Lecture 12:
How to Present a Causal Strategy

April 9, 2025

Course Administration

1. First half of class is lecture
2. Second half is workshop
3. Paper is due April 28 by 5 pm
4. Instructions for presentations posted

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2. Second half is workshop
3. Paper is due April 28 by 5 pm
4. Instructions for presentations posted
5. Next week: presentations
    - presenters, post slides by 4 pm
    - presentation instructions posted
6. Please come see me about your replication paper
7. Any other issues?

Paper **and** Presentation: Make Sure Your Words Are Your Own

- What you have to contribute as a scholar is your own words
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- I will sadly report you to the university
- Please let's avoid

Order of Discussion

1. Goal
2. Organization
3. Examples
    - Containerization
    - DC civil disturbance

Goal

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- Convince readers of the validity/plausibility of your causal strategy
- Explain to readers why your strategy is an improvement over a basic regression
- Illuminate what the variation you use is and where it comes from

Organization

Leading the Horse to Water and Making it Drink

Leading the Horse to Water and Making it Drink

1. Explain the causal question
   - Pose the "naive" OLS estimate
   - Explain the problems with the naive estimate, ideally with examples
2. Propose an alternative superior method to identify causal impact
   - Explain underlying assumptions
   - Explain how your solution satisfies assumptions

Containerization

Empirical Strategy

Does containerization impact local economic activity?

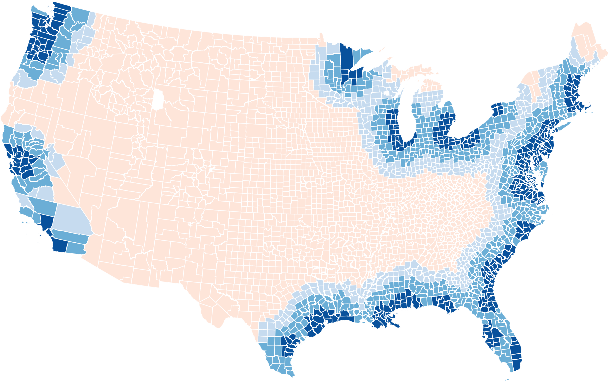
$$\Delta \ln(y_{i,t}) = \beta_0 + \beta_1 \Delta C_{i,t} + \beta_2 X_{i,1950} + \Delta\epsilon_{i,t} \ ,$$

Δ denotes long-run differences: $\Delta \ln(y_{i,t}) = \ln(y_{i,t}) - \ln(y_{i,1950})$

- $\Delta \ln(y_{i,t})$ = change in log population
- $\Delta C_{i,t}$ = change in presence of nearby container port
- $X_{i,1950}$ = baseline covariates

$\beta_1 > 0$ when containerization is associated with growth relative to non-adopters

Parameterizing Distance to Containerized Port



Darkest blue $\equiv$ counties 0 to 100 km from a container port
Lightest blue $\equiv$ counties 200 to 300 km from a container port

Benefits of First Difference Strategy

$$\Delta \ln(y_{i,t}) = \beta_0 + \beta_1 \Delta C_{i,t} + \beta_2 X_{i,1950} + \Delta \epsilon_{i,t}$$

- Nets out time-invariant city characteristics: climate, geography, long-run industry mix
- Allows for differential trends in population growth by baseline covariates
    - Region
    - Distance to the ocean
    - Number of ports in 1953 by 100 km distance bins
    - Total value of int. trade in 1955 by 100 km distance bins
    - Log population in 1920, 1930, and 1940
    - Manufacturing share of employment in 1956

First Differencing Compensates for Level Differences

	Near C. Port	Not Near C. Port
Population, 1950	31,571	14,472
Payroll/Employee, March 1956	740	640
Manuf. Shr. of Employment	0.42	0.26
Counties	1,335	1,668

Remaining Identification Challenge

- Time-varying feature correlated with containerization that causes population growth
  - for example, counties turn to containerization as a solution for slow growth
- $\rightarrow$ instrument

Depth as Instrument

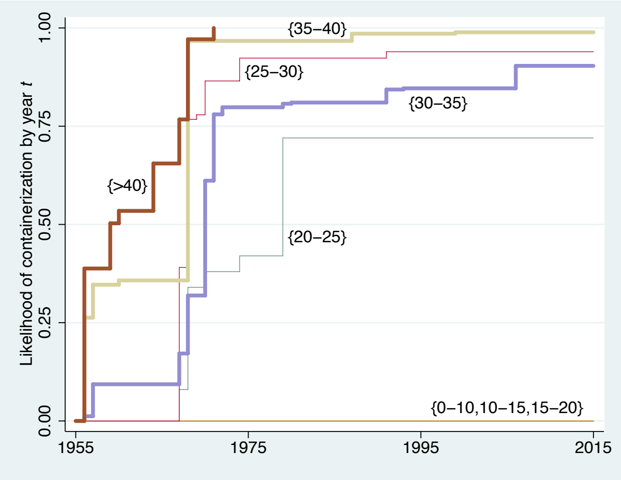
Instrument for containerization with proximity to 1953 very deep port

$$\Delta C_{i,t} = \alpha_0 + \alpha_1 Z_i + \alpha_2 X_{i,1950} + \eta_i$$

Key identifying assumptions

1. Strong relationship between containerization and initial depth of port
2. Proximity to very deep port in 1953 affects growth only through its impact on containerization

Assumption 1: Counties Near Deep Ports in 1953 More Likely to Be Near Container Ports in 2010



Assumption 2: Proximity to Very Deep Ports in 1953 Impacts Growth Only Through Containerization

Reasonable Objection: Deep Ports Were Always Valuable!

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- Port depth mattered to growth pre-containerization
- Yes: but ships' drafts weren't very deep
- Post-containerization, ships sit deeper in the water
- And require deeper ports
- Therefore, instrument with being "very" deep in 1953
- Historical sources regard 30 feet as the maximum useful depth
- $Z \equiv 1\{\text{county near port} > 30 \text{ feet deep in 1953}\}$

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Assumption 2, restated: Proximity to extreme depth poses no particular advantage before advent of containerization, conditional on covariates

Container Ships Much Larger Than Predecessors

WWII technology

Source: Rodgrigue, 2015.

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First container ships, 1956 to 1970s

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Container Ships Much Larger Than Predecessors

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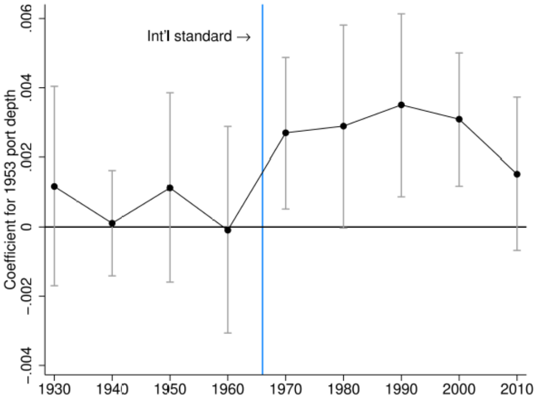
First container ships, 1956 to 1970s

Today, Post-Panamax

Source: Rodgrigue, 2015.

And Another Piece of Evidence We Came Up with Later

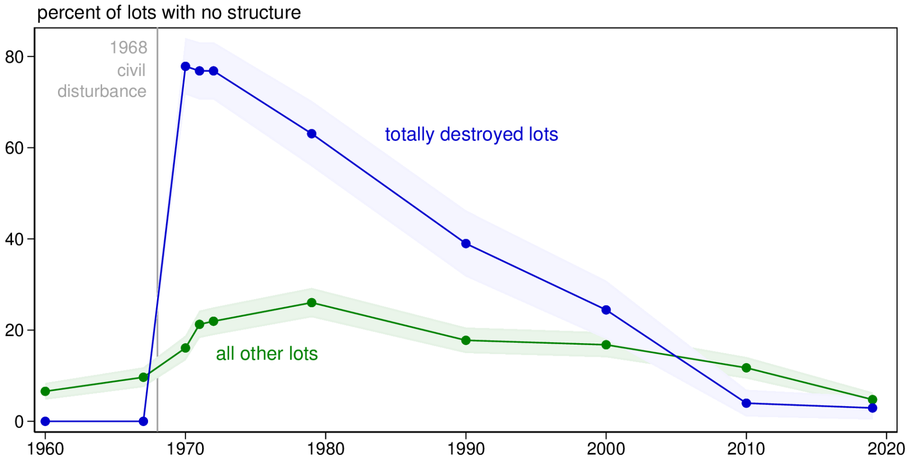
- impact of depth on population change
- dep var is change in population 1910 to year on x axis
- dot is regression coefficient on depth
- what role does this play in the explanation?



Evolving Consequences of DC's 1968 Civil Disturbance

Estimating Impact of Destruction

Unconditional Impact of Destruction is Large



Isolate the Impact of Destruction

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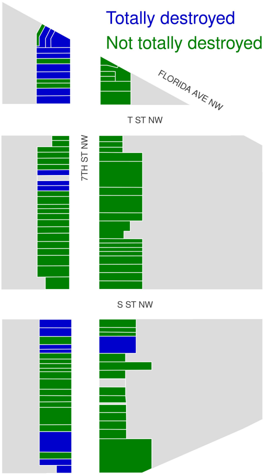
Within block comparison of destroyed and undestroyed lots



Long-Run Trajectory and Destruction

$$Y_{l,b,t} = \beta_0 + \beta_{1,t} D_l * \theta_t + X_l * \theta_t + \theta_t * \theta_b + \beta_2 D_l + \epsilon_{l,b,t}$$

- $Y_{l,b,t}$
  - presence of a structure
  - value of improvements per sq ft
  - land value per square foot
- $D_l \in \{0, 1\}$, 1 is totally destroyed
- $t \in \{$1960, 1967, 1970, 1971, 1972, 1979, 1990, 2000, 2010, 2019$\}$

- θ_t, time fixed effects
- θ_b, block fixed effects
- Coefficient of interest is $\beta_{1,t}$
- $\theta_b * \theta_t \rightarrow$ evolution relative to same-block lots in same year

Requirements for this Design to Deliver Causal Estimates

1. Destruction is random conditional on block

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2. Absent treatment, destroyed properties would have no differential trajectory post-treatment
   - destroyed and other properties have similar pre-treatment trends ▸ pre-trend

Assess Whether 1967 Characteristics Correlated with Destruction

$$
\begin{aligned}
D_l &= \alpha_0 + \alpha_1 \text{log(land\$/sqft)}_l + \alpha_2 \text{log(imprvmt\$/sqft)}_l + \alpha_5 \textbf{material}_l \\
&+ \alpha_3 \textbf{use}_l + \alpha_4 \textbf{quality}_l \\
&+ \alpha_6 \text{black-owned biz}_l + \theta_b + \epsilon
\end{aligned}
$$

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Material

- stone or concrete
- wood frame
- other non-brick

Use

- commercial
- residential
- store
- other

Quality

- ranked 1 to 10
- $>$ 5 in one category

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If destruction is random, conditional on block (θ_b), we expect $\alpha = 0$

return

Destroyed Properties Similar, Conditional on Block Fixed Effects

	1967 Lot Means				
	Totally destroyed	Not totally destroyed	p-value, H_0 : diff $= 0$	Regression, DV is totally destroyed	
	(1)	(2)	(3)	(4)	(5)
Type of building, commercial use omitted					
Residential	0.04	0.17	0.00	0.056	-0.033
				(0.04)	(0.066)
Store	0.96	0.76	0.00	0.268***	0.085
				(0.04)	(0.058)
Other	0.00	0.01	0.17	-0.038	0.129
				(0.058)	(0.129)
Material of construction, brick omitted					
Stone or concrete	0.00	0.01	0.14	-0.029	-0.272*
				(0.064)	(0.142)
Wood frame	0.02	0.02	0.72	0.164	0.057
				(0.103)	(0.122)
Other, non-brick	0.01	0.01	0.54	0.046	-0.126
				(0.114)	(0.115)
Site, Black-owned bus.	0.1	0.20	0.00	-0.124***	-0.046
				(0.031)	(0.028)
Lot value, Construction quality, depreciation				x	x
Block fixed effects					x
Observations	175	646		821	821
R-squared				0.092	0.394

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Therefore

- control for interaction of year and stone building
- also control for interaction of year and retail
- robustness tests omitting these properties

return

Testing for Pre-Destruction Differences

Sample is 1960 and 1967 lots.

Outcome variable	log(improvements assessment/sqft)	log(land assessment/sqft)	
Sample	Lots with improvements	All lots	Lots with improvements
	(1)	(2)	(3)
1967 x destroyed	0.0342	0.00947	0.0227
	(0.0721)	(0.0414)	(0.0409)
Year-Block FE	X	X	X
Destroyed FE	X	X	X
Observations	1,770	1,898	1,770
R-squared	0.329	0.779	0.783

return

Characterizing the Entire Path of Development with Intra-Block Analysis

$$
\begin{aligned}
Y_{l,b,t} = \beta_0 &+ \beta_{1,t} D_l * \theta_t + \beta_2 D_l \\
&+ \theta_t * \theta_b + \beta_3 1\{\text{retail}\}_l + \beta_4 1\{\text{stone}\}_l + \beta_5 1\{\text{Black biz}\}_l \\
&+ \theta_t * 1\{\text{retail}\}_l + \theta_t * 1\{\text{stone}\}_l + \theta_t * 1\{\text{Black biz}\}_l + e_{l,b,t}
\end{aligned}
$$

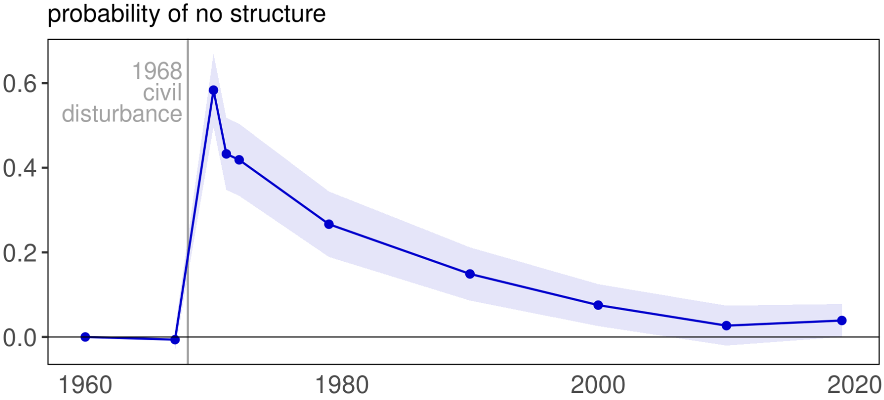
Measureable outcomes, $Y_{l,b,t}$

- Presence of structure
- Value of improvements per square foot
- Falsification: land value per square foot

Next slides report $\beta_{1,t}$

Structure Presence Requires at Least 30 Years to Converge

Dependent Variable is Absence of Any Structure



Workshop

Workshop

- Go find your group
- Talk amongst yourselves
- Stay as long or as little as you'd like
- I'll stay till 8

Upcoming

- Focus on issues of causality in your replication!
- Lecture 13: Presentations
- Lecture 14: Presentations
- Done!