Lecture 11: Modelo Hedónico

Urban Economics

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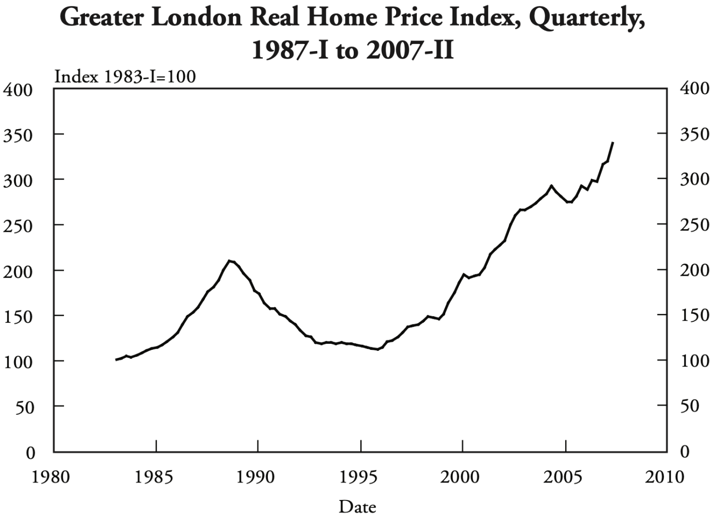
Modelos

- Where do you want to live?
  - Spatial equilibrium
  - Within cities: Alonso-Muth-Mills (Monocentric/Polycentric Model)
  - Hedonic pricing of amenities and local public goods (Rosen)
  - Across cities: Rosen-Roback

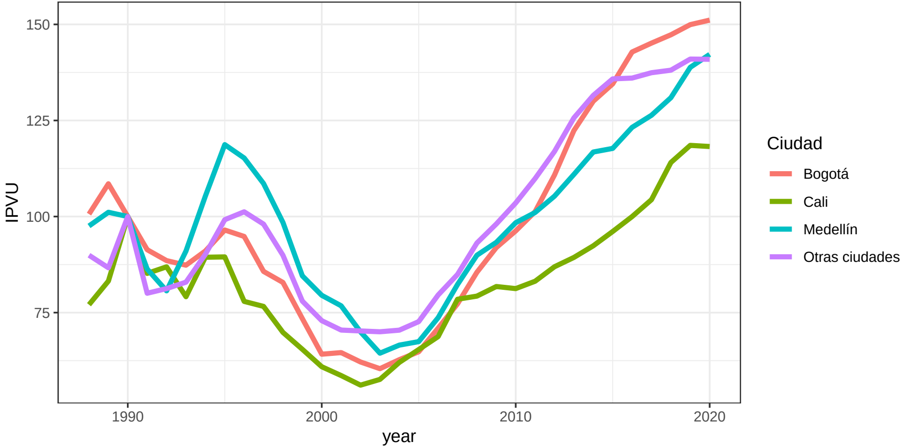
Mercados de Viviendas

- Residential real estate is a huge market
  - The course will not cover commercial real estate
- Housing is by far most household's main asset
- Macroeconomic relevance

Mercados de Viviendas: Motivation

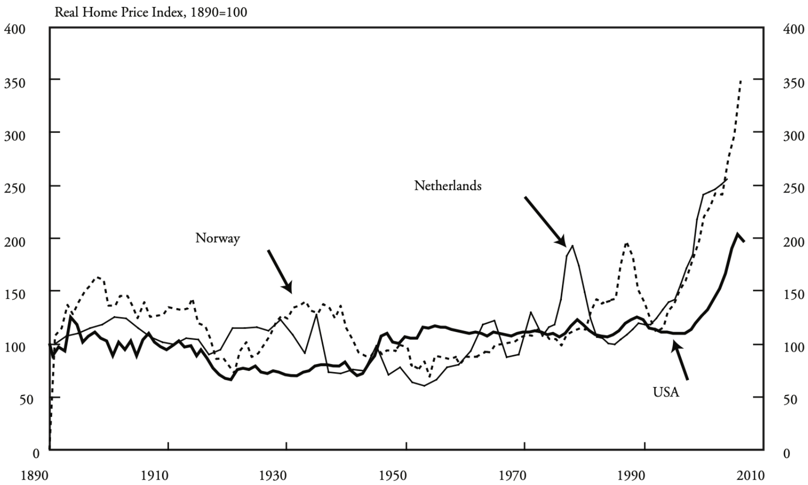


Mercados de Viviendas: Motivation



Mercados de Viviendas: Motivation

Home price indices deflated for consumer prices and rescaled to 1890=100, Netherlands, Norway, and USA.



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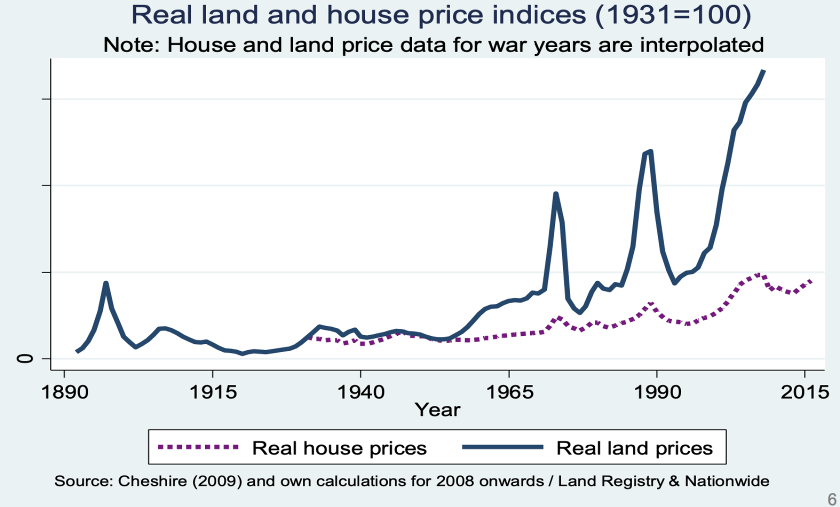

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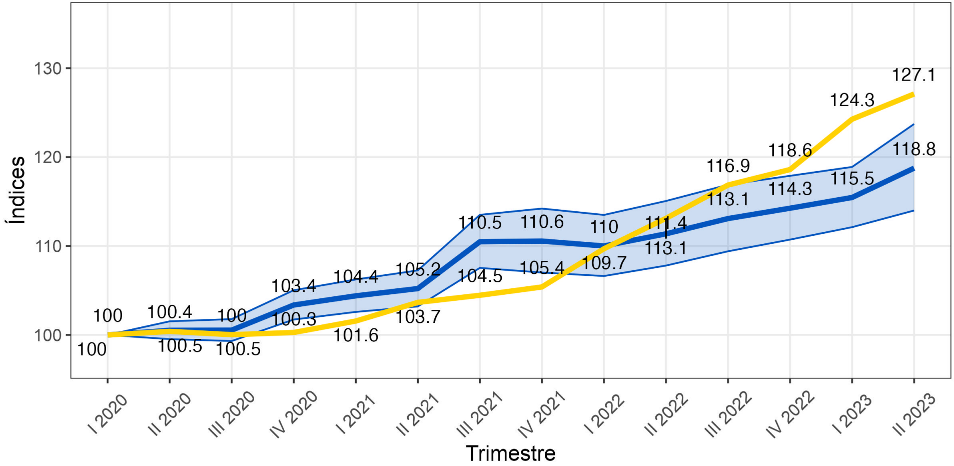


Mercados de Viviendas: Motivation

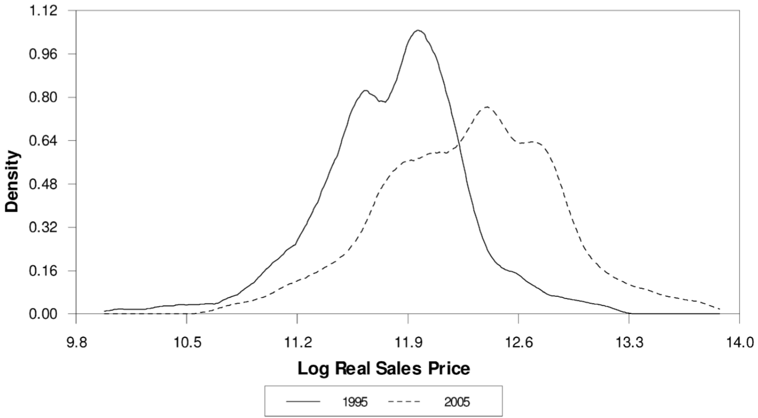
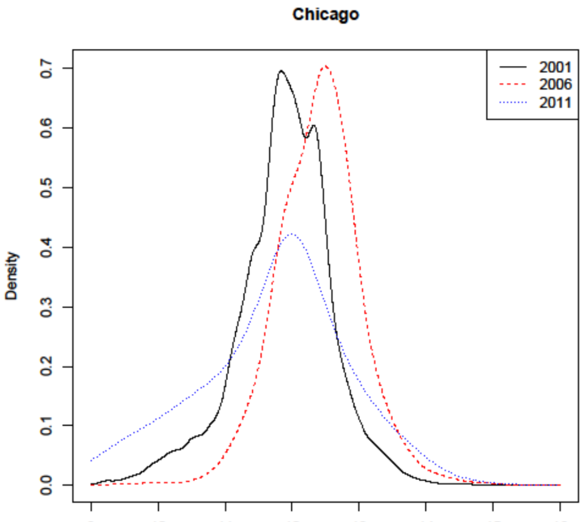


Fig. 1. Kernel density estimates for log of real sales price.

Mercados de Viviendas: Motivation

Figure 4: Estimated Sale Price Densities for Chicago



Rosen's Hedonic Model

- Goods are valued for their utility-bearing attributes
- Heterogeneous or differentiated goods are products whose characteristics vary in such a way that there are distinct product varieties even though the product is sold in one market (e.g. houses, cars, computers, etc).
- The variation in product variety gives rise to variations in product prices within each market.
- The hedonic method relies on market transactions for these differentiated goods to determine the implied value or implicit price of characteristics.

The Consumer's Problem

- House: $z = (z_1, \dots, z_)$
- Price: $p(z) = p(z_1, \dots, z_)$
- Consumer utility is $U(x, z)$ where x is non-housing consumption
- The consumer buys one house and has budget $y = x + p(z)$
  - y denotes exogenous income
  - x denotes consumption of non-housing goods

The Consumer's Problem

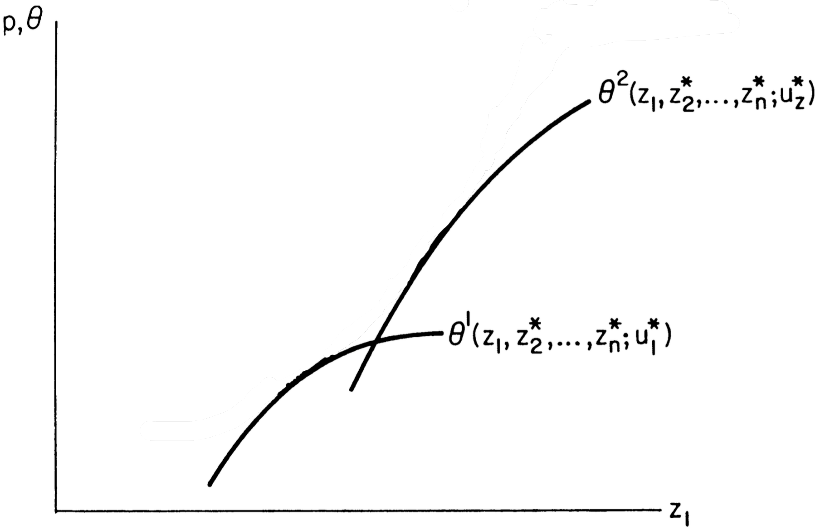
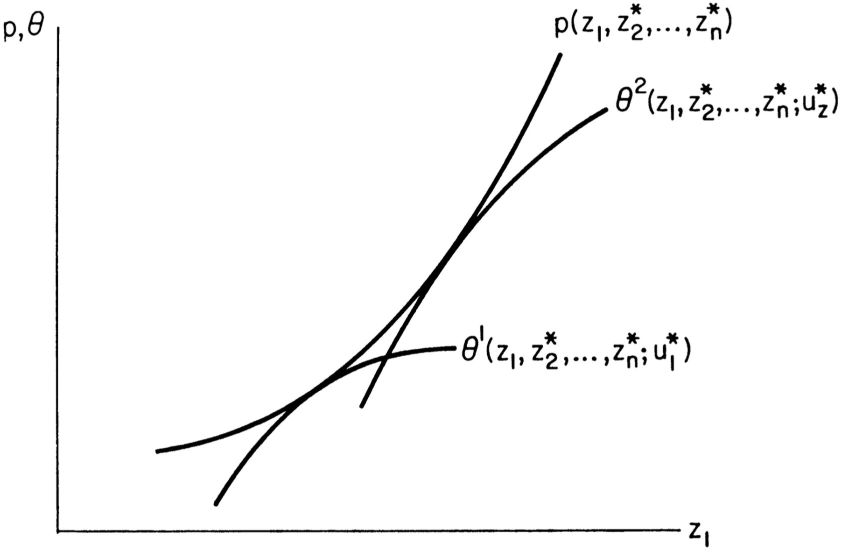


FIG. 1

The Consumer's Problem



The Producer's Problem

- Each firm produces a specific bundle of attributes $z = (z_1, \ldots, z_)$
- Production costs are $C(M, z, \beta)$ where
  - $M(z)$ denotes number of units produced of designs offering specification z
  - Producers have different technologies parametrized by β
- The firm is a price taker $p(z)$ and maximizes profits

$$\pi = Mp(z) - C(M, z) \tag{1}$$

The Producer's Problem

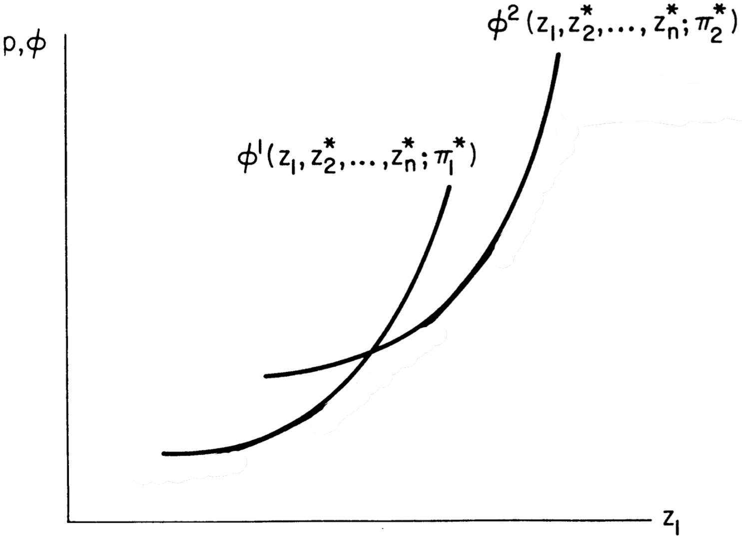
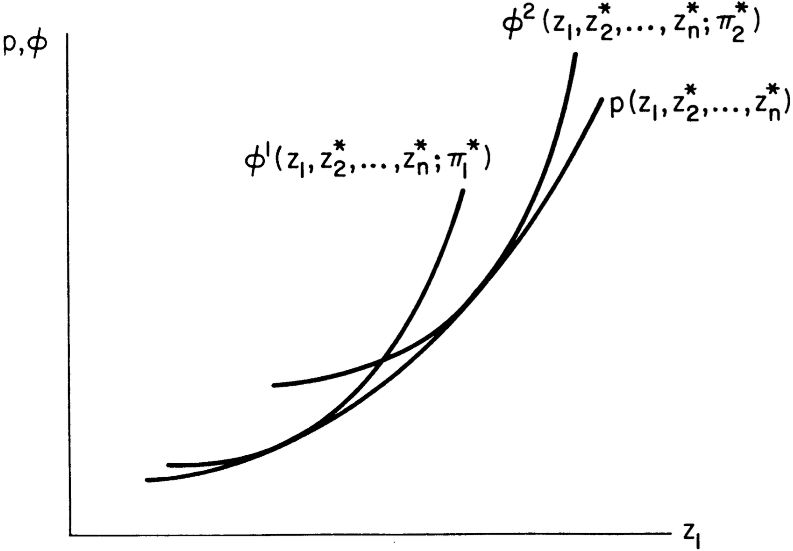


FIG. 2

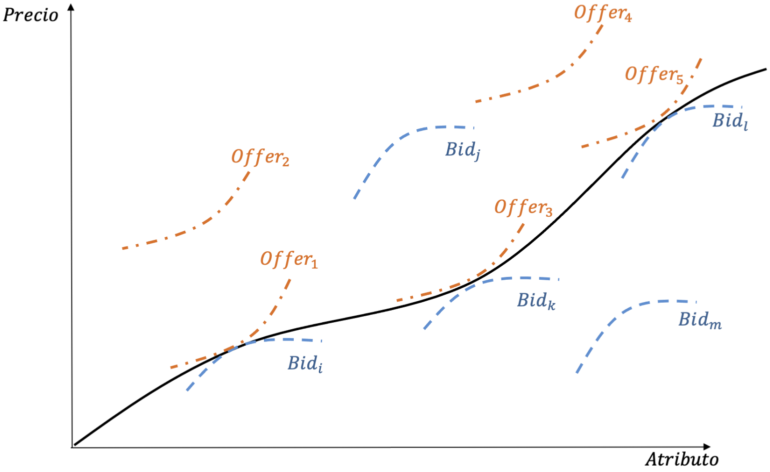
The Producer's Problem



Market Equilibrium

- The market hedonic function $p(z)$ is a joint envelope
  - Upper envelope of consumer's bid functions
  - Lower envelope of producer's offer functions
- Quantities demanded and supplied at each z depend on all of $p(z)$

Market Equilibrium



Empirics

- Rosen (1974) proposed a two-step empirical strategy
  1. Estimate hedonic prices $p(z)$ with the best fitting functional form
  2. Take partial derivatives of the estimate $\hat{p}(z)$ at the sample values and estimate the simultaneous demand and supply equations

$$\frac{\partial p}{\partial z_i} = F_i(z, x^d, y - p(z)) \tag{2}$$

$$\frac{\partial p}{\partial z_i} = G_i(z, x^s, p(z)) \tag{3}$$

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- Problems?

Empirics

Identification Problem

1. If $p(z)$ is non-linear, $\frac{\partial p}{\partial z_i}$ depend on z
   - Consumer preferences determine both quantities z and hedonic prices
   - The demand equation can never be estimated consistently by OLS
   - The problem arises whether supply is endogenous or exogenous
   - If supply is endogenous it suffers from the same problem
2. Observable prices $p(z)$ depend on consumer characteristics x^d
   - The hedonic regression can be estimated consistently by OLS only if its error term is uncorrelated with the error term of the demand equation
3. Consumer tastes also determine the supplier each consumer buys from
   - E.g., the homeowner's taste is correlated with the architect's ability
   - Supplier characteristics cannot be used as instruments
   - The typical exclusion restrictions for estimating demand systems fail

Empirics

Solutions

- Bartik (1987): exogenous shifts in the consumer's budget constraint
  - Exogenous income changes if you can find them (field experiments)
- Urban economists have mostly shied away from structural estimation
  - Stop at the first-step hedonic regression
  - Focus on omitted-variable bias

Empirics

Example: Linden and Rockoff (2008)

Abstract

We estimate the willingness to pay for reductions in crime risk using the location and move-in dates of sex offenders. We find significant effects of sex offenders' locations that are geographically localized. House prices within 0.1 miles of a sex offender fall by 4 percent on average. We then use this finding to estimate the costs to victims of sexual offenses, and find costs of over $1 million per victim--far greater than previous estimates. However, we cannot reject the alternative hypotheses that individuals overestimate risks posed by offenders or that living near an offender poses significant costs exclusive of crime risk.

Source: Estimates of the impact of crime risk on property values from Megan's laws Linden and Rockoff (2008)

Empirics

Example: Linden and Rockoff (2008)

1112 THE AMERICAN ECONOMIC REVIEW JUNE 2008

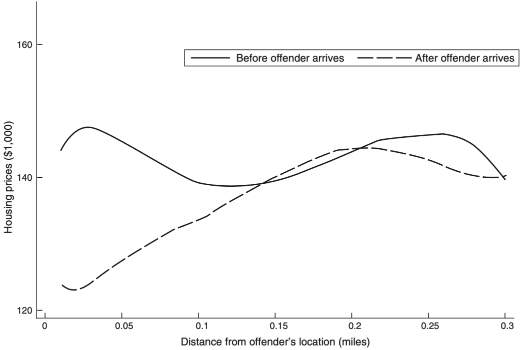


FIGURE 2B. PRICE GRADIENT OF DISTANCE FROM OFFENDER
(Sales during year before and after arrival)

Note: Results from local polynomial regressions (bandwidth = 0.075 miles) of sale price on distance from offender's future/current location.

Source: Estimates of the impact of crime risk on property values from Megan's laws Linden and Rockoff (2008)

Empirics

Example: Linden and Rockof (2008)

TABLE 3—IMPACT OF SEX OFFENDERS' LOCATIONS ON PROPERTY VALUE AND SALE PROBABILITY

	Log (sale price) pre-arrival		Log (sale price), pre- and post-arrival				Probability of sale†
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Within 0.1 miles of offender	−0.340 (0.052)*	−0.007 (0.013)	−0.007 (0.012)	<0.001 (0.013)	−0.006 (0.012)	−0.006 (0.012)	−0.029 (0.035)
Within 0.1 miles × post-arrival			−0.033 (0.019)+	−0.041 (0.020)*	−0.036 (0.021)+	−0.116 (0.059)+	0.126 (0.059)*
Dist*≤ 0.1 miles × post-arrival (0.1 Miles = 1)						0.107 (0.064)+	
Within 1/3 miles of offender				−0.010 (0.007)			
Within 1/3 miles × post-arrival				0.010 (0.010)	0.003 (0.016)	0.004 (0.016)	−0.055 (0.040)
H_0: within 0.1 miles × post-arrival = 0			*p-value* = 0.079	*p-value* = 0.0443	*p-value* = 0.0828	*p-value* = 0.0502	*p-value* = 0.0361
Housing characteristics		✓	✓	✓	✓	✓	✓
Year fixed effects	✓						
Neighborhood-year fixed effects		✓	✓	✓			
Offender area-year fixed effects					✓	✓	✓
Restricted to offender areas					✓	✓	✓
2 years pre- and post-arrival							
Standard errors clustered by…	*Neighbor-hood*	*Neighbor-hood*	*Neighbor-hood*	*Neighbor-hood*	*Offender area*	*Offender area*	*Offender area*
Sample size	164,993	164,968	169,557	169,557	9,086	9,086	1,519,364
R^2	0.01	0.84	0.83	0.83	0.75	0.75	0.01

Note: Pre-arrival (post-arrival) refers to the two-year period before (after) the date upon which offenders registered their current address. Standard errors in parentheses.

* Significant at 5 percent level.

+Significant at 10 percent level.

† Probability sale is measured as percentage points, e.g., probability of sale + 1 would be 100 percentage points.

Source: Estimates of the impact of crime risk on property values from Megan's laws Linden and Rockof (2008)

Empirics

Example: Currie et al (2015) AER

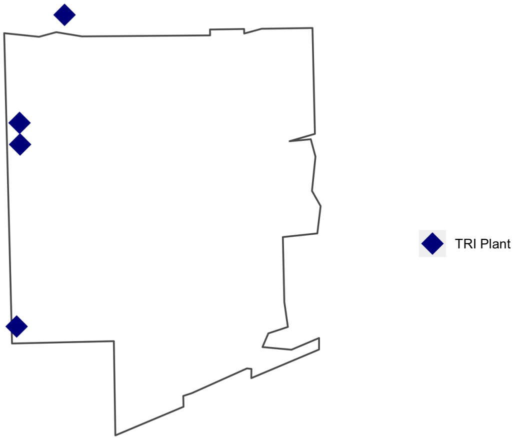
American Economic Review 2015, 105(2): 678–709
http://dx.doi.org/10.1257/aer.20121656

Environmental Health Risks and Housing Values: Evidence from 1,600 Toxic Plant Openings and Closings†

By JANET CURRIE, LUCAS DAVIS, MICHAEL GREENSTONE, AND REED WALKER*

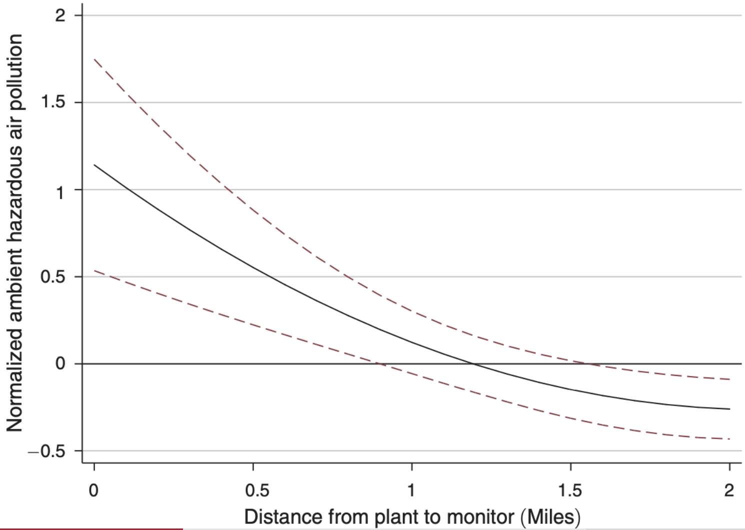
Empirics

Zip Code with TRI Toxic Plants within one mile



Empirics

Example: Currie et al (2015) AER



Empirics

Example: Currie et al (2015) AER

Table 2—The Effect of Toxic Plants on Local Housing Values

	0–0.5 Miles		0.5–1 Miles		0–1 Miles		0–1 Miles (+/– 2 years)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel C. First difference: Estimated effect of plant openings and closings								
1(Plant Opening) × Near	−0.096***	−0.107***	−0.007	−0.008	−0.020	−0.022	−0.030	−0.038
	(0.036)	(0.034)	(0.023)	(0.020)	(0.022)	(0.019)	(0.028)	(0.025)
1(Plant Closing) × Near	0.017	0.010	0.008	0.003	0.010*	0.005	0.005	0.001
	(0.011)	(0.009)	(0.005)	(0.004)	(0.006)	(0.005)	(0.007)	(0.005)
H_0: Opening = −Closing (p-value)	0.051	0.013	0.968	0.827	0.688	0.438	0.402	0.164
Observations	1,114,248	1,114,248	1,305,780	1,305,780	1,375,751	1,375,751	1,196,000	1,196,000
State × year fixed FE	X		X		X		X	
County × year FE		X		X		X		X

Empirics

Example: Currie et al (2015) AER

TABLE 4—THE EFFECT OF TOXIC PLANTS ON LOW BIRTHWEIGHT

	0–0.5 Miles		0.5–1 Miles		0–1 Miles		0–1 Miles (+/– 2 years)	
Panel B. Estimated effect of plant openings and closings								
1(Plant Opened)	0.0025	0.0022	0.0024***	0.0027***	0.0024**	0.0024***	0.0031*	0.0037**
× Near	(0.0019)	(0.0018)	(0.0009)	(0.0010)	(0.0009)	(0.0008)	(0.0017)	(0.0017)
1(Plant Closed)	–0.0002	–0.0007	–0.0009	–0.0009	–0.0007	–0.0009	–0.0016	–0.0021*
× Near	(0.0016)	(0.0016)	(0.0009)	(0.0010)	(0.0009)	(0.0009)	(0.0012)	(0.0013)
H_0: Opening = –Closing (p-value)	0.44	0.56	0.32	0.28	0.22	0.24	0.51	0.48
Observations	88,958	88,958	88,958	88,958	88,958	88,958	63,324	63,324
Plant count	3,438	3,438	3,438	3,438	3,438	3,438	3,438	3,438
Plant × Distance-bin FE	X	X	X	X	X	X	X	X
State × Year FE	X		X		X		X	
Plant × Year FE		X		X		X		X