INFO W18 Section 1
Final Project Report
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The Shape of Crime in NYC

INTRODUCTION

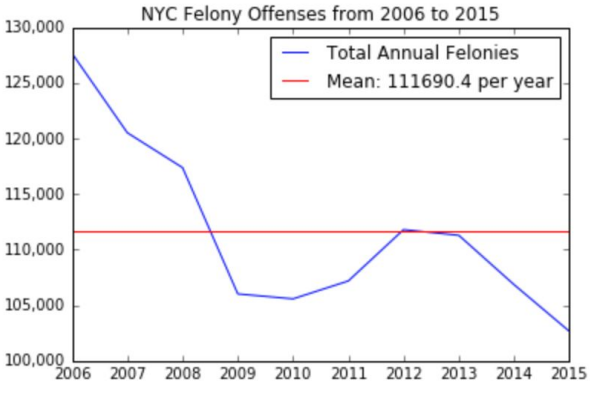
New York City has historically had a reputation for crime, but beyond the tourist anecdotes and TV show drama what does crime really look like for America's largest city? Extensive research by prominent sociologists and psychologists such as Berkeley's Dr. Emily Ozer[1] and Dr. Gayla Margolin[2] at the University of Southern California has long suggested a link between violence in a community and violence at school. Are patterns in New York crime levels reflected in its schools? In this report we explore felony level crime and incidents of school violence in NYC. Our analysis aims to identify trends in the type of crime and locations of each of these types of incidents as well as determine whether the data is consistent with a proposed relationship between community violence and school violence.

Our investigation relies on two data sources, both of which are made available to the public by the state of New York. The first is a quarterly report from the NYPD[3] that provides information about 1,123,465 felonies committed in New York City. The columns of this data set include the type of offense, the time in Eastern Time, and the location where it occurred. While the dates in the data set range from 1905 to 2015, initial analysis shows that 99% of the data falls within the time period between 2006 and 2015. We will focus our analysis on that time period.

The second data source consists of information from the Violent and Disruptive Incident Reports[4] (VADIR) that are filed annually by all New York Public Schools. We have pulled and collated the available data for the same time period as our NYPD dataset (2006-2015). Each of the 14,730 entries in this second dataset represent a single school's incidents in a single year. The categories of recorded incidents range from bullying and alcohol possession to kidnapping, assault and homicide. The data also includes information about the district and number of students for each school.

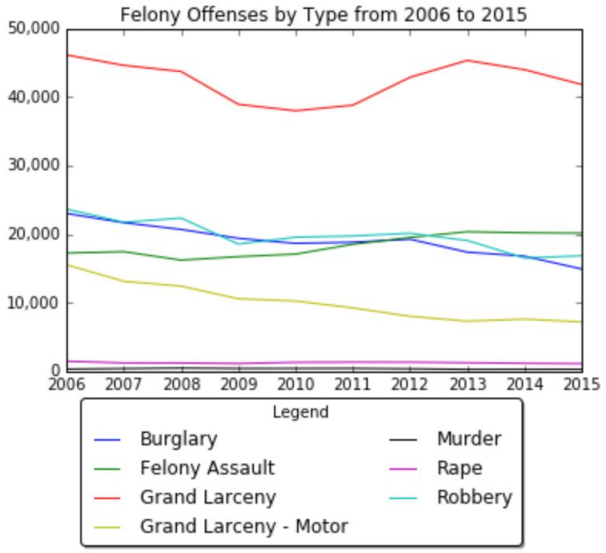
PART 1: How much crime and what kinds of crime occur in NYC and NYC schools?

Broadly speaking, felony crime in New York City has decreased over time since 2006, has risen and fallen on an annual cycle, and (except for "Grand Larceny") has been roughly proportional to borough population. Since 2006, the NYPD has recorded an average of 111,690 felonies per year with the highest number of felonies occurring in 2006 (127,649 felonies) and the lowest number occurring in 2015 (102,657 felonies). In the context of NYC's 2010 population (8,175,133) this average annual felony rate translates to roughly 0.013 crimes per person. To put this in context, Chicago Police Department's Bureau of Records reported per capita crime rate for 2014 was ~ 0.040 and



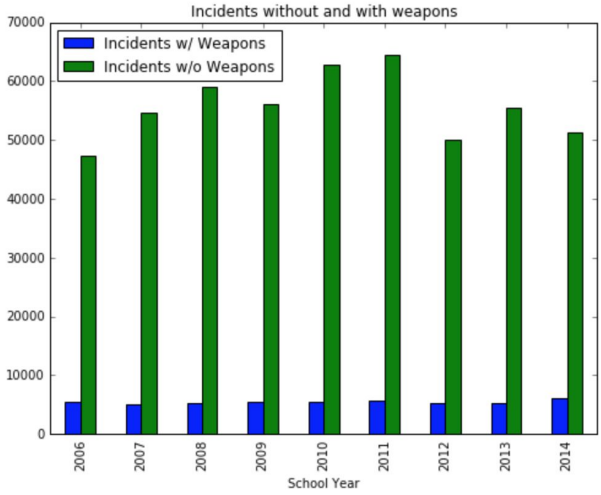
[1] Ozer, E.J. (2005). The impact of violence on urban adolescents: Longitudinal effects of perceived school connection and family support. *Journal of Adolescent Research*, 20(2), 167-192.
[2] Margolin, Gayla, et al. "The effects of family and community violence on children." *Annual review of psychology* 51.1 (2000).
[3] https://catalog.data.gov/dataset/nypd-7-major-felony-incidents
[4] http://www.p12.nysed.gov/irs/school_safety/school_safety_data_reporting.html

LA's 2013 per capita crime rate was ~0.026[5] (these numbers include both violent crime and property crime as does the NYPD data). The plot on the previous page shows NYC's downward trend in number of felonies each year. At right, a breakout by felony offense type reveals different trends in annual levels of different types of felonies.



Of the seven categories of felonies in our NYPD Dataset the number of incidents of Grand Larceny far exceed any other single felony (and constitute 38% of all felony incidents). The only offense type not declining over time is "Felony Assault". The most notably consistent decrease in crime rate is in auto theft ("Grand Larceny - Motor"). This view of the data also reveals that the dip in total felonies at the onset of the recent recession (2008-9) is primarily due to a reduction in "Grand Larceny" and "Robbery." As we'll discuss in the next section, this may be due to a broad definition of "Grand Larceny".

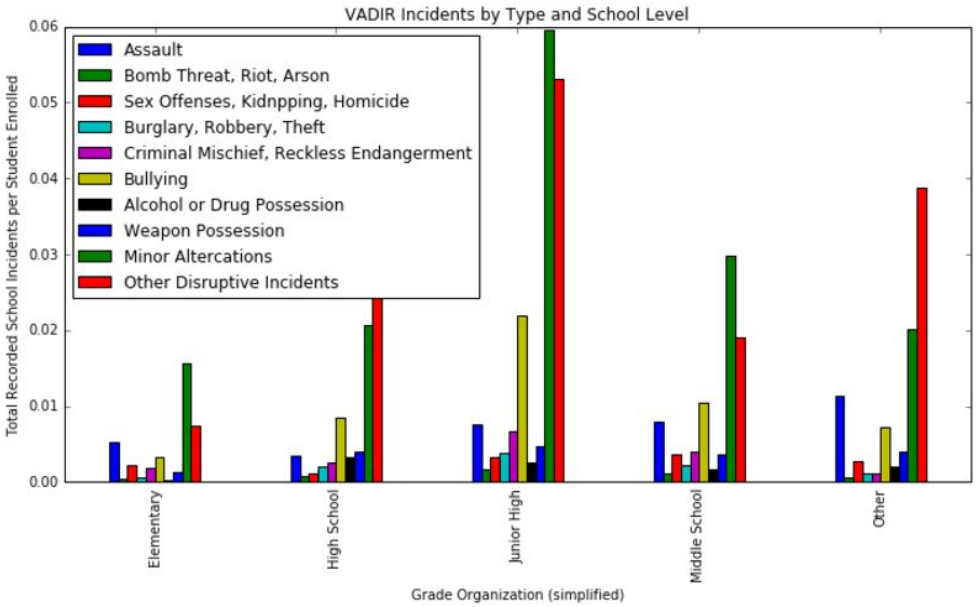
In contrast to New York's decreasing felony rates, school violence numbers since 2006 do not appear to have a clear downward or upward trend. On average, New York schools experience a total of 61,149 violent or disruptive incidents per year, of which 5,489 involve weapons on average. This translates to roughly 0.059 disruptions per student or alternatively, one incident for every 16.9 students. However we caution that these numbers may be biased or limiting due to the fact that incidents are self reported and that different schools may have different policies for how they classify incidents as 'disruptive' or not. The initial rise may simply indicate growing buy-in to reporting as the VADIR system was only recently adopted in 2005. The VADIR system was implemented because there was a growing discrepancy in city and state data over school violence. [6]



"Minor Altercations" is by far the most common category of disruptive incident in the VADIR dataset. With 186,486 reported events this category accounts for 34% of all reported incidents. The second most common category, "Other Disruptive Incidents," (incidents that do not fall under named categories but still resulted in a referral or disciplinary action) make up 158,045 events (28%).[7]

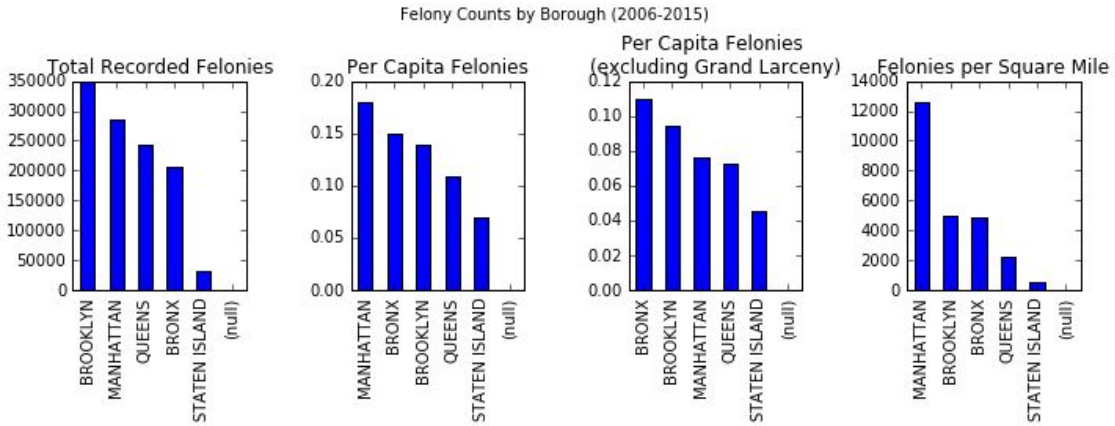
[5] https://en.wikipedia.org/wiki/Crime_in_Chicago, https://en.wikipedia.org/wiki/Crime_in_Los_Angeles
[6] http://www.wnyc.org/story/school-safety-incidents-vary-depending-who-counts/
[7] http://www.p12.nysed.gov/sss/ssae/schoolsafety/vadir/glossary08aaug.html

Diving in deeper into these categories by grade school, it's easy to see that the prevalence of "Minor Altercations" hold across all grade levels, even including the "Other" category which is made of specialty schools and smaller "K-12" schools. "Bullying", the third most common overall type of offense, happens more frequently in "Middle School" or "Junior High" levels. However, a possibly unexpected event is that "Criminal Mischief, Reckless Endangerment" has a higher frequency at the "Junior High" level than in the high school. This may be due to students escalating at the "High School" level going beyond the school into the community which could cause a population overlap in our felony data and school violence data. Or it could just be that students lash out more openly against authority at that age. Or it could be that students stop getting caught at the "High School" age. Moreover, "Assault" seems to have a diminishing count and proportion as age rises.

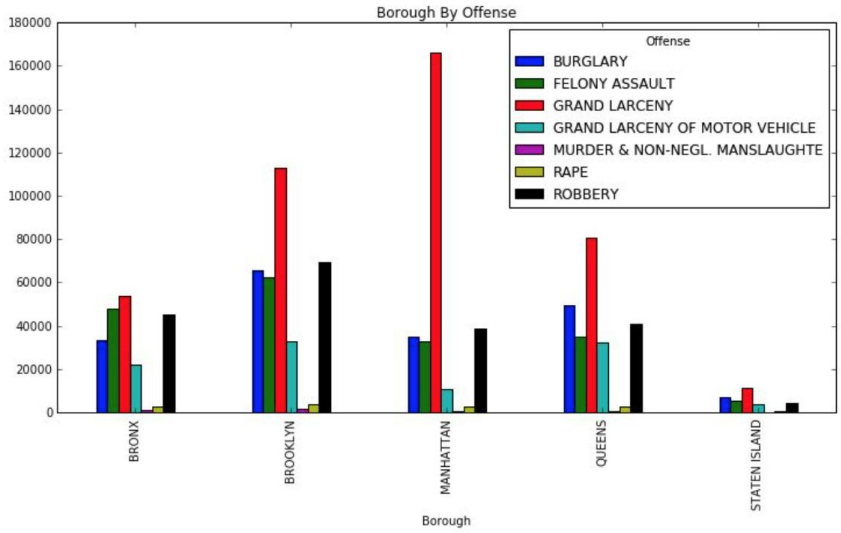


PART 2: How does crime vary by location and time?

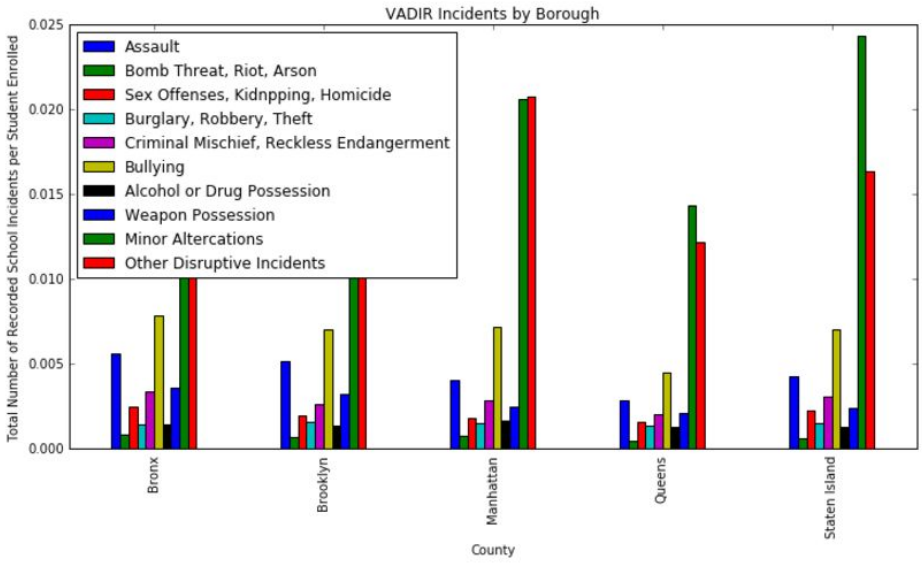
Given an initial picture of what kinds and how much felony crime and school violence occur each year in New York, we'll next look at how crime patterns differ by borough and over time. At first glance, Brooklyn has the highest number of felonies (349,301 in total) however the picture becomes more complicated when we take into consideration the varying populations and areas of each of the Boroughs. Manhattan has the highest per capita felonies (0.18) and felonies per square mile (>12,000), but if we exclude Grand Larceny (a crime that by definition will occur more in wealthier neighborhoods), then both the Bronx and Brooklyn's per capita felonies are higher (0.11 and 0.09 respectively).



As noted in part 1, not only is Grand Larceny the most prevalent of the New York Felony Offenses, but it is also the offense that is least proportional to borough population. This merits a closer look. Grand Larceny is broadly defined as "theft of personal property having a value above a legally specified amount"[8], however according to wikipedia there is often a murky distinction between crimes that are prosecuted as "Grand Larceny" and crimes that are considered "Embezzlement"[9]. A breakdown of felony type by borough shows that Manhattan, the financial center of the city, far exceeds the other boroughs in its numbers of "Grand Larceny" even though its other felony counts are roughly proportional to its smaller population and area. This further supports the theory that what we are seeing in the "Grand Larceny" numbers may be reflective of financial crimes instead of traditional 'theft'. Of course Manhattan is also among the wealthiest boroughs so without more data we cannot draw firm conclusions. Still, this is an important possibility to take into consideration when evaluating claims about NYC crime levels.



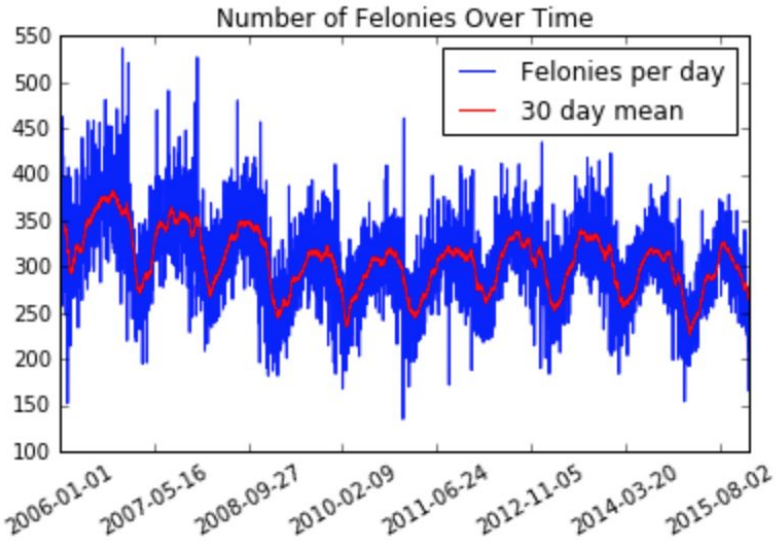
Like felony violence, school incidents also vary by borough but less than the felony data. When normalized per student, the ratios of different types of incidents are strikingly similar across boroughs. The top three non-generic categories are "Minor Altercations", "Bullying", and "Assault" from greatest to least, and the bottom three categories are generally "Bomb Threat, Riot, Arson", "Burglary, Robbery, and Theft", and "Alcohol or Drug Possession" from least to greatest. It seems that it doesn't matter if a student is from a wealthier neighborhood, a high-felony neighborhood, or a high-population neighborhood, the proportion of school incidents follow a similar pattern.

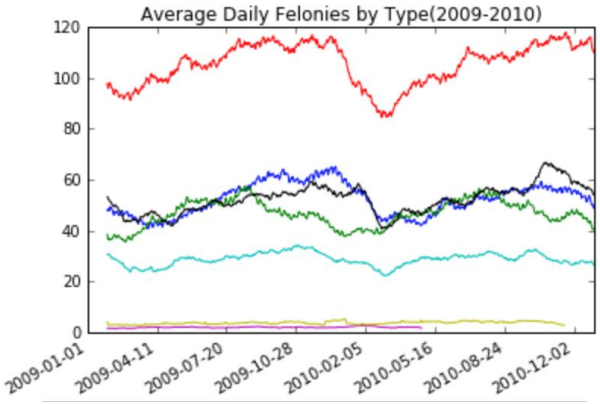


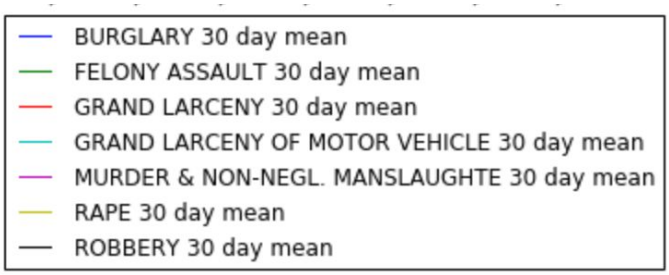
[8] http://legal-dictionary.thefreedictionary.com/grand+larceny

[9] https://en.wikipedia.org/wiki/Larceny

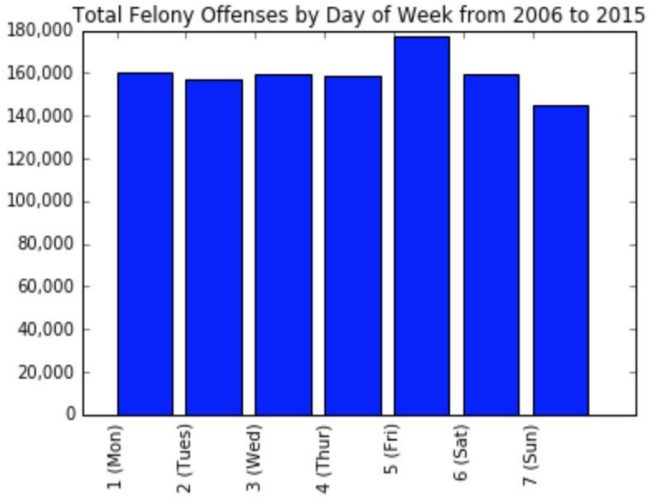
Another significant approach to the felony data is as a time series. The daily view of felony rates over the course of the year suggests a cyclical pattern to offenses over the course of the year. A close look at 2009 and 2010 shows that seasonal cycles bear up to some degree for all types of felonies except Rape and Murder. Both of these graphs suggest that crime peaks around October with the lowest levels of crime occurring in February. This could be due to seasonal fluctuations such as weather or changes in human behavior like relaxing and tightening of policing habits. However given our earlier observations and the fact that this 'seasonal cycle' is particularly pronounced for Grand Larceny, it is also possible that the record low in February may be connected in some way to a financial cycle that makes embezzlement more likely to be discovered and or committed at certain times of the year.





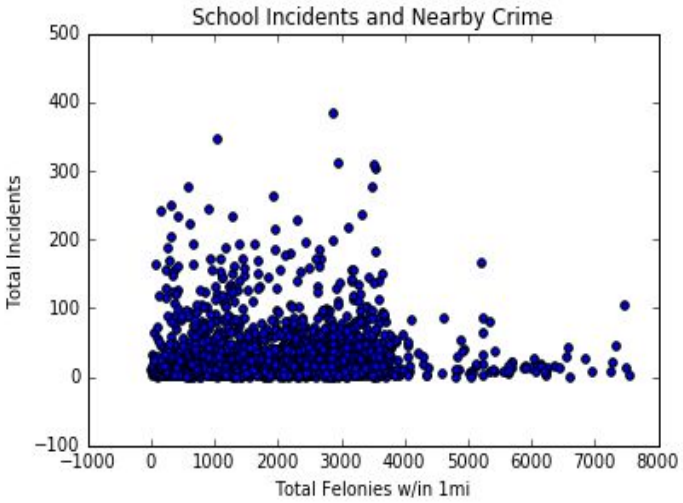


A final important observation about the timing of felony crime in NYC comes from looking at crimes by day of week. Friday shows a significant spike in number of felonies and comprises 15% of all the felonies in this dataset, while Sunday is clearly the lowest felony day of the week with only 13% of felonies occurring on a Sunday. The VADIR data does not include dates or time for incidents of school violence so we are unable to perform time series analysis of school violence for this project. However, future research might explore whether school violence also rises on Fridays.



PART 3: Is there a connection between school disruptions and community crime?

The final portion of our analysis explores whether this data is consistent with a proposed connection between school and community violence. Since 2006, New York City schools have experienced on average 37 disruptive incidents per year, 3 of which involved weapons. In the same timeframe, neighborhoods within a 1 mile radius of each school have experienced on average 411 robberies, 330 burglaries, 391 assaults, 155 auto thefts, 27 rapes and 9 murders. The "School Incidents and Nearby Crime" plot offers an initial look at the relationship between the total number of felonies that occur within a 1 mile radius of a school and the total number of disruptive incidents that occur that school in the same 1 year time period. A majority of schools are clustered in the region with less than 100 total incidents and less than 4,000 felonies, and both the explanatory and response variables seem to be heavily right-skewed.



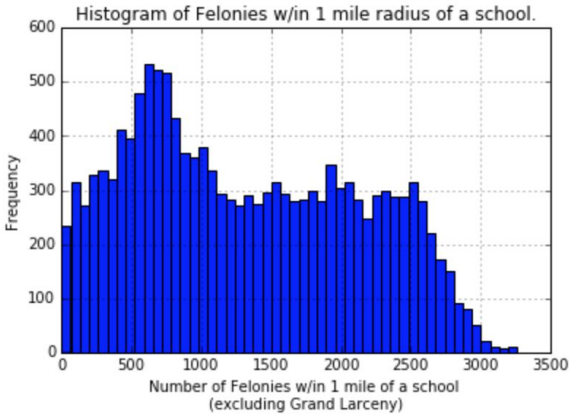
Given our prior analysis it seems likely that at least part of this skewness is due to the high proportion of "Grand Larceny" in the felony data and the high values of "Minor Altercations and Other Disruptive Incidents" in the school data. If indeed this is the case then we would not necessarily expect to see a correlation in this data since "Grand Larceny"(or embezzlement) is not the type of community crime theorized to affect school behavior. Furthermore the high number of reported "Minor Altercations" and "Other Disruptive Incidents" suggest that these categories may be used as catch-all categories by some self-reporting school administrators. If so, then the data in those categories is most likely reflective of administrative practices rather than a description of student behavior that can be compared from school to school.

A closer look at the outlying schools tentatively confirms some of these suspicions. Of the 14,730 VADIR Reports in our dataset, 54 records (20 unique schools) came from schools whose immediate (1mi) neighborhood experienced over 7,000 felonies in at least one year between 2006 and 2015. All 54 of these records represent public schools, and 48 are located in Manhattan. This group of schools has lower than average incidents of school violence in every category except Theft/Burglary and Alcohol or Drug Possession. These supposedly high-crime, low-disruption schools are not actually schools in violent and disruptive communities but rather are schools in a wealthier borough where a lot of Grand Larceny occurs.

In the same dataset, at the other end of the spectrum, 37 records (representing 24 unique schools) show an annual VADIR incident rate of over 400 incidents for at least one year between 2006 and 2015. Of these records, 25 are from Charter schools, 14 are located in Brooklyn and 10 are Elementary Schools. The average reported number of "Other Disruptive Incidents" for this group of schools is 439 per year (as compared to a mean of ~10 and standard deviation of 32 for the rest of

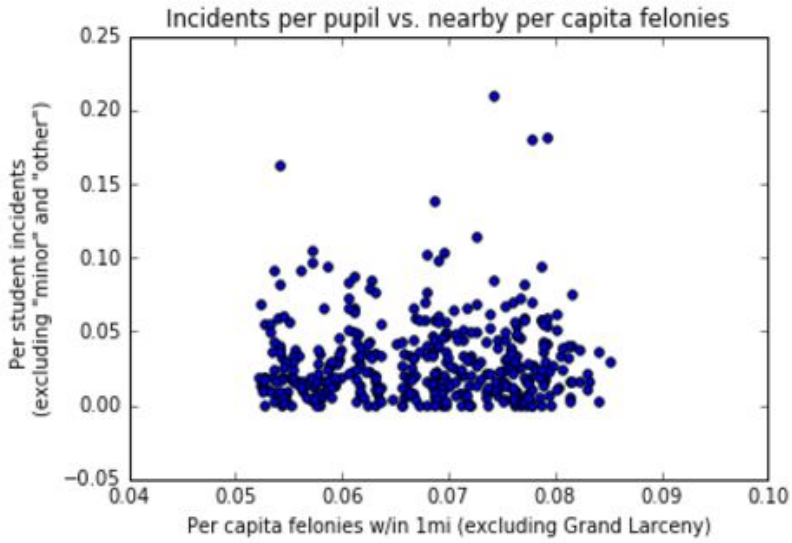
the data set!). Although we hesitate to conclusively say that these schools are not more disruptive than their peers, we strongly suspect that there may be other causes of their abnormal data.

Although the data has provided a fairly clear story for these two subsets of schools, the picture is less clear for the rest of the data. This histogram at right shows that if we disregard the category of "Grand Larceny" the majority of schools experience from 0 to 3500 felonies in their neighborhood (1mi radius) each year.



To further examine the data beyond the skew effects discussed above, we also excluded "Minor Altercations" and "Other Disruptive Incidents" from school incident tallies. To better compare schools of different size, we computed "Incidents per Student" using enrollment numbers and normed the values for felonies using population density of the borough in which the school was located. The scatterplot below shows a subset of this data for the year 2010. Although this view no longer shows the strong clustering along the x-axis the data still do not appear to show a clear relationship between felony incidents and school disruptions.

Despite the lack of visible trend in this scatterplot there is some evidence to suggest that the schools with the most disruptions are located in neighborhoods with high numbers of felonies. When looking at the top 75th percentile of Non-"Grand Larceny" per capita felony rate within one mile radius of the school we see 526 unique schools. When cross referencing these schools with the top 75th percentile of per-student incidents excluding "Minor Altercations" and "Other Disruptive Incidents" (995 unique schools), 304 of these schools are in both data sets. That's about 58% of the non-larceny per capita schools.



In conclusion this data is neither consistent nor inconsistent with a possible relationship between community violence and school disruptions. More research and maybe different data would be needed to truly answer such questions.

CONCLUSION

In summary, New York City has experienced a reduction in felony crime during the time period from 2006 to 2015. Grand Larceny is by and large the most robust felony, possibly due to its broad definition and possibly due to it being a "catch all" type of category. There is evidence to suggest a temporal aspect to crime, maximizing in October and minimizing in February. Interestingly, there are six months between the optimal months of crime. In terms of school violence, minor altercations make up the majority of the events while the major felony-type of incidents such as homicides and bomb threats make a very minor portion of the total population, which we can all agree is a good thing. Broken up by borough, the school violent incidents are extremely disparate using counts, but when the data is normalized, the proportions of incidents are surprisingly similar in the inter-borough comparisons. After a good deal of analysis, we conclude that NYPD felony data and VADIR incident reports are neither consistent nor inconsistent with a proposed relationship between community crime and school violence.

There are multiple questions that the above analyses raise but we lack data to answer. What is causing the drop in felony crimes over time? What is the crossover of students (in any grade) who are charged with felonies? Is there a consistent definition of "Grand Larceny" compared with "Embezzlement" in each borough? How many different categories are combined to make the known "catch all" type of scenarios, such as "Minor Altercations" or "Other Disruptive Incidents"? Future work is needed to focus on these questions as well as a more in depth understanding of the kinds of crimes and incidents reported in each of our datasets, and how reporting practices may inform our understanding of the shape of crime in New York City.