Valuing Environmental Benefits Using Housing Markets

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How to value non-market goods?

- Optimal Piguovian tax set equal to marginal benefits
- How can we estimate this?
- Challenge: Price not observed.

Similarly, valuation necessary for the optimal provision of public/ non-market goods (parks, schools, etc)

Methods for valuing environmental amenities

Travel Cost Method - Hotelling-Clawson-Knetsch

Stated Preference (Contingent Valuation)
– Mainstream debate following Exxon Valdez disaster
– JEP had articles from both sides then, and recently did a retrospective.

Averting expenditure methods People take defensive action to avoid exposure or the effects pollution

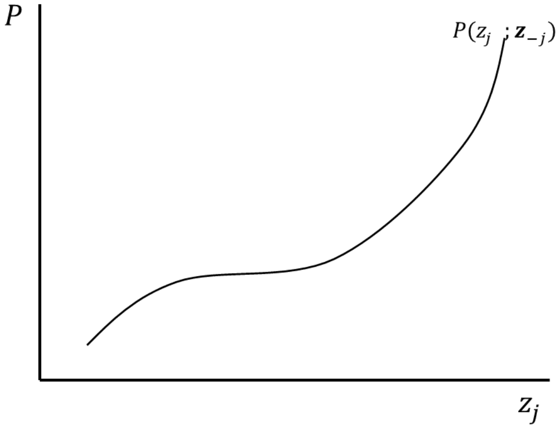
- stay home from the zoo [Graff Zivin and Neidell, 2009]
- buy asthma medication [Deschênes et al., 2017] or bottled water [Zivin et al., 2011]
- air purifiers [Ito and Zhang, 2016]

Hedonic Methods

- Goods are a bundle of attributes (cars, jobs, **houses**)
- If we could find two bundles that are identical on every dimension except one, difference in price tells us WTP for that amenity.
  - Rosen [1974] formalized this link
  - Bajari & Benkard (2004) extend

Has been used to value many goods of policy interest:
- School quality [Black, 1999]
- Crime [Linden and Rockoff, 2008]
- Health: [Davis, 2004]

Hedonic price schedule (Rosen 1974)



– Houses have J attributes $\mathbf{z} = \langle z_1, z_2, \ldots, z_J \rangle$

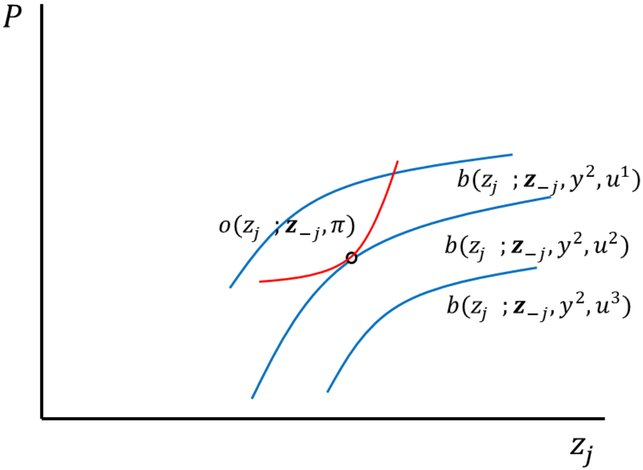
– Equilibrium prices are a function of these attributes $P(\mathbf{z})$

Going from observed prices to WTP

- Consumers get utility from their home's attributes (z) and consuming other goods: $U(\mathbf{z}, x)$
- Consider a "bid" function $b(\mathbf{z}; u, y)$ which reflects how much an individual would be willing to pay for particular set of Z
- Holding income and utility fixed, $b()$ traces out a series of consumer indifference curves for any z_j

$$
\begin{aligned}
u &= U(z, y - b) \\
U_j(z, y - b) - U_x(z, y - b)b_j &= 0 \\
b_j(z_j, \mathbf{z_{-j}}, y, u) &= U_j(z, y - b)/U_x(z, y - b)
\end{aligned}
$$

Rosen's insight was to relate bid curves to $P(z)$

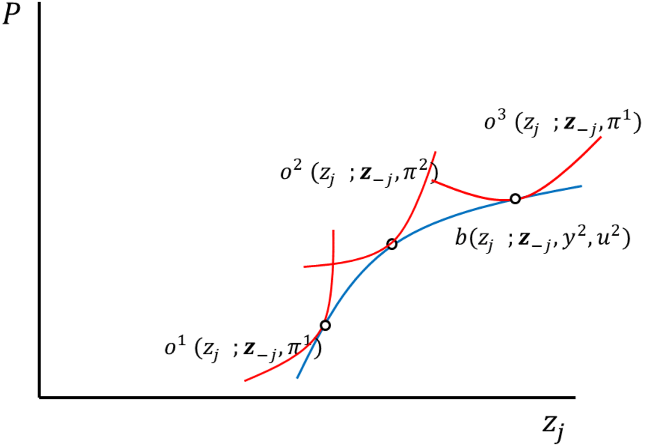


– Buyer: bid functions define a series of indifference curves

– Supplier: "offer" curves reflect price consumer must pay

– We observe prices where bids just equal prevailing offers

With many transactions from the same consumer, we could trace out the WTP curve



Note link between bids and compensating variation under this utility function

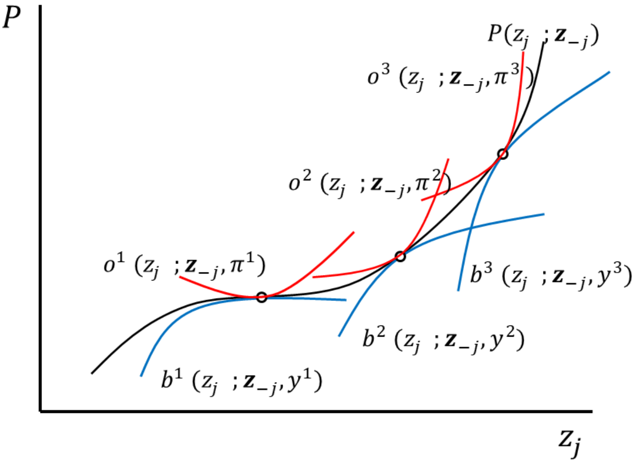
$$CV = b(x, z_0, y, u^0) - b(x, z_1, y, u^0)$$

$$CV = P(x, z_0) - b(x, z_1, y, u^0)$$

So if we know the compensated inverse demand curve, can get welfare by integrating.

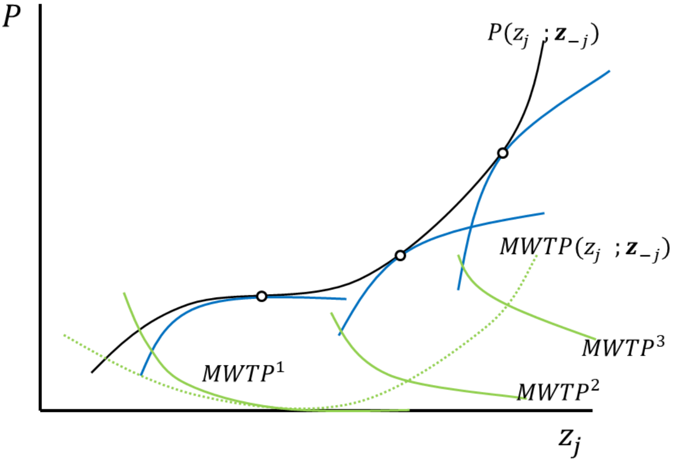
Unfortunately, price schedule we observe is an envelope of **many consumers'** bid functions

Variation in tastes and incomes lead to different house choices



Will not recover MWTP

MWTP varies over z_j *within* and *across* buyers



Rosen (1974): 2-step procedure to recover MWTP

Step 1: Estimate the equilibrium price schedule

Project prices onto all attributes as flexibly as possible

$$p = f(z; \alpha) + \epsilon$$

Marginal implicit price is the derivative of this function wrt the attribute

Step 2: Evaluate derivative at many points to recover bid

$$\partial p(\mathbf{z}) / \partial z_j = g(z_j; \beta) + \nu$$

In equilibrium, observed sale prices are tangent to unobserved bid curves

Both steps entail challenges...

Omitted variable bias

$$p_{it} = \alpha_0 + \alpha_1 z_{1it} \ldots + \alpha_J z_{Jit} + \epsilon_{it}$$

- Even with lots of controls, we still might worry $corr(z_{it}, \epsilon_{it}) \neq 0$
- Most papers use fine fixed effects
  - ie *within* house repeat sales
  - Does this solve our problem?

More recently, emphasis has been on IV or RDD

Example: WTP to avoid hazardous waste

Early 20th century, industrial firms often disposed of hazardous waste by burying it in the ground

By 1970's health problems at these sites led to national outrage

Superfund Program

- The 1980 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) gave the EPA the right to place sites that pose an imminent danger on the National Priorities List (NPL)
- In 1983, funding initially allocated for 400 sites
  - 1500 candidate sites identified, 690 finalists
- Each finalist was given a Hazardous Ranking System score
  - Cutoff: HRS> 28.5 were cleaned up; others weren't

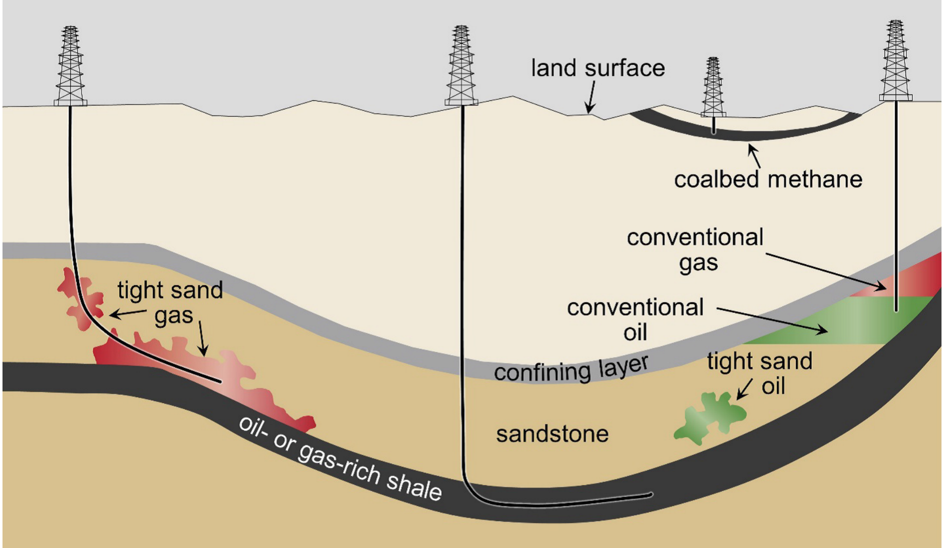
Greenstone and Gallagher [2008] used this cutoff to estimate WTP for hazardous waste cleanup

Samples Based on the 1982 HRS Sample Sites

					RD-style estimators		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Own Census tract							
1(NPL status by 2000)	0.035	0.037	0.043	0.047	0.007	0.022	0.027
	(0.031)	(0.035)	(0.031)	(0.027)	(0.063)	(0.042)	(0.038)
B. Adjacent Census tracts							
1(NPL status by 2000)	0.071	0.066	0.012	0.015	−0.006	−0.002	0.001
	(0.031)	(0.035)	(0.029)	(0.022)	(0.056)	(0.035)	(0.035)
C. Two-mile radius from hazardous waste sites							
1(NPL status by 2000)	0.021	0.019	0.011	0.001	0.023	−0.018	−0.007
	(0.028)	(0.032)	(0.029)	(0.023)	(0.054)	(0.035)	(0.034)
Ho: > 0.138, *p*-value	.000	.000	.000	.000	.018	.000	.000
D. Three-mile radius from hazardous waste sites							
1(NPL status by 2000)	0.059	0.055	0.035	−0.004	−0.027	−0.024	−0.006
	(0.033)	(0.038)	(0.031)	(0.022)	(0.051)	(0.034)	(0.034)
Ho: > 0.058, *p*-value	.483	.467	.236	.003	.048	.007	.031
1980 ln house price	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Instrument for 1 (NPL 2000)	No	Yes	Yes	Yes	Yes	Yes	Yes
1980 housing charasteristics	No	No	Yes	Yes	Yes	Yes	Yes
1980 economic and demographic variables	No	No	No	Yes	Yes	Yes	Yes
State fixed effects	No	No	No	Yes	Yes	Yes	Yes
Quadratic in 1982 HRS score	No	No	No	No	Yes	No	No
Control for pathway scores	No	No	No	No	No	Yes	No
RD sample	No	No	No	No	No	No	Yes

Valuing shale boom: Muehlenbachs et al. [2015]

Hydraulic Fracturing + Horizontal Drilling = Shale Boom



Generated enormous wealth

- ~ 75% mineral rights in US owned by private individuals
- Landowners receive thousands of dollars in (unobserved) bonus payments and 12.5-21% royalty payments
- Even if you don't lease, local spillovers / economic activity could increase home values

Fracking also associated with many negative externalities

- Drilling is destructive
- It's causing earthquakes (USGS 2016)
- Most media coverage has focused on the water impacts of fracking
  - see, for example, The New York Times "Drilling Down"

MST look at the property value impacts of these positive and negative effects

Adjacency effects: Impacts of being near a well independent of water impacts

- *Costs*: noise, air pollution, visual disruptions, etc
- *Benefits*: lease and royalty payments

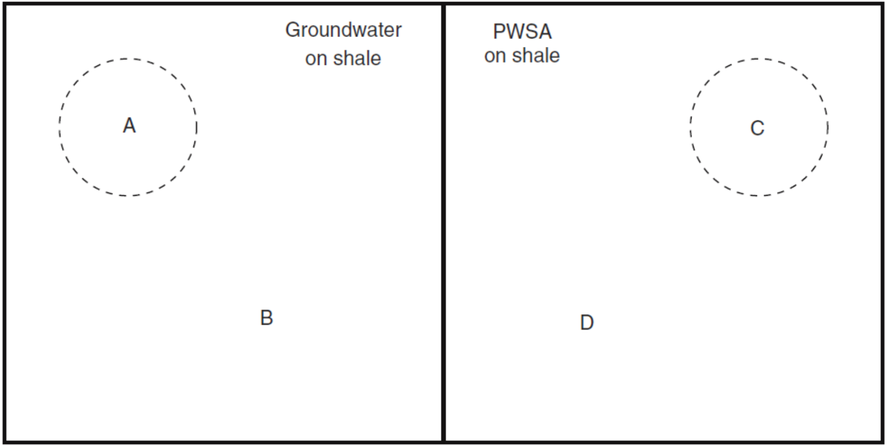
Groundwater contamination risk (GWCR): Some properties rely on groundwater, others use publicly treated water

Vicinity Effects Impacts of being in wider (e.g. 20 km) area with fracking

- *Costs*: traffic, accidents, etc
- *Benefits*: increased employment, spending, public finances, etc

What's their empirical strategy for separately estimating these?

MST Impact Groups



– circles represent adjacency effect buffers
– rectangles distinguish areas that rely on groundwater for drinking

Challenge: Wells are not located randomly

Comparing change in property value before and after fracking generates different price changes by property type:

$$\begin{aligned}
\Delta P_A &= \Delta Adjacency + \Delta GWCR + \Delta Vicinity_{GW} + \Delta Macro \\
\Delta P_B &= \Delta Vicinity_{GW} + \Delta Macro \\
\Delta P_C &= \Delta Adjacency + \Delta Vicinity_{PWSA} + \Delta Macro \\
\Delta P_D &= \Delta Vicinity_{PWSA} + \Delta Macro,
\end{aligned}$$

Adjacency DD: $\Delta P_C - \Delta P_D$

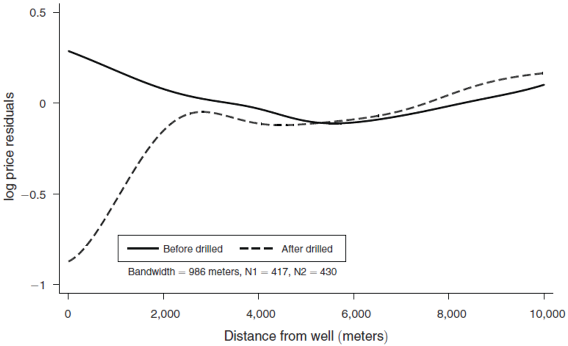
Groundwater DDD: $[\Delta P_A - \Delta P_B] - [\Delta P_C - \Delta P_D]$

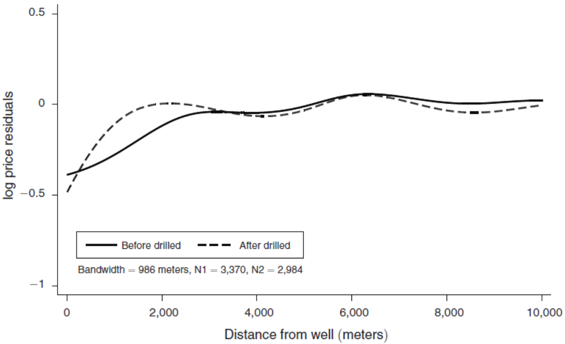
What do people think about this?

Data

- Transaction records of all PA properties sold 1995-2012 (Corelogic)
  - **What do people think about this?**
- Drilling locations and dates from PADEP
  - data contain 6,260 wellbores which MST group into 3,167 well pads
- Also observed quantity produced from each well
- Use GIS Viewshed tool to predict how many wells are within eyesight of each property

Model Free Evidence: Gradient in PWSA vs GW Areas





MST Results

TABLE 2—LOG SALE PRICE ON WELL PADS

	$K \leq 1$ km		$K \leq 1.5$ km		$K \leq 2$ km	
	Full (1)	Boundary (2)	Full (3)	Boundary (4)	Full (5)	Boundary (6)
Panel A. County-year fixed effects						
Pads in K km	0.028	0.026	0.029**	0.034*	0.016**	0.018*
	(0.025)	(0.035)	(0.014)	(0.02)	(6.9e-03)	(0.01)
(Pads in K km) × GW	−0.062	−0.165**	−0.042*	−0.099***	−0.023	−0.013
	(0.046)	(0.072)	(0.025)	(0.036)	(0.02)	(0.052)
Pads in 20 km	−7.8e-04***	−8.1e-04	−8.3e-04***	−9.3e-04*	−8.4e-04***	−9.4e-04*
	(3.0e-04)	(5.3e-04)	(3.0e-04)	(5.5e-04)	(3.0e-04)	(5.6e-04)
(Pads in 20 km) × GW	6.6e-04	2.0e-03***	7.0e-04	2.0e-03***	7.1e-04	1.7e-03**
	(4.7e-04)	(7.0e-04)	(4.9e-04)	(6.8e-04)	(5.2e-04)	(6.8e-04)
Property effects	Yes	Yes	Yes	Yes	Yes	Yes
County-year effects	Yes	Yes	Yes	Yes	Yes	Yes
Quarter effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	229,946	66,327	229,946	66,327	229,946	66,327
p-value ($\alpha_3 + \alpha_4 = 0$)	0.414	0.051	0.544	0.090	0.740	0.919
Avg. pads in K km	0.003	0.006	0.009	0.015	0.018	0.031
Avg. pads in 20 km	4.725	5.108	4.725	5.108	4.725	5.108

MST summary

- Risk of groundwater contamination negatively affects house values within 1-1.5 km of a fracked well in PA
  - Note this impact measures the *perceived* impact
- Find that households that rely on piped water actually benefited from being near wells
  - results appear to be driven by royalty payments
  - explained by wells that were drilled over a year prior to the sale (after drilling costs), and not visible
- Average annual loss for groundwater dependent homes within 1.5 km of a well is $30,167
  - This is larger than the average annual gain for piped water properties within 1.5 km of a well of $4,802

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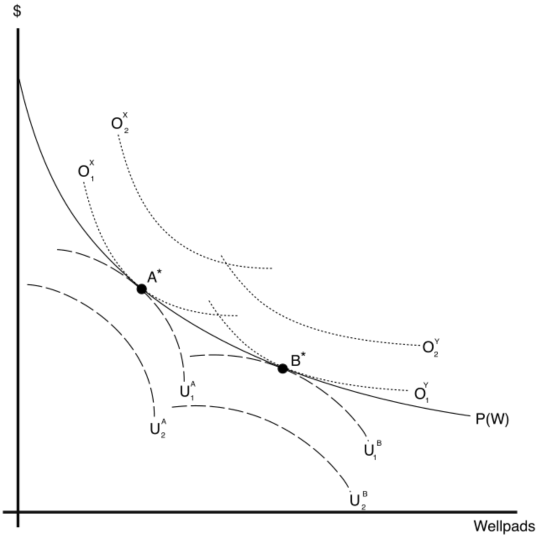
How do we go from these MST estimates to WTP?

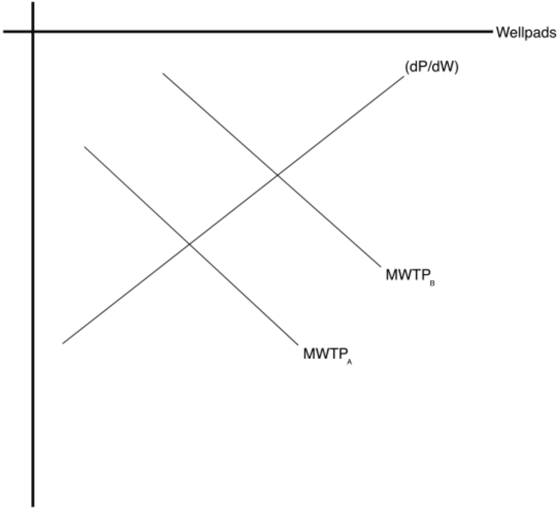
What MST estimated is the hedonic price gradient

It is comprised of tangents from heterogenous bid curves



This gives us ONE point on each MWTP curve

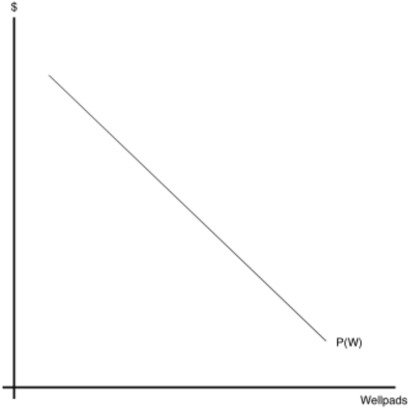
The line connecting those points has no interpretation (has wrong slope here....)



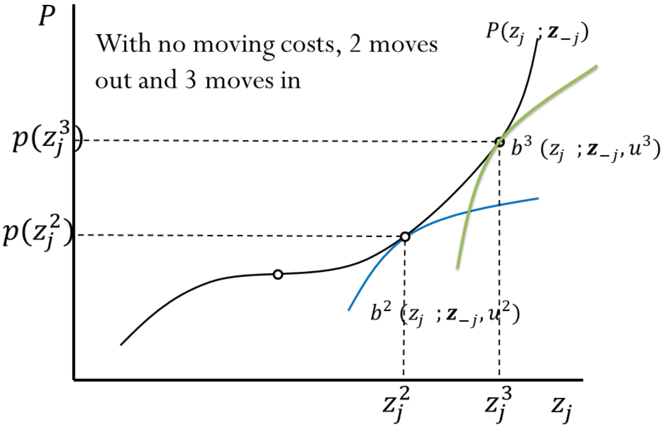
Common Assumption: Homogenous Preferences

- Then the hedonic price gradient *is* the bid function
  - [draw for upward sloping bid function]
- However, we still need the MWTP at a given point
  - So in practice, most reduced form hedonic papers claiming to recover MWTP also assume constant MWTP

Common Assumptions: MST

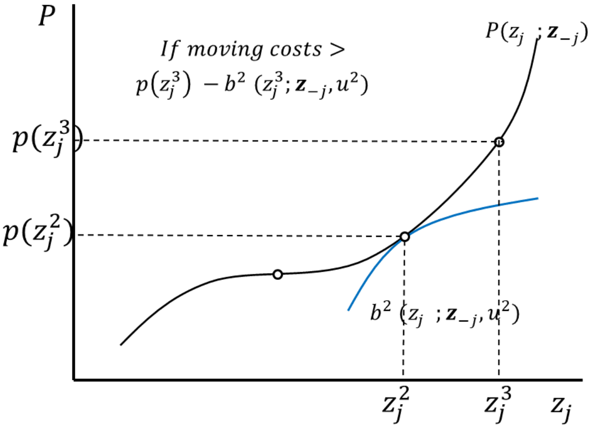


Nonmarginal changes: Partial equilibrium



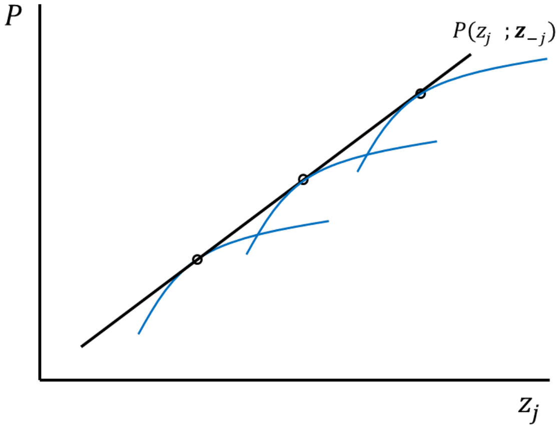
– Imagine a thick housing market
– Improve z_j at a single house
– Old tenant no longer wants to live there. Someone who values z_j more moves in
– The owner earns the "capitalization"

Nonmarginal changes: Partial equilibrium



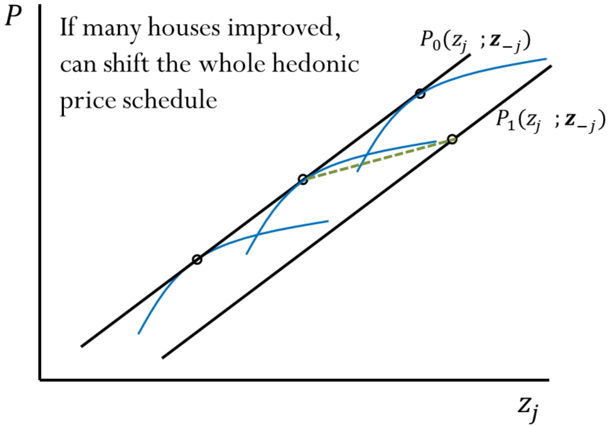
– If moving costs are large, old tenants stay
– But they're forced to spend too much on z_j
– This is why people dislike gentrification

Nonmarginal changes: General equilibrium



– In this example, MWT was constant at time 0
– What if we improve the quality of z for every house?

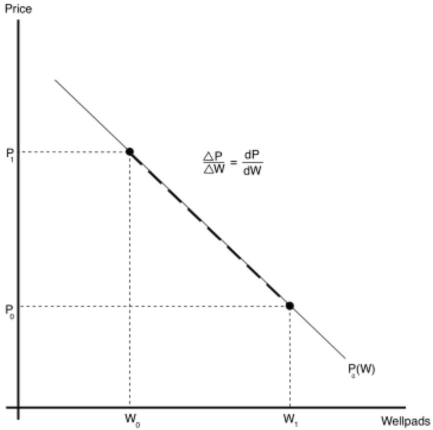
Nonmarginal changes: General equilibrium

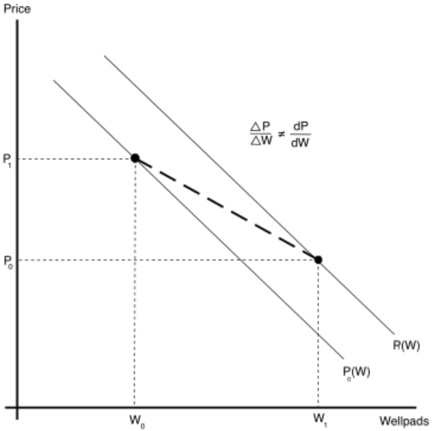


– This could actually shift the hedonic price gradient
– This creates a problem if we seek to identify MWTP using panel variation

This is an issue when using panel variation

- Even under assumptions above, will not recover MWTP
- Need time constant gradient assumption (TCGA)





When will capitalization be close to welfare?

- Recent wave of hedonic lit focussed on bias in the first stage
  - worried amenities correlated with unobservables
- This treats taste heterogeneity & sorting as an unobservable to be dealt with
  - see Parmeter and Pope [2013] for a survey
- This lit often focusses on temporal variation
  - market initially in equilib
  - some exogenous shock happens to an amenity of interest
  - prices adjust and the market clears
- Kuminoff and Pope [2014] seek to answer how this capitalization effect maps to WTP / Welfare

Theoretical Setup

- House price function $P(g, x; \omega)$
  - g is public good of interest
  - x all other attributes
  - $\omega(a, b, c)$ parameter vector describing distribution of consumers, producers and the public good

Rosen's first stage:

$$p_1 = g_1\theta_1 + x_1\eta_1 + \epsilon_1$$

Capitalization:

$$\Delta p = \Delta g\phi + \Delta x\gamma + \epsilon$$

KP show capitalization recovers welfare if

$$\phi = \frac{P[g_2, x_2; \omega(a_2, b_2, c_2)] - P[g_1, x_1; \omega(a_1, b_1, c_1)]}{g_2 - g_1}$$

1. $a_1 = a_2; b_1 = b_2$
   - preferences (for other amenities) and income constant
2. $\partial P()/\partial g = f(x, \omega)$
   - constant MWTP
3. $\partial \omega / \partial g = 0$
   - No supply or demand changes which change the house price gradient

Test validity of assumptions and implications for school quality

In US, school quality can change dramatically add school district borders. Previous lit has found this a credible strategy to estimate MWTP for schools.

Schools also change over time, with policy and rule changes providing plausibly exogenous within neighborhood variation. (example: NCLB)

KP ask how estimates from the latter compare to the former.

KP results

TABLE 4

IMPACT OF IDENTIFICATION STRATEGY ON ESTIMATES FOR THE AVERAGE RESIDENT'S WILLINGNESS TO PAY FOR A 1% INCREASE IN TEST SCORES

	(1)	(2)	(3)	(4)	(5)	(6)
Estimates for Willingness to Pay						
2003 school year	1,238	1,222	1,041	536	134	169
2007 school year	1,685	1,572	1,660	688	152	190
Identification Strategy						
Model	Hedonic	Hedonic	Hedonic	Hedonic	Capitalization	Capitalization
Sample	Full	Full	0.2 mile	0.2 mile	Full	0.2 mile
Data point	Block group	House	House	House	Block group	Boundary zone
Sample size	23,149	244,551	42,991	42,991	10,843	1,665
Controls for omitted variables	None	None	None	Boundary fixed effects	Differencing	Differencing + boundary fixed effects

NOTE: All measures of willingness to pay are reported in constant year 2000 dollars. Each measure is averaged over the samples from our five study regions, using the elasticities reported in Tables 3 and A1. For example, the estimates in column 4 are based on the elasticities reported in columns 6 through 10 of Table 3.

- controlling for unobservables (boundary FEs) cuts estimate in half
- capitalization estimates 25% of full estimates

Kuminoff and Jarrah (JUE 2010) explore the same question using calibration

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A new approach to computing hedonic equilibria and investigating the properties of locational sorting models

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ABSTRACT

This paper outlines a new way to solve the traditional housing market assignment problem and uses it to investigate the properties of hedonic equilibria. Our approach to computing equilibria is based on Rosen's (1974) bid function. It has four desirable features: (i) convergence implies a hedonic equilibrium; (ii) convergence is guaranteed if a hedonic equilibrium exists; (iii) it can solve for a new equilibrium following a shock to the market; and (iv) if multiple equilibria exist, it can identify them. The algorithm is applied to micro data from San Joaquin County, California, where the choice of a home provides access to public schools in particular school districts. First we calibrate the algorithm to approximately reproduce actual housing prices in San Joaquin County as a hedonic equilibrium. Then we introduce a policy that improves school quality in selected school districts. We find that there are several possibilities for the new equilibrium. For each of these potential equilibria, we compare the marginal willingness to pay for school quality

KJ introduce an “iterative bidding algorithm”

The IBA continues running second-price auctions until the occupant of every home is paying an ε above the second highest bid for that home. The complete algorithm consists of four steps:

Iterative Bidding Algorithm (6)

Order all the houses in the market from 1 to J. (6.a)

Define α_i, y_i, $\tilde{u}_i$ for each i. (6.b)

Conduct an auction for each house and update utility for the highest bidder. (6.c)

1. Solve for p_1 and k, and update $\tilde{u}_k = U(x_1, y_k - p_1; \alpha_k)$.
2. Solve for p_2 and k, and update $\tilde{u}_k = U(x_2, y_k - p_2; \alpha_k)$.

$\vdots$

J. Solve for p_J and k, and update $\tilde{u}_k = U(x_J, y_k - p_J; \alpha_k)$.

If (6.c) did not change the price of any home, stop. Otherwise repeat (6.c). (6.d)

Capitalization significantly overestimates true WTP for a non-marginal shock to school quality

Table 5
Comparison between capitalization rates and marginal willingness to pay for school quality (means and standard errors from 30 Monte Carlo replications).

N	Average MWTP for households in:			Capitalization rates for 15 point improvement to:			
	Stockton (score = 53.6)	Manteca (score = 80.1)	San Joaquin County	Stockton		Manteca	
				Min.[a]	Max.[a]	Min.[a]	Max.[a]
200	10.36	19.15	15.61	12.36	13.34	16.66	17.86
	(1.65)	(3.70)	(1.42)	(2.70)	(3.47)	(2.99)	(3.45)
500	10.19	19.79	15.52	12.35	12.53	16.06	17.16
	(1.38)	(2.20)	(0.72)	(1.88)	(2.03)	(2.00)	(2.53)
1000	9.44	21.01	15.76	11.25	11.54	17.13	18.43
	(0.68)	(1.74)	(0.55)	(1.58)	(1.65)	(1.43)	(1.52)
2000	9.35	21.01	15.65	11.40	11.56	16.87	18.30
	(0.47)	(1.06)	(0.40)	(0.75)	(0.79)	(1.11)	(1.15)

[a] The minimum and maximum capitalization rates are calculated over the set of potential equilibria on each Monte Carlo replication.

Sorting models

In hedonic analysis, complications arise due to heterogeneous preferences

If people have different tastes for an amenity, those with high WTP will end up in neighborhoods with more of it.

The fact that such sorting will occur continuously also frustrates our ability to lean from changes to the amenity (even when exogenous)

Sorting models treat these observations as a feature, not a bug, of housing markets

If the goal is to recover preferences, there is information in how people sort across different communities

Basic overview

Structural IO models typically have three components:

1. Demand System
2. Supply side
3. Equilibrium assumption

Sorting models typically take supply as fixed (although this is an active area of research)

Demand

Typically uses RUM framework (although pure characteristics papers also common).

Divide a market up in to J "neighborhoods" with a fixed supply of houses

- Need to define the choice set
- Many papers focus on a single MSA.
- The more you zoom in geographically, the less variation in amenities you have (and probably the worse it is)

Attributes taken as given, including an unobserved (to the econometrician) attribute ξ_j.

Often characteristics of *other* households in J enter into utility as well

- this generates spillovers

Equilibrium

Aggregate demand for a location by summing over household (typically logit for convenience).

Nash equilibrium

1. Demand equals supply
2. Vector of prices clears the market
3. No one wants to move conditional on what other households are doing

Theoretical Framework (Klaiber and Kuminoff)

Consider an MSA with j neighborhoods, each with (fixed) N_j houses.

Assume MSA is such that housing independent of job / commuting

Individuals i choose locations j to max utility

$$U_j^i = \alpha_h^i h_j + \alpha_g^i g_j + \alpha_p^i p_j + \xi_j + \epsilon_{ij}$$

– Communities have amenities g_j which could include public goods.

– Houses have attributes h_{h_j} and price P

– ξ_j is our familiar location specific unobservable (to the econometrician) quality dimension

Theoretical Framework (Klaiber and Kuminoff)

Tastes can vary based on observable individual characteristics (d)

$$\alpha_i = \alpha_0 + d_i' \alpha_1$$

This introduces horizontal differentiation.

Note we have constant marginal utility of income …

Assuming distribution of ϵ gives closed form expression

Assume that the choice set is fixed and exogenous

If ϵ is Type I extreme value probability that i chooses type t_j is

$$Pr_j^i = \frac{\exp(\alpha_h^i h_j + \alpha_g^i g_j + \alpha_p^i p_j + \xi_j)}{\sum_{s,k} \exp(\alpha_h^i h_k + \alpha_g^i g_k + \alpha_p^i p_k + \xi_k)}$$

Aggregating over households gives familiar share representation.

As in IO models, we don't actually use individual choice, but instead match shares

Equilibrium requires supply equals demand, with the unobservable ξ perfectly rationalizing observed shares.

Estimation

$$U_j^i = \alpha_h^1 d^i h_j + \alpha_g^1 d^i g_j + \alpha_p^1 d^i p_j + \theta_j + \epsilon_{ij} \quad (1)$$

$$\hat{\theta}_j = \alpha_h^0 h_j + \alpha_g^0 g_j + \alpha_p^0 p_j + \xi_j \quad (2)$$

Typically recover the observable dimensions of tastes and the mean indirect utility θ in a first stage

Berry (1994) contraction mapping rather than conditional logit here.

Instrumenting for price (or other equilib g)

We have the standard issue that prices and amenities are likely correlated with ξ

Bayer & Timmins (2007) propose using characteristics of "far away" neighborhoods as an instrument.

Here the logic is even stronger than typical demand estimation: Under fixed supply, altering the attributes of unchosen locations mechanically alters the sorting equilibrium.

If we are comfortable with the assumption that utility is independent of amenities at these unselected locations, then this is a useful instrument.

Estimation steps (Klaiber and Phaneuf (2010))

1. Estimate top part of Eq 1
2. Guess price coefficient α_p^{0*}
3. Project $\hat{\theta}_j - \alpha_p^{0*}$ on to amenities of *other* nearby neighborhoods
4. Feed this predicted mean utility back into Eq 1, using same α^1 to get the price p_j^{iv} the rationalizes shares.
5. Use this as an instrument

Solving for a new equilibrium

Having recovered preferences, can then simulate counterfactual housing market outcomes.

We'll review the easy case of exogenous amenities.

Endogenous amenities doable.

New Equilibrium steps (Klaiber and Phaneuf (2010))

1. Change amenities and estimate aggregate demand for each neighborhood (or type) $\sigma_j^{d,0}$. This is iteration 0.
2. If $\sigma_j^{d,0}$ is greater than supply of j, increase p_j slightly; If lower, decrease price.
3. Recompute demand $\sigma_j^{d,1}$
4. Iterate until convergence

How credible are sorting models?

- Choice of neighborhoods and market “scope” not innocuous
- Without choice set variation, model identified off of error assumptions alone
- As in hedonic model generally, assumes preferences accurately specified

What about dynamics?

People don't move every year

When is a dynamic approach necessary?

What about dynamics?

People don't move every year

When is a dynamic approach necessary?

- Amenity trending over time
- Amenity mean reverting

Note dynamics may also be *informative*

Pretty much all papers in this literature are static

Data:

- Need to follow *households*, not just houses
- Want characteristics of these households

Computationally challenging

- With consumer heterogeneity, curve of dimensionality

BMMT ECMA 2016 estimate dynamic model

Rich data setting in NoCal.

Develop a model of dynamic neighborhood choice.
- Devises a computationally light estimator (similar to durable demand lit)

Households decide about extensive margin (if/ when) and intensive margin (where) to move.
- Base this decision on expectations of amenities

Then compare estimates to a static model

Notable limitation: Amenities evolve exogenously (so no Tiebout here), including price

BMMT results

Table 6: Willingness to Pay for a 10-Percent Increase in Amenities – Static versus Dynamic Estimates by Income

	Static			Dynamic		
	\$40,000	\$120,000	\$200,000	\$40,000	\$120,000	\$200,000
Percent White	1627.02	1901.43	2221.66	612.14	2428.91	4888.42
	(11.28)	(18.76)	(48.55)	(84.45)	(116.72)	(277.96)
Violent Crime	-291.14	-380.67	-448.88	-350.15	-962.19	-1298.80
	(7.68)	(11.08)	(19.02)	(48.66)	(71.46)	(94.06)
Ozone	-66.24	-80.71	-97.04	-302.06	-380.03	-395.58
	(2.13)	(2.43)	(3.15)	(28.30)	(30.12)	(39.32)

What if market participants are not well informed about the attribute?

– Appeal of hedonic papers is that there is rich data available.

– Authors often combine information about the houses themselves with detailed information about community amenities

– In sum, models often include tens of attributes.

– Yet survey evidence reveals that homeowners are often uninformed about amenities in their own communities, and were even less informed before purchasing.

– What do hedonic studies uncover in these markets?

This is the subject of Pope [2008a] and Pope [2008b].

Are buyers well informed?

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Buyer information and the hedonic: The impact of a seller disclosure on the implicit price for airport noise

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[Pope, 2008a] looks for a shift in the hedonic price gradient following a buyer disclosure law

– Setting: RDU airport

– Noise levels public information, and presumably salient if you're living there

– 1995 law mandated all government notices be provided to buyers during sale process. In 1997, RDU crafted a separate noise disclosure notice

– Pope finds at 37 percent increase in the implicit cost of airport noise

What if only sellers are informed?

Do Seller Disclosures Affect Property Values? Buyer Information and the Hedonic Model

Jaren C. Pope

ABSTRACT. *The hedonic method is widely used to infer the value of environmental amenities that are bundled with real property. The interpretation of hedonic prices as marginal values requires that households are "fully informed." Yet, there is evidence that buyers are often less informed than sellers. A graphical illustration in this study suggests that asymmetric information between buyers and sellers can affect hedonic prices. This intuition is confirmed by a quasi-random experiment that exploits spatial and information discontinuities stemming from a seller disclosure for flood zones. Results suggest a 4% decline in housing prices in flood zones after disclosures commenced.* (JEL Q51, R52)

inform the public litigation process by providing information for Natural Resource Damage Assessments (Rowe and Schulze 1985).[2] With the advent of GIS and the increasing availability of housing data, there is reason to believe that the hedonic method will continue to be widely applied to valuation problems in environmental economics.

Despite the extensive use of the hedonic method, there has been debate about the degree to which estimated implicit prices correspond with the preferences of buyers and sellers in housing markets. Much of the

Full information

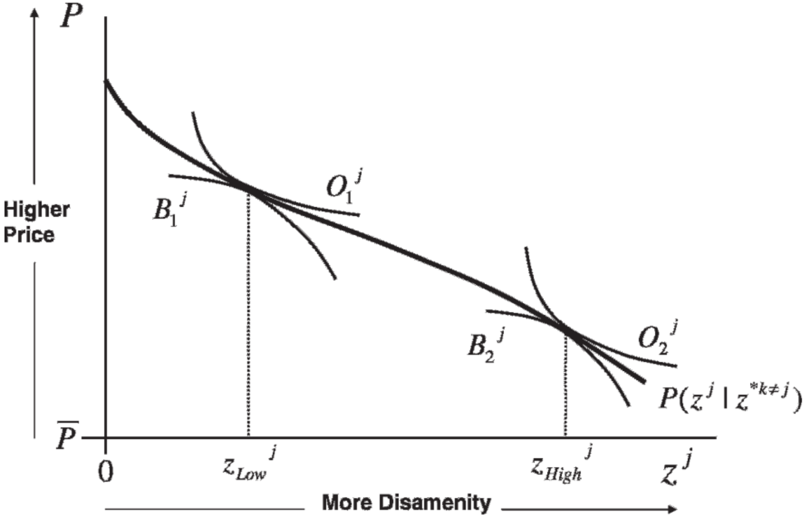


FIGURE 2
STANDARD HEDONIC DIAGRAM OF DISAMENITY

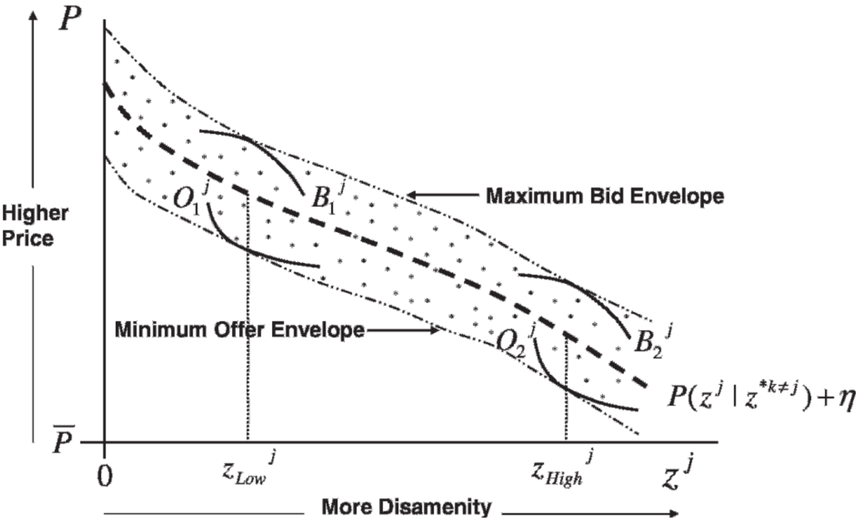
Full information assumptions

Equilibrium house *prices* reveal buyer and seller *preferences* requires:

1. continuity in the levels of attributes

2. full information about prices and attributes

What if consumers are not well informed about the attribute?



What if only sellers are informed?

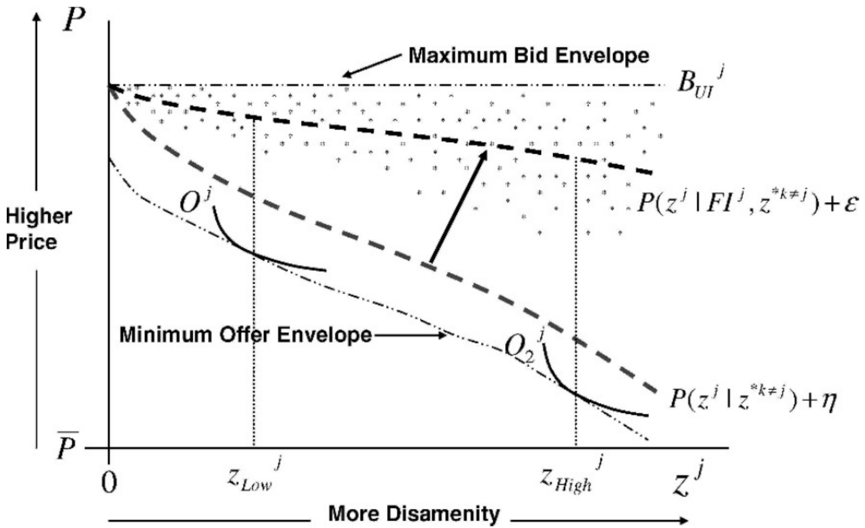


FIGURE 4
ASYMMETRIC INFORMATION AND THE HEDONIC

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