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.

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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

Source: https://www.educationcounts.govt.nz/indicators/main/education-and-learning-outcomes/1919

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

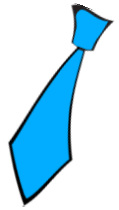
- How would the outcome of the two groups differ in the absence of the treatment?

- 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?

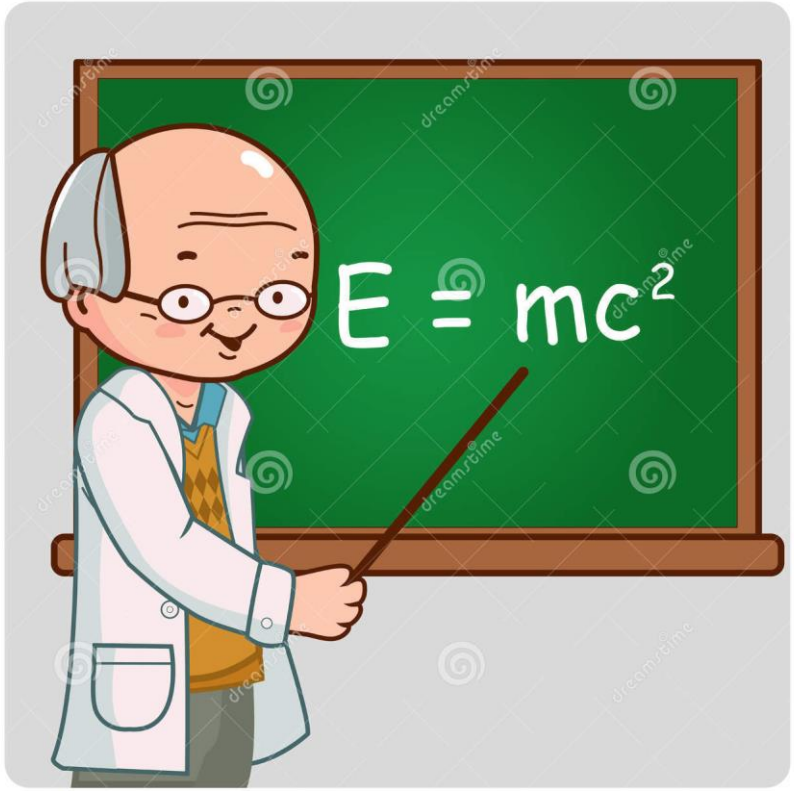


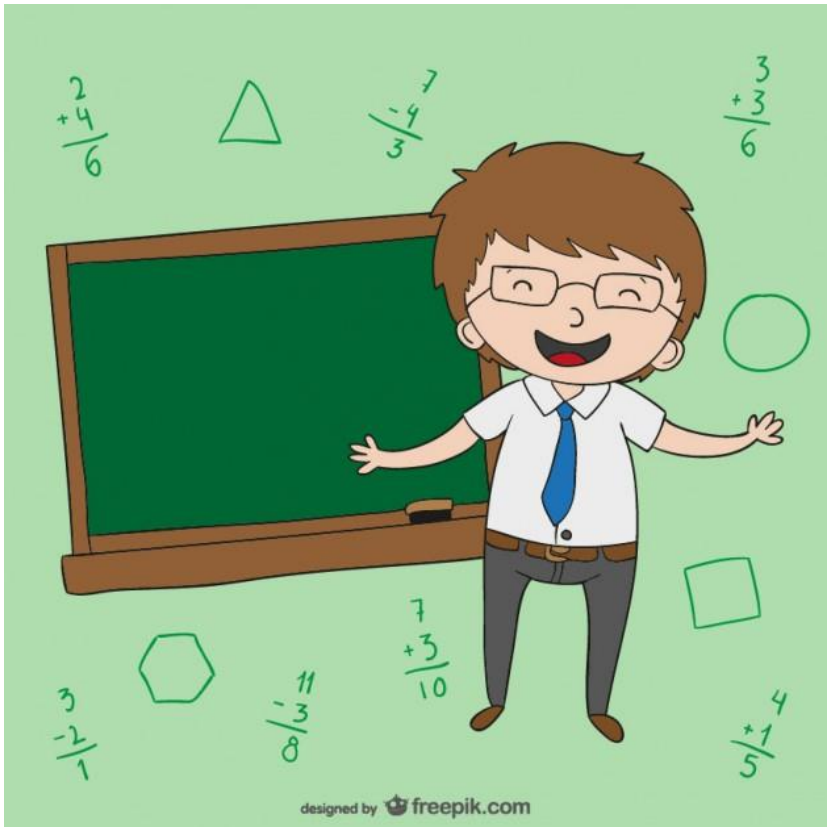
- People who are in a hospital have a 200% greater likelihood of dying in the next year.

- 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?

Source: Feld, Jan, Nicolás Salamanca, and Ulf Zölitz.
"Are professors worth it? The value-added and costs of tutorial instructors." (2018).

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.

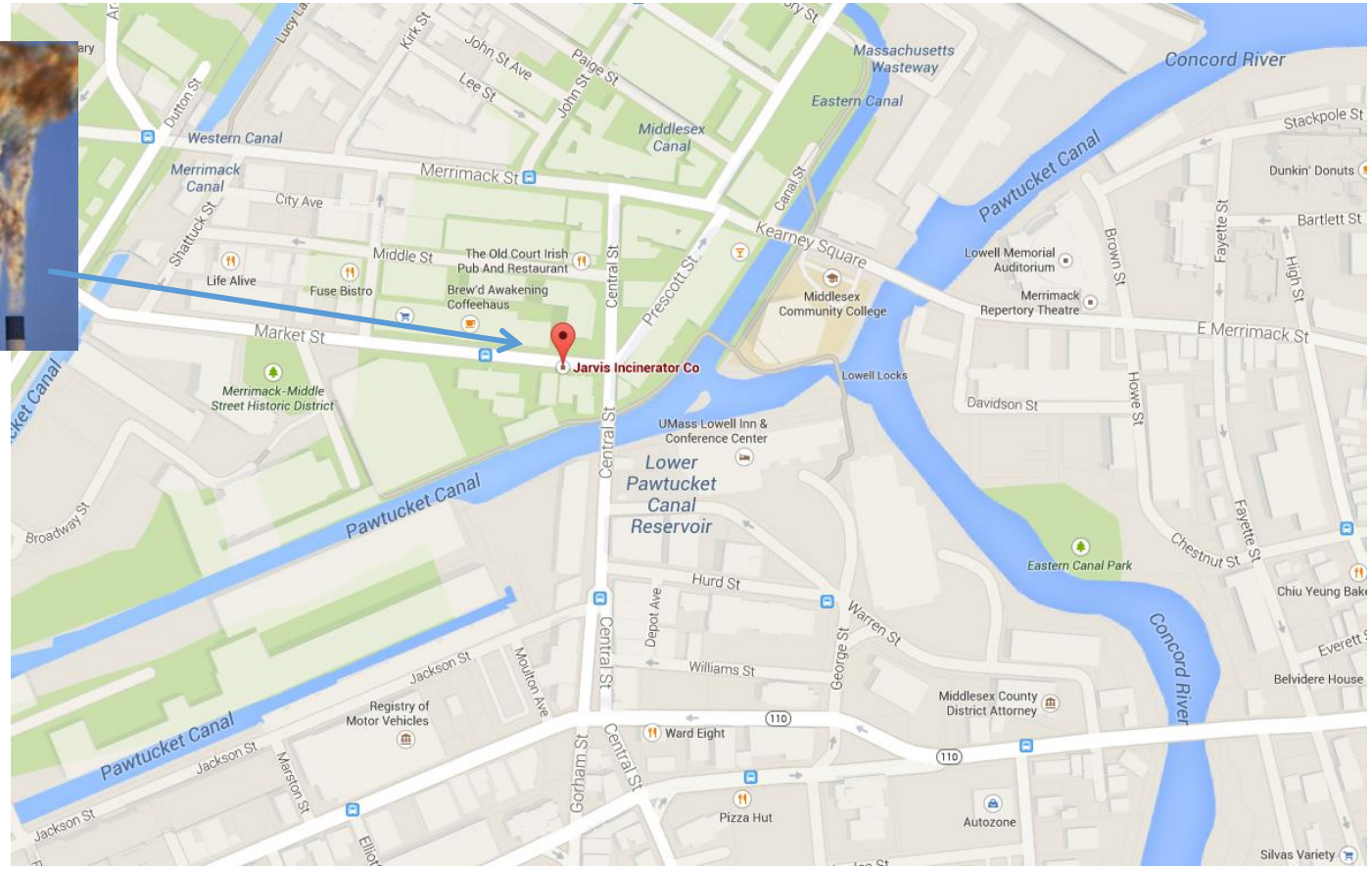
➢ At this business school, students are almost as effective as professors in tutorial teaching.

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

Interpreting the results

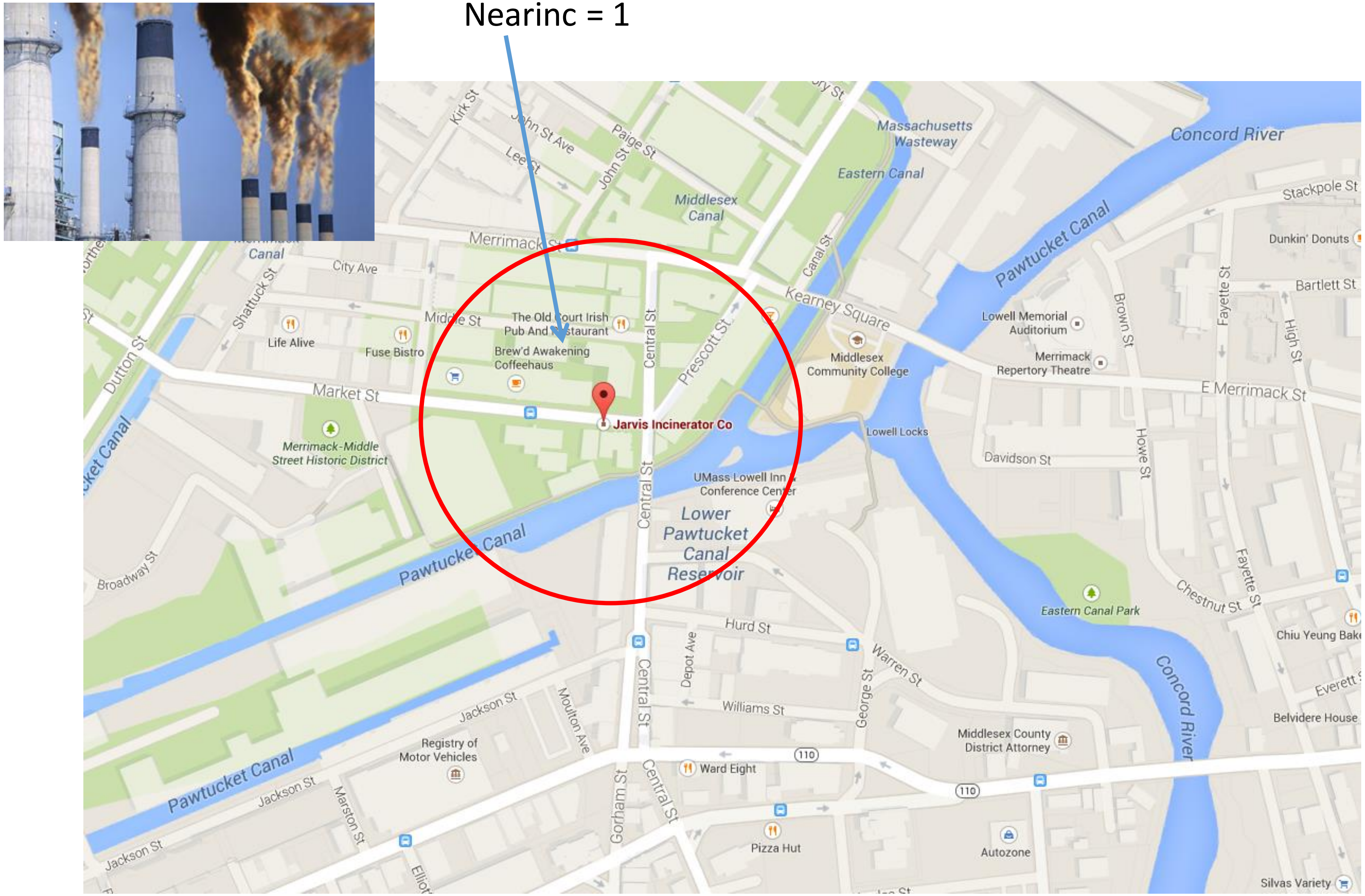
- Unproductive professors?
- Teaching might be valuable for students.
- Teaching may help professors improve course material?
- Effect might be different at different institutions.

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.

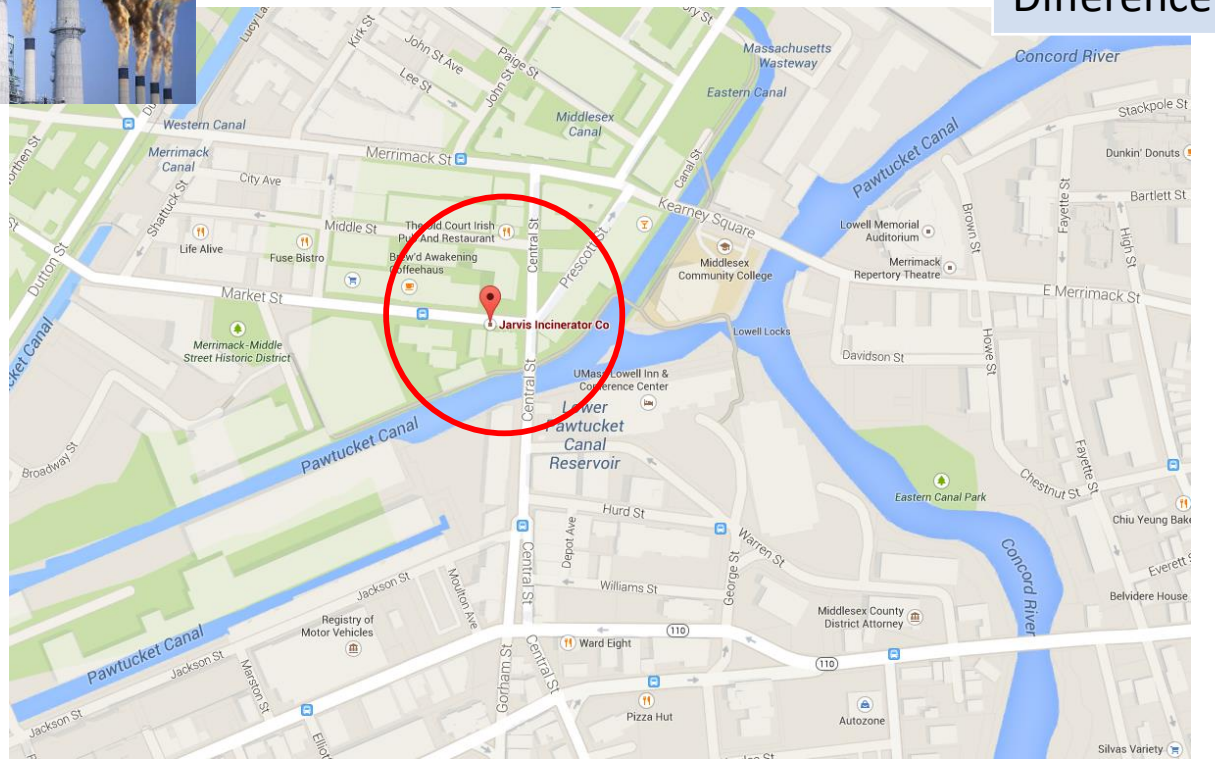
Nearinc = 1


Jarvis Incinerator Co
Merrimack St
Middle St
Market St
Central St
Prescott St
Kearney Square
Canal St
Paige St
John St
Lee St
Kirk St
City Ave
Shattuck St
Dutton St
Broadway St
Jackson St
Moulton Ave
Marston St
Gorham St
Depot Ave
Hurd St
Williams St
Warren St
George St
Davidson St
Howe St
Brown St
Fayette St
High St
Bartlett St
Stackpole St
Chestnut St
E Merrimack St
Concord River
Pawtucket Canal
Eastern Canal
Massachusetts Wasteway
Middlesex Canal
Canal
Lower Pawtucket Canal Reservoir
The Old Court Irish Pub And Restaurant
Brew'd Awakening Coffeehaus
Life Alive
Fuse Bistro
Merrimack-Middle Street Historic District
UMass Lowell Inn & Conference Center
Middlesex Community College
Lowell Locks
Lowell Memorial Auditorium
Merrimack Repertory Theatre
Dunkin' Donuts
Eastern Canal Park
Registry of Motor Vehicles
Ward Eight
Pizza Hut
Autozone
Middlesex County District Attorney
Belvidere House
Silvas Variety
110

Price differences in 1981

Average house prices
In 1981 $

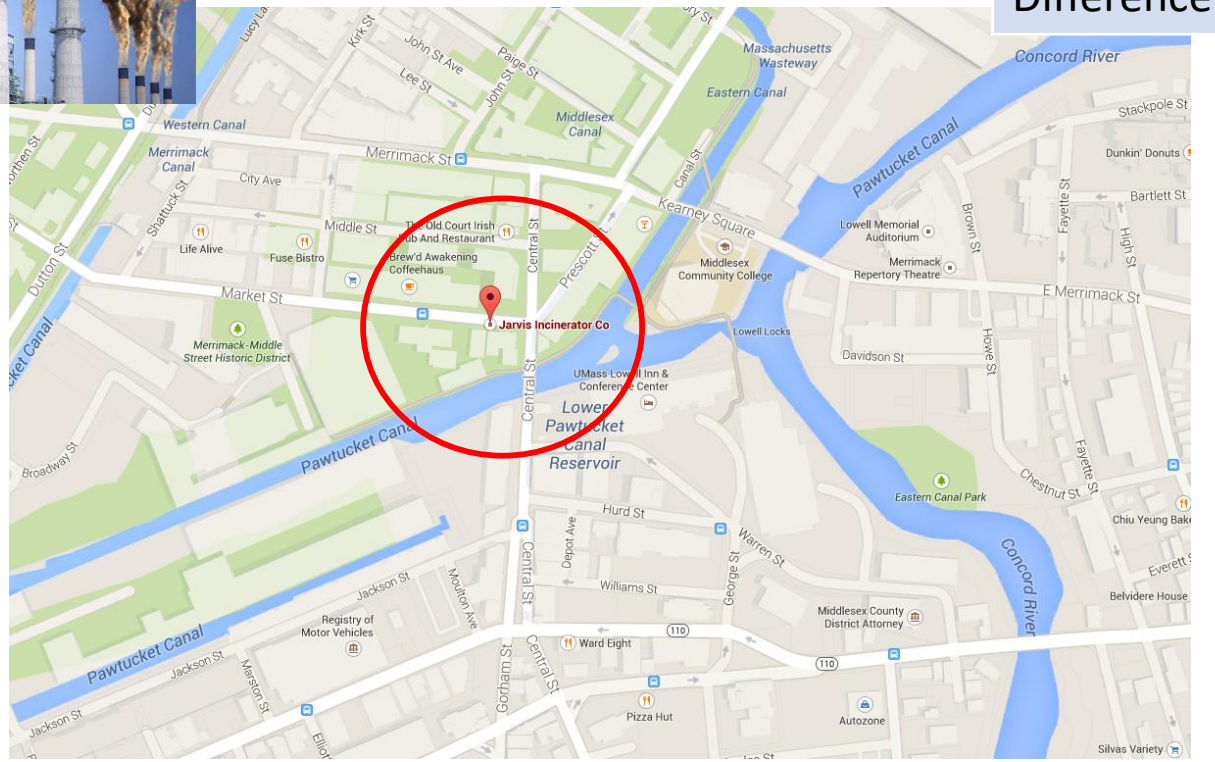
	After incinerator 1981
Not near	$ 101,307
Near	$ 70,619
Difference	$ -30,688



Is this the causal effect of the incinerator on house Prices?

Price differences in 1978

	Before incinerator 1978
Not near	$ 82,517
Near	$ 63,692
Difference	$ -18,825



There was already a difference in 1978!

Difference-in-Difference estimator

	Before incinerator 1978	After incinerator 1981
Not near	$ 82,517	$ 101,307
Near	$ 63,692	$ 70,619
Difference	$ -18,825	$ -30,688

$\Delta 1978$

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?

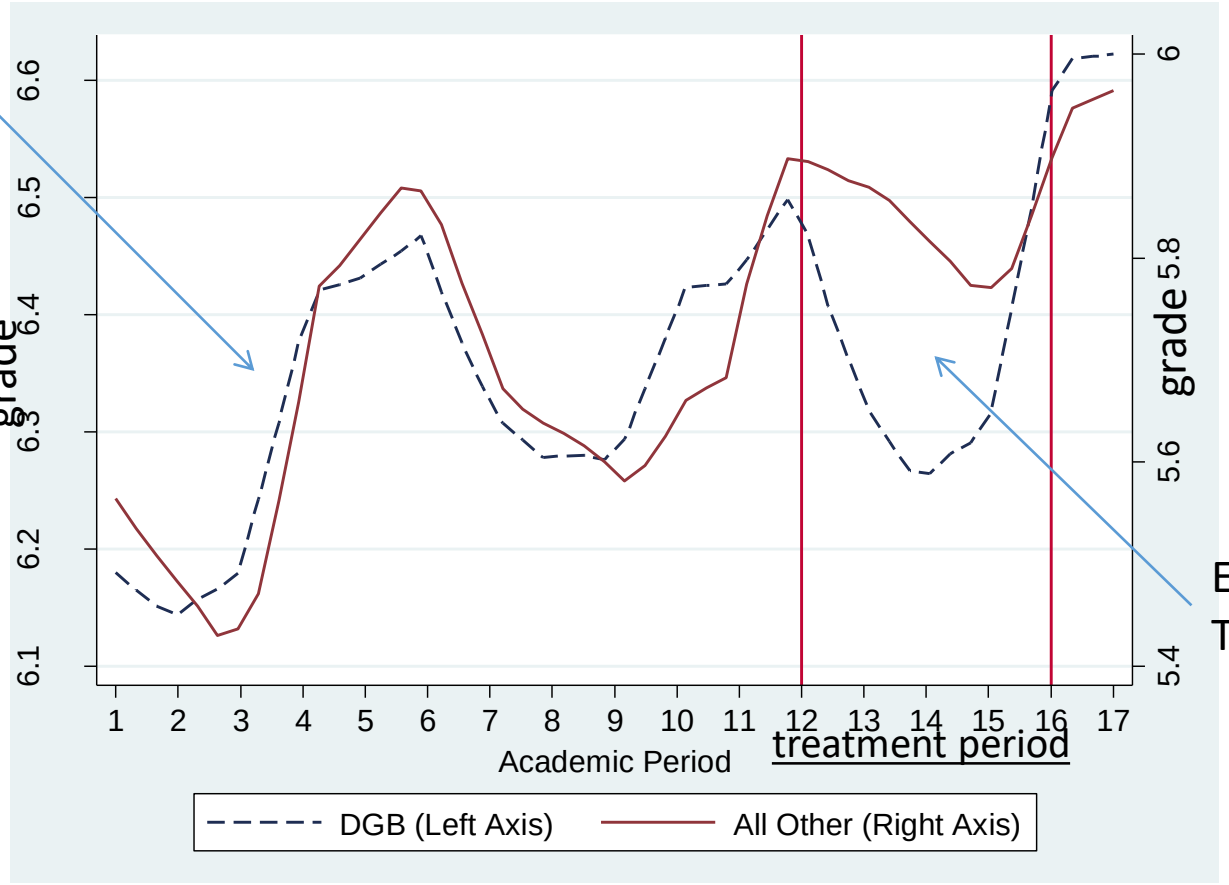
Poster Announcing Application on 1st of October 2011

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

Course Grades for DGB and All Other Nationality Students

parallel trends



Evidence of Treatment effect

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/)