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Externality of Hosting Mega-Events:  
Econometric Analysis of the 2012  
London Summer Olympics**

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# Evaluating Crime as a Negative Externality of Hosting Mega-Events: Econometric Analysis of the 2012 London Summer Olympics

Nicholas Le \*

## Abstract

Analysis of the benefits and the drawbacks of hosting large-scale sporting events like the Olympics or World Cup frequently ignore the effects of crime due to its relatively small economic impact in comparison to employment and consumption effects. Literature has frequently tied sporting events and tourism to crime, in addition to observing proximity effects on crime during sporting events. This research seeks to confirm both by implementing a difference-in-difference regression that can show whether crime increased during the Olympics, in particular in London boroughs which hosted venues for the Games. Ultimately, the research concludes that crime in London as a whole does increase although it is unable to find statistically significant evidence that crime increased in host boroughs at a magnitude larger than the general increase in crime in the city. Likely reasons we have been unsuccessful in pinpointing the location effects include data limitations (daily data would be superior to monthly data due to the dates during which the event was hosted) and the relatively small geographical size of each host borough, as well as their proximity to one another.

**Keywords:** Sporting Events, Economics, Crime, Olympics

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\* Nicholas Le is a 2017 economics graduate of Colgate University. This working paper is the winner of the 2017 Roger Noll Prize for Best Undergraduate Paper in Sports Economics.

## **1 Introduction**

A variety of factors combine to produce the allure of hosting a sporting mega-event, such as the World Cup, Olympics and Super Bowl. Of these factors, some are easily quantifiable, while others are much less so. It seems to be a “common-sense” expectation that hosting such an event is beneficial to a city or country by improving employment outcomes for residents, increasing expected income for residents, adding revenue to local businesses (which in turn trickles down to the government via taxes), and improving economic growth for the city or nation in the long run. Though little academic research has offered support for this assumption, Hotchkiss, Moore, and Zobay (2003) found positive employment effect and improved growth rates for both employment and wages in the state of Georgia in the aftermath of the 1996 Summer Olympics. Each of these perceived benefits falls within the realm of the easily quantifiable. However, other possible effects are much harder to find reliable data for. For instance, it also stands to reason that hosting an event like the World Cup or Olympics, with the unparalleled degree of international recognition each of these events promise, could lead to improvements in national morale and an increasingly favorable perception of the host nation given a smoothly-running event. Both of these potential outcomes, while observable to an extent, are far more difficult to quantify than the aforementioned economic impacts to the host country or region. However, crime provides a subset of economic data which bridges both what can easily be quantified and what cannot.

Crime has frequently been tied to macroeconomic variables. For instance, unemployment has been associated with increases in both property crime and its elasticity (Lin 2008). Other research suggests that a relationship between real income per capita and crime could exist (Habibullah and Law, 2008). Additionally, it is related to both the happiness of the populace by serving as a detriment to their living conditions, and high crime rates, perhaps given more

attention by the national spotlight a host country or city is placed under during such an event, undoubtedly result in a poorer international perception of the nation. This research paper seeks to examine the relationship between the hosting of the mega-event and the rate of occurrence of a variety of crimes. We also seek to test the hypothesis that proximity to locations in which events are held have an influence on crime rates. The basis behind this possibility is opportunistic crime occurring in areas where large groups of unaware tourists gather, who are likely unfamiliar with the area and possibly drunk. It specifically examines the city of London during the 2012 Olympic Summer Games, in equal parts due to the recentness of the event and the lack of reliable information for other recent mega-events which may be more interesting due to their host countries being developing nations; for instance the 2010 World Cup in South Africa, the 2016 World Cup in Brazil, and the 2016 Summer Olympics in Rio de Janeiro. These questions are relevant and economically significant due to the dearth of research geared towards examining the more difficult to quantify aspects of mega-event hosting. One previous examination of mega-events focused primarily on economic benefits; however despite a failure to find statistically significant evidence that any kind of income or employment effects exist, the authors refused to commit to a conclusion that mega-events were good or bad for the host nation due to the difficulty to quantify effects, like increased happiness to residents of the area (Hagn and Maennig, 2008). A similar analysis of the broad costs and benefits of hosting was published by Baade and Matheson (2016). Although costs are frequently difficult to quantify, in part due to corruption, benefits are far clearer. They include direct benefits, such as ticket revenue and television rights, but also indirect economic benefits of employment and consumption tied to preparation for the event and the tourism that comes with hosting. Additional concern is voiced over upward bias in ex-post analysis of these events, due to crowding out of local residents' expenditure and

crowding out of other tourists. Their ultimate conclusion, differing from Hagn and Maennig, is that Olympic hosting is economically unviable. Though the research on this paper is unable to provide a definitive answer to the level at which host citizens are affected, it tackles the topic tangentially by trying to quantify the effect of a negative externality that adversely affects them; crime. Attempting to quantify negative externalities, as we attempt to do in this paper, is one important step in developing a more comprehensive picture of the true cost of hosting mega-events.

## **2 Background and Literature Review**

Both mega-events and crime are fairly well-researched topics in economic literature, although convincing research that explicitly focuses on the relationship between the two is fairly sparse. Perhaps the most relevant prior research is Campaniello's examination of mega-events and crime, which attempts to link specific types of crime to the hosting of the 1990 World Cup in Italy (2013). Though the model utilized in this paper contains many similar elements as ours, it is important to note that the "treatment" period considered by Campaniello was the entire year during which the event was held, more than double the length of ours. Campaniello ultimately concludes that a causal effect between being a host city and most kinds of property-related crime exists, including bag-snatching, pick-pocketing, shoplifting and burglary. A similar study of the 2002 Salt Lake City Winter Olympics observed that while calls reporting crime and police activity increased during the games, the effect dissipated following the end of the event (Decker, Varano and Greene 2007). It should be noted that although the event was very similar to the Games which are the subject of our research, the host cities differ greatly. Salt Lake City is much

more isolated than London, and is more demographically homogenous which suggests difficulty in a direct comparison between the findings of our research and theirs.

Further research can be found dealing with the relationship between broader tourism and crime, which relates closely with our topic because mega events are largely geared towards tourists. In particular, Howsen and Jarrell (1990), McPheters and Stronge (1974), and Harper (2001) find that tourism has a positive impact on the crimes of burglary, larceny, and robbery but no impact on crimes against the person, suggesting that that influxes of strangers to a new area (specifically seasonal tourism in these three papers) result in the negative externality of increased property crime. Analysis of the America's Cup Yacht race from late 1999 to early 2000 in New Zealand provides further evidence that crime can be associated with special events, and was specifically tied to an influx of tourists (Barker, Meyer and Page 2002). This directly relates to our study due to the influx of tourists who flock to see the Olympic Games. The distinction that these different authors draw, in addition to Campaniello's treatment of different types of crime in her analysis of Italia 1990, suggests the importance of separating crime types in our own research. An additional study, observing an outdoor football stadium and an indoor multipurpose venue, noted that crime effects were unobservable in terms of their contribution to an overall increase in crime between event days and nonevent days; however, effects were observable when proximity to the stadium was a factor in the analysis (Billings and Depken 2011). The findings of this study were a large part of the reason we include dummy variables for each borough hosting Olympic events, as these findings provide reason to believe proximity effects are not negligible.

Contrary to other research, Hiller (2000) examines mega-events' potential to reduce crime, specifically in the context of the 2004 Olympic bid by Cape Town. He suggests that infrastructure provided by the event allows sport to be offered as an alternative to crime for local

youth. Though this is a valid observation, the longer term effects of the events, such as this, are beyond the scope of this paper or our data.

### **3 Data Discussion**

Data for this project is taken primarily from the Metropolitan Police Service of London database on crime. It is separated into a variety of types of offenses. These are violence against the person, sexual crimes, robbery, burglary, theft, fraud, damage, drugs and other. Each of these categories provided can be parsed out into further subcategories. However, for this research we combine the various categories into crimes against person and crimes against property. The former group contains violent and sexual crimes as well as robbery, while the latter includes burglary, theft and damage. It is important to note that we have omitted the drug, fraud, and other categories of offenses due to our separation of the crime statistics into these two groups, as these (relatively small) categories of crime do not fit well into either one. At surface level it seems that there is a slight difference in the means of property crime and crimes against the person, with host boroughs exhibiting higher crime rates for both categories. However, it should be obvious that this superficial level of analysis fails to account for other differences in other variables that affect crime. For interpretation purposes it should also be noted that crime figures are reported as the actual values which occurred; that is there is no scaling of crime occurrences. Also included are macroeconomic control variables as well, for United Kingdom average wages and United Kingdom unemployment. Data for both of these metrics comes from the Office for National Statistics. Aside from macroeconomic controls, data takes a panel format, with the 33 London boroughs observed over the 36 month period from April 2011 to March 2014, with the amount that each crime is reported to the police given on a monthly basis. Of the 33 boroughs, six were

home to venues for various Olympic events. These were Barking and Dagenham, Greenwich, Hackney, Newham, Tower Hamlets and Waltham Forest. The time during which the Olympics were held is also noteworthy; the games began in late July 2012 and concluded in mid-August of the same year. Although the games were held over a short period, it is fair to assume that the time period over which effects that the games might have had could be observable over a longer period. For instance, the employment benefits associated with hosting would have been realized a year or more in advance of the games due to the time consuming nature of large scale construction projects.

#### **4 Methodology**

Due to the nature of our data and research questions, we use a difference-in-difference approach in order to interpret the borough-level effects of having a venue during the event. We look at the effect of crime in two separate models, one evaluating crime against persons and the other evaluating property crime, with other aspects of the model being the same. Subscript  $i$  refers to a specific borough while subscript  $t$  refers to a specific month. The model had treatment groups as the aforementioned six boroughs that held events while the time of treatment was taken as the two months during which Olympic Events occurred, July 2012 and August 2012. Thus, our DID variable is the interaction between the time period during which the games were held and the borough in which they were held. Although a Hausman test indicated random effects estimator as a superior alternative to fixed effects, both are reported in this paper due to the Hausman test's known oversensitivity in rejecting fixed effects estimators, coupled with the intuitive borough level differences that likely exist. Therefore, random effects and fixed effects are used in one of our estimations, as well as a simple DID regression model. A Levin Lin Chu Test was additionally performed, which failed to find evidence of a unit root. Also included are



monthly dummies to account for seasonality effects on crime and United Kingdom national average wage and unemployment levels as general controls, in line with the research by Lin (2008) and Habibullah and Law (2008). Thus, our model is as follows:

$$(1, 2, 3) \quad \text{Crime Against Person}_{it} = \beta_0 + \beta_1(\text{Time})_{it} + \beta_2(\text{Treat})_{it} + \beta_3(\text{DID})_{it} + \beta_4(\text{Monthly Dummies}) + \beta_5(\text{Average Wage})_t + \beta_6(\text{Unemployment})_t + u_{ijt}$$

(Model 1 is with random effects, Model 2 with fixed effects and Model 3 without either)

$$(4, 5, 6) \quad \text{Property Crime}_{it} = \beta_0 + \beta_1(\text{Time})_{it} + \beta_2(\text{Treat})_{it} + \beta_3(\text{DID})_{it} + \beta_4(\text{Monthly Dummies}) + \beta_5(\text{Average Wage})_t + \beta_6(\text{Unemployment})_t + u_{ijt}$$

(Model 4 is with random effects, Model 5 with fixed effects and Model 6 without either)

This model setup alters coefficient interpretations.  $\beta_1$  is interpreted as the expected average change in crime during the event for only the control group, while  $\beta_2$  corresponds to the mean difference between the six host boroughs and the non-host boroughs outside of the time during which the Olympics were held.  $\beta_3$  is the coefficient of most interest given our research question; the DID estimator shows the mean change in crime between host boroughs and non-host boroughs.

## 5 Results and Discussion

Regression results are reported below, in *Figure 1*. Monthly dummy variable estimations are not reported.

Figure 1

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Crimes against person			Crimes against property		
	RE	FE	Pooled	RE	FE	Pooled
Olympics	11.66** (5.854)	11.66* (5.852)	11.66 (32.93)	42.74* (21.91)	42.74* (21.90)	42.74 (93.43)
Host Boroughs	114.4* (61.52)		114.4*** (15.61)	26.21 (150.8)		26.21 (44.30)
DID	1.983 (12.48)	1.983 (12.48)	1.983 (66.25)	29.95 (33.48)	29.95 (33.47)	29.95 (188.0)
Average Wage	-3.413*** (0.545)	-3.413*** (0.545)	-3.413** (1.504)	-4.362*** (0.876)	-4.362*** (0.876)	-4.362 (4.267)
Unemployment	-29.05*** (5.087)	-29.05*** (5.085)	-29.05 (18.57)	72.04*** (14.67)	72.04*** (14.66)	72.04 (52.70)
Constant	2,293*** (299.7)	2,314*** (268.8)	2,293*** (807.0)	2,709*** (443.8)	2,713*** (426.7)	2,709 (2,290)
Observations	1,188	1,188	1,188	1,188	1,188	1,188
R-squared		0.325	0.067	0.351	0.351	0.019
Number of Boroughs	33	33		33	33	

Robust standard errors in parentheses  
 \*\*\* p<0.01,  
 \*\* p<0.05,  
 \* p<0.1

The regression results suggest that average wage increases are associated with decreases in crime, generally at a statistically significant level. However, we fail to find a consistent relationship between unemployment and crime across different model variations. Additionally, insignificance of the DID coefficient suggests we are unable to verify increased crime in host boroughs during the Games. The coefficients are positive, albeit insignificantly so. However, it is worth noting that both fixed and random effects estimations yielded positive, statistically significant coefficients in front of the Olympic variable. This suggests an increase of crime during the Olympics in non-host boroughs. On the basis of this observation, it appears that although we are able to rule out crime increasing in boroughs which held venues for the event, crime in London as a whole increased as a result of the Olympics. A likely cause of our

observations relates to a detail of the proximity effect observed by Billings and Depkens (2011). Their research focuses on one stadium, and proximity effects in a several mile radius outside of it. Therefore, pinpointing location-related effects is problematic given both the small geographic size of London boroughs and also the close proximity of host boroughs to one another. This hypothesis partially explains Campaniello's findings, as the distance between host cities at the 1990 Italy World Cup was much greater than the distance between boroughs at these Olympics (2013). The estimator for the Host Boroughs variable is omitted in the fixed effect regression results due to collinearity with firm fixed effects. Also notable is the fact that although statistical significance is found with some variables, the magnitude of the results suggests little economic significance, with the largest coefficients on the Olympic variable being akin to an increase of only about 40 property crime incidents during the event.

## **6 Conclusion**

Reasons for increased crime during massive sporting events may seem self-evident. As major tourist destinations, these debacles attract throngs of confused tourists, frequently inebriated and battling a formidable language barrier which may make them appear soft targets for crime. This analysis of the effect of the 2012 Summer Olympics in London on crimes against both persons and property utilizes fixed and random effect difference-in-difference regressions to improve understanding of the relationship between sporting mega-events and crime. Though by no means conclusive, interesting results are found. Namely, it appears that crime in the whole of London did increase during the event, although the results could not confirm proximity effects by finding larger-than-standard crime increases in boroughs which hosted venues for the event. Further, these results are not without limitations. The control variables used were equivalent across each

borough, results likely could be refined by having borough-level macroeconomic variables that vary across both  $i$  and  $t$ . Additionally, although it may be tempting to broadly apply the findings of this paper to all sporting events, it should be noted that the relationship observed only exists for the data from the 2012 Summer Olympics. Therefore, these results can only be taken as suggestive evidence regarding the broader link between sporting mega-events and crime, and are unable to confirm or deny the existence of proximity effects. Data restrictions lead to further limitations. Although for regression purposes the Olympic dummy variable takes value 1 during July and August of 2012, the event only actually occurred between July 27 and August 12, meaning more than half the days tagged as “Olympic” actually did not occur during the Olympics. Unfortunately, because monthly data is the most precise crime data offered, little can be done to rectify this issue.

This research does have implications, both for policy and for future research. Obviously, mega-events are hotly contested between different candidates. Hosting is seen as so prestigious that several countries have (allegedly) been driven to corruption, including South Africa in 2010, as well as Russia and Qatar for the upcoming 2018 and 2022 World Cups. Despite the desire to host, definitive answers regarding the costs and benefits of doing so are difficult to find. This is partially due to difficulties in assessing these costs and benefits quantitatively. Although crime is less economically significant than, say, the potential employment benefits that come with hosting, it is still impactful, especially for the local population in host cities. Therefore, our results provide further consideration for host cities and host countries who may be deciding whether or not to bid for a mega-event. Additionally, this research provides a framework through which similar studies may be conducted. As noted previously, results are somewhat event specific, and expansion to other mega-events at other times and in other places could yield

interesting results. Ultimately, the relationship between mega-events and crime is a relevant cost (or benefit) that must be taken into account when weighing the pros and cons of hosting. This analysis seeks to contribute to the existing literature by examining a different event. As additional research is published, time will tell whether the above findings are more broadly applicable.

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## I. Appendix

Summary Statistics for Crime Variables:

	<i>Violence</i>	<i>Sex</i>	<i>Robbery</i>	<i>Burglary</i>	<i>Theft</i>	<i>Fraud</i>	<i>Person</i>	<i>Property</i>
<i>Mean</i>	385.11	26.36	85.76	230.77	814.79	55.92	497.23	1205.10

<i>SD</i>	148.04	11.91	59.61	85.32	501.505	55.36	207.38	573.86
<i>Minimum</i>	16	0	0	0	127	0	16	134
<i>Maximum</i>	782	80	316	539	3672	366	1071	4215
<i>Range</i>	766	80	316	539	3545	366	1055	4081

Summary Statistics for Crime Variables in Host Boroughs

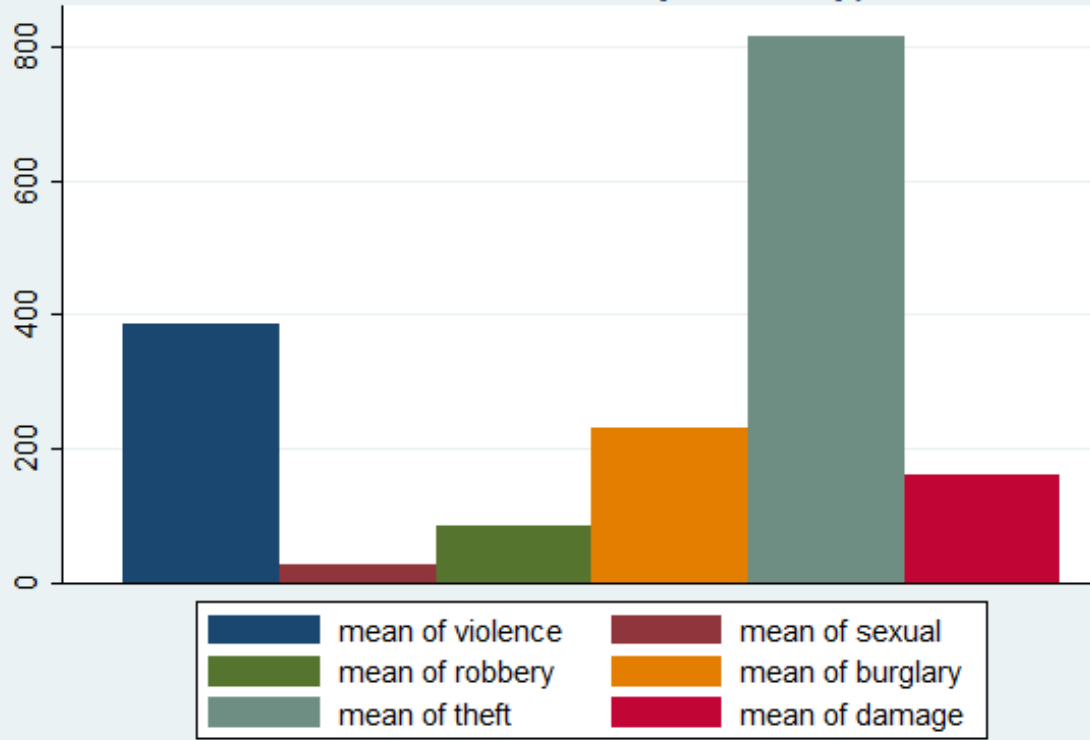
	<i>Violence</i>	<i>Sex</i>	<i>Robbery</i>	<i>Burglary</i>	<i>Theft</i>	<i>Fraud</i>	<i>Person</i>	<i>Property</i>
	<i>Crime</i>							
<i>Mean</i>	457.03	30.81	103.06	222.53	831.02	61.98	590.90	1227.91
<i>SD</i>	82.31	9.60	51.16	38.55	223.42	54.47	123.29	252.93
<i>Minimum</i>	281	10	22	101	404	0	342	711
<i>Maximum</i>	663	80	242	317	1380	223	902	1898
<i>Range</i>	382	70	220	976	976	223	560	1187

Summary Statistics for Crime Variables in Non-host Boroughs

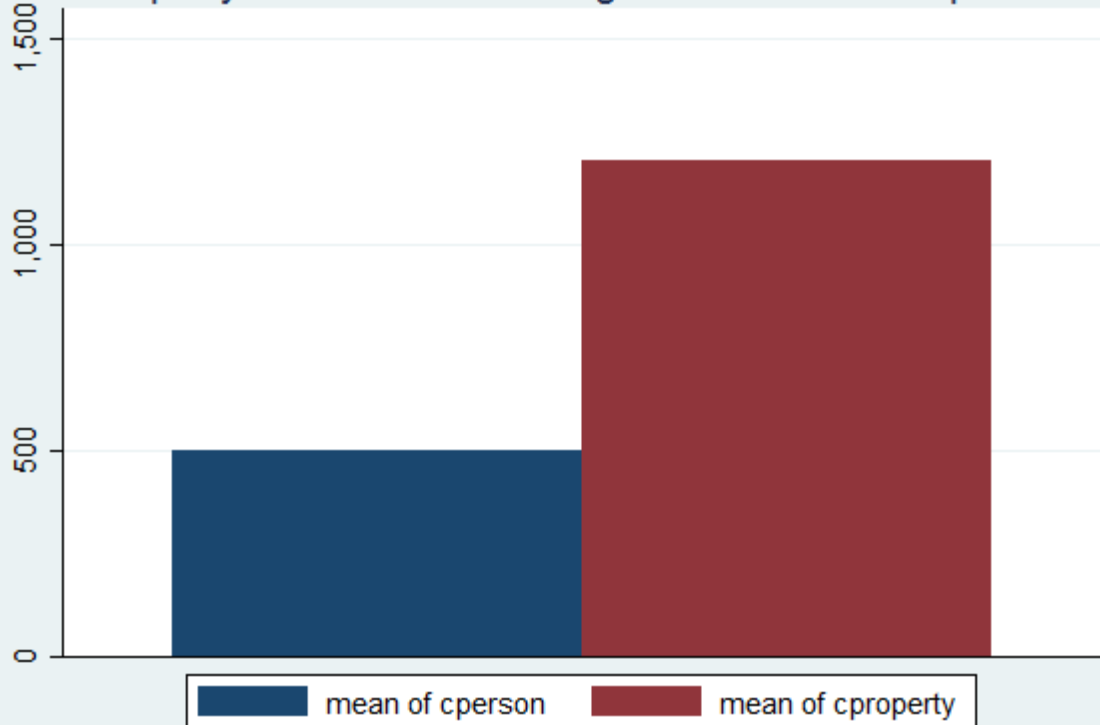
	<i>Violence</i>	<i>Sex</i>	<i>Robbery</i>	<i>Burglary</i>	<i>Theft</i>	<i>Fraud</i>	<i>Person</i>	<i>Property</i>
	<i>Crime</i>							
<i>Mean</i>	369.12	25.37	81.92	232.60	811.19	54.58	476.41	1200.04
<i>SD</i>	154.54	12.15	60.69	92.47	544.36	55.50	216.38	623.11
<i>Minimum</i>	16	0	0	0	127	0	16	134
<i>Maximum</i>	782	72	316	539	3672	366	1071	4215
<i>Range</i>	766	72	316	539	3545	366	1055	4081

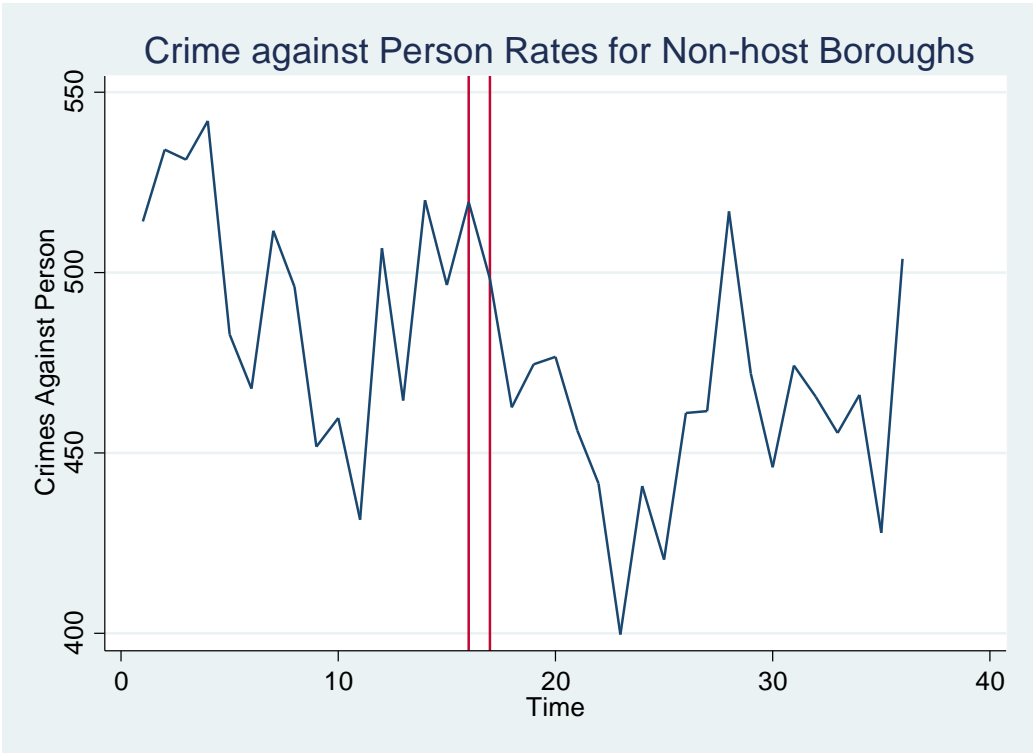
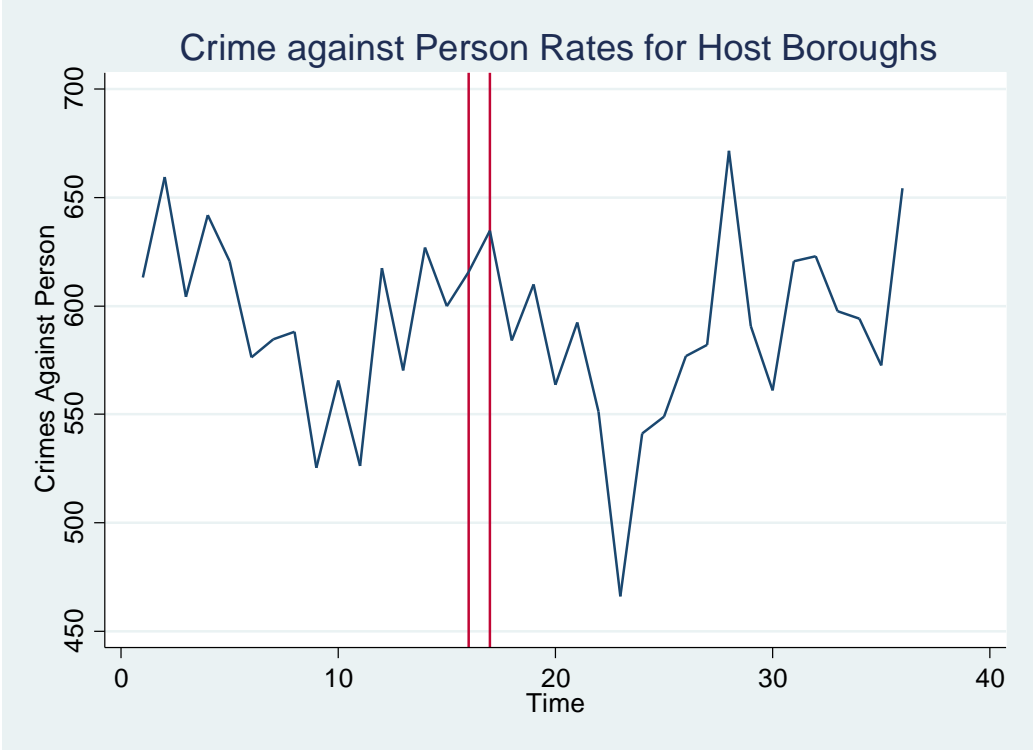


### Mean Occurrences by Crime Type

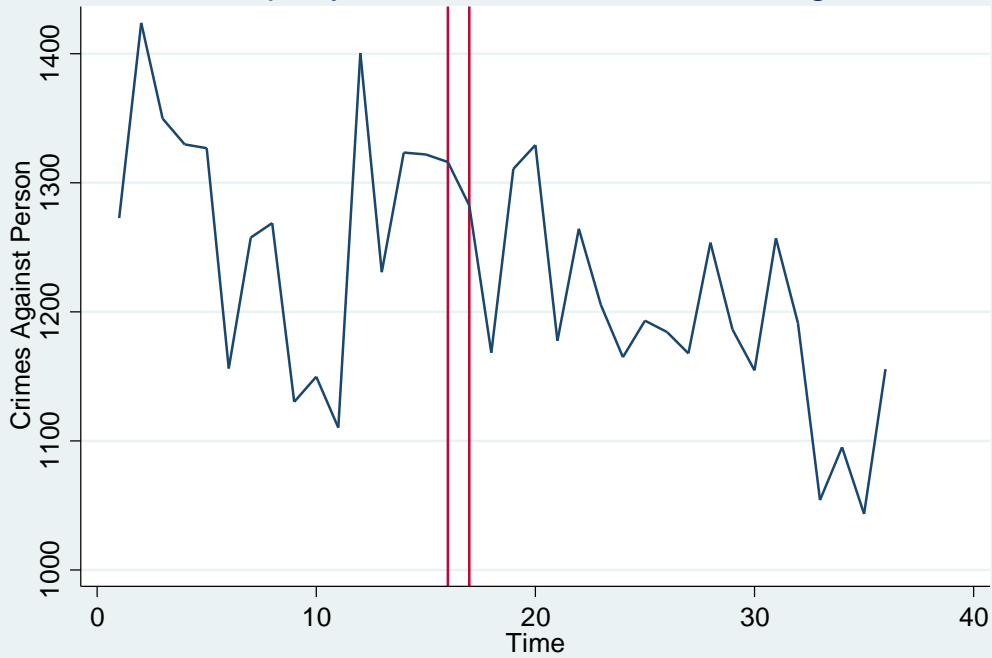


### Property and Personal Average Occurrence Comparison





### Property Crime Rates for Host Boroughs



### Property Crime Rates for Non-host Boroughs

