Housing Search Frictions: Evidence from Detailed Search Data and a Field Experiment

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Housing Choice Vouchers and Neighborhood Quality

- Residential location important determinant of long-run outcomes
  (cf. Wilson, 1987; Sampson & Groves, 1989; Chetty, Hendren, Katz 2016)
- School quality matters
  (cf. Angrist et al., 2010; Deming et al., 2014; Dobbie & Fryer, 2011; Schwartz, 2010)
- Most school choice is residential choice

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Housing Choice Voucher (HCV) Program

- $<$15% of families w/ children live in a low-poverty areas
  (Sard and Rice, 2016)
- Schools associated w/ HCV recipients worse compared to other low-income families
  (Ellen, Horn & Schwartz, 2016)

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$\Rightarrow$Why don't HCV families live in areas with better schools?

This Paper: The Role of Information Problems

We ask

1. Does additional school-quality information change families' search for housing?
2. Does it affect where families choose to live?

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2. Does it affect where families choose to live?
3. How much do HCV households value school quality?
4. How much would they appear to value it if we ignored information frictions?

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Hard questions to answer...

- Questions (1) and (2) require multiple partnerships to implement
  - Need information on schools and attendance zones
  - Need a platform to deliver information; must be timely, actionable
  - Need to be able to track where families live
- Questions (3) & (4) require a model

This Paper: The Role of Information Problems

To answer these questions, we combine:

- School quality data on near-universe of public schools
- Nationwide RCT adding school-quality info to online search platform
- Detailed search data
- Universe of residential data on voucher recipients
- Model of search for voucher housing (ongoing)

Literature

1. Impacts of vouchers
   - Lower neighborhood crime, poverty rates but not so much better schools

     (Katz, Kling, Liebman 2001; Kling, Liebman, Katz 2007; Sanbonmatsu et al 2006)
   - Positive long-run outcomes

     (Chetty, Hendren, Katz 2016; Chyn, 2018)
   - Not through schools (Jacob, 2004)

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2. School quality within centralized mechanism
   - Families respond to school-quality information

     (Hastings and Weinstein 2008; Corcoran et al., 2018; Allende, Gallego and Neilson, 2018)
   - Distance & racial composition strong determinants of choice

     (cf. Hastings et al. 2005; Glazerman & Dotter 2017)
   - Demand responds to absolute test scores, not value added (Abdulkadirolu et al., 2017)

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     (cf. Hastings et al. 2005; Glazerman & Dotter 2017)
   - Demand responds to absolute test scores, not value added (Abdulkadirolu et al., 2017)
3. Wealthier families will to pay for school quality
   - Test scores capitalized into housing prices

     (e.g. Black 1999; Figlio and Lucas, 2004; Bayer, Ferreyra, McMillan 2007)

Outline

Outline

1. Background on HCV program
2. Study partners
3. Intervention description
4. Descriptive results
5. RCT results
6. The model, ongoing and future work

Housing Choice Vouchers

"Section 8"/Housing Choice Voucher program.

- $\approx$ 2.2m families in U.S
- Administered by local housing authorities
- Typical features:
  - Income cutoff
  - Waitlist
  - Limited time to use voucher (typically 60-120 days)

  Subsidizes tenant's rent:

  - Tenant typically pays 30% of income toward rent and utilities
  - Landlord receives rent based on "fair market rent"
  - Rent capped at $\approx$40th percentile of metro-area rent
  - Landlord agrees to inspections

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Study Partners and Data

GoSection8.com

- Largest listings platform Housing Choice Voucher market
- $\approx 400,000$ unique users/month
- $11,000 - 13,000$ tenants registered per month
- Partners w/ local housing authorities
- Host intake survey, provide properties viewed, inquiries, property characteristics

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GreatShools.org

- Nonprofit organization rating $\approx 200,000$ PK-12 schools nationwide
- Ratings 1-10, based on test scores; 5 median within each state
- NCES data on school characteristics; Demographics, FRPL, FTEs
- Assign each GoSection8 property to E, M, H; construct mean rating

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US Department of Housing and Urban Development

- Location of HCV recipients, income, HH members and ages, rent, bedrooms
- Assign endline living location to E, M, H; construct mean rating

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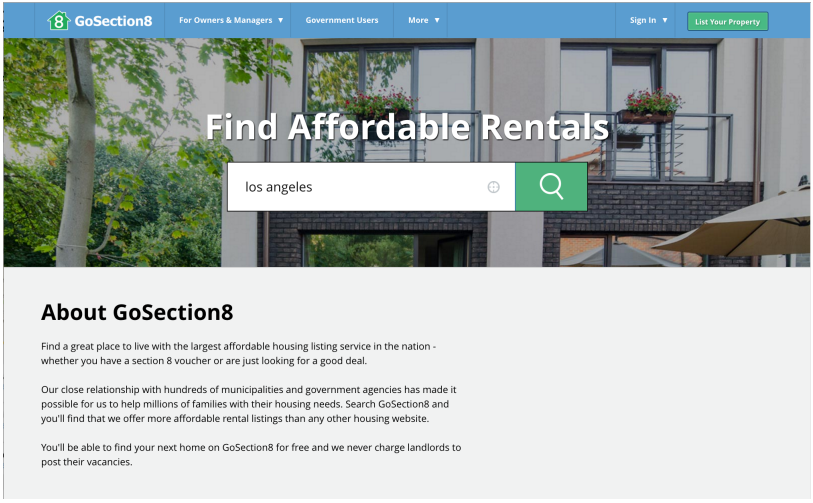
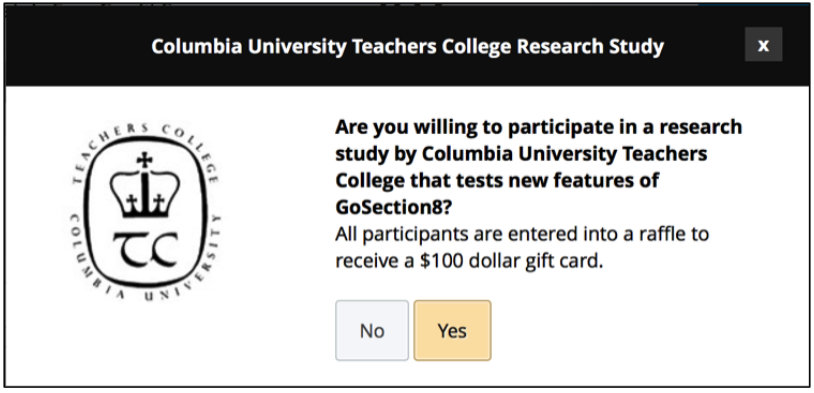
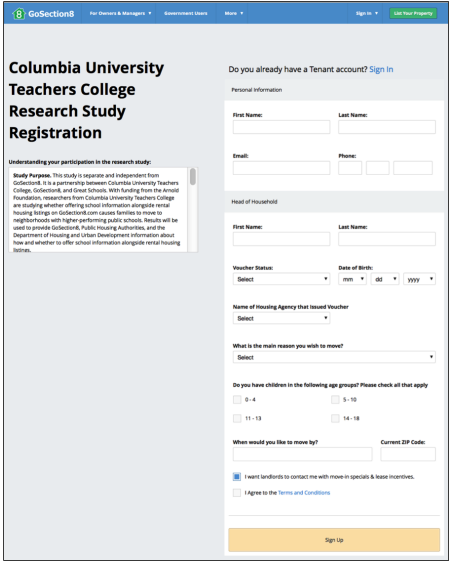
Search is geographic



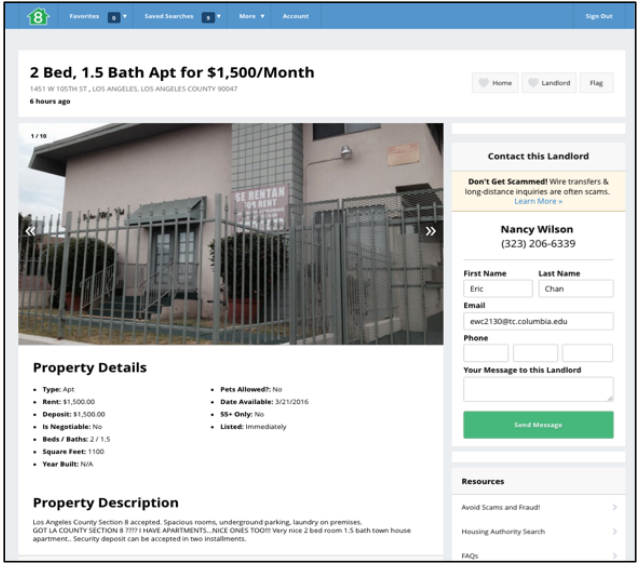
"Yes" $\Longrightarrow$ randomly assigned to treatment/control



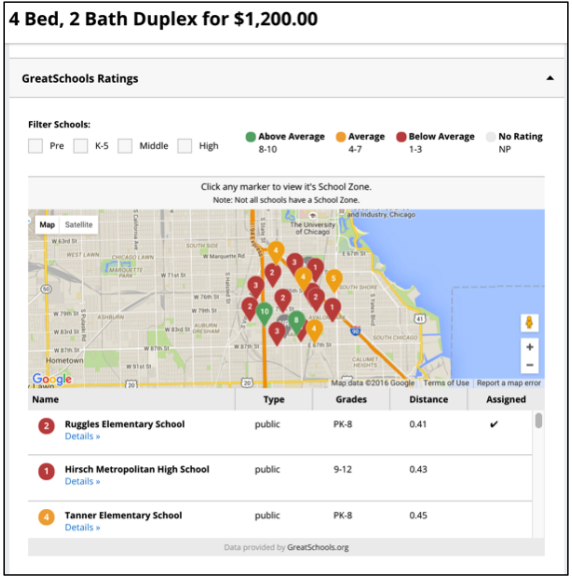
Intake survey



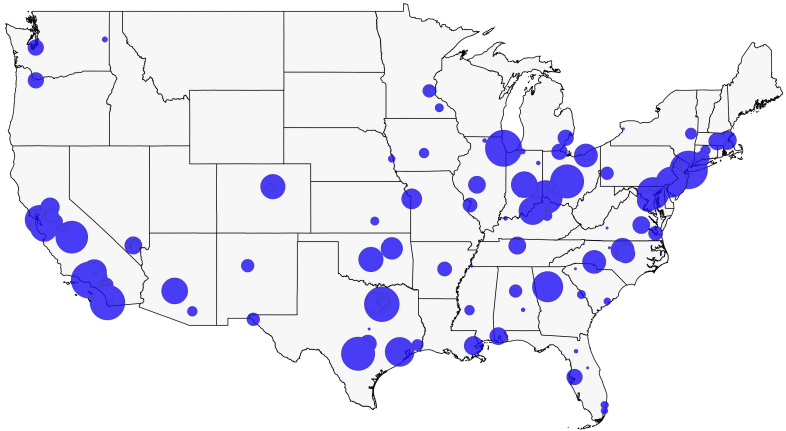
Listings


Favorites 0
Saved Searches 9
More
Account
Sign Out
2 Bed, 1.5 Bath Apt for $1,500/Month
1451 W 105TH ST , LOS ANGELES, LOS ANGELES COUNTY 90047
6 hours ago
Home
Landlord
Flag
1 / 10
SE RENTAN
UN RENT
Contact this Landlord
Don't Get Scammed! Wire transfers & long-distance inquiries are often scams.
Learn More »
Nancy Wilson
(323) 206-6339
First Name
Last Name
Eric
Chan
Email
ewc2130@tc.columbia.edu
Phone
Your Message to this Landlord
Send Message
Property Details
Type: Apt
Rent: $1,500.00
Deposit: $1,500.00
Is Negotiable: No
Beds / Baths: 2 / 1.5
Square Feet: 1100
Year Built: N/A
Pets Allowed?: No
Date Available: 3/21/2016
55+ Only: No
Listed: Immediately
Property Description
Los Angeles County Section 8 accepted. Spacious rooms, underground parking, laundry on premises.
GOT LA COUNTY SECTION 8 ???? I HAVE APARTMENTS...NICE ONES TOO!!! Very nice 2 bed room 1.5 bath town house apartment.. Security deposit can be accepted in two installments.
Resources
Avoid Scams and Fraud!
Housing Authority Search
FAQs

Treatment group only



Geography of the study sample



Voucher holders attend lower-quality schools

US Primary Schools vs. HUD vs. Study Sample

	US Elem Schools	HUD (5%)	Study Sample
GreatSchools Rating	5.78	4.71	3.27
Share Black	0.15	0.20	0.44
Share Hispanic	0.26	0.48	0.38
Share White	0.49	0.22	0.12
Share Asian	0.05	0.06	0.03
Share FRPL	0.52	0.71	0.84
Pupil-FTE Ratio	17.67	18.5	18.35
Observations	125,346	85,301	1,932

census tracts

Sample characteristics

Variable	Control Mean	T-C Difference	P-value	N
Female	0.88	−0.02	0.31	1,921
Hispanic	0.15	−0.03**	0.03	1,921
Black	0.62	0.01	0.71	1,918
White	0.38	−0.02	0.40	1,915
Annual income	14,513	104.00	0.84	1,921
<18 children in	1.84	−0.06	0.43	1,932
Intend to move within 3 months	0.66	0.01	0.65	1,928
Omnibus Test P-value: 0.20				

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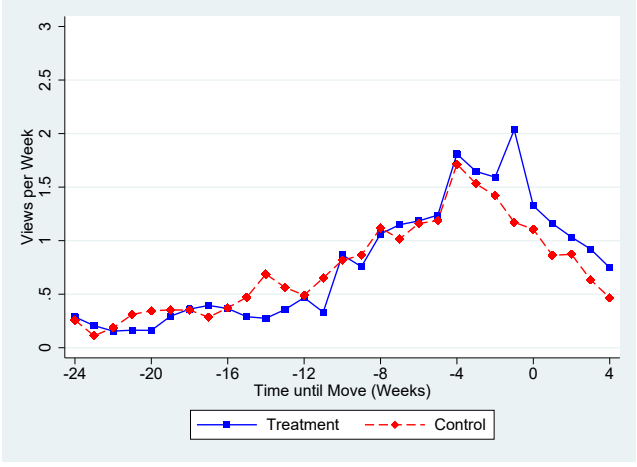
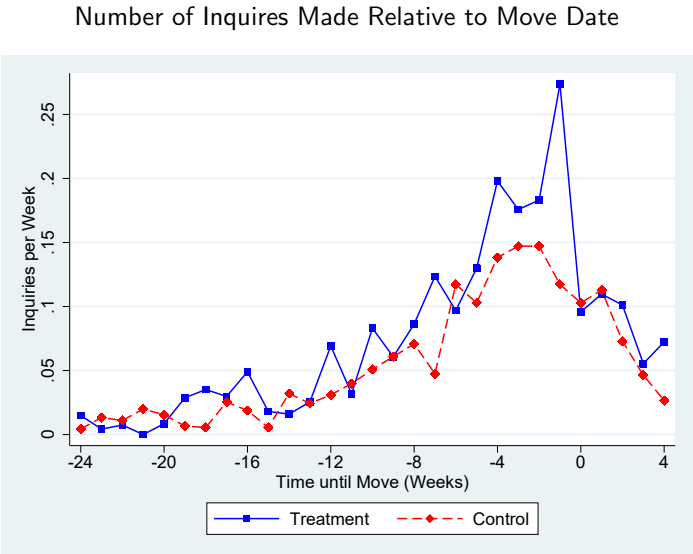
Search Behaviors: Small/no effects on number of views

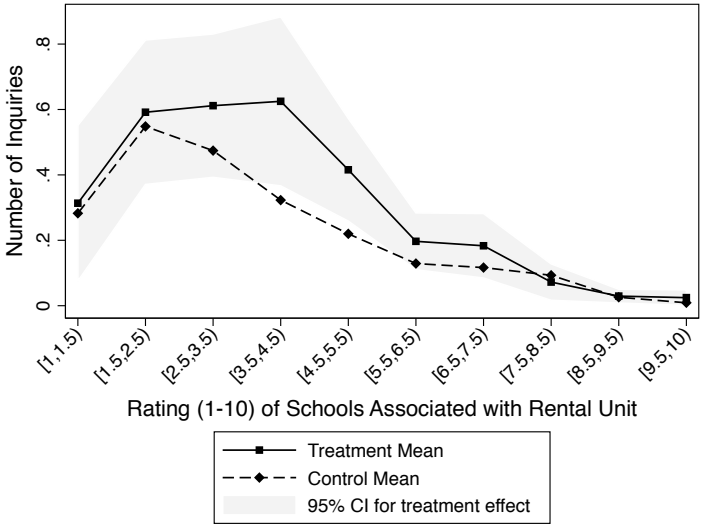
Number of Views Made Relative to Move Date



Search behaviors: Positive impacts on number inquiries



More and better inquiries if treated

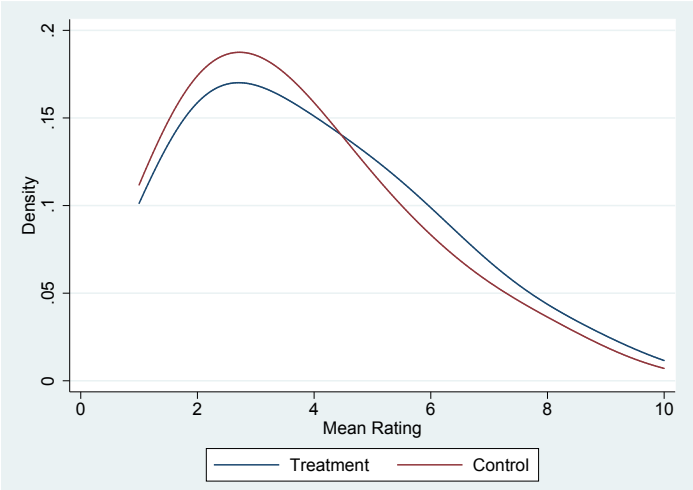


Search and Endline School Choice

Variable	Control Mean	Treatment Effect	Std Error	P-value	N
Search					
Total views	33.57	1.80	4.21	0.67	1,932
Total inquiries	2.32	0.80*	0.45	0.07	1,932
Schools Assigned to Where Families Live					
Average School Quality	3.69	0.28***	0.09	0.00	1,918
Maximum School Quality	4.85	0.32***	0.12	0.01	1,918
Minimum School Quality	2.67	0.19**	0.09	0.03	1,918
High School Rating	3.88	0.33***	0.12	0.00	1,731
Middle School Ratng	3.70	0.30***	0.12	0.01	1,845
Primary School Rating	3.56	0.23**	0.11	0.05	1,812
Mean share FRPL	0.72	−0.02**	0.01	0.05	1,866
Fraction Black or Hispanic	0.66	−0.02*	0.01	0.07	1,866

Notes: All outcome data from HUD merged to school quality data.
*** p<0.01, ** p<0.05, * p<0.10

Residential Choice: Neighborhood School Quality Density



Households target the "next" school

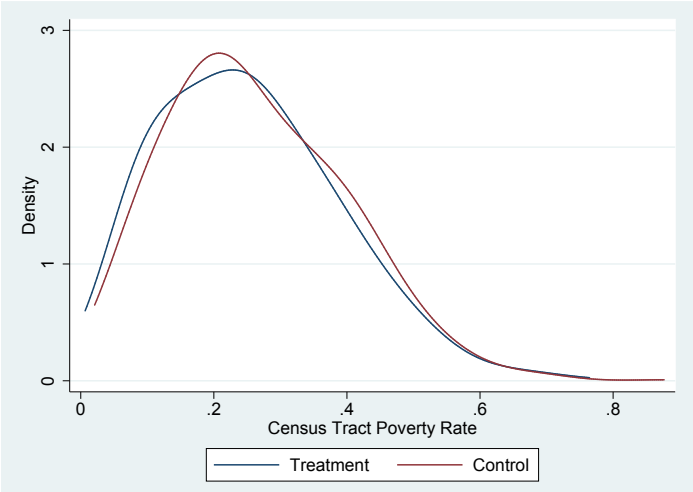
Variable	Control Mean	Treatment Effect	Std Error	P-value	N
Has Child 0-4					
Primary School Rating	3.31	0.44**	0.20	0.03	563
Middle School Rating	3.63	0.22	0.21	0.29	565
High School Rating	3.95	0.18	0.22	0.41	538
Has Child 5-10					
Primary School Rating	3.72	0.07	0.26	0.78	378
Middle School Rating	3.65	0.65***	0.26	0.01	372
High School Rating	3.78	0.68***	0.25	0.01	360
Has Child 11-13					
Primary School Rating	3.62	−0.13	0.31	0.67	233
Middle School Rating	3.80	−0.19	0.32	0.55	242
High School Rating	3.79	0.38	0.30	0.21	228
Has Child 14-18					
Primary School Rating	3.54	0.26	0.25	0.28	368
Middle School Rating	3.63	0.27	0.24	0.27	385
High School Rating	4.03	0.18	0.26	0.49	346

Moving farther from downtown for better schools?

Variable	Control Mean	Treatment Effect	Std Error	P-value	N
Percent Hispanic	0.23	−0.00	0.01	0.68	1,907
Percent White	0.50	0.01	0.01	0.36	1,907
Percent Black	0.34	−0.02	0.01	0.20	1,907
Percent Asian	0.04	0.00	0.00	0.24	1,907
Percent H.S. Graduates	0.79	0.01	0.00	0.18	1,907
Percent B.A. Graduates	0.19	0.00	0.01	0.41	1,907
Percent in Poverty	0.26	−0.01*	0.01	0.08	1,907
Percent on SNAP	0.56	−0.00	0.01	0.83	1,906
Walkscore	50.02	−3.40***	1.14	0.00	1,929
Commute to dwtn	15.36	1.97***	0.70	0.00	1,913

Notes: All outcome data from HUD merged to school quality data.
*** p<0.01, ** p<0.05, * p<0.10

Residential Choice: Neighborhood Poverty-Rate Density



No impacts on unit characteristics

Variable	Control Mean	Treatment Effect	Std Error	P-value	N
Rent	1151.08	−4.98	19.35	0.80	1,921
Bedrooms	2.47	−0.04	0.04	0.38	1,921
Beds per HH Member	0.90	0.01	0.02	0.72	1,907

Notes: All outcome data from HUD.
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Ongoing and future work

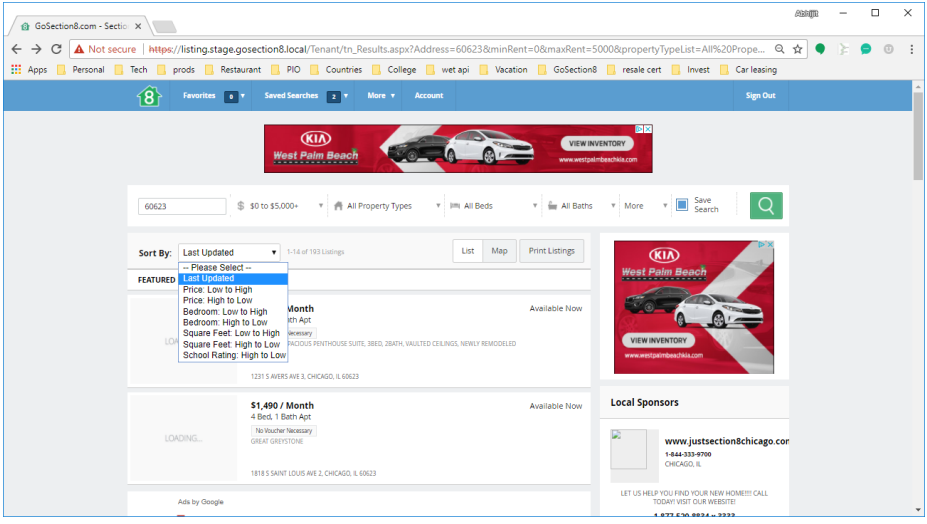
- Structural model of residential choice
  - Dynamic search model
  - Noisy signal of school quality v. known school quality
  - Estimate preferences under treatment/known school quality
  - Show that, under uncertainty, $\exists$ equivalent full-information model
  - Compare: if we ignore uncertainty, how much does it **appear** families value school quality?
  - Do families infer quality based on neighborhood characteristics?

Ongoing and future work

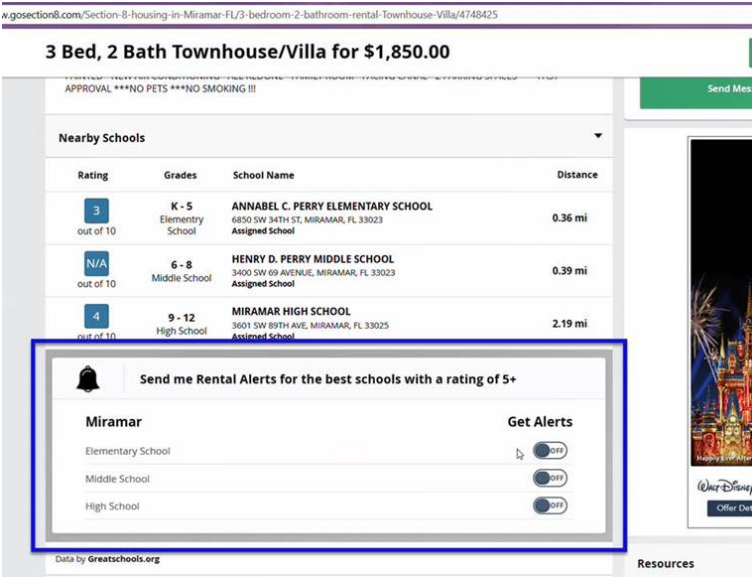
Continuing recruitment

- Continue GS school-quality treatment
- Improved interface
- More users

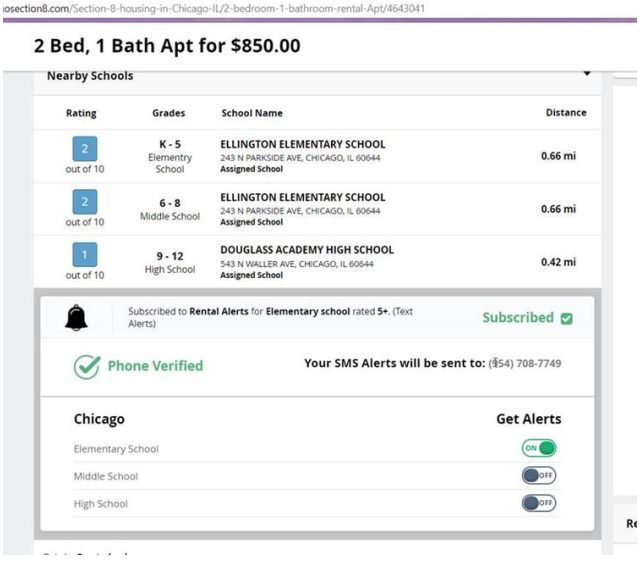
Sort by school quality



School quality treatment



SMS Enrollment



Ongoing work

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Demand side

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$\Rightarrow$ Add Opportunity Atlas mobility measures (Chetty et al., 2018)

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$\Rightarrow$ High cost, intensive search assistance to create moves to opportunity (Bergman, Chetty, DeLuca, Hendren, Katz, Palmer, ongoing)

Ongoing work

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Supply side

Ongoing work

Demand side
⇒ Add Opportunity Atlas mobility measures (Chetty et al., 2018)
⇒ Deposit subsidies/reduce liquidity constraints
⇒ High cost, intensive search assistance to create moves to opportunity (Bergman, Chetty, DeLuca, Hendren, Katz, Palmer, ongoing)

Supply side
⇒Landlord recruitment (Here in Austin!)

Demand for voucher housing

Model Overview

- Use model of households' views, inquiries/apartment visits, residence choice.
- Estimate welfare impacts, quantify information frictions.
- Key features:
  1. Finite horizon: $t = 1, \ldots, T$. (Must use voucher before deadline.)
  2. In each period, choice of platform use, inquiries, whether to move.
  3. Simultaneous search within a period. (Timing of inquiries, apartment visits)
  4. No recall. (Vacancies are short-lived.)

Markets, Households, Apartments

- Markets $m = 1, \ldots, M$.
- Households $i = 1, \ldots, N_m$.
- Apartments $j \in \mathcal{J}_m$.
- Time is discrete: $t = 1, \ldots, T < \infty$.
- Household i becomes active at $t = 1$, has until T to find an apartment.
- i receives payoff 0 if it fails to match by T.
- No discounting.

Search

1. At beginning of period t, i receives a cost draw

$$c_i^{search} \sim F_{c^{search}}(\cdot)$$

iid across periods. i observes cost, chooses whether to use platform.

2. If so, i pays c_i^{search}, draws J_{it} according to

$$\{x_{ij}, q_{ij}, \hat{q}_{ij}, \epsilon_{ij}\}_{j \in J_{it}} \sim F_{go8}(\cdot)$$

.

3. Regardless of search, i draws off-platform options J_{it}^0 for free as

$$\{x_{ij}, q_{ij}, \hat{q}_{ij}, \epsilon_{ij}\}_{j \in J_{it}^0} \sim F_0(\cdot),$$

where $x =$ observed characteristics, $\hat{q} =$ perceived school quality, $q =$ true quality, $\epsilon =$ unobservable.

Inquiries and decisions

4 i draws a cost shock

$$c_{it}^{accept} \sim F_{c^{accept}}(\cdot|c_{it}^{search}).$$

5 i observes $x, \hat{q}, \epsilon$ for all $j \in J_{it} \cup J_{it}^0$, chooses

$$J_{it}^{inquiry} \subseteq J_{it} \cup J_{it}^0,$$

makes inquiries for free.

6 Inquiries succeed with probability $p(x_j, q_j)$.

7 i chooses whether to accept a listing with a successful inquiry (if any) or continue to the next period. If i accepts j, i pays c_{it}^{accept} and withdraws from the market.

Information and indirect utility

- i receives $u(x, q, \epsilon) = x\beta_x + q\beta_q + \epsilon$, with $\epsilon \sim N(0, 1)$.
- Households observe noisy signal on platform: $\hat{q} = q + \eta$:
  - If treated, $\hat{q} = q$.
  - Otherwise:

$$\begin{pmatrix} q \\ q+\eta \end{pmatrix} | x \sim N\left(\begin{pmatrix} x'\gamma \\ x'\gamma \end{pmatrix}, \begin{pmatrix} \sigma_2^q & \\ \sigma_2^q & \sigma_2^q + \sigma_2^\eta \end{pmatrix} \right).$$

- Expected quality:

$$E(q|q+\eta) = s \cdot (q+\eta) + (1-s) \cdot \mu_q,$$

  where $s \equiv \frac{\sigma_q^2}{\sigma_q^2 + \sigma_\eta^2}$.
- Expected utility given i's information:

$$\hat{u} = x\beta + \left(s\hat{q} + (1-s)x'\gamma\right)\beta_q + \epsilon$$

- Off-platform: analogous, but with σ_0^η.

Discussion

Off-platform search serves two purposes:

1. Explain users who match to voucher housing they didn't view/inquire about on platform.
2. Match timing of views.

Utility according to econometrician

- Econometrician observes q, x. Not $\hat{q}$ or ϵ.
- $\hat{u} = x' \left((1-s)\beta_q + \beta_x\right) + qs\beta_q + (s\beta_q\eta + \epsilon)$
- From econometrician's point of view, household's expected utility is a r.v. with

$$\hat{u}|x, q \sim N(q\left(s\beta_q\right) + x(\beta + (1-s)\beta_q\gamma), \sigma_\epsilon^2 + s^2\beta_q^2\sigma_\eta^2)$$

Equivalent model

- Define $\tilde{\beta}, \tilde{c}, \tilde{\epsilon}$ as

$$\begin{aligned}
\tilde{\beta}_x &= \frac{1}{\sqrt{1+s^2\beta_q^2\sigma_\eta^2}}\left(\beta_x + (1-s)\beta_q\gamma\right) \\
\tilde{\beta}_q &= \frac{s}{\sqrt{1+s^2\beta_q^2\sigma_\eta^2}}\beta_q \\
\tilde{c} &= \frac{1}{\sqrt{1+s^2\beta_q^2\sigma_\eta^2}}c \\
\tilde{\epsilon} &= \frac{\epsilon + s\beta_q\eta}{\sqrt{1+s^2\beta_q^2\sigma_\eta^2}}.
\end{aligned}$$

- Then

$$\hat{u} = \left(x\tilde{\beta} + q\tilde{\beta}_q + \tilde{\epsilon}\right) \cdot \sqrt{1+s^2\beta_q^2\sigma_\eta^2}.$$

- Scale is irrelevant in discrete choice. Multiply all terms by a factor $\frac{1}{\sqrt{1+s^2\beta_q^2\sigma_\eta^2}}$. Obtain:

$$\tilde{u} = x\tilde{\beta} + q\tilde{\beta}_q + \tilde{\epsilon}, \quad \tilde{\epsilon} \sim N(0,1). \tag{1}$$

Testable implications

- Previous result: for each market and error variance, there is always an equivalent model with full information about quality.
- Can estimate "equivalent model" separately by market and treatment status, obtain "As if" WTP for quality.
- Can also estimate jointly over treatment, imposing restrictions, recover σ_η.
- If γ is known (e.g. is "rational expectations") can test hypothesis of Bayesian updating under maintained assumptions (parametric forms, treatment operates only via information channel) (via LRT).
- Can always find unique γ ("subjective prior") to perfectly reconcile estimates from treatment and control groups.
  - Pick σ_η, β_q to match error variance and quality coefficient. Choose γ to match remaining coefficients.

Characteristics and costs

- "on-platform" listings sampled from empirical distribution of $\{J_{it}\}_{i \in I_m,\ t=1,\ldots,T}$ by market and treatment status.
- "off-platform" listings: characteristics as on-platform, number $\sim Poisson(\lambda)$.
- Probability of inquiry success:

$$p(x, q) = \frac{\exp((x, q)'\alpha)}{1 + \exp((x, q)'\alpha)}.$$

- Independent lognormal cost distributions

$$\begin{pmatrix} \log c_{view} \\ \log c_{accept} \end{pmatrix} \sim N\left(\begin{pmatrix} \mu_{view} \\ \mu_{accept} \end{pmatrix}, \begin{pmatrix} \sigma^2_{view} & \\ 0 & \sigma^2_{accept} \end{pmatrix} \right).$$

Can relax independence assumption.

Moments and parameters

"Offline" parameters:

- γ, σ_q

Parameters to estimate:

- $\alpha, \beta_x, \beta_q, \mu_c, \sigma_c^2, \lambda, \sigma_\eta^2, \sigma_{\eta_0}^2$.

Estimation via MSM. Match following moments:

1. P(search) in period t, $t = 1, \ldots, T$.
2. Number of inquiries in t, $t = 1, \ldots, T$.
3. Number of inquiries in t with quality above $\overline{q}$, $t = 1, \ldots, T$, $\overline{q} \in [2, 4, 6]$.
4. 1(match to any HUD)
5. 1(match to on-platform listing)
6. mean inquiry characteristics.
7. mean match characteristics.
8. mean characteristics of on-platform matches.

Users' neighborhoods roughly similar to HUD population

Census Tract Characteristics

HUD 5% Sample vs. Study Sample

	HUD 5%	Study Sample
Share White	0.57	0.49
Share Black	0.27	0.34
Share Asian	0.05	0.05
Share Hispanic	0.23	0.24
High School +	0.80	0.79
Bachelors +	0.20	0.19
Poverty	0.25	0.25
Food Stamps	0.55	0.57
Observations	85,301	1,932

return