Distance to Schools and Equal Access in School Choice Systems

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School choice: decoupling residences from schools

Many cities in the US and abroad use school choice systems

→ Boston, NY, New Haven, Amsterdam, Paris, Santiago ...

School choice

→ Use parents' stated preferences to assign students to schools

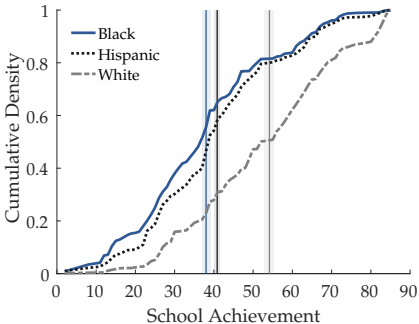
→ In contrast to neighborhood assignment rules

Decoupling residences from schools to:

> *"Our goal is to create an assignment plan that provides all Boston students with* **high-quality desegregated education***"* (Boston Public Schools, 1987)

Cross-race gaps in access to high-achieving schools

School Choice Assignments



Neighborhood Assignments

Cross-race gaps in access to high-achieving schools

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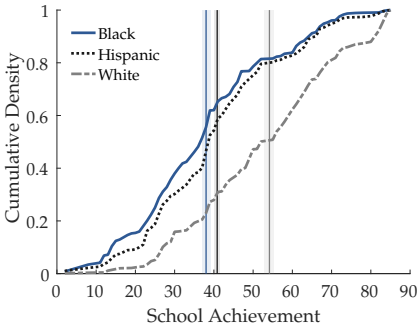

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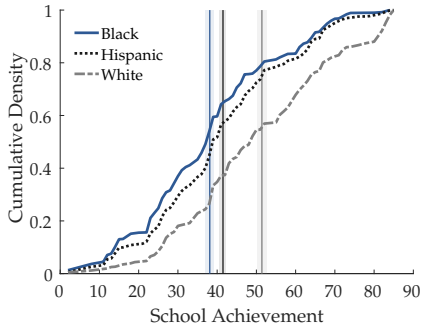

This paper

→ **Investigates the reasons why the effects of choice are limited**

Why are minority students assigned to high-achieving schools less often?

→ **Quantify the contribution of three mechanisms to the cross-race gap in school achievement**

1. Cross-race differences in distance to high-achieving schools
2. Cross-race differences in preferences for location-independent school attributes
3. Assignment rules

Strategy

1. **Estimate model of school demand**

   Disentangle preference for proximity and location-independent school valuations

2. **Quantify the contribution of mechanisms: compare students' assignments under counterfactual scenarios**

   1. Change in residential location
   2. Change in parents' demand parameters
   3. Change in assignment rules

→ **Applications to prekindergarten in Boston Public Schools (BPS) between 2010 and 2013**

Findings

1. **Distance to high-achieving schools explain half of cross-race gap**
   - → 53% of the gap for black-white gap
   - → 49% of the hispanic-white gap

2. **Valuation of non-location school attributes explain a smaller share of gap**
   - → 41% of the black-white gap
   - → 30% of the hispanic-white gap

3. **Rules of the algorithm have no effect**

Related Literature

1. Effectiveness of school choice generating system-wide improvements

   Friedman 1982, Chubb and Moe 1990, Hoxby 2003, Abdulkadiroğlu *et al.* 2020, Hastings *et al.* 2009, Barseghyan *et al.* 2014, Borghans *et al.* 2015

2. Neighborhood effects and the provision of public goods

   Chetty *et al.* 2014, 2016 2018, Chetty and Hendren 2018, Biasi 2019, Laliberte 2018

3. Use rankings data to study properties of assignment algorithms and parental demand

   Son 2020, Kapor *et al.* 2020, Luflade 2018, Agarwal and Somaini 2018, Fack *et al.* 2019, Calsamiglia *et al.* 2020, Hastings *et al.* 2009, Borghans *et al.* 2015, Abdulkadiroğlu *et al.* 2020, Abdulkadiroğlu *et al.* 2017, Oosterbeek *et al.* 2019

Outline

Setting and Descriptive Evidence

School Preferences

Counterfactual Analysis

Conclusion

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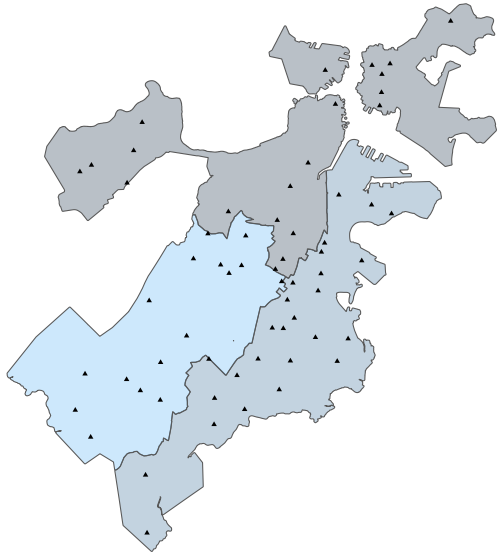
The assignment process

1. **Parents' preferences**
   - → List any number of schools in preference order
   - → Geographic restrictions on school menu
2. **School Priorities**
   - → Students with a sibling are prioritized
   - → Students who live within a mile of a school are prioritized
3. **Assignment**
   - → Student proposing deferred acceptance algorithm
   - → Strategy-proof: truth telling is a weakly dominant strategy

Choice menus: schools in the zone + schools within a mile of the residence



Data

Boston Public Schools Applicants' Data

- → First round applicants to prekindergarten between 2010 and 2013
- → Rank-ordered list, residential location, race, assigned school and priorities
- → School capacities and locations
- → Get linear and walking distance for every student-school pair

Massachusetts DOE School Characteristics

- → School Achievement → % 3rd-grade students scoring Advanced or Proficient in Math MCAS
- → School Demographics → % Low-income in K, % Black, Hispanic, white

Student Descriptive Statistics

	All	*Black*	*Hispanic*	*White*	*Asian*	*Other*
Applicants	**8,869**	**22.9**	**42.8**	**22.8**	**7.8**	**3.6**
Tract Income	55,551	43,705	49,873	76,753	55,166	63,660
	(25,429)	(19,205)	(21,711)	(24,850)	(22,875)	(27,363)
Applications						
Size of Choice Menu	24.8	26.0	24.8	23.5	25.0	24.4
	(2.4)	(2.2)	(2.4)	(1.9)	(1.9)	(2.3)
Distance in Choice Menu	2.6	2.4	2.7	2.7	2.6	2.5
	(0.8)	(0.7)	(0.9)	(0.8)	(0.8)	(0.8)
Maximum distance in Choice Menu	5.6	5.5	5.8	5.3	5.9	5.3
	(1.3)	(1.1)	(1.3)	(1.5)	(1.2)	(1.4)
Length of Submitted List	5.0	5.5	5.0	4.8	4.1	5.7
	(3.1)	(3.4)	(3.0)	(2.8)	(2.7)	(3.6)
Share English Language Learners	37.5	19.4	58.2	11.4	64.7	11.7
Assignments						
Assigned Rank	1.8	1.9	1.7	1.7	1.6	2.3
	(2.2)	(2.1)	(1.8)	(2.7)	(1.6)	(3.3)
Distance to Assigned School	1.2	1.3	1.3	1.0	1.1	1.2
	(1.3)	(1.3)	(1.3)	(1.0)	(1.1)	(1.2)
Share Assigned with Sibling Priority	36.0	31.3	34.4	43.8	40.0	33.9
Share Assigned with Walk-Zone Priority	48.4	47.4	46.6	53.5	48.1	49.1
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Note: Standard errors in parenthesis

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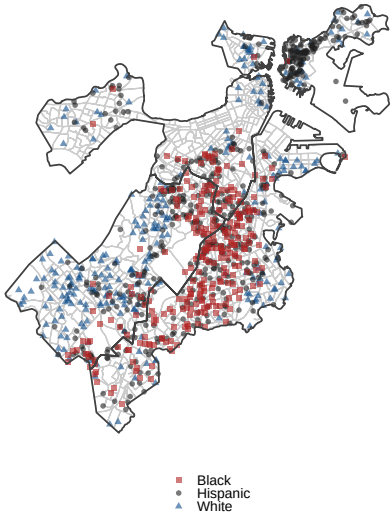
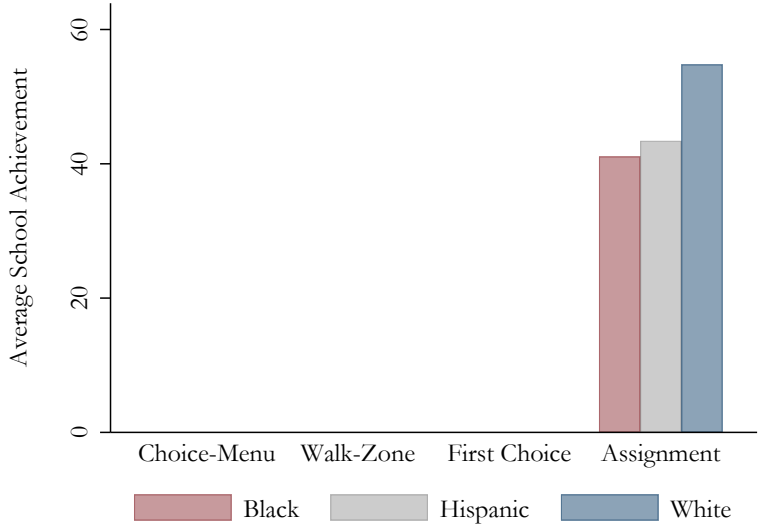
Student locations



School Descriptive Statistics

	Mean	*St. Dev.*	*Min*	*Max*
Capacity	30.9	15.7	6.0	108.0
Achievement				
% Scoring Advanced-Proficient Math	46.1	19.2	2.0	90.0
% Scoring Advanced-Proficient English	37.8	16.0	10.0	86.0
Demographics				
% Black Students	32.0	19.3	2.1	79.7
% Hispanic Students	44.2	19.3	14.3	91.1
% White Students	14.6	14.7	0.0	65.8
% Low Income Kindergarten Students	67.5	19.8	7.7	100.0
Observations		258	(67 distinct schools)	

Mechanisms: preference heterogeneity, distance and assignment rules



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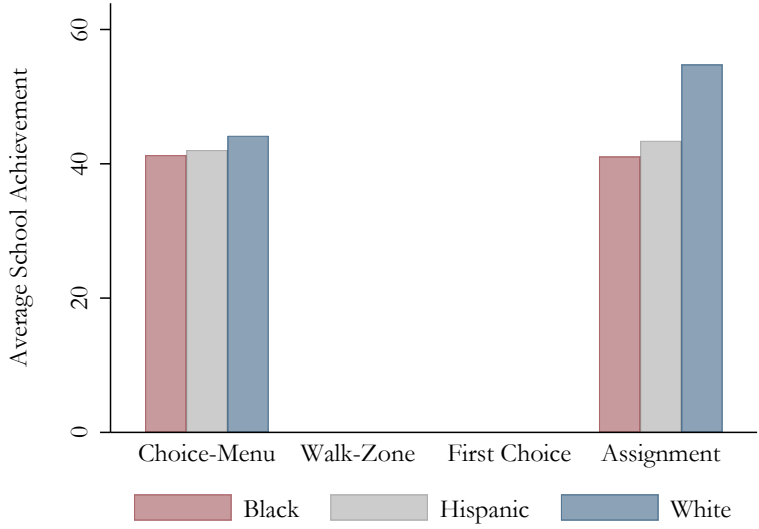

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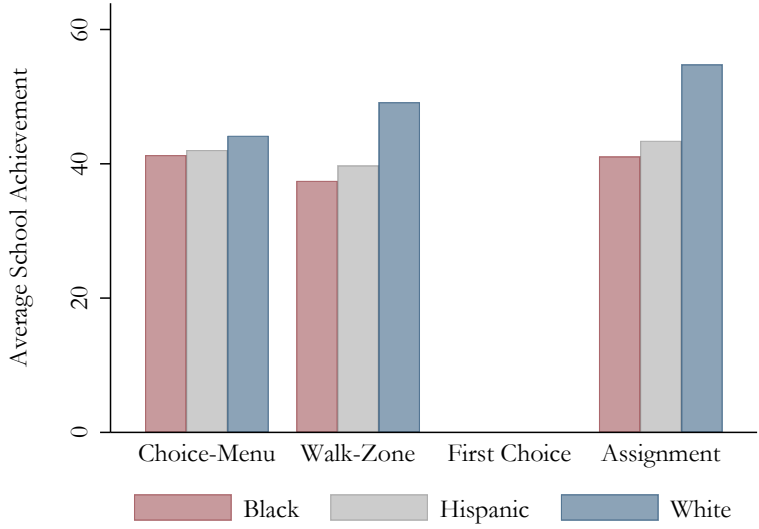

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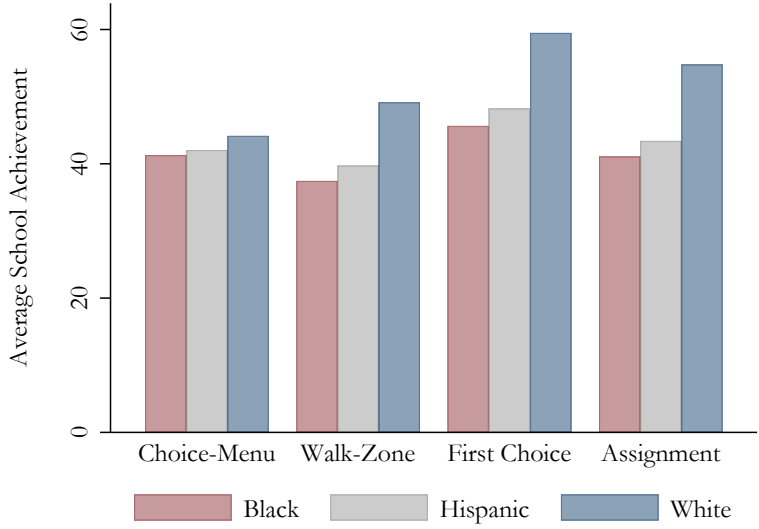
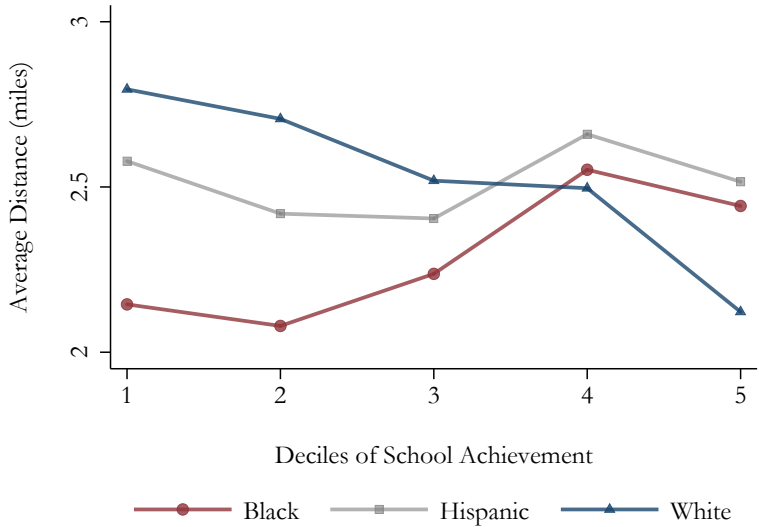


Minorities trade-off distance and achievement



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School preferences

→ Group-specific random utility model

$$u_{ij} = \beta_c d_{ij} + \gamma_c l_{ij} + \delta_{cj} + \epsilon_{ij} \tag{1}$$

where clusters are the intersection of i's race, and census tract income income category

clusters

→ **A1:** parents rank all acceptable schools in preference order

→ **A2:** parents consider all schools in their choice set

→ **A3:** d_{ij} is independent of ϵ_{ij} conditional on δ_{cj} and l_{ij}, for each covariate cell

→ Parameters jointly estimated by ML, $\epsilon_{ij} \sim T1EV$

Mapping the model to the data

Assumptions 1 and 2 imply

→ Parents submit truthful rankings:

$$R_{i1} = \underset{j \in \mathcal{J}_i}{\arg\max} \quad u_{ij}$$

$$R_{ik} = \underset{j \in \mathcal{J}_i \setminus \{R_{im} : m < k\}}{\arg\max} \quad u_{ij}$$

where $R_i = (R_{i1}, \cdots, R_{il_i})$ is i's rank ordered list

→ and,

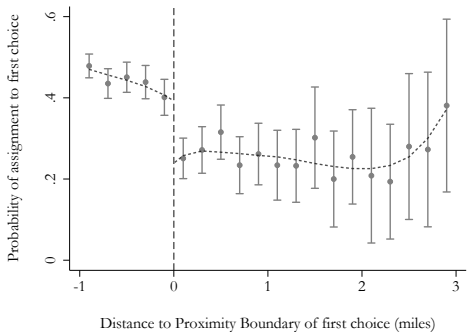
$$u_{ij} > u_{i0} \quad \forall \quad j \in R_i$$

$$u_{i0} > u_{ij} \quad \forall \quad j \in \mathcal{J}_i \setminus R_i$$

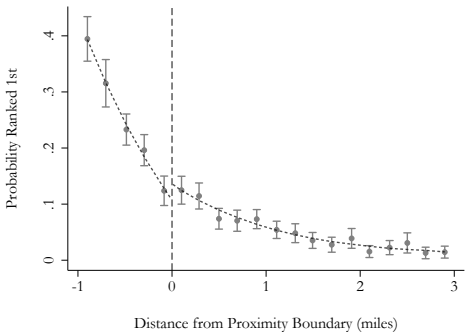
where $u_{i0} = 0$ is the expected utility of the best alternative if unassigned

Identification of β_c: ranking schools near or sorting near preferred schools?

(a) Probability of Assignment



(b) Probability of Ranking First



▸ Boundary Others

School Mean Utilities and School Characteristics

	Standardized δ_j^r/β					
	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
% Scored Advanced-Proficient Math	0.10	0.67	0.02	0.21	0.30	1.05
	(0.37)	(0.33)	(0.29)	(0.26)	(0.27)	(0.28)
% of Black Students	0.30	2.10	-3.67	-1.20	1.32	-0.85
	(1.14)	(1.02)	(0.90)	(0.80)	(0.83)	(0.86)
% of White Students	2.26	4.04	2.11	4.12	2.88	6.67
	(1.38)	(1.24)	(1.09)	(0.96)	(1.00)	(1.04)
% of Black Students Squared	-1.01	-2.82	1.05	-1.24	-4.12	0.17
	(1.51)	(1.35)	(1.19)	(1.05)	(1.09)	(1.14)
% of White Students Squared	-1.01	-3.43	-3.15	-3.22	-3.02	-8.20
	(2.42)	(2.16)	(1.91)	(1.69)	(1.75)	(1.82)
% Low-Income Students in Kindergarten	-0.07	-0.43	-0.23	-0.35	-0.07	-0.15
	(0.35)	(0.31)	(0.28)	(0.24)	(0.25)	(0.26)
Constant	-0.28	-0.76	0.99	0.24	-0.17	-0.72
	(0.41)	(0.37)	(0.33)	(0.29)	(0.30)	(0.31)
Observations	233	233	233	233	233	233
Race	B	B	H	H	w	w
Income	Q1	Q2	Q1	Q2	Q1	Q2
R^2	0.12	0.29	0.45	0.60	0.42	0.51

Note: Standard errors in parenthesis

▸ Proximity

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Counterfactuals

For the universe of schools and students in 2011

→ Change residential location of a minority student at random

→ Change demand parameters of a minority student

→ Eliminate proximity priorities and choice menu restrictions

Recover the distribution of school achievement in each case

Residential location change

How to handle the sibling priority after a residence change?

1. Student lose any sibling priority previously held
   → both siblings search for a school in the new location

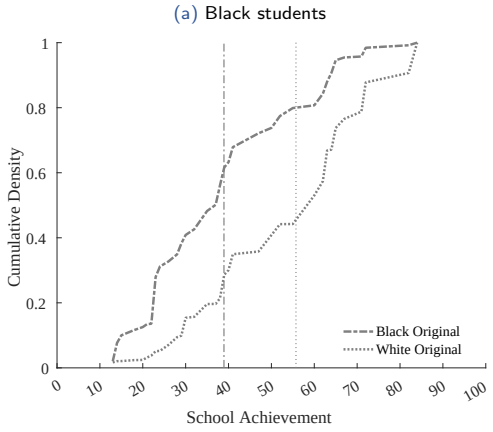
2. Student keep sibling priority at the school they held it before
   → older sibling stays in the original school

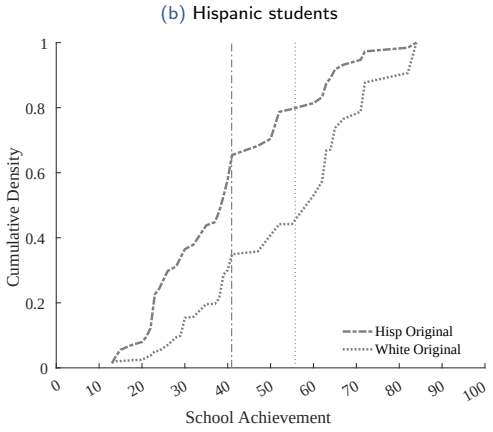
3. Predict sibling school in new location
   → older sibling assignment had they lived in the new location then?

4. Assume sibling priority at first ranked school
   → extreme case where older sibling is always assigned to first choice

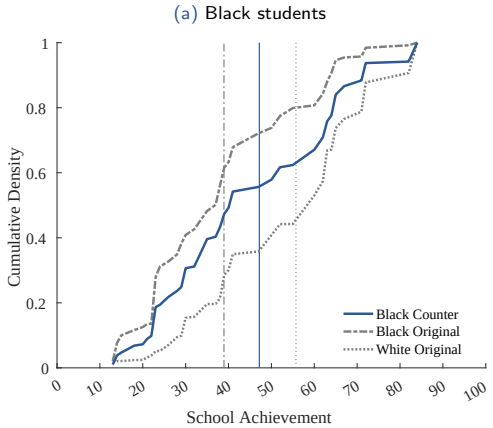
Change in Residential Location

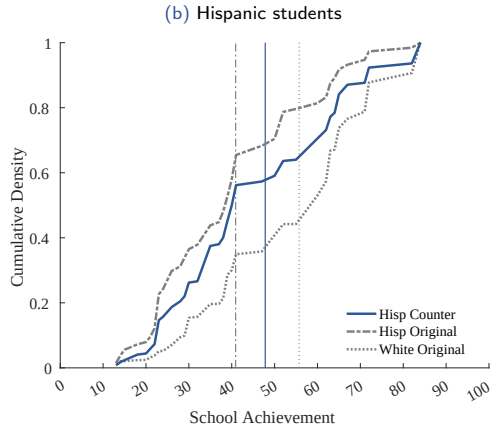
T1: Residential location change assuming students lose any sibling priority





T1: Residential location change assuming students lose any sibling priority





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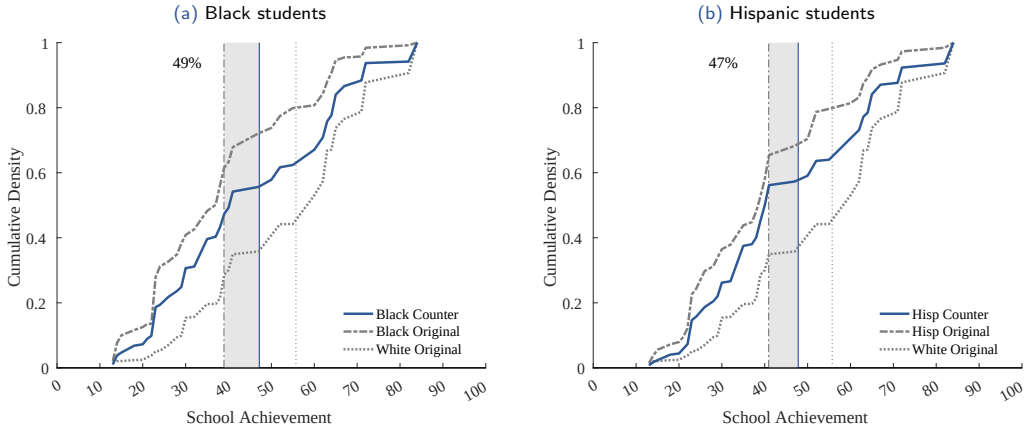
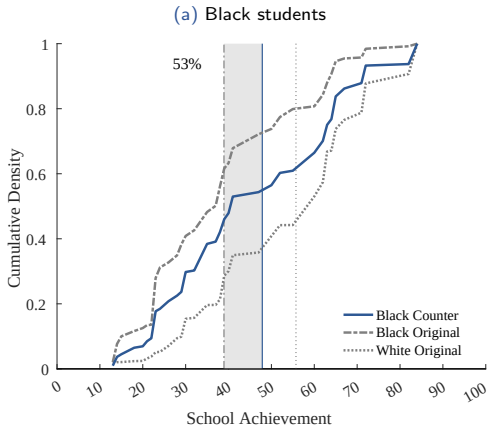
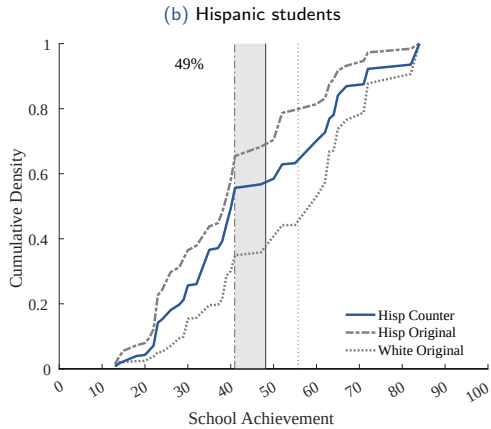
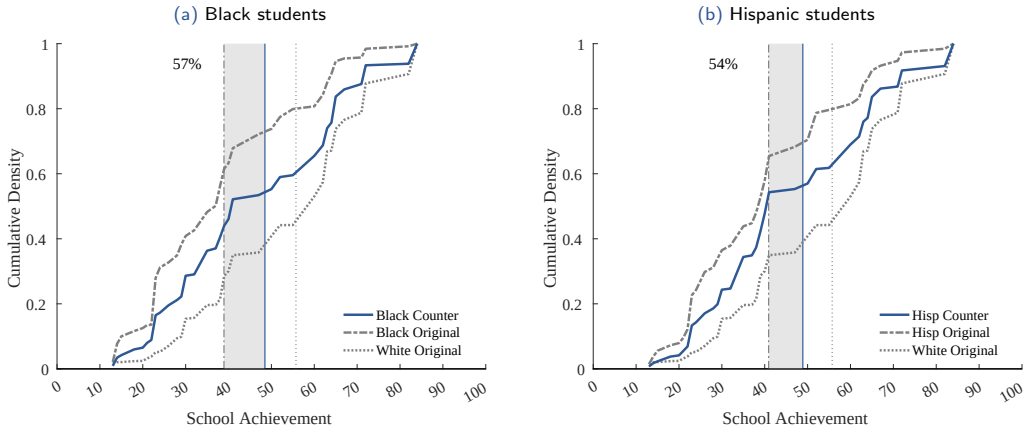


T3: Residential location change predicting the sibling school in the new location



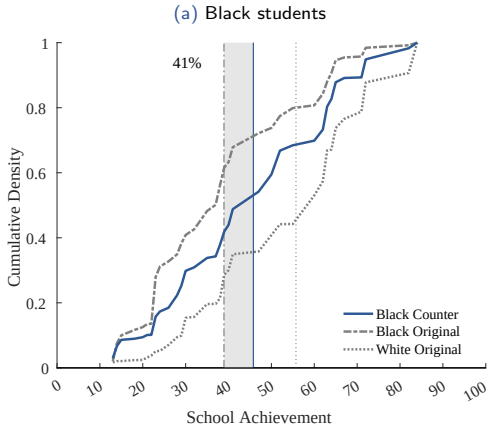


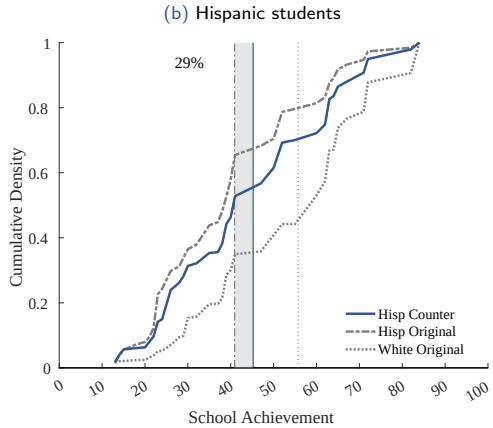
T4: Residential location change assuming sibling school is the first ranked



Change in Preference Parameters

Change in demand parameters

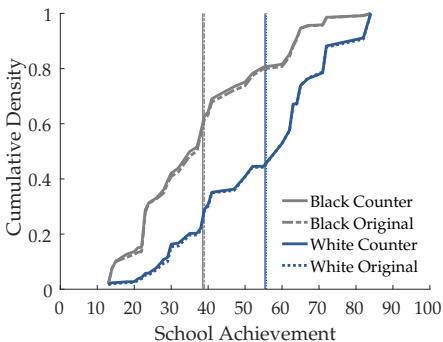




Change in Assignment Rules

Change to location-specific assignment rules

(a) Eliminate choice-menu restrictions



Change to location-specific assignment rules

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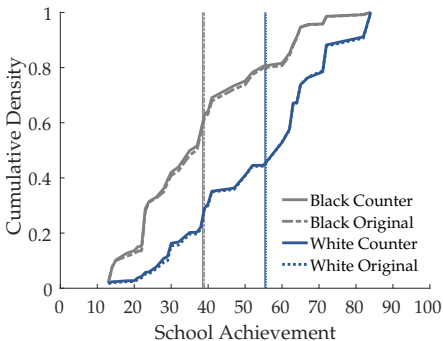
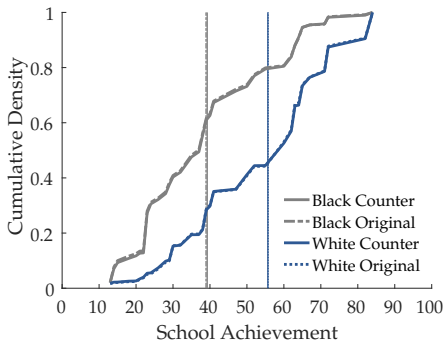
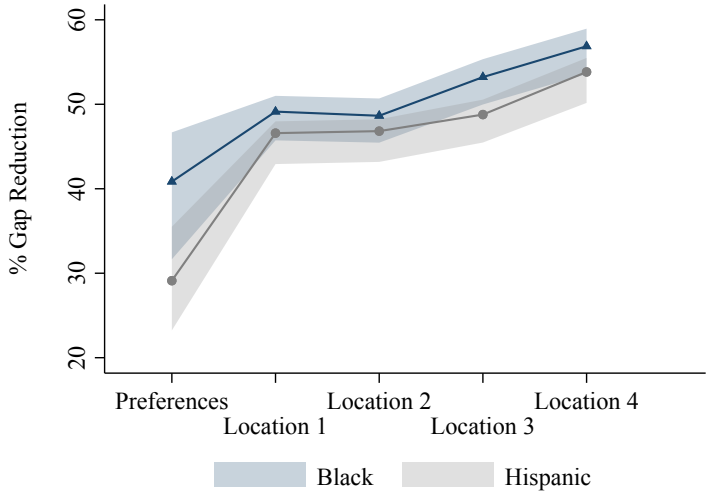


(b) Eliminate proximity priorities



Salient effects of distance



Outline

Setting and Descriptive Evidence

School Preferences

Counterfactual Analysis

Conclusion

Conclusion

In this paper

→ Among other objectives, school choice systems are sought for their potential to equalize access to high-quality desegregated school, among other objectives

→ Black and Hispanic students access higher-achieving schools at a lower rate in Boston

Findings

→ Black and Hispanic students live farther from higher-achieving schools then white students do

→ Location has a big impact on school assignments even in a choice setting

→ Choice systems should not discourage efforts to equate spatial distribution of quality

Thanks!

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Distribution of Students in Space

	Mean	*St. Dev.*	*Min*	*Max*
Potential applicants that are within 3.8 miles of each school				
Cluster 1 - Black Q1	442.4	294.9	20	1,274
Cluster 2 - Black Q2	175.2	108.9	6	496
Cluster 3 - Hispanic Q1	618.9	297.0	116	1,515
Cluster 4 - Hispanic Q2	390.6	207.0	31	1,052
Cluster 5 - White Q1	60.5	32.4	10	144
Cluster 6 - White Q2	463.9	307.9	43	1,224
Applicants per school				
Cluster 1 - Black Q1	113.0	77.2	17	373
Cluster 2 - Black Q2	50.3	38.9	7	164
Cluster 3 - Hispanic Q1	171.0	128.7	13	686
Cluster 4 - Hispanic Q2	107.7	83.0	8	418
Cluster 5 - White Q1	17.5	16.8	0	71
Cluster 6 - White Q2	124.0	167.9	0	686

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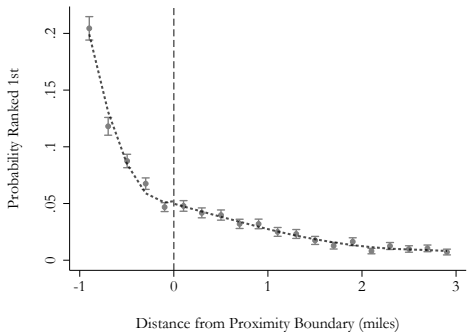
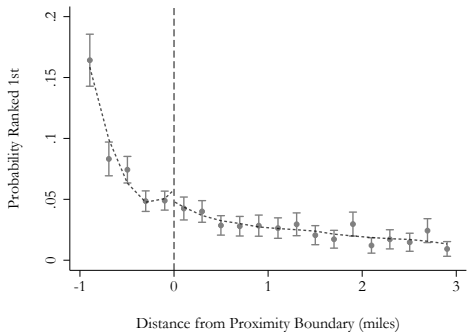
Sorting on walk-zone boundaries

(a) All Students



(b) Black Students



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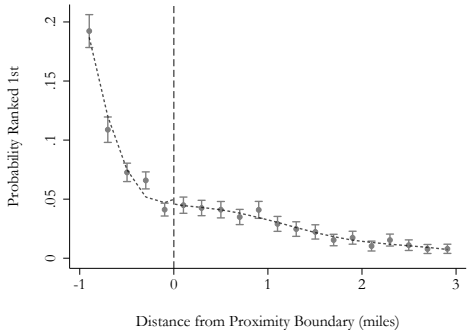
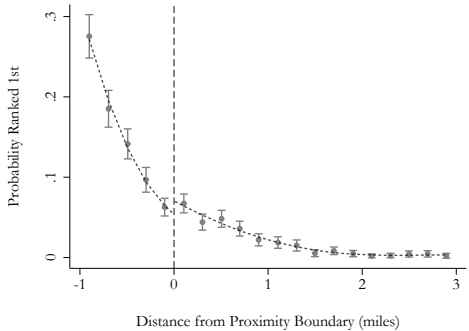
Sorting on walk-zone boundaries

(a) Hispanic Students



(b) White Students



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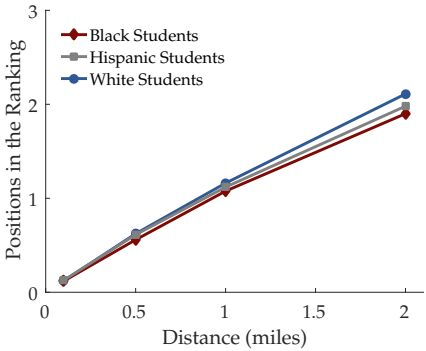
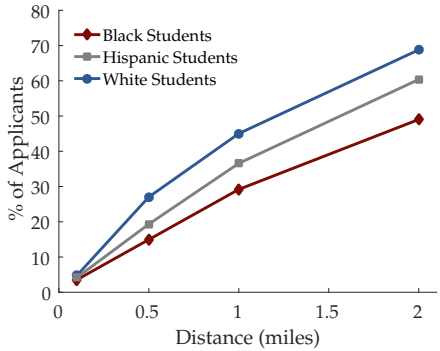
Preferences for Proximity

Figure: Increased Distance and Application Behaviour

(a) Positions lost



(b) Share of applicants lost



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Are schools in the new location on average preferred?

The relocation increases utility. The increase is equivalent to a reduction in travel distance by 0.3 miles for Black and Hispanic families

$$\sum_{i \in \mathcal{I}^r} \frac{\delta^r_{\tilde{\mu}(i)} - \delta^r_{\mu(i)}}{|\beta^r| N^r} = 0.3 \text{ miles}$$