The Road to Conflict: How the Interstate Highway System Divides Communities and Polarizes Politics

Clayton Nall

Stanford University
I. Interstate Highways: A Massive Government Project
A Massive Spatial Intervention
A Massive Spatial Intervention

41,000 miles
A Massive Spatial Intervention

42 billion cubic yards of dirt excavated

Clayton Nall (Stanford University)
A Massive Spatial Intervention

42 billion cubic yards of dirt excavated
A Massive Spatial Intervention

42 billion cubic yards of dirt excavated
(116 Panama Canals)
A Massive Spatial Intervention

Clayton Nall (Stanford University)

The Road to Conflict
A Massive Spatial Intervention

670 billion vehicle-miles per year
A Massive Spatial Intervention

670 billion vehicle-miles per year
(Voyager 1: 17.1 billion miles)
A Massive Spatial Intervention
A Massive Spatial Intervention

22 trillion vehicle-miles since 1956
A Massive Spatial Intervention

22 trillion vehicle-miles since 1956
(3.74 light years)
A Massive Spatial Intervention

22 trillion vehicle-miles since 1956
(3.74 light years)
(Distance to Alpha Centauri: 4.37 light years)
A Massive Spatial Intervention

In the next 75 minutes, 96 million miles
(Distance to sun: 93 million miles)
(Distance to Alpha Centauri: 4.37 light years)

Clayton Nall (Stanford University)
A Massive Spatial Intervention

In next 75 minutes, 96 million miles
A Massive Spatial Intervention

In next 75 minutes, 96 million miles
(Distance to sun: 93 million miles)
A Massive Spatial Intervention

In next 75 minutes, 96 million miles
(Distance to sun: 93 million miles)
Major Program, Massive Spending

Federal Highway Spending

$ Billion (2010 Dollars)

Pre–Interstate Era

Post–Interstate Era

90% Federal Funding

US Highways: 50% federal $. Interstate Highways: 90% Federal $.

Clayton Nall (Stanford University)

The Road to Conflict
II. Wide-Ranging Expectations, Bipartisan Support
Expected Consequence: Congestion Reduction ×

“City streets comprise one-tenth of the total highway mileage and carry 50 percent of all motor vehicle traffic.”
–U.S. Conference of Mayors Resolution, 22 September 1953
“Cities that have built expressways have discovered that they lead to new patterns of development from which the whole community benefits.... This expressway will be a citizens’ highway, a people’s highway.... It will remove blight and congestion and restore property values that are now depressed by traffic.” – Milwaukee Mayor Frank Zeidler, 17 March 1952
A Bipartisan Bill

House: 388-19
Senate: 89-1

Eisenhower
Fallon
Gore
How Highways Catalyze Facilitate Residential Sorting

Highways exacerbate individual-level sorting processes

Homophily-driven ("birds of a feather") sorting (Schelling 1978)

Individuals as consumers of public goods

Dividing "communities of interest"

Highways exacerbate discriminatory policies' effects

Redlining, covenants, realtor discrimination, zoning (Massey & Denton 1993)

Highways create new places with new politics

Help developers & entrepreneurs create new places (Burns 1994)

Highways partition communities
How Highways Catalyze Facilitate Residential Sorting

1. Highways exacerbate individual-level sorting processes

2. Highways exacerbate discriminatory policies' effects

3. Highways create new places with new politics

4. Highways partition communities
How Highways Catalyze Facilitate Residential Sorting

1. Highways exacerbate individual-level sorting processes
   Homophily-driven ("birds of a feather") sorting (Schelling 1978)
How Highways Catalyze Facilitate Residential Sorting

1. **Highways exacerbate individual-level sorting processes**
   - Homophily-driven (“birds of a feather”) sorting (Schelling 1978)
   - Individuals as consumers of public goods

2. Highways exacerbate discriminatory policies’ effects
   - Redlining, covenants, realtor discrimination, zoning (Massey & Denton 1993)

3. Highways create new places with new politics
   - Help developers & entrepreneurs create new places (Burns 1994)

4. Highways partition communities

Clayton Nall (Stanford University)
How Highways Catalyze Facilitate Residential Sorting

1. Highways exacerbate individual-level sorting processes
   Homophily-driven (“birds of a feather”) sorting (Schelling 1978)
   Individuals as consumers of public goods
   Dividing “communities of interest”
How Highways Catalyze Facilitate Residential Sorting

1. Highways exacerbate individual-level sorting processes
   Homophily-driven ("birds of a feather") sorting (Schelling 1978)
   Individuals as consumers of public goods
   Dividing "communities of interest"

2. Highways exacerbate discriminatory policies’ effects
How Highways Catalyze Facilitate Residential Sorting

1. Highways exacerbate individual-level sorting processes
   - Homophily-driven (“birds of a feather”) sorting (Schelling 1978)
   - Individuals as consumers of public goods
   - Dividing “communities of interest”

2. Highways exacerbate discriminatory policies’ effects
   - Redlining, covenants, realtor discrimination, zoning (Massey & Denton 1993)
How Highways Catalyze Facilitate Residential Sorting

1. **Highways exacerbate individual-level sorting processes**
   - Homophily-driven ("birds of a feather") sorting (Schelling 1978)
   - Individuals as consumers of public goods
   - Dividing "communities of interest"

2. **Highways exacerbate discriminatory policies’ effects**
   - Redlining, covenants, realtor discrimination, zoning (Massey & Denton 1993)

3. **Highways create new places with new politics**
How Highways Catalyze Facilitate Residential Sorting

1. Highways exacerbate individual-level sorting processes
   Homophily-driven (“birds of a feather”) sorting (Schelling 1978)
   Individuals as consumers of public goods
   Dividing “communities of interest”

2. Highways exacerbate discriminatory policies’ effects
   Redlining, covenants, realtor discrimination, zoning (Massey & Denton 1993)

3. Highways create new places with new politics
   Help developers & entrepreneurs create new places (Burns 1994)

4. Highways partition communities
Highways Attract Residents to Affluent Suburbs

Highways Attract Residents to Affluent Suburbs


Clayton Nall (Stanford University)
Highways Open Migration to Low-Tax Communities

CONVENIENT and COMPLETE

Greenway Terrace is only 18 minutes from Downtown Milwaukee via the new I-94 expressway... yet you have the advantages of low City of Waukesha taxes... wide, gently curving streets... concrete curbs, gutter and city sidewalks... elementary and junior high school and shopping center sites are adjacent to Greenway Terrace.

Pack up the family and visit Greenway Terrace today. And make plans to join the 60 other happy families who in 1964 chose Greenway Terrace for lasting value, 120 choice sites are still available; and imagine, prices for these beautiful improved lots start at only $3,900!
Imagining the US Without Major Urban-Suburban Freeways?
Imagining the US Without Urban-Suburban Highways?

Gen. John S. Bragdon (Ret.)
Special Assistant to President Public Works Planning
1956-1960

Bertram D. Tallamy
Federal Highway Administrator
1957-1961
Competing Visions of Urban Interstates

“[Pending review of urban routes] I...recommend....that the Department of Commerce delay to the fullest extent practicable further approval and expenditures on the urban segments of the Interstate System.”–18 September 1959

Bragdon
“To follow the direction proposed by General Bragdon would be harmful to the...economy, would provide no solution to the pressing problem of metropolitan traffic congestion, would break faith with Congress and...the public, and would ultimately require larger expenditures of both private and public funds.” – 13 October 1959
Evaluating Historical Counterfactuals

What if Bragdon had succeeded in stopping urban freeways?

What if the IHA had demoted local transportation priorities?

How would American social and political geography be different?

Difficult to answer

But can exploit Interstate construction to demonstrate implications:

Spatial, temporal variation in Interstate construction

Examine multiple geographic units and levels of aggregation

Causal inference with assumptions suitable to available data
Evaluating Historical Counterfactuals

What if Bragdon had succeeded in stopping urban freeways?

How would American social and political geography be different?

Difficult to answer

But can exploit Interstate construction to demonstrate implications:

Spatial, temporal variation in Interstate construction

Examine multiple geographic units and levels of aggregation

Causal inference with assumptions suitable to available data
Evaluating Historical Counterfactuals

What if Bragdon had succeeded in stopping urban freeways?
What if the IHA had demoted local transportation priorities?
Evaluating Historical Counterfactuals

What if Bragdon had succeeded in stopping urban freeways?
What if the IHA had demoted local transportation priorities?
How would American social and political geography be different?
Evaluating Historical Counterfactuals

What if Bragdon had succeeded in stopping urban freeways?
What if the IHA had demoted local transportation priorities?
How would American social and political geography be different?
Difficult to answer
Evaluating Historical Counterfactuals

What if Bragdon had succeeded in stopping urban freeways?
What if the IHA had demoted local transportation priorities?
How would American social and political geography be different?

Difficult to answer
But can exploit Interstate construction to demonstrate implications:
What if Bragdon had succeeded in stopping urban freeways?
What if the IHA had demoted local transportation priorities?
How would American social and political geography be different?
Difficult to answer
But can exploit Interstate construction to demonstrate implications:
   Spatial, temporal variation in Interstate construction
Evaluating Historical Counterfactuals

What if Bragdon had succeeded in stopping urban freeways?
What if the IHA had demoted local transportation priorities?
How would American social and political geography be different?

Difficult to answer

But can exploit Interstate construction to demonstrate implications:

- Spatial, temporal variation in Interstate construction
- Examine multiple geographic units and levels of aggregation
Evaluating Historical Counterfactuals

What if Bragdon had succeeded in stopping urban freeways?
What if the IHA had demoted local transportation priorities?
How would American social and political geography be different?

Difficult to answer

But can exploit Interstate construction to demonstrate implications:

- Spatial, temporal variation in Interstate construction
- Examine multiple geographic units and levels of aggregation
- Causal inference with assumptions suitable to available data
Example: Localities in the Milwaukee Area
Example: Localities in the Milwaukee Area

Municipal-level presidential returns, 5-county Milwaukee area, 1944-2008
Example: Localities in the Milwaukee Area

Municipal-level presidential returns, 5-county Milwaukee area, 1944-2008
Geographically coded time-series data on freeway construction
Example: Localities in the Milwaukee Area

Municipal-level presidential returns, 5-county Milwaukee area, 1944-2008
Geographically coded time-series data on freeway construction
Two-party vote before/after local freeway construction
Example: Localities in the Milwaukee Area

Municipal-level presidential returns, 5-county Milwaukee area, 1944-2008
Geographically coded time-series data on freeway construction
Two-party vote before/after local freeway construction
Highways Cause Republican Suburban Growth

Clayton Nall (Stanford University)
Municipal Case Study: Brookfield, WI
Highway-Induced Republican Growth

Brookfield, WI, 1944-2008
An Instrument of Segregation?
Highways and Racial Segregation

- Urban renewal: used to clear and partition areas slated for “slum” clearance
- Federal policy allowed “double-dipping”: money to clear “slums,” more federal money to build highways (Schrag 2005)
- By delimiting existing racial/ethnic neighborhoods, reinforced residential segregation
Birmingham and I-59 (Excerpted from Connerly 2002)

The city's sixty-one census tract neighborhoods lost population. Of these forty-eight, the top ten losers are shown in Table 1 in rank order of population loss. Overall, these neighborhoods lost 24,337 inhabitants or 61 percent of the city's net loss of 39,977.

Of the ten neighborhoods shown in Table 1, eight were predominantly black neighborhoods in 1960 and only one had a population less than 40 percent black in 1960. Of the nine neighborhoods with a significant black population, eight had key interstate or other federal highways (the Red Mountain Expressway) built through them in the 1960s. Moreover, one of these black neighborhoods, located in Census Tract 43, experienced significant population loss in the wake of the federally funded urban renewal expansion of the University of Alabama at Birmingham. In addition, the predominantly white neighborhood located in Census Tract 49, just south of Tract 43, also lost substantial population to the expansion of UAB.

The city's largest population loser was Tract 28.2, a black neighborhood located just west and north of downtown Birmingham in what is today the southern part of the Fountain Heights neighborhood. With the construction of both I-65, I-59, and the interchange of these two highways, this neighborhood lost 4,587 inhabitants, nearly all of who were black. Overall, the neighborhood lost two-thirds of its population between 1960 and 1970, reflecting a population loss nearly twice as great as the next highest population loser.

In general, therefore, the interstate highways built or started in Birmingham in the 1960s are associated with significant population losses in eight of the city's predominantly black neighborhoods. Black households displaced by the interstates had to move somewhere, and while some left the city, many others moved to neighborhoods within Birmingham. With this internal migration came a significant change in Birmingham. Whereas the city's racial zoning law and racial

Figure 4. Map showing proposed Interstate 59 as racial boundary between the black Tuxedo neighborhood and the white Ensley Highlands neighborhood. Source: Adapted from DeLeuw, Cather and Company (1958, Exhibit 2).
New Evidence to Measure Urban Politics
Petition Data, Wisconsin 76th Assembly District

Legend
- Nominating Paper Signatures
- District 76 Voters
- Freeway
- Voting Wards, 2006
Suggested Readings

- Seely, 1987, *Building the American Highway System*
- Grannis, 1998, “The Importance of Trivial Streets”
- Grannis, 2009, *From the Ground Up: Translating Geography into Community through Neighbor Networks*
Extra Slides
“If you had a choice of living anywhere you wanted to, in which of those types of places would you rather live?” Gallup question used slightly different wording. Respondents who report living in a “large city” (Roper) or a city over 500,000 (Gallup). Source: *Roper Reports Poll 1976-02, Gallup Poll #1207G*. 
Extra Slides–Milwaukee Case Study

Extra Milwaukee Slides
Democratic Decline in Milwaukee Suburbs Relative to Regional Average

The Road to Conflict
Highways Facilitate Republican Growth

Good Housekeeping Honors

All Homes Open Today, 1 to 6; Monday Through Thursday, 6 to 9; Saturday, 1 to 5

Directions: Located in beautiful CAMELOT FOREST IN THE CITY of Brookfield. Directions: Take North Ave. west to Springdale Rd. (222nd St.), then right 1 block to entrance of Camelot Forest.

improved sewer and blacktop roads

beautiful CAMELOT FOREST in the city of Brookfield. Your choice of more than 150 homesites located in an enticing, wooded surrounding. Arrive to see Camelot Forest today: ... the most popular, most desirable, most unique new subdivisions location in all of greater Milwaukee.

LOTS PRICED FROM $5,500

Expressway–22 Min to Milw

Camelot Forest, Brookfield, April 1965
Highway-Induced Growth After White Flight Period

Clayton Nall (Stanford University)

The Road to Conflict
Highway-Induced Growth After White Flight

Farmington, WI, 1944-2008
Estimation: Suburban County Sample

For each year $t$, create CEM sample with treatment variable $z_t$, 3 bins/variable (Iacus, King, Porro 2009)

From CEM sample, create a bootstrapped sample independently for each election year. For each sample:
- Regress change in Democratic vote (1952 to $t$) on $z_t$ and controls
- Extract point estimates, $\hat{\beta}_{z_t}$
- Run lowess curve through $\hat{\beta}_{z_t}$ estimates, 1960-2008

Annual average of $\hat{\beta}_{z_t}$: bootstrapped estimate

Lowess-smoothed estimate: mean of lowess simulations, by year

Lowess-smoothed CIs: quantiles of lowess simulations, by year

Causal estimand: ATT on pop. represented by matched sample
For each year $t$, create CEM sample with treatment variable $z_t$, 3 bins/variable (Iacus, King, Porro 2009)
Estimation: Suburban County Sample

- For each year $t$, create CEM sample with treatment variable $z_t$, 3 bins/variable (Iacus, King, Porro 2009)
- From CEM sample, create a bootstrapped sample independently for each election year. For each sample:
Estimation: Suburban County Sample

- For each year $t$, create CEM sample with treatment variable $z_t$, 3 bins/variable (Iacus, King, Porro 2009)
- From CEM sample, create a bootstrapped sample independently for each election year. For each sample:
  - Regress change in Democratic vote (1952 to $t$) on $z_t$ and controls
Estimation: Suburban County Sample

- For each year $t$, create CEM sample with treatment variable $z_t$, 3 bins/variable (Iacus, King, Porro 2009)
- From CEM sample, create a bootstrapped sample independently for each election year. For each sample:
  - Regress change in Democratic vote (1952 to $t$) on $z_t$ and controls
  - Extract point estimates, $\hat{\beta}_{z_t}$

Lowess-smoothed CIs: quantiles of lowess simulations, by year

Annual average of $\hat{\beta}_{z_t}$: bootstrapped estimate

Run lowess curve through $\hat{\beta}_{z_t}$ estimates, 1960-2008
Estimation: Suburban County Sample

- For each year $t$, create CEM sample with treatment variable $z_t$, 3 bins/variable (Iacus, King, Porro 2009)
- From CEM sample, create a bootstrapped sample independently for each election year. For each sample:
  - Regress change in Democratic vote (1952 to $t$) on $z_t$ and controls
  - Extract point estimates, $\hat{\beta}_{z_t}$
  - Run lowess curve through $\hat{\beta}_{z_t}$ estimates, 1960-2008
For each year $t$, create CEM sample with treatment variable $z_t$, 3 bins/variable (Iacus, King, Porro 2009)

From CEM sample, create a bootstrapped sample independently for each election year. For each sample:

- Regress change in Democratic vote (1952 to $t$) on $z_t$ and controls
- Extract point estimates, $\hat{\beta}_{zt}$
- Run lowess curve through $\hat{\beta}_{zt}$ estimates, 1960-2008

Annual average of $\hat{\beta}_{zt}$: bootstrapped estimate
Estimation: Suburban County Sample

- For each year $t$, create CEM sample with treatment variable $z_t$, 3 bins/variable (Iacus, King, Porro 2009)
- From CEM sample, create a bootstrapped sample independently for each election year. For each sample:
  - Regress change in Democratic vote (1952 to $t$) on $z_t$ and controls
  - Extract point estimates, $\hat{\beta}_{z_t}$
  - Run lowess curve through $\hat{\beta}_{z_t}$ estimates, 1960-2008
- Annual average of $\hat{\beta}_{z_t}$: bootstrapped estimate
- Lowess-smoothed estimate: mean of lowess simulations, by year
Estimation: Suburban County Sample

- For each year \( t \), create CEM sample with treatment variable \( z_t \), 3 bins/variable (Iacus, King, Porro 2009)
- From CEM sample, create a bootstrapped sample independently for each election year. For each sample:
  - Regress change in Democratic vote (1952 to \( t \)) on \( z_t \) and controls
  - Extract point estimates, \( \hat{\beta}_{z_t} \)
  - Run lowess curve through \( \hat{\beta}_{z_t} \) estimates, 1960-2008
- Annual average of \( \hat{\beta}_{z_t} \): bootstrapped estimate
- Lowess-smoothed estimate: mean of lowess simulations, by year
- Lowess-smoothed CIs: quantiles of lowess simulations, by year
Estimation: Suburban County Sample

- For each year $t$, create CEM sample with treatment variable $z_t$, 3 bins/variable (Iacus, King, Porro 2009)
- From CEM sample, create a bootstrapped sample independently for each election year. For each sample:
  - Regress change in Democratic vote (1952 to $t$) on $z_t$ and controls
  - Extract point estimates, $\hat{\beta}_{z_t}$
  - Run lowess curve through $\hat{\beta}_{z_t}$ estimates, 1960-2008
- Annual average of $\hat{\beta}_{z_t}$: bootstrapped estimate
- Lowess-smoothed estimate: mean of lowess simulations, by year
- Lowess-smoothed CIs: quantiles of lowess simulations, by year
- Causal estimand: ATT on pop. represented by matched sample
CEM Matching Quality

The Road to Conflict

Clayton Nall (Stanford University)
CEM Matching Quality (No Early Adopters, p.1)
Placebo Test on 1952 Democratic Presidential Vote

---

Clayton Nall (Stanford University)
Placebo Test, Outcome: 1956 Democratic Presidential Vote

All Suburban Counties

Year

Avg Effect on Dem Vote (ATT, Matched Sample)


Clayton Nall (Stanford University)
CEM Matching, Including Early Adopters

All Suburban Counties

Avg Effect on Dem Vote (ATT, Matched Sample)

Year

Treated units:
103 211 312 351 369 380 383 384 385 385 385 385
364 403 376 329 296 285 279 275 274 274 274 274

Clayton Nall (Stanford University)
CEM Matching, Including Early Adopters

Southern Counties

Avg Effect on Dem Vote (ATT, Matched Sample)


Year

0.06
0.05
0.04
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
-0.07
-0.08
-0.09
-0.1

Treated units:
57 98 123 120 129 128 129 129 129 129 129 129

Clayton Nall (Stanford University)
Genetic Matching, Excluding Early Adopters

<table>
<thead>
<tr>
<th>Year</th>
<th>Diff. in Change in Dem. Vote Share, 1952−(Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1964</td>
<td>-0.08</td>
</tr>
<tr>
<td>1976</td>
<td>-0.07</td>
</tr>
<tr>
<td>1988</td>
<td>-0.06</td>
</tr>
<tr>
<td>2000</td>
<td>-0.05</td>
</tr>
</tbody>
</table>

Clayton Nall (Stanford University)

The Road to Conflict
Matching Counties With Highways Built 1956-1968 Vs. No Highways
Effect of Time-Varying Highway Treatment, No Matching

Average Treatment Effect

Year (Treatment: Interstate at Least 4 Years Prior)

Clayton Nall (Stanford University)
Effect of Time-Varying Highway Treatment, No Matching, No Early Adopters

Clayton Nall (Stanford University)
Effect of Time-Varying Highway Treatment, East of Rockies

![Graph showing the change in Democratic vote share from 1952 to various years. The x-axis represents the years 1960, 1968, 1976, 1984, 1992, 2000, and 2008, and the y-axis represents the difference in change in Democratic vote share. The graph includes a line and dots indicating the trend over time.]
Early Adopters

CA, CT, MO, NY, OH, OK, PA, TX, VA, WA
Estimation: Urban-Suburban Polarization

Average urban-suburban Democratic gap within decade

Exits treatment:
• \( z_t = 1 \) if exits/sq. mi. above sample median at beginning of decade, 0 otherwise

Rays treatment:
• \( z_t = 1 \) if rays count above sample median at beginning of decade, 0 otherwise

Create matched samples for each decade using genetic matching (Diamond and Sekhon 2009)

Regress average gap in each decade on \( z_t \) and controls in each sample

Construct 95% and 80% confidence intervals by standard method

Causal estimand: Average treatment effect on treated (ATT)
Estimation: Urban-Suburban Polarization

- Average urban-suburban Democratic gap within decade
Estimation: Urban-Suburban Polarization

- Average urban-suburban Democratic gap within decade
- Exits treatment: $z_t = 1$ if exits/sq. mi. above sample median at beginning of decade, 0 otherwise
Estimation: Urban-Suburban Polarization

- Average urban-suburban Democratic gap within decade
- Exits treatment: $z_t = 1$ if exits/sq. mi. above sample median at beginning of decade, 0 otherwise
- Rays treatment: $z_t = 1$ if rays count above sample median at beginning of decade, 0 otherwise

Create matched samples for each decade using genetic matching (Diamond and Sekhon 2009)

Regress average gap in each decade on $z_t$ and controls in each sample

Construct 95% and 80% confidence intervals by standard method

Causal estimand: Average treatment effect on treated (ATT)
Estimation: Urban-Suburban Polarization

- Average urban-suburban Democratic gap within decade
- Exits treatment: $z_t = 1$ if exits/sq. mi. above sample median at beginning of decade, 0 otherwise
- Rays treatment: $z_t = 1$ if rays count above sample median at beginning of decade, 0 otherwise
- Create matched samples for each decade using genetic matching (Diamond and Sekhon 2009)
Estimation: Urban-Suburban Polarization

■ Average urban-suburban Democratic gap within decade
■ Exits treatment: $z_t = 1$ if exits/sq. mi. above sample median at beginning of decade, 0 otherwise
■ Rays treatment: $z_t = 1$ if rays count above sample median at beginning of decade, 0 otherwise
■ Create matched samples for each decade using genetic matching (Diamond and Sekhon 2009)
■ Regress average gap in each decade on $z_t$ and controls in each sample
Estimation: Urban-Suburban Polarization

- Average urban-suburban Democratic gap within decade
- Exits treatment: \( z_t = 1 \) if exits/sq. mi. above sample median at beginning of decade, 0 otherwise
- Rays treatment: \( z_t = 1 \) if rays count above sample median at beginning of decade, 0 otherwise
- Create matched samples for each decade using genetic matching (Diamond and Sekhon 2009)
- Regress average gap in each decade on \( z_t \) and controls in each sample
- Construct 95% and 80% confidence intervals by standard method
Estimation: Urban-Suburban Polarization

- Average urban-suburban Democratic gap within decade
- Exits treatment: $z_t = 1$ if exits/sq. mi. above sample median at beginning of decade, 0 otherwise
- Rays treatment: $z_t = 1$ if rays count above sample median at beginning of decade, 0 otherwise
- Create matched samples for each decade using genetic matching (Diamond and Sekhon 2009)
- Regress average gap in each decade on $z_t$ and controls in each sample
- Construct 95% and 80% confidence intervals by standard method
- Causal estimand: Average treatment effect on treated (ATT)
Estimation: Urban-Suburban Polarization

- Average urban-suburban Democratic gap within decade
- Exits treatment: \( z_t = 1 \) if exits/sq. mi. above sample median at beginning of decade, 0 otherwise
- Rays treatment: \( z_t = 1 \) if rays count above sample median at beginning of decade, 0 otherwise
- Create matched samples for each decade using genetic matching (Diamond and Sekhon 2009)
- Regress average gap in each decade on \( z_t \) and controls in each sample
- Construct 95% and 80% confidence intervals by standard method
- Causal estimand: Average treatment effect on treated (ATT)
Match Quality, Exits

The graph shows the standardized imbalance (mean for all covariates) over time from 1960 to 2000. The full sample line is solid, peaking around 1976, while the matched sample line is dashed, showing a generally lower trend. The y-axis ranges from 0.0 to 0.6.
Match Quality, Rays

![Graph showing标准化偏移（Mean）与年份的关系。Full Sample和Matched Sample在不同年份的标准化偏移值。]
Exits vs. Rays

Log(Exits/Sq Mi)

Rays

CHICAGO
PITTSBURGH
PROVIDENCE
SACRAMENTO
SAN FRANCISCO

Clayton Nall (Stanford University)
Rays vs. 1950 Population

The Road to Conflict

Clayton Nall  (Stanford University)
Exits: Dichotomized, Matching, Estimation by Election Year

OLS Estimates of ATT
Exits Per Sq. Mi. > Median

Polarization Effect (%)
(ATT)


-2
-1
0
1
2
3
4
5
6
7
8
9

Clayton Nall (Stanford University)
Rays: Dichotomized, Matching, Estimation by Election Year

OLS Estimates of ATT
Rays > Median

Polarization Effect (%)
(ATT)


Clayton Nall (Stanford University)
Exits: Effect on Urban Democratic Vote

<table>
<thead>
<tr>
<th>Year</th>
<th>Avg Effect on Dem Vote</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>−4</td>
</tr>
<tr>
<td>1968</td>
<td>−3</td>
</tr>
<tr>
<td>1976</td>
<td>−2</td>
</tr>
<tr>
<td>1984</td>
<td>−1</td>
</tr>
<tr>
<td>1992</td>
<td>0</td>
</tr>
<tr>
<td>2000</td>
<td>1</td>
</tr>
<tr>
<td>2008</td>
<td>2</td>
</tr>
</tbody>
</table>

OLS Estimates of ATT
Exits Per Sq. Mi. > Median

Year

Clayton Nall (Stanford University)
Exits: Effect on Suburban Democratic Vote

OLS Estimates of ATT
Exits Per Sq. Mi. > Median

Average Effect on Dem Vote (%)
(ATT, Matched Sample)

<table>
<thead>
<tr>
<th>Year</th>
<th>Avg Effect on Dem Vote (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>-11</td>
</tr>
<tr>
<td>1968</td>
<td>-10</td>
</tr>
<tr>
<td>1976</td>
<td>-9</td>
</tr>
<tr>
<td>1984</td>
<td>-8</td>
</tr>
<tr>
<td>1992</td>
<td>-7</td>
</tr>
<tr>
<td>2000</td>
<td>-6</td>
</tr>
<tr>
<td>2008</td>
<td>-5</td>
</tr>
</tbody>
</table>
Exits as a Fixed Quantity

To which Senator Gore replied: "Well, we were very careful to write into the act the provision to which you have referred that equal emphasis shall be given to local traffic needs and the interstate needs. We were also careful to write into the act a safeguard against possible abuse by requiring the approval of the Secretary of Commerce for the addition of any access points after the plan is once approved by the Secretary of Commerce." Hearings Before a Subcommittee on Public Works, United States Senate on the Progress and Status of the National Highway Program, 85th Congress, 1st session, 1957 at pages 16 and 46 through 47.

Senator Al Gore’s comments re: approval of access points by Secretary of Commerce. Quoted by Tallamy in response to Bragdon, 12 October 1959
Geocoding of Urban Petition Data