Land Use Restrictions and Segregation

The Effect of Single-Family Zoning in Austin

Noah J. Case

Vassar College

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Background

- Expenditures on housing make up more than one-third of annual consumer spending in the United States (Bureau of Labor Statistics 2022, Table B).
- Blacks and Hispanics spend an even higher proportion of their incomes on housing than do Whites, despite being likelier to live in multi-family housing (Harvard JCHS 2017; Harvard JCHS 2011)
- Many point to zoning as a cause of high housing costs, because it diminishes the available quantity of housing (Quigley and Raphael 2004, page 205).
- Zoning has macroeconomic consequences, because it channels economic activity further from centers of agglomeration (Hsieh and Moretti 2019).

Research Questions

- Does single-family zoning cause segregation?
- What is the mechanism? People of color are poorer than Whites, but does that explain racial segregation?
- Are there heterogeneities in the relationship between zoning and segregation?
- How segregated would US cities be without zoning?

Hypothesis

Single-Family zoning causes segregation by diminishing the quantity of housing available.

- Zoning is the set of laws and regulations that determine what type of housing can be built and in what quantities. Zoning varies within and across cities. I study variation in zoning within one city.
- Segregation, for my purposes, is when there are significant differences in the racial composition of adjacent census blocks on either side of a zoning boundary.
- Zoning functions as a decrease in housing supply.
- I explore various mechanisms, such as income, preferences, and signalling.

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Zoning Literature

- Seminal Coase (1960) paper on externalities.
  - Externalities are resolved if there are complete property rights and frictionless bargaining.
- Fischel (1975) book *The Economics of Zoning Laws*.
  - Zoning is an incomplete assignment of property rights, so the externalities are not resolved.
- Resseger (2022) paper on zoning and segregation in Boston.
  - Permitting multi-family housing by right increases integration.

Measuring Segregation I

I take advantage of the rich literature of nuanced segregation measures:

- Herfindal-Hirshman Index (1950)

$$\text{HHI} = \sum_{i=1}^{n} \left(\frac{\text{Population}_i}{\text{Population}} \right)^2 \tag{1}$$

- Dissimilarity Index (Jahn, Schmid, and Schrag 1947)

$$D = \frac{1}{2} \sum_{i=1}^{N} \left| \frac{\text{White}_i}{\text{White}_{total}} - \frac{\text{non-White}_i}{\text{non-White}_{total}} \right| \tag{2}$$

Measuring Segregation II

- Exposure Index (Blau 1977)

$$E = \sum_{i=1}^{n} \left(\frac{\text{non-White}_i}{\text{non-White}_{total}} \right) \left(\frac{\text{White}_i}{\text{Population}_i} \right) \tag{3}$$

- Entropy Index (White 1986)

$$H = -\sum_{i=1}^{n} \text{share}_i \log(\text{share}_i) \tag{4}$$

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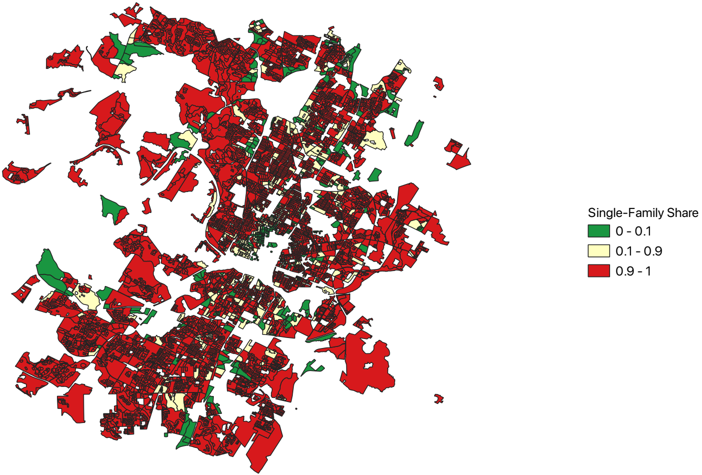
Data

- I use demographic data from the US census for income and race at the census tract- and block-level respectively.
- I use by-address zoning data for all Austin addresses.
- I use the Census Bureau's free batch geocoder service to match addresses to census blocks.
- This allows me to construct a dataset of race, zoning, and income by census block in Austin.

Identification

- I identify the causal effect of zoning on racial makeup by selecting census blocks adjacent to zoning boundaries in Austin, TX.
- This method builds on Resseger (2022) who used a similar method to estimate the segregating effect of zoning in and around Boston, MA.

Map of Austin Census Blocks



Boundary Subset

Summary Statistics

Table: Summary Statistics for Boundary Subset (N=332)

Variables	Mean	Median	SD	Min	Max
Population	228.401	94.000	324.142	3.000	2152.000
Share Non-Hispanic-White	0.505	0.521	0.236	0.000	0.949
Share Black	0.085	0.046	0.120	0.000	0.767
Share Asian	0.067	0.039	0.095	0.000	0.782
Share AIAN	0.012	0.000	0.029	0.000	0.263
Share NHPI	0.001	0.000	0.009	0.000	0.125
Share Other	0.100	0.069	0.110	0.000	0.562
Share Multiracial	0.159	0.135	0.107	0.000	0.875
Share Hispanic	0.288	0.235	0.189	0.000	0.895
Median Household Income	71,150	71,467	25,912	6322	228,929
SF-Zoned Addresses	0.597	0.972	0.483	0.000	1.000
HHI	4655	4399	1447	1562	9007
Entropy Index	0.893	0.918	0.247	0.144	1.451

Limitations

- Multi-family addresses are twice as likely to have no match when I geocode.
- Local Average Treatment Effect problem, similar to other discontinuity designs.
- Generalizability.
- Residual Endogeneity.

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Bivariate Regressions over the Boundary Subset

I regress the white share in each census block on zoning in a naive bivariate regression, first with OLS, and then with Logistic Regression.

$$Y_i = \alpha + \beta S_i + \epsilon_i \tag{5}$$

$$Z_i = \log\left(\frac{Y_i}{1 - Y_i}\right) \tag{6}$$

Results from Bivariate Regressions

Table: Bivariate Regressions, Geographic Discontinuity Design

	Dependent variable:	
	White Share	
	OLS	*Logistic*
	(1)	(2)
Single Family Share	0.082***	0.329***
	(0.026)	(0.106)
Observations	332	332
Adjusted R^2	0.025	
Log Likelihood		−227.197

Note: Robust Standard Errors in Parentheses. *p<0.1; **p<0.05; ***p<0.01

Regressions with Controls

I repeat the regression from the previous slide with controls for block population P_i, neighborhood characteristics (Census Tract FE) $\boldsymbol{B_a}$, and census tract income, W_a. I use OLS and Logistic specifications, but focus on the OLS models.

$$Y_{ia} = \alpha + \beta S_i + \delta P_i + \varphi W_a + \epsilon_{ia} \tag{7}$$

$$Y_{ia} = \alpha + \beta S_i + \delta P_i + \boldsymbol{\gamma} \cdot \boldsymbol{B_a} + \epsilon_{ia} \tag{8}$$

OLS Results with Controls

Table: OLS Estimates with Controls, Geographic Discontinuity Design

	Dependent variable:				
	White Share				
	(1)	(2)	(3)	(4)	(5)
Single Family Share	0.073***	0.071***	0.085***	0.087***	0.066**
	(0.026)	(0.027)	(0.025)	(0.026)	(0.027)
Observations	332	332	332	332	332
Adjusted R^2	0.079	0.029	0.429	0.427	0.080
Income	Y	N	N	N	Y
Population	N	Y	N	Y	Y
Tract FE	N	N	Y	Y	N

Note: Robust Standard Errors in Parentheses. *p<0.1; **p<0.05; ***p<0.01

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Mechanisms

- Income: I show that the relationship between zoning and segregation survives various controls for income.
- Preferences: The Schelling (1971) model of segregation suggests that even small racial differences in housing preference can lead to segregation, but DeFina (2007) studies this empirically and finds no strong evidence.
- Self-Segregating: Some scholars have suggested that Blacks have a particular and idiosyncratic preference for self-segregation. The empirical evidence for this is weak.
- Signalling: Zoning is a signal of the likelihood a non-White resident will experience discriminatory treatment in a particular neighborhood.

Heterogeneity

- Geographic: I test for heterogeneous effects north and south of the Colorado River, and find no significant heterogeneity.
- Class: I test for heterogeneous effects in the rich half of the sample, and again find no significant heterogeneity.

Robustness

I use a weighted regression on the boundary subset, where I weigh tighter spatial comparisons more strongly. Coefficients on zoning continue to be significant and socially meaningful, suggesting that my results are *not* driven by poor spatial comparisons.

Policy Implications

- My results indicate that zoning causes racial segregation. This means governments can promote integration by liberalizing zoning.
- The politics of this reform are challenging, but not impossible. The traditional opponents of zoning reform are incumbent homeowners. But broad-based upzoning increase property values by increasing the property rights associated with land ownership.
- Options for reforms: I focus on single- versus multi-family, but FAR, setback requirements, building codes, etc. also offer avenues for reform.

Concluding Remarks

- I find that a one standard deviation increase (25.7 percentage points) in single-family zoning causes a census block to have 2.2 percentage points more white people.
- This result holds even when I use more sophisticated measures of segregation, such as the Entropy and Herfindahl-Hirshman Indices.
- Future research should try to replicate these results in different cities, particularly as more data becomes available.
- And, as empirical estimates of zoning's effects become more reliable and abundant, the next step is identifying mechanisms.

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Heterogeneity Tables

Table: Test for Heterogeneous Effects by Census Tract Income

	Dependent variable:	
	White Share	
	OLS	*Logistic*
	(1)	(2)
Single Family Share	0.073**	0.326
	(0.032)	(0.383)
Single Family Share × Rich Indicator	0.028	0.139
	(0.046)	(0.548)
Observations	332	332
Adjusted R^2	0.425	
Log Likelihood		−166.228
Akaike Inf. Crit.		534.457
Note: Robust Standard Errors in Parentheses.	*p<0.1; **p<0.05; ***p<0.01	

Heterogeneity Tables

Table: Test for Heterogeneous Effects in North vs. South Austin

	Dependent variable:	
	White Share	
	OLS	*Logistic*
	(1)	(2)
Single Family Share	0.101**	0.444
	(0.042)	(0.499)
Single Family Share × North Indicator	−0.021	−0.075
	(0.050)	(0.591)
Observations	332	332
Adjusted R^2	0.425	
Log Likelihood		−166.455
Akaike Inf. Crit.		534.910
Note: Robust Standard Errors in Parentheses	*p<0.1; **p<0.05; ***p<0.01	

Entropy Table

Table: Regressions on the Entropy Index, Boundary Subset

	Dependent variable:				
	Entropy Index				
	(1)	(2)	(3)	(4)	(5)
Single Family Share	-0.093^{***}	-0.066^{**}	-0.094^{***}	-0.076^{***}	-0.061^{**}
	(0.027)	(0.027)	(0.026)	(0.027)	(0.027)
Observations	332	332	332	332	332
Adjusted R^2	0.092	0.101	0.297	0.312	0.144
Income Control	Y	N	N	N	Y
Population Control	N	Y	N	Y	Y
Tract FE	N	N	Y	Y	N

Note: Robust Standard Errors in Parentheses. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

HHI Table

Table: Regressions on the Herfindahl-Hirschman Index, Boundary Subset

	Dependent variable:				
	Herfindahl-Hirschman Index				
	(1)	(2)	(3)	(4)	(5)
Single Family Share	478.664***	408.978**	526.791***	498.155***	384.016**
	(157.522)	(162.471)	(161.051)	(166.120)	(161.007)
Observations	332	332	332	332	332
Adjusted R^2	0.061	0.043	0.210	0.208	0.072
Income Control	Y	N	N	N	Y
Population Control	N	Y	N	Y	Y
Tract FE	N	N	Y	Y	N

Note: Robust Standard Errors in Parentheses. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Logistic Estimates

Table: Logistic Estimates with Controls, Boundary Subset

	Dependent variable:				
	White Share				
	(1)	(2)	(3)	(4)	(5)
Single Family Share	0.295^{***}	0.285^{***}	0.386^{***}	0.392^{***}	0.267^{**}
	(0.106)	(0.111)	(0.112)	(0.119)	(0.111)
Observations	332	332	332	332	332
Log Likelihood	−221.291	−226.566	−166.434	−166.433	−221.018
Akaike Inf. Crit.	448.583	459.131	530.868	532.865	450.035
Income	Y	N	N	N	Y
Population	N	Y	N	Y	Y
Tract FE	N	N	Y	Y	N

Note: Robust Standard Errors in Parentheses. *p$<$0.1; **p$<$0.05; ***p$<$0.01

Whole City Estimates

Table: OLS Estimates with Controls

	Dependent variable:				
	White Share				
	(1)	(2)	(3)	(4)	(5)
Single Family Share	0.026**	0.055***	0.095***	0.091***	−0.008
	(0.012)	(0.013)	(0.012)	(0.012)	(0.013)
Observations	6,250	6,252	6,252	6,252	6,250
Adjusted R^2	0.142	0.023	0.602	0.602	0.151
Income	Y	N	N	N	Y
Population	N	Y	N	Y	Y
Tract FE	N	N	Y	Y	N

Note: Robust Standard Errors in Parentheses. *p<0.1; **p<0.05; ***p<0.01