

Transit-Oriented Development and Housing Displacement:

The case of the Chicago Red Line extension

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Outline

- Context
- Problem definition & RQ
- Literature
- Empirical strategy
- Data
- Initial Results
- Next steps

Context

- Current: 23.4 mile heavy rail line
 - Northern edge of Chicago, through downtown, terminating at the Far Southeast Side
- Extension: 5.3 miles – terminating at the southern edge of Chicago
- Far Southeast Side
 - Transit Desert
 - Predominately black/African-American & low-income



Extension Process

- Pre-2002
 - Decades of transit neglect
 - 2002
 - Developing Communities Project (DCP)
 - Organizing to promote the RLE in
 - Aim: Move recommendations to implementation
 - 2016
 - CTA board approved \$75 million amendment to its 2016-2020 Capital Improvement Plan for the RLE
 - Includes Preliminary Engineering & Analysis, Environmental Impact Assessment
 - Alignment selected
 - \$2..3 billion budget
 - 2018+
 - \$1 billion needed from federal funding
 - Construction:
 - earliest in 2022
 - Functioning 2026
-
- The timeline diagram illustrates the progression of the extension process. It consists of six blue rectangular boxes connected by white arrows, representing sequential steps. The first box is labeled 'Draft EIS' and features a red icon of a train. The second box is labeled 'Option Selection' and has a yellow circle with a checkmark. The third box is labeled 'Final EIS'. The fourth box is labeled 'Additional Engineering'. The fifth box is labeled 'Secure Funding'. The sixth box is labeled 'CTA notifies owners of intent to purchase' and ends with a large red arrow pointing to the right.

103th Street Proposed



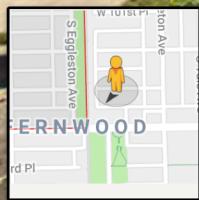
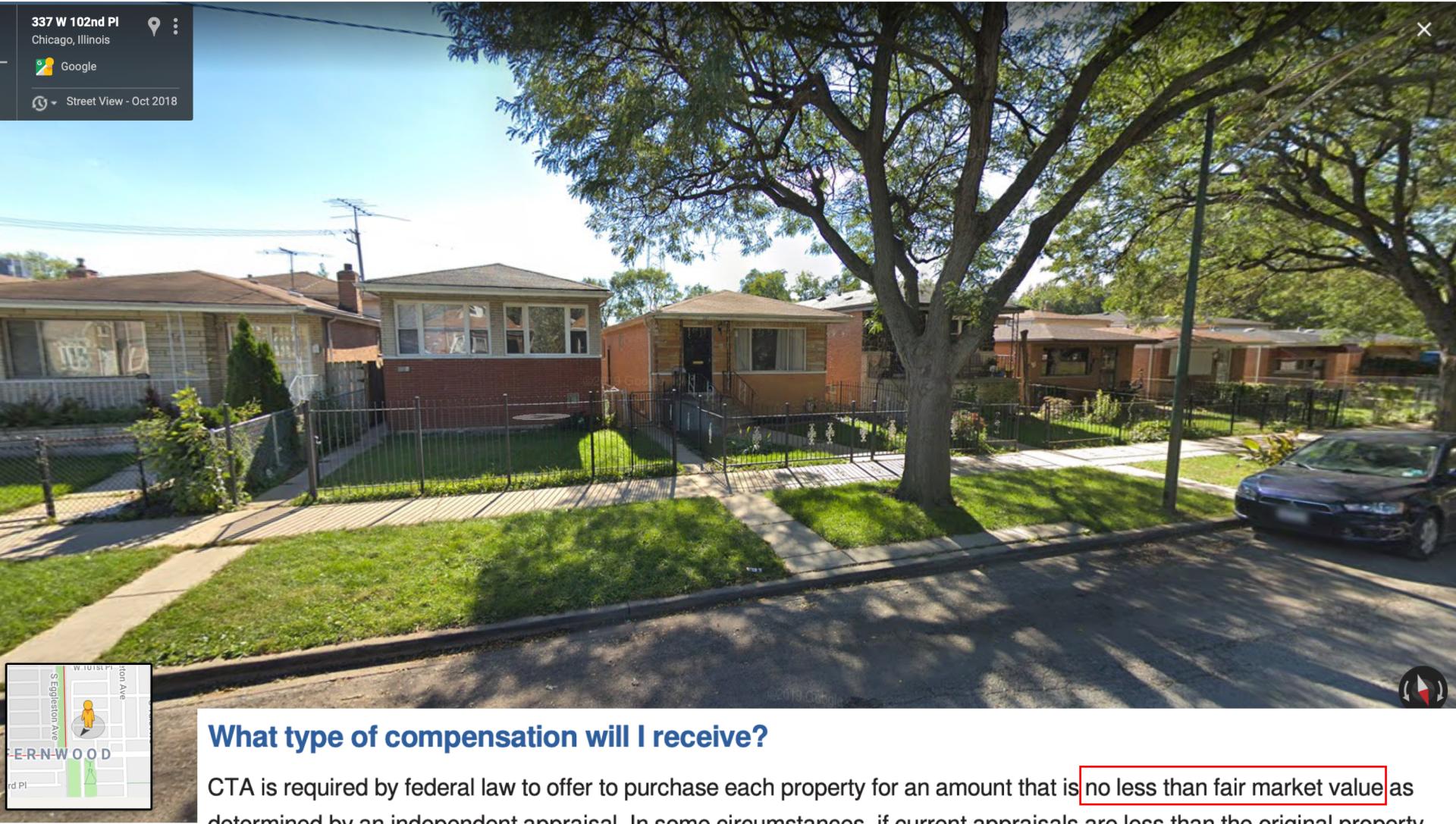
337 W 102nd Pl



Chicago, Illinois



Street View - Oct 2018



What type of compensation will I receive?

CTA is required by federal law to offer to purchase each property for an amount that is no less than fair market value as determined by an independent appraisal. In some circumstances, if current appraisals are less than the original property purchase price, an owner may be eligible for compensation equal to the original purchase price.

In addition, CTA must provide financial assistance and relocation services, as required by federal regulations for property owners as well as commercial and residential occupants who must move because of the RLE Project.

Problem Definition and Research Question

Transit-induced Displacement

- Needed Overall Neighborhood Improvements (Transit Access in a Transit Desert)
- Necessary Infrastructure (Physical Infrastructure of RLE)



- What happens to the displaced residents?
- Where will they potentially relocate?
- Will the new locations provide the residents with similar transit access and amenities as would the Red Line Extension?



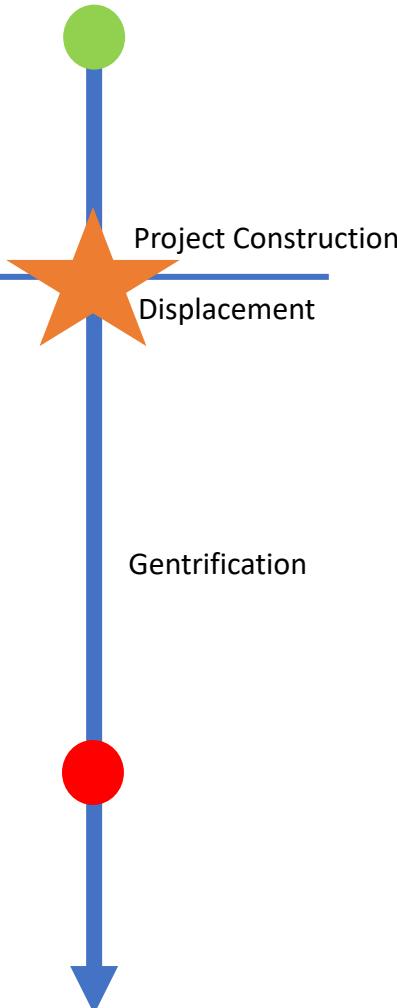
Aim: Predict Residential Relocation Choices of future Displaced Residents

Residential Mobility



-
- How do we deal with TODs in terms of resident displacement?
 - Do we have an accurate way to calculate the costs of displacement?

Literature: Transit-Induced Gentrification/Displacement



- Ex-ante: Potential Outcomes
 - Lopez & Greenlee (2016)
- During: Infrastructure Construction
 - Eminent Domain: (Fullilove & Wallace, 2011; Pritchett, 2003; Zuk et al, 2017)
 - Physical Displacement through infrastructure construction
 - Making way for further developments
- Ex-post: Gentrification/Displacement
 - Post-developments (Baker & Lee, 2017; Dong, 2017; Kahn, 2007)
 - Little help for residents already displaced

The Need for Anticipating Adequate Spaces of Relocation for the Displaced

Predict potential location choices for transit displacees

Analyze such locations as they relate to their current neighborhood conditions with the transit upgrade

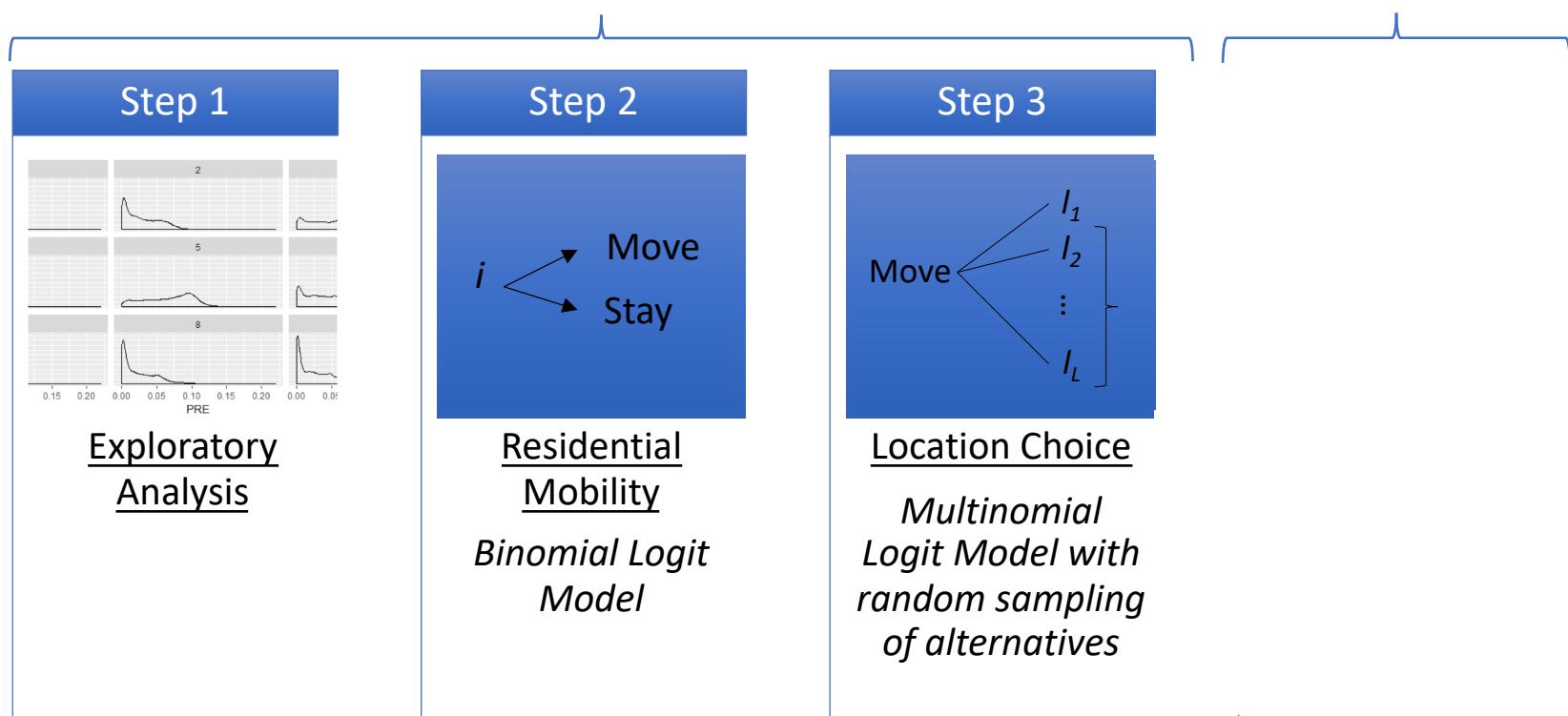
Method

- Multi-step process to model housing choices and use them as the base for forecasting

STAGE 1

- Exploratory analysis of how does RM and LC works in the city
- Baseline to forecast location of future displacees

STAGE 2



Residential Mobility

- Households decide between moving or staying w.r.t.

$$\Pr_{nm} = \Pr(U_{nm} > U_{ns}) = \Pr(U_{nm} - U_{ns} > 0)$$

- \Pr_{nm} : Prob. Household n moves (m)

$$\Pr_{nm} = \Pr(V_{nm} + \varepsilon_{nm} > V_{ns} + \varepsilon_{ns}) = \Pr(V_{nm} - V_{ns} > \varepsilon_{ns} - \varepsilon_{nm})$$

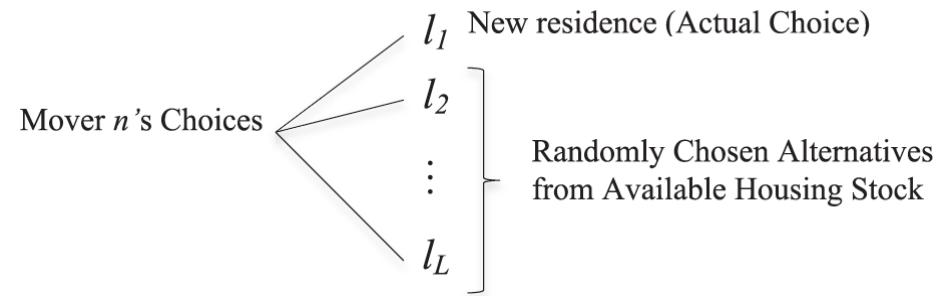
$$\Pr_{ns} = \Pr(V_{ns} + \varepsilon_{ns} > V_{nm} + \varepsilon_{nm}) = \Pr(V_{ns} - V_{nm} > \varepsilon_{nm} - \varepsilon_{ns})$$

- $U_{nm} = V_{nm} + \varepsilon_{nm}$: Hhld utility is observed and non-observed

Logit Model

$$\begin{aligned}\Pr_{nm} &= \exp^{V_{nm}} / (\exp^{V_{nm}} + \exp^{V_{ns}}) \\ &= \exp^{\beta' X_{nm}} / (\exp^{\beta' X_{nm}} + \exp^{\beta' X_{ns}})\end{aligned}$$

Location Choice



- Households decide for a house between a set of alternatives w.r.t.

$$U_{nlt} = V_{nlt} + \varepsilon_{nlt}$$

- Which derives in a multinomial logit

$$\Pr_{nlt} = \exp^{V_{nlt}} / \left(\sum_{j=1:L} \exp^{V_{njt}} \right) = \exp^{\beta t_i X_{nlt}} / \left(\sum_{j=1:L} \exp^{\beta t_i X_{njt}} \right)$$

- This provides an assessment of how households – conditional on their characteristics , dewilling and neighborhood characteristics, choose a particular property.

Forecasting Location choices

- Residents about to be displaced are looking at the available housing stock in time t , in order to choose a house to live in $t+1$.
- We used the estimated parameters from the MNLM, together with the housing stock C_t , to calculate the level of utility a particular house could provide an individual i

$$V_{nlt} = \beta_T' X_{nlt}, \text{ for all } l = \{1, \dots, L\} \text{ and } t = T + 1$$

- Now all 10 alternatives are randomly sampled from the available housing stock (housing sales/rent postings)
- Bootstrap: We repeated the MNLM and the forecasting 500 times to get C.I.s

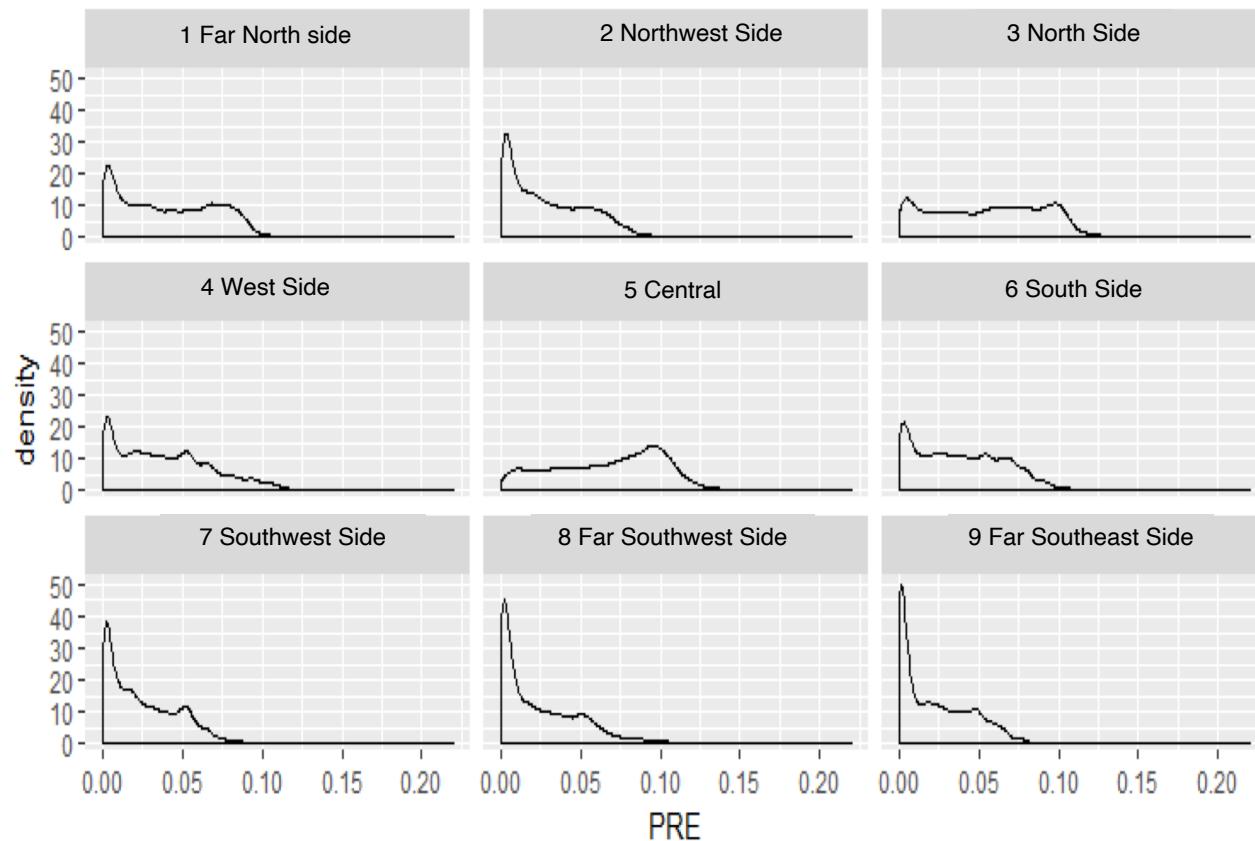
Data: Residential Mobility

- *Source:* InfoUSA – USPS (US Postal Service)
- *Description:* Addresses and Names of residents
 - Address changes between years
- *Time frame:* 2014-2015
- *Spatial reference:* City of Chicago, IL
- *Unit of Analysis:* Household
- *Variable Groups:*
 - Identification [familyid, houseid, address]
 - Demographics [age, size, length of stay, No. Kids, etc.]
 - Financial Variables [income, purchase power]

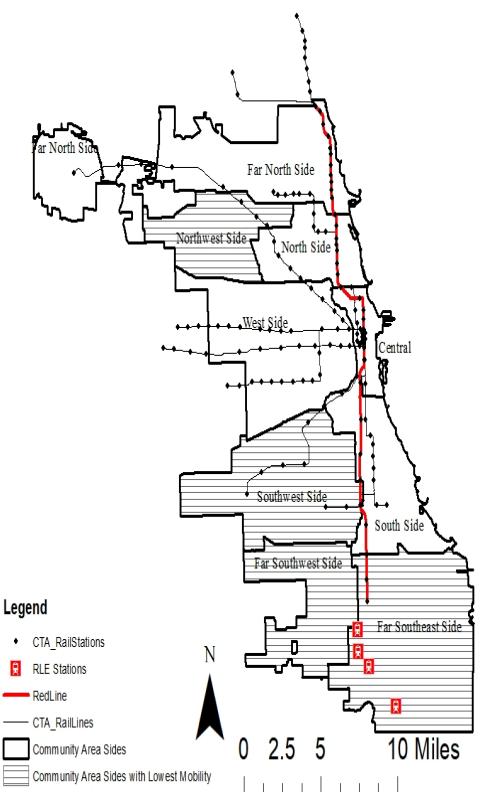
Complementary Data

- House Sales
 - Type: Assessor and historic files
 - Time frame: 2014-2015
 - Variables: Price, Size, Features, Location, PIN.
- Neighborhood (census tracts) characteristics
 - Distance to HRS and parks
 - Income, income per-capita
 - Crime rates
 - % of Renters, Rental Vacancy, Ethnicities, etc.
- Zillow postings
 - May-July 2017

Residential Mobility:



Dependent variable:	
	move
owner	-0.101 (0.015)***
married	0.125 (0.014)***
length_of_res	-0.136 (0.001)***
childrenhhcount	0.156 (0.014)***
SingleFam	-0.231 (0.015)***
hhincome	0.001 (0.0001)***



Note:

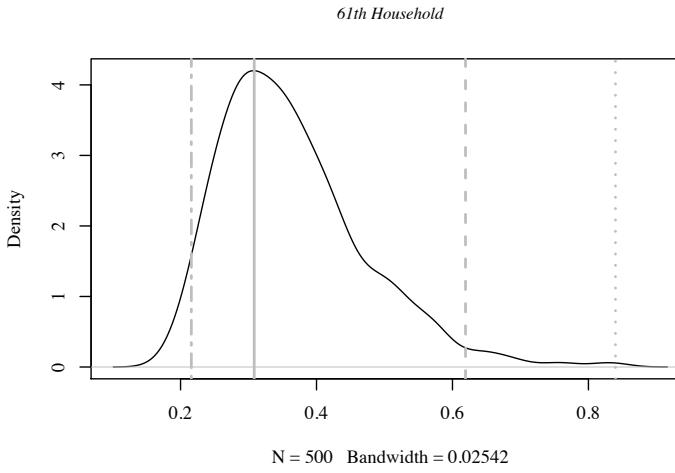
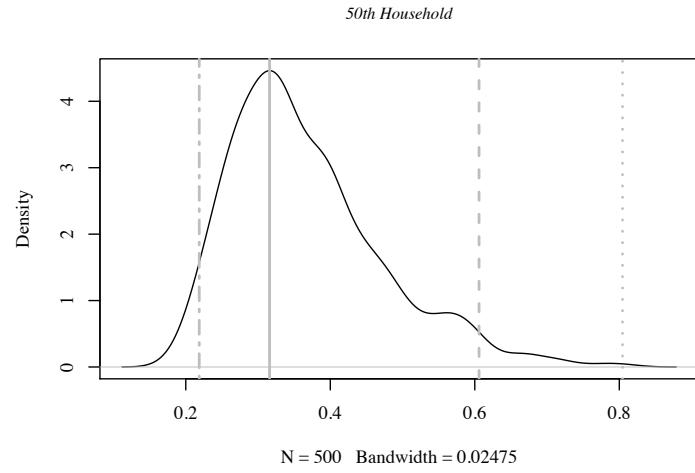
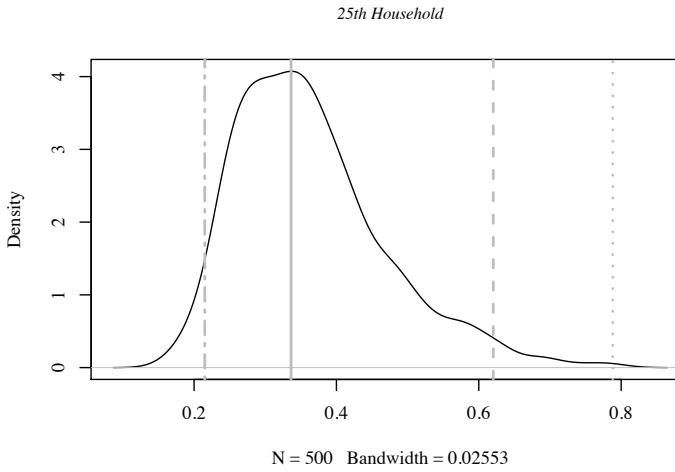
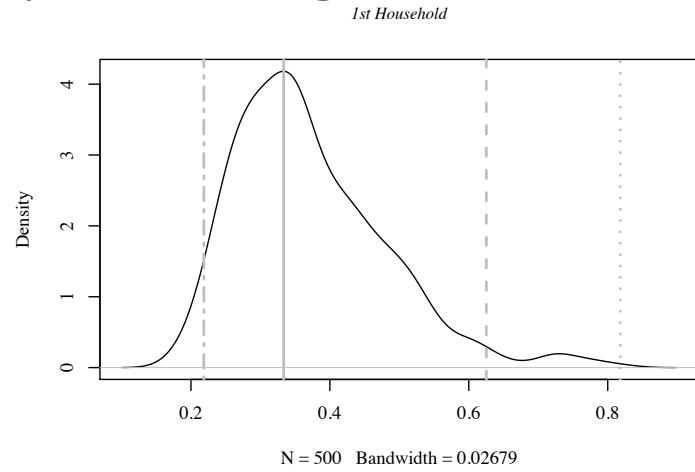
*p<0.1; **p<0.05; ***p<0.01

Forecasting Locations

- Algorithm
 - For each future displacee, build a set of 10 randomly chosen alternatives out of Zillow postings
 - Choose a baseline MNLM estimation
 - Calculate the Predicted Utility Levels that each house gives to each household
 - Market Clearing (FCFS)
 - Repeat 500 times
- Modelling Choices
 1. Use the whole city of Chicago
 2. Restrict only to the southside
 3. Restrict to the most likely destinations

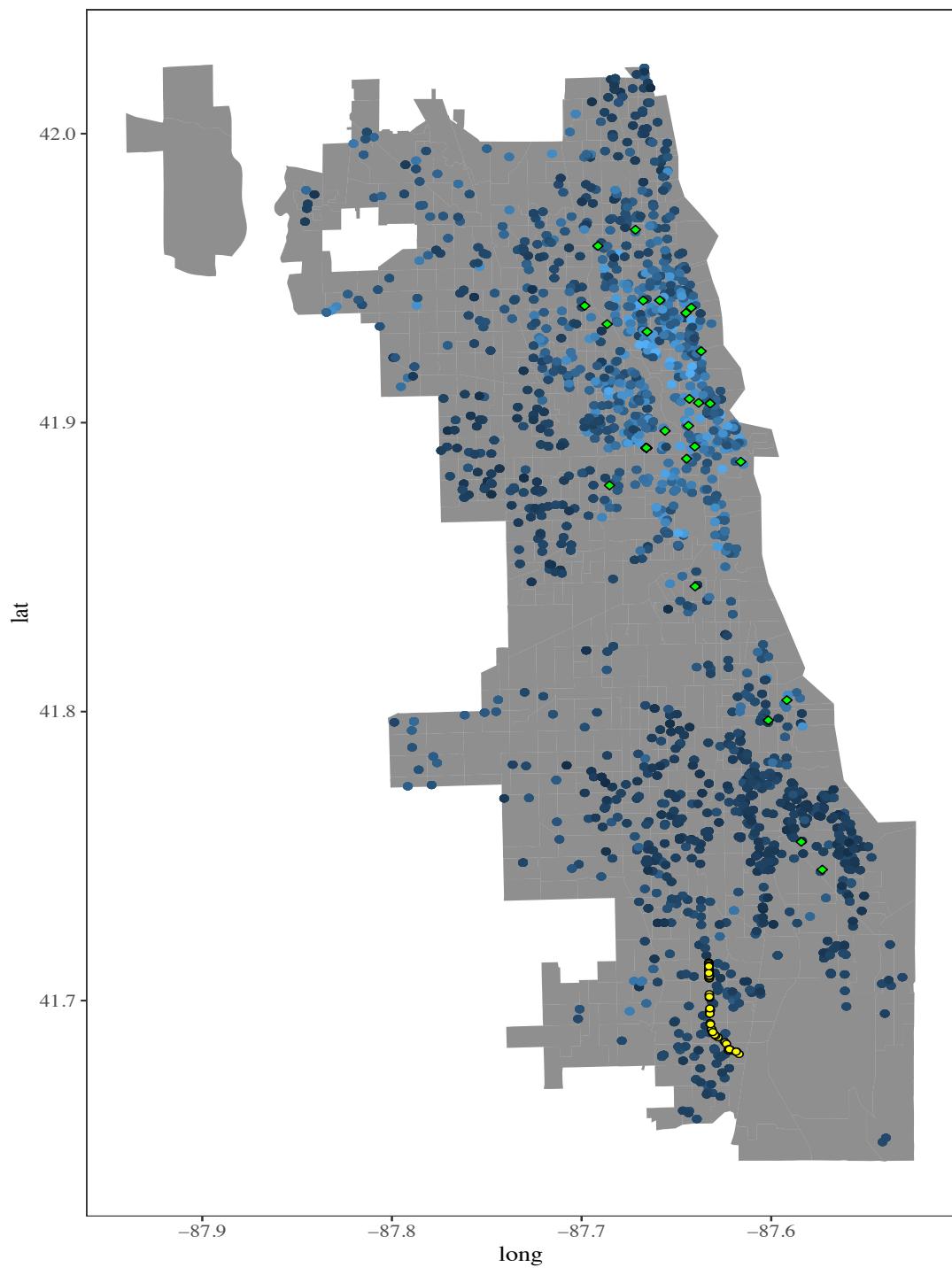
Forecasting MNLM Location Choices for displaces

City of Chicago



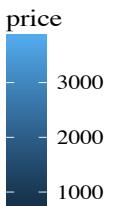
— Lower Bound 95% CI — Most Frequent — Upper Bound 95% CI ··· Maximum

Highest Predicted Choice (500 replications) City of Chicago

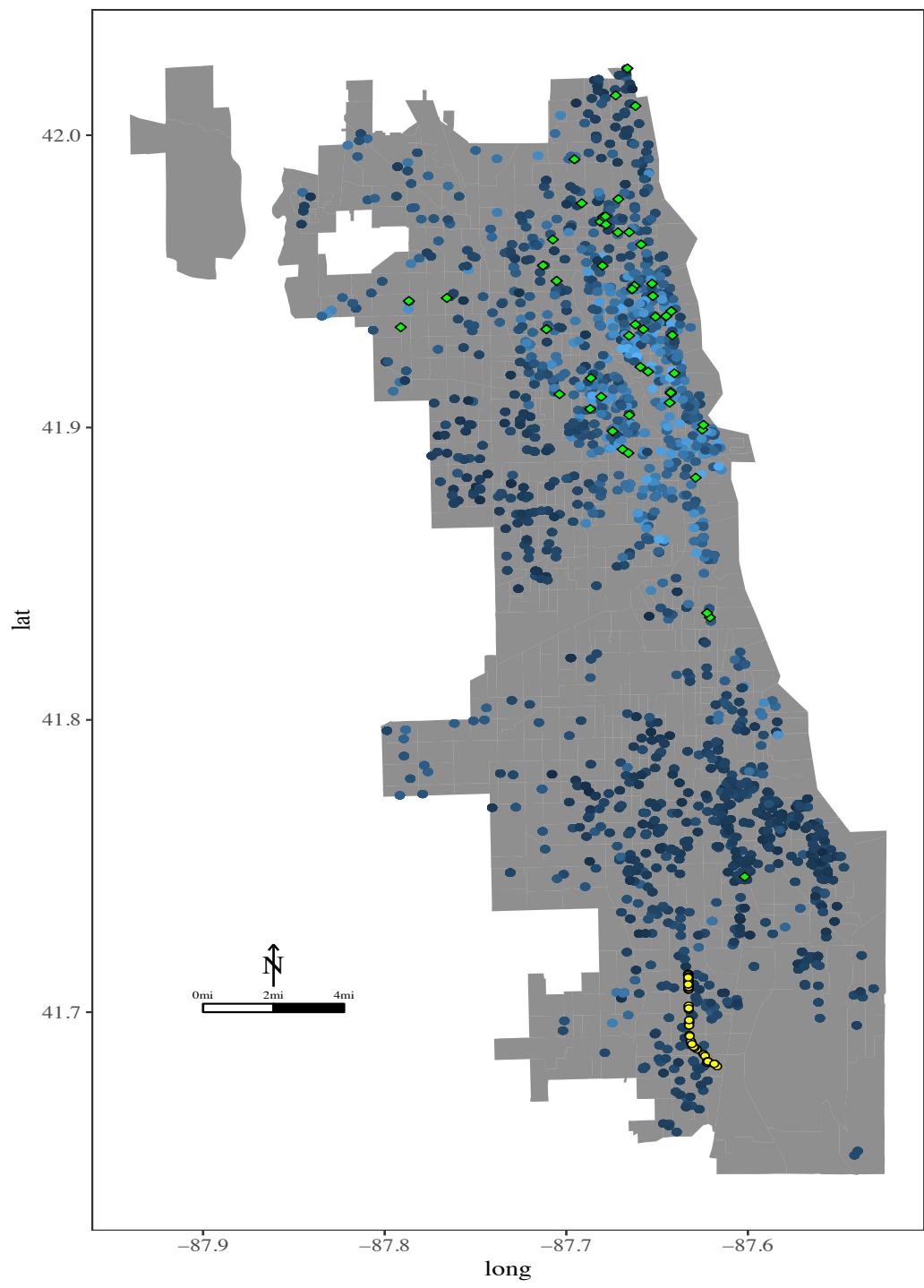


Red Line
Highest Predicted Choice

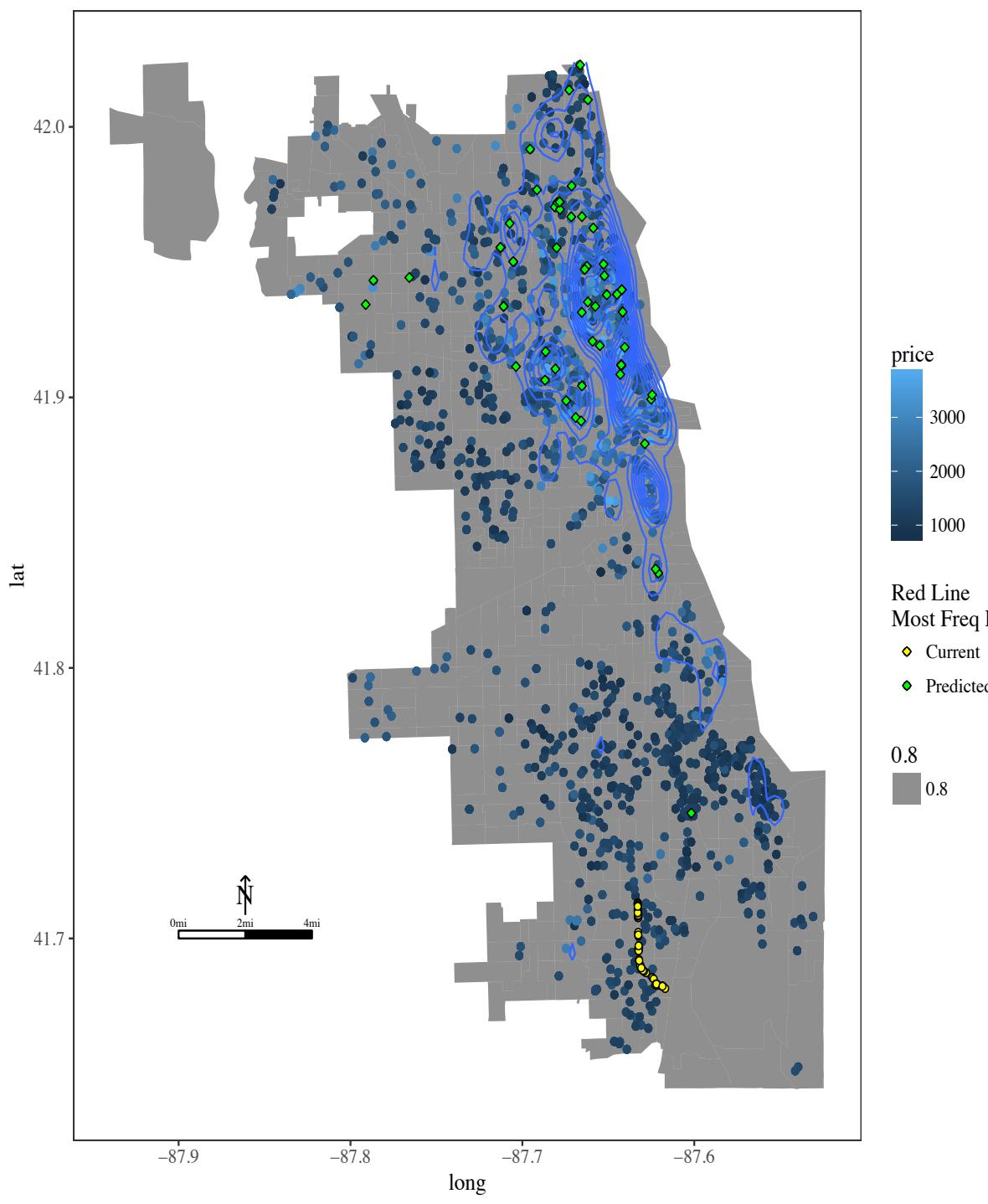
- ♦ Current
- ♦ Predicted



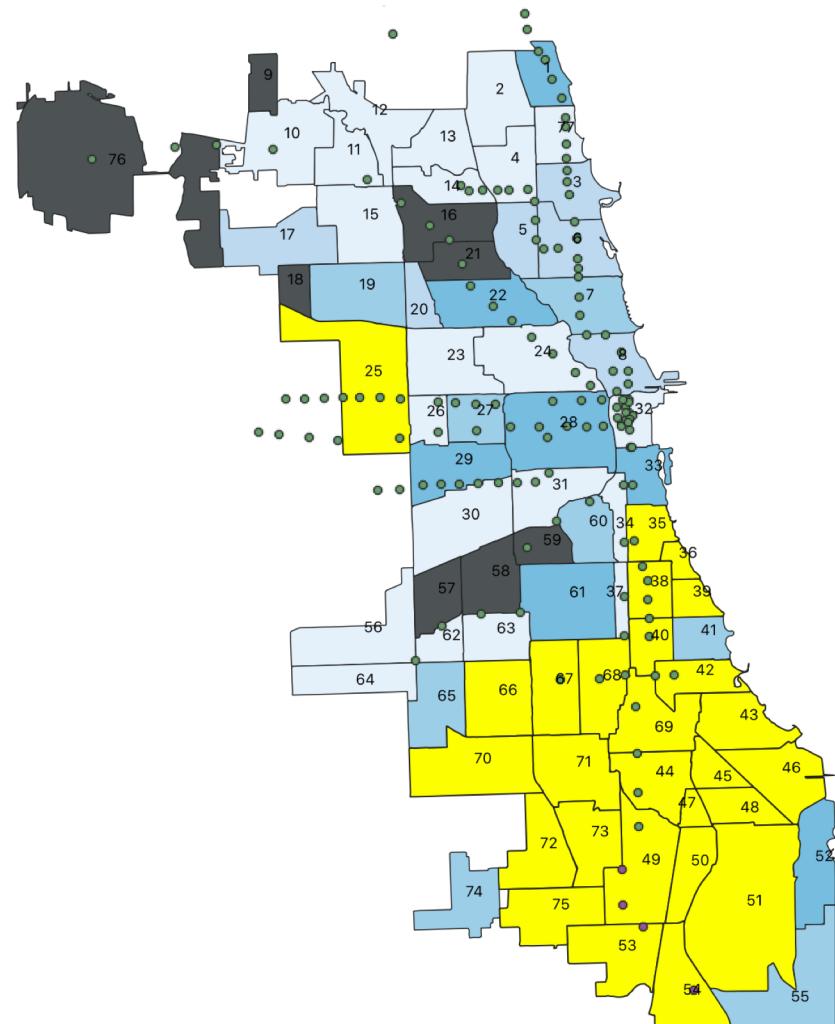
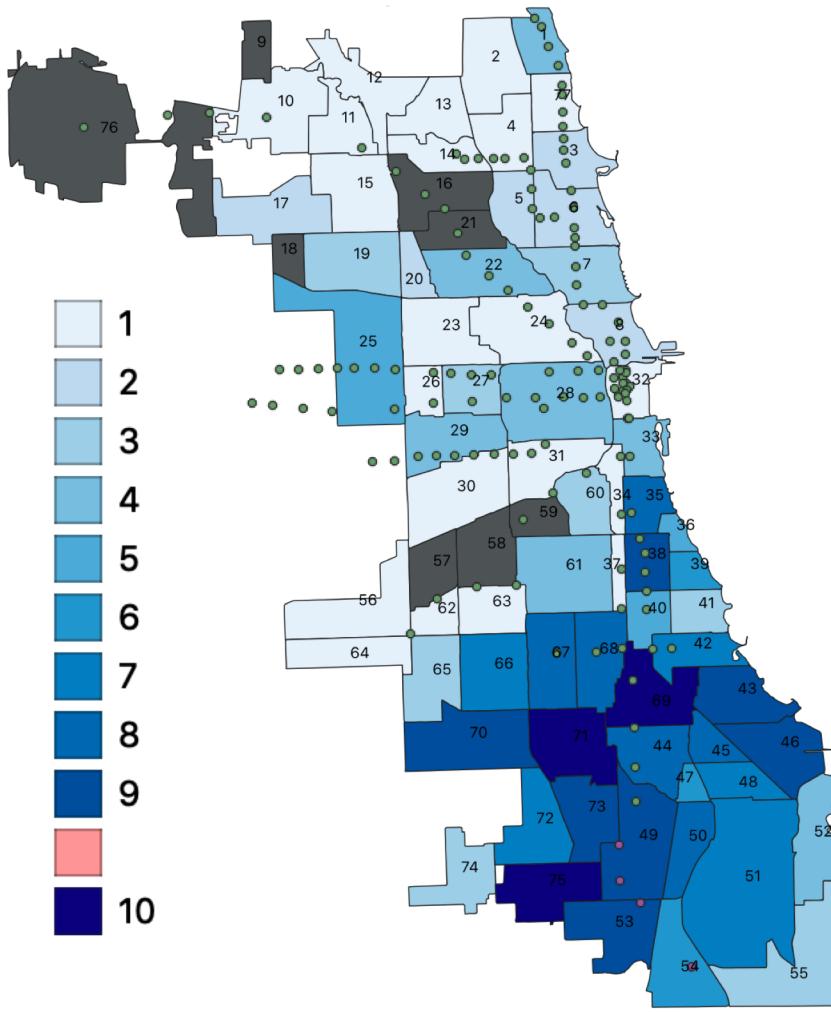
Most frequent Predicted Choice (500 replications) City of Chicago



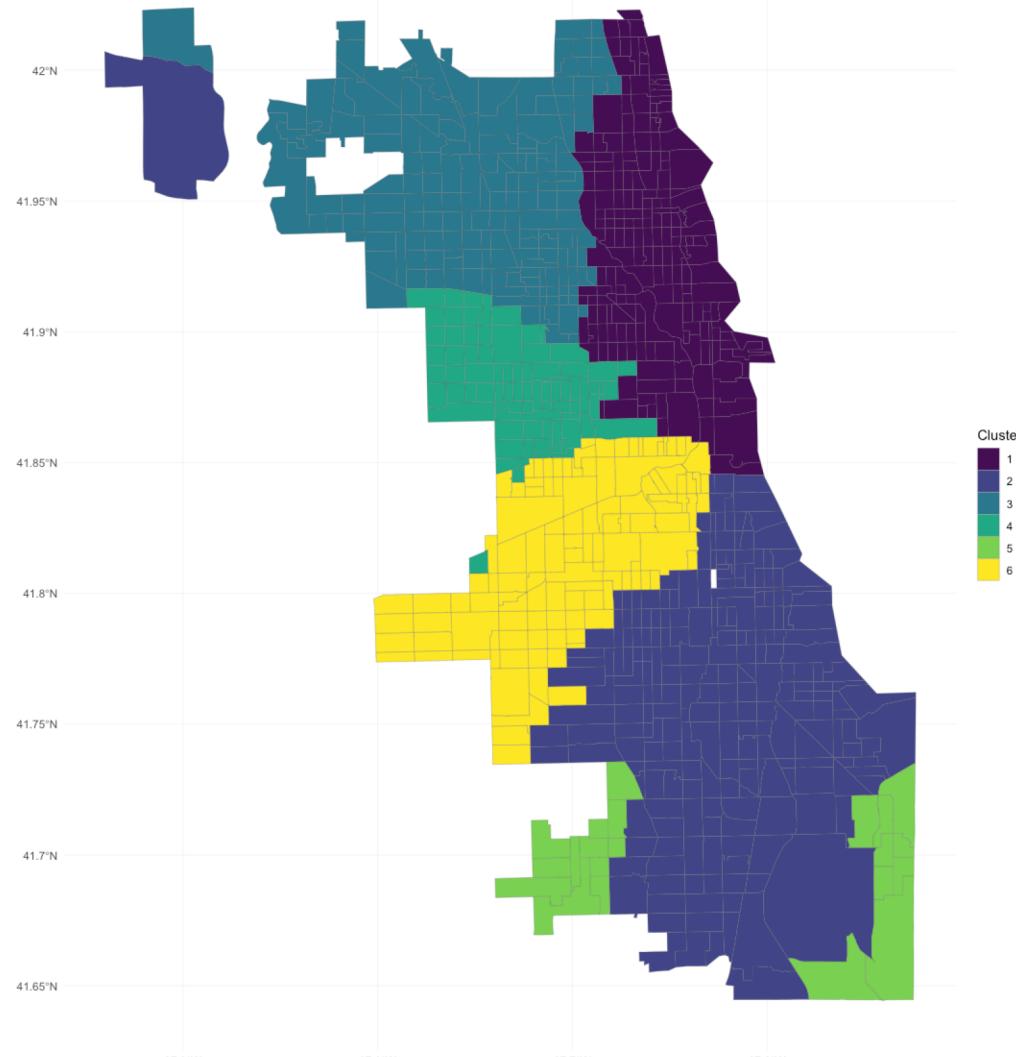
Spatial Density of Predicted Choices (500 replications) City of Chicago



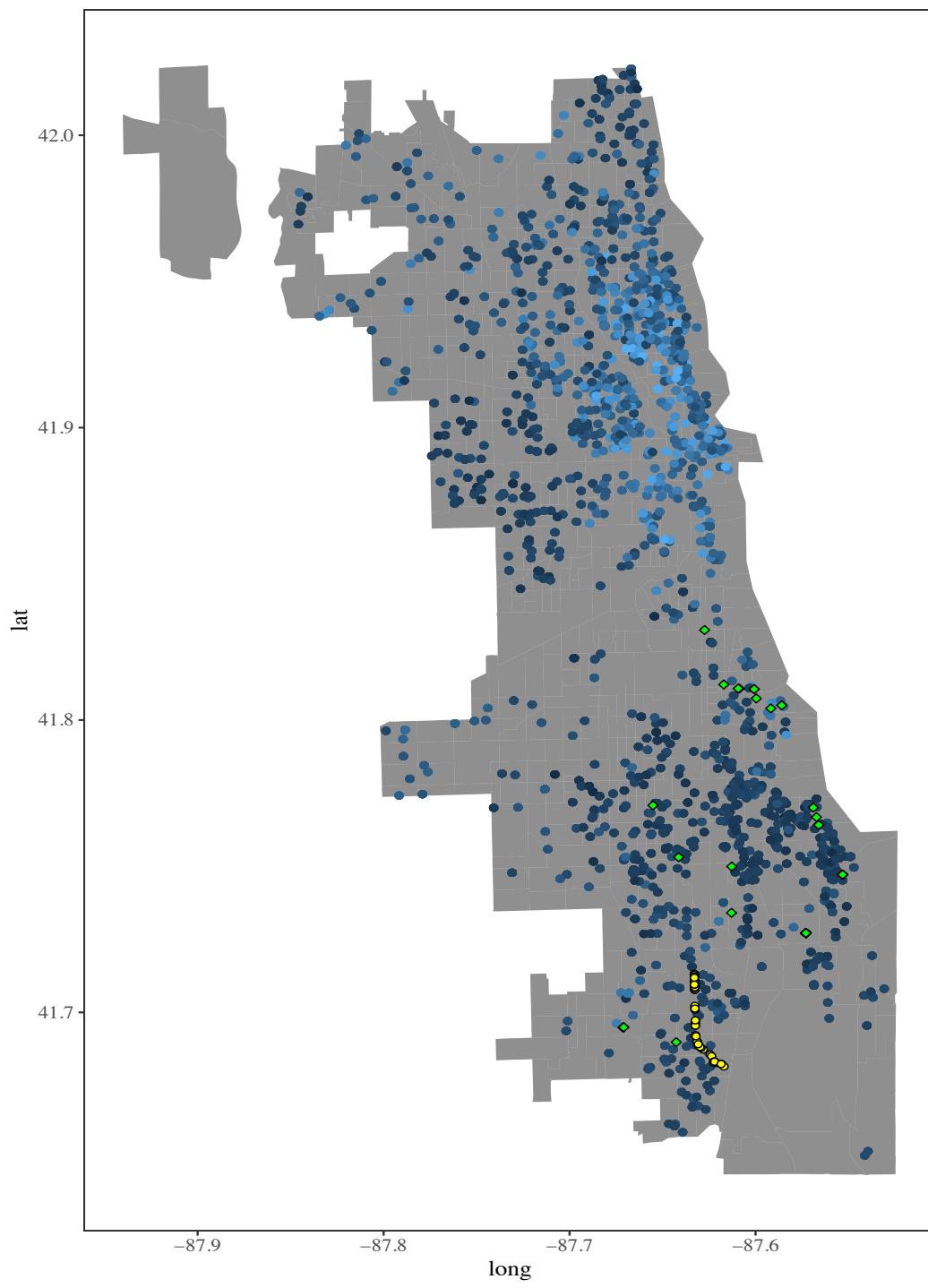
2014-2015 Residential mobility of the neighboring CAs to the Red Line extension



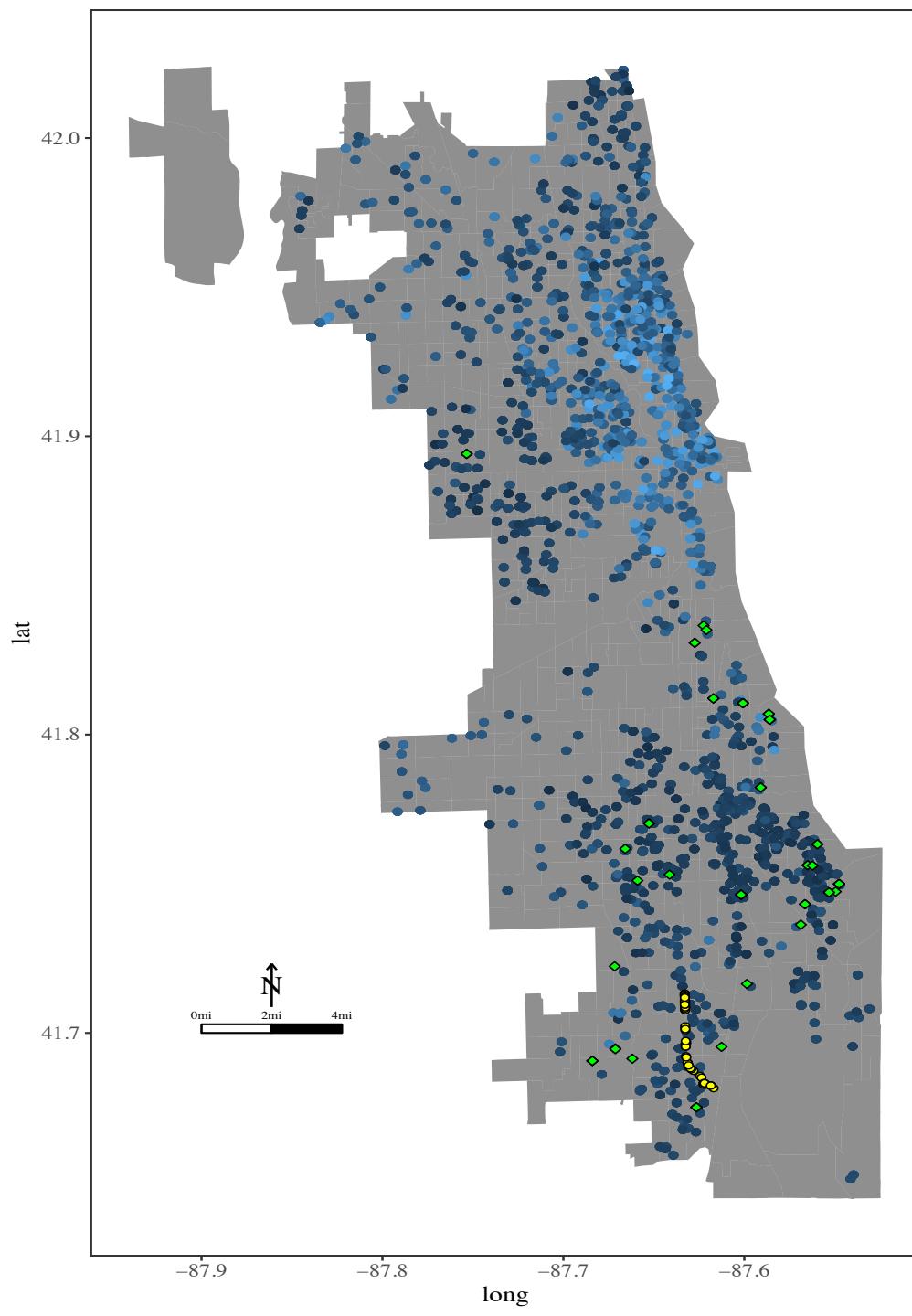
Clusters based upon the share of movers between tracts



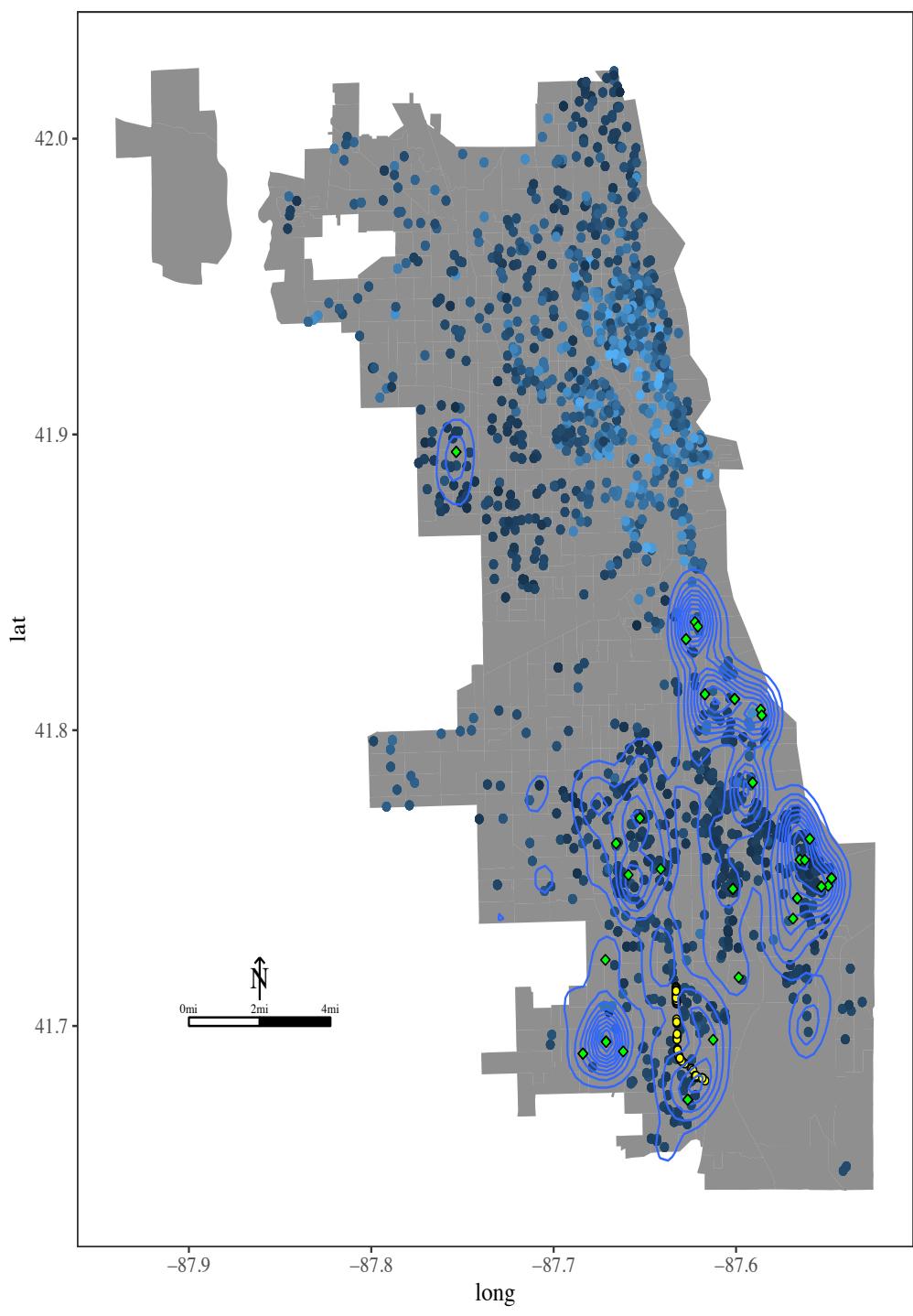
Highest Predicted Choice (500 replications) Option 3



Most frequent Predicted Choice (500 replications) Option 3



Spatial Density of Predicted Choices (500 replications) Option 3



price
3000
2000
1000

alpha
0.8

Red Line
Most Freq Predicted Choice

- ◆ Current
- ◆ Predicted

Current vs. Predicted Household situation

	Current	Highest Probability	Highest Frequency	Median (p50)	Lower (p2.5)	Upper (p97.5)
<i>Neighborhood Level Characteristics</i>						
Median Income	29,138.77	49,086.33	41,505.43	37,879.02	38,211.84	38,373.57
Owner Occupied	0.548	0.697	0.419	0.427	0.465	0.428
Home Value	88,095.08	178,927.90	163,309.80	164,778.70	153,121.30	157,060.70
HHs with Children	0.376	0.263	0.299	0.318	0.319	0.32
Married HHs	0.248	0.252	0.252	0.229	0.238	0.231
Heavy Rail Commuters	0.033	0.021	0.052	0.043	0.067	0.052
POV Commuters	0.745	0.706	0.574	0.576	0.586	0.585
0 Vehicle HHs	0.147	0.146	0.182	0.196	0.19	0.198
Black	0.843	0.885	0.774	0.8	0.8	0.827
Latino/a	0.128	0.028	0.053	0.07	0.067	0.059
<i>Household Level Characteristics</i>						
disGroceries	0.279	0.184	0.342	0.349	0.361	0.323
disParks	0.379	0.375	0.225	0.255	0.237	0.238
disSchools	0.251	0.167	0.244	0.246	0.25	0.23
disCTArail	1.835	2.32	1.955	1.749	1.599	1.667
disPrevious Residence	0	4.482	5.863	5.434	5.454	5.385
Rent: Predicted Choice	0	1,900.08	2,034.64	1,679.25	1,924.56	1,747.38

Further Steps

1. Restrict the randomization of alternatives
 - Choose specific alternatives by sections of the housing price distribution
2. Explore accuracy gains
 - Counterfactual predictions with previous years
 - Expand beyond single parametric estimation
 - Spatial probit models
 - Individual's specific logit estimations
 - Machine learning, random forests, etc.
3. Field work
 - Survey current residents about their housing preferences and beliefs about their future location.

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