Final Report Summary

The Bloomingdale Trail and Park, known colloquially as The 606, is a 2.7-mile long, elevated rails-to-trail project located in Chicago's Northwest side. Opened in June 2015, The 606 runs through four neighborhoods (Wicker Park, Bucktown, Humboldt Park, and Logan Square), with 13 distinct access points (Figure 1). By many measures, the multiuse trail has been successful; although numbers on estimated use are difficult to verify, the Trust for Public Land estimates 80,000 people live within a ten-minute walk of the trail. However, the increased mobility and promise of economic development brought by the project has prompted critics to claim the trail is responsible for elevated crime in the area. For this project, I aimed to test whether that fear was well founded – that is, answer the question: **what impact has the construction of the Bloomingdale Line Trail and Park had on patterns of criminal activity in the surrounding community?**

I. Project Overview

To evaluate the trail's overall effect since its opening on June 6, 2015, I pulled historical crime data from the City of Chicago's Data Portal (Figure 2). This dataset included police incidents since 2001, as reported in the Chicago Police Department's CLEAR system, with information on each entry including coordinate location, relevant police beat area, arrest outcome, and primary crime type. To this, I added features of the Euclidean distance, as well as the cardinal direction, for each observation, relative to the trail.

Narrowing the scope of inquiry, I decided to consider only incidents within the police beat areas directly bordering the trail. Bounding selections based on police beat seemed a natural choice as the smallest and most relevant areal unit: crime events are reported and investigated based on these administrative boundaries. Furthermore, I chose only beats contingent to the trail, as I was most concerned with its local effect. If the trail was exerting an influence on crime, I reasoned, it would be through either two different causal mechanisms: one, the trail could serve to draw more individuals to the area – thus, increasing the opportunities for crime – or, as an elevated path with restricted entrances, to provide a means of comparatively shielded transportation to or away from targets, decreasing the relative cost of crime.

Therefore, I was left with a dataset comprising crime events occurring in each of the five police beat areas bordering the trail between June 6, 2015 (the date of the trail's opening) and ending approximately 16 months later, on November 1, 2016. Of these 6,119 events, the most commonly observed primary crime type was theft, at a rate of around 30.0%, followed by battery at 15.6% and criminal damage at 12.0%. Interestingly, only 976, or about 16% of crimes resulted in an arrest.

II. Research Methodology

In an attempt to gain a rough understanding of crime distribution in the selected area, I first performed some preliminary, exploratory data analysis. I began by looking to point-distance measures of contiguity for suggestions of clustering. At a critical distance of approximately .07 miles, I constructed a threshold weight function for the crime data. While the connectivity histogram was fairly symmetric, with a slight left tail, a cluster of about 100 outlying observations occurred above a 150 nearest neighbor count. This hotspot was located at the intersection of North, Damen, and Milwaukee Ave, about two blocks south of The 606 (Figure 3). By all appearances, this cluster is unrelated to the trail: the area is a popular commercial and retail center, near the CTA Blue Line Damen Station. Perhaps unsurprisingly, given this fact, the majority of these crimes – over 58% – were for theft, consistent with the narrative of a largely retail presence.

A. Point-Pattern Analysis

With this in mind, I needed a slightly more rigorous assessment of event spatial correlation. To do so, I had to first convert the projection of the data points, in order to extract meaningful distance measures. Having created an accurate point-pattern object, I was able to calculate an average intensity of observed crime within the selected region of about 6.4×10^{-4} events per square foot; likewise, a simple visual assessment of the point-pattern map suggests a nearly uniformly high concentration of crime.

Next, I used a kernel density function to estimate changes in point-pattern intensity across the region. For an initial estimate, I took the default Gaussian kernel function, with a standard deviation bandwidth (Figure 4). The resulting graph is consistent with the previous, exploratory data analysis: a hotspot appears near the six-way intersection of North, Damen, and Milwaukee Ave, to the south-east of the region. Unsurprisingly, an apparent cold spot exists on the eastern border of the area, where the Kennedy Expressway intersects the police beat. While points of elevated intensity occurred congruent with The 606, the direction of correlation appears to run north-south, rather than east-west, suggesting little direct effect of the trail. Overall, the density function proved very sensitive to bandwidth values; the map in Figure 4 seemed optimal, in returning a level of smoothing amenable to interpretable results.

From the kernel density map, then, I extracted evidence of spatial clustering in crime location. To test against the null hypothesis of complete spatial randomness, I next computed nearest neighbor statistics on dataset. For this approach, I used a convex hull polygon, rather than the police beat limits, to bound the data. I believe this approach gave a truer representation of the set of event spatial possibilities, as, on the eastern border of the selected region, the beat boundaries contain land belonging to the Chicago River. The graph of a J statistic function on the data is given in Figure 5. The results do not appear particularly sensitive to how the function is estimated or the border effects treated: for all estimates, across the entire range of distances, the functions are below the theoretical Poisson point process value of 1, suggesting the presence of clustering. Looking to the randomized envelope (Figure 5), the observed J function is consistently below the range of randomization. Altogether, then, this analysis suggests evidence of clustering, but not in a systematic way that would indicate a spatial influence of The 606.

B. Aggregating Analysis

While the point-pattern analysis gave little support to the hypothesis of The 606 brought increased crime to its neighborhood, possible correlations could be masked by exogenous variables. Therefore, I attempted aggregating analysis in an effort to extricate the particular effect of the trail. I began with a hedonic approach, measuring crime, over the time period in observation, for beat areas near the trail compared to those directly on it. In this way, the trail served as a ‘treatment’, and difference could be measured in resulting crime rates between ‘treated’ and ‘untreated’ beats. In order to do so, I made two main, not unreasonable, assumptions: one, that neighboring beats were similar enough to compare, and, two, that the number of reported crimes could be safely aggregated within a beat for the given time period. By design, beat areas are constructed similarly, so that police resources are allocated more efficiently. Therefore, I feel somewhat justified presupposing base-line homogeneity, as well as in comparing gross observations, across neighboring beats. While this approach is imperfect, it is, I believe, fair, given existing information constrains.

For this new area subset, I defined a nearby beat as within one order of queen contiguity to a trail contingent beat. In total, this added 15 beat areas, and an additional 19,728 observations to the dataset. Reassuringly, the distribution of primary crime types remained similar: 28.2% of reported crimes were for theft, 16.7% for battery, and 11.4% for criminal damage. A choropleth map of percentile observations is given in Figure 7. The raw distribution of crimes skewed slightly left, with a single beat maximum of 2,326, and median of 1,146 events. No obvious clustering was evident around the location of the trail, although an east-west intensity split seemed possible.

Continuing with the beat-level analysis, I computed a univariate local Moran’s I statistic to detect clustering of crime intensity within each selected police beat area. To do so, I used an order-one, queen contiguity weight function. The calculated value of Moran’s I was both positive and significant, suggesting a clustering of like values (Figure 8). The beats located on the trail are shown in red; overall, they appear fairly close to the mean. At a bandwidth of 0.5, the Lowess regression slope through the plotted points had a sharp peak around the graph’s origin, suggesting a possible structural break in the data. The resultant beat areas in the high-high quadrant of the Moran scatter plot were all located along the southwest edge of the selected region (Figure 9).

The cluster map computed from the local Moran statistic is given in Figure 10. Two significant groupings exist: a high-low cluster of three beats in the southeast, and a low-low cluster of two beats in the north-center of the region. The same results hold for both G and G* cluster detection. A beat area containing The 606 is located in each cluster; this would suggest that, either, if the trail had any effect on crime, it would not be applied uniformly across its run, or that the effect of the trail is overwhelmed by simultaneous, competing influences.

With this in mind, then, I created various exploratory variogram mappings for the same observations. The cloud variogram scatterplot (Figure 11) shows a few potential outliers, with a strong suggestion of anisotropy; the semivariance in number of crimes per beat increases with distance. The empirical variogram, at a cut-off distance of 0.04 miles (Figure 12) weakly levels off after a sharp peak. Both these plots indicate a degree of spatial dependence in the data; although, taken with the previously discussed statistics, they do not strongly suggest a role for The 606 in this correlation.

Ideally, an analysis on the effect of The 606 would incorporate spatial as well as temporal controls. Constrained by limitations of technique and time, I attempted a pseudo difference-in-difference approach: for three years – 2014, 2015, and 2016 – I calculated the aggregate crime for each of the police beats in the regions near The 606. I chose to group by month in order to control for seasonality effects on crime, while allowing for easier time-unit comparison. During this time, total crime fell, from 18,722 reported incidents in November, 2014, to 17,562 in 2015, and 15,380 in 2016. Looking at the averages chart of these three time periods shows the mean difference in crime between beats selected on whether a beat was adjacent to the trail below that of those nearby to it (Figure 13). Running a difference-in-difference OLS regression test, though, did not find a statistically significant difference between the 'treated' and 'untreated' beats. This temporally-based analysis would agree with the previous, solely spatially based analysis, in describing a negligible effect of The 606 on crime in the local community.

III. Discussion

Ultimately, then, from each of examined means of analysis – point-pattern, aggregated, and temporal – The 606 would appear to have little impact on criminal activity in the surrounding community. While this results may disappoint from an academic standpoint, it is perhaps reassuring to policymakers – it may be an instructive addition to the broader, national discussion of rails-to-trails programs. As part of initiatives to promote green space, urban renewal, and alternative transportation, such a policy, in this instance, does not show immediate evidence of negative, criminal externalities.

Opportunities for further research on the topic certainly exist. I would like to more rigorously test the dynamic component of this analysis, perhaps incorporating more time periods, or a more granular scope to time. However, I believe the above results are sound. I can safely refute some of the criticism associated with The 606 project, while suggesting the possibility of broader policy implications.

IV. Figures

Figure 1

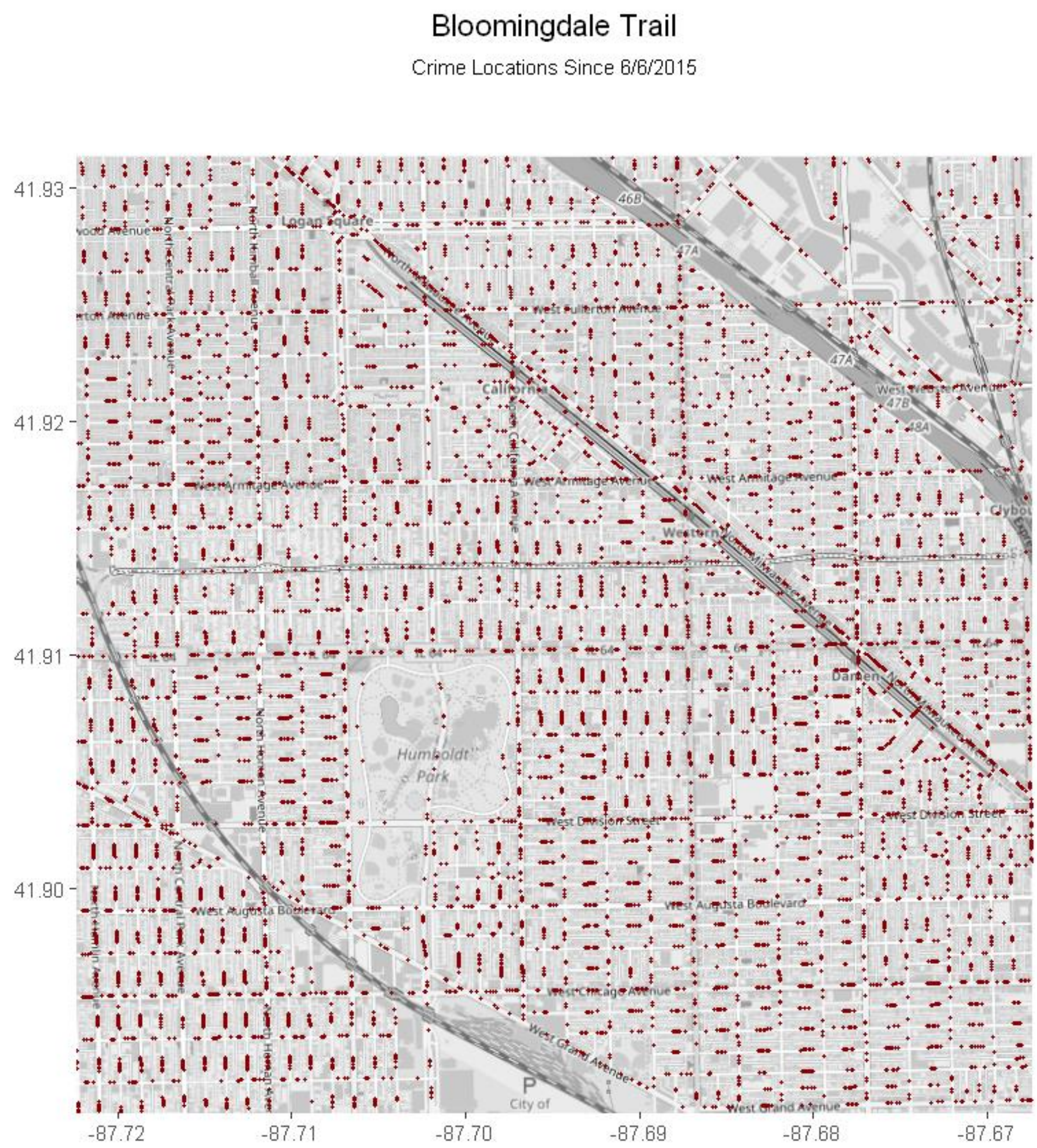
Bloomingdale Trail
Crime Locations Since 6/6/2015
41.93
41.92
41.91
41.90
-87.72
-87.71
-87.70
-87.69
-87.68
-87.67
Logan Square
West Fullerton Avenue
California
West Armitage Avenue
West Armitage Avenue
West Armitage Avenue
Western
Damen
Humboldt Park
West Division Street
West Division Street
West Augusta Boulevard
West Augusta Boulevard
West Chicago Avenue
West Grand Avenue
West Grand Avenue
46B
47A
47B
48A

Figure 2

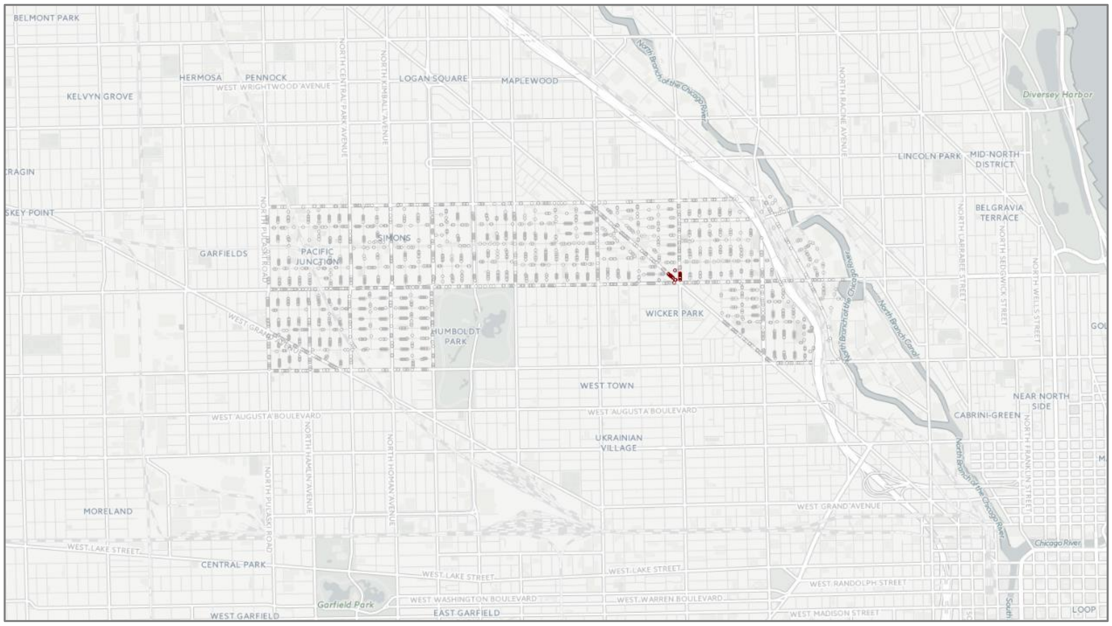

Figure 3

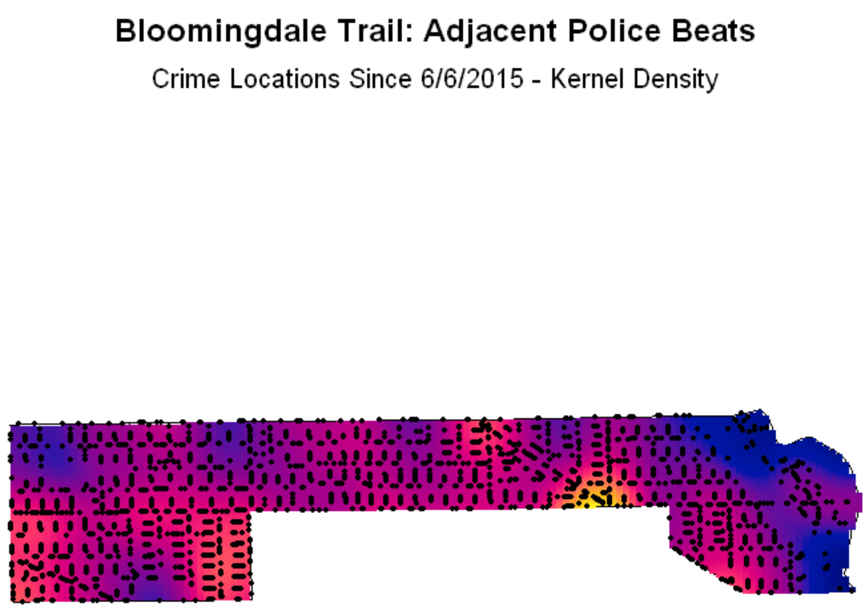

Figure 4

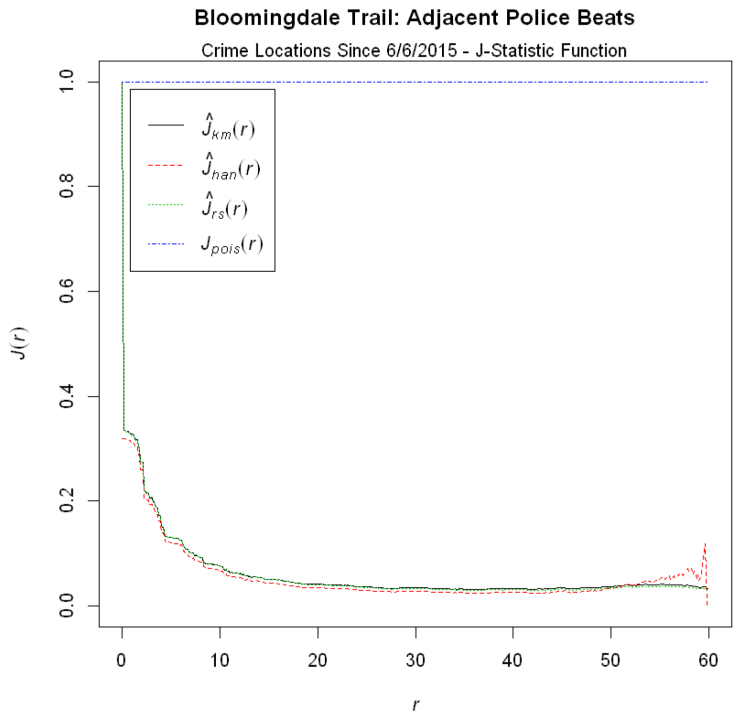

Figure 5

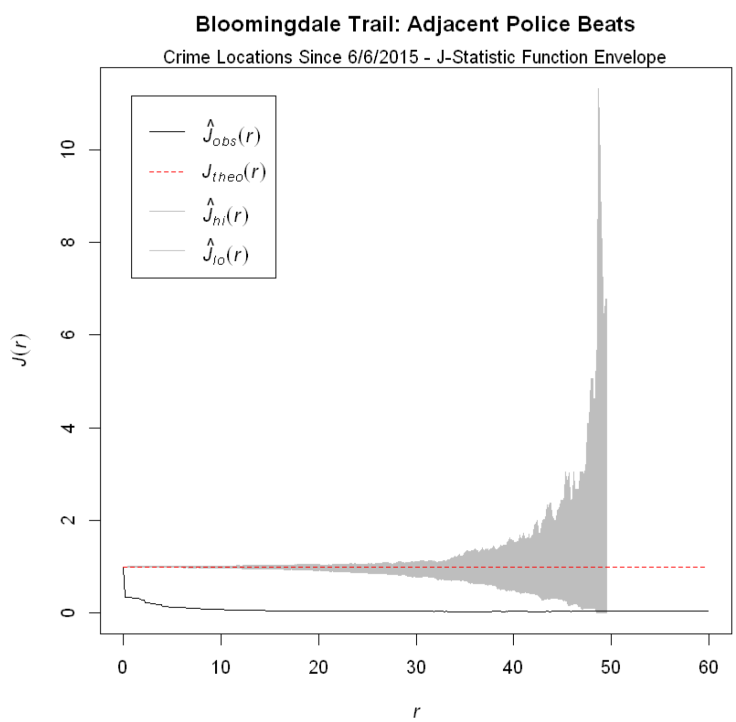

Figure 6

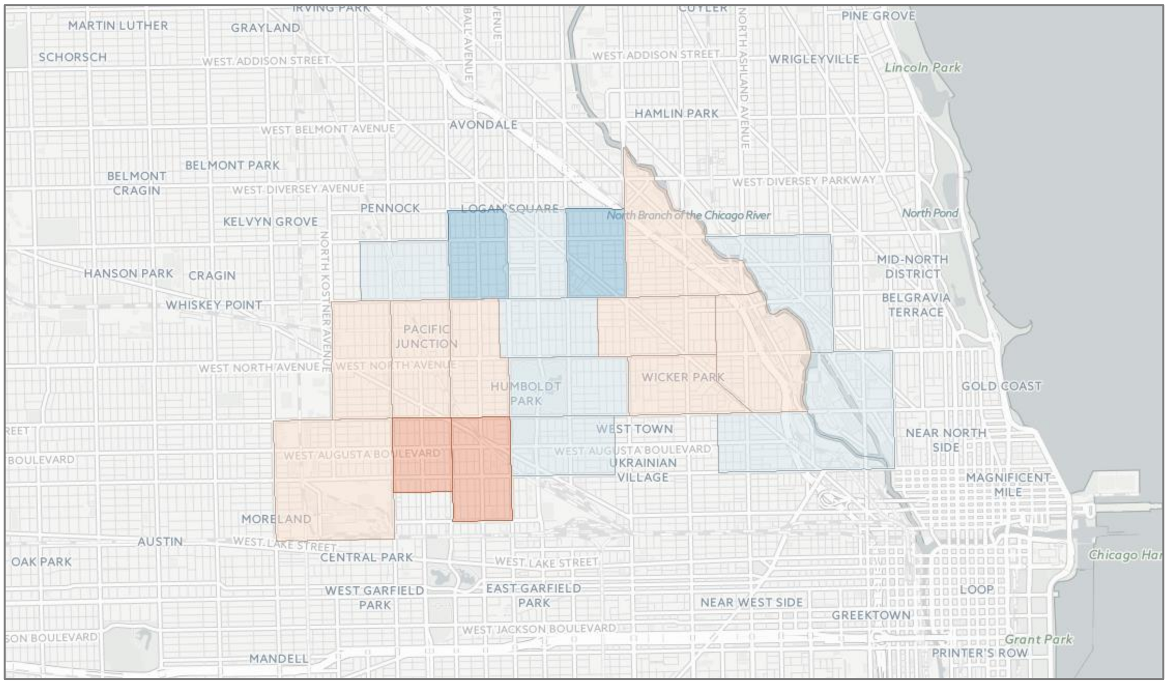

Figure 7

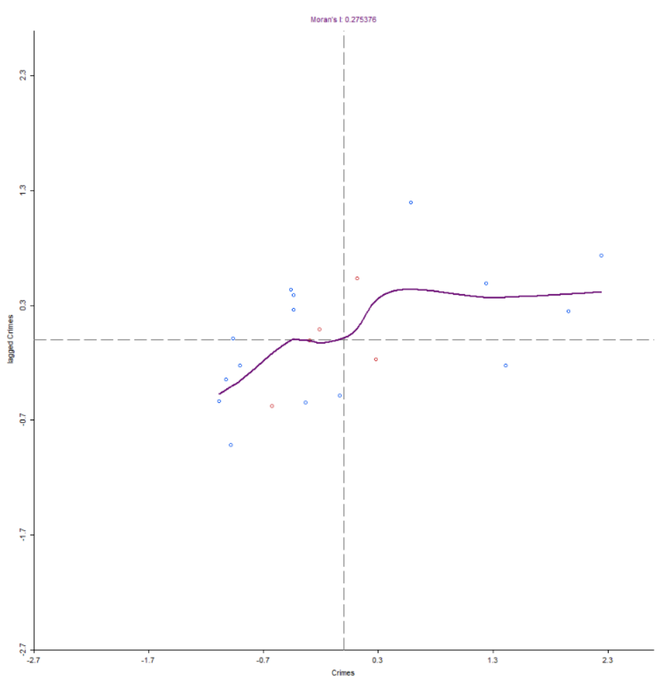

Figure 8

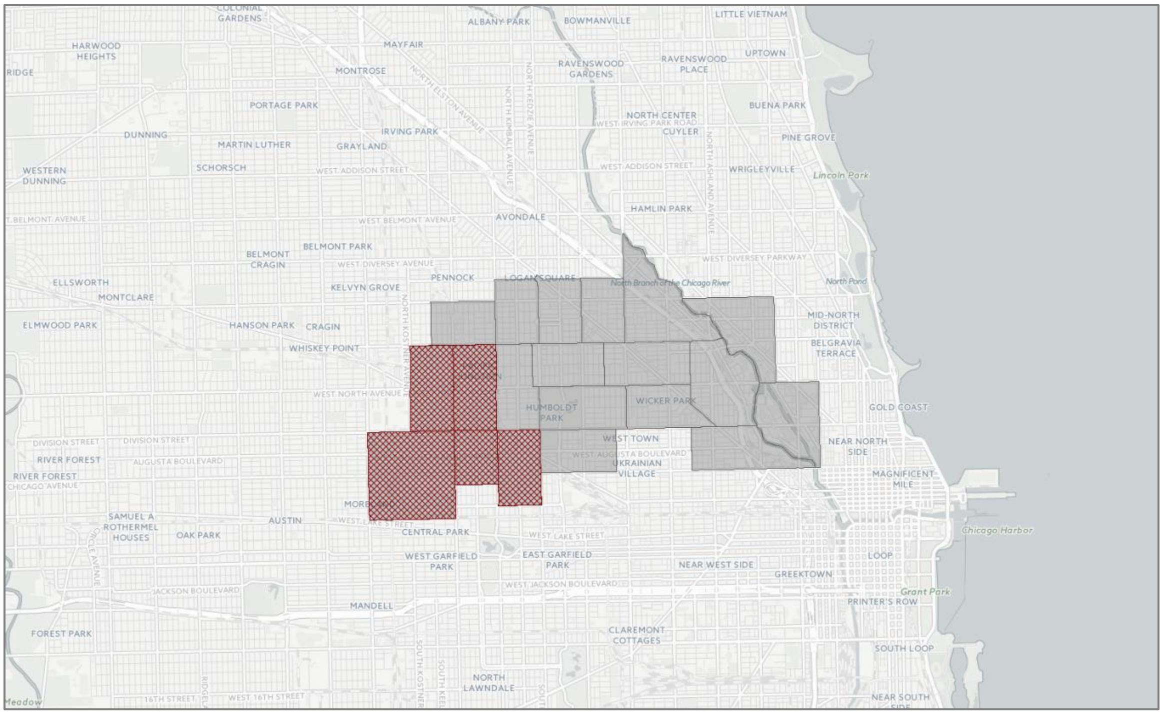

Figure 9

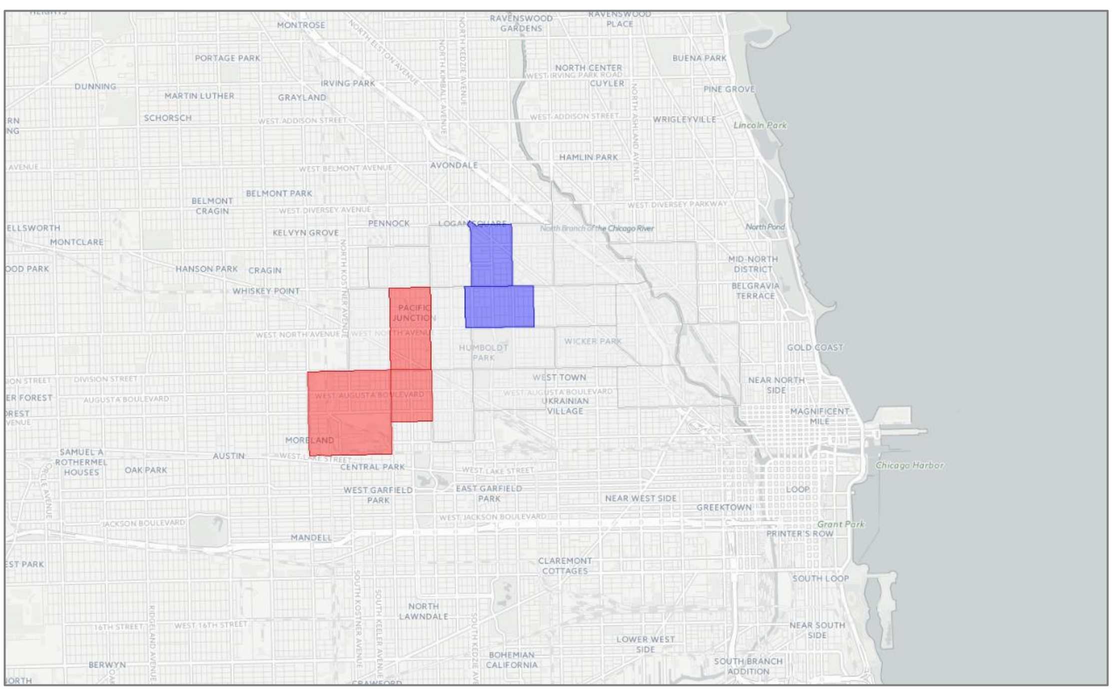

Figure 10

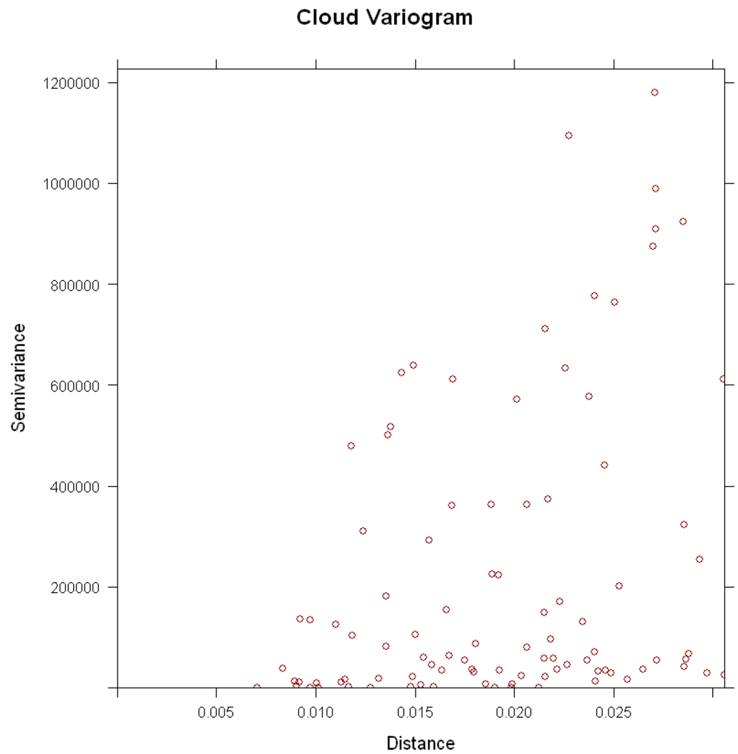

Figure 11

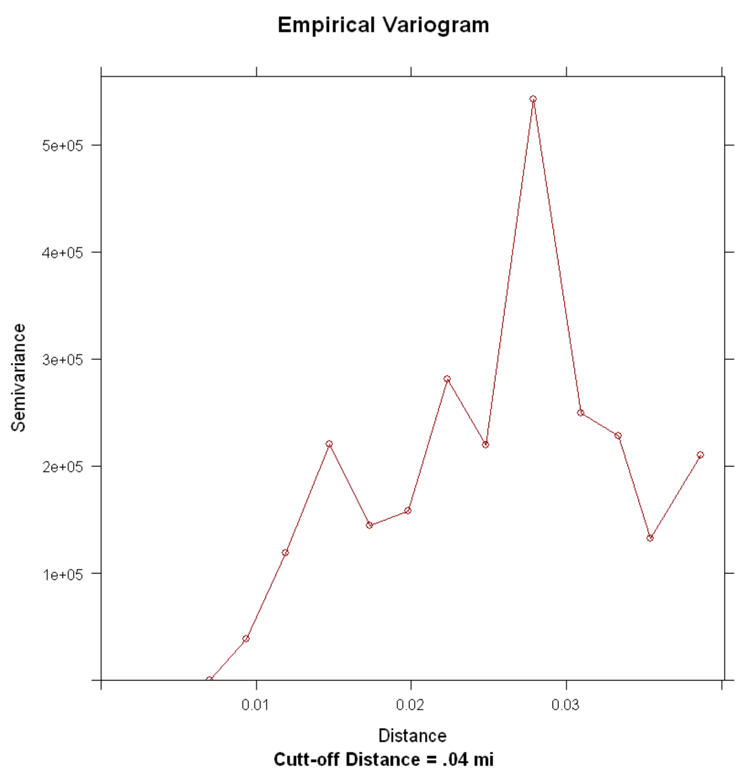

Figure 12

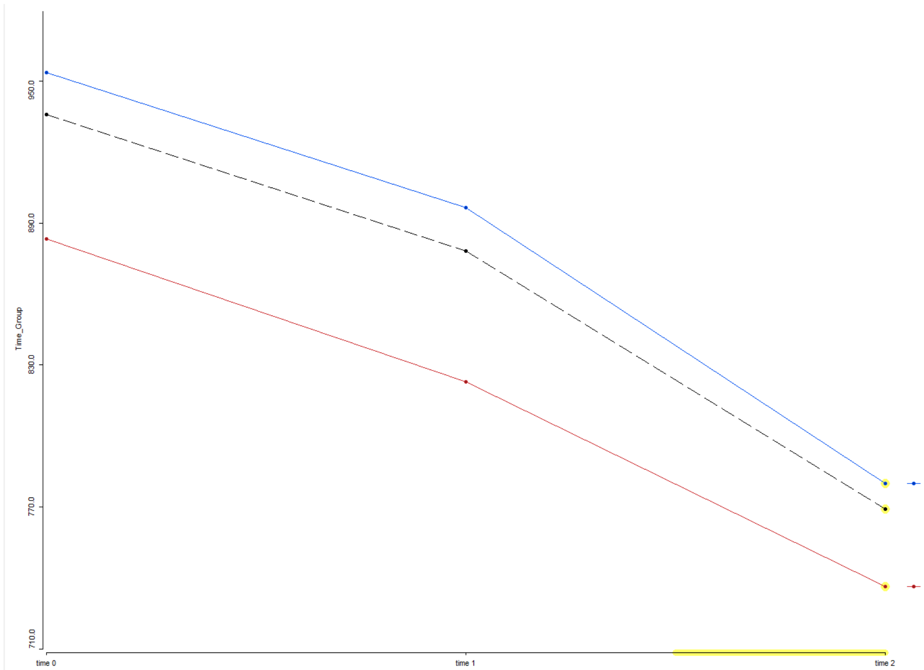

Figure 13