The Assessment Gap: Racial Inequalities in Property Taxation

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Research Question

Individuals face three main taxes in US: 1) sales, 2) income, 3) property

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This paper: Holding property tax rates fixed, do racial and ethnic minorities in the US face higher property tax burden?

- Document: yes
- Two channels; underlying mechanisms
- Potential solution

Motivation: Why Study Race and Property Tax?

1. Property taxes affect essentially everyone
   - Central funding source for: schools, roads, public safety, etc.
   - $450-$500 billion annual total revenues
2. Large implications for household finance
   - Median black / white household net worth: 13k / 139k
   - Many families: home is largest asset & primary savings/leverage technology
3. Institutional discrimination and statistical/algorithmic bias
   - Racial disparities illegal under federal law since 1968 (F.H.A)
   - Race-blind policies vs race-neutral outcomes

How Can Tax Burden Vary, Holding Rates Fixed?

Key feature of property tax:

- Tax paid intended to be proportional to market value of home…
- … but tax bills are computed based on “assessment” value

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$$\underset{\text{ad valorem tax)}}{(\textit{Theoretical}} \qquad \frac{r\,M_i}{M_i} = \frac{r\,M_j}{M_j}$$

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→ Tax Bill

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(*How the property tax actually works*)

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Effective tax rate: $f\left(\frac{A}{M}; r\right)$

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➢ Within taxing jurisdiction, variation in assessment ratio is sufficient for inequality

This Paper

Form taxing jurisdictions

- Holds fixed: intended taxation, public goods, assessment practices
- Challenging: local governments very spatially complex
- Rely on shapefiles for universe of local governments

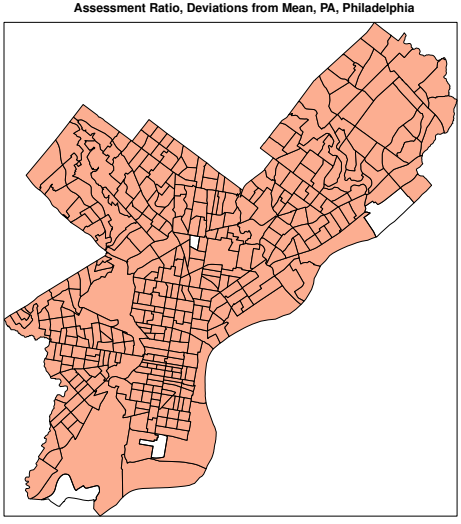
Form assessment ratios

- Annual assessments for 118M homes; 53M observed transactions
- Restriction to arms-length, full consideration sale

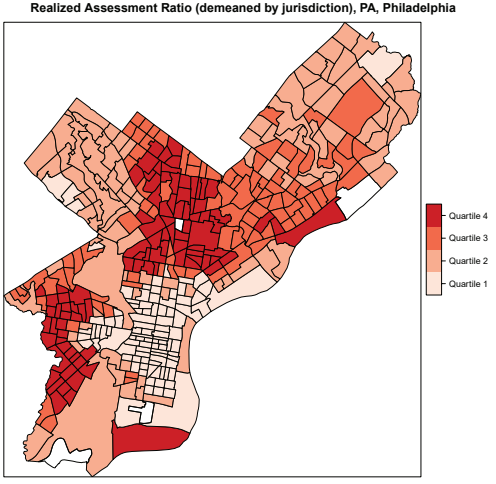
Associate assessment ratios with homeowner race & ethnicity

Variation in assessment ratio $\Rightarrow$ reject equitable tax null

Theoretical Assessment Ratio (Assessed Value / Market)



Philadelphia: Assessment Ratios and Demographic Heatmap



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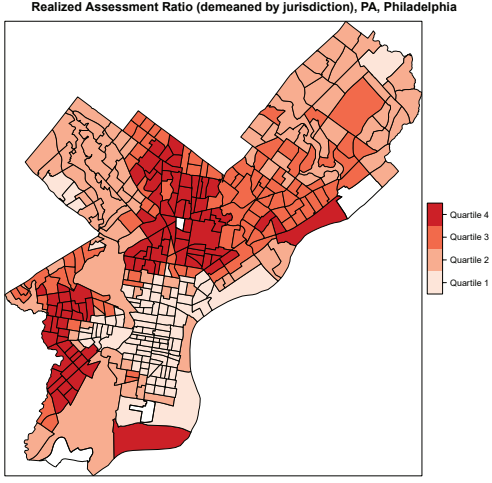
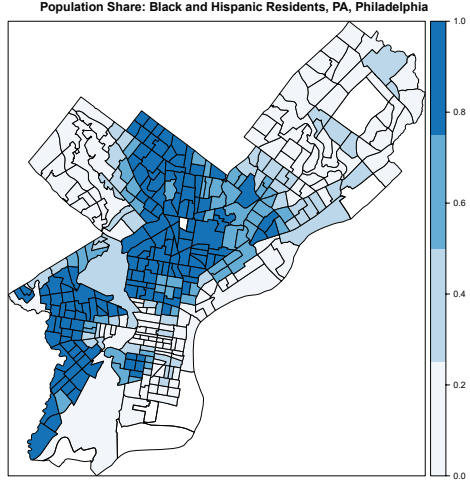
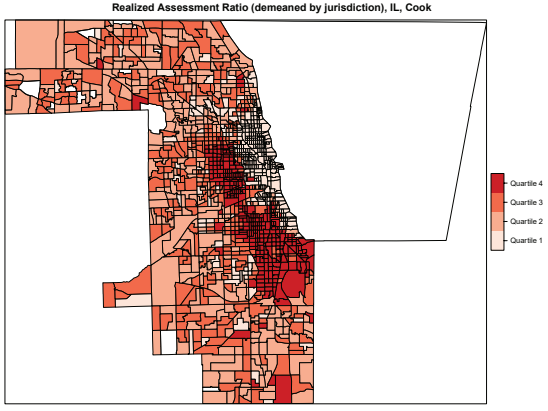




Cook County, IL: Assessment Ratios and Demographics



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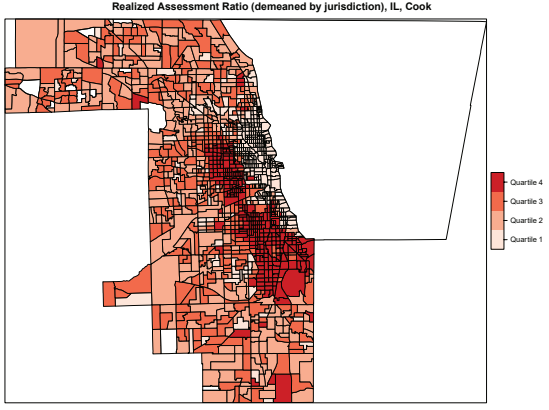
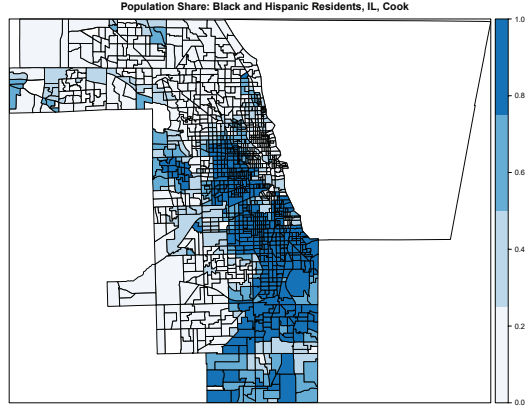




Preview of Findings

Assessment gap: 10-13% higher tax burden for black and Hispanic homeowners

- Cannot be Tiebout sorting along preferences for public goods
- $300-$390 annually for median minority homeowner
- At 90th percentile: approx $800 annually

Two channels:

- 6%-7%: neighborhood attributes and racial sorting **(spatial / between)**
  - ▶ Assessments insufficiently responsive to highly local characteristics
- 5%-6%: individual homeowner **(not spatial / within)**
  - ▶ Racial differential in appeals behavior/outcomes

Small-geography Home Price Indices are potential policy fix

- Simple algorithm, using public data, fixes ~70% of total inequality

Contribution to the Literature

Black-white wealth gap

- Spatial sorting: Cutler and Glaeser 1997, Card and Rothstein 2007, Charles and Guryan 2008, Ananat 2011, Chetty et al 2014, Chetty et al 2019
- Here: public finance channel; highly persistent; wealth rather than wages

Racial and ethnic differences in outcomes

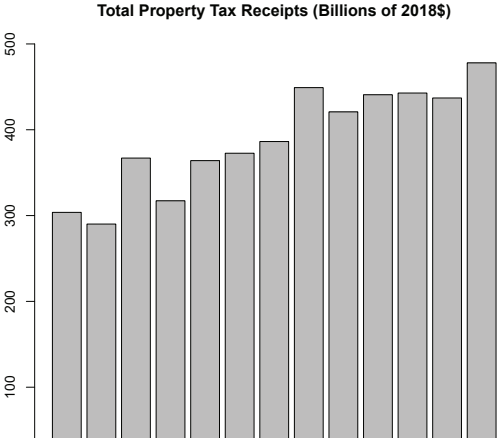
- Housing markets: Charles and Hurst 2002, Bayer et al 2007, Card et al 2008, Bayer et al 2017, Atuahene 2018, Atuahene and Berry 2019
- Here: national differences in tax burdens; non-market setting

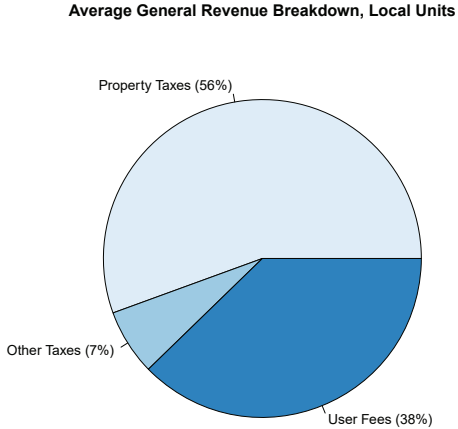
Bias in algorithms

- Machine learning and lending: Bartlett et al 2018, Fuster et al 2018, Kleinberg et al 2018
- Here: race-blind policies will exacerbate discriminatory outcomes

Property Taxes Central for Local Governments

Property taxes are local taxes that provide the largest source of money local governments use to pay for schools, streets, roads, police, fire protection and many other services" *-Texas State Comptroller*





Residential Property Taxes Are Ad Valorem

2018 Georgia Code, Title 48, Chapter 5: Ad Valorem Taxation of Property:

> *Except as otherwise provided in this Code section, taxable tangible property shall be assessed at 40 percent of its fair market value and shall be taxed [...] according to 40 percent of the property's fair market value.*

> *"Fair market value of property" means the amount a knowledgeable buyer would pay for the property and a willing seller would accept for the property at an arm's length, bona fide sale.*

Local Property Tax Overview

- Local Choice (political)
- Unobserved

Policy Rate: 5%
Target Assessment Ratio: 40%

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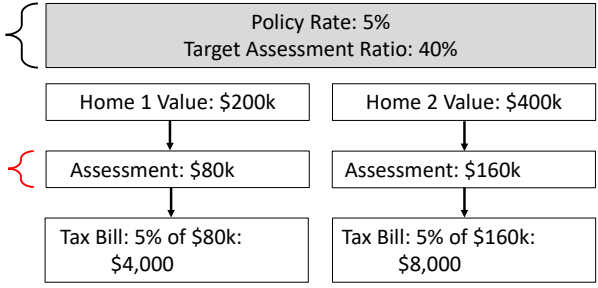

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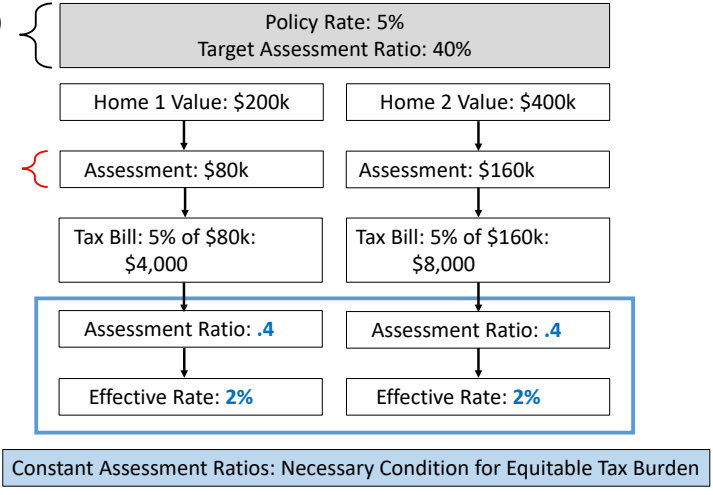
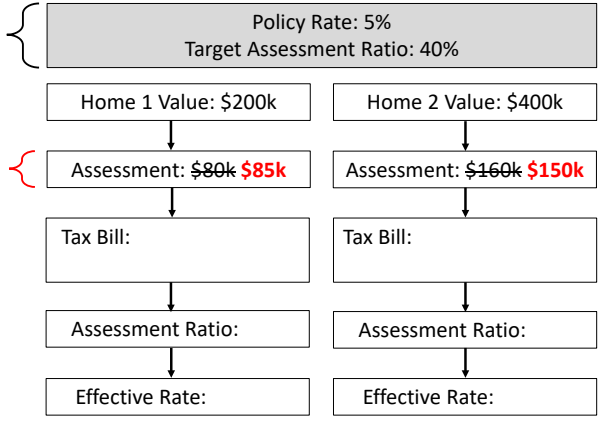


Constant Assessment Ratios: Necessary Condition for Equitable Tax Burden

Assessment Ratio is Object of Interest

- Local Choice (political)
- Unobserved



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Realized Assessments

Home 1 Value: $200k	Home 2 Value: $400k
Assessment: ~~$80k~~ **$85k**	Assessment: ~~$160k~~ **$150k**
Tax Bill: 5% of ~~$80k~~ $85k: ~~$4,000~~ $4,250	Tax Bill: 5% of ~~$160k~~ 150k: ~~$8,000~~ $7,500
Assessment Ratio: **.425**	Assessment Ratio: **.375**
Effective Rate: **2.125%**	Effective Rate: **1.875%**

Variation in the Assessment Ratio: sufficient for unequal tax burden

Two Major Empirical Challenges

Challenge #1:

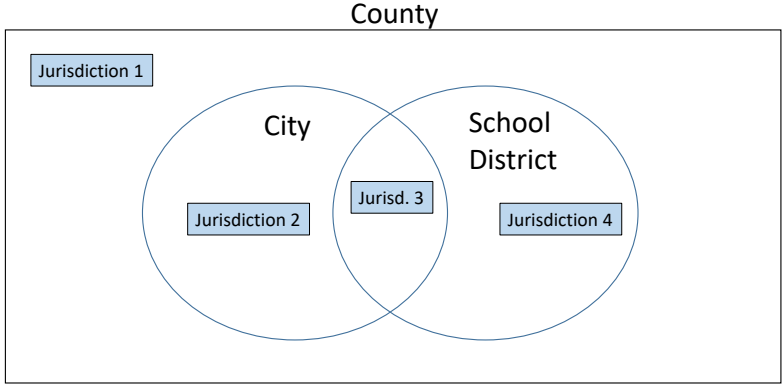
- Must hold fixed intended level of taxation and public goods
- 75,000 potential taxing entities; annual changes
- Extremely complex spatial overlay of local governments
  - Tax Code Areas (TCAs) fail to capture provision of public goods for nontaxing local districts.

Challenge #2:

- Must also hold target assessment ratio fixed (unobserved)
- "Natural" benchmark of 1-to-1 is less common
- Target may change annually by legislation

▸ Realized Jurisdiction ARs

"Taxing Jurisdiction": Precise Definition



"Jurisdiction": Geography served by unique network of overlapping gvts

▸ Further Theoretical Example ▸ Real-World Example

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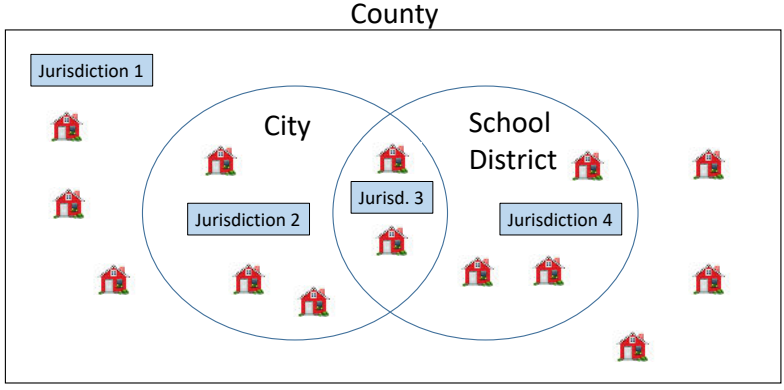

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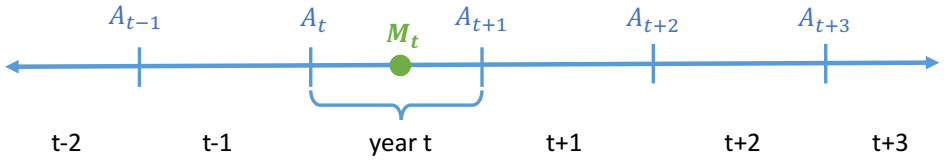
Outline

Data Sources

1. Panel data: 118M properties, 2003-2016; annual assessments; all transactions (53M); longitude & latitude; home attributes (ATTOM)
   - ▶ California: results in paper. Here: results from 49 states.
2. Shapefiles: a) cities, towns, school districts, b) special/utility districts, c) custom shapefiles for any issuer of public debt. (Atlas Muni Data)
3. Loan-level reported race & ethnicity for mortgage origination (HMDA)
4. Demographic info from ACS; tract and block group shapefiles from US Census

▸ Race and Ethnicity

Timing Details



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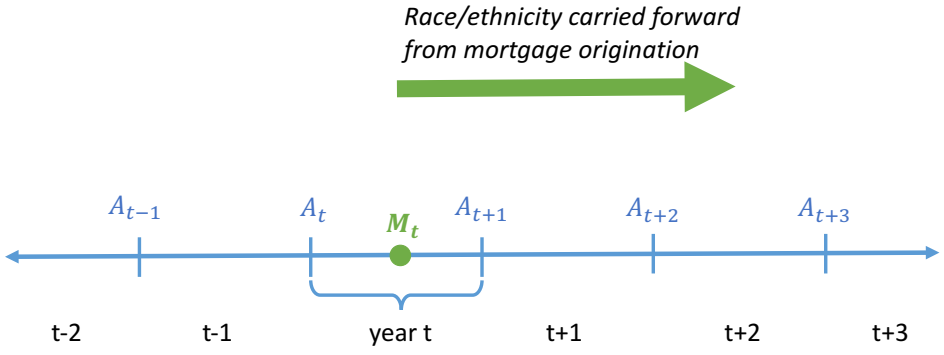

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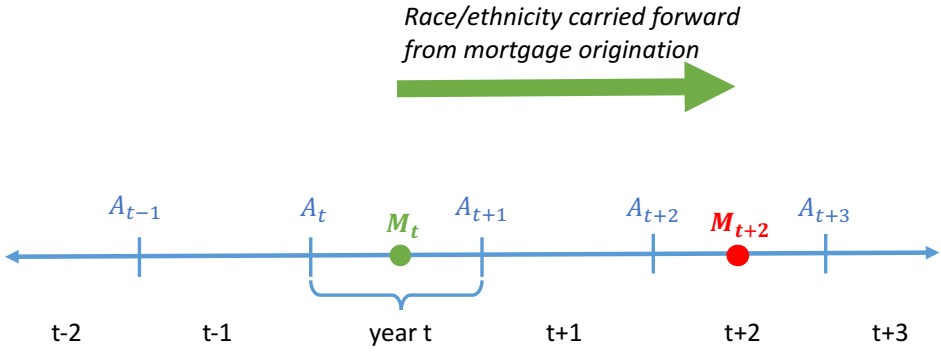

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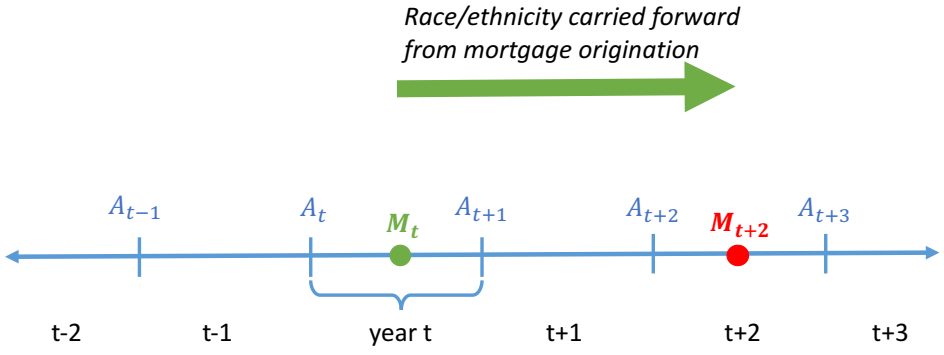

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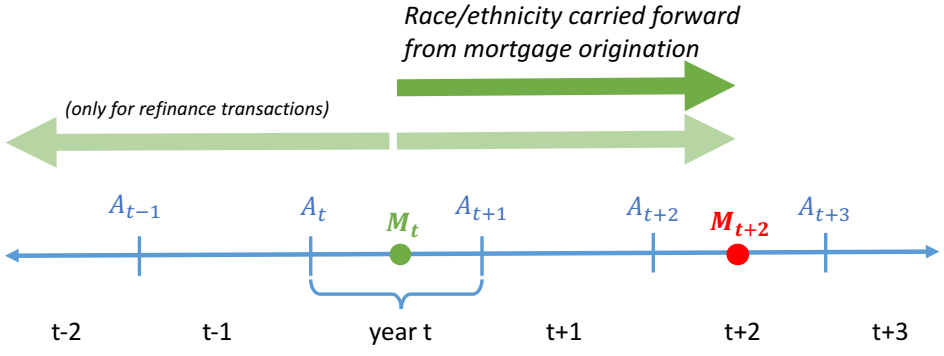

Estimating Equation

- Equitable tax null: $\beta = 0$
- Omitted group in all regressions: white, non-Hispanic residents

: property, : jurisdiction, : year, *race*: race or ethnicity

▸ Equitable Null Derivation

Estimating Equation

$$ln(\frac{A_{ijt}}{M_{ijt}}) = \gamma_{jt} + \beta\, race_{ijt} + \varepsilon_{ijt}$$

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i: property, j: jurisdiction, t: year, *race*: race or ethnicity

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Group Means: Legal Grounding

$$ln(\frac{A_{ijt}}{M_{ijt}}) = \gamma_{jt} + \beta\, race_{ijt} + \varepsilon_{ijt}$$

"Disparate impact" is legal standard by which courts evaluate discrimination claims

Federal Law, 24 CFR S100.500(a):

> *"[a] practice has a discriminatory effect where it actually or predictably results in a disparate impact on a group of persons[...] because of race, color, religion, sex, handicap, familial status, or national origin"*

US Supreme Court (2015): in housing, sufficient for discrimination

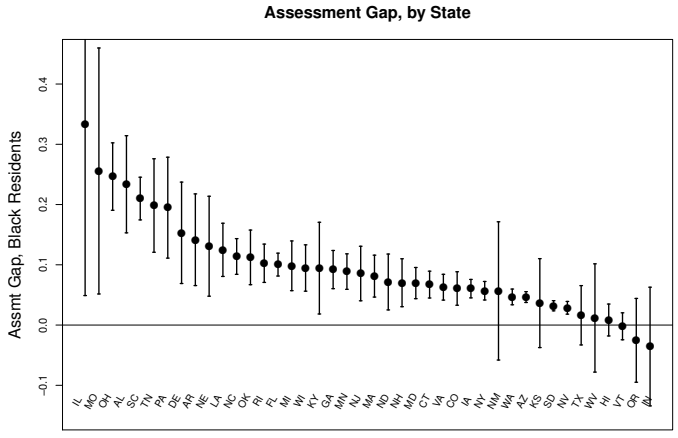
Overall Assessment Gap

	log(Assessment) - log(Market)	
	(1)	(2)
Black Mortgage Holder	0.1266***	
	(0.0150)	
Black or Hispanic Mortgage Holder		0.0984***
		(0.0106)
Fixed Effects	Jurisd-Year	Jurisd-Year
Other Controls	N	N
No. Clusters	37723	37723
Observations	6,987,915	6,987,915
R^2	0.8798	0.8798
Note:	*p<0.1; **p<0.05; ***p<0.01	

Median minority homeowner: 207k home and 1.4% tax: $300 - $390 annually

Fiscal Cycle Robustness

State Breakdown



▸ State Breakdown, Black or Hispanic ▸ California Results

Outline

Decomposing Assessment Gap

Roadmap:

1. Distinguish: within-neighborhood inequality vs between-neighborhood inequality
2. *Neighborhood Composition*: between-variation in assessment ratio
3. *Homeowner Effect*: within-variation in assessment ratio

"Neighborhood": US Census tract or block group (much smaller than jurisdiction)

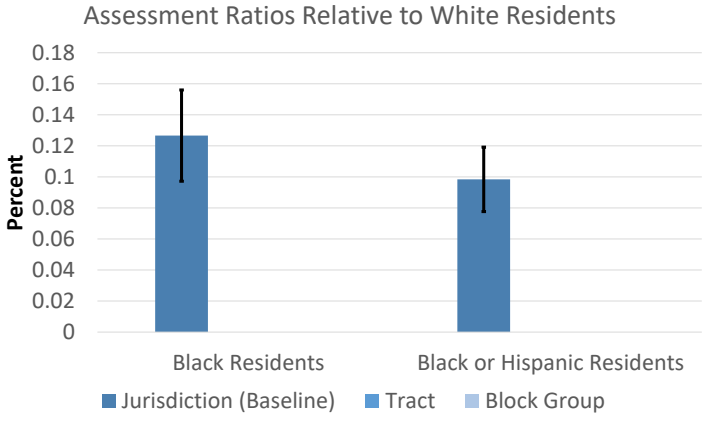
Homeowner Effect

Goal: Hold constant all spatial & geographic factors

Ideal experiment: Adjacent homes; homeowners of different race/ethnicity

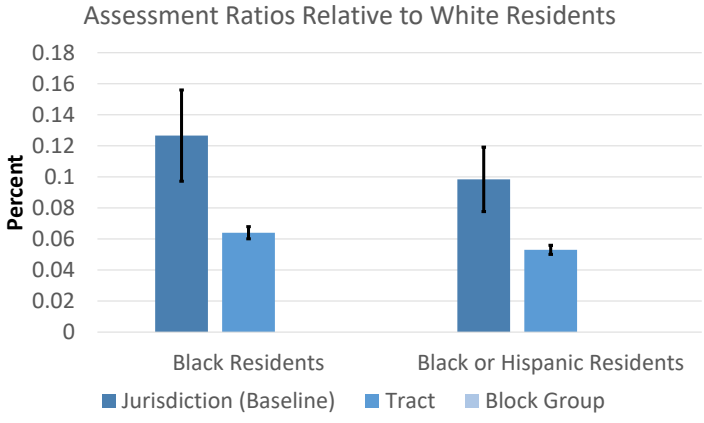
Feasible: Condition on successively smaller geographies; show stable estimates

Homeowner Effect



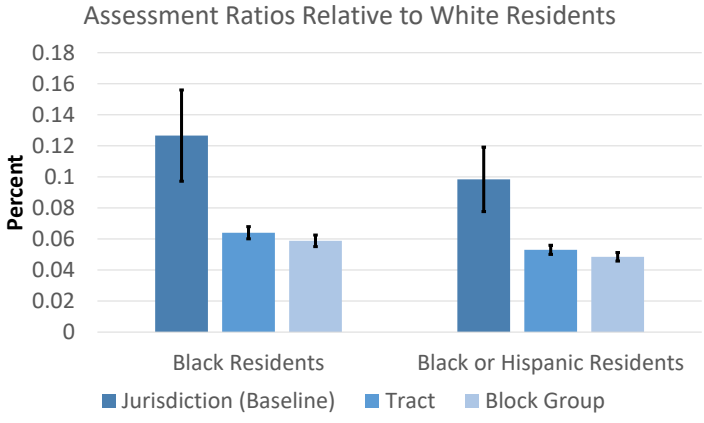
Baseline Regression

Homeowner Effect



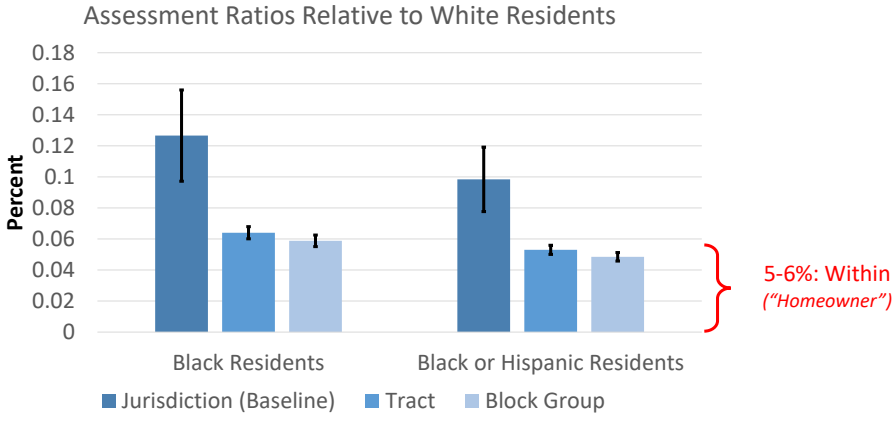
Baseline Regression
Tract Regression

Homeowner Effect



▸ Baseline Regression ▸ Tract Regression ▸ Block Group Regression

Homeowner Effect



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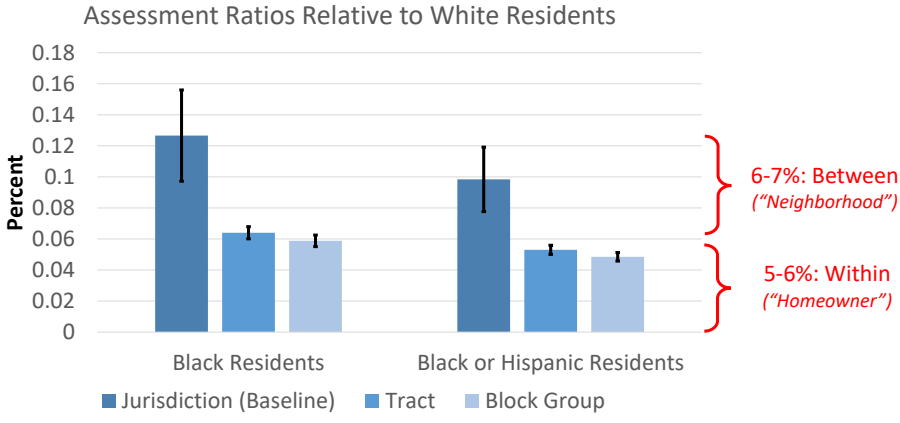


Baseline Regression Tract Regression Block Group Regression

Neighborhood Composition

Spatial sorting by race in US is well-known

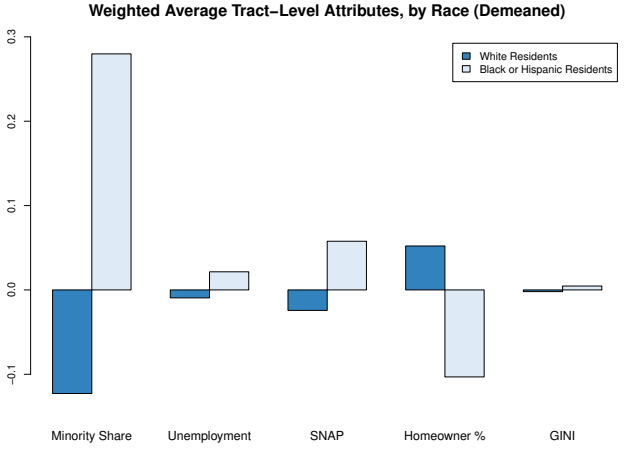
- Ananat (2011), Cutler and Glaeser (1997); many others

Result: neighborhood attributes faced by average resident varies by race

Characteristics are capitalized differently in market prices vs assessments

Generates spatial variation in tax burden that correlates with race

Sample Differences



▸ More Variables ▸ Baseline Regression Evidence ▸ More Regression Evidence

Implied Hedonic Prices

"Automated Valuation Models": some form of hedonic regression

Estimate two hedonic models: 1) LHS = Market, 2) LHS = Assessment

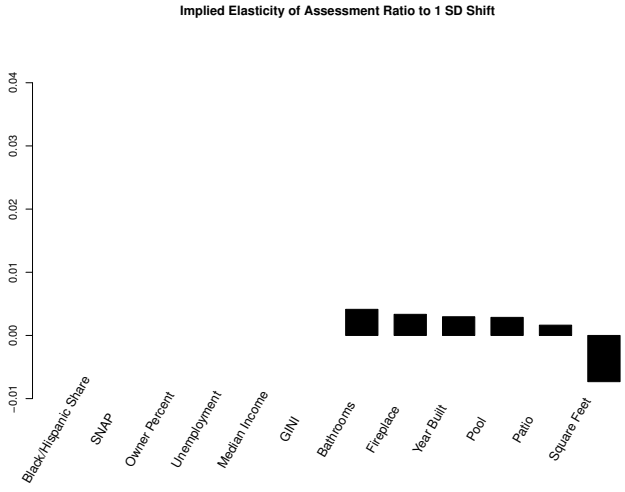
$$V_{icjt} = \gamma_{jt} + \Theta^V X_{icjt} + \beta^V W_{cjt} + \varepsilon_{icjt}$$

Goal: compare Θ^A, β^A with Θ^M, β^M

V: assessment or market; i: home, c: tract, j: jurisdiction

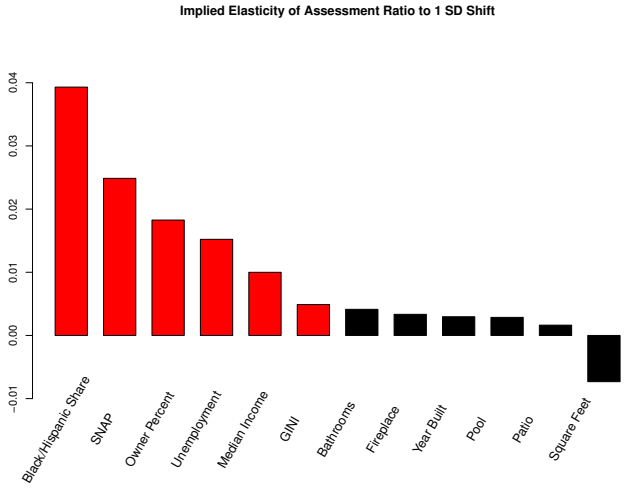
t: time, X_{icjt}: home attributes, W_{cjt}: local attributes

Relative Hedonic Prices



▸ Estimated Hedonic Prices

Relative Hedonic Prices



Estimated Hedonic Prices

Spatial Variation in Tax Burden Correlated with Race

	log(Assessment) - log(Market)	
	(1)	(2)
Black Mortgage Holder	0.079***	
	(0.004)	
Black Share	0.299***	
	(0.046)	
Black or Hispanic Mortgage Holder		0.067***
		(0.003)
Black or Hispanic Share		0.277***
		(0.042)
Jurisd-Year FE	Y	Y
Other Controls	N	N
No. Clusters	37679	37679
Observations	6,944,439	6,944,439
R^2	0.881	0.881
Note:	*p<0.1; **p<0.05; ***p<0.01	

Taking Stock

Overall assessment gap: 10-13%

Between variation: 6-7%

- Assessors underweight neighborhood attributes in projecting market prices
- Tactically: hedonic F.E. or rule-of-thumb growth for too large an area

Within variation: 5-6%

- So far unexplained
- Hypothesis: racial differential in appeals behavior/outcomes

Outline

Mechanism for Homeowner Effect

Extensive social science literature:

- Minority residents may be less trusting of public officials
- May perceive institutions are not designed to serve them

Assessment Appeals:

- Almost always process for appealing assessment
- Obtained administrative micro-data from 2nd largest county

Cook County, IL

Population: 5M; Homes: 1.9M

- Appeals, 2003-2015: 3.5M

Usual to hire tax attorney - perception: connections matter
Antiquated data/tech & low staffing: "assessment by appeal"

Additional info:

1. Appeal filed
2. Win / loss
3. Amount of reduction

▸ IL Homeowner Effect

Results: Appeals in Cook County

	Dependent Variable:		
	Appeal	Win Appeal	Reduction
	(1)	(2)	(3)
Black or Hispanic Mortgage Holder	−0.982***	−1.993***	−0.258***
	(0.068)	(0.245)	(0.074)
Baseline Rate	14.6	67.4	12.0
Fixed Effects	BG-Year	BG-Year	BG-Year
No. Clusters	3954	3933	3893
Observations	4,076,655	694,553	476,368
R^2	0.383	0.415	0.443
Note:			*p<0.1; **p<0.05; ***p<0.01

Notes: 1) linear probability model, 2) coefficients are (%)

Black Homeowners

Consistent with National Data

Racial differential in appeals $\Rightarrow$ different assessment trajectories by race

Test by exploiting changes of racial ownership within properties across time

(Note: no market prices; only instance today)

$$\Delta log(A_{ict}) = \alpha_i + \gamma_{ct} + \beta\, race/ethnicity_{ict} + \varepsilon_{ict}$$

Results: Diff in Diff around Racial Ownership

	Assessments			
	Growth		Levels	
	(1)	(2)	(3)	(4)
Black Mortgage Holder	0.0711*		0.2917***	
	(0.0386)		(0.0415)	
Black or Hispanic Mortgage Holder		0.4103***		0.7923***
		(0.0255)		(0.0274)
Fixed Effects	Two-Way	Two-Way	Two-Way	Two-Way
No. Clusters	12268641	12268641	12268641	12268641
Observations	54,970,191	54,970,191	54,970,191	54,970,191
R^2	0.6925	0.6925	0.9910	0.9910
Note:				*p<0.1; **p<0.05; ***p<0.01

Notes: coefficients are (%)

Outline

Extensions & Robustness

1. Assessment gap by year — Annual Estimates
2. Role of market prices — Market Prices
3. Ruling out pure income effect — Income
4. Ruling out pure property price effect — Price Controls
5. Pass-through of assessment ratio to taxes paid — Taxes Paid
6. Assessment gap distribution: county-level estimates — County Estimates
7. Sample split by racial animus — Animus
8. Sample split by county-level home price growth — By County HPI
9. Sample split by county-level minority population — County Minority Share
10. Effect of homeowner tenure — Time Since Sale
11. Simple ratios instead of log(assessment ratio) — Simple Ratios

Outline

Algorithm for Equitable Assessments

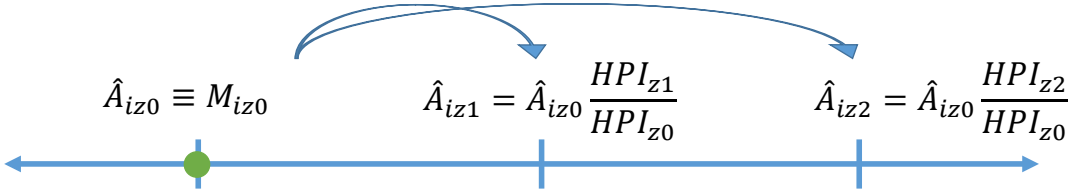
Neighborhood composition drives at least half of distortion

Feasible to construct assessments that reflect spatial attributes?

Algorithm for Equitable Assessments

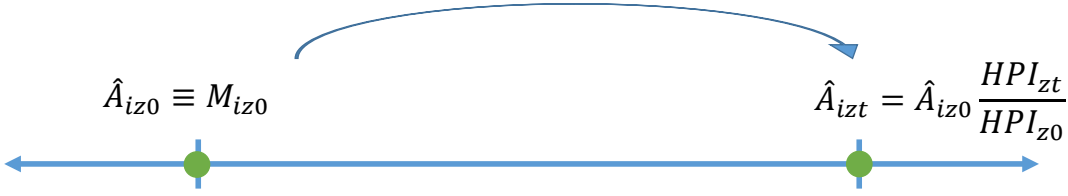
Neighborhood composition drives at least half of distortion

Feasible to construct assessments that reflect spatial attributes?

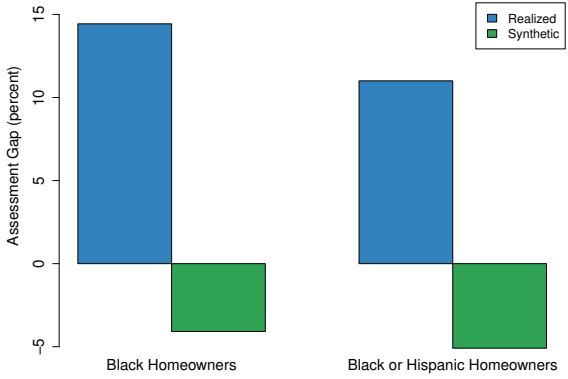


Algorithm for Equitable Assessments

Test: compare inequality with realized assessments vs synthetic assessments



Results: Using Zip-Code Level HPIs



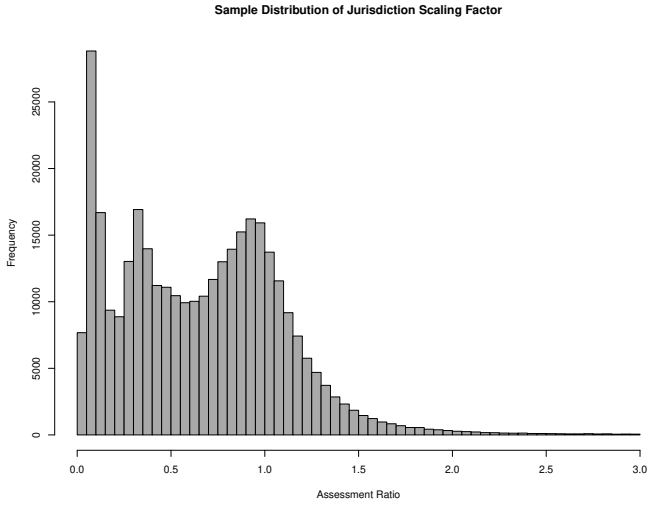
▸ Underlying Regressions

Conclusion

1. 10-13% higher property tax burden for black and/or Hispanic residents
2. Geographic channel and a homeowner channel:
   - Assessments insufficiently sensitive to local attributes
   - Racial differentials in appeals behavior and outcomes
3. Inequality can be significantly reduced by linking assessments to local-HPIs

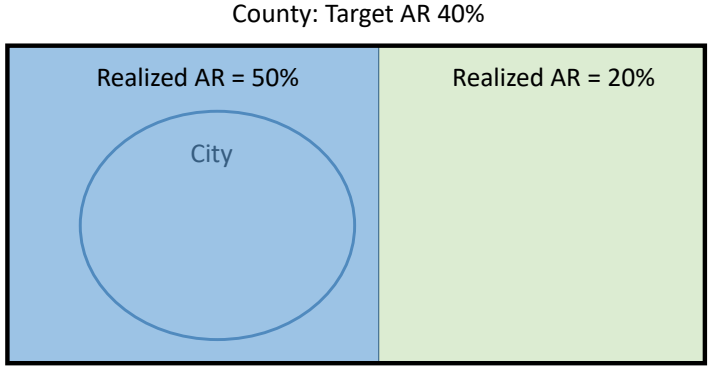
Thank you!

Realized Assessment Ratio, by Jurisdiction



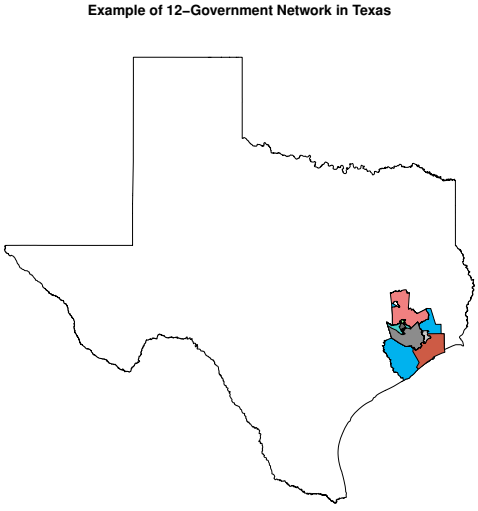
Back

Inequality Is Variation Within Jurisdiction



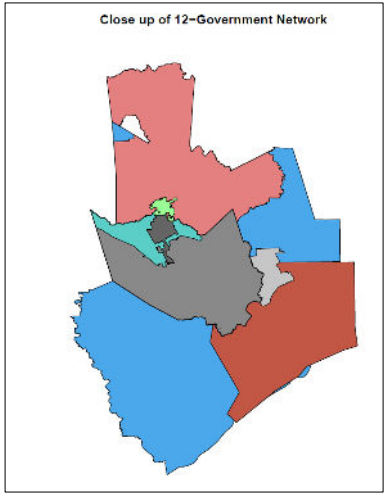
1) Inequality in county tax
2) But ***no*** inequality in city tax

Real World Example: Harris County



Back

Real World Example: Harris County



Harris County
City of Houston
Houston Community Colleges
Katy Independent School District
Harris County Flood Control
Port of Houston
Gulf Coast Waste Disposal
Coastal Water Authority
Willow Fork Drainage District
Cinco MUD
North Fort Bend Water Authority
Multi-County Economic Dev. Entity

- These 12 intermingled entities create several jurisdictions.
- One jurisdiction is the intersection of all twelve
- Within our sample: 84 properties (with observed sale) at intersection of all 12

Race & Ethnicity of Mortgage Holder

Observe race and ethnicity from 2 sources: Census & HMDA

Both sources: race and ethnicity are separate questions:

- "Black or African-American" (one of 6 racial options)
- "Hispanic or Latino" (binary ethnicity option)

We show results for three groupings:

1. Black homeowners
2. Black and/or Hispanic homeowners
3. All other non-white homeowners *(in paper)*

Survey Choices Back

Robustness: Jurisdiction-Month-Year FE

	log(Assessment) - log(Market)	
	(1)	(2)
Black Mortgage Holder	0.1283***	
	(0.0174)	
Black or Hispanic Mortgage Holder		0.0988***
		(0.0124)
Fixed Effects	Jurisd-Month-Year	Jurisd-Month-Year
No. Clusters	37723	37723
Observations	6,987,915	6,987,915
R^2	0.9000	0.8999
Note:		*p<0.1; **p<0.05; ***p<0.01

Back

Baseline Assessment Gap

	log(Assessment) - log(Market)	
	(1)	(2)
Black Mortgage Holder	0.1266***	
	(0.0150)	
Black or Hispanic Mortgage Holder		0.0984***
		(0.0106)
Fixed Effects	Jurisd-Year	Jurisd-Year
Other Controls	N	N
No. Clusters	37723	37723
Observations	6,987,915	6,987,915
R^2	0.8798	0.8798
Note:	*p<0.1; **p<0.05; ***p<0.01	

Back

Homeowner Channel - Tract

Within tract (avg 4,000 people):

	log(Assessment) - log(Market)	
	(1)	(2)
Black Mortgage Holder	0.0640***	
	(0.0020)	
Black or Hispanic Mortgage Holder		0.0530***
		(0.0015)
Fixed Effects	Jurisd-Tract-Yr	Jurisd-Tract-Yr
Other Controls	N	N
No. Clusters	37723	37723
Observations	6,987,915	6,987,915
R^2	0.9005	0.9005
Note:		*p<0.1; **p<0.05; ***p<0.01

Back

Homeowner Channel - Block Group

Tract may be too large. Can look within Block Group (avg 1,200 people):

	log(Assessment) - log(Market)	
	(1)	(2)
Black Mortgage Holder	0.0588***	
	(0.0019)	
Black or Hispanic Mortgage Holder		0.0485***
		(0.0014)
Fixed Effects	Jurisd-BG-Yr	Jurisd-BG-Yr
Other Controls	N	N
No. Clusters	37723	37723
Observations	6,987,915	6,987,915
R^2	0.9166	0.9166
Note:	*p<0.1; **p<0.05; ***p<0.01	

Back

Race and Ethnicity, HMDA Options

HMDA race:

1. African American or black
2. Asian
3. American Indian or Alaskan Native
4. Native Hawaiian or Other Pacific Islander
5. White

HMDA Ethnicity:

1. Hispanic or Latino
2. Not Hispanic or Latino

Back

Estimating Equation

Equitable Tax Null within a Jurisdiction:

- $\frac{Equitable\ Tax_i}{Market\ Price\ Home_i} = const_{jur}$ (Ad-valorem tax)

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- $\frac{Assessment_i}{Market\ Price_i} = \frac{const_{jur}}{rate_{jur}}$ (Actual Tax = Equitable Tax)

Estimating Equation

Equitable Tax Null within a Jurisdiction:

- $\frac{Equitable\ Tax_i}{Market\ Price\ Home_i} = const_{jur}$ (Ad-valorem tax)
- $Actual\ Tax_i = rate_{jur} * Assessment_i$ (Tax bill based on ***assessed value***)
- $\frac{Assessment_i}{Market\ Price_i} = \frac{const_{jur}}{rate_{jur}}$ (Actual Tax = Equitable Tax)

Estimating Equation:

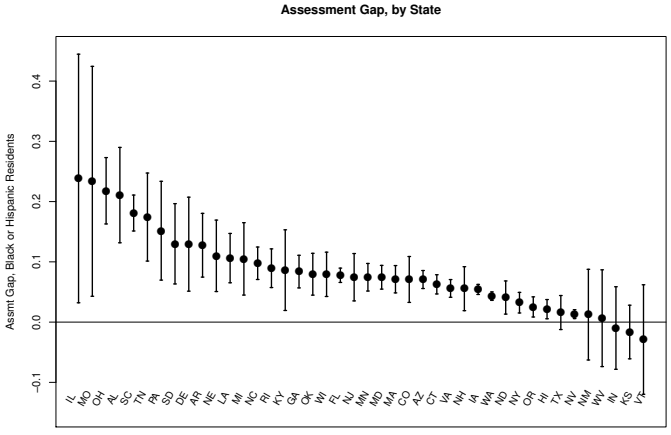
$$\ln\left(\frac{A_{ijt}}{M_{ijt}}\right) = \gamma_{jt} + \beta race_{ijt} + \epsilon_{ijt}$$

i: property, j: jurisdiction, t: year

Assessment Gap: California

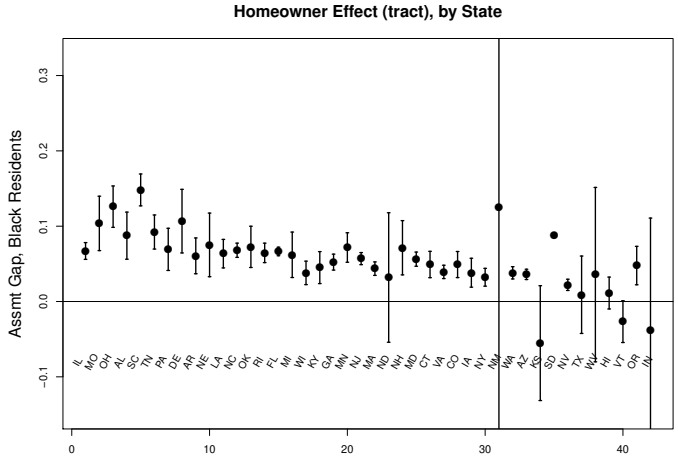
	Assessment Value / Market Value		
	(1)	(2)	(3)
Black Mortgage Holder	0.0413***		
	(0.0101)		
Black or Hispanic Mortgage Holder		0.1060***	
		(0.0044)	
Other Non-White Mort. Holder			0.0653***
			(0.0030)
Fixed Effects	Jurisd-Year	Jurisd-Year	Jurisd-Year
Other Controls	N	N	N
No. Clusters	5603	5603	5603
Observations	1,186,388	1,186,388	1,186,388
R^2	0.3816	0.3820	0.3820
Note:			*p<0.1; **p<0.05; ***p<0.01

State Breakdown, Black and Hispanic Homeowners



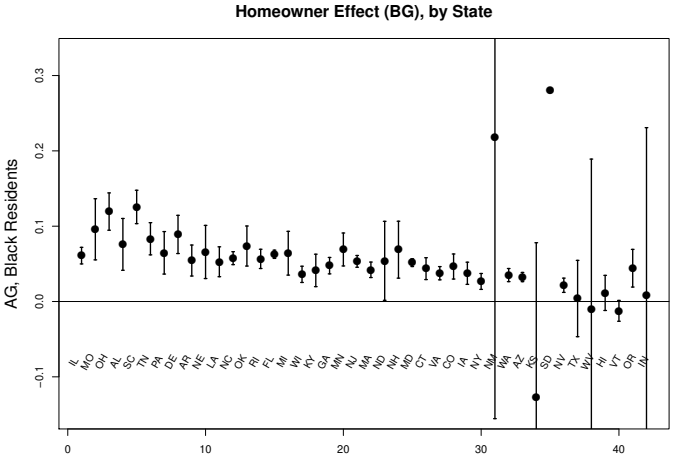
Back

Homeowner Effect, Black Residents (tract)



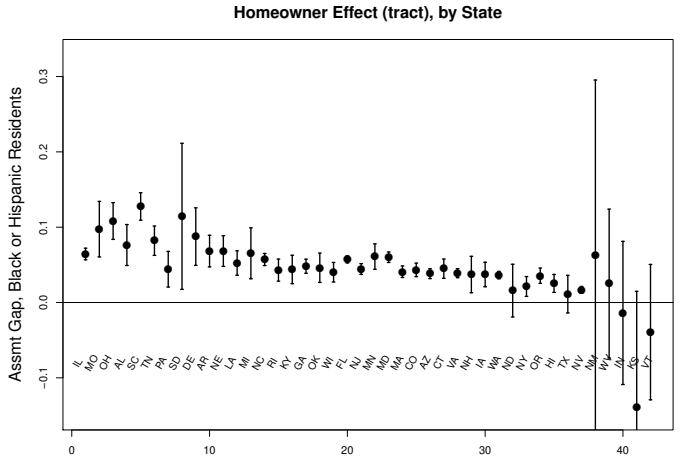
Back

Homeowner Effect, Black Residents (block group)



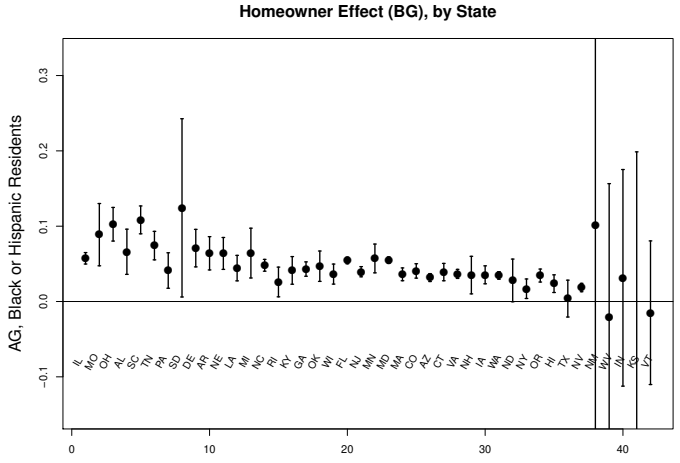
Back

Homeowner Effect, Black or Hispanic Residents (tract)



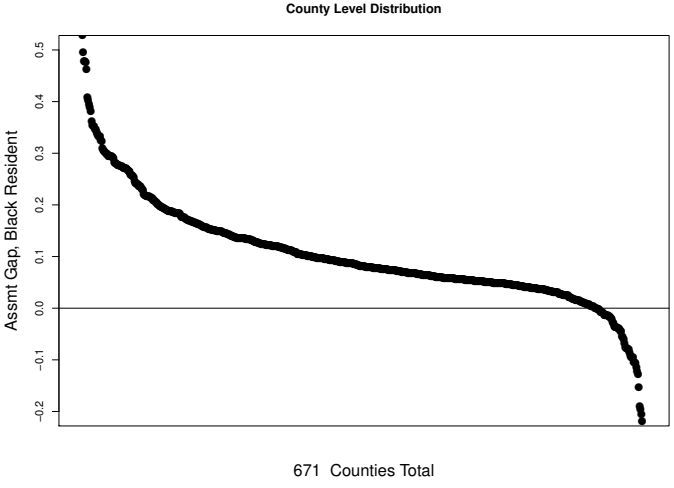
Back

Homeowner Effect, Black or Hispanic Residents (B. G.)



Back Back to Cook

County Distribution



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Neighborhood Comparison, All Variables

	Average Tract-Level Attribute Faced By:			
	White Residents	Black Residents	Black or Hispanic Residents	Other Non-White Residents
Black Population Share	0.07	0.45	0.30	0.10
Black or Hispanic Population Share	0.16	0.58	0.58	0.26
Other Non-White Population Share	0.06	0.06	0.07	0.23
Unemployment Rate	0.07	0.11	0.11	0.08
SNAP Assistance Share	0.10	0.20	0.20	0.11
Home-Owner Percentage	0.71	0.55	0.53	0.61
GINI Coefficient	0.41	0.43	0.42	0.41
Household Median Income ($)	63,777	46,684	46,891	69,058
Median Home Value ($)	240,776	181,919	210,200	346,008

Back

From Heatmaps to National Data

	log(Assessment) - log(Market)	
	(1)	(2)
Black Mortgage Holder	0.079***	
	(0.004)	
Black Share	0.299***	
	(0.046)	
Black or Hispanic Mortgage Holder		0.067***
		(0.003)
Black or Hispanic Share		0.277***
		(0.042)
Jurisd-Year FE	Y	Y
Other Controls	N	N
No. Clusters	37679	37679
Observations	6,944,439	6,944,439
R^2	0.881	0.881
Note:	*p<0.1; **p<0.05; ***p<0.01	

Back

Neighborhood Correlates, Racial Demographics

	log(Assessment) - log(Market)	
	(1)	(2)
Black Share	0.027***	
	(0.005)	
Black or Hispanic Share		0.035***
		(0.006)
Other Non-White Share	−0.021***	−0.015***
	(0.005)	(0.004)
Median HH Income	0.015***	0.017***
	(0.004)	(0.004)
Unemployment	0.033***	0.030***
	(0.004)	(0.003)
SNAP Assistance	0.021***	0.020***
	(0.004)	(0.004)
Owner Percentage	−0.011***	−0.009***
	(0.002)	(0.002)
GINI Coef	0.003*	0.008***
	(0.002)	(0.003)
Homeowner Race Coef	0.077	0.065
Jurisd-Year FE	Y	Y
Other Controls	N	N
No. Clusters	37679	37679
Observations	6,944,439	6,944,439
R^2	0.881	0.881

Hedonic Prices: Market vs Assessments

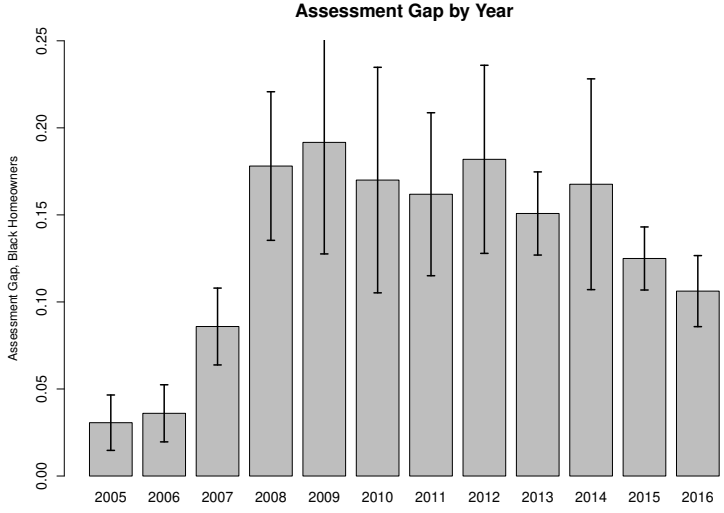
	Market	Assessment	Market	Assessment
	(1)	(2)	(3)	(4)
Black Share	−0.092***	−0.056***		
	(0.004)	(0.004)		
Black or Hispanic Share			−0.117***	−0.078***
			(0.006)	(0.005)
Median HH Income	0.157***	0.144***	0.145***	0.135***
	(0.008)	(0.008)	(0.008)	(0.008)
Unemployment	−0.027***	−0.013***	−0.030***	−0.015***
	(0.003)	(0.002)	(0.004)	(0.002)
SNAP Share	−0.089***	−0.061***	−0.075***	−0.050***
	(0.006)	(0.004)	(0.006)	(0.004)
Owner Share	−0.049***	−0.032***	−0.053***	−0.035***
	(0.005)	(0.003)	(0.005)	(0.004)
GINI	0.066***	0.059***	0.058***	0.053***
	(0.004)	(0.004)	(0.004)	(0.004)
Square Feet	0.256***	0.264***	0.256***	0.264***
	(0.029)	(0.030)	(0.029)	(0.030)
Bathrooms	0.107***	0.103***	0.107***	0.103***
	(0.017)	(0.017)	(0.017)	(0.017)
Year Built	0.031***	0.028***	0.030***	0.028***
	(0.003)	(0.003)	(0.003)	(0.003)
Other Attributes	Y	Y	Y	Y
Jurisd-Year FE	Y	Y	Y	Y
No. Clusters	26152	26152	26152	26152
Observations	4,877,658	4,877,658	4,877,658	4,877,658

Results: Appeals in Cook County

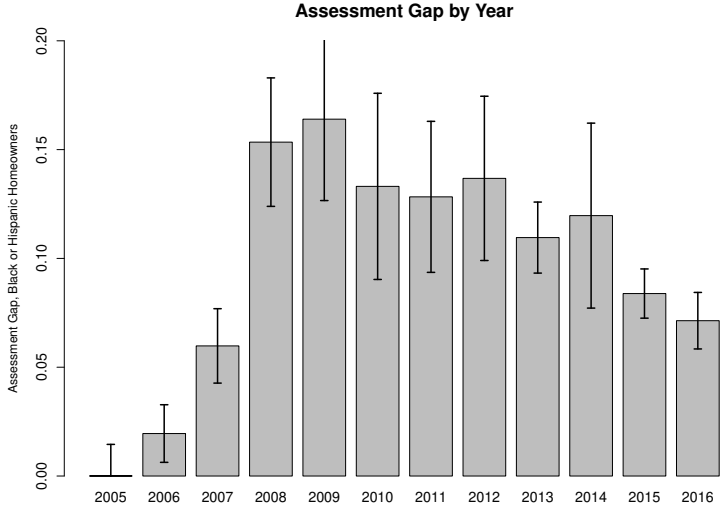
	Dependent Variable:		
	Appeal	Win Appeal	Reduction
	(1)	(2)	(3)
Black Mortgage Holder	-0.840^{***}	-2.193^{***}	-0.480^{***}
	(0.083)	(0.354)	(0.117)
Baseline Rate	14.6	67.4	12.0
Fixed Effects	BG-Year	BG-Year	BG-Year
No. Clusters	3954	3933	3893
Observations	4,076,655	694,553	476,368
R^2	0.383	0.415	0.442
Note:			*p<0.1; **p<0.05; ***p<0.01

Back

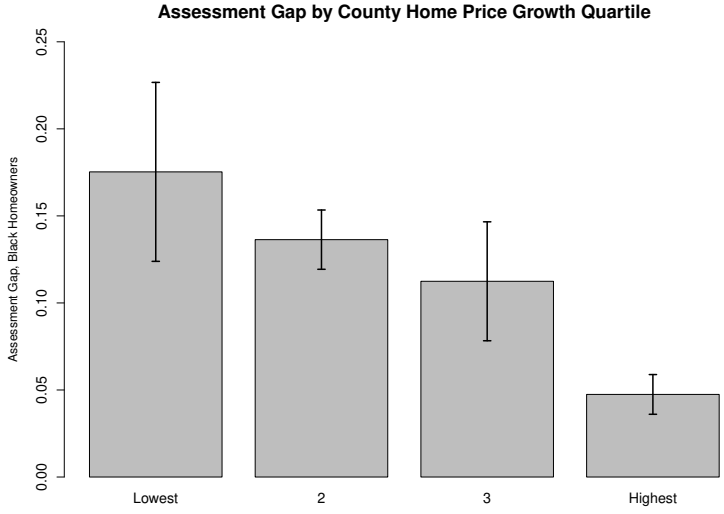
Annual Estimates of Assessment Gap (Black Homeowners)



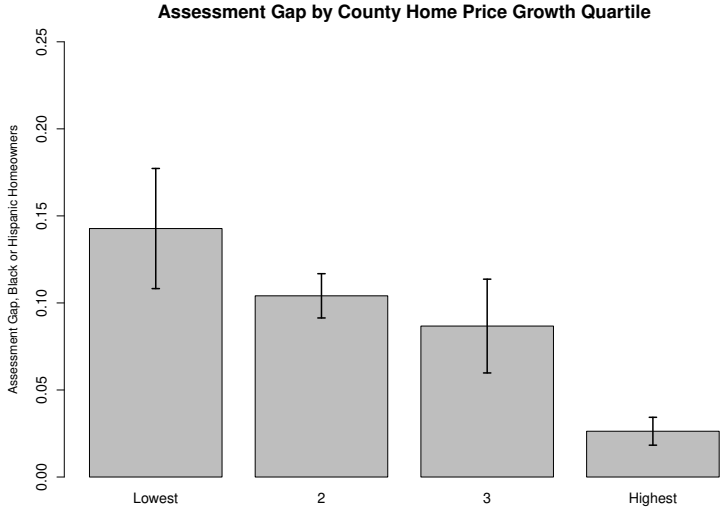
Annual Estimates of Assessment Gap (Black or Hispanic)



Assessment Gap by County Home Price Growth



Assessment Gap by County Home Price Growth



Role of Market Prices

Setup: racial or ethnic variation in $\frac{A}{M}$ represents incorrect assessments

Racial differences in transacted prices would also induce variation in $\frac{A}{M}$

Bayer, Casey, Ferreira, McMillan (2007): uses repeat transactions for within-property test in four large metro regions

- 2% premium for black/Hispanic buyers
- Largest for within-race transactions (majority nationally)
- Would bias our estimates of inequality downwards, relative to "true" value

We test directly using slightly different methodology

Back

Alternate Test for Racial Difference in Transacted Prices

Focus on subset of repeat transactions

Use P_0 to form projection of $\hat{P}_t$ according to local home price dynamics:

$$\hat{P_{izt}} = P_{iz0} \frac{HPI_{zt}}{HPI_{z0}}$$

Then test for racial difference in unexpected component of transaction price:

$$log(P_{ijzt}) - log(\hat{P_{izt}}) = \gamma_{jt} + \beta^r race_{seller} + \varepsilon_{ijzt}$$

i: property, z: zip code, j: census block group

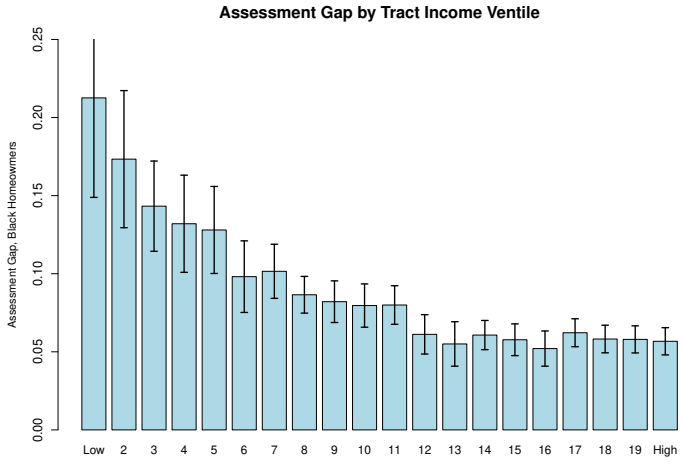
Back

Result: Test of Racial Differences in Transacted Prices

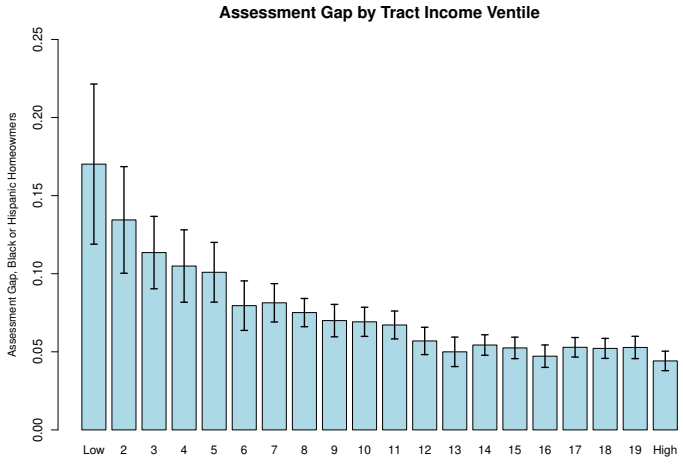
	Proportional Realized Price Difference	
	(1)	(2)
Black Seller	0.022***	
	(0.002)	
Black or Hispanic Seller		0.033***
		(0.002)
Fixed Effects	Jurisd-B.G.-Yr	Jurisd-B.G.-Yr
No. Clusters	18984	18984
Observations	2,196,003	2,196,003
R^2	0.801	0.802
Note:		*p<0.1; **p<0.05; ***p<0.01

If correct basis is latent "true" value: inequality increases by 2-3%

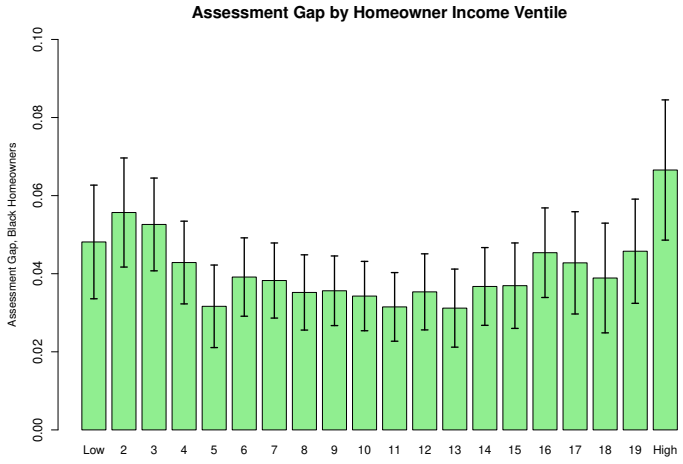
Assessment Gap by Tract-Level Income (Black Residents)



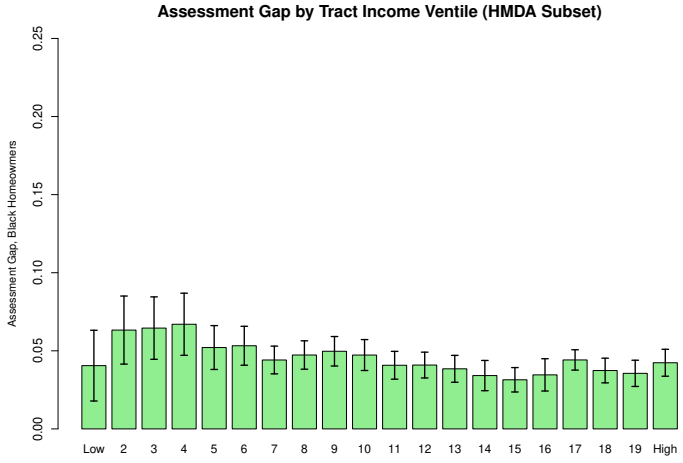
Assessment Gap by Tract-Level Income (Black or Hispanic)



Gap by Homeowner Income Bins (Black Residents)



Tract-Level Income; Income-Declared Subsample (Black)



Result: Effects Controlling for Price Bins

	log(Assessment) - log(Market)				
	Attribute FE		Hedonic Price FE		
	(1)	(2)	(3)	(4)	
Black Mortgage Holder	0.1195***		0.1208***		
	(0.0083)		(0.0084)		
Black or Hispanic Mortgage Holder		0.0916***		0.0927***	IV synthetic, black
		(0.0057)		(0.0057)	
Juris-Yr FE	Y	Y	Y	Y	
No. Clusters	26006	26006	26006	26006	
Observations	4,872,323	4,872,323	4,872,323	4,872,323	
R^2	0.8985	0.8985	0.8978	0.8978	

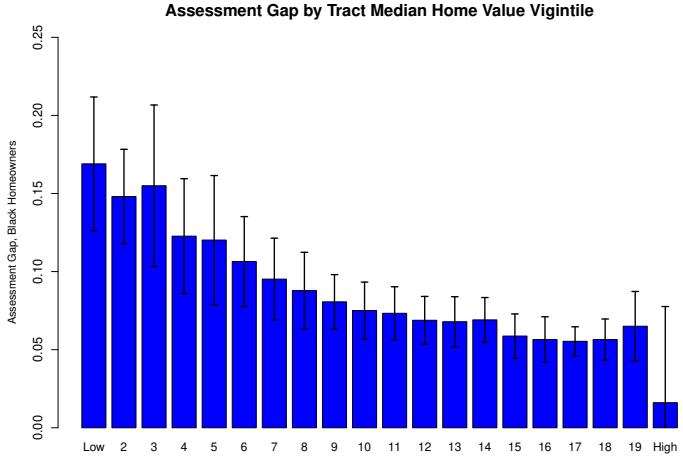
Note: *p<0.1; **p<0.05; ***p<0.01

Result: Effects Instrumenting for Price

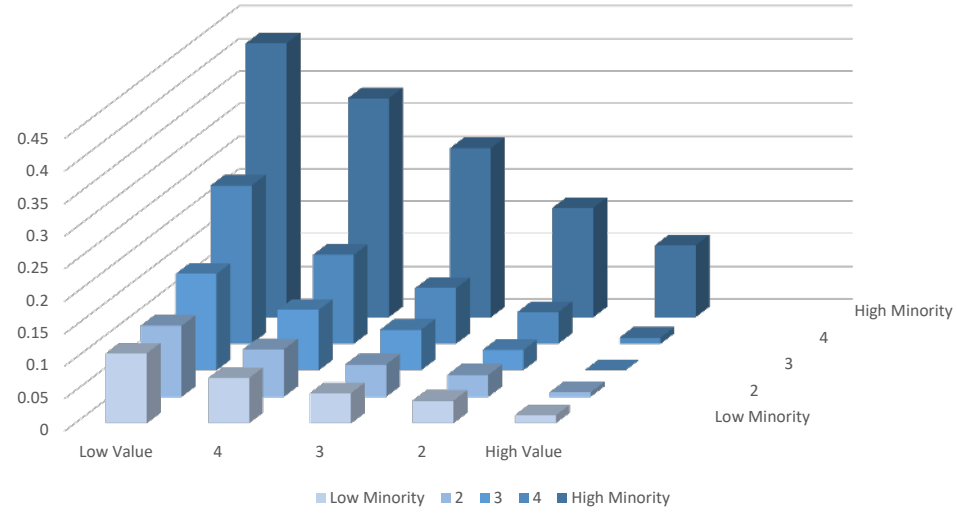
	log(Assessment) - log(Market)				
	(1)	(2)	(3)	(4)	(5)
Black Mortgage Holder	0.1204***	0.1140***	0.1123***	0.1162***	0.1123***
	(0.0084)	(0.0076)	(0.0075)	(0.0078)	(0.0075)
Price		−0.00000***	−0.00000***	−0.00000***	−0.00000***
		(0.00000)	(0.00000)	(0.0000)	(0.00000)
Fixed Effects	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year	Jurisd-Year
Baseline	Inst Version	Log All	Log One	Lvl All	Lvl One
No. Clusters	25911	25596	25596	25596	25596
Observations	4,677,886	4,393,978	4,393,978	4,393,978	4,393,978
R^2	0.8993	0.9044	0.9053	0.9032	0.9053

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

Assessment Gap by Tract-Level Home Value



Assessment Gap by Tract-Level Home Value and Minority Share



Result: Controlling for Attributes within Neighborhood

	log(Assessment Ratio)					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Jurisdiction						
Black Mortgage Holder	0.1092***		0.1195***		0.1218***	
	(0.0081)		(0.0087)		(0.0093)	
Black or Hispanic Mortgage Holder		0.0852***		0.0910***		0.0921***
		(0.0053)		(0.0060)		(0.0065)
Panel B: Tract						
Black Mortgage Holder	0.0562***		0.0602***		0.0553***	
	(0.0020)		(0.0023)		(0.0023)	
Black or Hispanic Mortgage Holder		0.0463***		0.0494***		0.0454***
		(0.0015)		(0.0017)		(0.0017)
Panel C: Block Group						
Black Mortgage Holder	0.0484***		0.0530***		0.0475***	
	(0.0018)		(0.0021)		(0.0020)	
Black or Hispanic Mortgage Holder		0.0409***		0.0440***		0.0400***
		(0.0013)		(0.0015)		(0.0016)
Price FE	attbin	attbin	200Q	200Q	500Q	500Q
No. Clusters	25798	25798	25798	25798	25798	25798

Direct Test of Tax Burden

Higher assessment ratio mechanically implies larger tax burden

Direct tests:

1. $effectiverate_{ijt} = \gamma_{jt} + assessmentratio_{ijt} + \varepsilon_{ijt}$
2. $effectiverate_{ijt} = \gamma_{jt} + \beta\, race/ethnicity_{ijt} + \varepsilon_{ijt}$

Main concerns: 1) exemptions, 2) partial tax year

Assessment Ratio Pass-Through to Effective Rate

	Effective Tax Rate - Year of Sale (%)		
	Tax Bill	Tax Bill	Before Exemptions
	(1)	(2)	(3)
All Mortgage Holders	0.9913***		
	(0.0039)		
White Mortgage Holder		0.9925***	0.8569***
		(0.0037)	(0.0128)
Black or Latinx Mortgage Holder		0.9857***	0.8517***
		(0.0056)	(0.0131)
Other Non-White Mortgage Holder		0.9892***	0.8536***
		(0.0040)	(0.0131)
Fixed Effects	Jurisd-Year	Jurisd-Year	Jurisd-Year
No. Clusters	26371	26371	26371
Observations	3,373,164	3,373,164	3,373,164
R^2	0.9191	0.9192	0.7672

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

Other controls: age, tenure,labor force

Effective Tax Rate, in Sale Year

	Effective Tax Rate - In Sale Year (%)			
	Tax Bill	Before Exemptions	Tax Bill	Before Exemptions
	(1)	(2)	(3)	(4)
Black Mortgage Holder	14.8834***	12.2187***		
	(1.9459)	(2.0551)		
Black or Hispanic Mortgage Holder			11.3977***	8.0480***
			(1.4335)	(1.5783)
Jurisd-Year FE	Y	Y	Y	Y
Other Controls	N	N	N	N
No. Clusters	26371	26371	26371	26371
Observations	3,373,164	3,373,164	3,373,164	3,373,164
R^2	0.6803	0.6481	0.6802	0.6478

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

Other controls: age, tenure,labor force

Lag Lead Back

Effective Tax Rate, One Year Prior to Sale

	Effective Tax Rate - One Year Before Sale (%)			
	Tax Bill	Before Exemptions	Tax Bill	Before Exemptions
	(1)	(2)	(3)	(4)
Black Mortgage Holder	15.2528***	12.2586***		
	(2.0458)	(2.1646)		
Black or Hispanic Mortgage Holder			11.6826***	7.8133***
			(1.4850)	(1.6357)
Jurisd-Year FE	Y	Y	Y	Y
Other Controls	N	N	N	N
No. Clusters	26371	26371	26371	26371
Observations	3,373,164	3,373,164	3,373,164	3,373,164
R^2	0.6659	0.6315	0.6657	0.6312

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

Other controls: age, tenure,labor force

Back

Effective Tax Rate, One Year After Sale

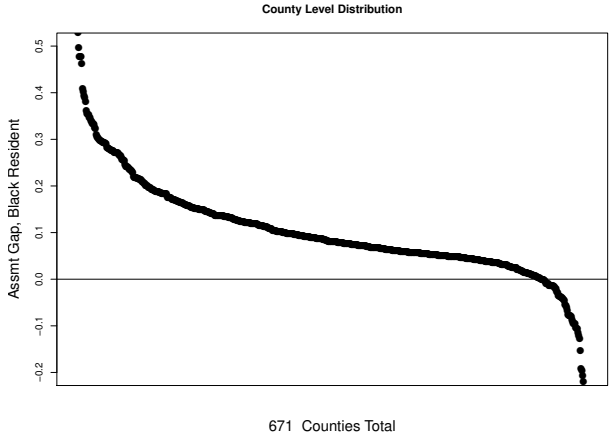
	Effective Tax Rate - One Year After Sale (%)			
	Tax Bill	Before Exemptions	Tax Bill	Before Exemptions
	(1)	(2)	(3)	(4)
Black Mortgage Holder	13.1055***	10.2602***		
	(1.8480)	(1.9628)		
Black or Hispanic Mortgage Holder			9.7809***	7.0178***
			(1.3657)	(1.4751)
Jurisd-Year FE	Y	Y	Y	Y
Other Controls	N	N	N	N
No. Clusters	26371	26371	26371	26371
Observations	3,373,164	3,373,164	3,373,164	3,373,164
R^2	0.7042	0.6703	0.7039	0.6701

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

Other controls: age, tenure,labor force

Back

Assessment Gap Estimated by County



90th percentile: 24% higher assessment ratio -> $786 annually

Sample Split: Racial Animus

	Assessment Value / Market Value				
	Baseline	By Media Market		By State	
	(1)	(2)	(3)	(4)	(5)
Black Mortgage Holder	0.128***				
	(0.015)				
Black, High Animus		0.150***	0.070***	0.145***	0.076***
		(0.022)	(0.003)	(0.011)	(0.003)
Black, Low Animus		0.084***	0.055***	0.106***	0.049***
		(0.008)	(0.002)	(0.033)	(0.002)
Fixed Effects	Jurisd-Yr	Jursid-Yr	Jurisd-Tract-Yr	Jurisd-Yr	Jursid-Tract-Yr
No. Clusters	37106	37106	37106	37106	37106
Observations	6,856,585	6,856,585	6,856,585	6,856,585	6,856,585
R^2	0.881	0.881	0.902	0.881	0.902
Note:					*p<0.1; **p<0.05; ***p<0.01

Animus from Stephens-Davidowitz (JPE 2014) Index

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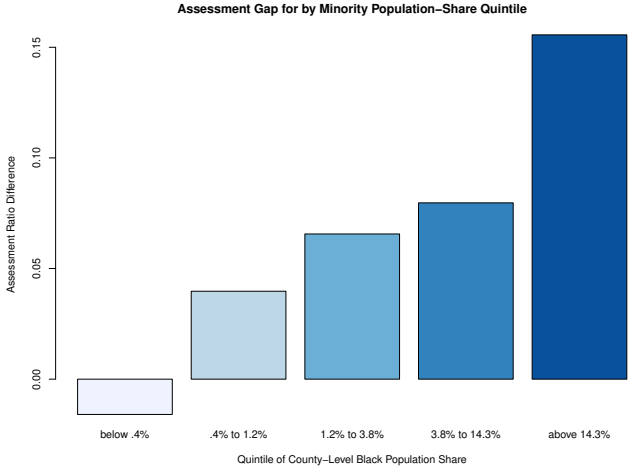
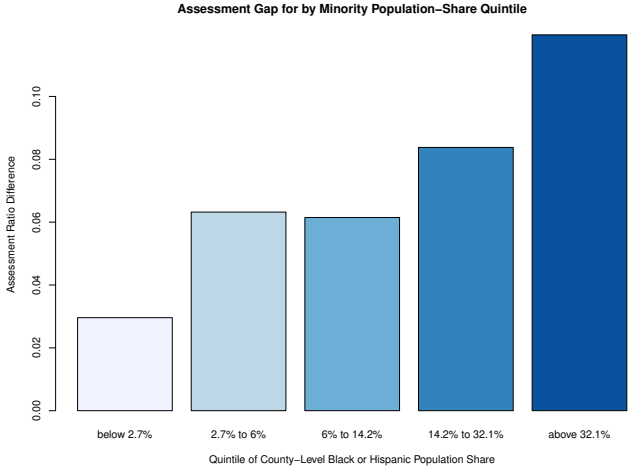
Sample Split: County Minority Share



Underlying Regression Back

Sample Split: County Minority Share



Underlying Regression Back

Sample Split: County Share Regressions

	Assessment Value / Market Value				
	Quintile of County-Level Minority Population Share				
	(1)	(2)	(3)	(4)	(5)
Black Mortgage Holder	−0.016	0.040***	0.066***	0.080***	0.156***
	(0.054)	(0.007)	(0.004)	(0.006)	(0.022)
Fixed Effects	Jurisd-Yr	Jurisd-Yr	Jurisd-Yr	Jurisd-Yr	Jurisd-Yr
No. Clusters	2008	6491	9490	12813	6323
Observations	53,919	405,323	909,640	3,114,742	2,372,961
R^2	0.856	0.938	0.906	0.888	0.850

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

◂ Back to Graphs ◂ Back to Extensions

Sample Split: County Share Regressions

	Assessment Value / Market Value				
	Quintile of County-Level Minority Population Share				
	(1)	(2)	(3)	(4)	(5)
Black or Hispanic Mortgage Holder	0.030**	0.063***	0.061***	0.084***	0.120***
	(0.014)	(0.006)	(0.003)	(0.006)	(0.019)
Fixed Effects	Jurisd-Yr	Jurisd-Yr	Jurisd-Yr	Jurisd-Yr	Jurisd-Yr
No. Clusters	3215	5989	10998	12089	4843
Observations	73,243	295,057	1,433,767	2,796,141	2,258,377
R^2	0.819	0.786	0.858	0.879	0.882
Note:					*p<0.1; **p<0.05; ***p<0.01

◂ Back to Graphs ◂ Back to Extensions

How Does Homeowner Tenure Affect Inequality?

	log(Assessment) - log(Market)	
	(1)	(2)
Black Mortgage Holder	0.1532***	
	(0.0183)	
Black or Hispanic Mortgage Holder		0.1175***
		(0.0122)
Years Since Sale	0.0050***	0.0053***
	(0.0003)	(0.0003)
Fixed Effects	Jurisd-Year	Jurisd-Year
No. Clusters	32567	32567
Observations	4,117,014	4,117,014
R^2	0.8937	0.8937
Note:		*p<0.1; **p<0.05; ***p<0.01

Homeowner Tenure Bins (Black Residents)

	log(Assessment) - log(Market)		
	1-5 Years	6-10 Years	10+ Years
Black Mortgage Holder	0.1436***	0.1632***	0.1352***
	(0.0193)	(0.0192)	(0.0152)
Fixed Effects	Jurisd-Year	Jurisd-Year	Jurisd-Year
No. Clusters	28558	27188	14762
Observations	2,260,875	1,508,207	347,932
R^2	0.9036	0.8865	0.9013

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

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Homeowner Tenure Bins (Black or Hispanic Residents)

	log(Assessment) - log(Market)		
	1-5 Years	6-10 Years	10+ Years
Black or Hispanic Mortgage Holder	0.1090***	0.1242***	0.0926***
	(0.0124)	(0.0135)	(0.0101)
Fixed Effects	Jurisd-Year	Jurisd-Year	Jurisd-Year
No. Clusters	28558	27188	14762
Observations	2,260,875	1,508,207	347,932
R^2	0.9036	0.8864	0.9012

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

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Robustness: Simple Ratios

	Assessment Value / Market Value		
	(1)	(2)	(3)
Black Mortgage Holder	0.0897***		
	(0.0057)		
Black or Hispanic Mortgage Holder		0.0696***	
		(0.0039)	
Other Non-White Mort. Holder			0.0208***
			(0.0010)
Fixed Effects	Jurisd-Year	Jurisd-Year	Jurisd-Year
Other Controls	N	N	N
No. Clusters	37723	37723	37723
Observations	6,987,915	6,987,915	6,987,915
R^2	0.6987	0.6986	0.6986

Note: *: <0.1, **: <0.05, ***: <0.01

Results: Assessments Using Zip-Code Level HPIs

	log(Assessment) - log(Market)			
	Real Assessments			Zillow Assessments
	(1)	(2)	(3)	(4)
Black Mortgage Holder	0.144***		−0.041***	
	(0.015)		(0.003)	
Black or Hispanic Mortgage Holder		0.110***		−0.051***
		(0.011)		(0.003)
Jurisd-Year FE	Y	Y	Y	Y
Other Controls	N	N	N	N
No. Clusters	18853	18853	18853	18853
Observations	2,135,922	2,135,922	2,135,922	2,135,922
R^2	0.910	0.910	0.712	0.713

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

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