Lecture 13:
Panel data III

PPHA 34600

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An example: The Clean Water Act

Policy issue:

- Rivers in the U.S. used to be incredibly polluted
- We might want to clean these rivers up
- Is this clean-up worth it?

Approach:

- Look at the Clean Water Act
- Estimate the effects of the CWA on water pollution
- We didn't randomize water treatment plants
- ...but we can do a pre-vs-post, treated-vs-untreated, upstream-vs-downstream comparison

$\rightarrow$ Use a DDD model to estimate treatment effects

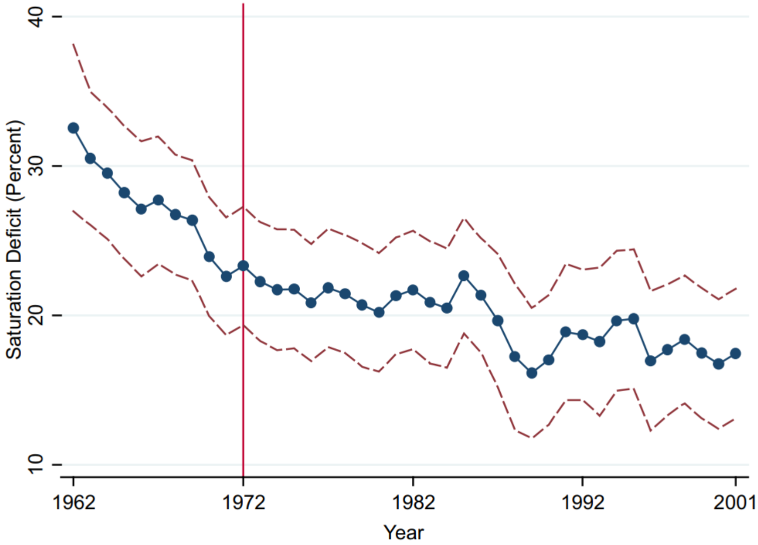
Estimating the effects of the Clean Water Act

The authors will run a version of:

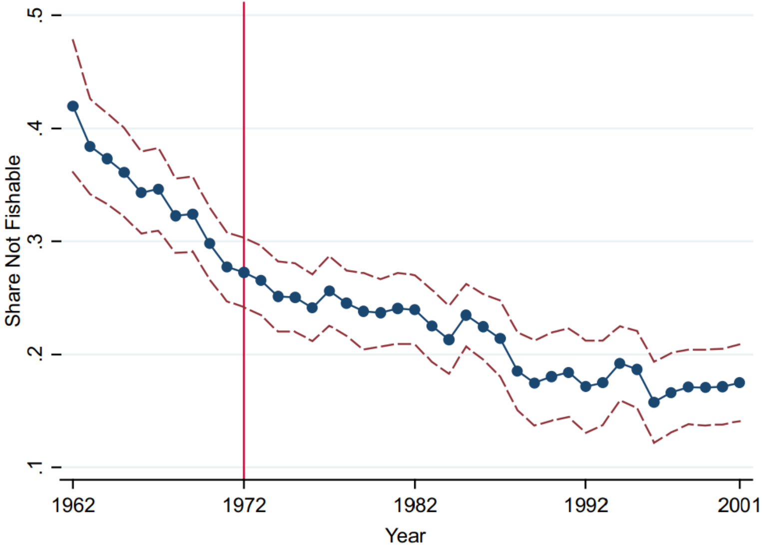
$$\begin{aligned} Y_{ijt} = \beta_0 &+ \beta_1 Treat_i + \beta_2 Post_t + \beta_3 Downstream_j + \beta_4 (Treat_i \times Post_t) \\ &+ \beta_5 (Post_t \times Downstream_j) + \beta_6 (Treat_i \times Downstream_j) \\ &+ \tau (Treat_i \times Post_t \times Downstream_j) + \varepsilon_{ijt} \end{aligned}$$

where
Y_{ijt} is pollution at plant i in year y by downstream status j
$Treat_i \times Post_t \times Downstream_j$ turns on for plants after they've gotten a grant

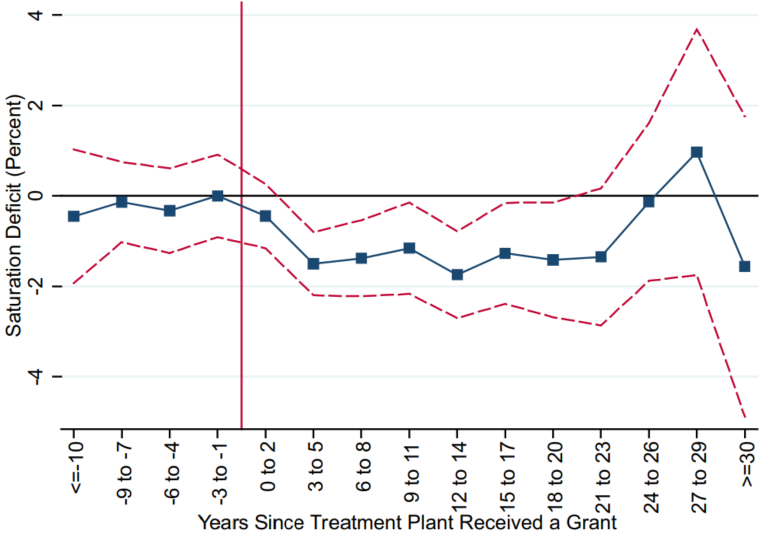
Pollution over time



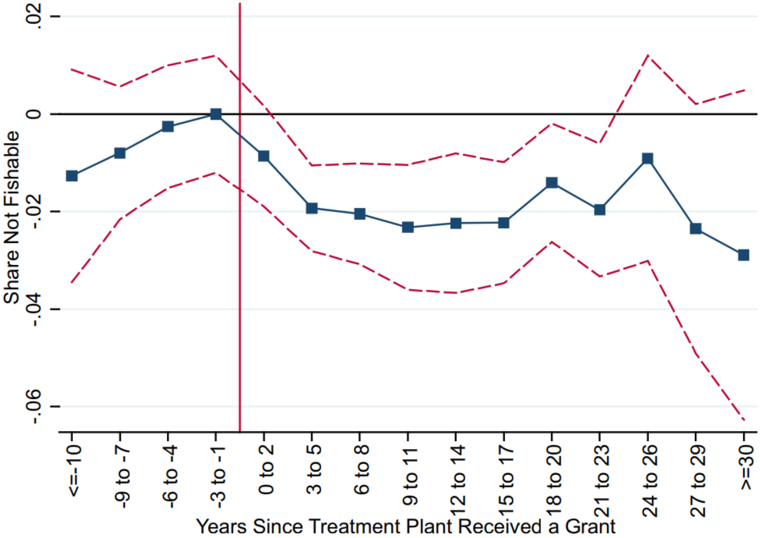
Pollution over time



Causal effects of treatment



Causal effects of treatment



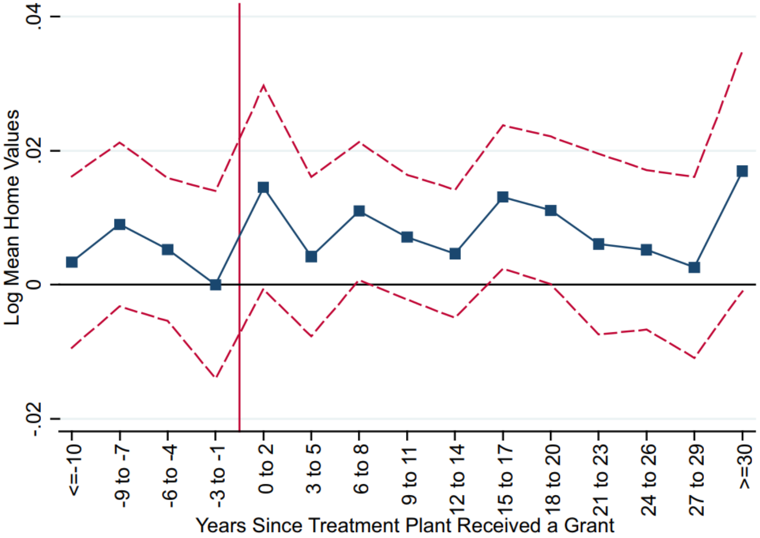
Causal effects of treatment

TABLE II
EFFECTS OF CLEAN WATER ACT GRANTS ON WATER POLLUTION

	Main pollution measures		Other pollution measures			
	Dissolved oxygen deficit (1)	Not fishable (2)	Biochemical oxygen demand (3)	Fecal coliforms (4)	Not swimmable (5)	Total suspended solids (6)
Downstream *Cumul. # grants	-0.681^{***}	-0.007^{**}	-0.104^{**}	-204.059^{**}	-0.004^{*}	-0.497
	(0.206)	(0.003)	(0.041)	(98.508)	(0.002)	(0.635)
N	55,950	60,400	28,932	34,550	60,400	30,604
Dep. var. mean	17.092	0.328	4.411	5,731.028	0.594	42.071
Fixed effects:						
Plant-downstream	Yes	Yes	Yes	Yes	Yes	Yes
Plant-year	Yes	Yes	Yes	Yes	Yes	Yes
Downst.-basin-year	Yes	Yes	Yes	Yes	Yes	Yes
Weather	Yes	Yes	Yes	Yes	Yes	Yes

Notes. Each observation in a regression is a plant-downstream-year tuple. Data cover 1962–2001. Dissolved oxygen deficit equals 100 minus dissolved oxygen saturation, measured in percentage points. Dependent variable mean describes mean in 1962–1972. Standard errors are clustered by watershed. Asterisks denote p-value $< .10$ (*), $< .05$ (**), or $< .01$ (***).

Home values over time



Cost-effectiveness

Clean Water Act Grants: Costs and Effects on Home Values ($2014Bn)

	(1)	(2)	(3)	(4)
Ratio: Change in home values/costs	0.06	0.26	0.22	0.24
	(0.03)	(0.36)	(0.36)	(0.41)
p-value: ratio = 0	[0.05]	[0.46]	[0.55]	[0.56]
p-value: ratio = 1	[0.00]	[0.04]	[0.03]	[0.06]
Change in value of housing ($Bn)	15.92	89.25	73.7	91.97
Costs ($Bn)				
Capital: fed.	86.24	102.26	102.26	114.16
Capital: local	35.81	41.81	41.81	48.00
Variable	166.1	197.36	197.36	222.81
Total	288.15	341.44	341.44	384.97
Max distance homes to river (miles)	1	25	25	25
Include rental units			Yes	Yes
Include nonmetro areas				Yes