

Crime Attractors, Deterrents, and Generators in Micro Places

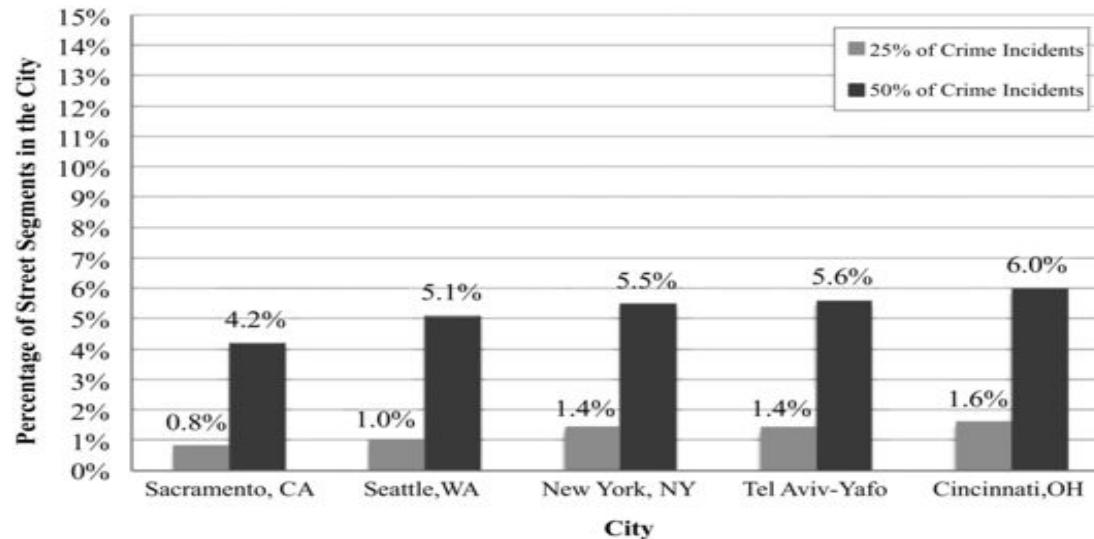
James LeDoux

Agenda

- Theory
- Crime Concentration Overview
- Models

Context: Definition (Weisburd, 2014)

- 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

- Society has an equilibrium level of crime
- 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

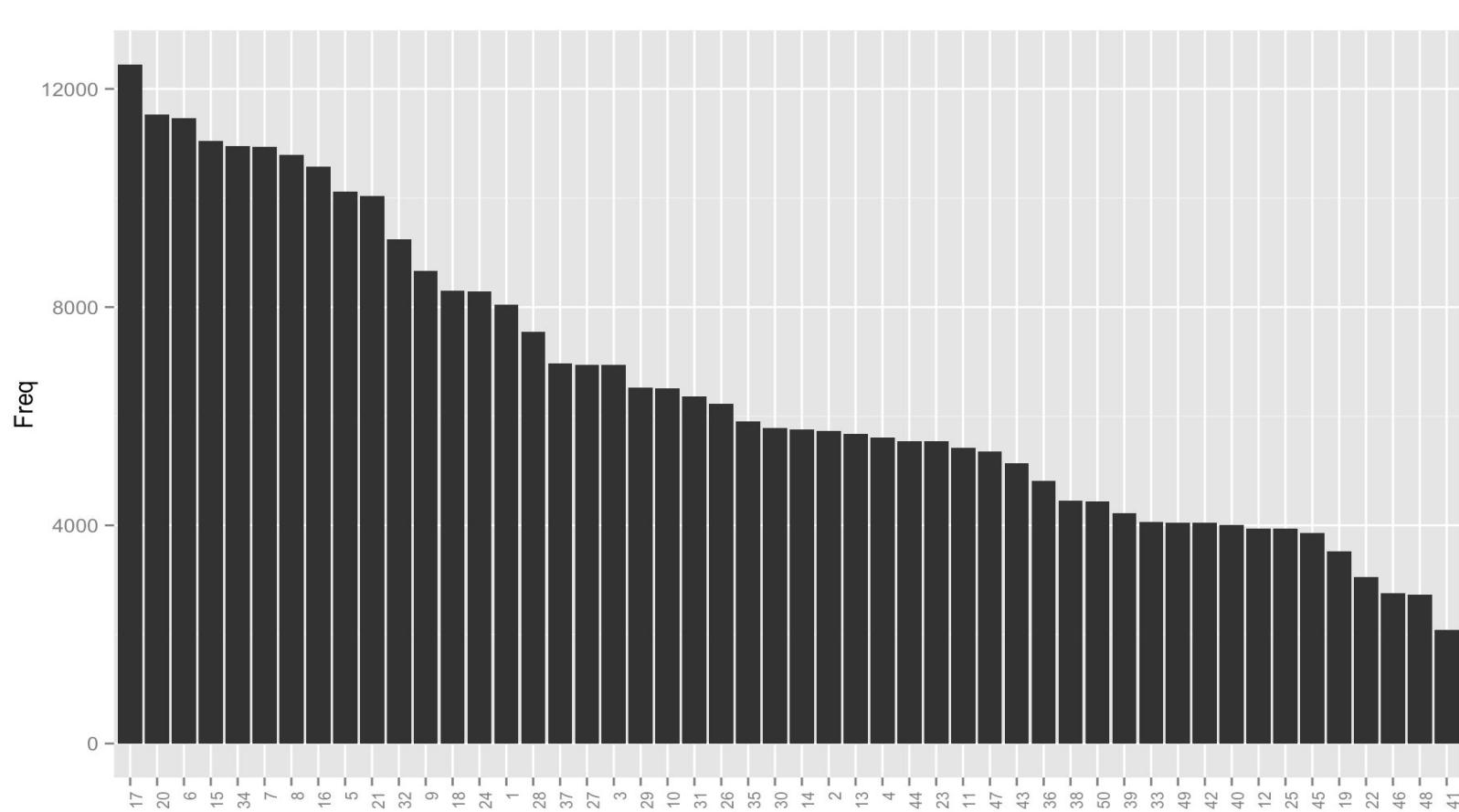
- Routine activity patterns influence crime patterns through the convergence in space and time of:
 - Motivated offenders
 - Suitable targets
 - The absence of capable guardians against crime
- Explanations of crime across place and time require the study of how the environment facilitates the transition of criminal intents into actions

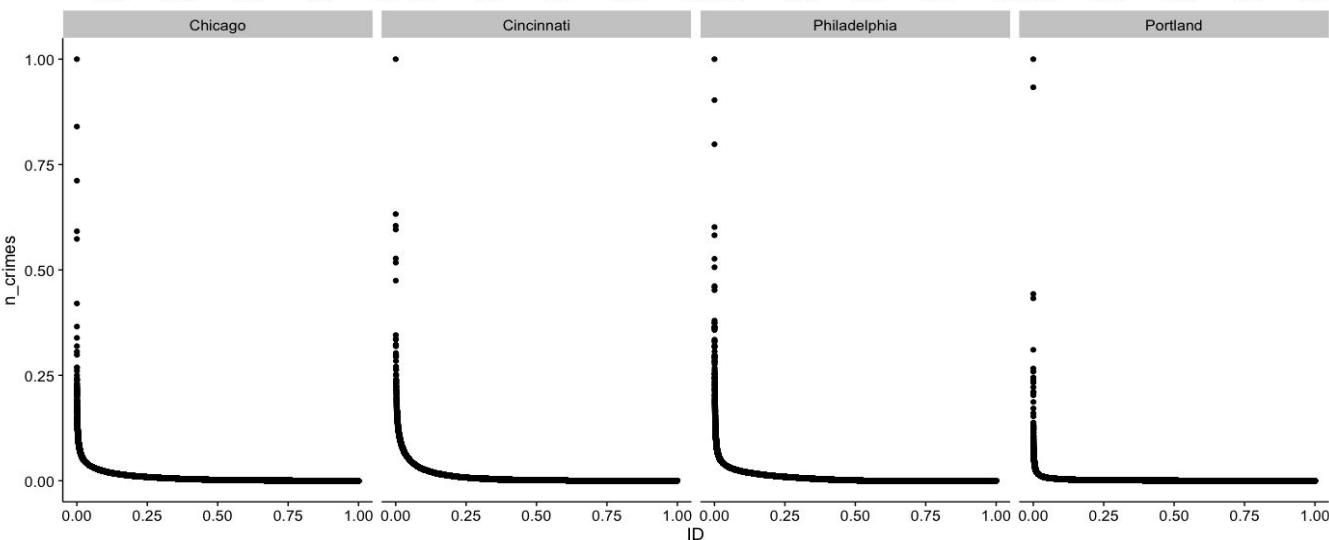
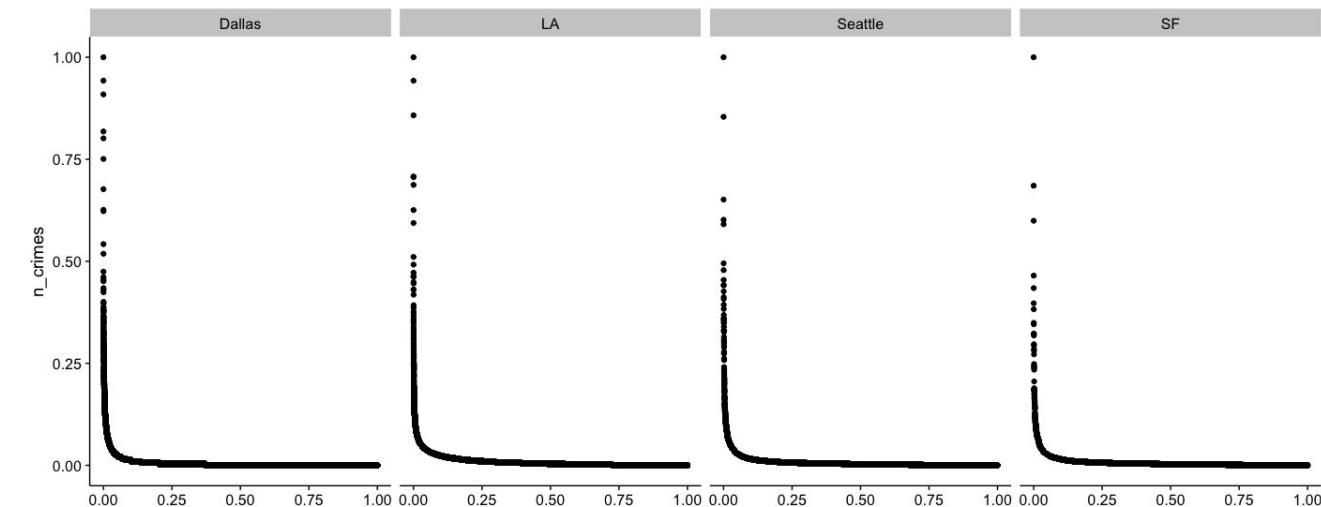
Theory: Crime Patterns

Brantingham and Brantingham, 1993

- Crime can be understood by the ways in which criminal and innocent activity patterns intersect
- Places framework:
 - Crime generators
 - Crime attractors
 - Crime neutral
 - Fear generators

Why Go Micro?





Crime Concentration

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	APTMENT	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)			

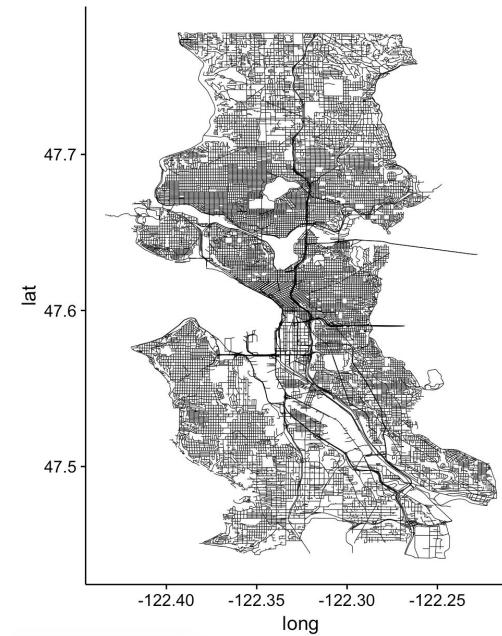
Slot "data":

	OBJECTID	FNODE_ID	TNODE_ID	TRANS_ID	PRE_DIR	STREET_NAM	STREET_TYP	SUF_DIR	STREETNAME	L_F_ADD	L_T_ADD	R_F_ADD	R_T_ADD	LOGICLF	LOGICLT		
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	0	E	0	0	14000	14000	60621	60621
1	7300	7398	2	N	1999/01/01	N	<NA>	B	0	0	E	0	0	14000	14000	60619	60619
2	10800	10898	4	N	1999/01/01	N	<NA>	B	-2500	0	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		
0	170316802002035	170316802002035	2451	WIENGLEWOODIAVEI			2208		62501S111		0	220.5660	0	<NA>	<NA>		
1	170316909002000	170316908003004		8001E173RDISTI			170	8001E174THISTI			172	664.7746	0	<NA>	<NA>		
2	170317503001010	170317503001011		25001WI108THISTI			1803	25001WI109THISTI			1805	665.3785	0	<NA>	<NA>		
	EWNS_DIR	EWNS_COORD	CREATE_USE	CREATE_TIM	UPDATE_USE	UPDATE_TIM	Shape_Leng										
0	W	232	EXISTING	1999/01/01	EXISTING	1999/01/01	0.000606										
1	<NA>	0	EXISTING	1999/01/01	EXISTING	1999/01/01	0.001825										
2	W	2500	EXISTING	1999/01/01	EXISTING	1999/01/01	0.001826										

An object of class "Line"

Slot "coords":

	[,1]	[,2]
[1,]	-87.68382	41.69724
[2,]	-87.68381	41.69699
[3,]	-87.68380	41.69684
[4,]	-87.68380	41.69666
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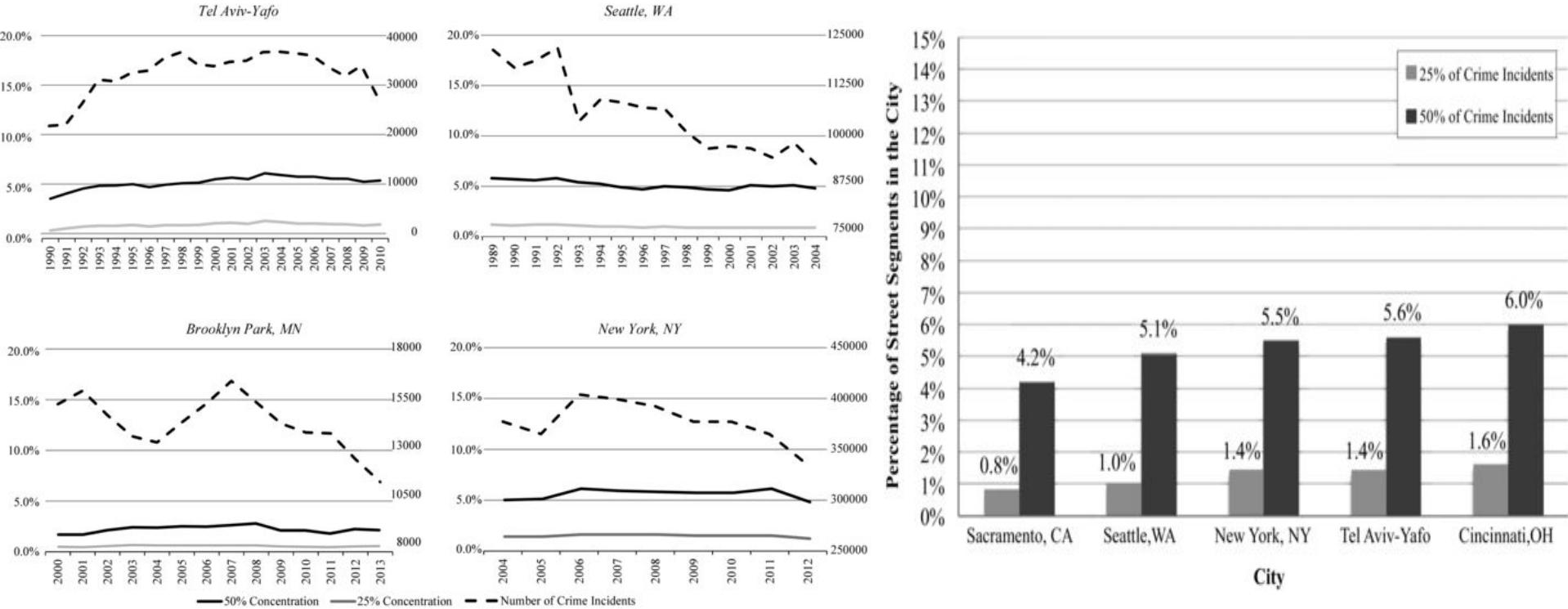
Population Statistics

	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

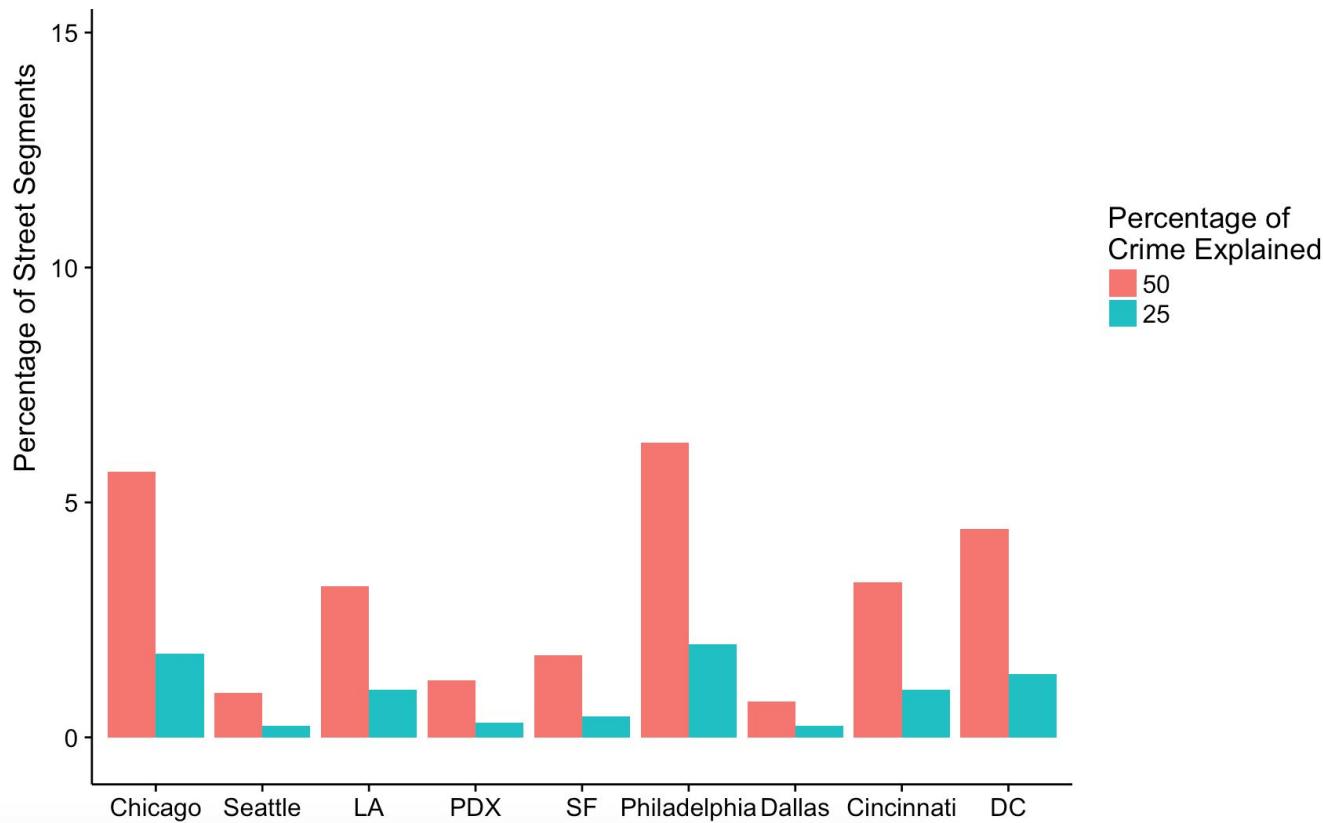
Original Weisburd Findings



Findings from Extended Sample (All Crime)

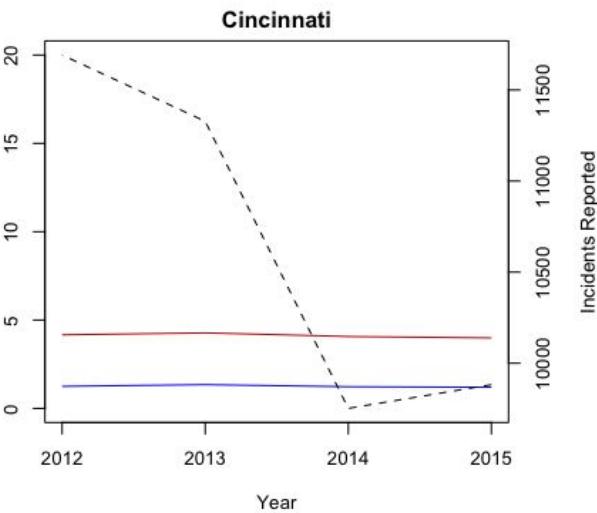
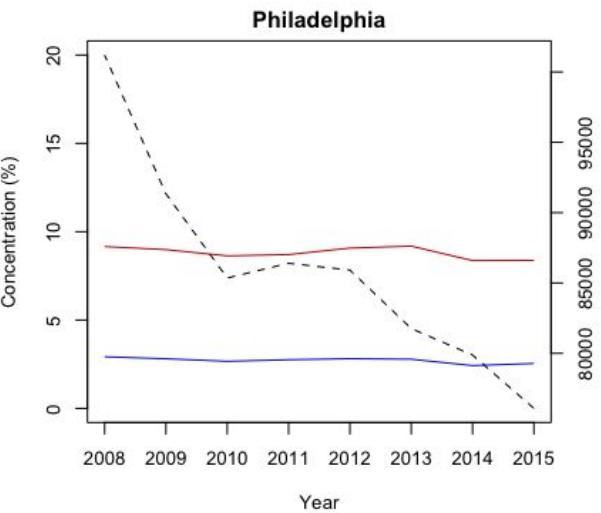
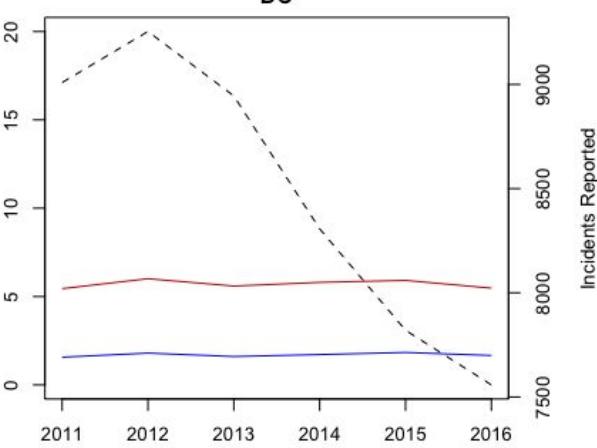
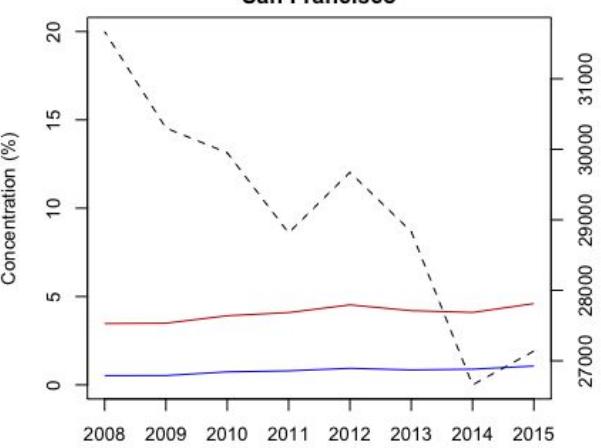


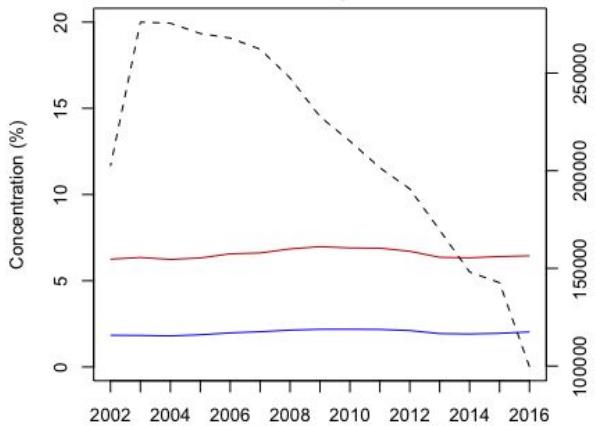
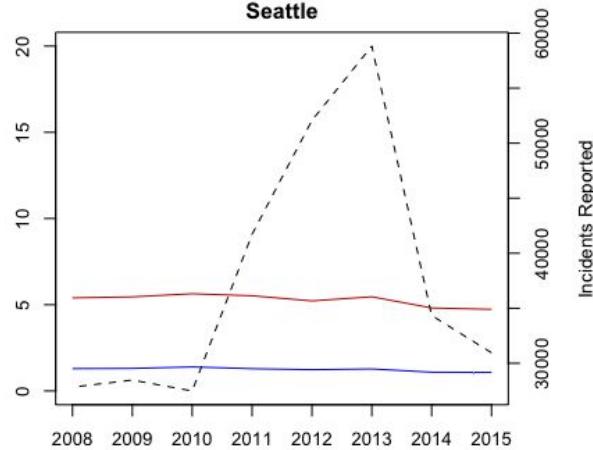
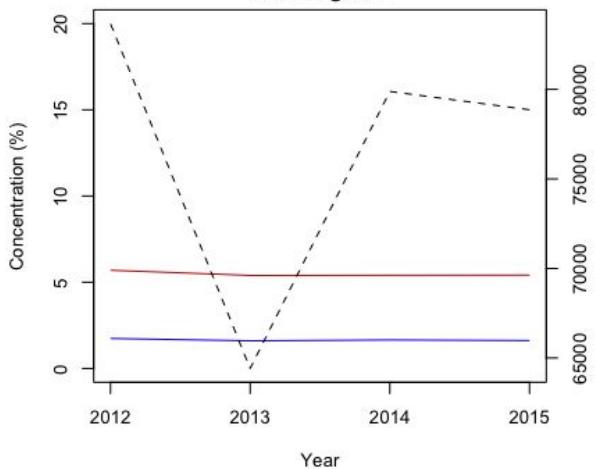
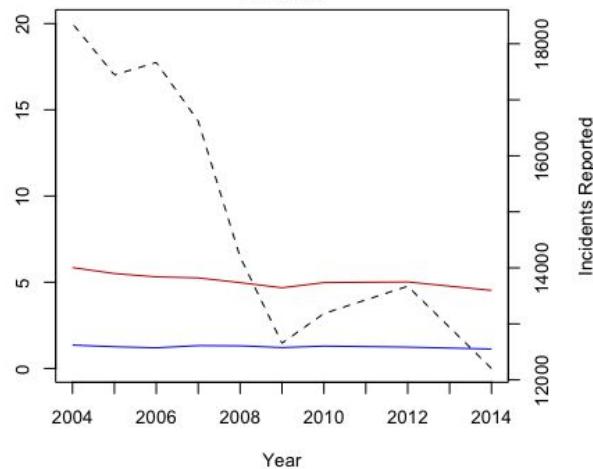
Violent Crime



Stability of Concentration Level over Time:

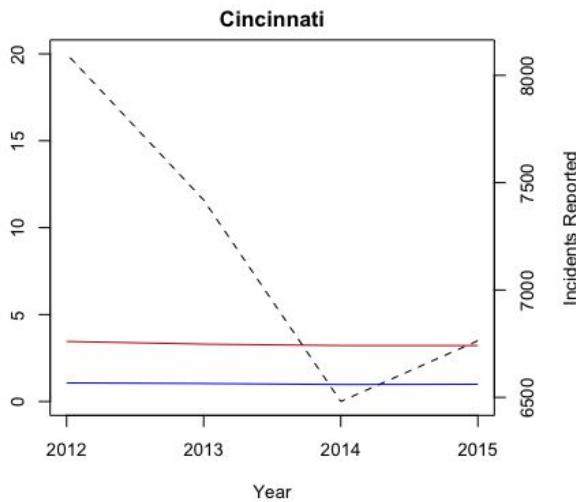
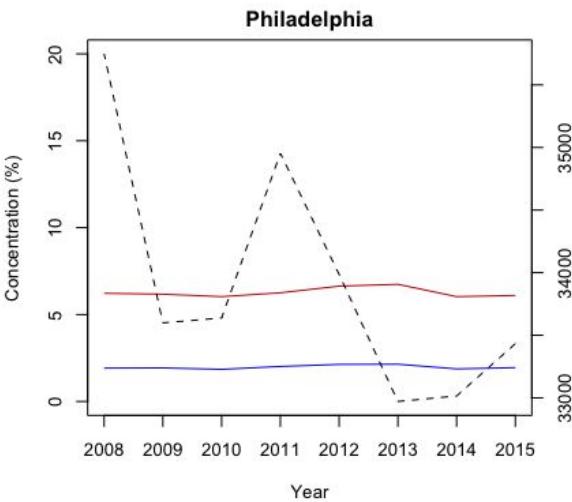
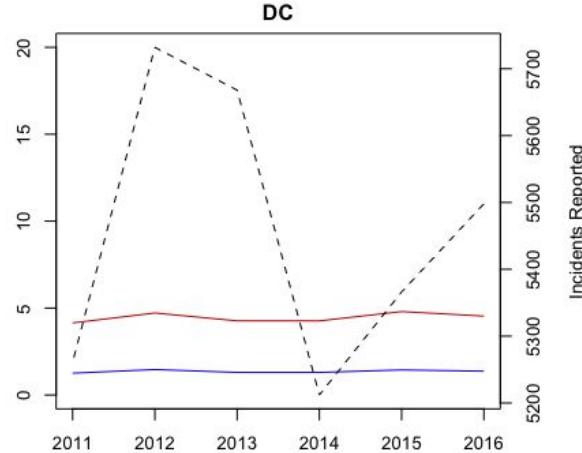
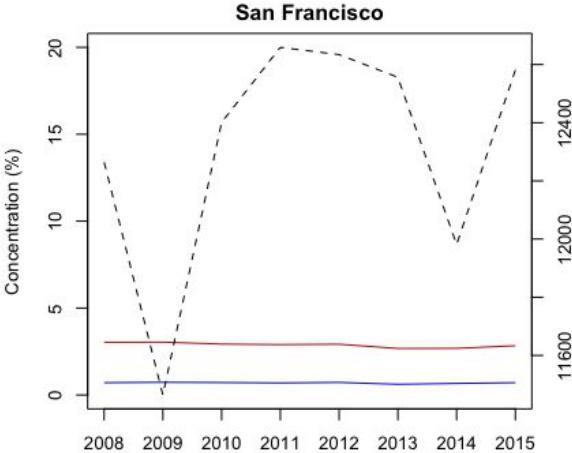
All Crime

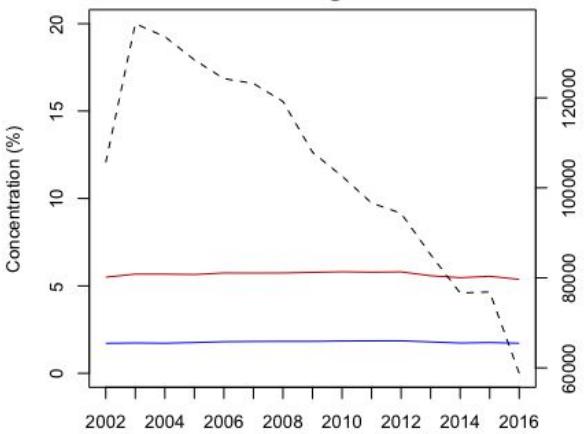
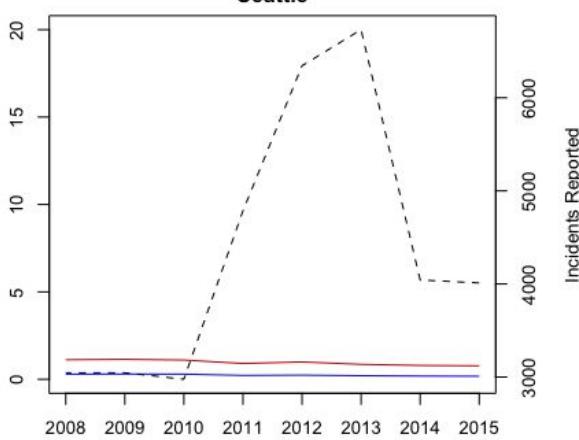
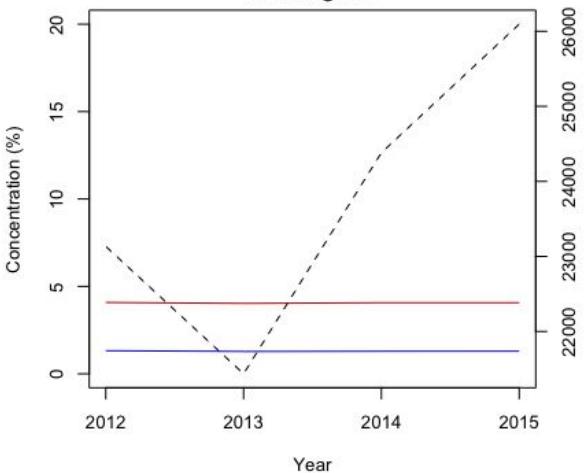
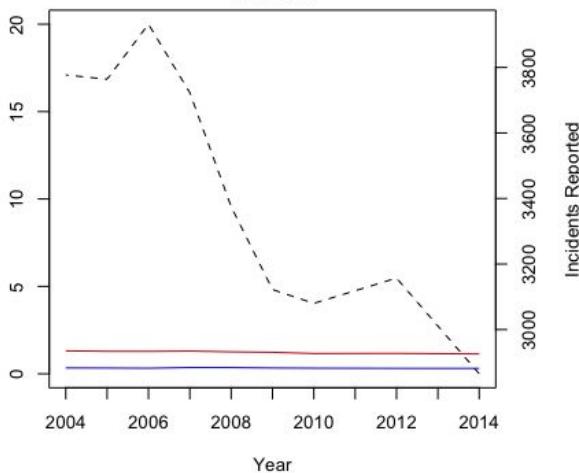


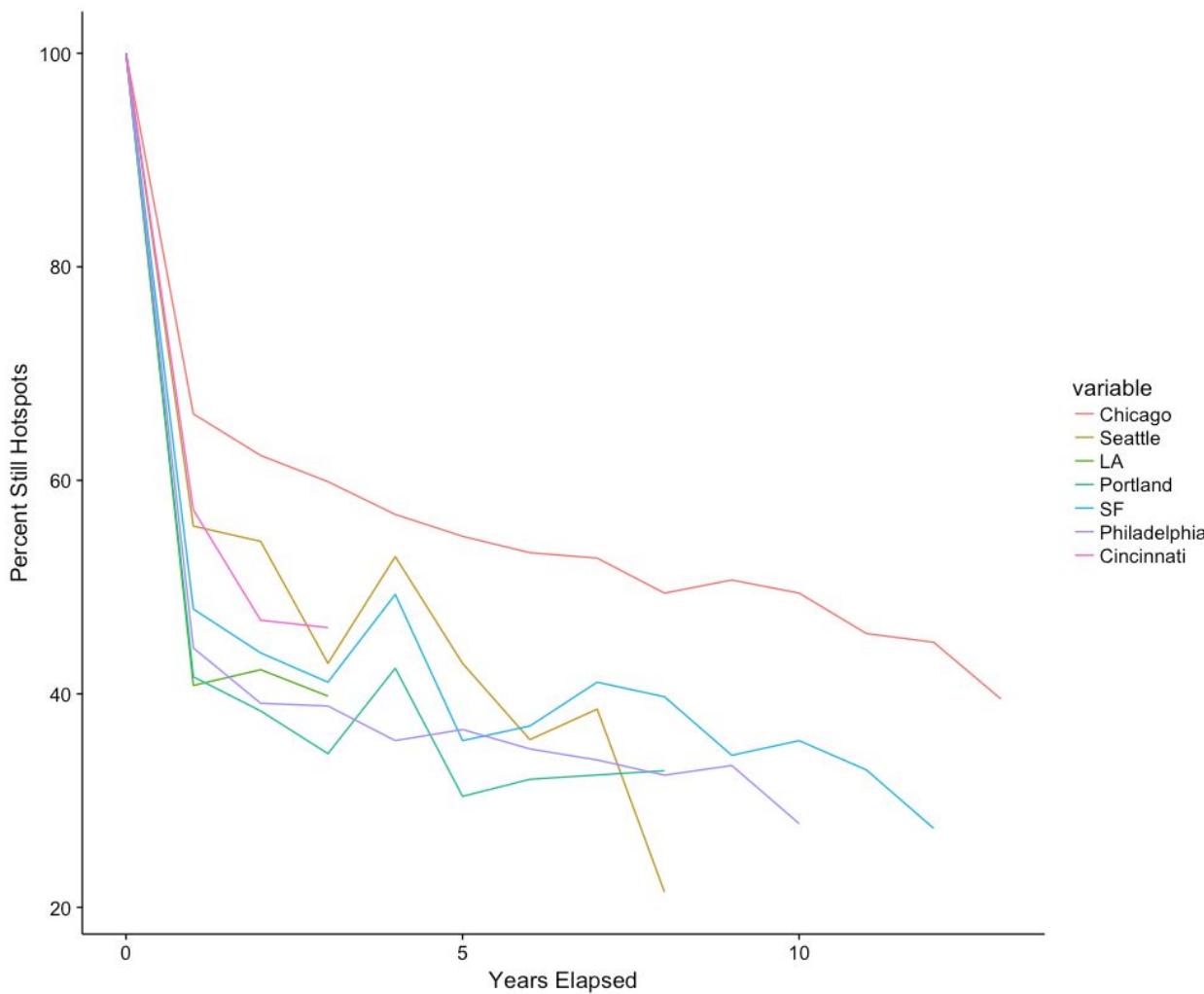
Chicago**Seattle****Los Angeles****Portland**

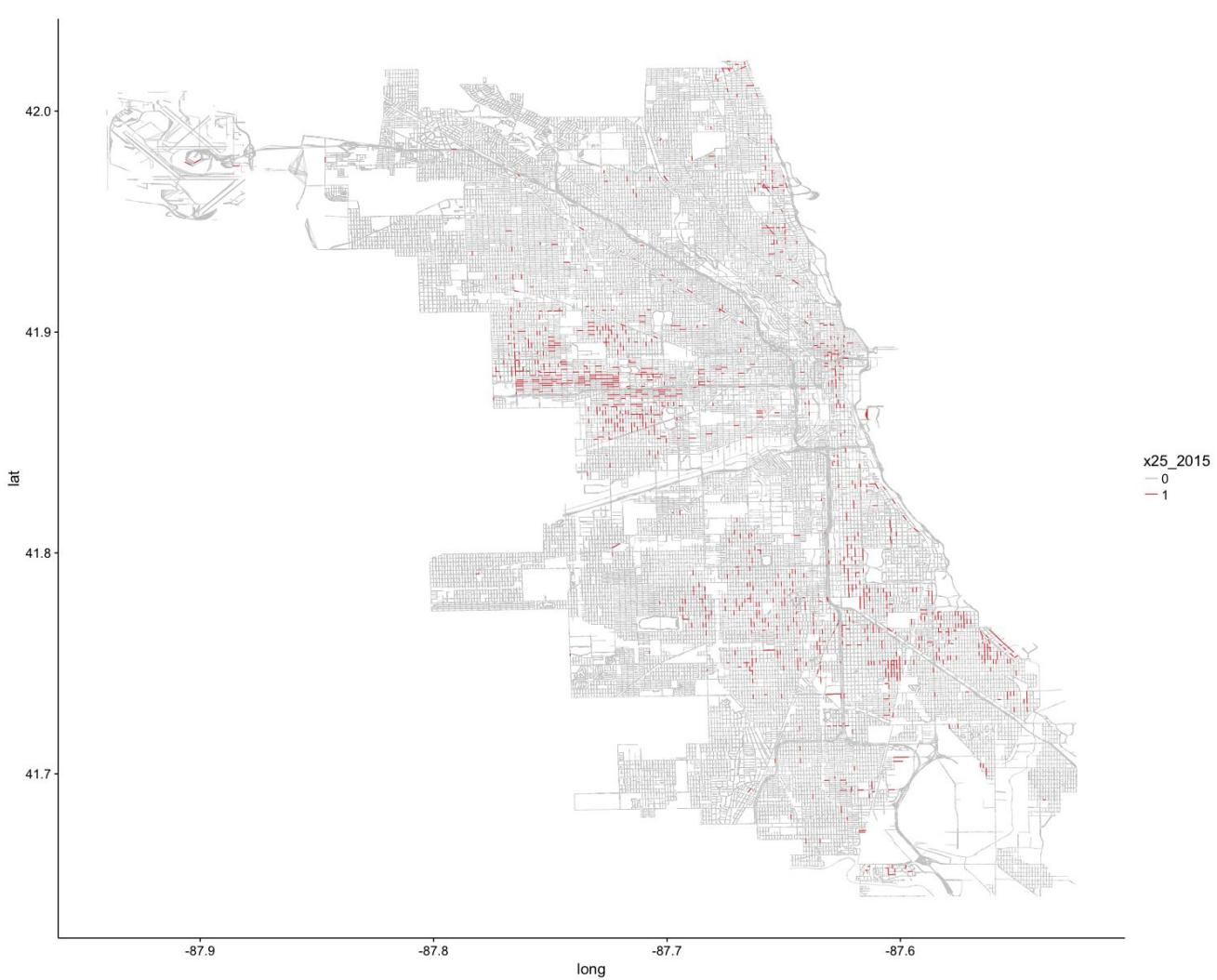
Stability of Concentration Level over Time:

Violent Crime

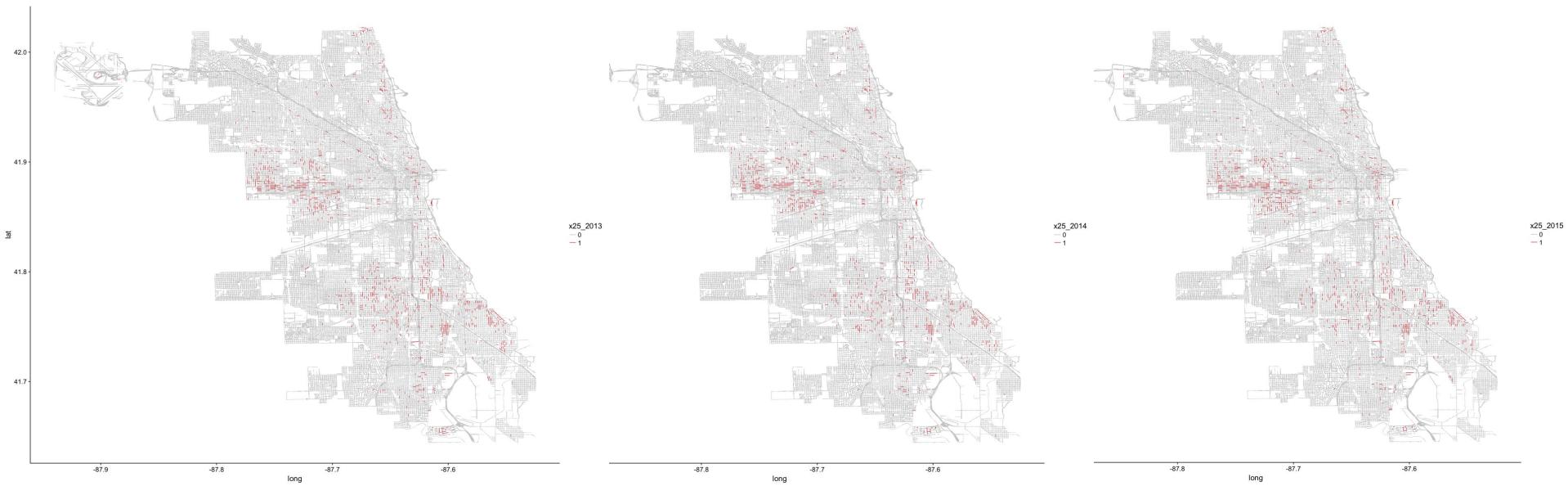


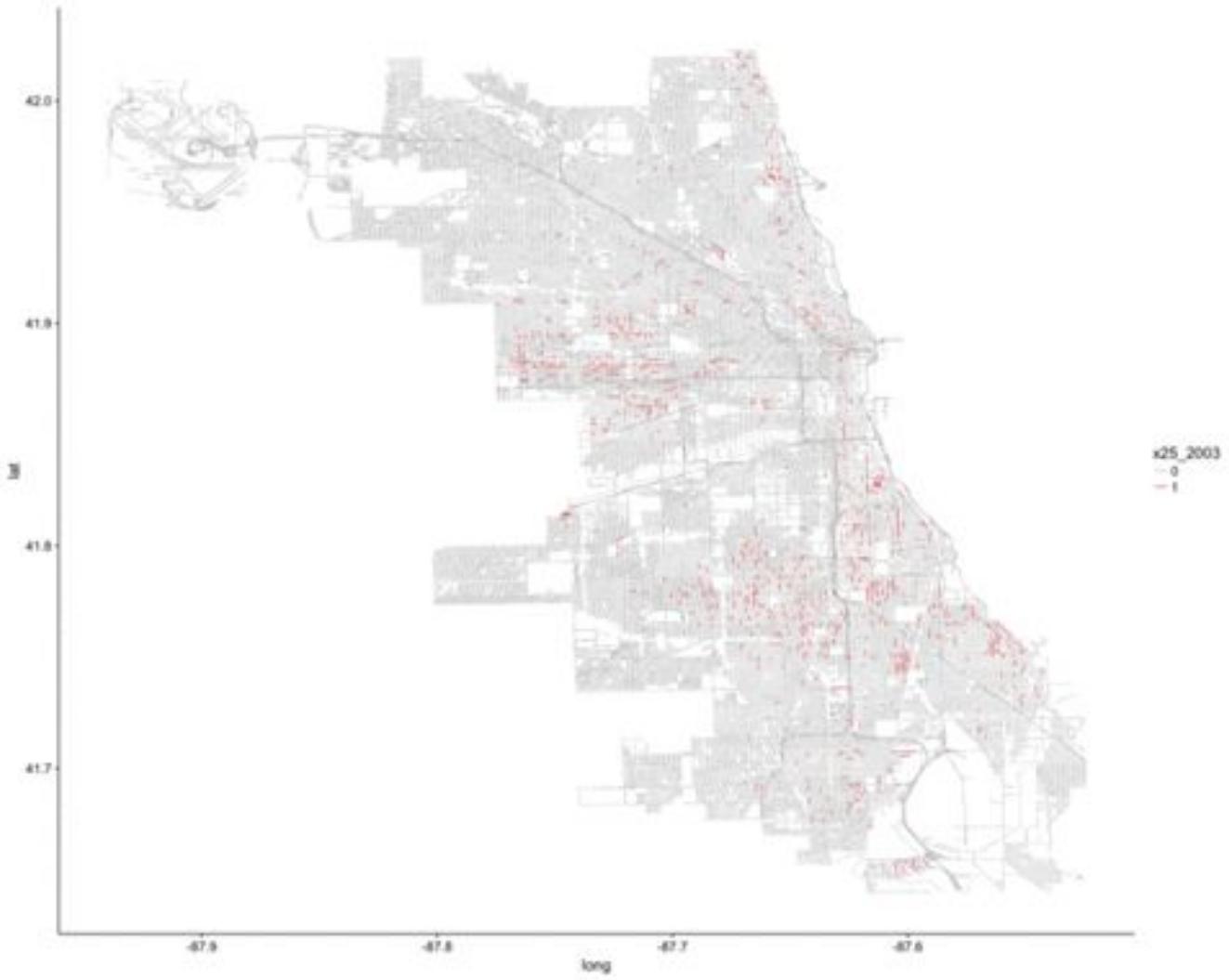
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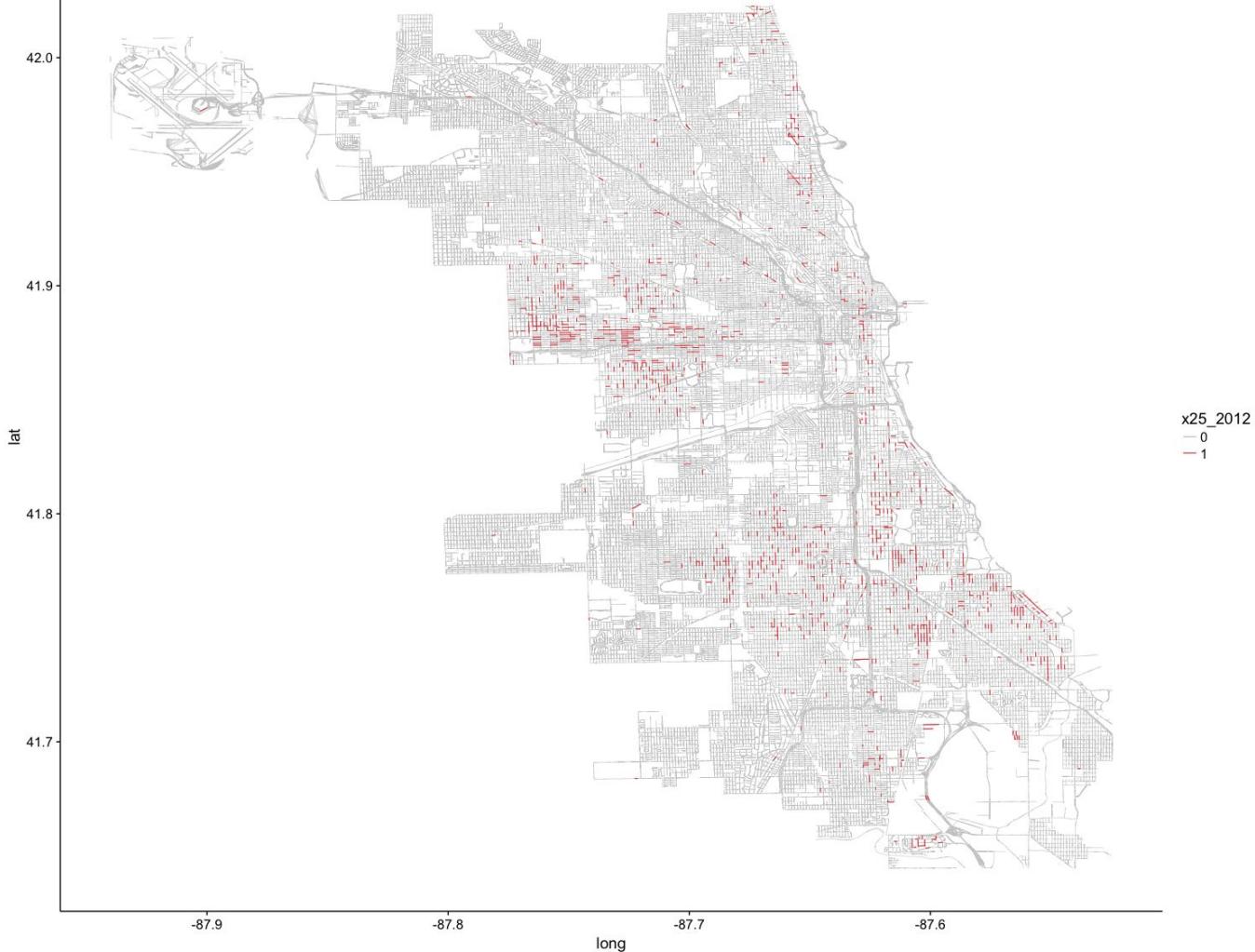


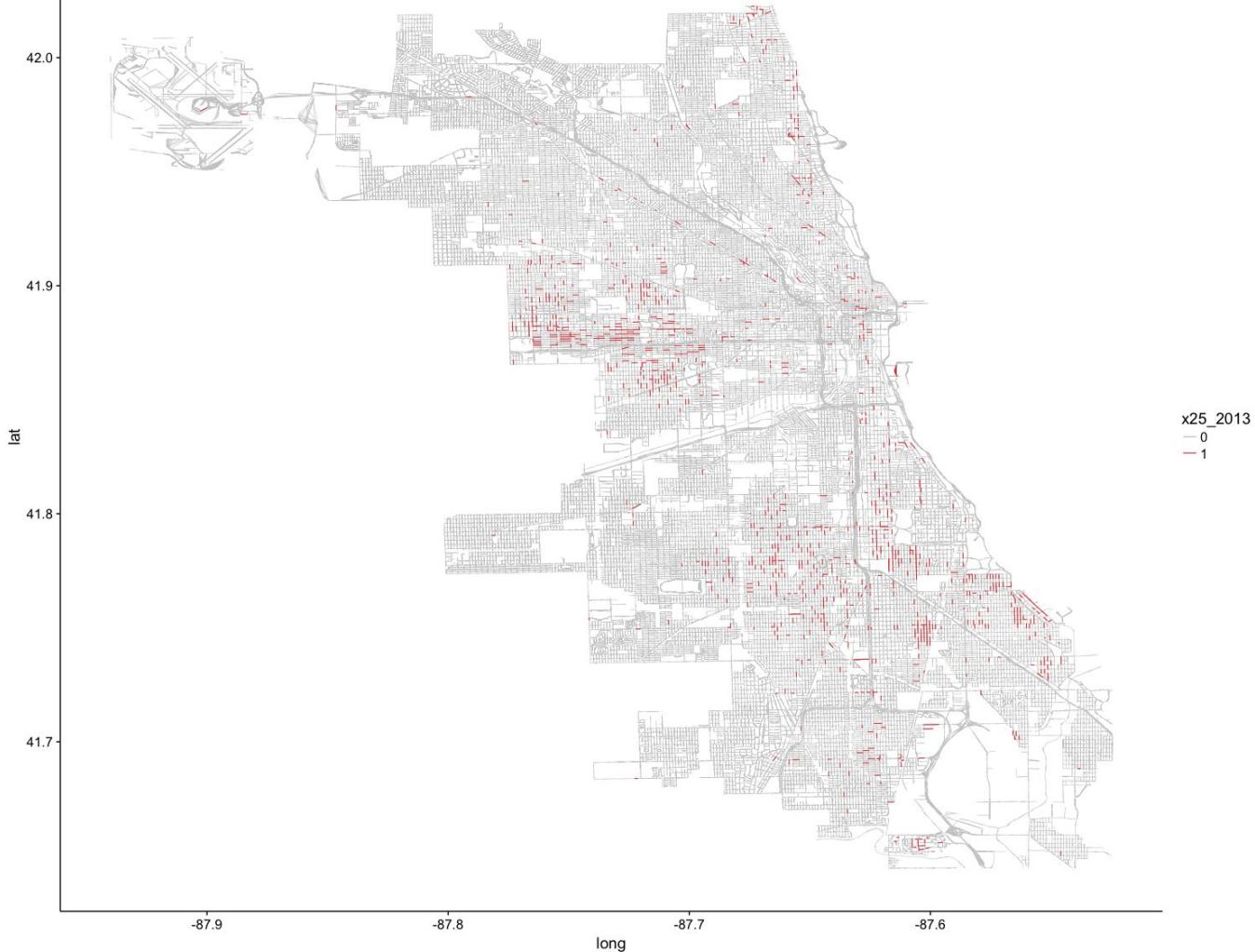


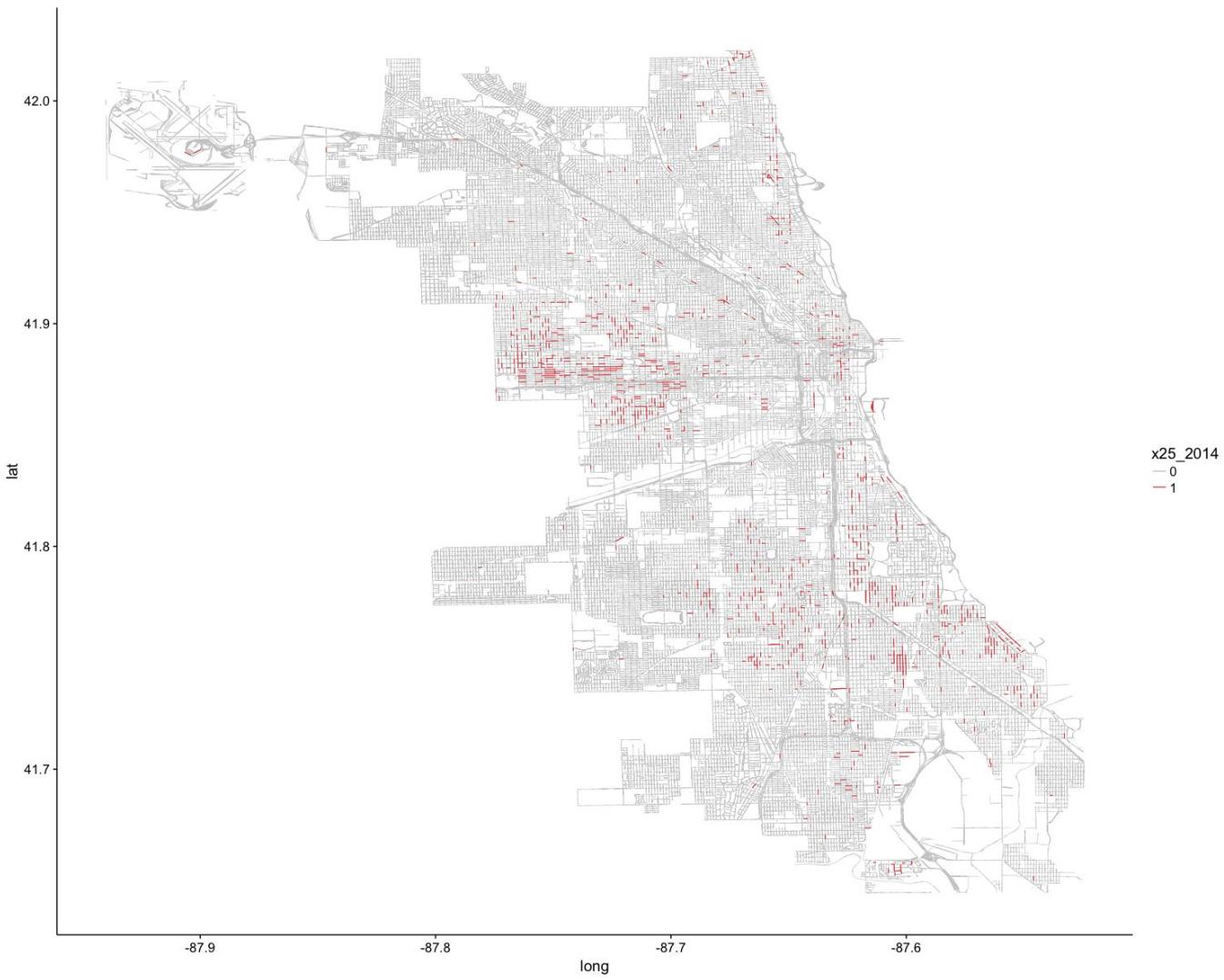
Hotspot Change Visualized

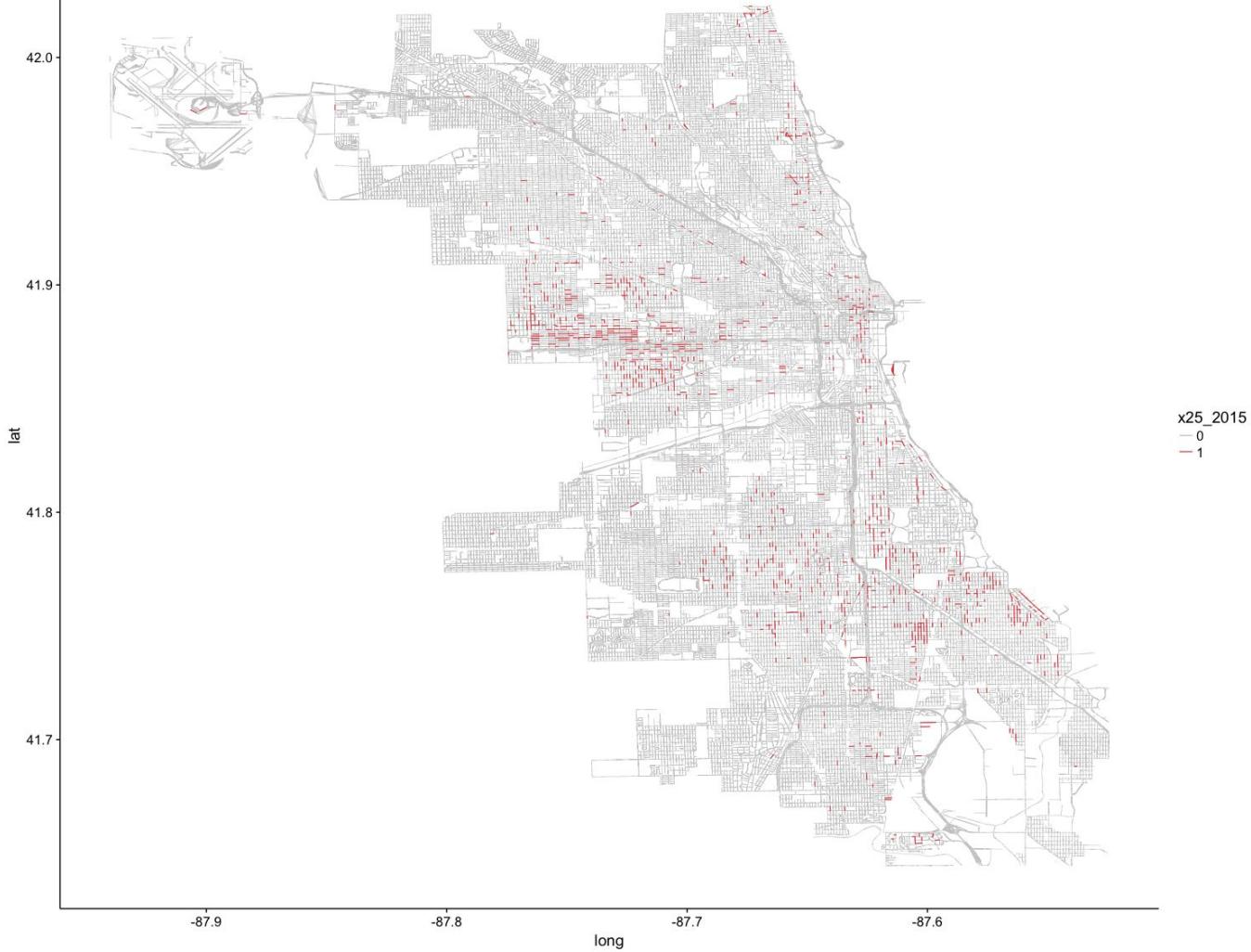




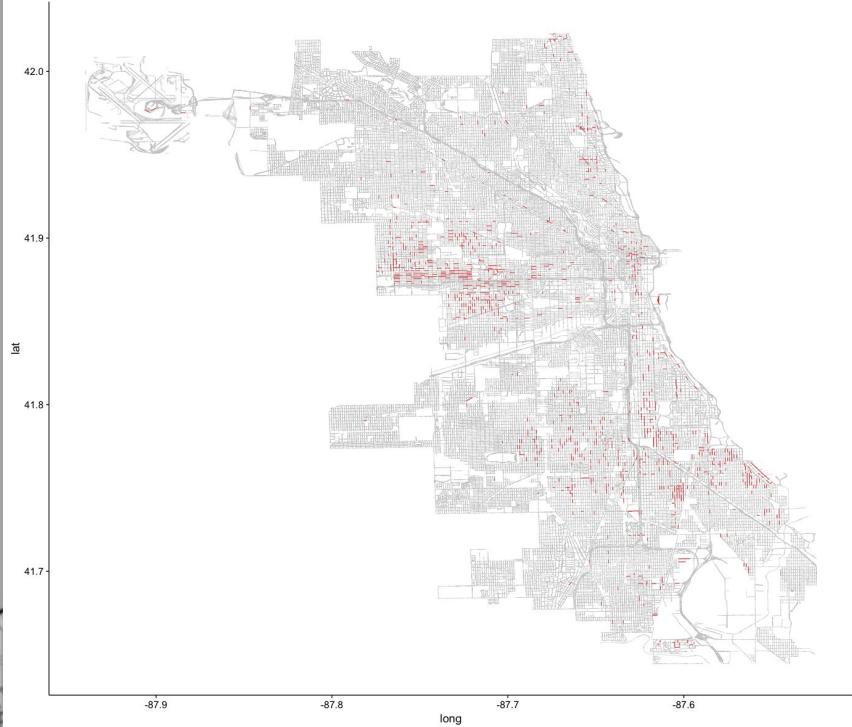
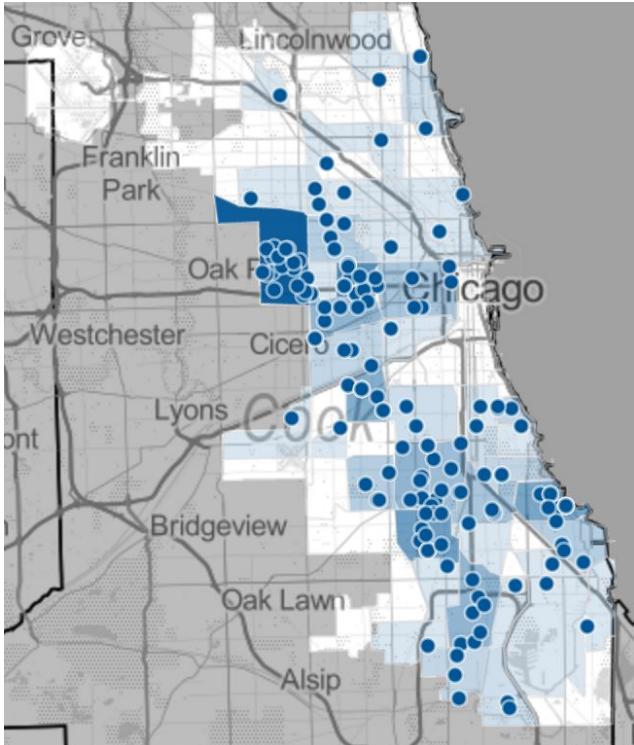




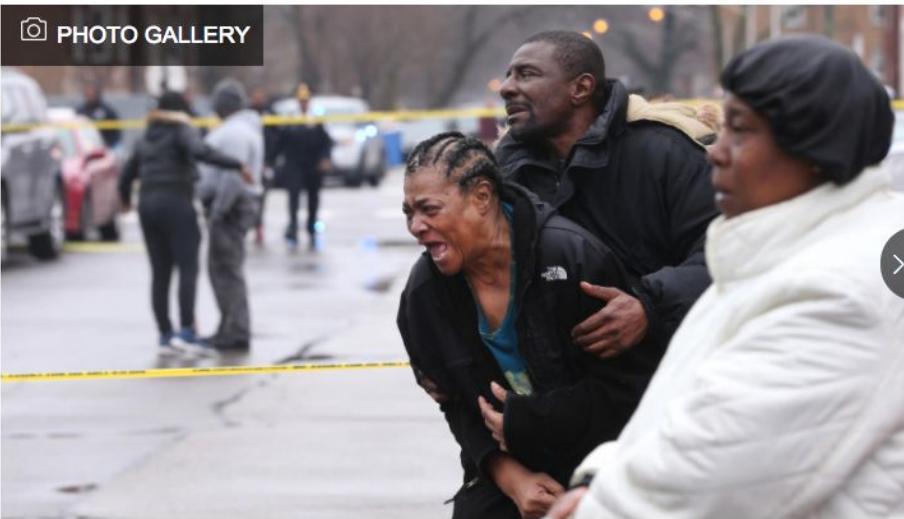




Chicago Tribune: “Where Homicides Happen in Chicago”



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

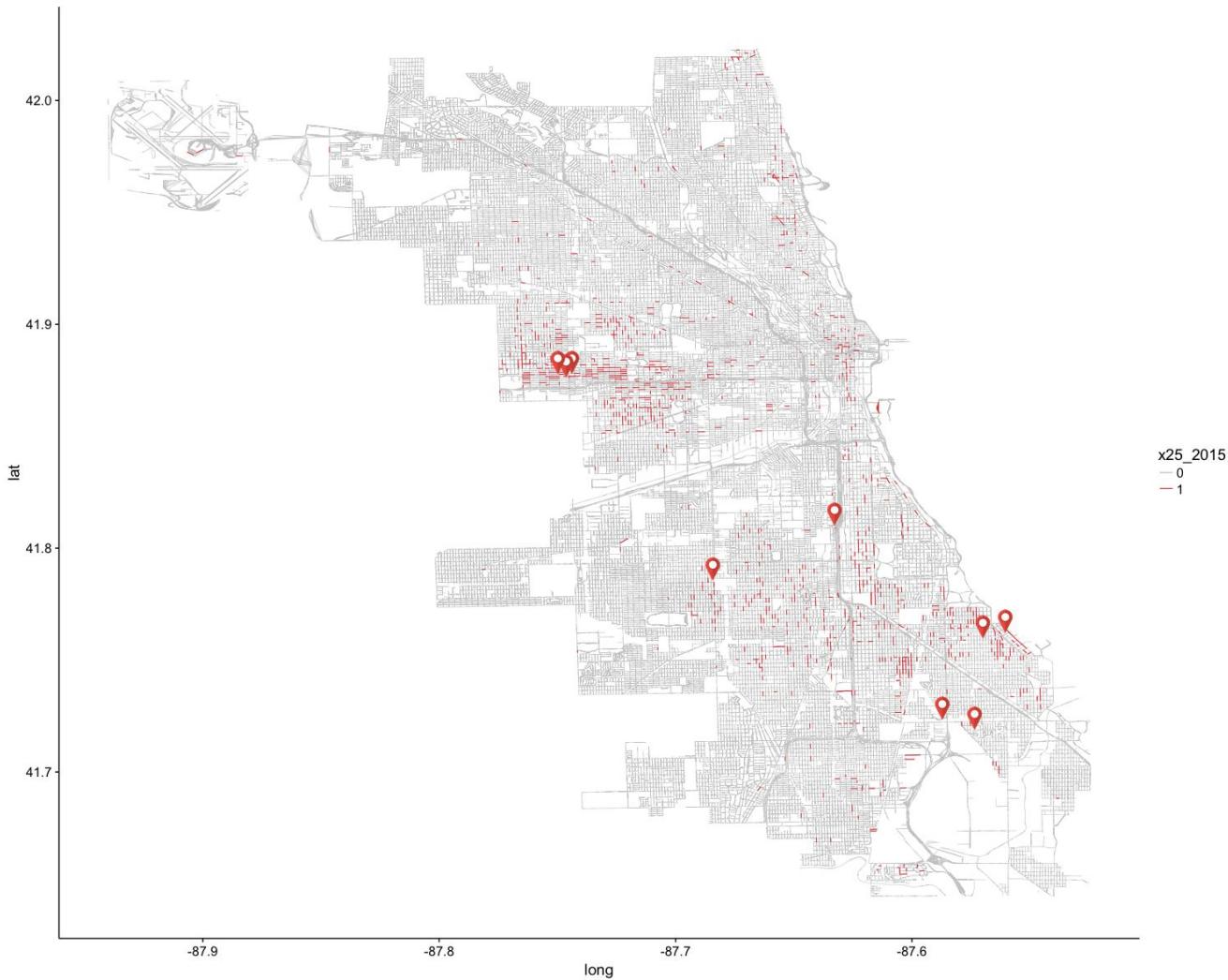


Report of gunfire shuts part of Dan Ryan

MAR. 30, 2017



Map: Where shootings



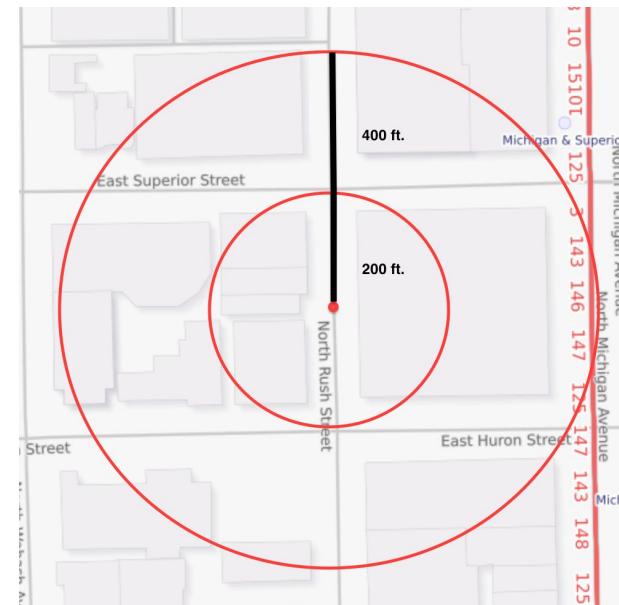
Models

What Contributors 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

Model	Dependent Variable	Purpose
OLS	Crime count	Estimating amount of crime driven by each feature
Beta	Crime count	Interpretability
Logit	Binary (1 if hotspot, 0 otherwise)	A different, more appropriate way of stating the crime problem

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

Questions?