# Lecture 9: Modelo Hedónico

## Urban Economics

Ignacio Sarmiento-Barbieri

Universidad de los Andes

September 9, 2024

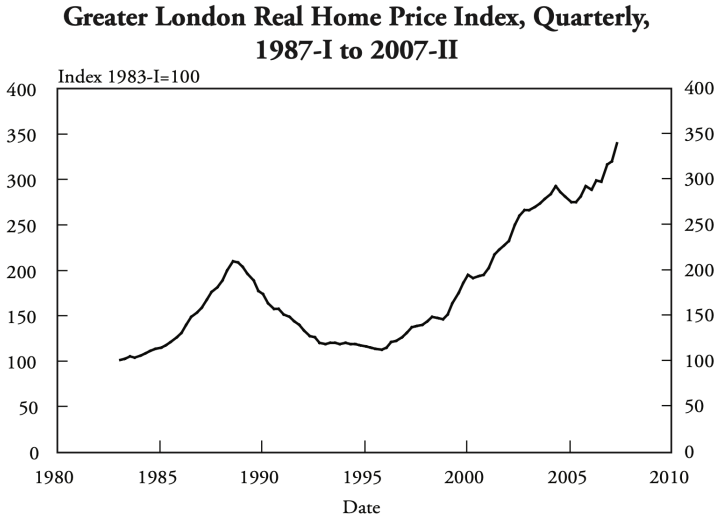
# Modelos

- 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 locations: Rosen-Roback

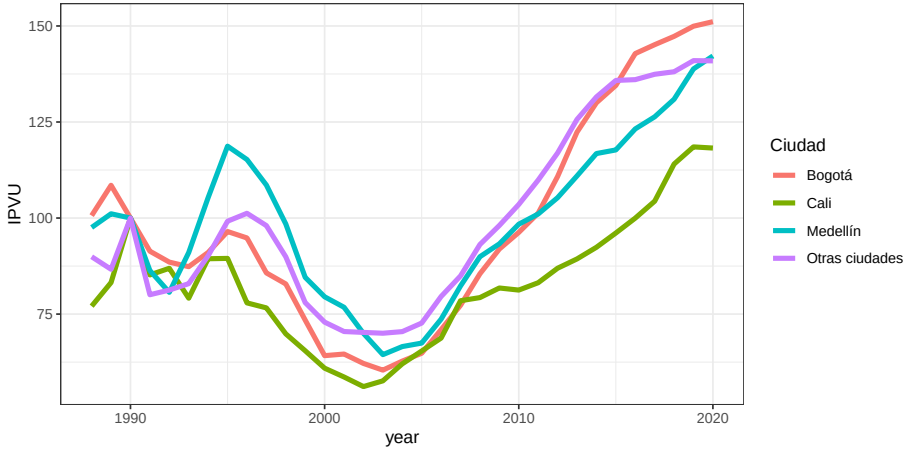
# Mercados de Viviendas

- Residential real estate is a huge market
  - The course will not cover commercial real estate
- Housing is by far the main asset for most households
- Macroeconomic relevance

# Mercados de Viviendas: Motivation

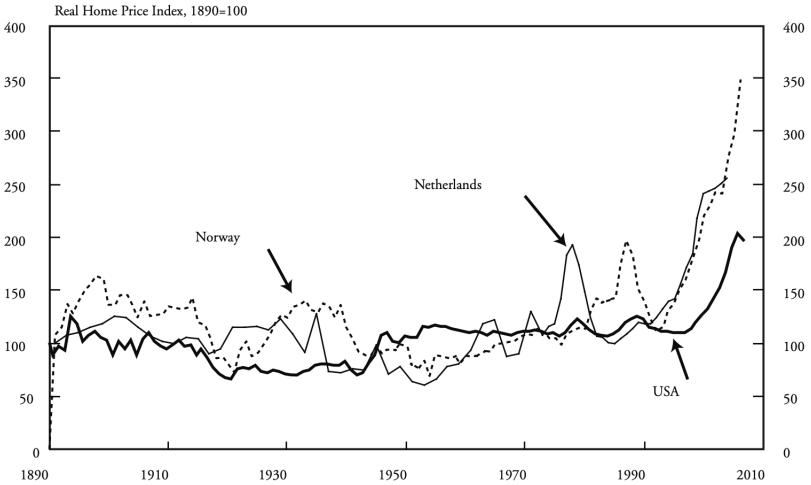


# Mercados de Viviendas: Motivation

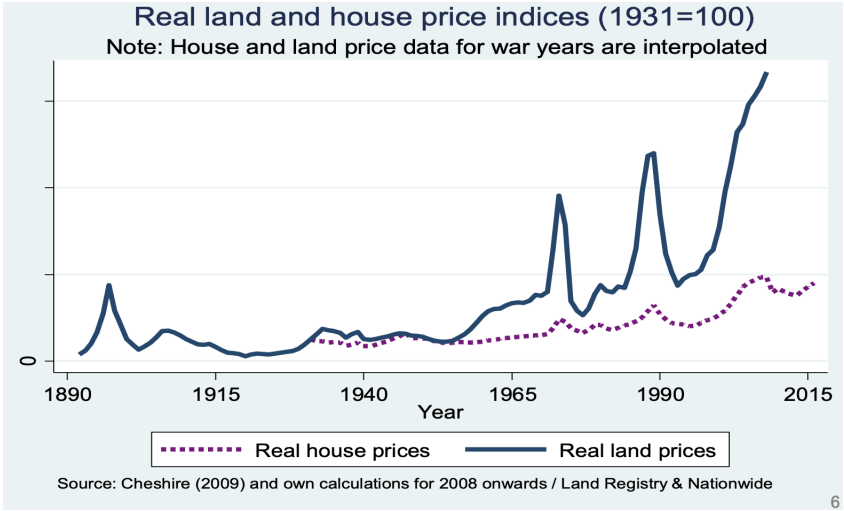


# Mercados de Viviendas: Motivation

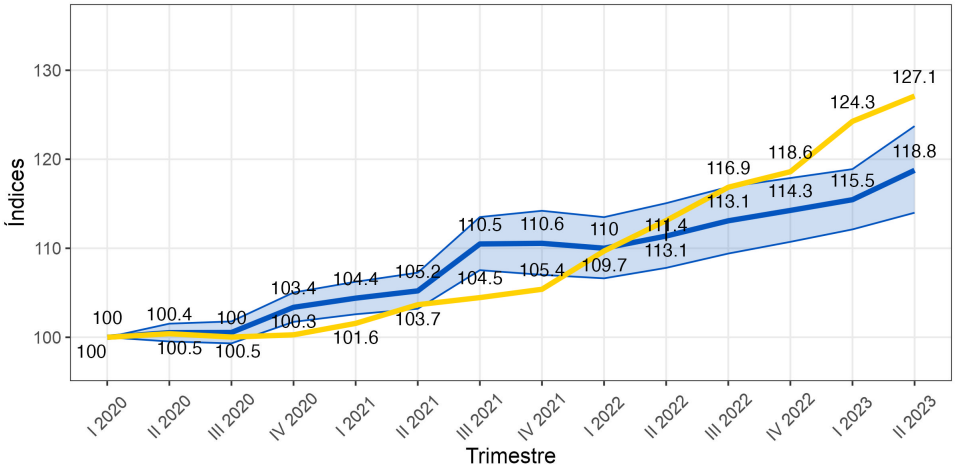
**Home price indices deflated for consumer prices and rescaled to 1890=100, Netherlands, Norway, and USA.**



# Mercados de Viviendas: Motivation



# Mercados de Viviendas: Motivation



# Mercados de Viviendas: Motivation

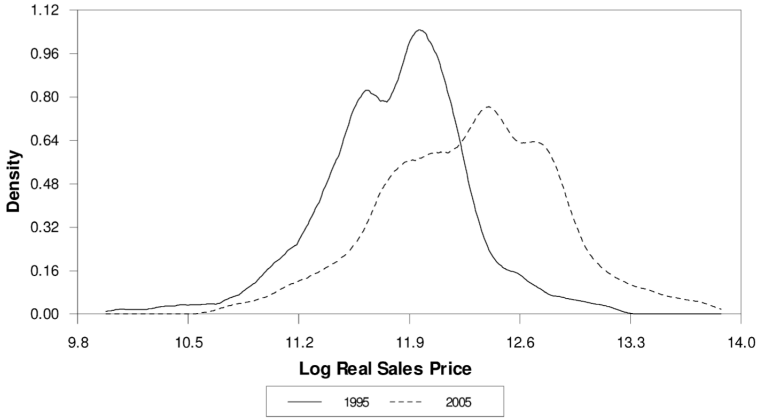
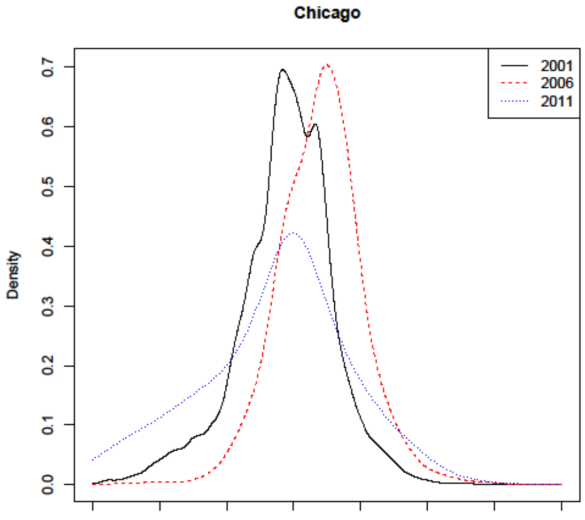



**Fig. 1.** Kernel density estimates for log of real sales price.

# 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: $z = (z_1, \ldots, z_n)$
- Price: $p(z) = p(z_1, \ldots, z_n)$
- 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

# The Consumer's Problem

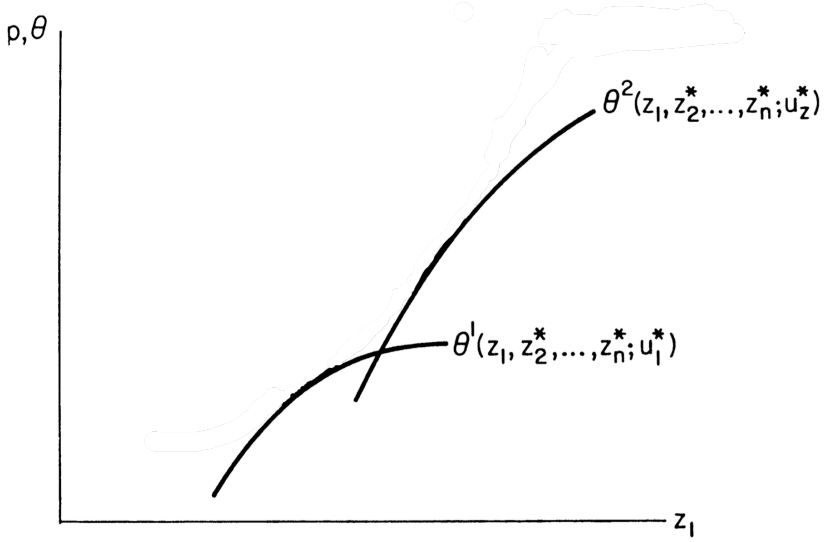
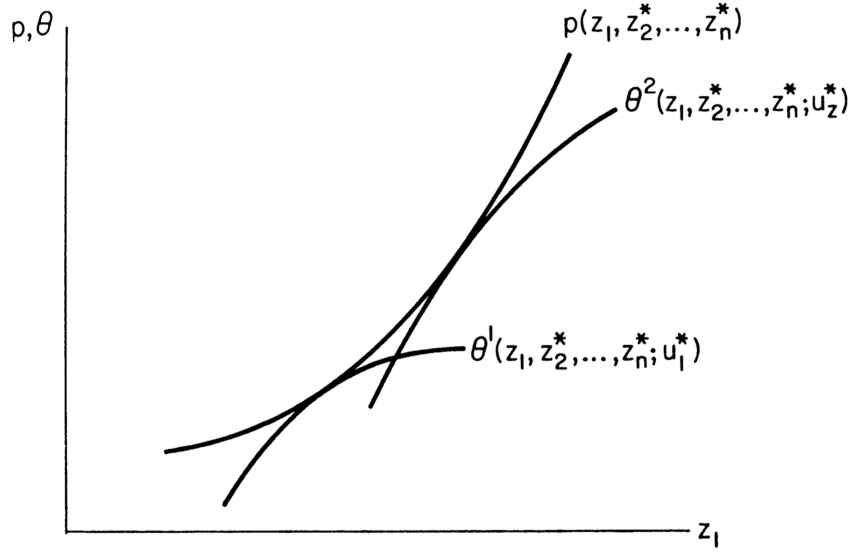



FIG. 1

# The Consumer's Problem



# The Producer's Problem

- Each firm produces a specific bundle of attributes $z = (z_1, \ldots, z_n)$
- 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 $\beta$
- The firm is a price taker $p(z)$ and maximizes profits

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

# The Producer's Problem

# The Producer's Problem

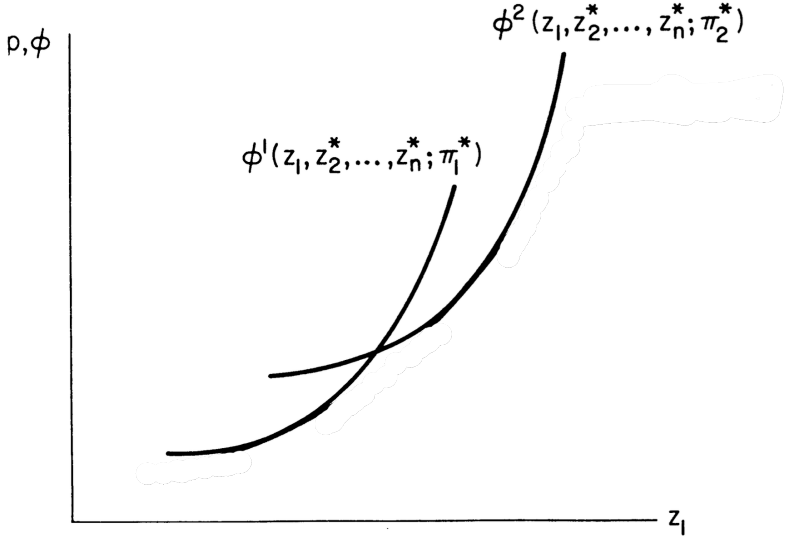
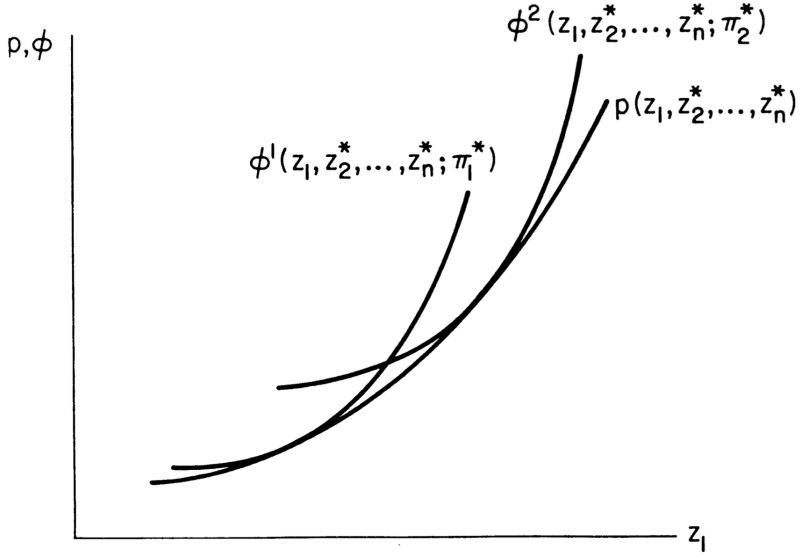



FIG. 2

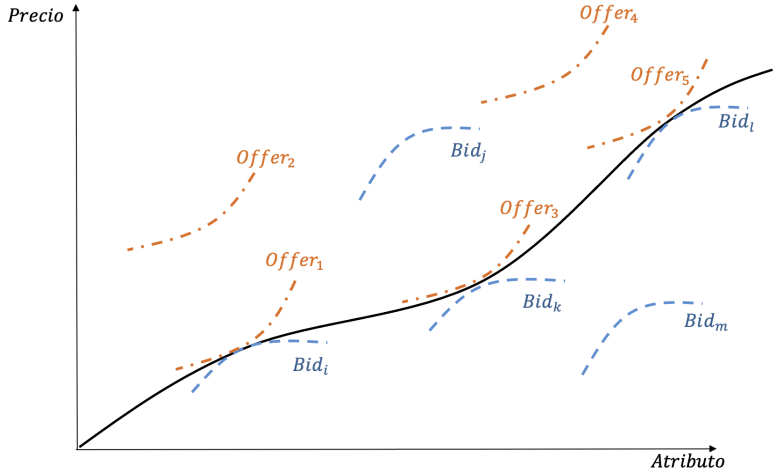
# The Producer's Problem



# 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

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

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

# 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

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

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

- Problems?

# 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: Currie et al (2015) AER

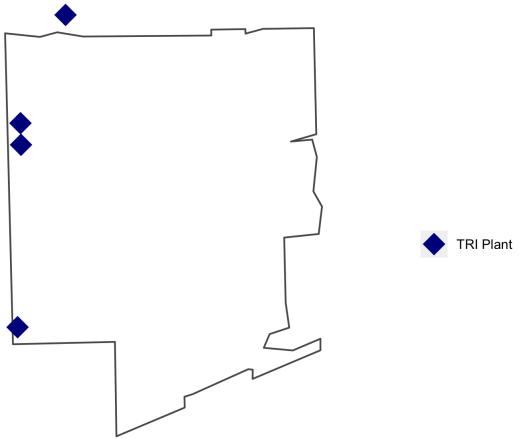
*American Economic Review 2015, 105(2): 678–709*
*http://dx.doi.org/10.1257/aer.20121656*

### 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*

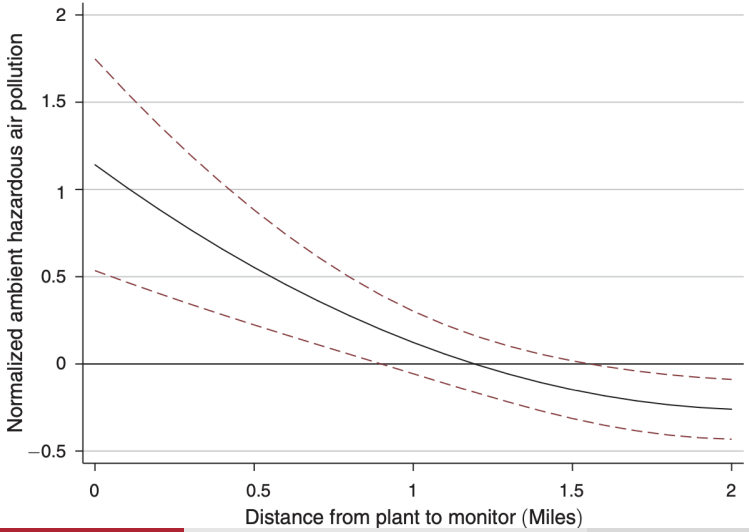
# Empirics

## 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) | −0.096*** | −0.107*** | −0.007 | −0.008 | −0.020 | −0.022 | −0.030 | −0.038 |
| × Near | (0.036) | (0.034) | (0.023) | (0.020) | (0.022) | (0.019) | (0.028) | (0.025) |
| 1(Plant Closing) | 0.017 | 0.010 | 0.008 | 0.003 | 0.010* | 0.005 | 0.005 | 0.001 |
| × Near | (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 |