selection bias.
  • Ask them to make a list of other reasons why the treatment and control group could be different.

• Ask students to find instances where people confuse correlation and causation.
Additional resources

• For more about the fun part of economics, check out these two podcasts:
  • Planet Money (http://www.npr.org/sections/money/)
  • Freakonomics (http://freakonomics.com/)