

BLUE LIGHT CAMERA EFFECTIVENESS STUDY



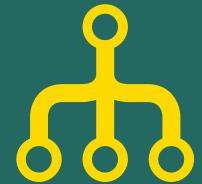
Ning Zhang

Roger Ren

Keting Lyu



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General View
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Sectional Analysis
Overview
/Change of Rate

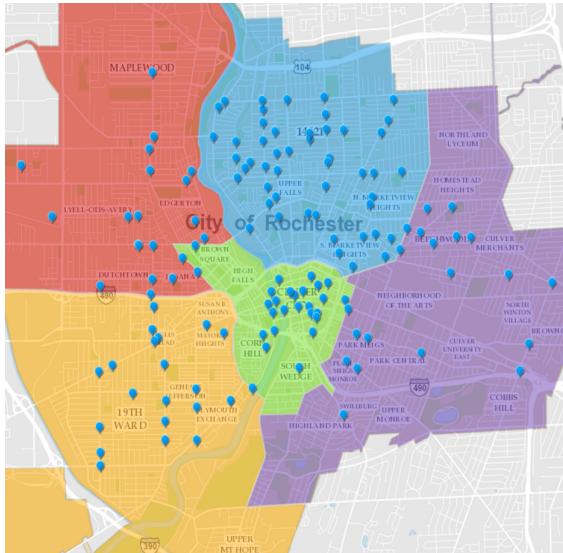


Impact Analysis
Individual Test/
Wilcoxon Test/
Case Analysis



INTRODUCTION BACKGROUND

- RPD purchased/installed 50 cameras in 2008
- Up to 2010, a total of 82 cameras were installed
- Current number of cameras is 136 (2017)



INTRODUCTION WHAT WE HAVE DONE

- General crime trend analysis
- Sectional crime analysis
- Crime distribution analysis
- Camera impact analysis
- Overall impact of cameras
- List of effective and non-effective camera locations



INTRODUCTION DATA



Camera

X	Y	OBJECTID	Address	Type	Program	Year	Month	section
-77.6127	43.17339	3	N Clinton Ave and Scrantom St	Video	BlueLight	2009	7	7
-77.6031	43.18073	4	Ave D and Bauman St	Video	BlueLight	2009	7	7

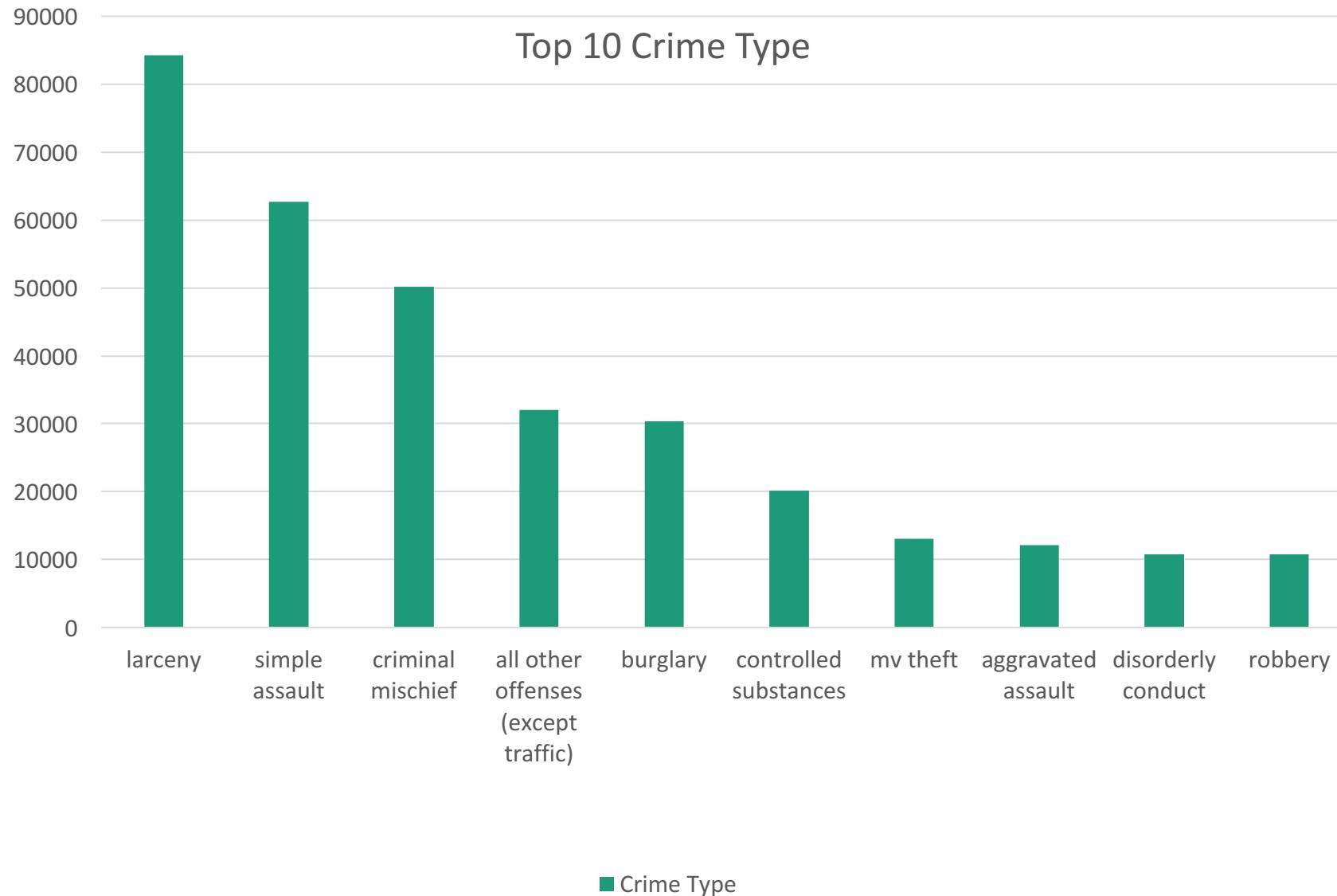


Crime

FullAddress	LocationScene Description	Lat	Lon	CrimeType	Section	Description	Occur Date	Offense DOW	Offense Month	Offense Quarter	Offense Year	RPDPlato on
810 BROWN ST	NA	43.15069	-77.6355	BURGLARY	3	BURGLARY	2/1/2005	Wednesday	February	1	2005	1
501 GENESEE ST	NA	43.14028	-77.6372	LARCENY	3	PETIT LARCENY	2/1/2005	Wednesday	February	1	2005	3



INTRODUCTION DATA



1. Crimes are not evenly distributed by crime types.
2. This inspired us to analyze the camera effectiveness based on crime types.

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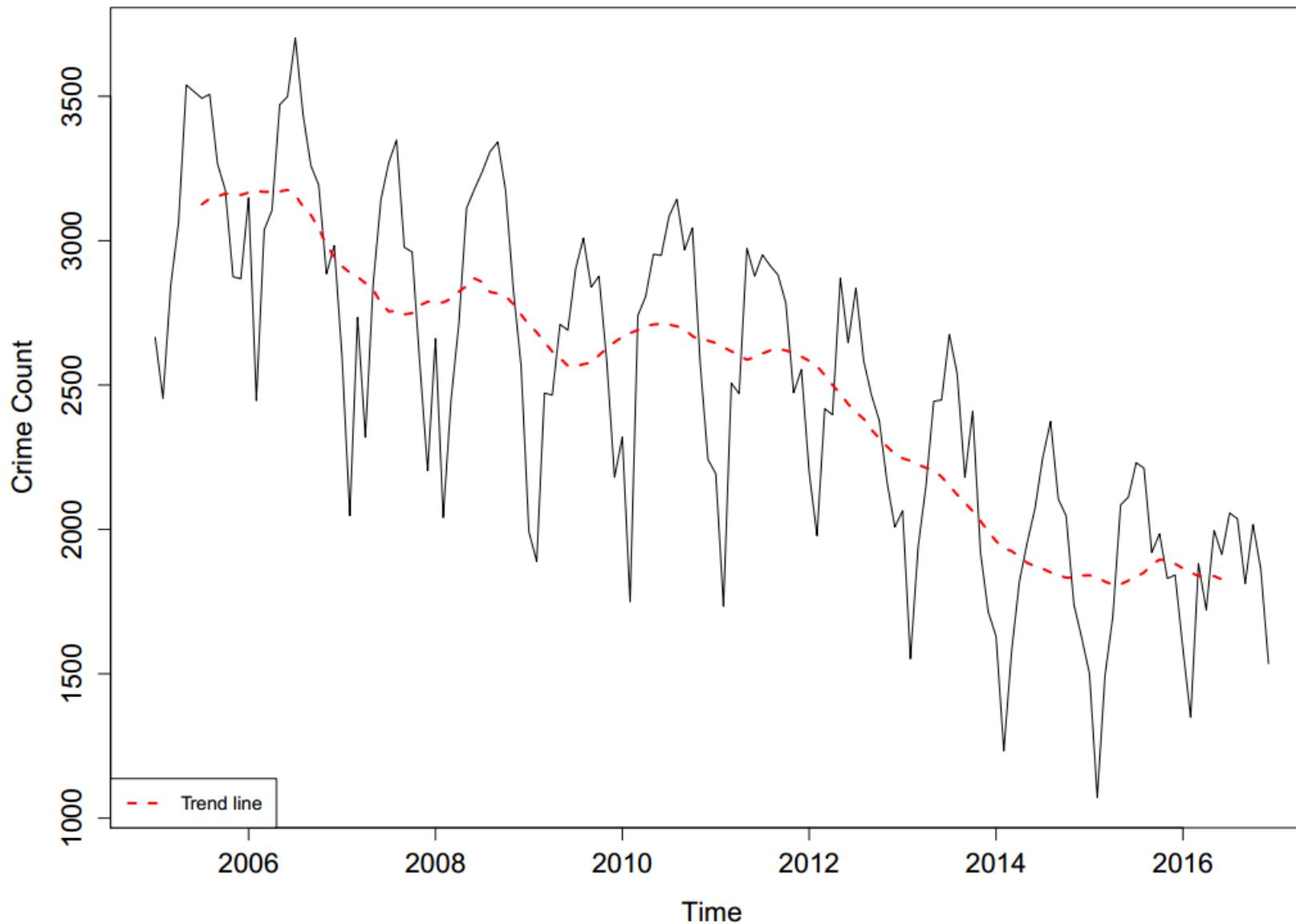


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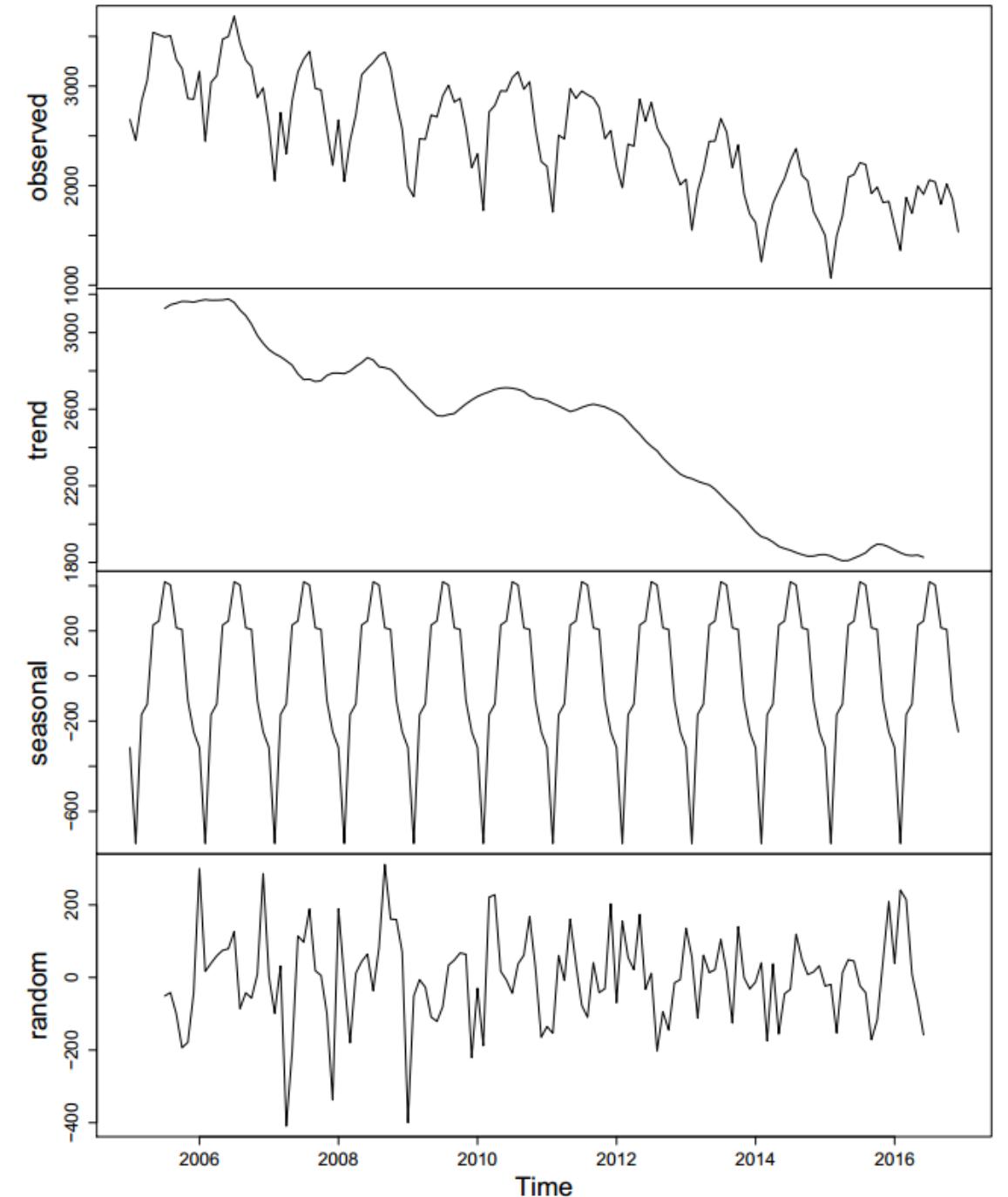
GENERAL VIEW TIME SERIES

Crime Count with Time in Rochester

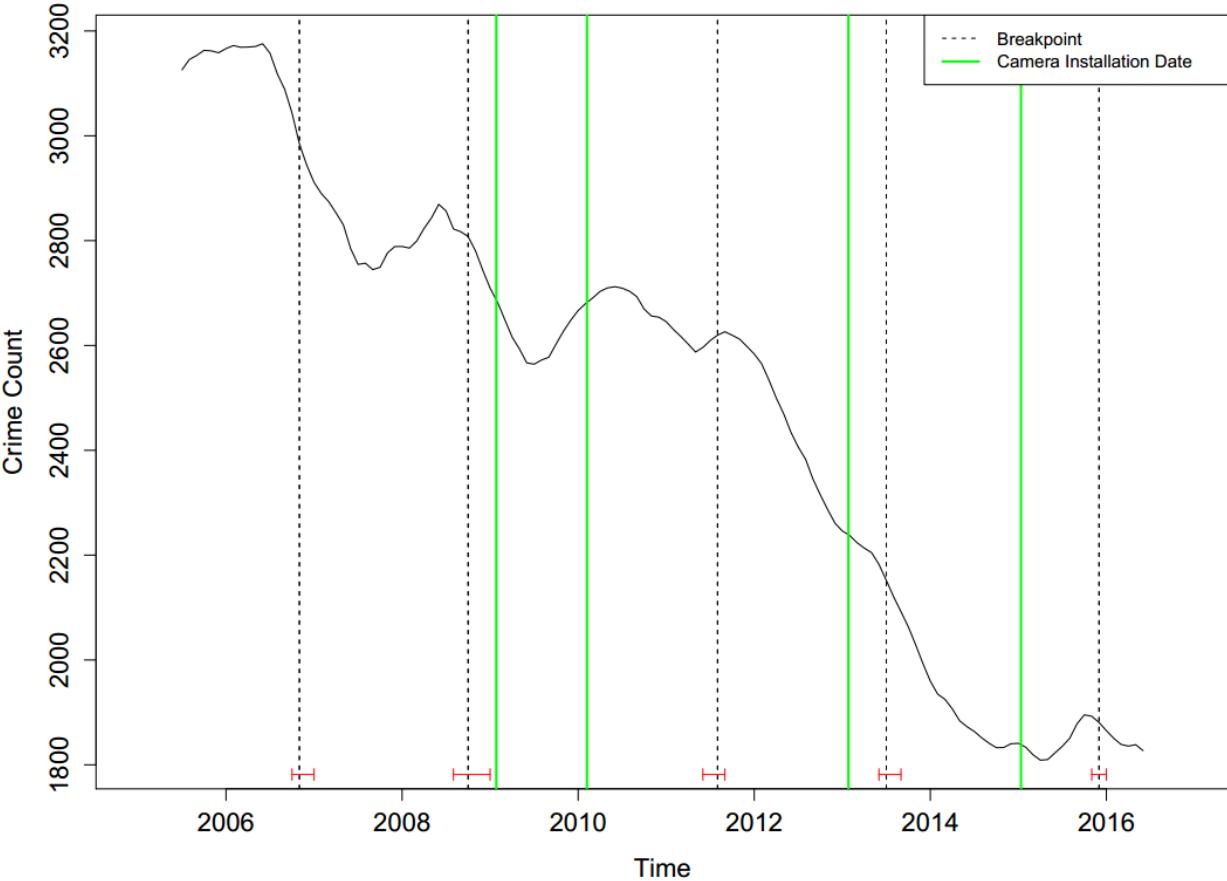


1. A general decreasing trend can be observed.
2. This trend adds complexity to our analysis.
3. Crime count shows strong cyclical effects.

Decomposition of additive time series



Real Trend Breakpoint

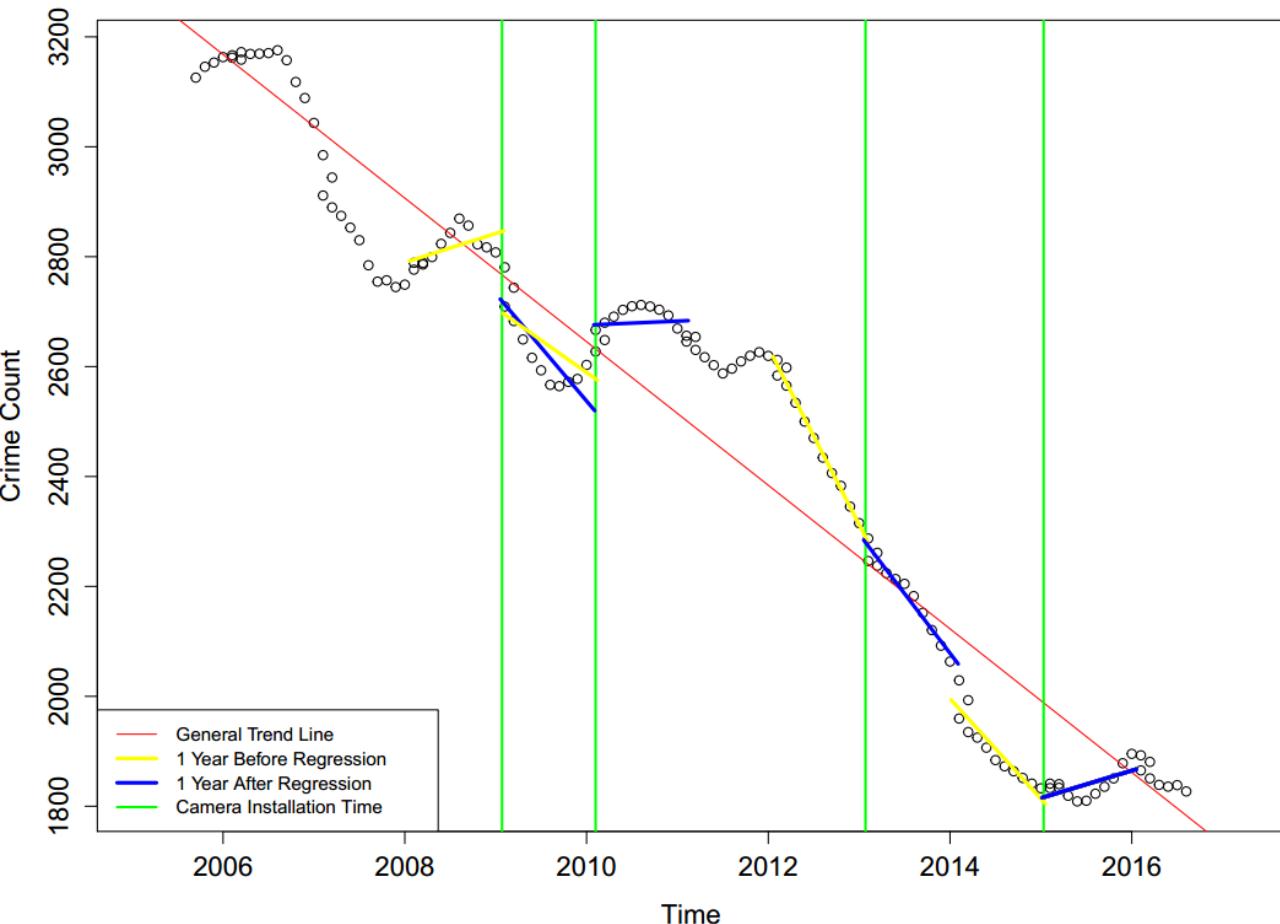


1. The graph on the left shows the decomposition of the total crime count in Rochester.
2. The graph on the right shows breakpoint analysis where a structural change was observed.

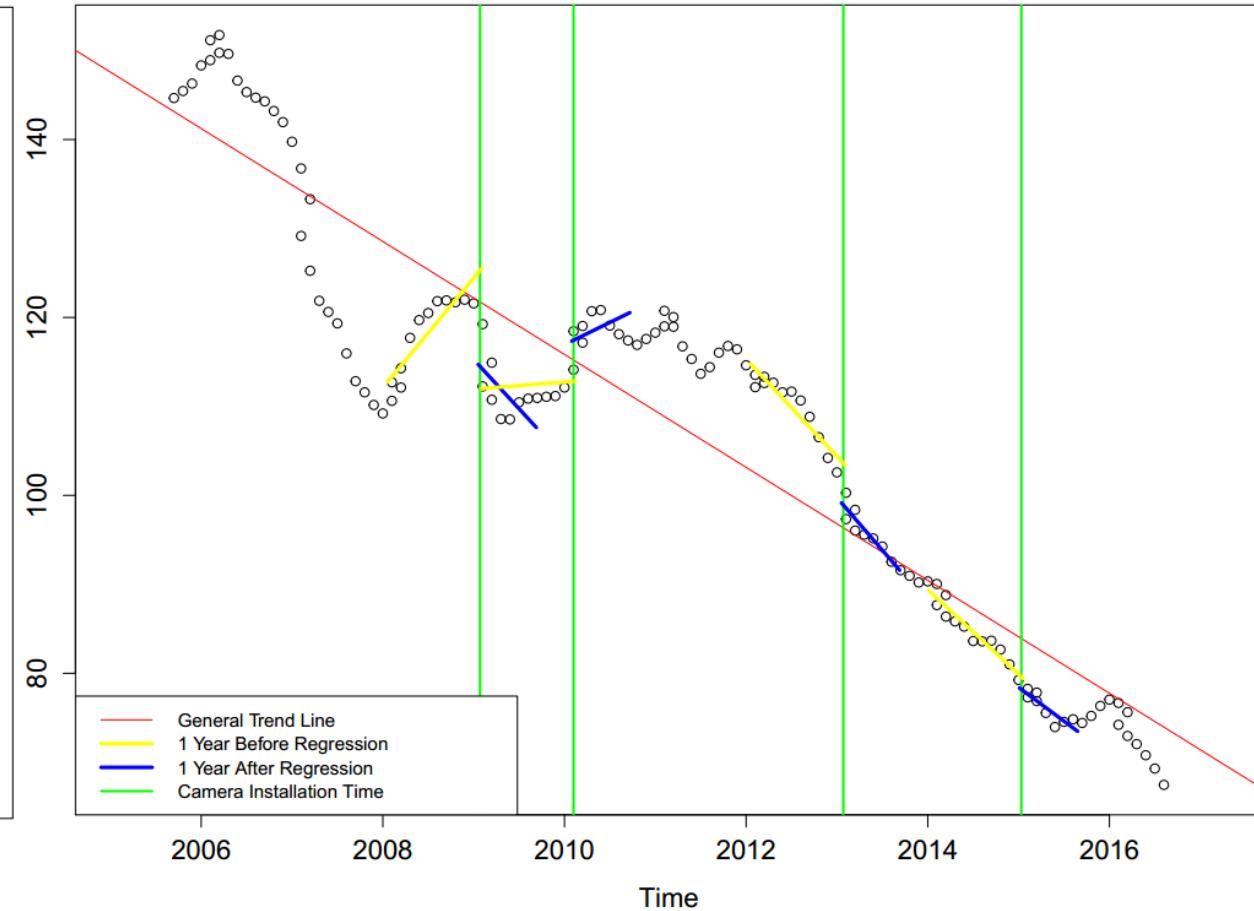


GENERAL VIEW TIMESERIES

Real Trend Regression



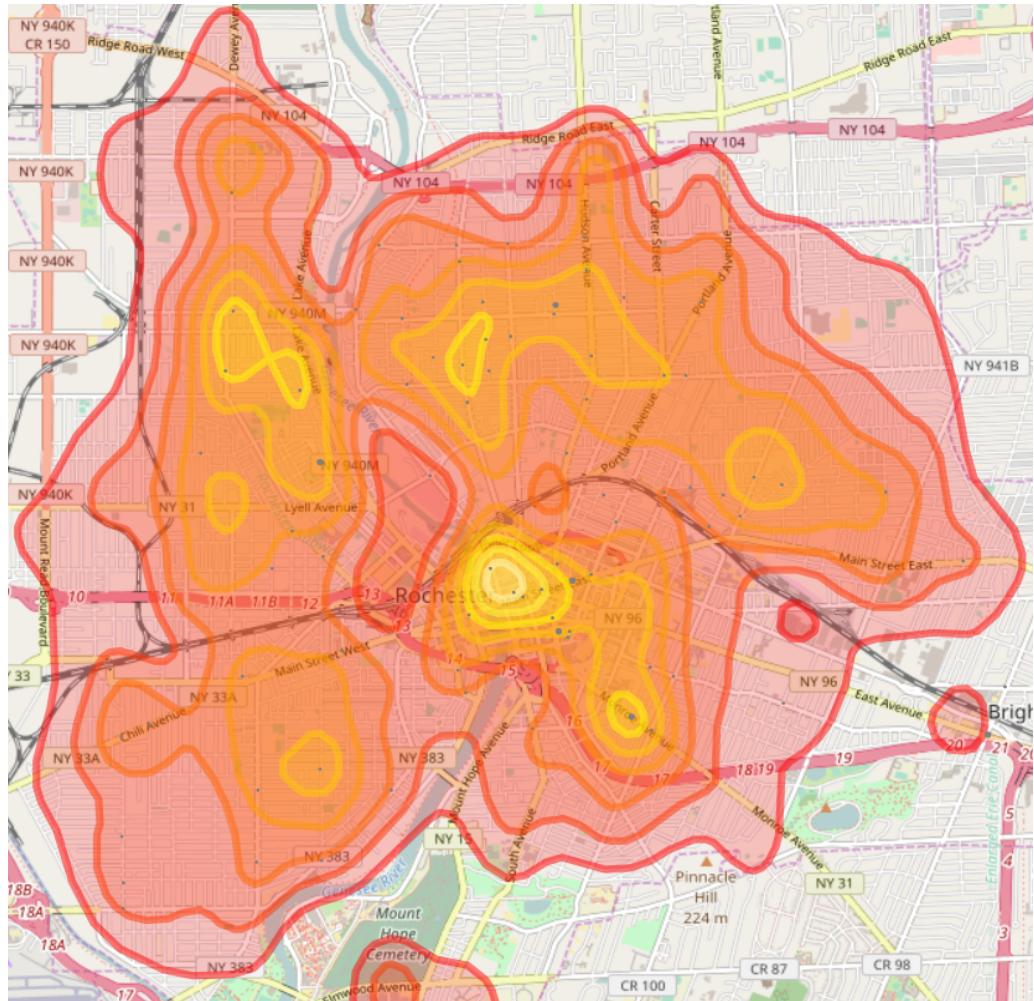
Real Trend Regression (Near Cameras)



1. Crime count near cameras (a sample) shows similar trend with the general crime count over the city (the population).
2. Some trend changes were observed around camera installation time. The most significant batch was the batch installed in 2009.

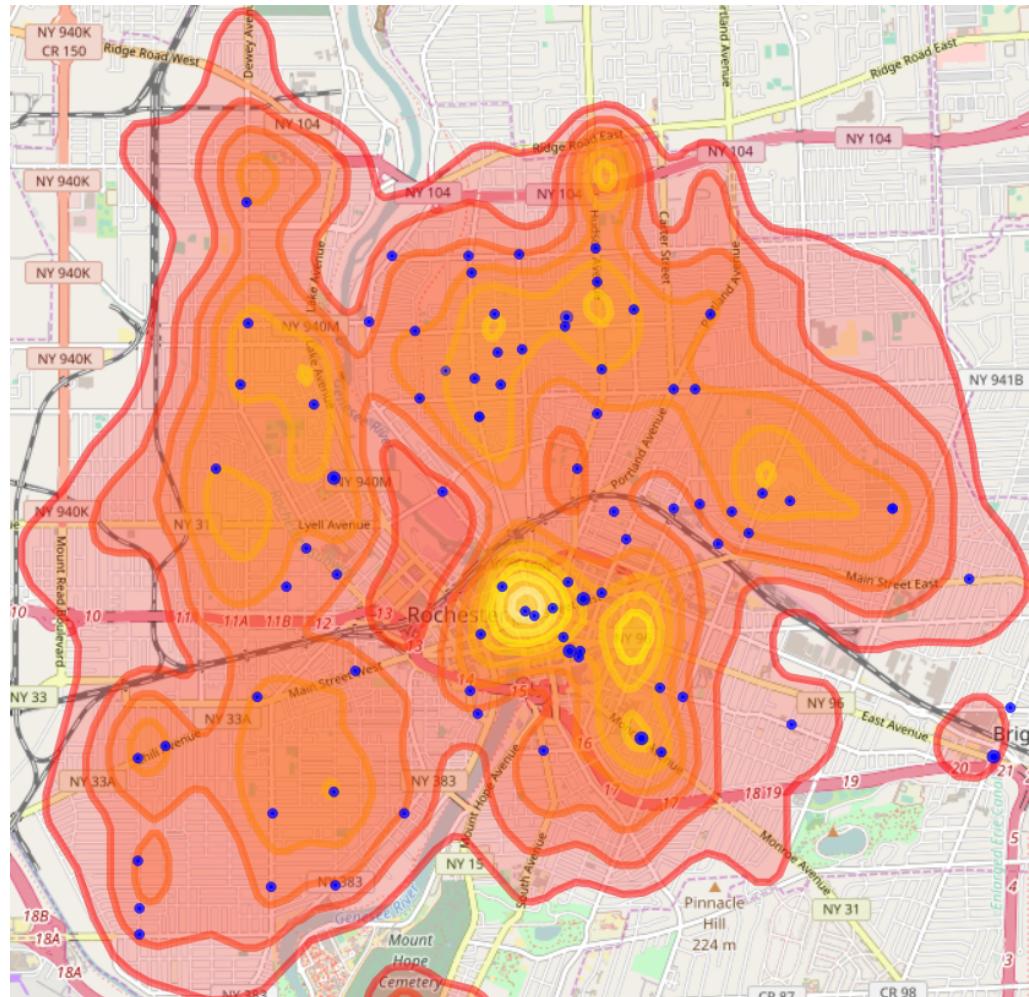


GENERAL VIEW CONTOUR MAP



Contour Map of Crimes (Year:2005-2008)

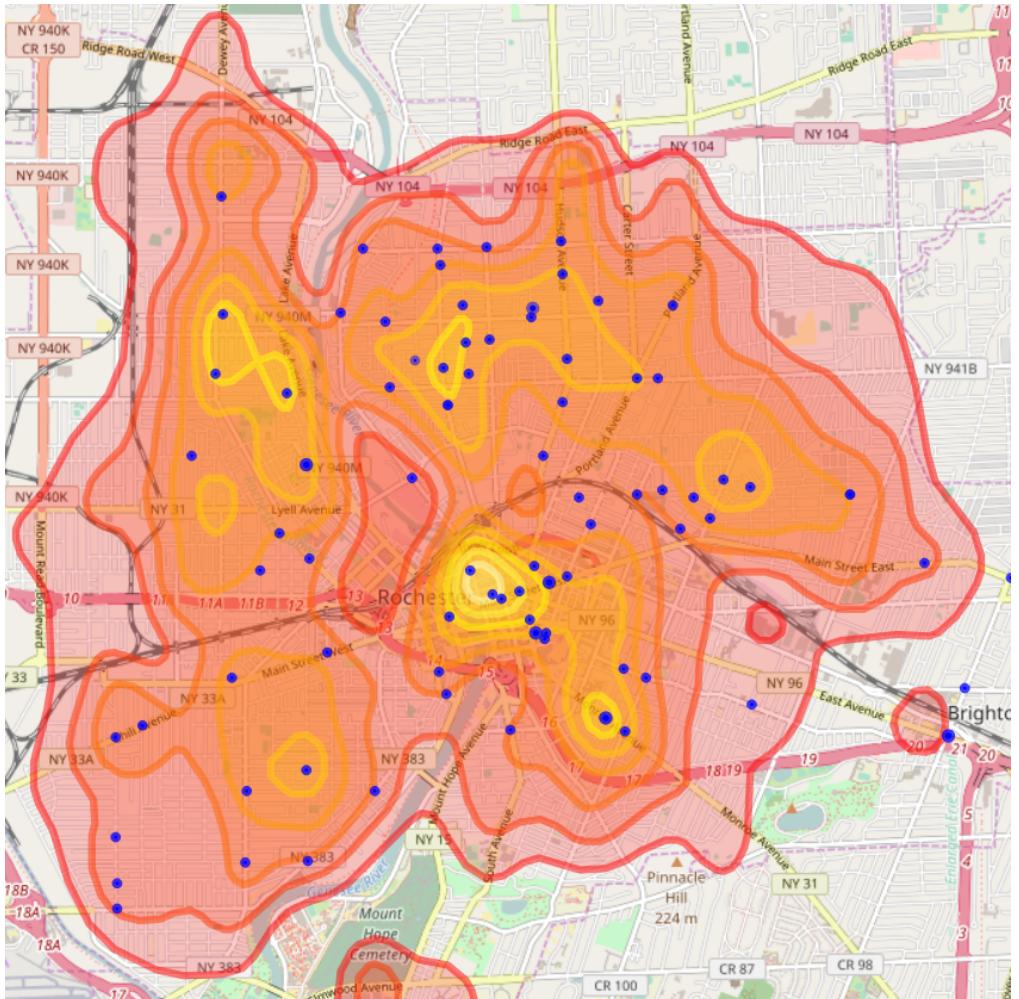
- ✓ Density Decrease
- ✓ Crime distribution skewness



Contour Map of Crimes (Year:2009-2012)

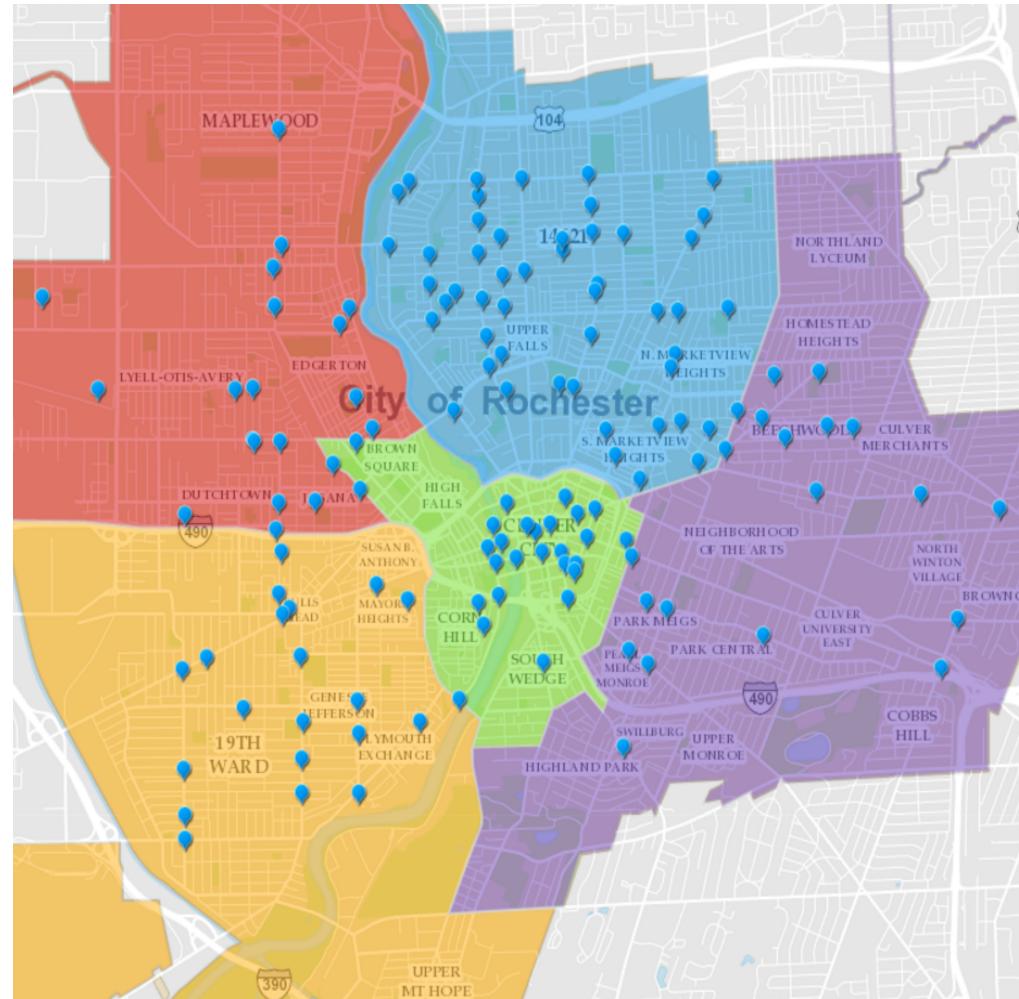


GENERAL VIEW CONTOUR MAP



Contour Map of Crimes (Year:2005-2008)

✓ Overlapping



Map of Five Sections in Rochester

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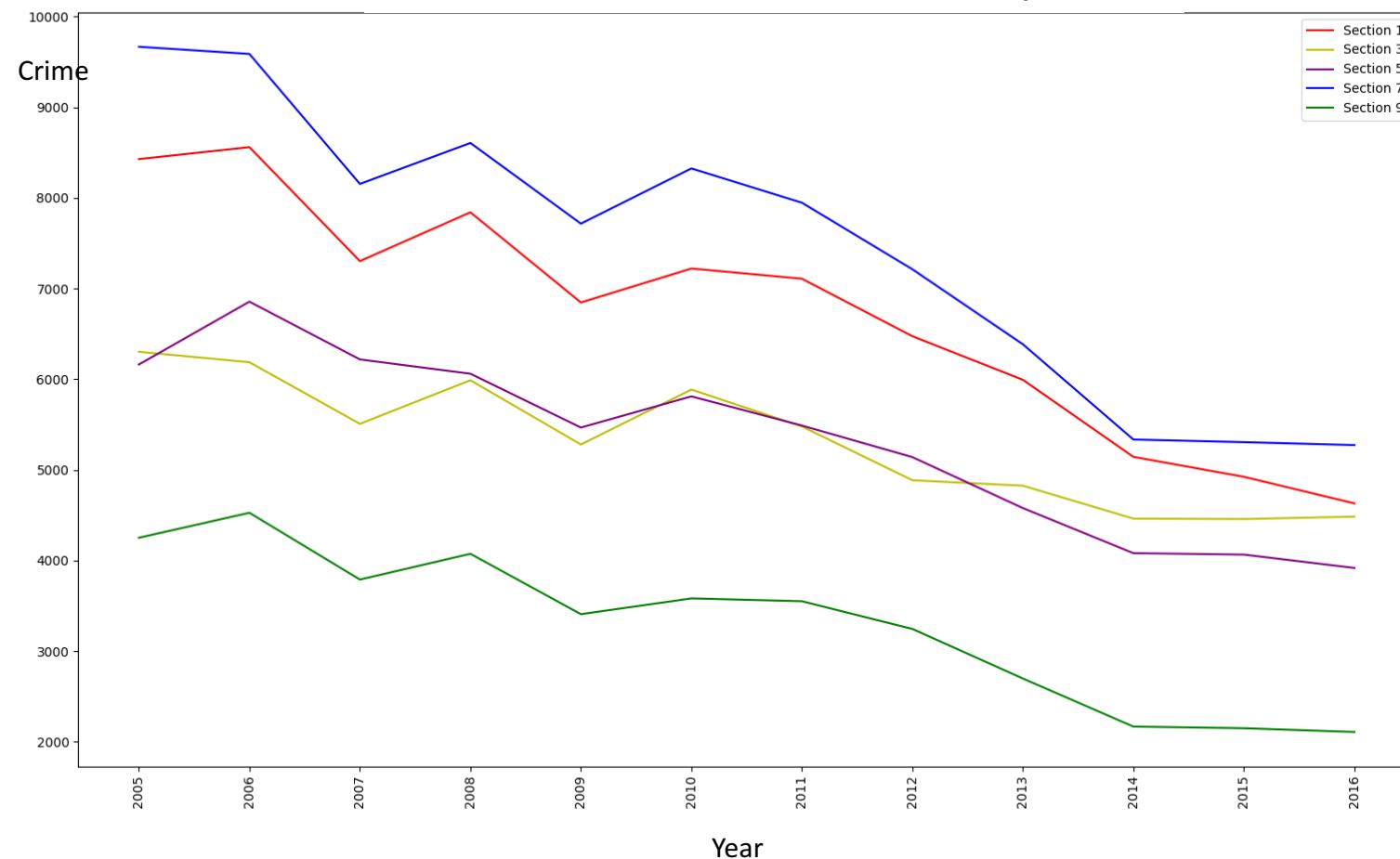


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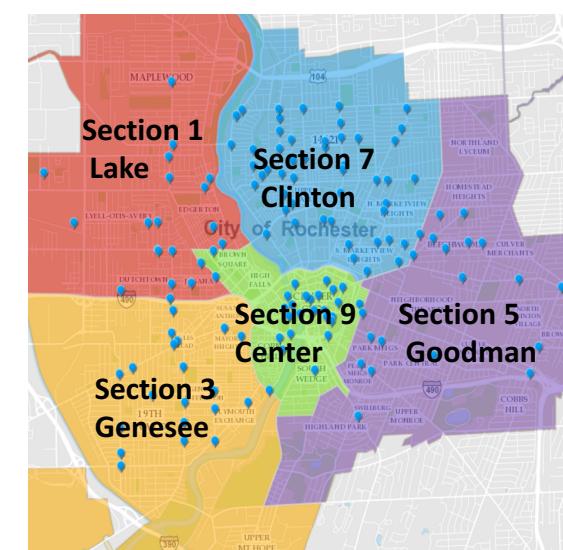
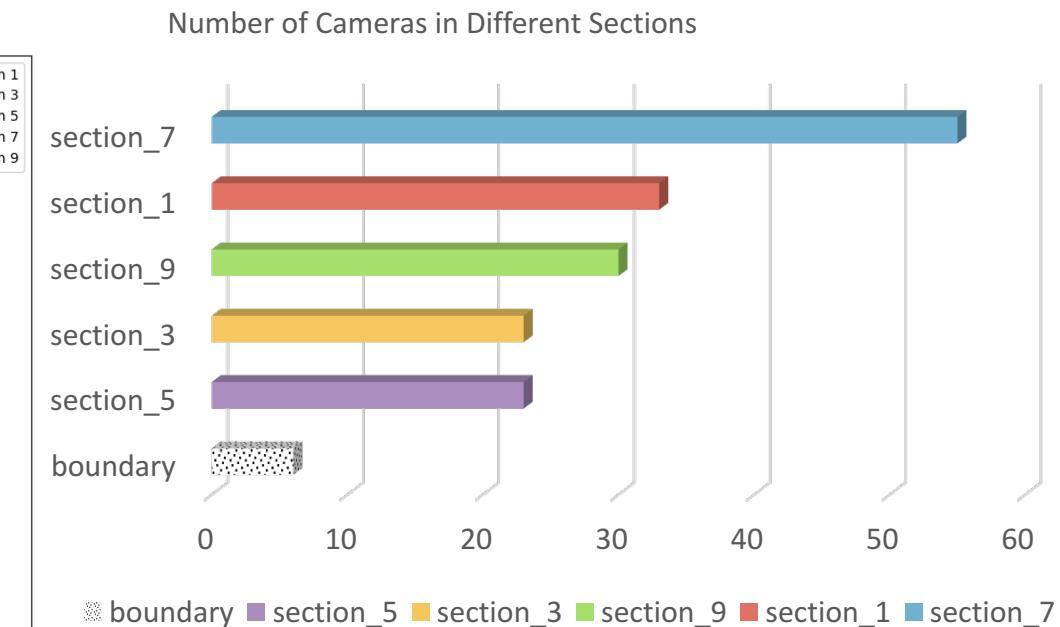


SECTIONAL ANALYSIS OVERVIEW

Crime Count in Different Sections by Year



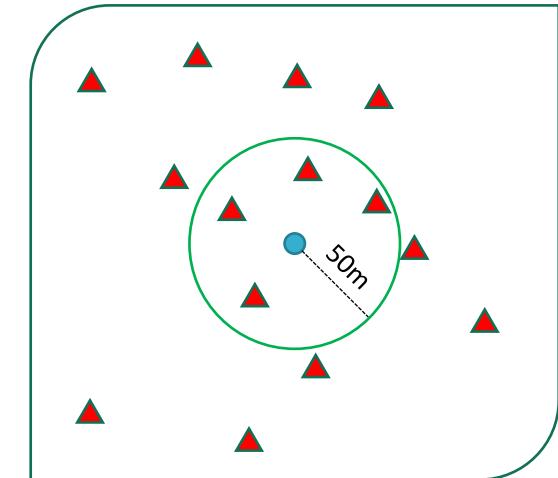
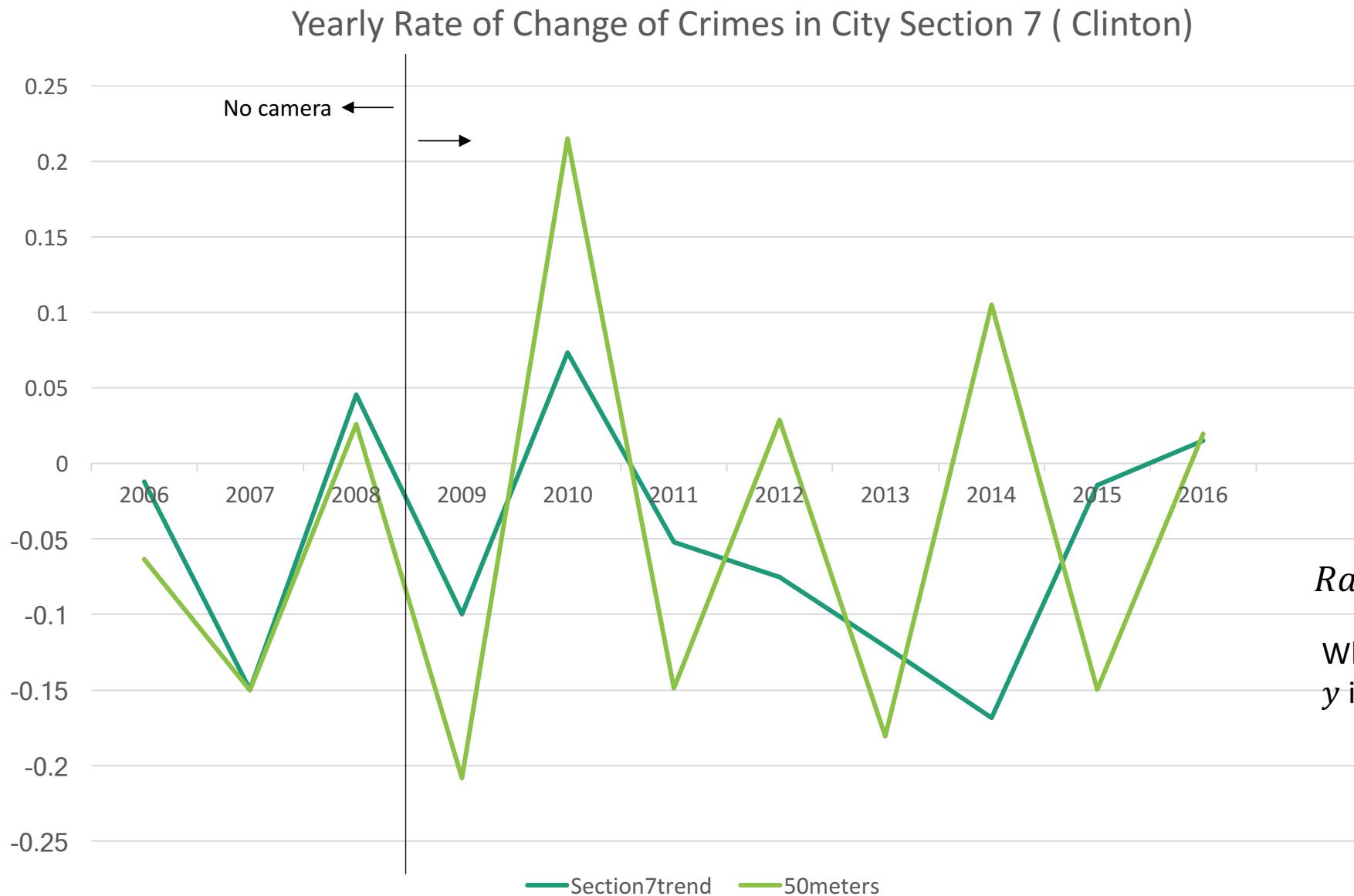
Number of Cameras in Different Sections





SECTIONAL ANALYSIS

Rate of Change



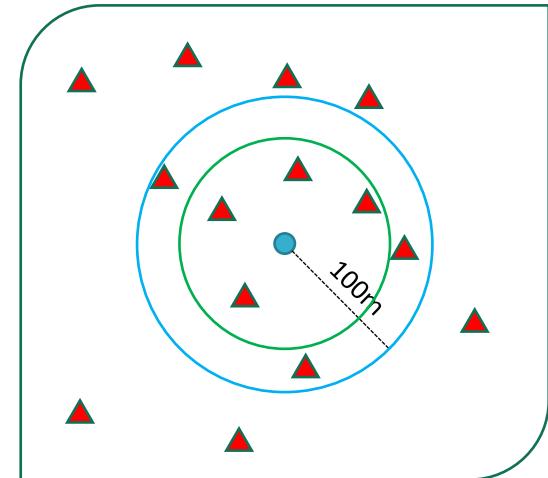
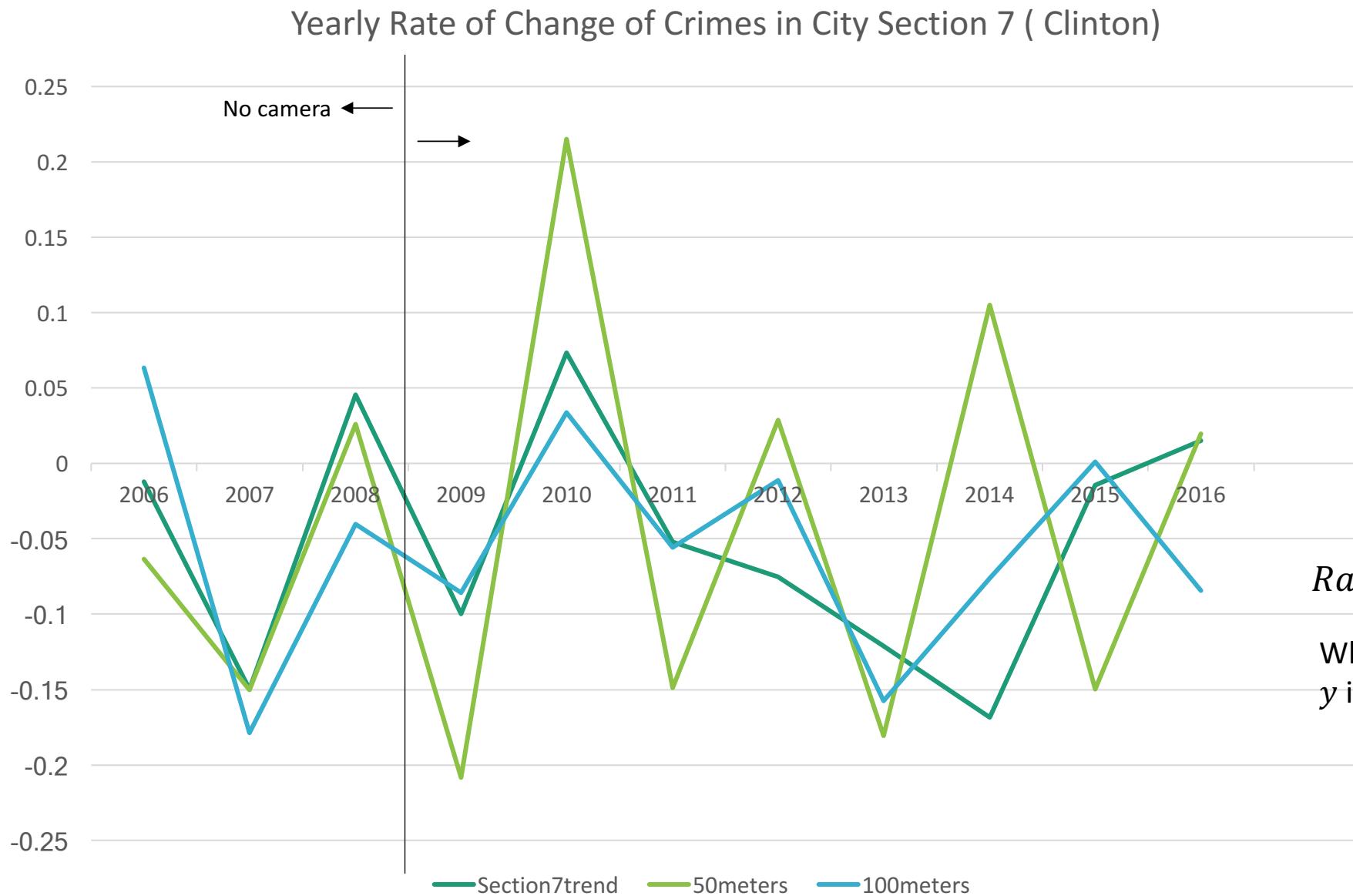
$$\text{Rate of Change} = \frac{y(t) - y(t-1)}{y(t-1)}$$

Where t is time period,
 y is crime count during this period



SECTIONAL ANALYSIS

Rate of Change



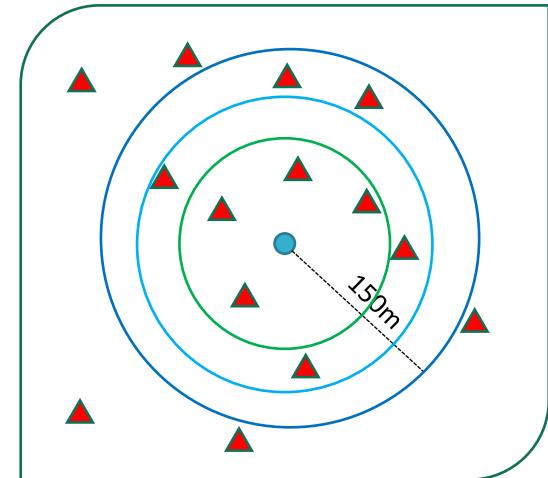
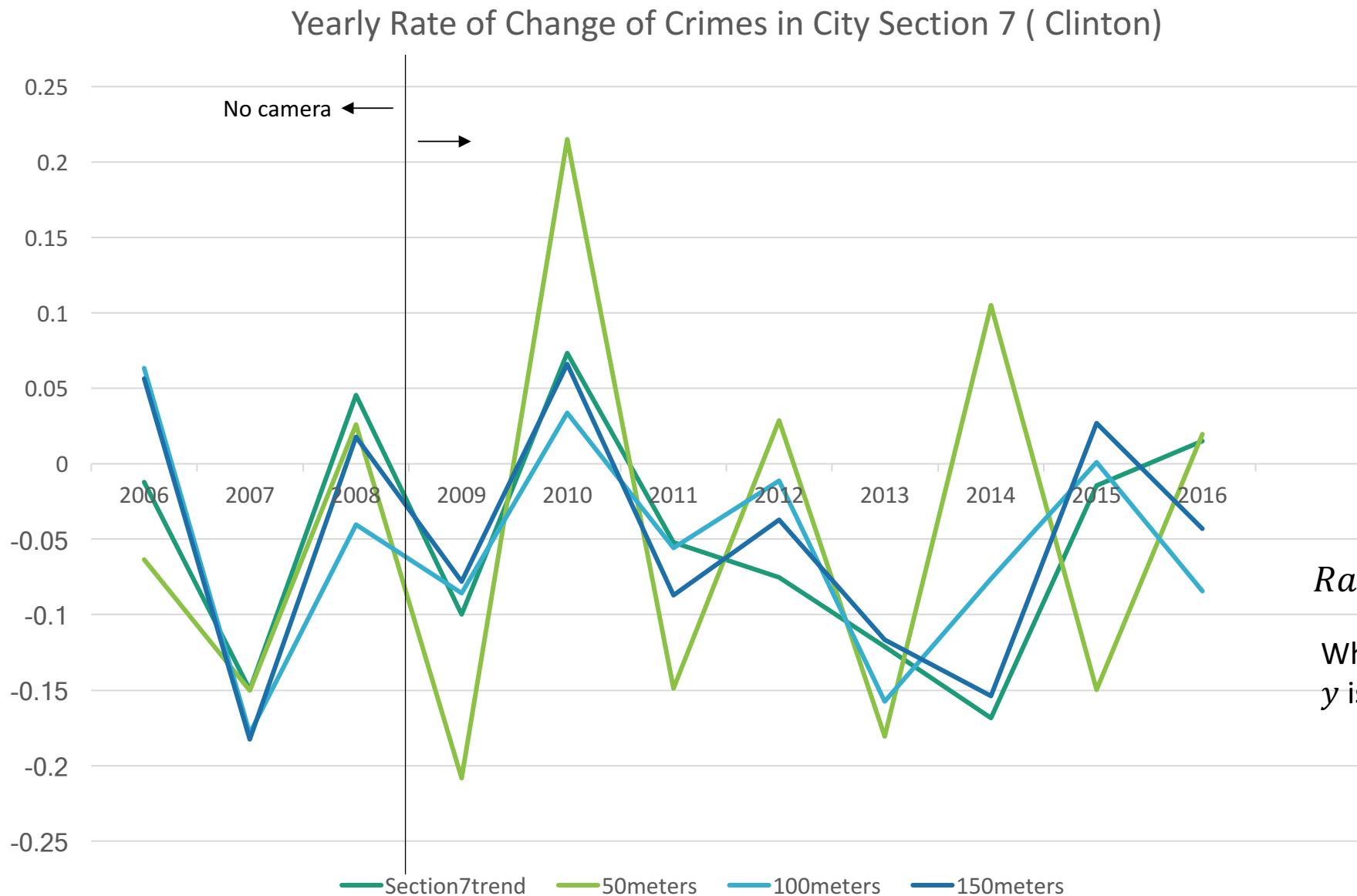
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SECTIONAL ANALYSIS

Rate of Change



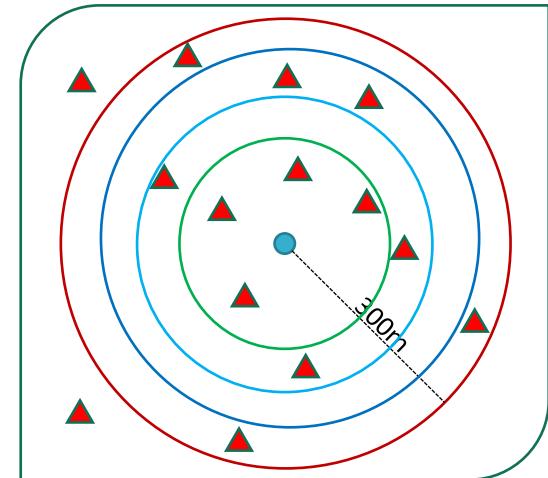
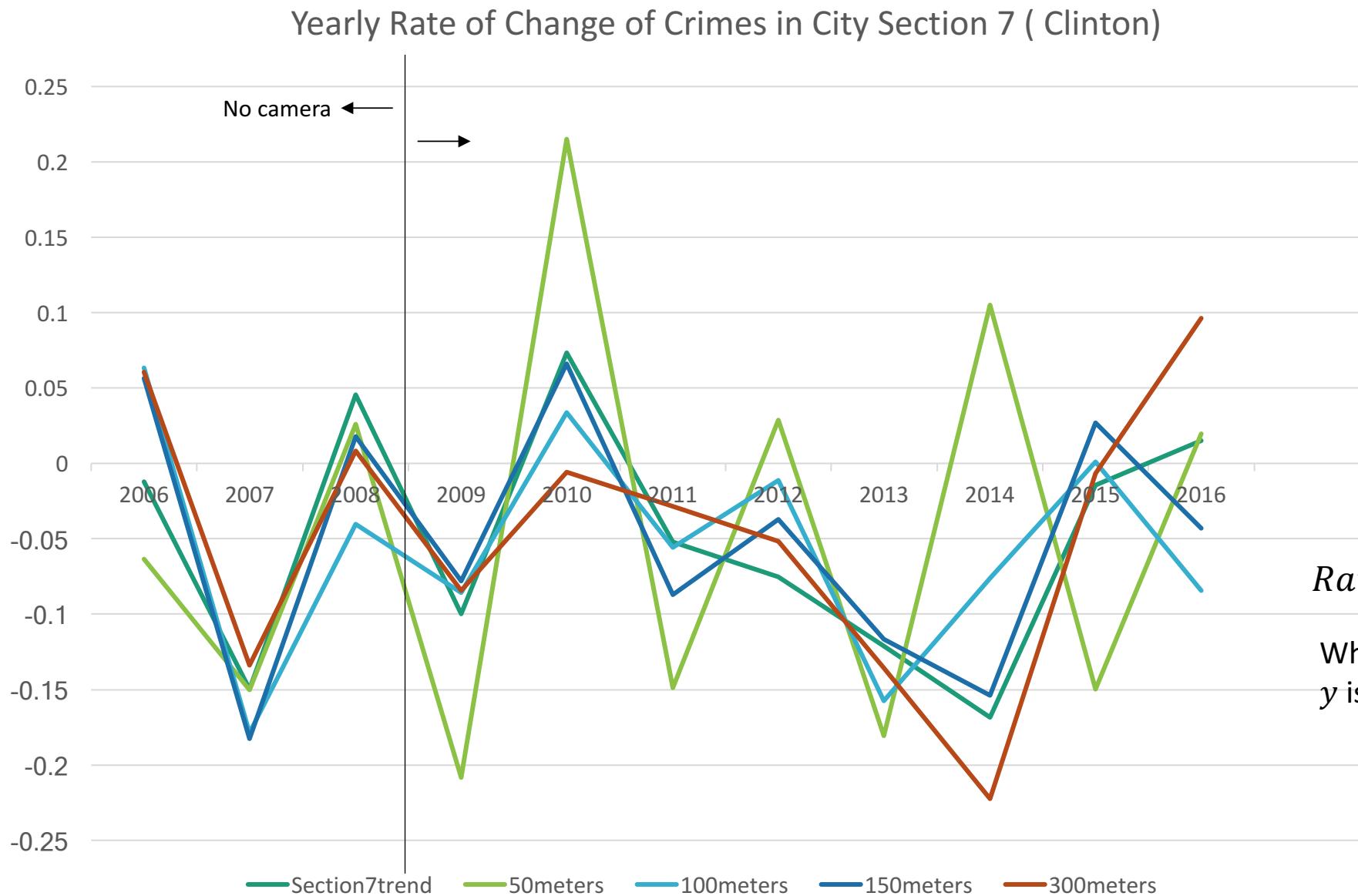
$$\text{Rate of Change} = \frac{y(t) - y(t-1)}{y(t-1)}$$

Where t is time period,
 y is crime count during this period



SECTIONAL ANALYSIS

Rate of Change



$$\text{Rate of Change} = \frac{y(t) - y(t-1)}{y(t-1)}$$

Where t is time period,
 y is crime count during this period



SECTIONAL ANALYSIS

Rate of Change

Part1(2005-2008) Part2(2009-2012)



2005

2009.01

2012

$$\text{Rate of change} = \frac{\text{Part2} - \text{Part1}}{\text{Part1}}$$

	All Crime	larceny	simple assault	criminal mischief	controlled substances	burglary	aggravated assault	all other offenses (except traffic)	dangerous weapons	disorderly conduct	mv theft	robbery
Section1	-0.14157	-0.13847	0.100487	-0.06366	-0.12794	0.03925	0.012987	-0.5165	-0.34037	0.02991	-0.52017	-0.2976
9 Cameras S1	-0.30844	-0.14458	-0.36111	-0.24528	0.025	-0.17073	-0.58621	-0.40323	-0.25	-0.35294	-0.69565	-0.6
Section3	-0.1052	-0.05516	0.169746	-0.06962	-0.12313	0.247227	-0.04251	-0.48387	-0.41399	0.004566	-0.55111	-0.33976
12 Cameras S3	-0.10158	0.09434	0.139344	-0.04225	-0.13333	0.205882	-0.38462	-0.34483	-0.5	-0.2381	-0.45	-0.36667
Section5	-0.13904	-0.07402	0.206359	-0.08977	-0.22857	0.191805	-0.10837	-0.54693	-0.315	-0.24077	-0.64416	-0.21429
12 Cameras S5	-0.12266	0.401361	0.095652	-0.17391	-0.35652	0.228571	-0.51351	-0.07143	-0.33333	-0.28049	-0.66667	-0.68421
Section7	-0.13998	0.043791	0.033642	-0.1009	-0.18952	-0.01762	-0.03294	-0.4591	-0.31796	-0.11332	-0.61054	-0.2699
33 Cameras S7	-0.26682	0.131868	-0.12971	-0.17333	-0.41935	-0.27711	0.02439	-0.16667	-0.39474	-0.5	-0.57143	-0.60345
Section9	-0.16638	-0.10232	0.033236	-0.19942	-0.0048	-0.2679	-0.06122	-0.49098	-0.23077	0.35443	-0.62776	-0.38147
16 Cameras S9	-0.01553	-0.19694	0.417476	-0.26263	0.2	-0.5641	0.266667	-0.12121	0	1.315315	-0.75	-0.45238
CityWide	-0.13723	-0.06544	0.104105	-0.0949	-0.15562	0.065697	-0.03608	-0.49933	-0.33914	0.016888	-0.58982	-0.28952
ALLCameras (82)	-0.15731	-0.02113	0.055696	-0.18065	-0.24905	-0.15948	-0.18894	-0.19617	-0.36145	0.052752	-0.62827	-0.57037

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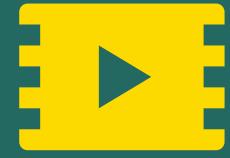
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IMPACT ANALYSIS WILCOXON

Part 1

Crime Data Before Installation

Part 2

Crime Data After Installation

Installation time

Test Hypothesis:

$$H_0: \text{Part 1} \leq \text{Part 2}$$

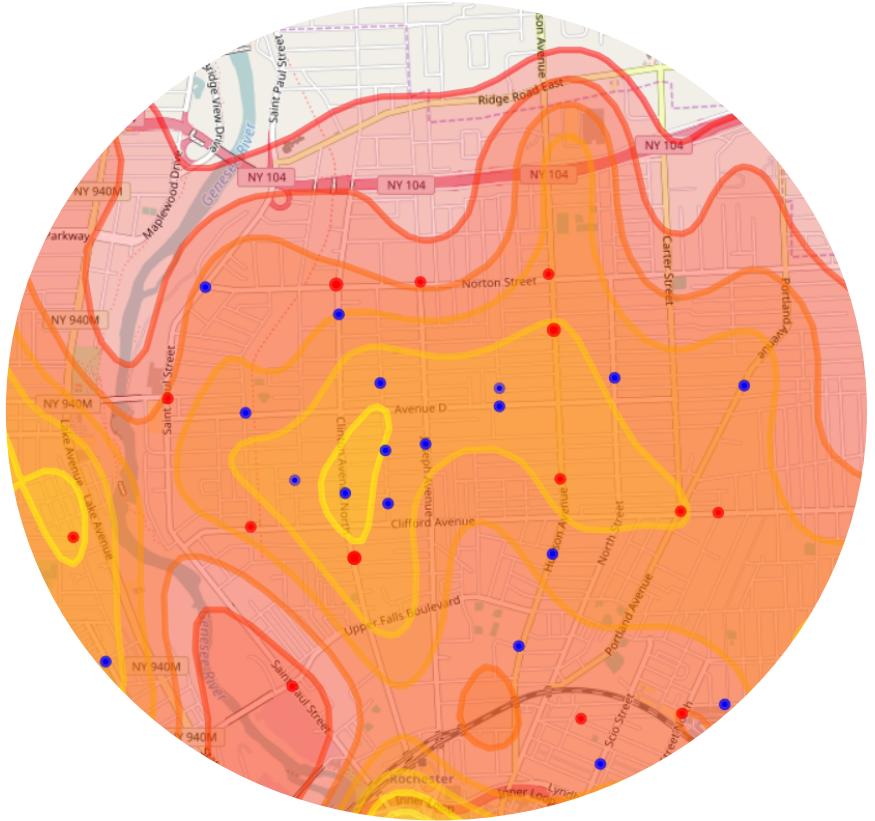
$$H_a: \text{Part 1} > \text{Part 2}$$

Result:

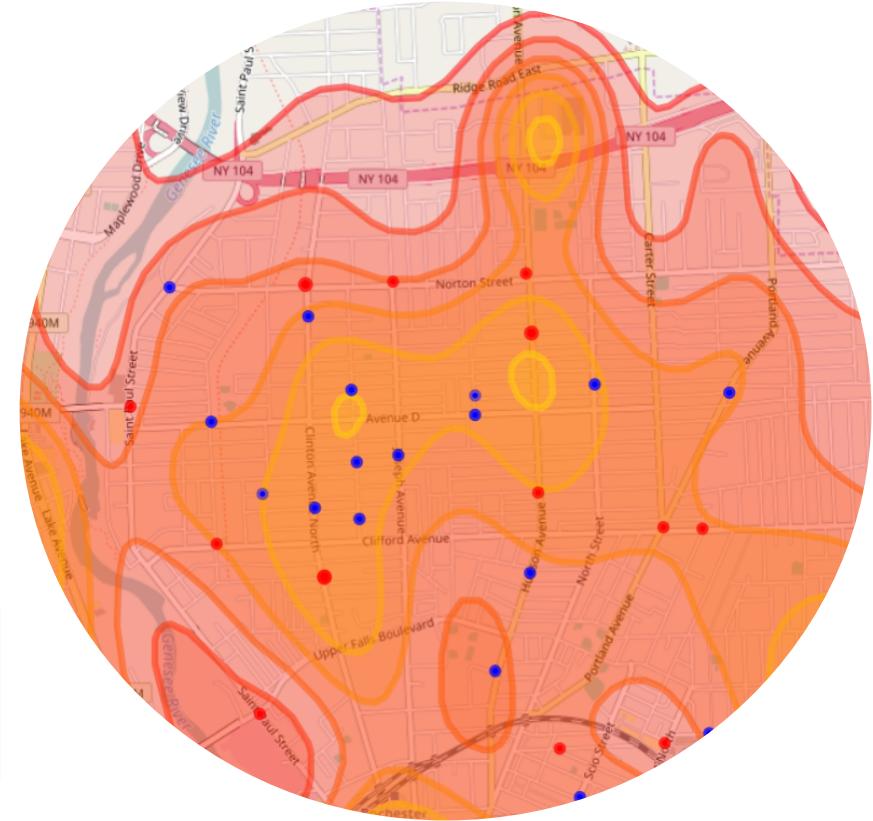
Number of Cameras	Reject	Fail to Reject
82	42	40



IMPACT ANALYSIS WILCOXTION



Section7 Contour Map of Crimes (Year:2005-2008)



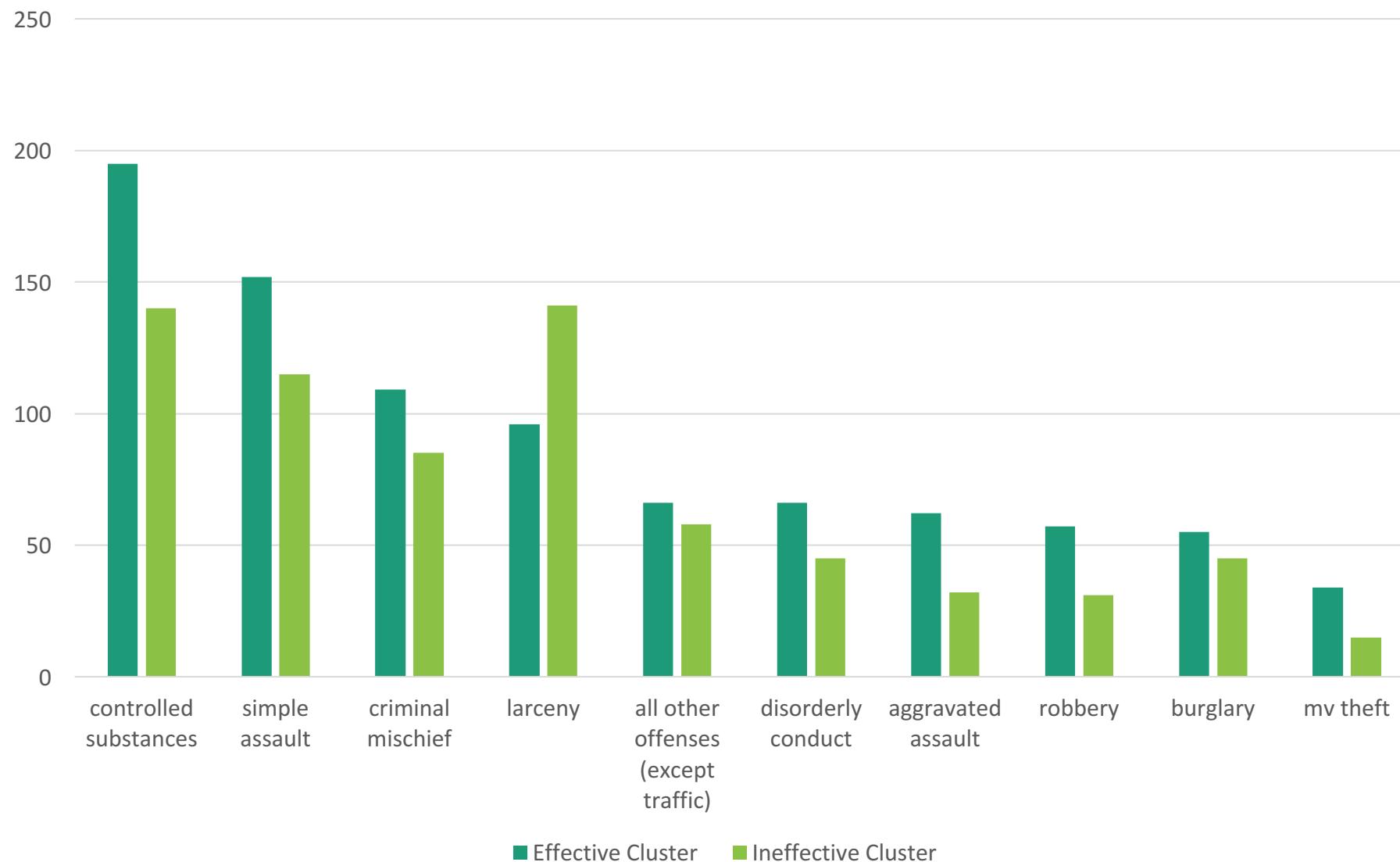
Section7 Contour Map of Crimes (Year:2009-2012)

Number of Cameras	Pass(● red point)	Fail(● blue point)
82	42	40



IMPACT ANALYSIS CASE ANALYSIS

Crime by Type for Effective and Ineffective Cameras

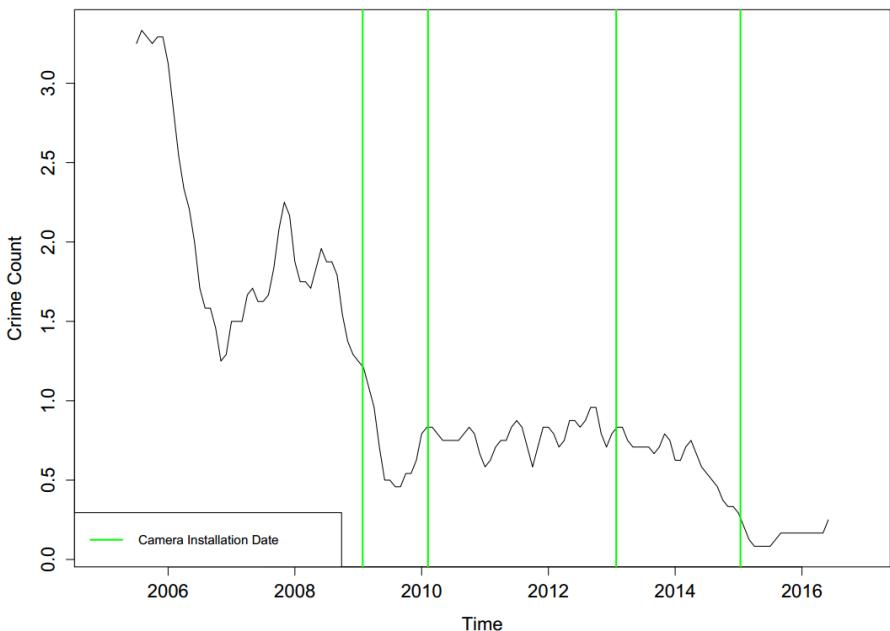




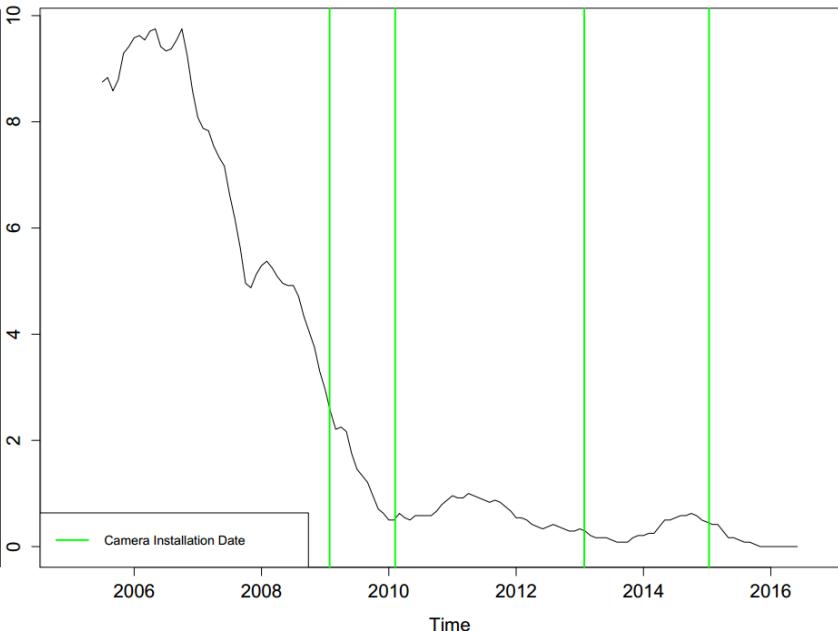
IMPACT ANALYSIS

CASE ANALYSIS

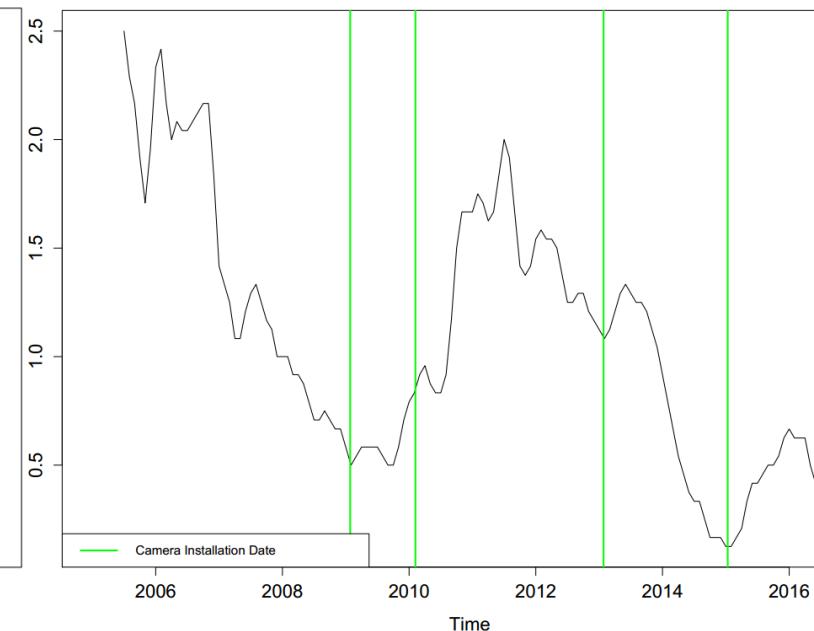
Crime Count Trend with Time for Camera 4



Crime Count Trend with Time for Camera 61



Crime Count Trend with Time for Camera 69



Reject Hypothesis

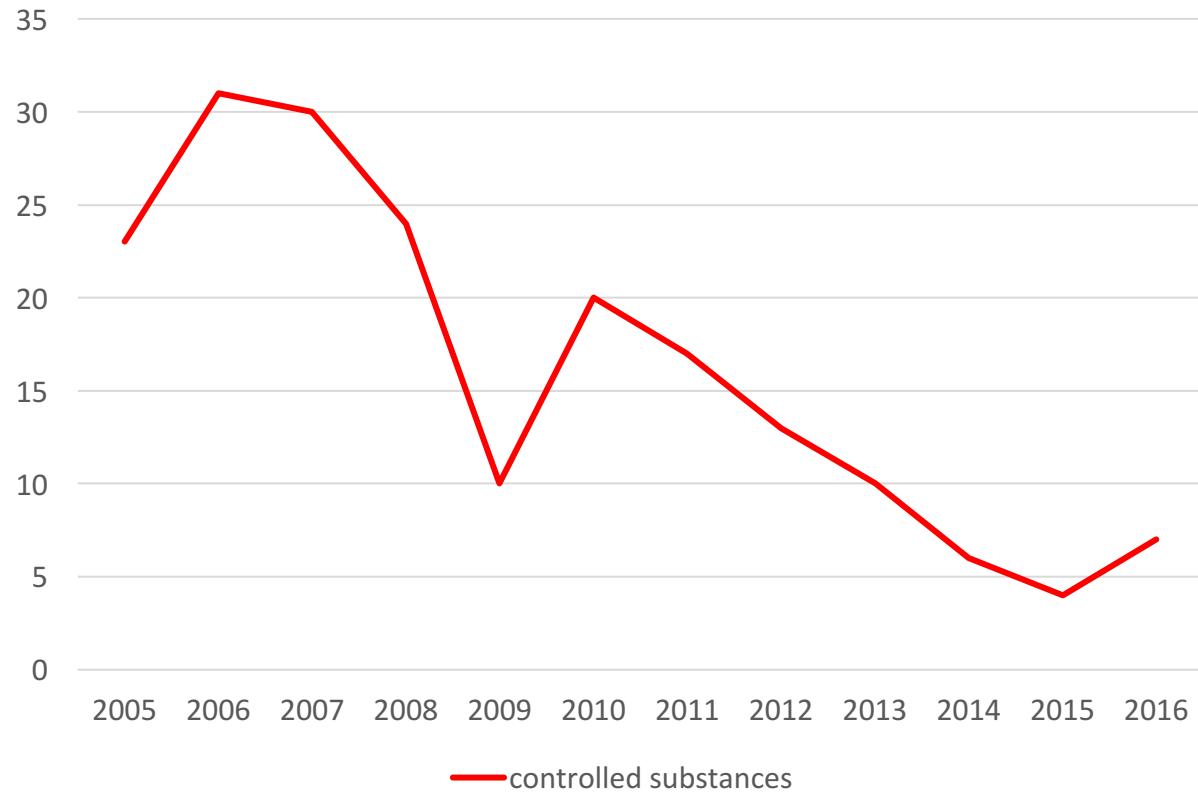
Reject Hypothesis

Fail to reject Hypothesis

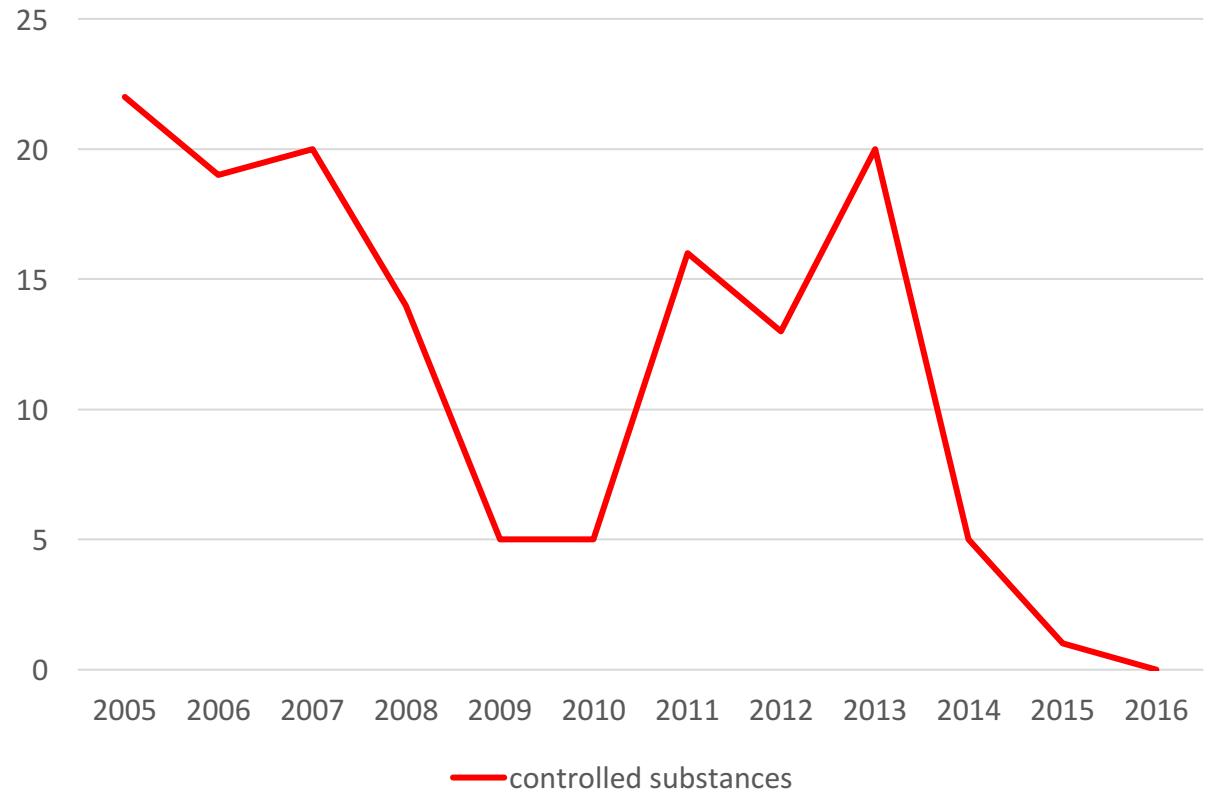


IMPACT ANALYSIS CASE ANALYSIS

Crime Yearly Count Around Effective Clusters



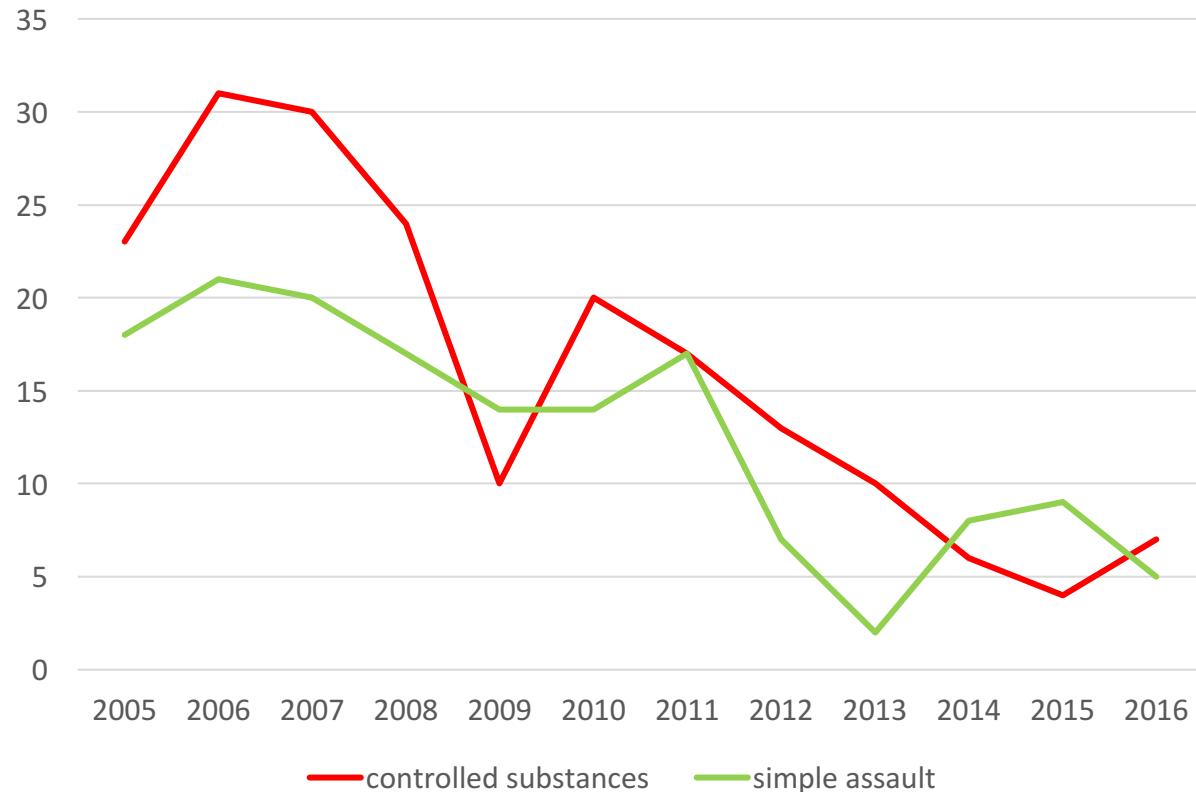
Crime Yearly Count Around Ineffective Clusters





IMPACT ANALYSIS CASE ANALYSIS

Crime Yearly Count Around Effective Clusters



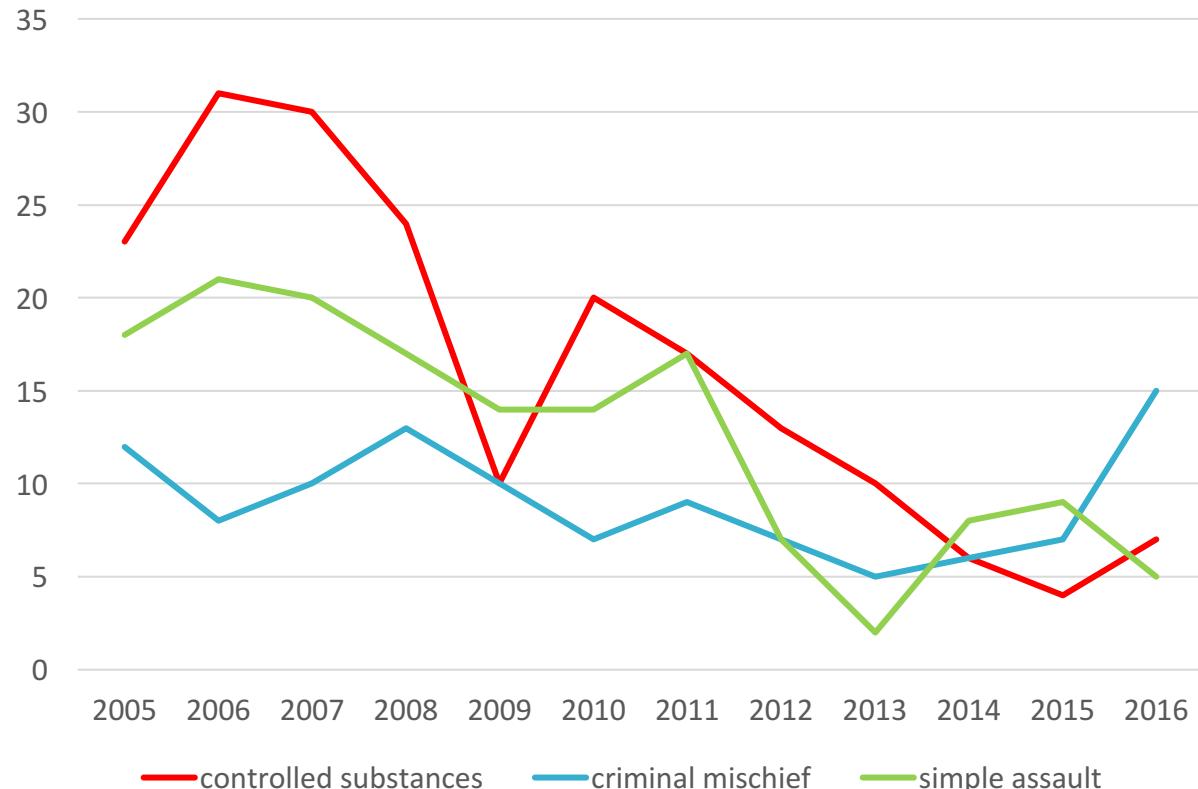
Crime Yearly Count Around Ineffective Clusters



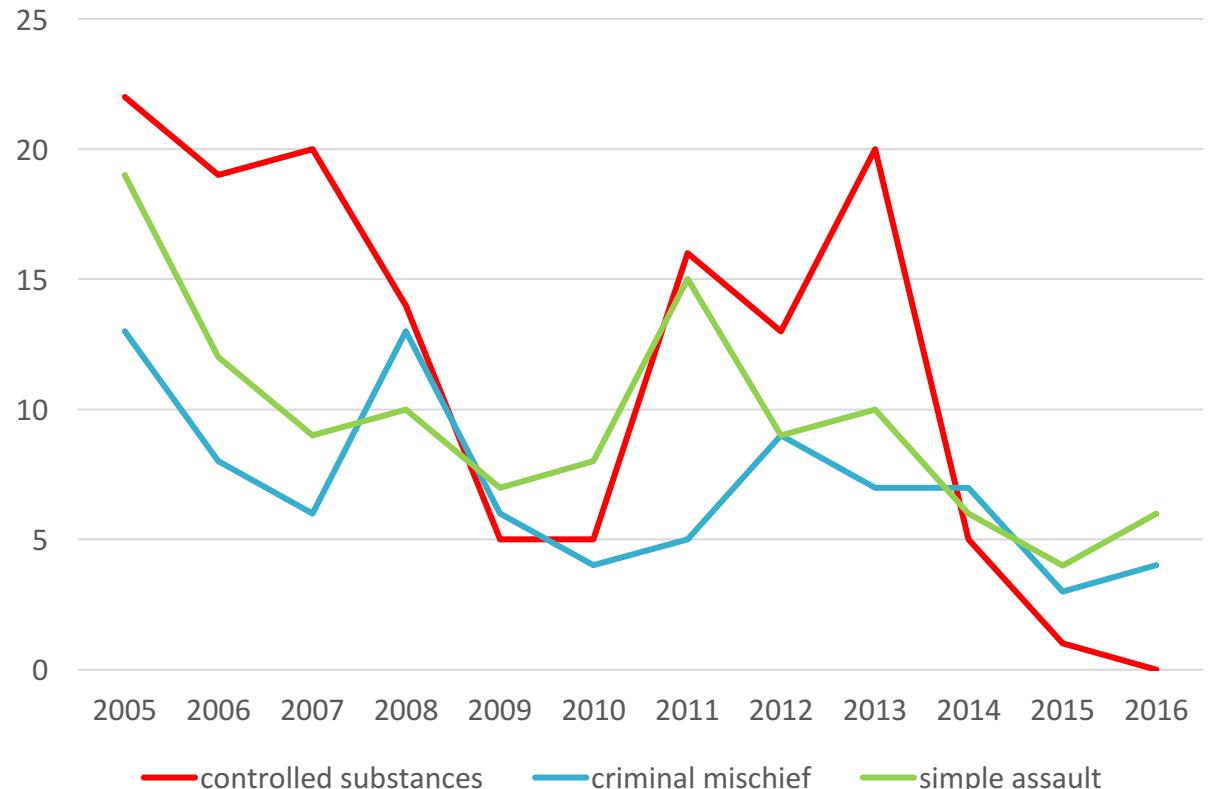


IMPACT ANALYSIS CASE ANALYSIS

Crime Yearly Count Around Effective Clusters



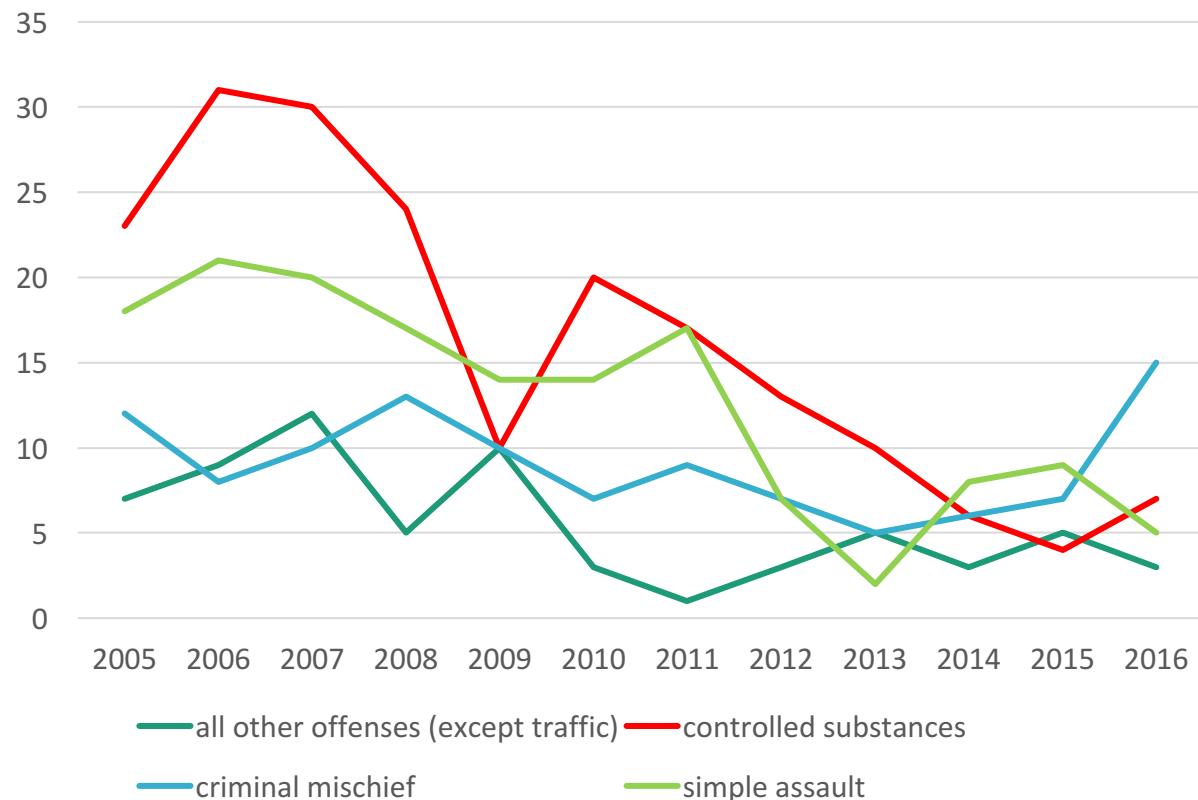
Crime Yearly Count Around Ineffective Clusters



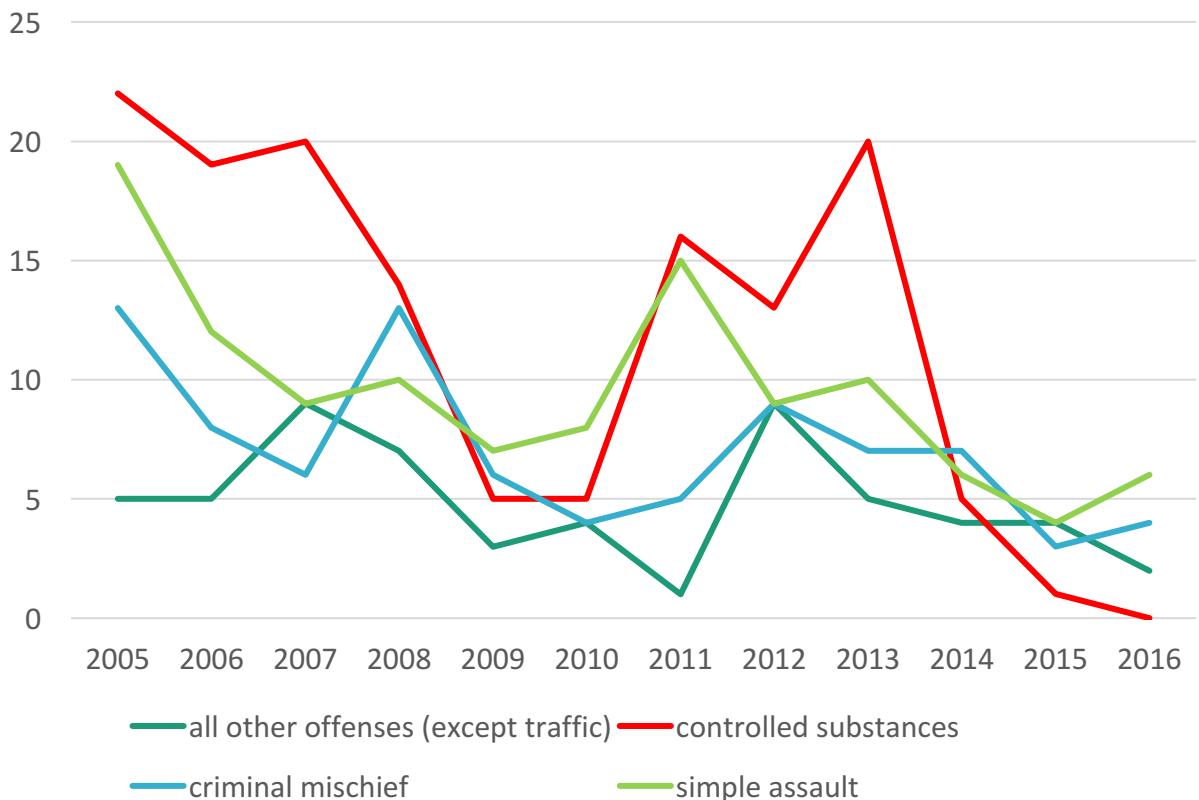


IMPACT ANALYSIS CASE ANALYSIS

Crime Yearly Count Around Effective Clusters



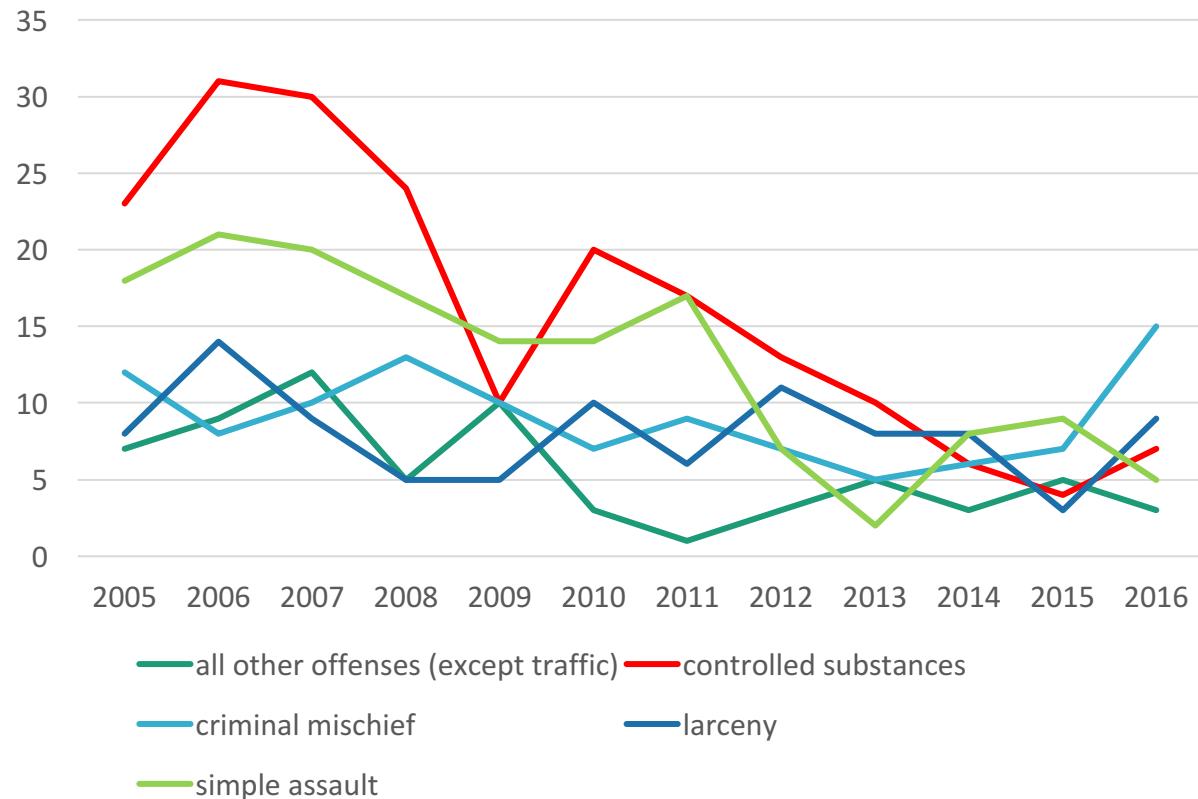
Crime Yearly Count Around Ineffective Clusters



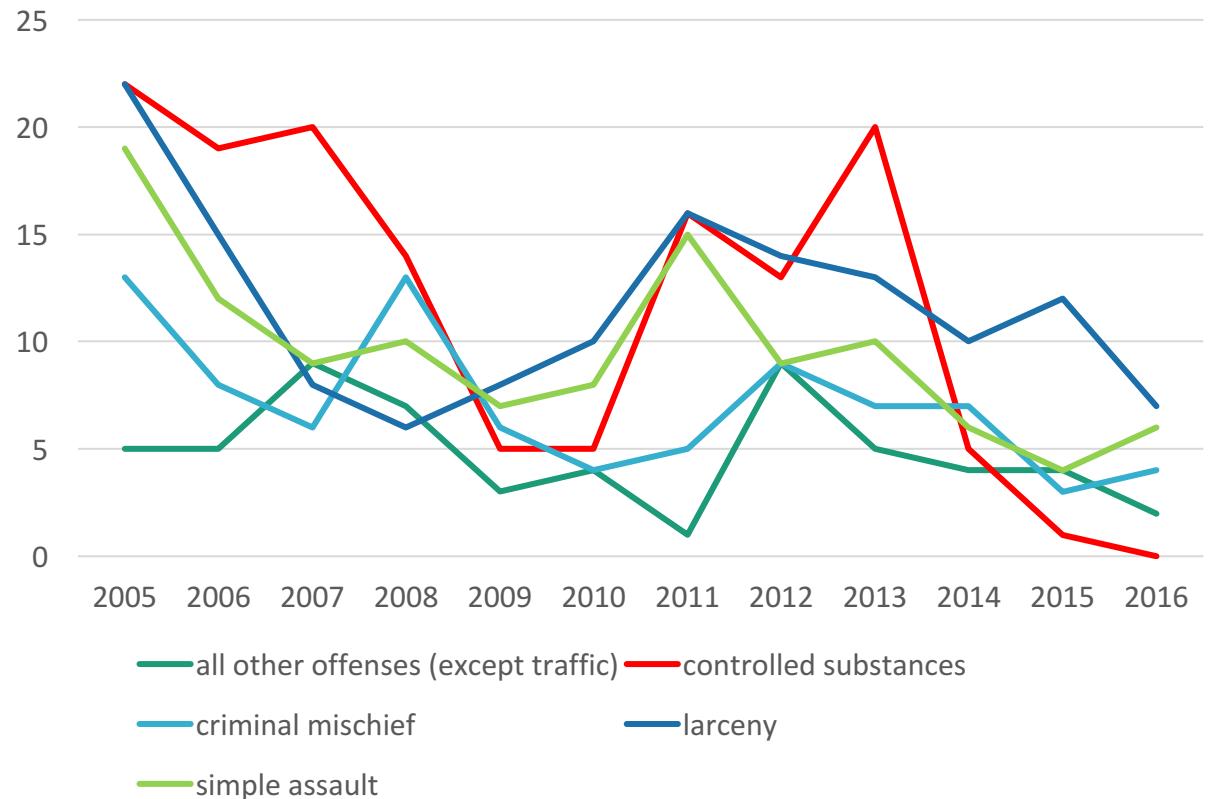


IMPACT ANALYSIS CASE ANALYSIS

Crime Yearly Count Around Effective Clusters



Crime Yearly Count Around Ineffective Clusters





Conclusion

1. Some Bluelight cameras installed in Rochester were observed to help deter crimes through two approaches:
 - Directly decrease crime count in adjacent areas
 - Skew distribution of crimes
2. However, nearly a half of cameras that were installed before 2011 did not see significant decrease of crime around the location.
3. Effective cameras has higher probability to appear as a cluster. Ineffective cameras are more likely to be on main streets.
4. Certain crime types are more sensitive to the presence of cameras (e.g. crimes involve controlled substance).





Future Work



Based on our analysis, to find future candidate camera installation locations. Similarly, find which cameras can be removed.



For the effective cameras, try to find if there is any decay effects with time.



Try to find a control group to conduct a DID analysis.





QUESTIONS?



THANK YOU!

Have a Nice Day!