Crime Attractors, Deterrents, and Generators in Micro Places

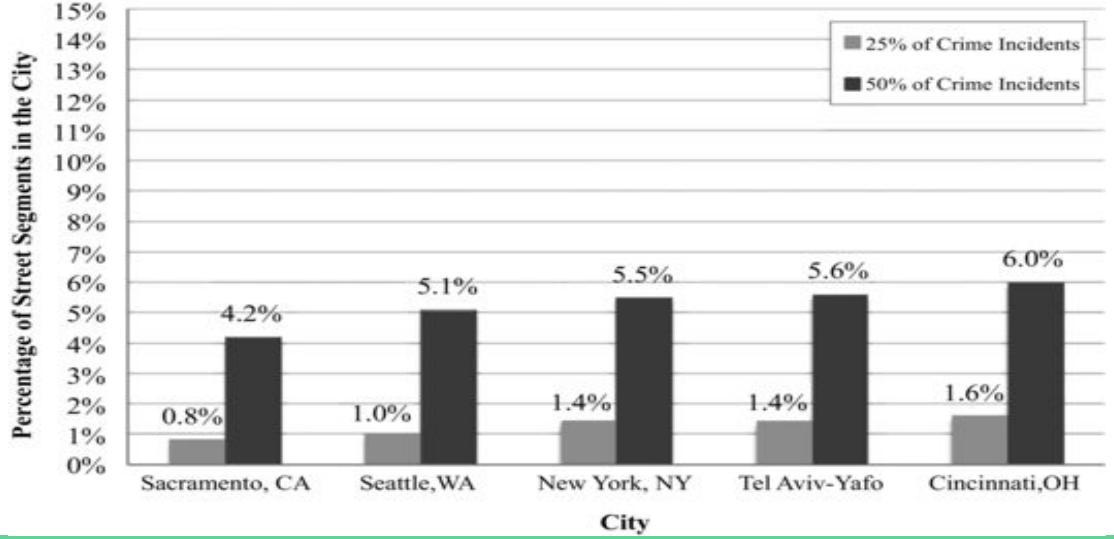
James LeDoux

Agenda

- Overview
- Theory
- Summary Stats
- Findings

Context: Definition (Weisburd, 2004)

- For a defined measure of crime at a specific microgeographic unit, the concentration of crime will fall within a narrow bandwidth of percentages for a defined cumulative proportion of crime
- While crime hot spots differ, these ratios holds similar across cities



Theory

Theory: Rational Choice
Becker, 1968

- Utilitarian belief that man always acts rationally
- Criminals act according to their own utility functions in order to meet their needs for money, social status, entertainment, etc.
- Each crime represents a cost-benefit analysis on the part of the offender
- Crime can be controlled by adjusting the swiftness, severity, and certainty of punishment

Theory: Routine Activities
Cohen and Felson, 1979

- A practical branch of Rational Choice Theory
- Routine activity patterns influence crime patterns through the convergence in space and time of:
  - Motivated offenders
  - Suitable targets
  - The absence of capable guardians against crime
- Explanations of crime across place and time require the study of how the environment facilitates the the transition of criminal intents into actions
- Examples:
  - Unemployment rates
  - Women joining the workforce, 1940s

Theory: Crime Patterns
Brantingham and Brantingham, 1993

- Crime can only occur at the intersection of an offender and a victim's activity space
- Crime can be understood at the city-level as the extent to which criminal and innocent activity spaces intersect
    - The places where routine activities intersect in ways that make for tempting criminal opportunities
    - Criminals are most likely to offend along the paths they use in their everyday lives
- Places framework:
    - Crime generators
    - Crime attractors
    - Crime neutral
    - Fear generators

Theory: The Criminology of Place

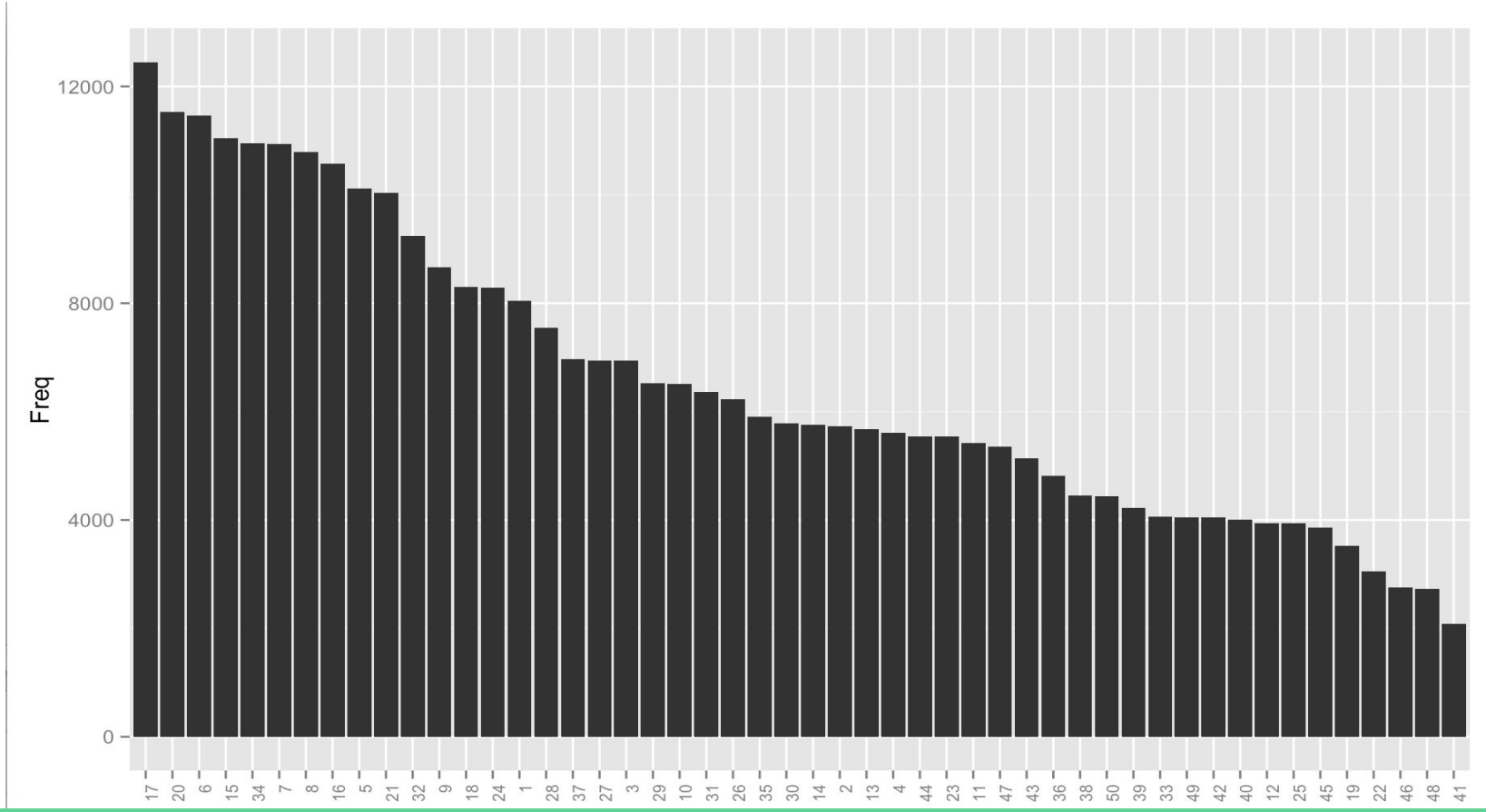
Distinguishing Features:

- Motivation agnostic
- Microgeographic focus
- Largely empirical

Analyses of place:

- Crime generators vs. crime attractors
- Fear generators and crime-neutral spaces

Why Go Micro?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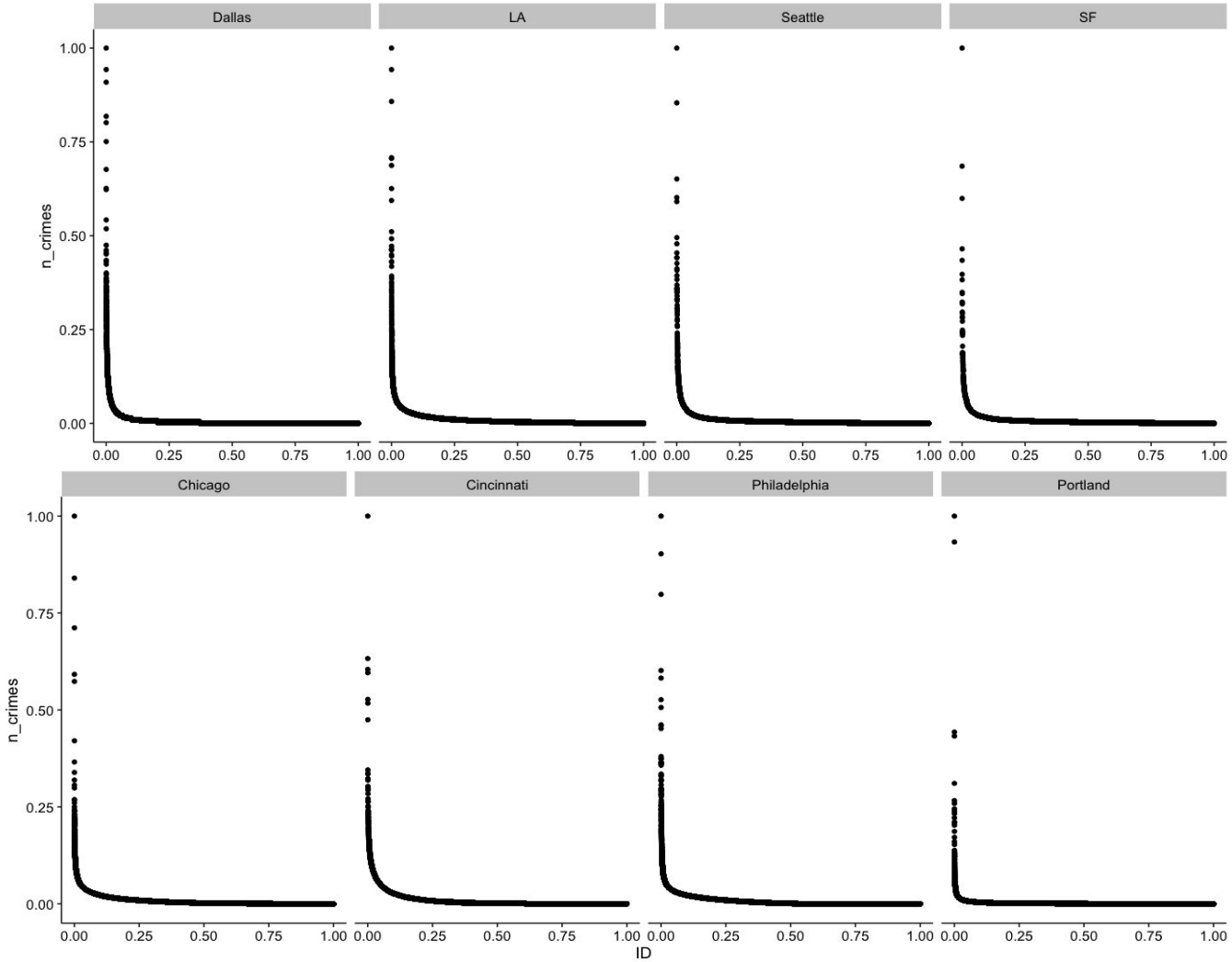
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Seattle
SF
Chicago
Cincinnati
Philadelphia
Portland
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0.25
0.50
0.75
1.00

Data and Methods

Data

- Sources
  - Open data portals (data.cityofchicago.org, data.seattle.gov, etc.)
  - Census Bureau
- Types
  - Cross-Sectional
  - Shapefiles

	ID	CaseNumber	Date	Block	IUCR	PrimaryType
1	2153481	HH396616	05/25/2002 09:30:00 PM	027XX W 87TH ST	0460	BATTERY
2	2153482	HH382731	05/15/2002 09:00:00 PM	055XX W GRAND AVE	143B	WEAPONS VIOLATION
3	2153483	HH402117	05/28/2002 02:00:00 PM	046XX N MARINE DR	0440	BATTERY
4	2153485	HH396036	05/25/2002 04:10:00 PM	060XX S ARTESIAN AVE	0460	BATTERY
5	2153488	HH396760	05/25/2002 10:30:00 PM	059XX S CAMPBELL AVE	0460	BATTERY
6	2153489	HH402223	05/28/2002 04:15:00 PM	046XX N MAGNOLIA AVE	0560	ASSAULT

	Description	LocationDescription	Arrest	Domestic	Beat	District	Ward	CommunityArea
1	SIMPLE	APARTMENT	false	true	835	8	18	70
2	UNLAWFUL POSS OTHER FIREARM	RESIDENCE	false	false	2515	25	29	19
3	AGG: HANDS/FIST/FEET NO/MINOR INJURY	HOSPITAL BUILDING/GROUNDS	false	false	2312	19	46	3
4	SIMPLE	RESIDENCE	false	true	825	8	15	66
5	SIMPLE	RESIDENCE	false	true	824	8	16	66
6	SIMPLE	SIDEWALK	true	false	2311	19	46	3

	FBICode	XCoordinate	YCoordinate	Year	UpdatedOn	Latitude	Longitude	Location
1	08B	1159719	1846824	2002	04/15/2016 08:55:02 AM	41.73539	-87.69044	(41.735393691, -87.690440384)
2	15	1138788	1913480	2002	04/15/2016 08:55:02 AM	41.91871	-87.76551	(41.918711651, -87.76551063)
3	08B	1170399	1931093	2002	04/15/2016 08:55:02 AM	41.96641	-87.64885	(41.966409353, -87.648852157)
4	08B	1161075	1864479	2002	04/15/2016 08:55:02 AM	41.78381	-87.68499	(41.783813715, -87.684985016)
5	08B	1160720	1865271	2002	04/15/2016 08:55:02 AM	41.78599	-87.68626	(41.785994409, -87.68626473)
6	08A	1167085	1930846	2002	04/15/2016 08:55:02 AM	41.96580	-87.66104	(41.965803579, -87.661044244)

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0	1	10809	16581	127104	S	YALE	AVE	<NA>	1782	0	0	6228	6248	0	0
1	2	6501	34082	128895	S	COTTAGE GROVE	AVE	<NA>	1236	7301	7359	7300	7358	7301	7399
2	3	15338	22358	142645	S	CAMPBELL	AVE	<NA>	1177	10801	10859	10800	10858	10801	10899

	LOGICRF	LOGICRT	CLASS	STATUS	STATUS_DAT	TIERED	ONEWAY_DIR	DIR_TRAVEL	EWNS	L_PARITY	R_PARITY	F_ZLEV	T_ZLEV	L_FIPS	R_FIPS	R_ZIP	L_ZIP
0	6228	6248	4	N	1999/01/01	N	S	F	-232	O	E	0	0	14000	14000	60621	60621
1	7300	7398	2	N	1999/01/01	N	<NA>	B	0	O	E	0	0	14000	14000	60619	60619
2	10800	10898	4	N	1999/01/01	N	<NA>	B	-2500	O	E	0	0	14000	14000	60655	60655

	R_CENSUSBL	L_CENSUSBL	F_CROSS	F_CROSS_ST	T_CROSS	T_CROSS_ST	LENGTH	EDIT_DATE	EDIT_TYPE	FLAG_STRIN
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2	170317503001010	170317503001011	2500|W|108TH|ST|	1803	2500|W|109TH|ST|	1805	665.3785	0	<NA>	<NA>

	EWNS_DIR	EWNS_COORD	CREATE_USE	CREATE_TIM	UPDATE_USE	UPDATE_TIM	Shape_Leng
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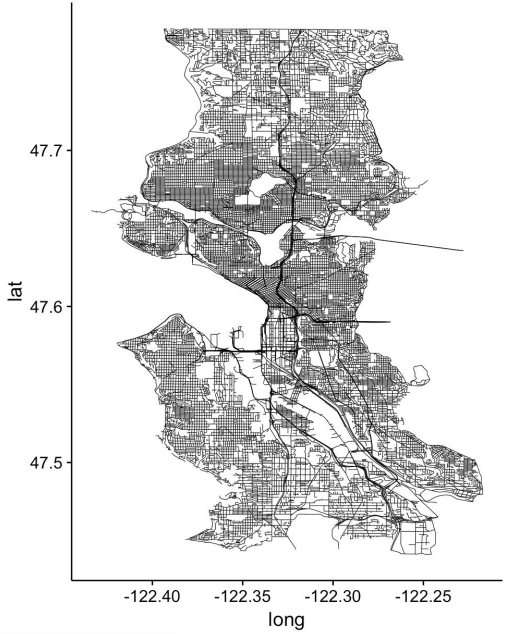


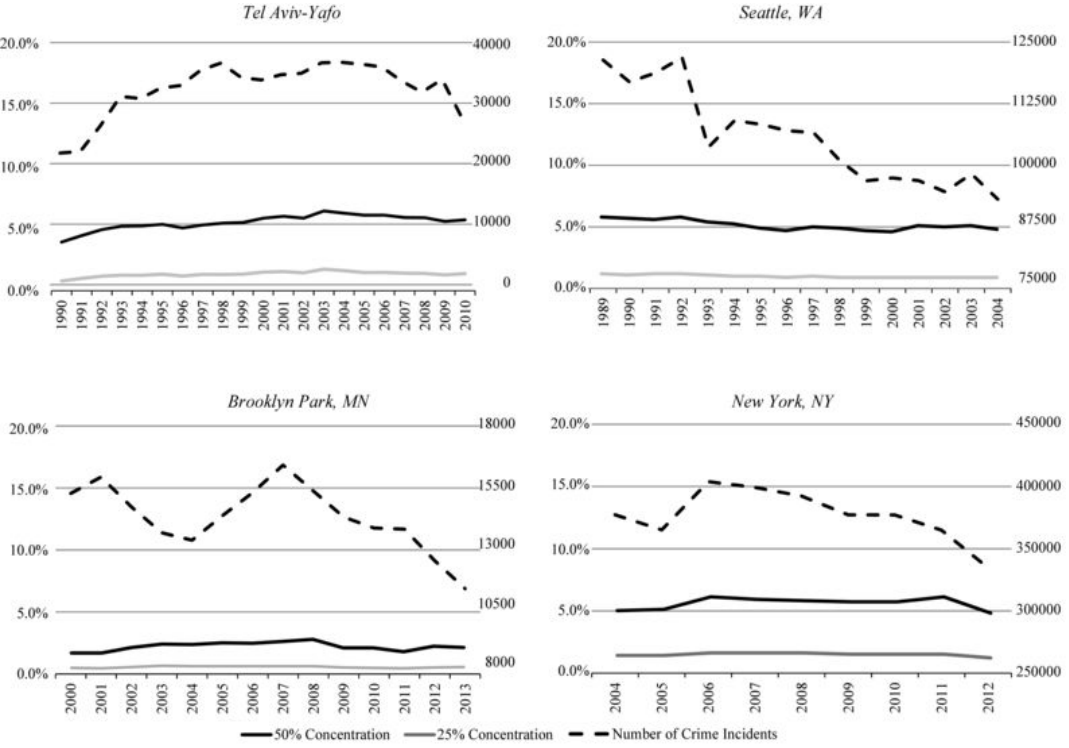
Population Statistics

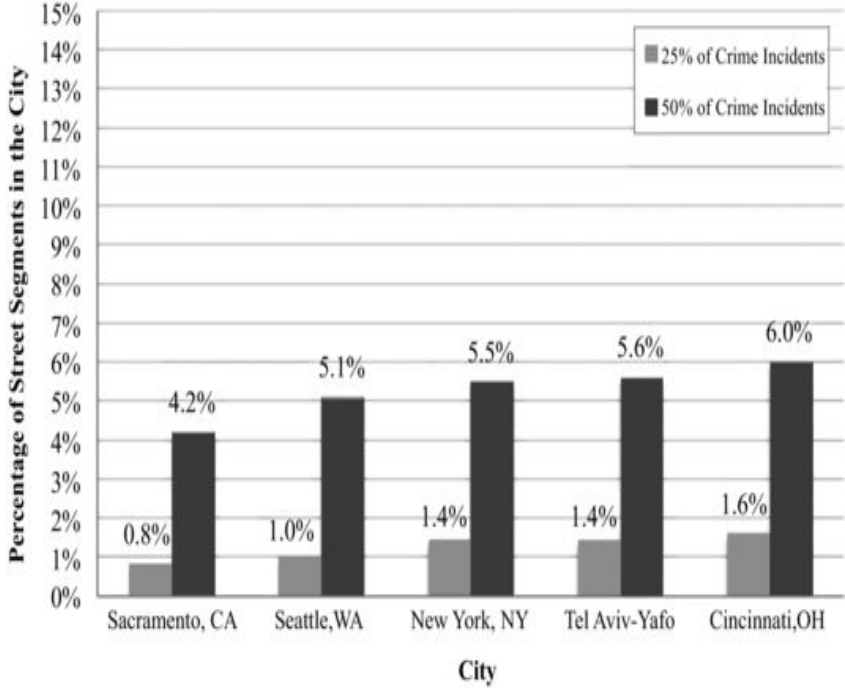
	CHI	SEA	LA	PDX	SF	PHI	DAL	DC	CIN
Population (in thousands)	2,719	652	3,884	609	837	1,553	1,258	658	297
Crime per 1k residents	39.22	63.76	30.52	43.26	70.24	41.80	42.16	59.45	65.41
Violent crime per 1k residents	9.08	6.02	6.45	5.26	7.85	10.30	6.98	12.69	9.26
Percent black	31.9	7.3	9.2	6.1	5.7	43.0	24.6	49.6	43.5
Percent below poverty line	22.7	14.0	22.4	18.3	13.3	26.7	24.1	18.2	30.9
Percent age 18 - 24	10.9	13.3	11.3	9.1	8.5	12.4	10.4	13.1	14.3

Crime at Street Segments

	CHI	SEA	LA	PDX	SF	PHI	DAL	DC	CIN
Date Range	2001-2016	2008-2016	2012-2015	2004-2014	2003-2016	2006-2016	2015-2016	2011-2016	2012-2015
# Segments	52887	23895	84018	37355	13978	41020	97932	13462	10061
Avg. Segment Length (ft.)	415	429	465	151	NA	354	NA	NA	445
Avg. 50% Concentration Level (%)	6.55	5.28	5.48	5.11	4.05	8.09	4.76	5.75	5.55
Avg. 25% Concentration Level (%)	1.99	1.25	1.65	1.26	0.79	2.71	0.99	1.70	1.69

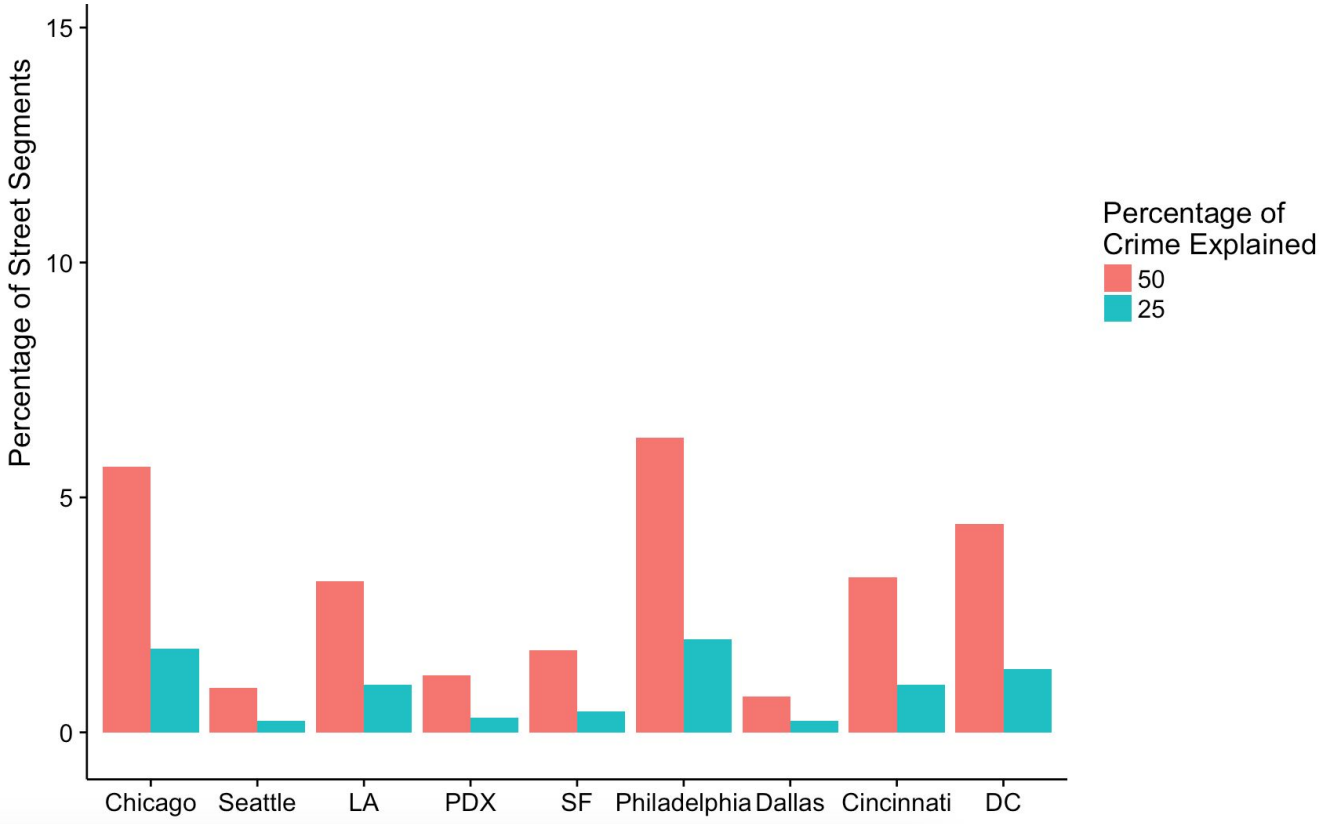
Original Weisburd Findings





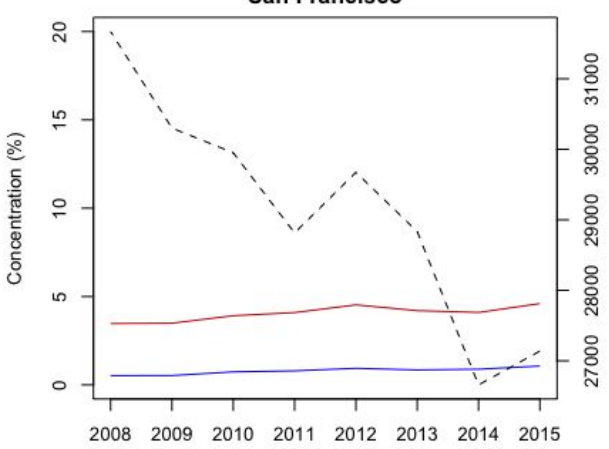
Findings from Extended Sample (All Crime)

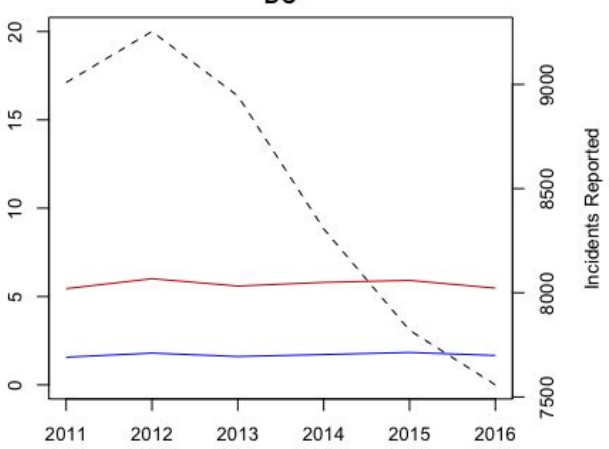
Violent Crime

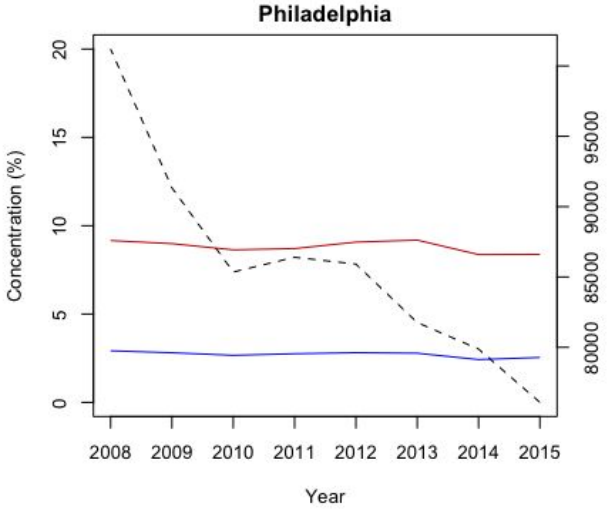


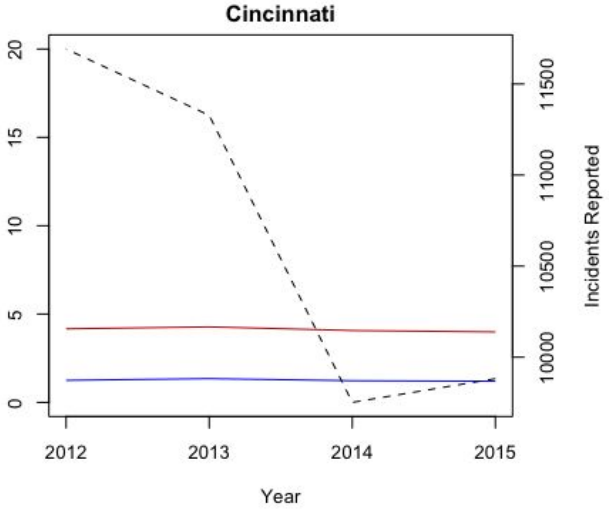
Stability of Concentration Level over Time:

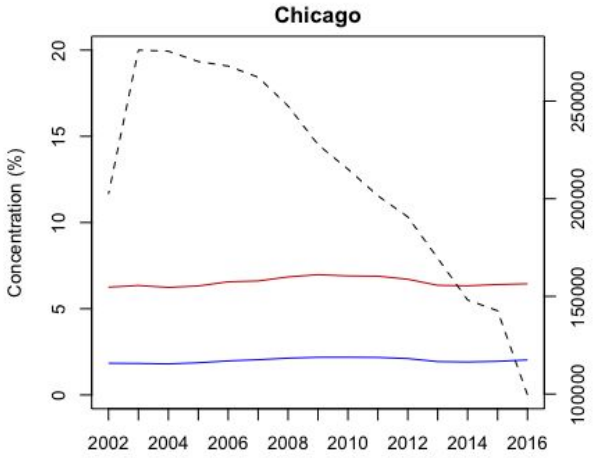
All Crime










Chicago
Concentration (%)
0
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100000
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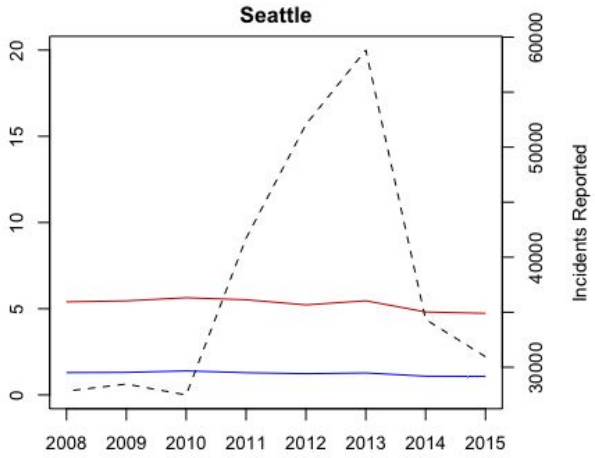
Seattle
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Incidents Reported
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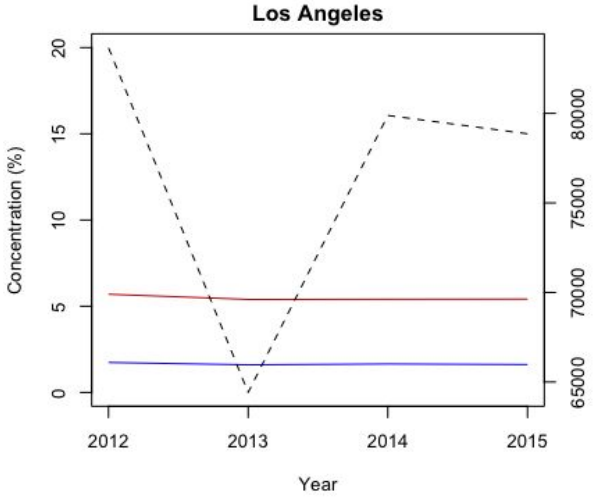
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Concentration (%)
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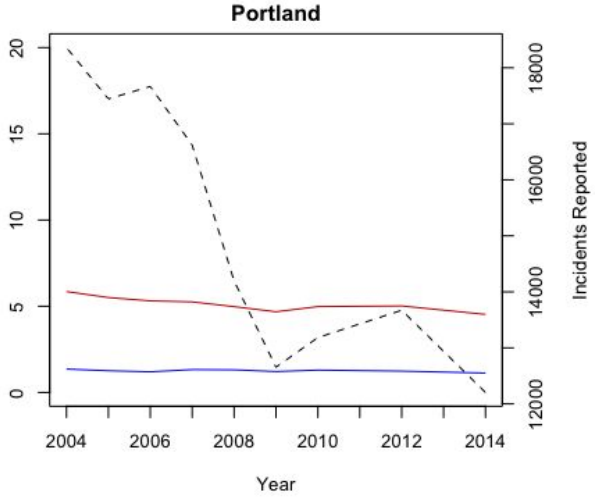
2013
2014
2015
Year


Portland
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12000
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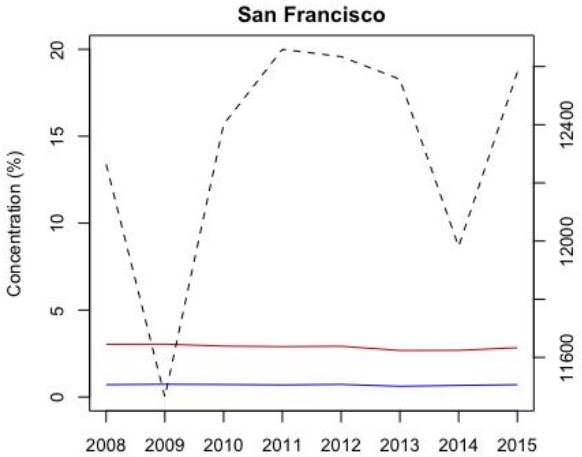
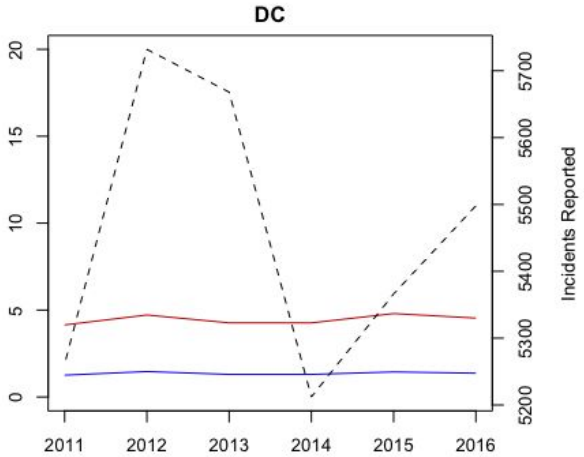
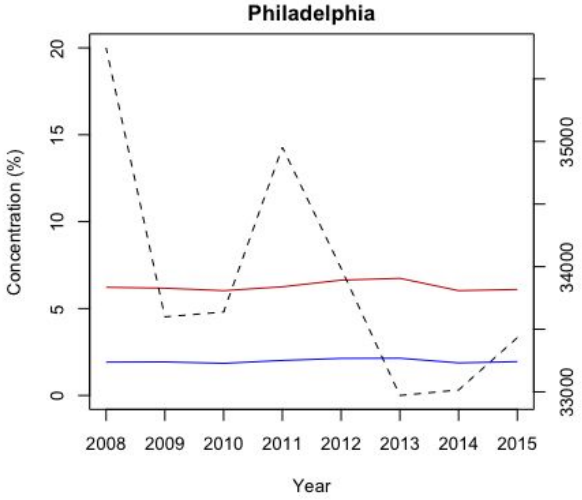
16000
18000
Incidents Reported
2004
2006
2008
2010
2012
2014
Year

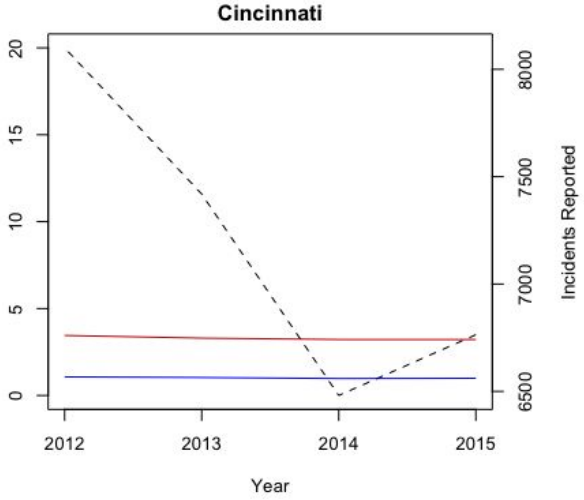
Stability of Concentration Level over Time:

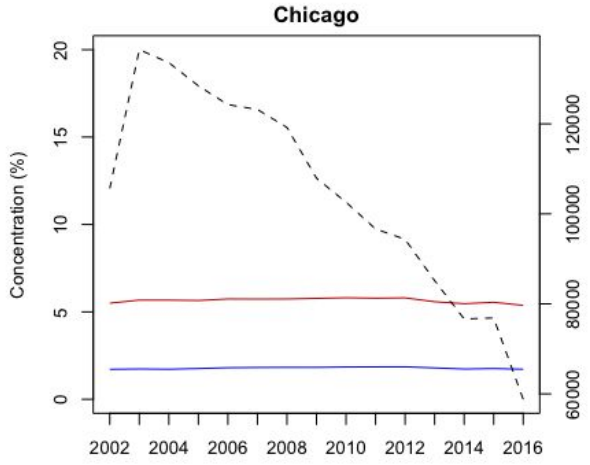
Violent Crime










Chicago
Concentration (%)
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15
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2002
2004
2006
2008
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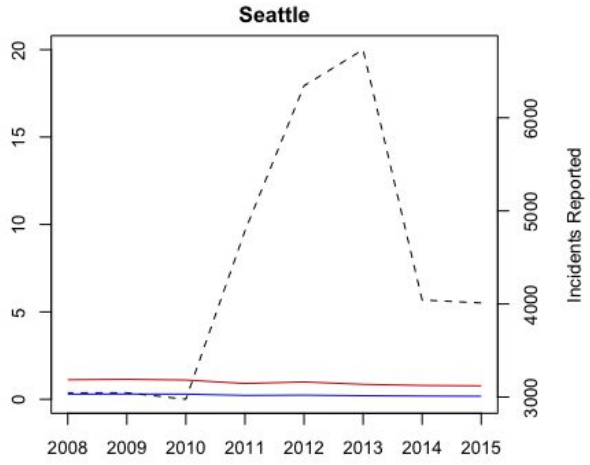
2016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Incidents Reported
2008
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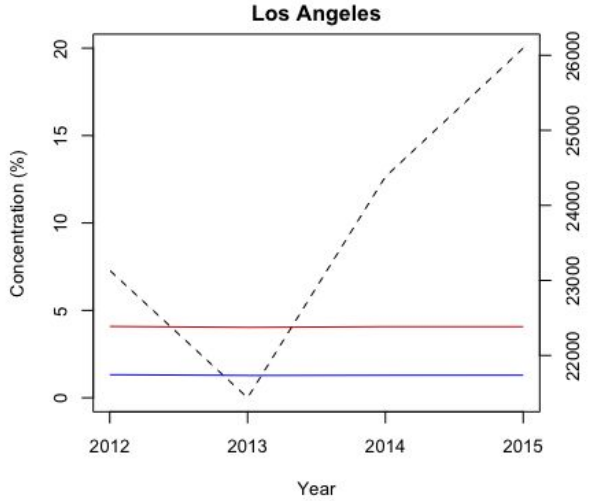
Los Angeles
Concentration (%)
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2012
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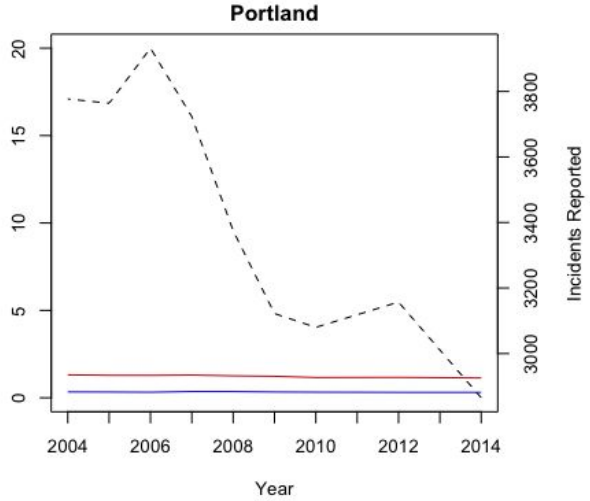
Year


Portland
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3800
Incidents Reported
2004
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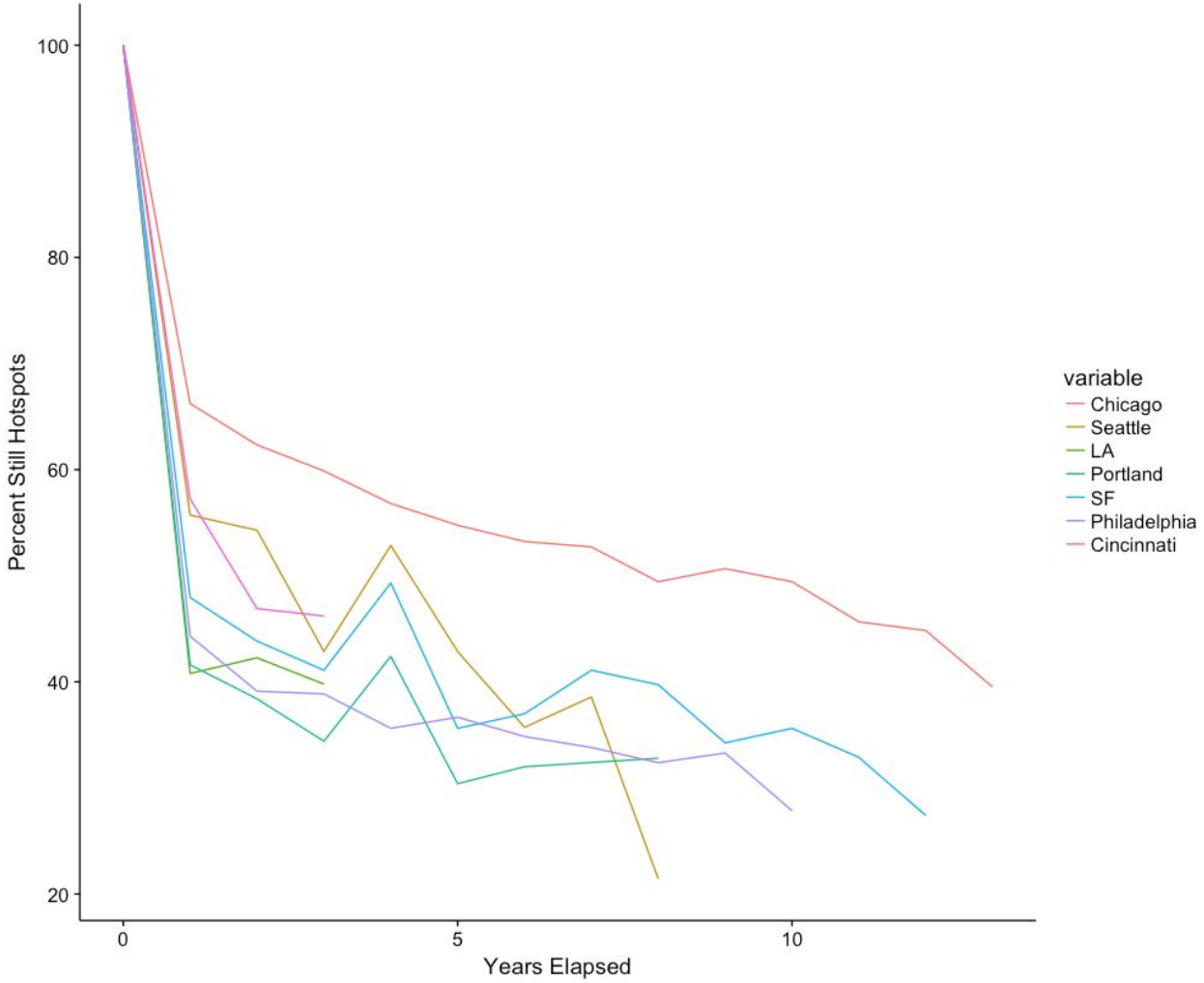
Year


100
80
60
40
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Percent Still Hotspots
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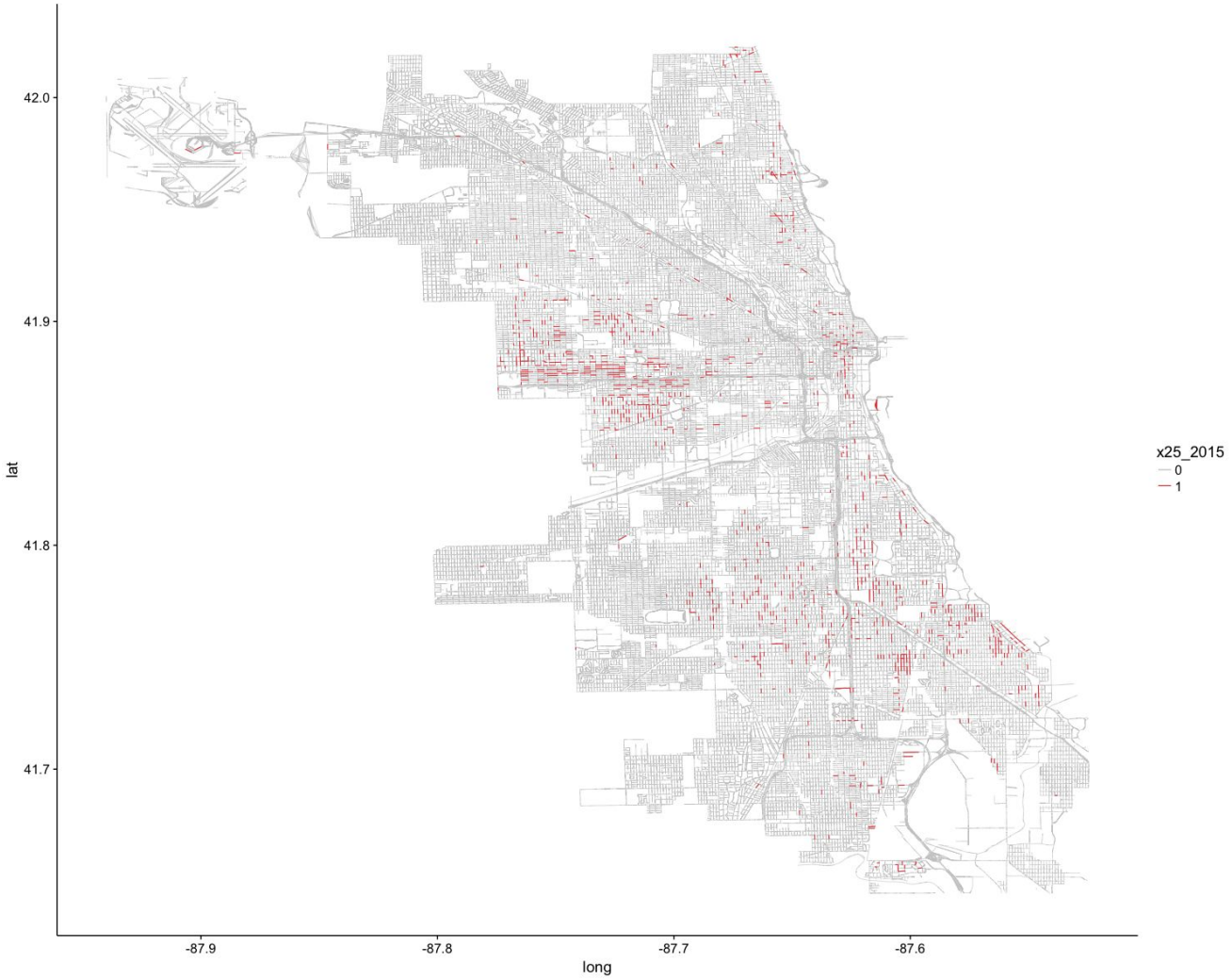
10
Years Elapsed
variable
Chicago
Seattle
LA
Portland
SF
Philadelphia
Cincinnati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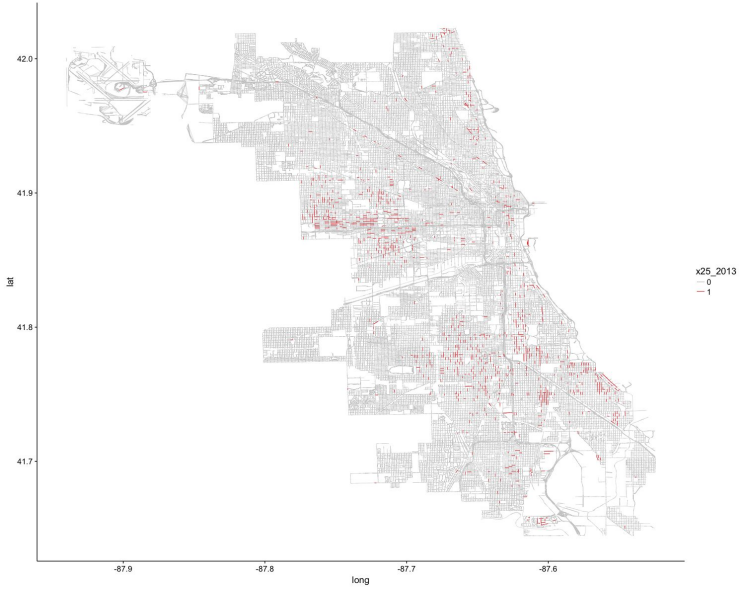
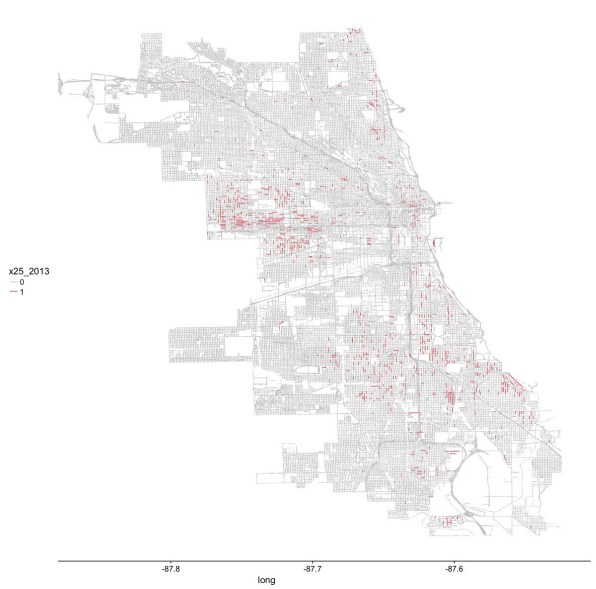
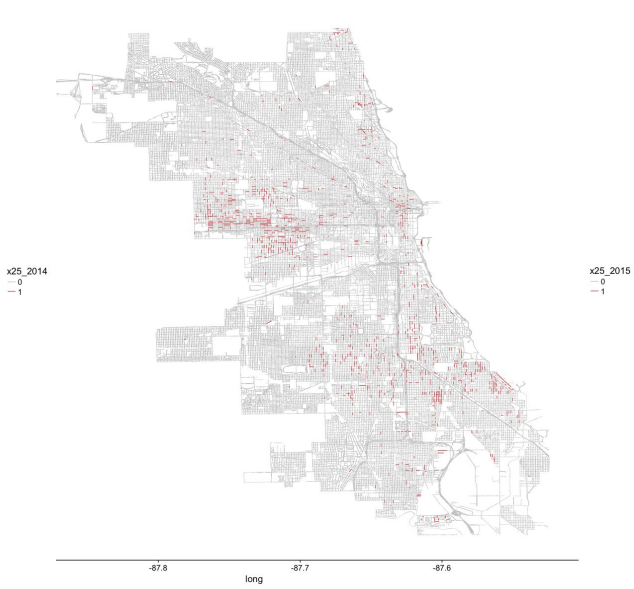
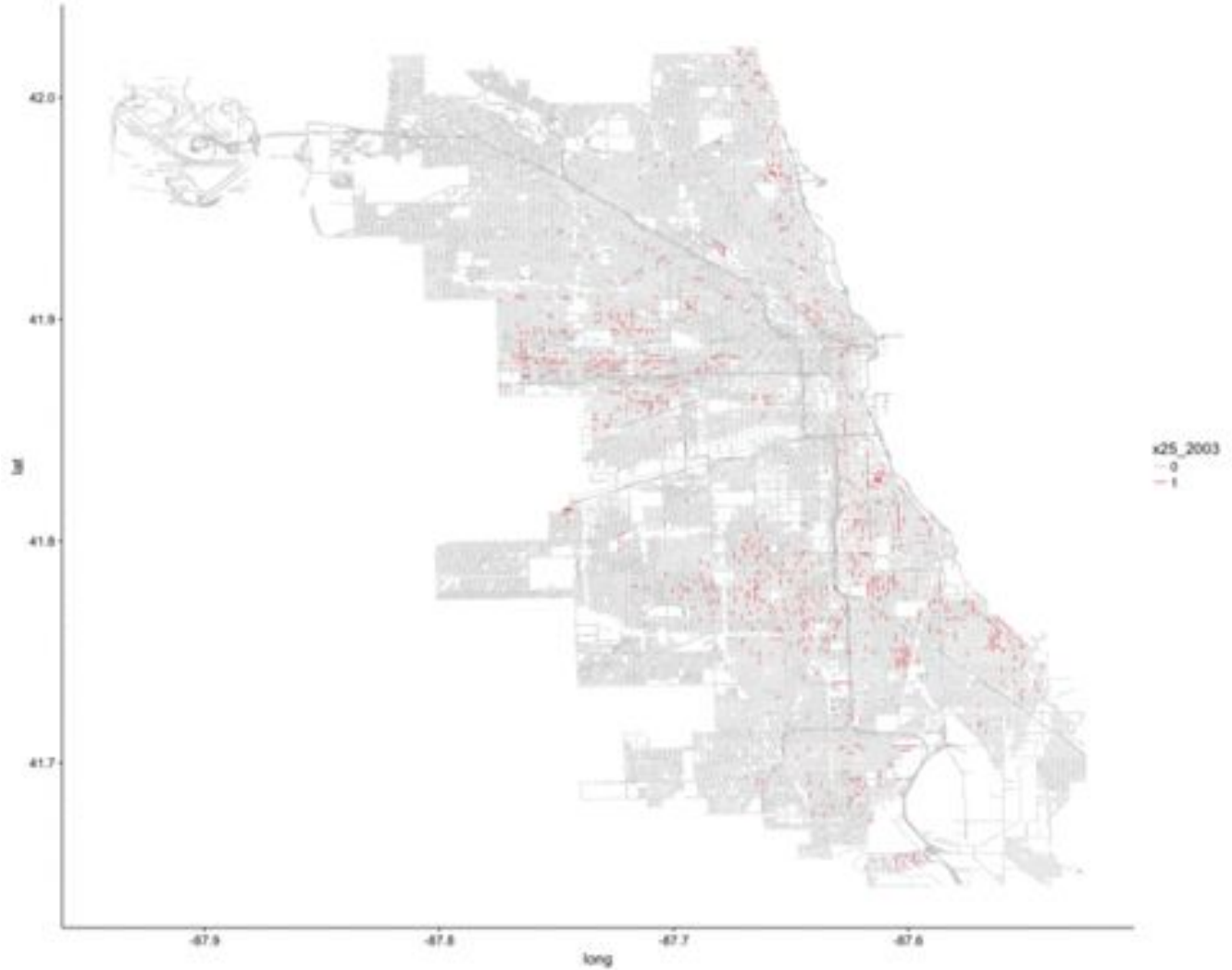
Hotspot Change Visualized





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41.7
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long
x25_2003
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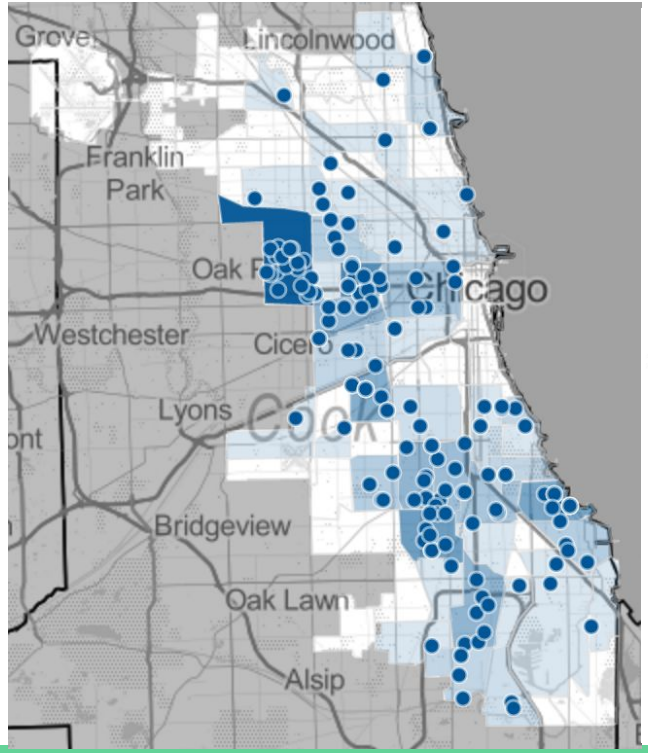
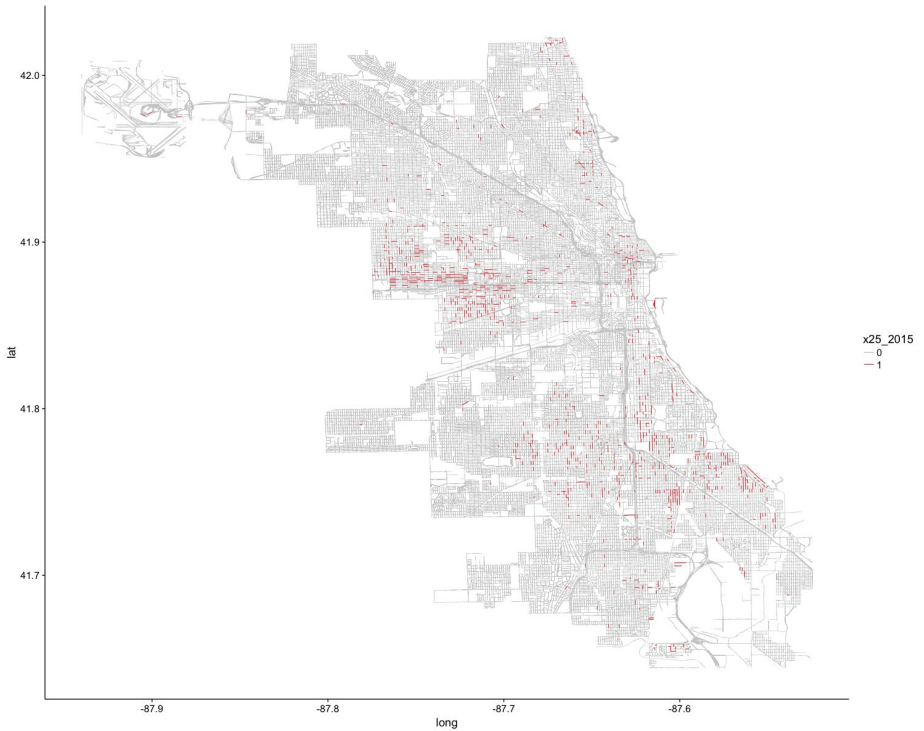
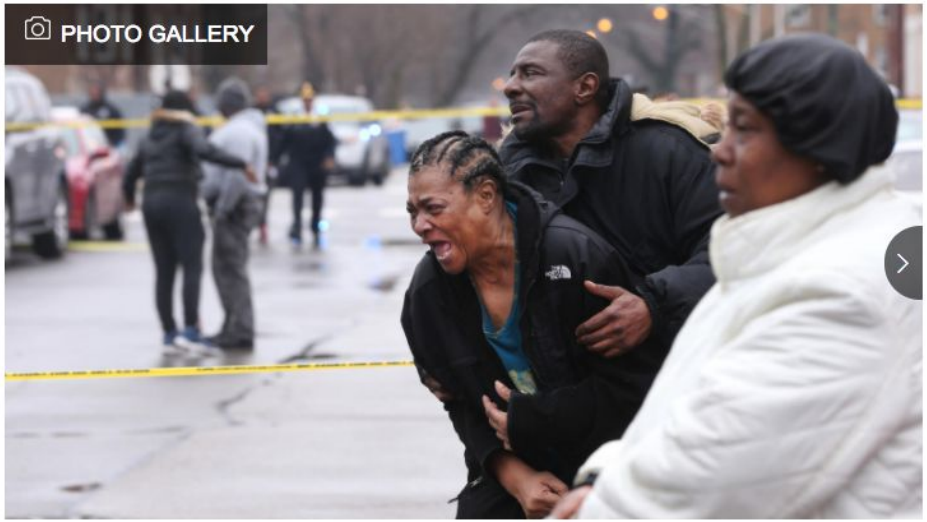
1

Chicago Tribune: “Where Homicides Happen in Chicago”





Bloody day in South Shore: 7 people shot dead in four-block area on South Side



A gunman approached Nadia Fish and Chicken in the South Shore neighborhood and fired shots on March 30, 2017. Dillon Jackson, 20, was found dead outside the restaurant. His brother, Raheem Jackson, 19, was found against a tree. Emmanuel Stokes, 28, was inside the restaurant with Edwin Davis. 32.

By **Peter Nickeas, Deanese Williams-Harris, Megan Crepeau and Elyssa Cherney • Contact Reporters**
Chicago Tribune

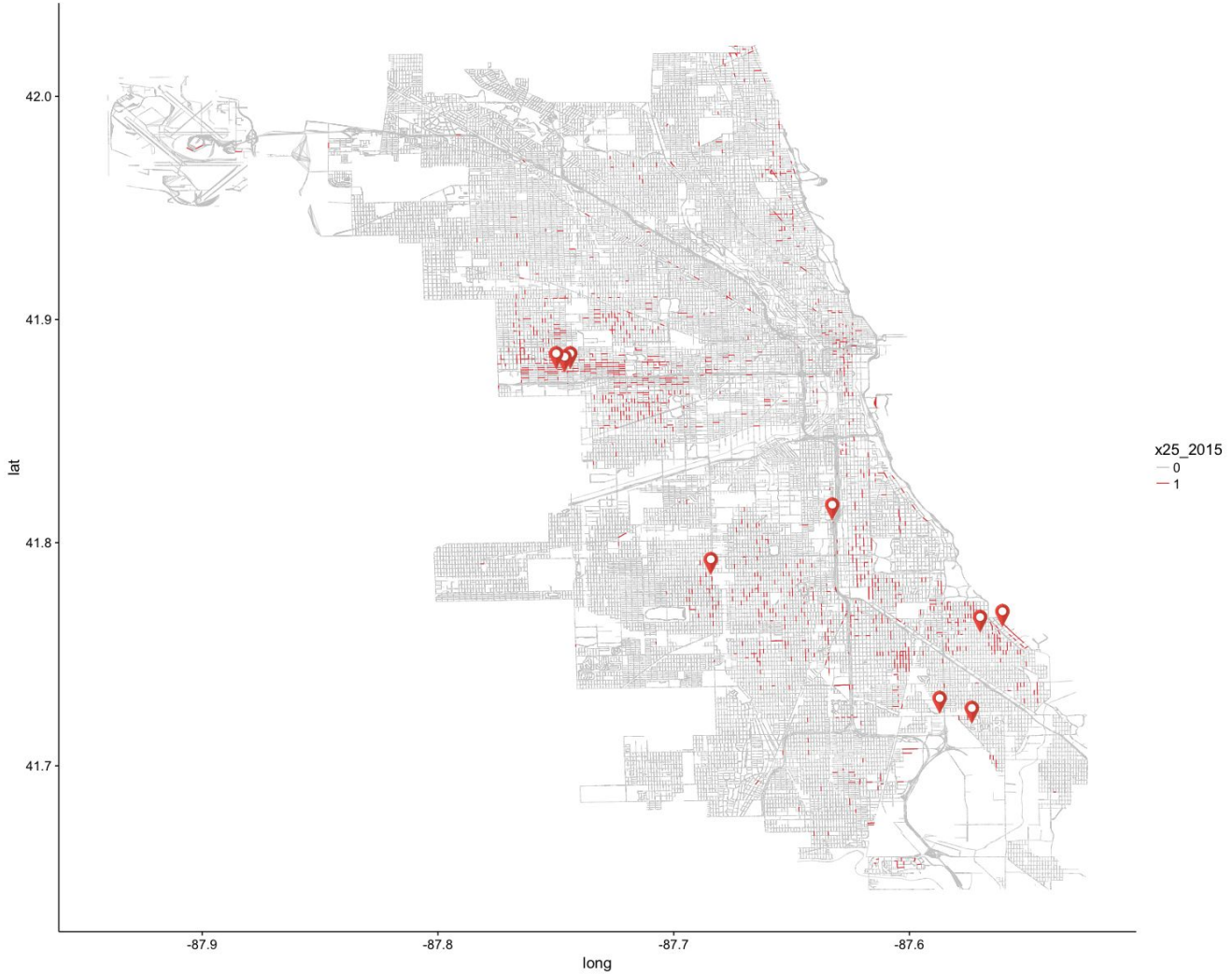
MARCH 31, 2017, 2:23 PM

In case you missed it

4 dead in restaurant shooting: 'It is not OK. It is not OK when we lose a child like this'
MAR. 31, 2017

Report of gunfire shuts part of Dan Ryan
MAR. 30, 2017

Map: Where shootings


42.0
41.9
41.8
41.7
lat
-87.9
-87.8
-87.7
-87.6
long
x25_2015
0
1

Causality

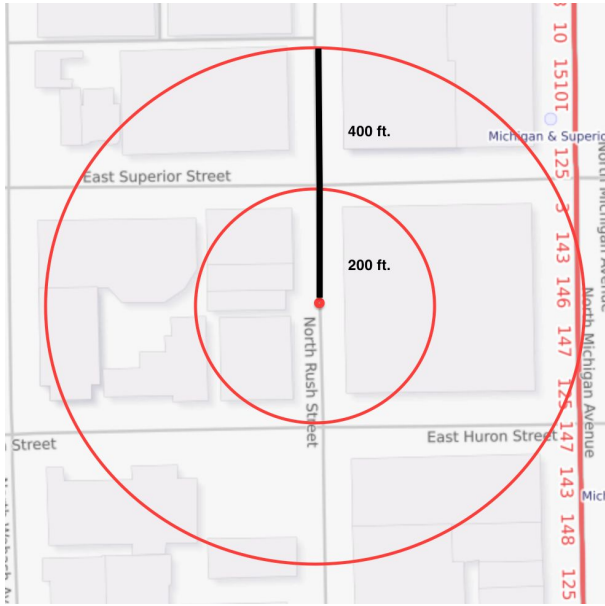
What Contributes to the Crime Problem?

- Facilities
  - Bars and Taverns
  - Schools
  - Rehab Facilities
  - Retirement homes
  - Grocery stores
  - Restaurants
  - Liquor stores
  - Daycare facilities
  - Veterinary clinics
  - Gas stations
  - Pawn shops
  - Arts venues
  - Other businesses
- Spatial Features
  - Subway Stops
  - Bus stops
  - Distance to City Center
  - Vacant Lots
  - Graffiti
  - Parks
  - Street segment length
- Socioeconomics
  - People per household
  - Poverty level
  - Education level
  - Income
  - Hardship Index
  - Population age

Definition of Features

- Cocentric circles
  - Distance Matrix from street segment centroid to all facility locations
  - Pro: Computationally reasonable, a reliable way to count observations
  - Con: Not as precise as street network distance

- FEATURENAME_oneblock
  - The count of that type of facility within 200 feet of a street segment centroid
- FEATURENAME_twoblocks
  - Count of that type of facility between 200 and 600 feet of a centroid



Three Models

- OLS
- Beta
- Logit

Coefficients:

	Estimate	Standardized	Std. Error	t value	Pr(>|t|)	
(Intercept)	-0.226480524	0.000000000	0.647704232	-0.350	0.726590	
subway_oneblock	0.607960425	0.044784372	0.058532823	10.387	< 2e-16	***
bus_stops_oneblock	0.007053254	0.015721120	0.002521332	2.797	0.005153	**
graffiti_oneblock	-0.000730512	-0.038118957	0.000106910	-6.833	8.40e-12	***
parks_oneblock	0.081371004	0.013379882	0.025095495	3.242	0.001186	**
log_dist_city_center	0.074360161	0.021637909	0.019100868	3.893	9.91e-05	***
bars_oneblock	0.118846881	0.041151338	0.015495753	7.670	1.75e-14	***
LENGTH	0.001085474	0.069947490	0.000063304	17.147	< 2e-16	***
drug_centers_oneblock	0.238114826	0.027727311	0.035721323	6.666	2.65e-11	***
groceries_oneblock	0.220032662	0.036624067	0.028387856	7.751	9.27e-15	***
senior_centers_oneblock	0.186956062	0.005364186	0.141480012	1.321	0.186363	
schools_oneblock	0.292095518	0.048125551	0.025094617	11.640	< 2e-16	***
businesses_oneblock	0.002349465	0.023330243	0.000551347	4.261	2.04e-05	***
liquor_stores_oneblock	0.127170308	0.045651160	0.017099337	7.437	1.04e-13	***
daycares_oneblock	0.050945235	0.011882058	0.019030821	2.677	0.007431	**
animal_care_oneblock	-0.047691651	-0.007137124	0.029759938	-1.603	0.109041	
gas_stations_oneblock	0.124648536	0.022886708	0.027267736	4.571	4.86e-06	***
pawn_oneblock	0.066045901	0.003499375	0.081547561	0.810	0.417997	
arts_venues_oneblock	0.055283663	0.006292469	0.042350784	1.305	0.191770	
PERCENT.OF.HOUSING.CROWDED	-0.000766279	-0.000839899	0.005649299	-0.136	0.892105	
PERCENT.AGED.16..UNEMPLOYED	0.050074531	0.106223959	0.004151017	12.063	< 2e-16	***
PER.CAPITA.INCOME	0.000010347	0.045541812	0.000001968	5.258	1.46e-07	***
PERCENT.HOUSEHOLDS.BELOW.POVERTY	0.039523393	0.123447202	0.002661035	14.853	< 2e-16	***

Coefficients:

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	-7.760175417	1.436520629	-5.402	6.59e-08	***
subway_oneblock	0.358915720	0.087821508	4.087	4.37e-05	***
bus_stops_oneblock	0.010007590	0.004746834	2.108	0.035008	*
graffiti_oneblock	-0.001129826	0.000278179	-4.062	4.88e-05	***
parks_oneblock	0.132336447	0.053245188	2.485	0.012940	*
log_dist_city_center	0.161770392	0.044788110	3.612	0.000304	***
bars_oneblock	0.129505499	0.023892861	5.420	5.95e-08	***
LENGTH	0.000812564	0.000099104	8.199	2.42e-16	***
drug_centers_oneblock	0.236975363	0.059218525	4.002	6.29e-05	***
groceries_oneblock	0.130666725	0.049197986	2.656	0.007909	**
senior_centers_oneblock	0.231549936	0.274726860	0.843	0.399320	
schools_oneblock	0.394751761	0.047790416	8.260	< 2e-16	***
businesses_oneblock	0.001332027	0.000812900	1.639	0.101294	
liquor_stores_oneblock	0.142185879	0.030775856	4.620	3.84e-06	***
daycares_oneblock	0.085043896	0.038937234	2.184	0.028953	*
animal_care_oneblock	-0.141606242	0.079554035	-1.780	0.075076	.
gas_stations_oneblock	0.159118994	0.047308284	3.363	0.000770	***
pawn_oneblock	0.099296272	0.124102106	0.800	0.423643	
arts_venues_oneblock	-0.109789939	0.077617046	-1.415	0.157213	
PERCENT.OF.HOUSING.CROWDED	-0.028437298	0.014068754	-2.021	0.043248	*
PERCENT.AGED.16..UNEMPLOYED	0.033153839	0.008787232	3.773	0.000161	***
PER.CAPITA.INCOME	0.000018124	0.000005106	3.549	0.000386	***
PERCENT.HOUSEHOLDS.BELOW.POVERTY	0.069266781	0.005596579	12.377	< 2e-16	***

Economic Significance

- The coefficients and marginal effects are small. Do they matter?
  - Theoretical interest (Crime Pattern Theory)
  - Comparative magnitudes
- Implementation
  - Ranking areas of interest

Why Not Probit?

- Probit is:
  - Slower than logit
  - Less interpretable
- Logit has nice mathematical properties
  - Logs cancel out the exponentiations when taking the log likelihood