

Evaluation of Public Policies and Social Programs

Session 6: Revealed Preference — Hedonic Pricing, Travel Cost & Discrete Choice

Andrés Barrios Fernández

Monday, August 24, 2026

MA in Economics, Universidad de los Andes, Chile — Second Semester 2026

Today

1. Hedonic theory, and the diagram behind it
2. Exercise: school quality capitalized into housing prices
3. Discrete choice and the log-sum welfare formula
4. Exercise: a discrete choice model of school choice
5. Travel cost (brief) and what we learned
6. Paper presentation (closes today's session)

Learning Objectives

By the end of today's session, you will be able to:

- Derive the hedonic equilibrium diagram and explain why the implicit price is a valid marginal WTP only *at* the point of tangency
- Compute an implicit price and aggregate WTP from a hedonic regression
- State the random utility model and the log-sum formula for welfare change under a discrete choice
- Apply both frameworks to a case where the choice set itself changes — exactly what opening the Astoreca school does to a family's school options

Hedonic Theory

Recall: no demand curve for non-market goods

Session 4 ended on a cliffhanger: school quality has no market of its own, so there is no demand curve to read a price off of.

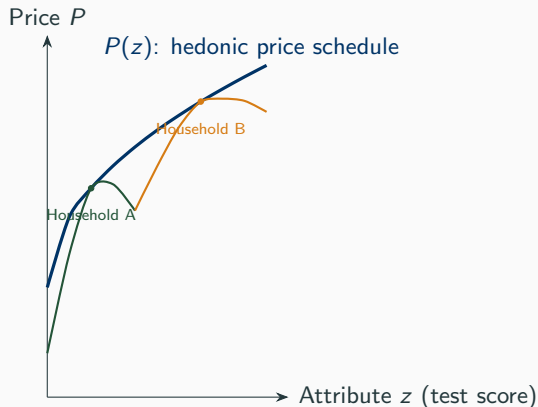
Today's answer: look for the good's *shadow* inside a market that does exist.

Rosen, S. (1974), “Hedonic Prices and Implicit Markets,” JPE

A differentiated good (a house) is really a bundle of attributes $z = (z_1, \dots, z_k)$ (square footage, school quality, distance to work, ...). The market does not price attributes directly — it prices *houses*. But if enough houses with different bundles trade, the attribute prices are implicit in the pattern of house prices.

- Implicit price of attribute k : $\partial P / \partial z_k$
- Applications: housing capitalizes school quality, pollution, crime; wages capitalize mortality risk (VSL, Session 10)

The hedonic equilibrium, visually



Each household's bid curve is tangent to $P(z)$ at the attribute level it actually chose — that tangency is what makes $\partial P / \partial z$ a valid marginal WTP *for that household, at that point*. Standard hedonic equilibrium diagram, following Rosen (1974).

Why this matters: implicit price $\neq$ average WTP

- The slope of $P(z)$ at a point equals the marginal WTP of the household who *chose* that point — not the average household's marginal WTP for a bigger change
- Two households with different tastes sort into different bundles; the curve $P(z)$ is the *envelope* of many different bid curves, not any one household's demand curve
- This is why hedonic estimates identify marginal, local WTP well, but extrapolating to large or non-marginal changes (like a whole new school) requires more assumptions

Exercise: School Quality Premium

Hedonic regression (simulated)

$$\ln(\text{price}) = 12.1 + 0.004 \times \text{test score} + \dots$$

- Mean house price: \$250,000; mean test score: 60
- Policy: school improvement raises scores by 10 points
- Neighborhood: 5,000 households

1. Calculate the implicit price per test-score point
2. Estimate average household WTP for a 10-point improvement
3. Calculate total WTP for the neighborhood
4. What assumption justifies using house prices as WTP here? When might it fail?

Implicit price = $0.004 \times \$250,000 = \$1,000$ per point

WTP for 10 points = \$10,000 per household

Total WTP = $5,000 \times \$10,000 = \$50\text{M}$

The key assumption

Households are freely mobile and fully informed about school quality when choosing where to live — otherwise the price gradient does not reflect true WTP.

Deep discussion: is this identified?

A regression of $\ln(\text{price})$ on test scores is *not*, by itself, a causal estimate of WTP for quality.

- What else is correlated with test scores across neighborhoods (income, crime, amenities)? Omitted variable bias runs in an unknown direction
- **Black (1999)** solves exactly this problem with a boundary discontinuity design — comparing houses on opposite sides of an attendance-zone boundary — and is Session 7's paper presentation; watch for how she does it then
- This is Session 1's causal-inference lesson again: a hedonic *price gradient* still needs a credible identification strategy before you trust it as WTP

Discrete Choice and the Log-Sum Formula

McFadden, D. (1974), “Conditional Logit Analysis of Qualitative Choice Behavior”

A household chooses among J alternatives, deriving utility $U_{ij} = V_{ij} + \varepsilon_{ij}$ from each.

With ε_{ij} i.i.d. type-I extreme value, choice probabilities take the closed form:

$$P_{ij} = \frac{\exp(V_{ij})}{\sum_k \exp(V_{ik})}$$

From “which option” to “how happy”: expected utility

- A family doesn't experience *one* V_{ij} — they draw a noisy $U_{ij} = V_{ij} + \varepsilon_{ij}$ for every option and simply take the best one: realized utility = $\max_j U_{ij}$
- Because each ε_{ij} is i.i.d. extreme value, that maximum has a remarkably clean *expected* value (McFadden again):

$$E[\max_j U_{ij}] = \ln \sum_j \exp(V_{ij}) + \gamma$$

where γ is just a constant (it cancels whenever we compare two choice sets)

- Look closely: $\sum_j \exp(V_{ij})$ is the exact same sum that sat in the denominator of P_{ij} one slide ago. It was already doing double duty — normalizing probabilities *and* encoding expected utility. Taking its log just extracts the second job.

From utils to dollars: where does α come from?

- V_{ij} is measured in utils, not dollars — so is $\ln \sum_j \exp(V_{ij})$. We need the same money-metric trick as Hicks (Session 3): divide a utility change by the *marginal utility of income* to convert it into a dollar figure
- Income enters V_{ij} through cost, linearly: $V_{ij} = -\alpha \cdot \text{cost}_j + \dots$, so $\alpha = -\partial V_{ij} / \partial \text{cost}_j$ is literally “utils lost per dollar of cost” — exactly the marginal utility of income
- **Concretely, in today’s exercise:** $V_j = -0.002 \times \text{cost}_j + 0.4 \times \text{quality}_j$ — read the cost coefficient straight off that equation, and $\alpha = 0.002$

Dividing a utility gain by α answers: “how many dollars would generate this same utility gain?” — which is exactly CV.

The log-sum: welfare from a change in the choice set

$$CV_i = \frac{1}{\alpha} \left[\ln \sum_j \exp(V_{ij}^1) - \ln \sum_j \exp(V_{ij}^0) \right]$$

- Expected utility of the choice set (from two slides ago), *after* minus *before*, converted to dollars by $1/\alpha$ (from one slide ago) — nothing new, just the two pieces combined
- Superscripts 0/1: choice set *before* and *after* the policy
- This is exactly the tool for evaluating the Astoreca school: it doesn't just change a price, it **adds a whole new option** to families' choice sets

Setup: A Discrete Choice Model of School Choice

Three schools

- Public: \$0/yr, quality index 3
- Astoreca-subsidized: \$300/yr, quality index 5
- Other private: \$2000/yr, quality index 6

Estimated $V_j = -0.002 \times \text{cost}_j + 0.4 \times \text{quality}_j$

Task (groups, 15 minutes)

1. Compute V_j and choice probabilities P_j for all three schools
2. Simulate the policy that opens the Astoreca school (adds it to a choice set that used to be {public, private} only)
3. Compute the log-sum welfare gain per family, and aggregate to 2,000 families in the catchment area

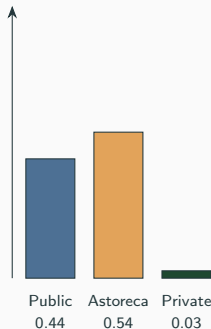
Solution: utilities and probabilities

$$V_{\text{public}} = -0.002(0) + 0.4(3) = 1.20$$

$$V_{\text{Astoreca}} = -0.002(300) + 0.4(5) = 1.40$$

$$V_{\text{private}} = -0.002(2000) + 0.4(6) = -1.60$$

Choice probability



Solution: the welfare gain from a new option

$$\text{Before: \{public, private\}} \quad \ln [e^{1.20} + e^{-1.60}] = \ln(3.52) = 1.259$$

$$\text{After: \{public, Astoreca, private\}} \quad \ln [e^{1.20} + e^{1.40} + e^{-1.60}] = \ln(7.58) = 2.025$$

$$\text{CV per family} = \frac{2.025 - 1.259}{0.002} \approx \$383/\text{yr}$$

$$\text{Aggregate (2,000 families)} \approx \$766,000/\text{yr}$$

Even families who don't switch to Astoreca are still better off — their outside options got better.

Deep discussion: the IIA problem

- Logit imposes **independence of irrelevant alternatives**: the ratio P_i/P_k doesn't depend on what other options exist (the classic “red bus / blue bus” problem)
- If the Astoreca school is a much closer substitute for *one* existing school than for the others (e.g., both are academically focused, vs. a vocational alternative), logit will overstate how much it draws from the dissimilar option
- Nested or mixed logit relax this — worth flagging in your report if your team's substitution pattern looks implausible under plain logit

Travel Cost (Brief)

Travel cost, in one slide

- Demand for a *site* (a park, a clinic, a school) revealed by how far people travel to reach it and what that costs them
- Travel cost = monetary cost + time cost (time $\times$ wage rate)
- Useful if your team studies *access* or *distance* effects for the Astoreca catchment area — not pursued further this semester otherwise

What We Learned Today

- The hedonic price schedule is an envelope of many households' bid curves — its slope is a valid marginal WTP only at the tangency point each household actually chose
- A hedonic regression is a starting point, not an answer, until you have a credible identification strategy (today's paper shows one way)
- The log-sum formula extends discrete choice welfare analysis to changes in the *choice set itself* — exactly what a new school does
- Logit's IIA assumption is a real limitation to flag when substitution patterns are uneven across alternatives

- Begin Problem Set 2 (hedonic/discrete choice; self-study checkpoint by Session 12)

Paper Presentation (75–90 min)

Emilia Perez & R. Lagomarsino

Bailey, M.J. & Goodman-Bacon, A. (2015), “The War on Poverty’s Experiment in Public Medicine: Community Health Centers and the Mortality of Older Americans,”
AER