Attendance Boundary Policy and the Segregation of Public Schools in the United States

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Racial Segregation and Schools in the United States

- School desegregation is one of the most ambitious social policies in U.S. history.
- Starting with *Brown* in 1954, the government placed a mandate on local school districts to integrate.
- Decision signaled the beginning of an era of federal oversight on local desegregation efforts.
- We are now on the other side of this era, local officials have been handed the reins back. But the mandate remains.
- What is the landscape school integration policy in the modern, unsupervised status quo?

School Attendance Boundaries (SABs)

- SABs are the country's most common form of student assignment policy, serving 95% of K-12 pupils in SY 2013-14.
- Local district officials are responsible for drawing these.
- Beyond state provisions allowing school transfers, there is no regulation on SAB policy.
- SABs adjust periodically to accommodate school construction and neighborhood aging.

Research Questions

- How do policymakers set SABs? Do they do so to target school segregation?
- What is the distribution of modern integration policy?
- What does the integrative school district look like?
- Does integration policy matter for educational outcomes?
- Is integration policy stable to non-compliance reactions from parents?

This Talk

- Develop a counterfactual, 'neighborhood schools', SAB policy for (almost) each large school district.
- Relative to this, I estimate a parameter measuring the rate at which actual SABs integrate.
  - Call this parameter 'district-specific integration policy'.
- I describe the distribution of integration policy and characterize integrative districts.
- How unstable is integration policy? Estimate causal effect of SAB racial composition on racial Tiebout sorting (white flight?)

Findings

- The average district enacts SABs that are modestly integrative, reducing segregation by about 10%.
- There is substantial policy heterogeneity across districts.
  - 5% of districts oversegregate schools by more than 10%.
  - 12% reduce segregation by more than a third.
- Districts with active desegregation court orders show policy 60% stronger than the average district.
  - Notably, there are districts that never had orders, but are just as integrationist.
- The integrative district travels larger distance to school, and is smaller, better funded, less residentially segregated, and more gerrymandered. Some evidence of smaller school quality gaps.
- The effect of SAB composition on residential composition change is about 15% over a decade.

Roadmap

1. Literature and Data
2. Empirical Framework.
3. The Distribution of Integration Policy.
4. Validation of Method.
5. Characterization of Integration Policy.
6. Integration Policy and Household Non-Compliance.

Literature Review and Data

Literature

- SABs and School Segregation
  - Saporito et al. (2006, 2009, 2016); Richards (2014).
- The Effects of School Segregation
  - Card and Rothstein (2007); Hanushek et al. (2009); Jackson (2009); Billings et al. (2014).
- Desegregation orders
  - Cascio et al (2008, 2010); Reber (2005, 2010, 2011); Johnson (2011); Coleman et al (1966).
- School Assignment / Choice
  - Black (1999); Rothstein (2006); Bayer et al. (2007).
  - Abdulkadiroglu, et al. (2006), Pathak (2011).
- Congressional Gerrymandering
  - Chen and Cottrel (2016)

Data

- SABs - School Attendance Boundary Survey (SABS)
  - Coverage: 90% of LEAs, 85% of schools. 2013 SY.
  - Short Panel: SABS pilot survey, 500 large LEAs, 2009 SY.
  - Long Panel: 2000-2010 SAZs for CMS.
- 2010 Census Blocks – Population by Race by Age
  - Minorities (blacks and hispanics) and non-minorities (all others).
- Other sources:
  - 2010 Census Block Groups - Income
  - Common Core of Data (NCES)
  - Office of Civil Rights (OCR) - School Quality
  - Ed Facts - Student Proficiency Data
  - Stanford CEPA - Desegregation orders / Achievement Gaps
- **Sample Selection**:
  - Primary Schools.
  - LEAs with at least 5 primary schools with overlapping grades.
  - $N = 1,607$ LEAs, serving 11.5 million K4 students.

SABs

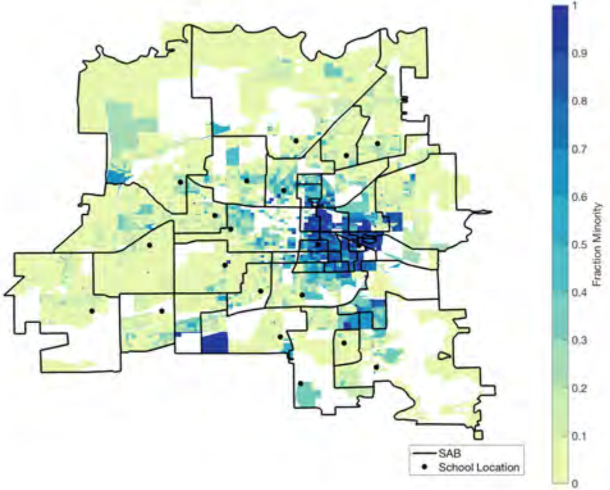


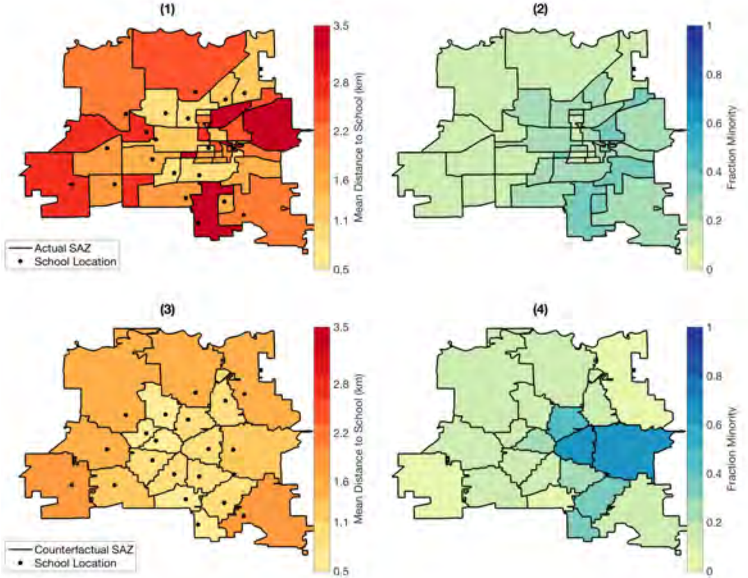
Figure: School Attendance Boundaries – Springfield Public Schools, IL.

Empirical Framework

Counterfactual SABs

- In order to assess extent of manipulation of boundaries, a baseline is needed for comparison.
- For the case of SABs, a natural counterfactual is boundaries that minimize student distance travelled to school (Voronoi Map) .
  - Can be motivated with an analogy to a 'neighborhood schools' scheme.
  - Call this baseline: 'Neighborhood SABs'.
- Assuming Neighborhood SABs are a low cost alternative to actual SABs:
  - Districts reveal preference when making costly departures from this baseline.

Neighborhood SABs



Neighborhood SABs

- Quick Aside: Euclidean Distance?
  - While quick and elegant, Euclidean distance may be an unrealistic approximation of travel time.
- One solution: Query Google Maps API
  - Pro: True travel time.
  - Con: Slow and costly. We need to compute millions of distances.
- Another Solution: Compute road network using Census road shapefiles and use Dijkstra's algorithm to find shortest path.
  - Pro: Don't need permission
  - Con: Ignores speed limits and congestion.

Figures

Stylized Model of Integrative SAB Drawing

- Schools/Neighborhoods $i = 1, ..., K$.
- Neighborhood Population $N_i = N$.
- Minority population N_i^m
    - Neighborhood composition: $r_i = N_i^m / N$.
- At baseline, students assigned neighborhood school.
- Policymaker may assign a_{ij} students from neighborhood i to school j
    - School composition: $s_i = S_i^m / S_i = \sum_j a_{ij} r_j / \sum_j a_{ij}$.
    - Baseline school comp.: $s_i = r_i$
- Integration Policy: reassign a fraction p of pupils from neighborhood to other schools.

$$a_{ij}^p = \begin{cases} \frac{p}{K-1} N_i & \text{if } i \neq j \\ (1-p) N_i & \text{if } i = j \end{cases}$$

- School composition now: $s_i = (1-p) r_i + p \bar{r}_{-i}$

Integration Policy Estimation

- Consider the following statistical model for the assigned fraction of minority students, s, at a given school i ran by district j:

$$s_{ij} = \gamma_j + \beta_j r_{ij} + \nu_{ij} \tag{1}$$

  where n_{ij} is the fraction minority in the school's neighborhood.
- For a given district, compute race-specific average school composition.

$$\bar{s}_j^r \approx \gamma_j + \beta_j \bar{r}_j^r$$

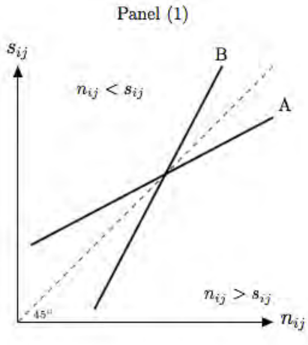
  then

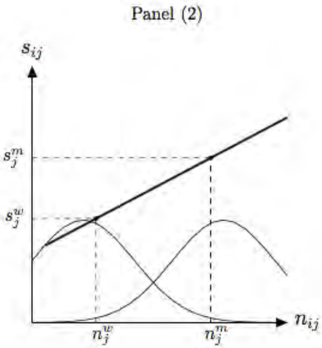
$$\Delta \bar{s}_j \approx \beta_j \Delta \bar{r}_j \tag{2}$$

- **Define the SAB Integration Rate (Policy)**

$$p_j = 1 - \beta_j \tag{3}$$

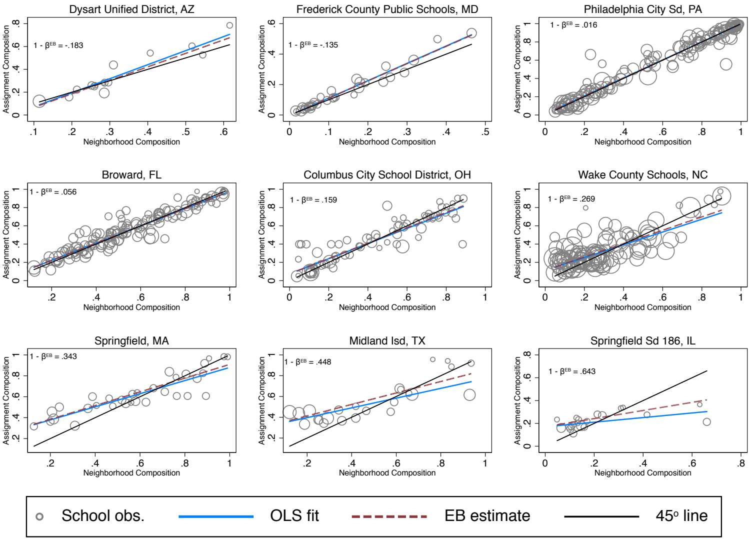
Integration Policy Estimation





The Distribution of Integration Policy.

Empirical Distribution of Integration Policy



Empirical Distribution of Integration Policy

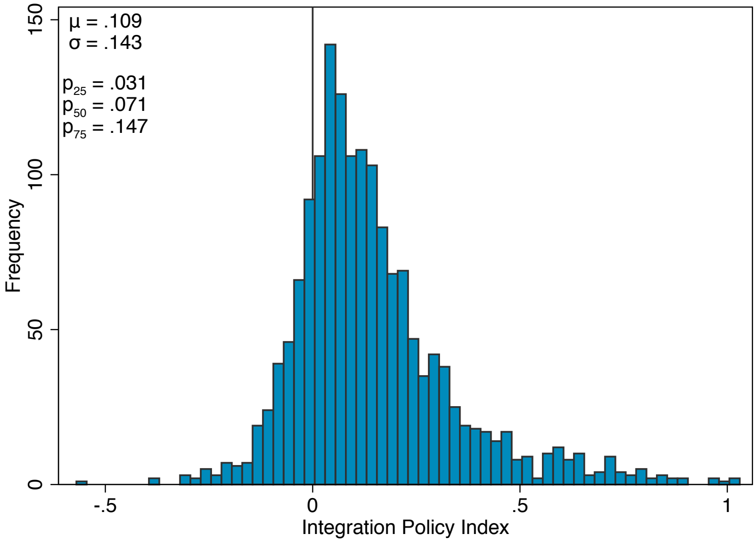


Figure: Distribution of Integration Policy Index

Empirical Distribution of Integration Policy

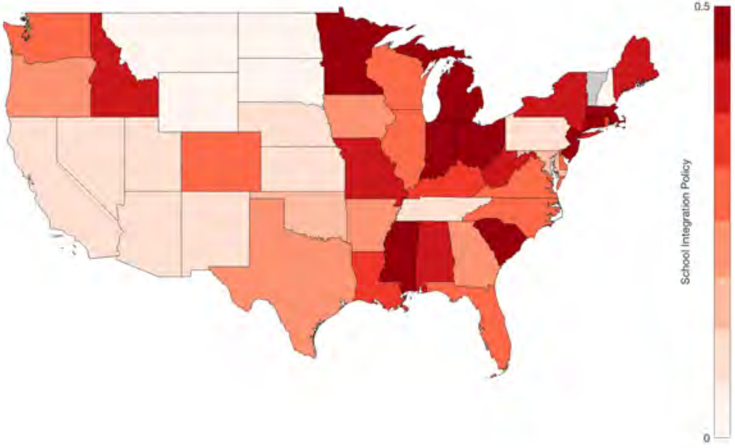


Figure: Spatial Distribution of Integration Policy

Validation of Method

Validation: Desegregation Orders

- In theory, desegregation court orders raise the opportunity cost of maintaining a segregated school system.
- The federal government can withhold Title I funding from districts that do not comply with the Civil Rights Act.
- Researchers have shown that districts with more funding at risk were more likely to desegregate (e.g. Cascio et al., QJE 2010).
- It is important to differentiate between districts that have been under order, versus those that have one in effect.
- All else equal, one would expect districts with effective orders to haver stronger integration policy.

Validation: Desegregation Orders

Table: OLS – Outcome: Estimated SAB Integration Rate

	(1)	(2)	(3)	(4)
Ever Under Order	0.0624***	0.0410*		
	(0.0188)	(0.0209)		
Released from Order			0.0586***	0.0305
			(0.0212)	(0.0238)
Order in Effect			0.0753***	0.0653***
			(0.0187)	(0.0187)
Covariates	✓	✓	✓	✓
State Fixed Effects		✓		✓
Mean of Independent Variable	.469		.318	
N	1607	1604	1607	1604
R^2	0.0568	0.195	0.0580	0.199

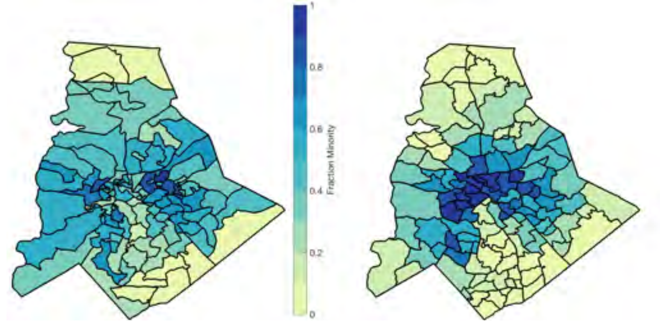
Standard errors clustered at the state level in all models.

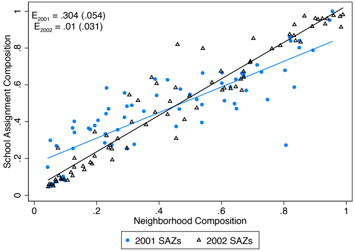
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

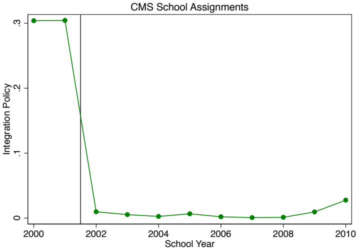
Validation: The End of Busing in Charlotte, NC

- Charlotte Mecklenburg Schools (CMS) has an important role in the history of school desegregation.
- CMS was the defendant in the Supreme Court's 1971 *Swann* case, making desegregation busing constitutional.
- CMS implemented integration policy until a lawsuit in 1999 challenged it on the basis of equal protection.
- Starting in 2002, CMS switched to a choice plan, with default assignments based on 'neighborhood schools'.
- I have obtained SAB data from CMS elementary schools for years 2000-2010.

Validation: The End of Busing in Charlotte, NC



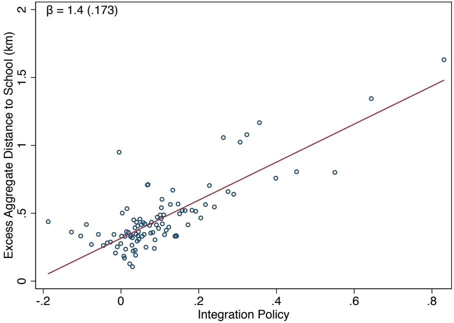




Validation: Distance to School

- The baseline comparison policy is based on minimum student distance travelled to school.
- By construction, actual SABs must have weakly higher distance per pupil than baseline.
  - Define: Excess Distance $=$ Actual Distance Travelled by Avg. Student $-$ Baseline Distance Travelled by Avg. Student
- Estimated integration policy measures attenuation in excess exposure to minorities.
- Such attenuation need not vary systematically with excess distance.
- However, integration plans typically involve busing implying large distances.

Validation: Distance to School



	Excess Distance (km)			Ln(Marginal Distance Cost)		
	(1)	(2)	(3)	(4)	(5)	(6)
Integration Policy	1.400***	1.388***	1.218***	0.543	-0.372***	-0.286**
	(0.173)	(0.188)	(0.204)	(0.403)	(0.102)	(0.122)
Observations	1605	1605	1602	1327	1327	1325
R^2	0.256	0.277	0.438	0.008	0.645	0.669
StateFE			✓			✓
Covariates		✓	✓		✓	✓

Standard errors clustered at the state level in all models.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Validation: Gerrymandering

- SAB integration policy entails a districting problem related to congressional gerrymandering.
- In political science, several metrics have been proposed to measure gerrymandering.
  - Many are based off a district's 'bizarreness'.
  - The idea is that in the absence of manipulation, districts would have a 'regular' shape.
  - Define Bizarreness $= Area(SAB)/Area(ConvexHull(SAB))$ Fig
- Caveat: The literature seems to be moving away from these metrics as they lack counterfactuals. See Chen and Cottrell (2016).

Validation: Gerrymandering

Table: OLS – Outcome: Estimated SAB Integration Rate

	(1)	(2)	(3)	(4)	(5)
SAB Satellites (Busing)	0.202***				-0.0163
	(0.0399)				(0.0883)
Average SAB Bizarreness		0.677***			0.726***
		(0.0928)			(0.228)
Open Enrollment			0.0305		0.141
			(0.118)		(0.102)
Multiple Assignment				0.131***	0.139***
				(0.0246)	(0.0250)
Observations	1602	1602	1602	1602	1602
R^2	0.229	0.265	0.190	0.237	0.317
IndepVarMean	.112	.216	.019	.145	
StateFE	✓	✓	✓	✓	✓
Covariates	✓	✓	✓	✓	✓

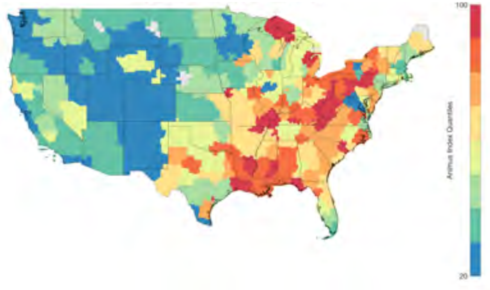
Standard errors clustered at the state level in all models.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Validation: Racial Animus

- Historically, school desegregation efforts have been met with great social unrest arguably related to racial animus.
- In the context of this project, one can posit that racial animus shifts a district's preferences for racial integration.
- Stephens-Davidowitz (2014) proposes a proxy for racial animus based on Google search queries that use racially charged language.
- Do districts with more racial animus have lower integration policy?

Validation: Racial Animus



	(1)	(2)	(3)	(4)
Racial Animus	0.0224	-0.209	-0.155	-0.277**
	(0.104)	(0.166)	(0.106)	(0.112)
Covariates	✓	✓	✓	✓
No Western States		✓		✓
State Fixed Effects			✓	✓
N	1602	1156	1599	1153
R^2	0.0493	0.0569	0.196	0.189

Standard errors clustered at the state level

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Characterization of Integration Policy

Characterization of Integration Policy

Now that we are (fairly) certain that the proposed metric captures integration policy, we may ask:

- What do integrative districts look like?
- Which district characteristics are most predictive of integration policy?
- Is integration policy beneficial for minority students?

Characterization: Basic Demographics

Table: OLS – Outcome: Estimated SAB Integration Rate

	(1)	(2)	(3)	(4)	(5)
Ln(Total District Population)	-0.0221***			-0.0196***	-0.0124**
	(0.00479)			(0.00710)	(0.00531)
Baseline School Segregation		-0.175***		-0.0257	-0.140**
		(0.0553)		(0.101)	(0.0587)
District Baseline Composition			-0.0739***	-0.0153	0.0401*
			(0.0228)	(0.0279)	(0.0211)
Constant	0.373***	0.127***	0.127***	0.352***	
	(0.0600)	(0.0135)	(0.0140)	(0.0799)	
State Fixed Effects					✓
Mean of Independent Variable	12.44	.168	.395		
N	1605	1605	1605	1605	1602
R^2	0.0383	0.0223	0.00929	0.0391	0.190

Standard errors clustered at the state level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Characterization: Enrollment Segregation

	Segregation of Assignments		Segregation of Enrollments	
	(1)	(2)	(3)	(4)
Integration Policy	-0.287***	-0.152***	-0.279***	-0.150***
	(0.0387)	(0.0197)	(0.0500)	(0.0185)
Baseline School Segregation		0.909***		0.941***
		(0.0260)		(0.0514)
Observations	1605	1602	1605	1602
DepVarMean	.158		.195	
StateFE		✓		✓
Covariates		✓		✓

Standard errors clustered at the state level

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Characterization: LEA Finance

Panel A: Socioeconomic Characteristics	(1)	(2)	(3)	(4)	(5)
ln(Median HH income)	-0.0222				0.0542
	(0.0238)				(0.0425)
ln(Median property value)		-0.0230			-0.0388
		(0.0174)			(0.0233)
Fraction of pupils FRL			0.0234		-0.0951
			(0.0424)		(0.0793)
Fraction of schools Title I eligible				0.104***	0.163***
				(0.0280)	(0.0418)
Mean of Independent Variable	10.913	12.083	.622	.783	.783
Panel B: District Finance	(1)	(2)	(3)	(4)	(5)
ln(Total Revenue)	0.0925*				
	(0.0482)				
ln(Local Revenue)		0.0340			0.0566**
		(0.0204)			(0.0242)
ln(State Revenue)			-0.00844		0.0350*
			(0.0174)		(0.0201)
ln(Federal Revenue)				-0.0188	-0.0328
				(0.0206)	(0.0198)
Covariates	✓	✓	✓	✓	✓
State Fixed Effects	✓	✓	✓	✓	✓
Mean of Independent Variable		8.45	8.496	6.95	
N	1600	1600	1600	1600	1600
R^2	0.198	0.198	0.193	0.194	0.202

Note: Standard errors clustered at the census block group level in all models.

Characterization: Racial Gaps

Definition of exposure gap in variable y:

$$\Delta y = E[y|minority] - E[y|white]$$

Teachers

	(1) Inexperienced Teachers	(2) Certified Teachers	(3) Teacher Absenteeism
Integration Policy	-2.493***	-0.203	-0.523
	(0.646)	(0.598)	(0.421)
Covariates	✓	✓	✓
State FE	✓	✓	✓
Mean of Dependent Var	.867	-.378	.692
N	1600	1600	1600
R^2	0.279	0.170	0.133

Standard errors clustered at the state level

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Characterization: Racial Gaps

School Quality

	(1) GT Program	(2) Ability Grouping	(3) Student Retention Rate
Integration Policy	0.118***	0.568	-0.0309***
	(0.0359)	(1.498)	(0.00717)
Covariates	✓	✓	✓
State FE	✓	✓	✓
Mean of Dependent Var	-.081	-.144	.023
N	1600	1600	1600
R^2	0.329	0.0705	0.325

Standard errors clustered at the state level

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Characterization: Racial Gaps

CEPA Achievement Gaps

	(1) ELA	(2) Math	(3) Composite
Integration Policy	0.0793	0.0357	0.0630
	(0.0542)	(0.0467)	(0.0453)
Covariates	✓	✓	✓
State FE	✓	✓	✓
Mean of Dependent Var	.698	.657	.679
N	1251	1165	1312
R^2	0.536	0.406	0.500

Standard errors clustered at the state level

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Characterization: Racial Gaps

Ed Facts Proficiency Gaps

	(1) ELA	(2) Math	(3) Composite
Integration Policy	0.0216	0.0200	0.0208
	(0.0139)	(0.0147)	(0.0142)
Covariates	✓	✓	✓
State FE	✓	✓	✓
Mean of Dependent Var	.21	.204	.207
N	1594	1594	1594
R^2	0.660	0.553	0.613

Standard errors clustered at the state level

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Recap

Contributions

- Developed counterfactual SAB policy for large sample of school districts.
- Proposed empirical framework to assess SAB integration policy relative to this baseline.
- Validated method showing that SAB integration rate is related to variables that, *a priori*, we would expect to relate to integration policy.
- Described and characterized distribution of modern integration policy.

Question Remaining

- How unstable is integration policy, regarding household non-compliance and residential/Tiebout sorting?

Integration Policy and Non-Compliance

Integration Policy and Non-Compliance

- Researchers have documented that desegregation court orders led to increases in private school enrollment of whites and white flight to the suburbs (e.g Baum-Snow and Lutz (2011)).
- Are these patterns present in the current context of integration policy?

Non-Compliance: Descriptive

Table: Integration Policy and Outside Options

	ln(# Private Schools)	ln(Private School Enrollment)			Suburban Ring	ln(Charter Enr.)
	(1)	(2) Total	(3) White	(4) Minority	(5)	(6)
P	0.0481	-0.327*	-0.478	0.0331	0.0114	-0.166
	(0.0804)	(0.170)	(0.350)	(0.227)	(0.0431)	(0.603)
P × South	-0.154	0.212	0.456	-0.342	-0.0764	-0.409
	(0.137)	(0.333)	(0.444)	(0.365)	(0.0591)	(0.776)
P × Midwest	0.234**	1.118***	1.397***	0.324	0.121*	0.105
	(0.116)	(0.319)	(0.424)	(0.378)	(0.0721)	(0.961)
P × West	-0.195	0.304	0.691	-0.0679	0.0684	0.274
	(0.171)	(0.393)	(0.444)	(0.484)	(0.0552)	(0.849)
Covariates	✓	✓	✓	✓	✓	✓
State Fixed Effects	✓	✓	✓	✓	✓	✓
Mean of Dep. Var.	2.953	7.773	7.273	6.139	.125	5.974
N	1600	1600	1600	1600	1598	1600
R^2	0.927	0.765	0.751	0.850	0.630	0.743

Standard errors clustered at the state level

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Case Study: The Effect of SAB Composition

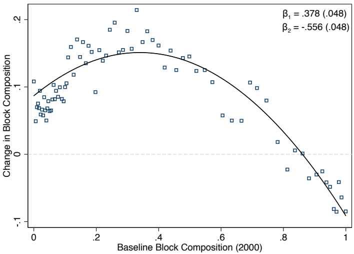
- As mentioned above, Charlotte Mecklenburg Schools (CMS), NC, ended its school integration plan in 2002.
- CMS abruptly changed its SABs from an integration scheme in 2001 to a minimum distance scheme in 2002.
- The exact timing of this policy shock was unlikely to be predicted by households.
- This presents an opportunity to estimate the causal effect of SAB composition on the composition of residences
  - Key paremeter allowing us to assess the stability of SAB integration to residential sorting

Case Study: The Effect of SAB Composition

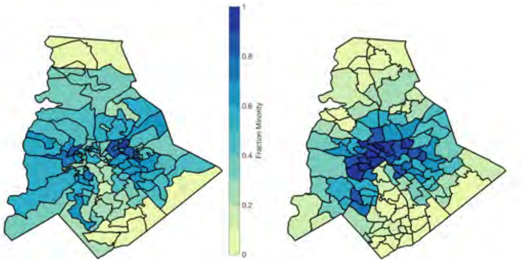
- I construct a longitudinal data set of Census Blocks for the years 2000 and 2010.
- I am interested in the effect of a change in SAB composition in the ten year change in block racial composition.
- Parallel analysis of effects on property prices.

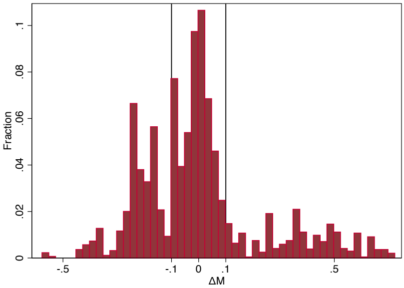
	2000		2010		Change	
	mean	sd	mean	sd	mean	sd
Census Block Demographics						
Block Population	141.10	220.95	175.65	331.67	34.55	210.30
Fraction Minority	0.33	0.35	0.41	0.35	0.08	0.18
Census Block Real Estate						
ln(Mean Property Sales Price)	11.98	0.71	11.89	0.94	-0.08	0.65
ln(Mean Property Appraisal Value)	11.92	0.70	11.84	0.73	-0.07	0.41
SAB Demographics (2000 Census Constant)						
SAB Population	803.52	254.08	621.20	211.71	-182.32	302.30
Fraction Minority	0.43	0.21	0.43	0.31	0.00	0.23
Observations	4393		4393		4393	

Case Study: The Effect of SAB Composition



Case Study: The Effect of SAB Composition





Case Study: Empirical Strategy

- Correlated mean reversion in block composition changes implies that we must control for baseline block composition.
- Pre-period SABs were integrative, hence non-random. Variation used for estimation should come from within small geo areas for which such selection concern is minimal.
- Propose following class of regression models to estimate the causal effect of SAB composition.

$$\Delta y_{bk} = \gamma_{ks_0(b)} + \beta \Delta M_{s(b)} + g(y_{bk0}) + \epsilon_{bk} \tag{4}$$

- ID Assumption: Conditional on baseline composition, new SABs were as good as randomly drawn within small geographic areas (Old SABs and Census Tracts).

Case Study: Results

Panel A: Change in Block Composition	(1)	(2)	(3)	(4)
Change in SAB Composition (2000 Census)	0.158***	0.193***	0.151***	0.143**
	(0.0334)	(0.0283)	(0.0474)	(0.0601)
Baseline SAB Composition	✓			
Quadratic Baseline Composition	✓	✓	✓	✓
Old SAB Fixed Effects		✓	✓	
Census Tract Fixed Effects			✓	
Old SAB-by-Census Tract Fixed Effects				✓
N	4393	4393	4393	4393
R^2	0.236	0.416	0.519	0.543
Panel B: Change in Mean Property Price	(1)	(2)	(3)	(4)
SAB Composition Shock	0.0422	-0.0174	-0.0666	-0.0282
	(0.0812)	(0.0966)	(0.176)	(0.215)
Baseline SAB Composition	✓			
Quadratic Baseline Composition	✓	✓	✓	✓
Old SAB Fixed Effects		✓	✓	
Census Tract Fixed Effects			✓	
Old SAB-by-Census Tract Fixed Effects				✓
N	3460	3460	3460	3451
R^2	0.0407	0.0938	0.161	0.194

Note: Standard errors clustered at the census block group level in all models.

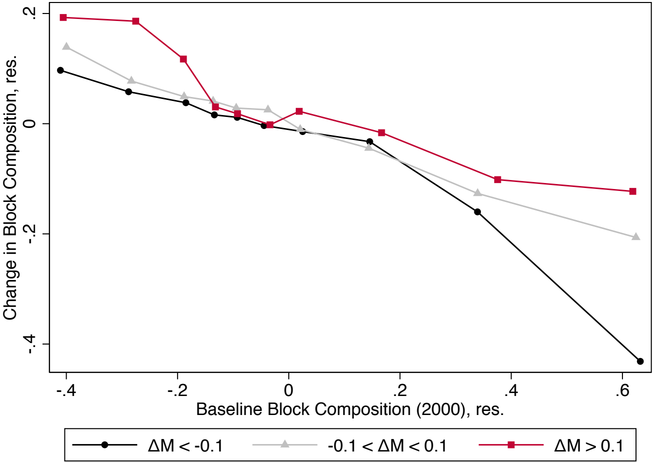
Case Study: Results

Panel A: Change in Block Composition	(1)	(2)	(3)	(4)
SAB Composition Shock	0.151***	0.155***	0.161***	0.172***
	(0.0474)	(0.0473)	(0.0521)	(0.0661)
New School		-0.0311**	-0.0309**	-0.0204
		(0.0129)	(0.0132)	(0.0165)
SAB Shock × New School			-0.0117	-0.0552
			(0.0419)	(0.0542)
Quadratic Baseline Composition	✓	✓	✓	✓
Old SAB Fixed Effects	✓	✓	✓	
Census Tract Fixed Effects	✓	✓	✓	
Old SAB-by-Census Tract Fixed Effects				✓
N	4393	4393	4393	4393
R^2	0.519	0.521	0.521	0.544
Panel B: Change in Mean Property Price	(1)	(2)	(3)	(4)
SAB Composition Shock	-0.0666	-0.0668	-0.0897	-0.0215
	(0.176)	(0.175)	(0.168)	(0.206)
New School		0.00142	0.000682	-0.0563
		(0.0516)	(0.0517)	(0.0566)
SAB Shock × New School			0.0510	-0.00787
			(0.177)	(0.216)
Quadratic Baseline Composition	✓	✓	✓	✓
Old SAB Fixed Effects	✓	✓	✓	
Census Tract Fixed Effects	✓	✓	✓	
Old SAB-by-Census Tract Fixed Effects				✓
N	3460	3460	3460	3451
R^2	0.161	0.161	0.161	0.194

Note: Standard errors clustered at the census block group level in all models.

Case Study: Results

Mechanisms



Discussion

- Shocks in SAB composition generated by the end of busing in CMS provide opportunity to estimate causal effect of SAB composition on white flight.
- I can reject the non-existence of a white flight reaction at the 1% confidence level.
- Nevertheless, white flight is relatively small, a 25 pp. increase in SAB fraction minority leads to about a 3.95 pp. increases in the fraction minority of residences over a decade.
- Find no evidence of dynamic effects on real estate values.
- Integration policy seems to be stable to Tiebout residential sorting for at least a few years.

Conclusions

- Integration policy is still a prevalent feature of public school systems across the country.
- Some districts try harder than others. We can now quantify these differences with precision.
- Integration policy is a normal good for districts.
- Integration policy is associated with smaller racial gaps in school quality measures, but not with smaller achievement gaps.
- Tiebout sorting exists but it is gradual and relatively modest. Integration policy is stable in the short-run to medium-run.

THANK YOU!

APPENDIX

Appendix: Students Attend Assigned School

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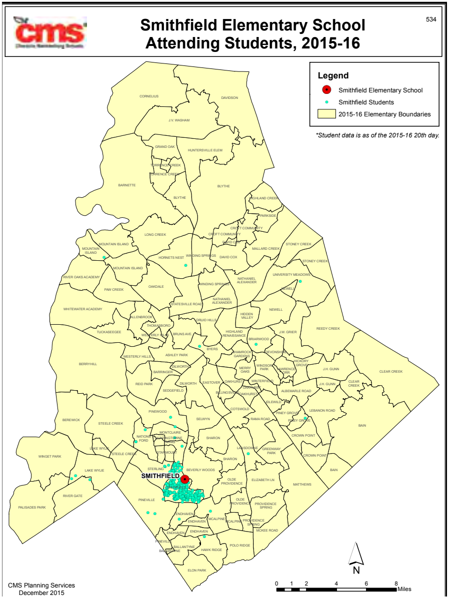

Appendix: SAZs Change Periodically

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Table: SAZ Changes Summary Stats – 2009-2013 SY

	LEAs with New Schools		LEAs without New Schools	
	mean	count	mean	count
All Schools				
1(Any Change)	0.34	3903	0.32	4909
1('Effective' Change)	0.14	3903	0.17	4909
Schools with Any SAZ changes				
Intensive Change (Num. Blocks)	0.94	1327	-2.28	1553
Pct. population change	0.03	1327	-0.01	1553
Schools with Effective SAZ changes				
Intensive Change (Num. Blocks)	2.49	548	-3.95	845
Pct. population change	0.07	548	-0.02	845

Appendix: Shrinking Estimates via Empirical Bayes

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We have a noisy estimate of the parameter of interest:

$$\hat{\beta}_j = \beta_j + e_j$$

then

$$\underbrace{Var(\hat{\beta}_j)}_{empirical} = Var(\beta_j) + Var(e_j)$$

But we also have estimates of the noise term: $\hat{\sigma}^2(\hat{\beta}_j) \equiv \hat{\sigma}_j^2$. Let $\widehat{Var}(e_j) = \frac{1}{J}\sum_j \hat{\sigma}_j^2$. Now, define

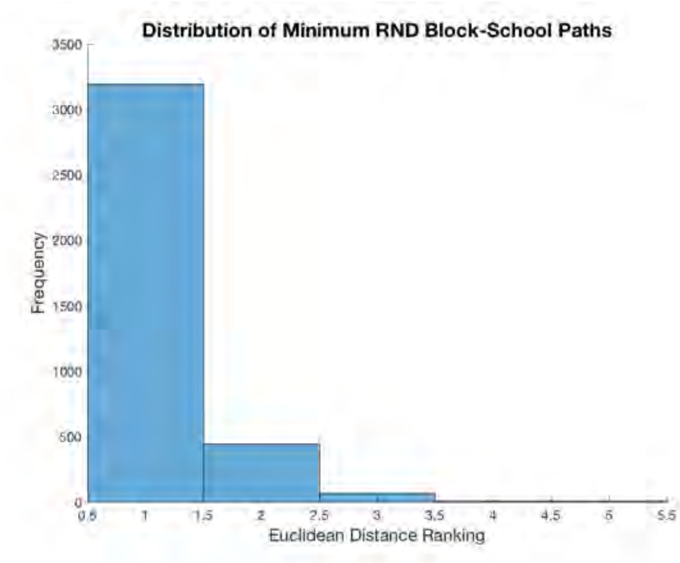
$$\hat{\sigma}_o^2 \equiv Var(\hat{\beta}_j) - \widehat{Var}(e_j)$$

Compute estimate of signal-to-noise ratio: $\lambda_j = \frac{\hat{\sigma}_o^2}{\hat{\sigma}_o^2 + \hat{\sigma}_j^2}$.

Finally, shrink betas toward 1:

$$\hat{\beta}_j^{EB} \equiv \lambda_j \hat{\beta}_j + (1 - \lambda_j)$$

Empirical Framework – Road Network Voronoi Zones



Empirical Framework – Road Network Voronoi Zones

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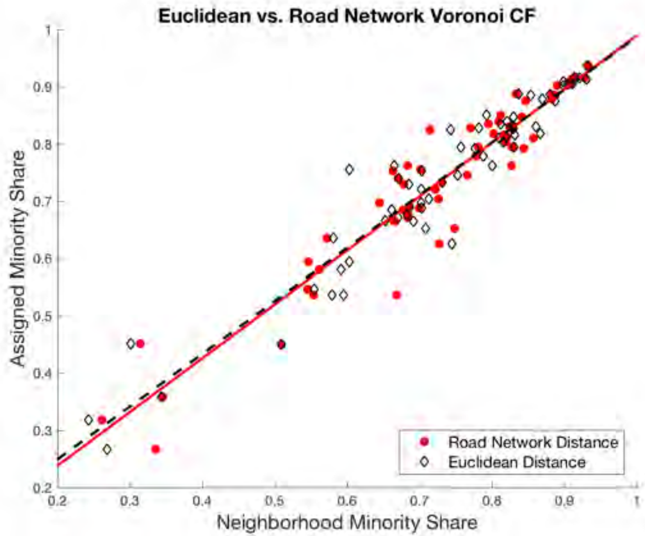

Appendix: Distribution of School Capacity

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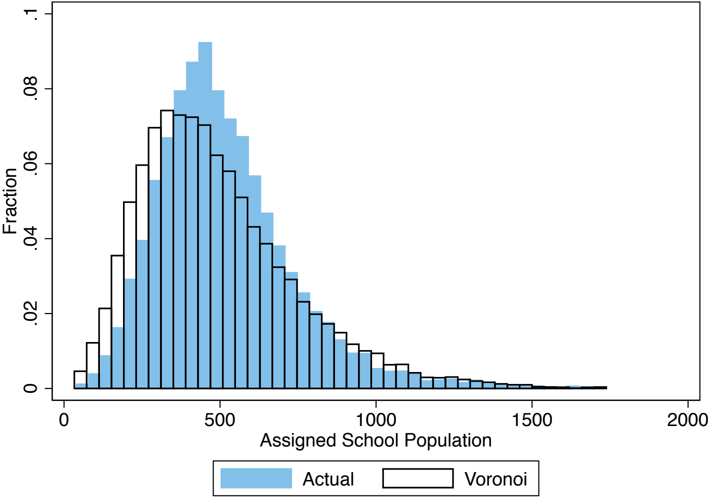

Appendix: SAB Bizarreness

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