Lecture 13:
Panel data III

PPHA 34600
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An example: Do people pay attention to taxes?

Policy issue:

- Unlike elsewhere, in the US we don't apply sales tax until checkout

- Do people over-buy things because they ignore tax?

Approach:

- Place tax labels on some products in the store

- Estimate the impact of product tags on purchasing

- We *did!* run an RCT by food category

- ...but we still want to include time and store controls

→ Use a DDD model to estimate treatment effects

Estimating the impacts of tax labels

The authors will run a version of:

$$Y_{ijt} = \beta_0 + \beta_1 Treat_i + \beta_2 Post_t + \beta_3 Product_j + \beta_4(Treat_i \times Post_t)$$
$$+ \beta_5(Post_t \times Product_j) + \beta_6(Treat_i \times Product_j)$$
$$+ \tau(Treat_i \times Post_t \times Product_j) + \varepsilon_{ijt}$$

where
Y_{ijt} is purchases at store i in time y of product j
$Treat_i \times Post_t \times Product_j$ turns on for treated products in treated stores during the treatment period

Treatments

Do people make mistakes?

Panel B. Grocery store survey			
Local sales tax rate	7.48	7.39	0.80
(Actual rate is 7.375 percent)			
Fraction correctly reporting tax status			
All items	0.82	1.00	0.38
Beer	0.90	1.00	0.30
Cigarettes	0.98	1.00	0.15
Cookies	0.65	1.00	0.48
Magazines	0.87	1.00	0.34
Milk	0.82	1.00	0.38
Potatoes	0.81	1.00	0.39
Soda	0.76	1.00	0.43
Toothpaste	0.80	1.00	0.40

$N = 91$

Summary statistics

	Treatment store		Control stores		Total
	Treatment products (1)	Control products (2)	Treatment products (3)	Control products (4)	All stores and products (5)
Panel A. Category-level statistics					
Weekly quantity sold	25.08	26.63	27.84	30.64	29.01
per category	(24.1)	(38.1)	(27.4)	(47.0)	(42.5)
Weekly revenue	$97.85	$136.05	$107.04	$154.66	$143.10
per category	(81.9)	(169.9)	(92.3)	(207.7)	(187.1)
Number of categories	13	95	13	95	108
Panel B. Product-level statistics					
Pre-tax product price	$4.46	$6.26	$4.52	$6.31	$6.05
	(1.8)	(4.3)	(1.7)	(4.2)	(4.1)
Pre-tax product price	$4.27	$5.61	$4.29	$5.59	$5.45
(weighted by quantity sold)	(1.7)	(3.9)	(1.6)	(3.8)	(3.7)
Weekly quantity sold	1.47	1.82	1.61	1.98	1.88
per product (conditional > 0)	(0.9)	(1.6)	(1.1)	(1.9)	(1.7)

DDD table

TABLE 3— EFFECT OF POSTING TAX-INCLUSIVE PRICES: *DDD* ANALYSIS OF MEAN QUANTITY SOLD

Period	Control categories	Treated categories	Difference
Panel A. Treatment store			
Baseline (2005:1–2006:6)	26.48	25.17	−1.31
	(0.22)	(0.37)	(0.43)
	[5,510]	[754]	[6,264]
Experiment (2006:8–2006:10)	27.32	23.87	−3.45
	(0.87)	(1.02)	(0.64)
	[285]	[39]	[324]
Difference over time	0.84	−1.30	$DD_{TS} = -2.14$
	(0.75)	(0.92)	(0.68)
	[5,795]	[793]	[6,588]
Panel B. Control stores			
Baseline (2005:1–2006:6)	30.57	27.94	-2.63
	(0.24)	(0.30)	(0.32)
	[11,020]	[1,508]	[12,528]
Experiment (2006:8–2006:10)	30.76	28.19	−2.57
	(0.72)	(1.06)	(1.09)
	[570]	[78]	[648]
Difference over time	0.19	0.25	$DD_{CS} = 0.06$
	(0.64)	(0.92)	(0.95)
	[11,590]	[1,586]	[13,176]
DDD Estimate			−2.20
			(0.59)
			[19,764]

DDD regressions

TABLE 4—EFFECT OF POSTING TAX-INCLUSIVE PRICES: REGRESSION ESTIMATES

Dependent variable	Quantity per category (1)	Revenue per category ($) (2)	Log quantity per category (3)	Quantity per category (4)	Quantity (treat. categories only) (5)
Treatment	−2.20 (0.60)	−13.12 (4.89)	−0.101 (0.03)	−2.27 (0.60)	−1.55 (0.35)
Average price	−3.15 (0.26)	−3.24 (1.74)		−3.04 (0.25)	−15.06 (3.55)
Average price squared	0.05 (0.00)	0.06 (0.03)		0.05 (0.00)	1.24 (0.34)
Log average price			−1.59 (0.11)		
Before treatment				−0.21 (1.07)	
After treatment				0.20 (0.78)	
Category, store, week FEs	x	x	x	x	x
Sample size	19,764	19,764	18,827	21,060	2,379