Minimum Lot Size and Segregation in Connecticut

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Camp Resources XX

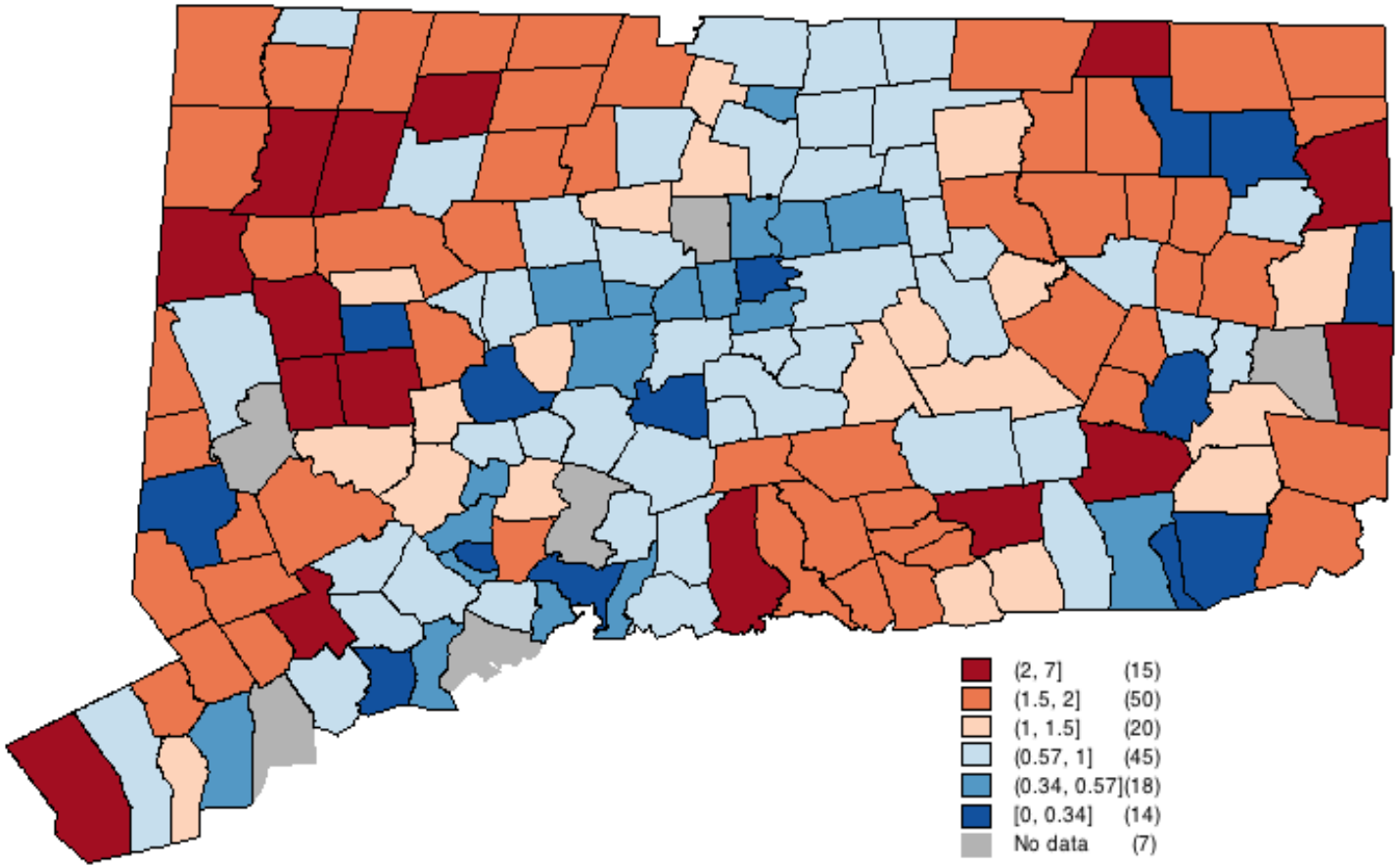
History of zoning policies

- Rapidly developed in the 1910-1930
- Development of the interstate highway system in the 1960s made people more mobile
- Zoning policies were then widely adopted in order to prevent undesired development and became more exclusionary in the 1970s

Policy of minimum lot size

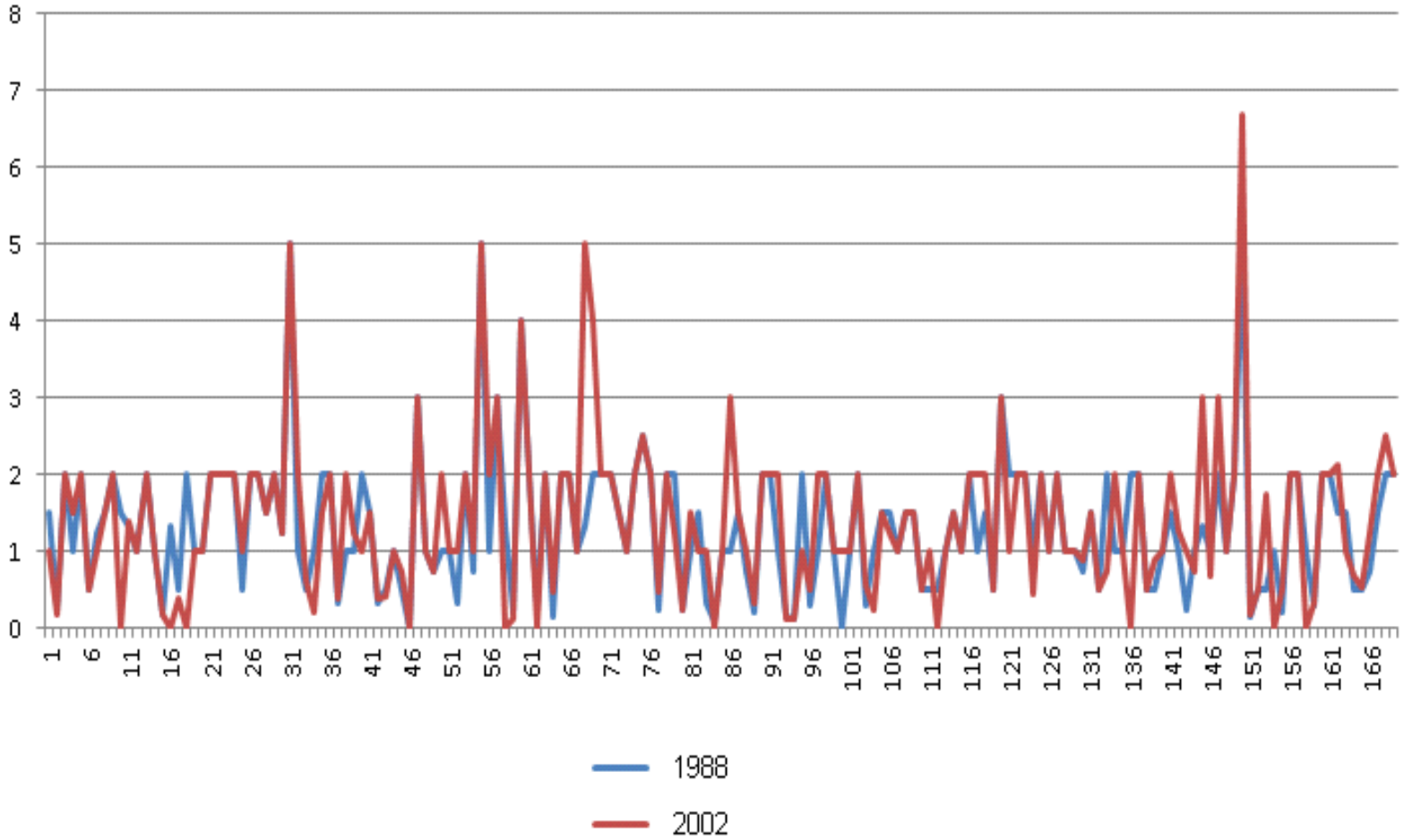
- Help minimize the negative externalities of groundwater use. In the United States, over 15 million households depend on private wells for drinking water supply.
- Improve amenities, and believed to preserve home values
- Reduce negative tax externalities
- Distort free market
- Sorting out 'less desirable' people including the poor or ethnic minorities

Minimum Lot Size

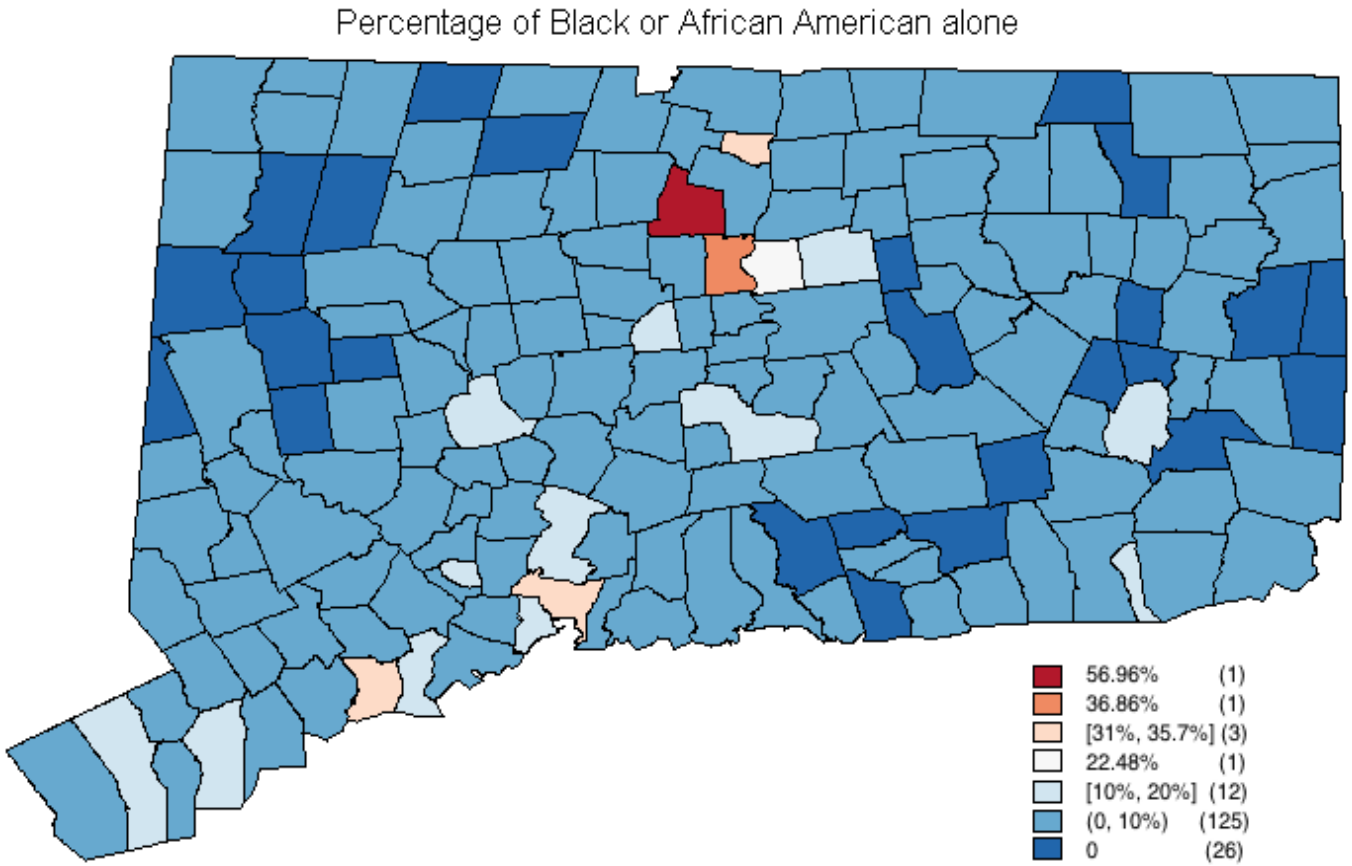


Washington in Litchfield county has minimum lot size 6.67 acres.

Minimum Lot Size

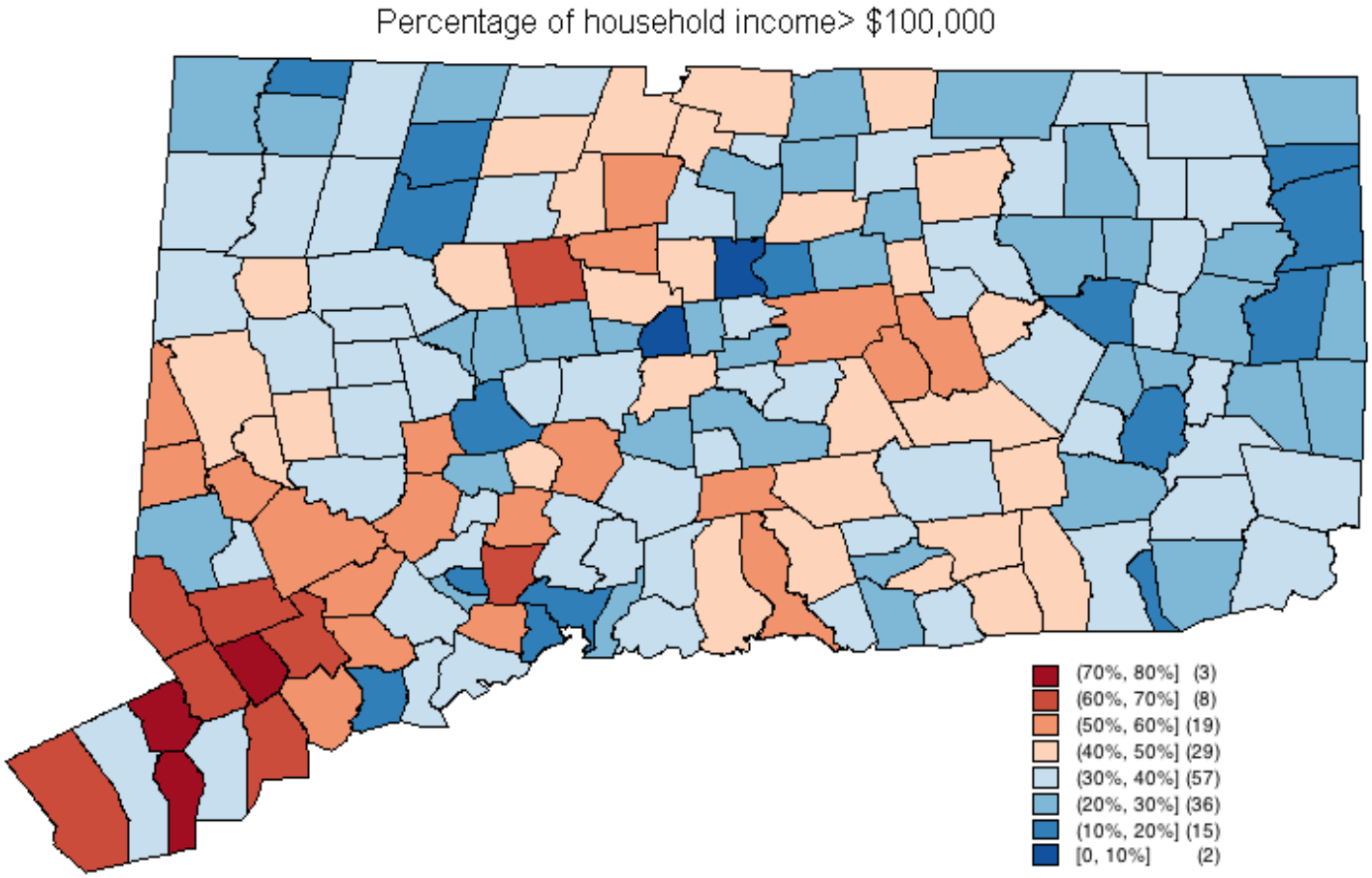


Status of Racial Segregation in Connecticut



Note: first 10 towns have 64% population of black or African American alone. The highest town is Bloomfield in Hartford county, with 57% black population

Status of Income Segregation in Connecticut



Note: the first three towns are Western, Darien and New Canaan, all in Fairfield county, with more than 70% of household income great than $100,000.

Literature background

- Zoning could cause higher housing prices (Glaeser and Gyourko, 2003)
- Housing Demand and Racial Segregation (Bajari and Kahn, 2005)
- Racial Segregation with BLP (Bayer et al., 2004)
- Impact of Minimum Lot Size on housing price (Dalton and Zabel, 2011)

Research outline

- Objective: to find out if minimum lot size policy contributes to racial or income segregation
- Methodology: to isolate impact of policies in a housing demand model

Model

$$V_i = V_i(h, c) \tag{1}$$

s.t.

$$price_h + c \leqslant Y_i \tag{2}$$

$$V_{khl} = \sum_{m=0}^{M} \alpha_m^k X_{hm} + \sum_{n=0}^{N} \beta_n^k Z_{ln} - price_h + \eta_{kl} + \epsilon_{hkl} \tag{3}$$

- k: type of buyer by race and income
- h: house
- X: house characteristics including number of room, bathroom, bedroom, built year, interior size, lotsize
- Z: neighborhood characteristics including minimum lot size, percentage of type k, travel time to work, town average expenditure

- More specific model

$$V_{khl} = \alpha_1^k intersize_h + \alpha_2^k lotsize_h + \alpha_3^k builtyears_h + \delta_{kl} - price_h + \epsilon_{hkl} \tag{4}$$

in which:

$$\delta_{kl} = \sum_{n=0}^{N} \beta_n^k Z_{ln} + \eta_{kl} \tag{5}$$

- Two-step estimator
  - First-step: Generalized logit model with fixed effect and contraction mapping
  - Second-step: Decompose δ_{kl}

First-step estimation

- Equilibrium condition

$$V_{khl} > V_{whl} \qquad \forall w \neq k \tag{6}$$

- MLE

$$\max L = \sum_{l} \sum_{h} \sum_{k} ln(Prob_{khl}) I_{khl} \tag{7}$$

- Market clear

$$\frac{\partial L}{\partial \delta_{kl}} = N_{kl} - \sum_{h} Prob_{khl} = 0 \quad \forall l \tag{8}$$

- Contraction mapping

$$\delta_{kl}^{t+1} = \delta_{kl}^{t} - ln(\frac{\sum_h Prob_{khl}}{N_{kl}}) \tag{9}$$

Second-step estimation

$$\delta_{kl} = \sum_{n=0}^{N} \beta_n^k Z_{ln} + \eta_{kl} \tag{10}$$

- Similar to minimum wage problem?
- Problem of truncated data or censored data?
- Problem of bias selection and need Heckman correction?
- Isolation of policy impact of minimum lot size

$$X_h = MLS_l + \xi_h \tag{11}$$

Main Dataset

- Housing transaction data in Connecticut collected by DataQuick
- Loan application registry information under the Home Mortgage Disclosure Act (HMDA)
- Survey data of minimum lot size regulations for 162 Connecticut towns
- Fiscal Indicators by Office of Policy and Management of Connecticut
- American Community Survey by U.S. Census Bureau

Summary statistics

Variable	Obs.	mean	Std. Dev	Min	Max
nroom	11269	6.77	1.70	2	18
nbath	11269	1.90	0.81	0.5	7
nbed	11269	3.18	0.88	0	9
intersize	11269	1620.94	1132.25	0	67410
lotsize	11269	36928.95	57888.48	1	1383466
age	11254	47.83	33.29	0	309
income (thousand $)	10857	114.64	170.88	5	7500
min lot size	162	1.46	1.01	0	6.67
expenditure (thousand $)	169	2949.69	600.71	1524.34	6209.00
travel	169	12.57	2.24	7.59	18.53

Table: Type definition of buyers

Type	Race	Household income	Obs.
1	White	[0, 59,999)	2545
2	White	(60,000, 99,999]	2839
3	White	[100,000, ∞)	2854
4	Black	[0, 59,999)	243
5	Black	(60,000, 99,999]	150
6	Black	[100,000, ∞)	47
7	Others	[0, 59,999)	813
8	Others	(60,000, 99,999]	812
9	Others	[100,000, ∞)	966

First-Step results

Table: Model 1

Type	Var 1	Estimate	ProbChiSq	Var 2	Estimate	ProbChiSq	Var 3	Estimate	ProbChiSq
1	interior size	0.000173	<.0001	lot size	2.80E-06	<.0001	built	0.00363	<.0001
2	interior size	0.000436	<.0001	lot size	5.39E-06	<.0001	built	-0.0021	<.0001
3	interior size	0.000955	<.0001	lot size	8.86E-06	<.0001	built	-0.00387	<.0001
5	interior size	0.000467	<.0001	lot size	4.71E-06	<.0001	built	-0.00322	<.0001
6	interior size	0.000286	<.0001	lot size	3.37E-06	<.0001	built	-0.00663	<.0001
7	interior size	0.000305	<.0001	lot size	4.02E-06	<.0001	built	-0.0008	<.0001
8	interior size	0.000549	<.0001	lot size	4.65E-06	<.0001	built	-0.00602	<.0001
9	interior size	0.00109	<.0001	lot size	5.71E-06	<.0001	built	-0.0122	<.0001
other									
price		1							
δ_{kl}		Yes							

Second-step results: preliminary

Variable	Type	Model 1	$Pr > \|t\|$	model 2	$Pr > \|t\|$	Model 3	$Pr > \|t\|$	Model 4	$Pr > \|t\|$
MLS	1	0.18	0.5199	1.86***	<.0001	2.37***	<.0001	4.83***	<.0001
MLS	2	0.67***	0.0072	2.84***	<.0001	2.95***	<.0001	10.37***	<.0001
MLS	3	2.26***	<.0001	6.97***	<.0001	3.97***	<.0001	18.80***	<.0001
MLS	4	0	1	0	1	0	1	0	1
MLS	5	0.73	0.6872	3.51	0.2379	6.13*	0.028	11.96***	<.0001
MLS	6	-0.14	0.9701	3.03	0.6136	1.25	0.8248	10.74*	0.0376
MLS	7	0.77	0.1954	3.28***	0.0007	3.72***	<.0001	6.48***	<.0001
MLS	8	1.34***	0.0089	4.42***	<.0001	5.38***	<.0001	11.99***	<.0001
MLS	9	-2.49***	<.0001	0.38	0.6942	0.55	0.551	12.62***	<.0001
travel res		Yes		Yes		Yes		Yes	
expenditure		Yes		Yes		Yes		Yes	
type%		Yes		Yes		Yes		Yes	
obs.		10304		10304		10045		10045	
R-square		0.67		0.73		0.71		0.93	

Second-step results: preliminary

	Percentage of each type								
Type	1	2	3	4	5	6	7	8	9
1	-7.15***	-25.31***	4.72***	-26.51***	-26.62***	12.65**	-11.09***	-35.22***	69.58***
2	-13.49***	-39.05***	10.4***	-36.17***	-9.21***	-3.48 ***	-17.79***	-8.79***	82.29***
3	-19.11***	-94.81***	16.76***	-78.56***	-29.06***	97.37	-5.96 ***	154.43**	111.90***
4	0	0	0	0	0	0	0	0	0
5	-12.74	-61.51	12.16	-14.26	-131.66	184.84**	-29.52	100.76	-32.80
6	9.57	-70.48	6.3	-68.24	-176.83	582.83**	3.28	-76.13	-5.27
7	-5.2***	-49.99***	2.06***	-38.86***	-41.84***	76.78	-15.81***	3.48	59.83***
8	-9.48	-47.61***	8.32***	-27.61***	-45.99***	87.14	-28.08***	6.78***	94.01***
9	5.17	-98.36***	9.94	-39.18*	-236.49***	274.41***	-16.35	77.89**	-2.91

Note: ***p<0.01 ** p<0.05 * p<0.1

Conclusion

- The highest demand for policy of minimum lot size is white with high income
- Higher income group attracts people; Higher income black shows very strong signal of attracting his own type; Low income group distracts people and Black low income group distracts more
- Warning: very preliminary The minimum lot size contributes 19% of segregation.

Further work

- More model specifications
- Sensitivity analysis
- Collect more detailed spatial data for minimum lot size
- Collect more detailed time series data for minimum lot size
- Collect more detailed spatial data for neighborhood