

## Relationship Between Disadvantage and Crime using Geodemographics

### Introduction

In this assignment, the goal was to explore the relationship between disadvantage and crime by comparing the two in a bivariate choropleth map. Exploring the spatial patterns assists in the identification of areas that are in need of help in the form of policing and social assistance.

### Data and Methods

Data for the project was collected via the US Census Bureau and the Philadelphia Police Department. The data from the Census Bureau includes census tracts and demographic information by census tract such as the percentage of families in poverty, percentage households headed by a single female with children, percentage of people over 25 with a Bachelor's degree or higher, percentage of housing units that are owner occupied, as well as total population. The data from the Philadelphia Police Department includes the location and type of crimes committed in 2017.

First, the Census Bureau census tracts were changed to project into Pennsylvania State Plane South and then limited the tracts to the City of Philadelphia. Separately, the crime data was limited to only violent crimes which include Aggravated Assault Firearm, Aggravated Assault No Firearm, Homicide – Criminal, Other Assaults, Rape, Robbery Firearm, or Robbery No Firearm. After this was done, the demographic data from the US Census Bureau was joined to the census tract shape file. As the data came from separate tables, the necessary data was saved and then the join was undone to allow for another join. With the necessary data in the shapefile, the socioeconomic disadvantage index was found for each census tract within Philadelphia. The formula to find the socioeconomic disadvantage index is  $((a/10) + (b/10)) - ((c/10) + (d/10)) / 4$  with each variable representing the saved demographic information in order. Once this was done, the violent crime data was joined with the census tracts and the number of the crimes per census tract was added together.

With the disadvantage index and the crime data in the census tract shape file, the correlation between disadvantage and crime is able to be visualized in a bivariate choropleth map and a scatterplot. The map divides the census tracts into 4 categories which include high disadvantage and high crime, low disadvantage and low crime, high disadvantage and low crime, and low disadvantage and high crime. This is also represented in a scatter plot where the correlation between disadvantage and crime is visualized.

### Results

The relationship between disadvantage and crime is visualized in a scatter plot (Figure 1) which shows a positive relationship of 0.39. The data was also visualized by census tract in the form of a bivariate choropleth map (Figure 2) to show the relationship between disadvantage and

crime in different areas of the city. A large part of the city has both a large disadvantage index and a high violent crime rate, concentrated mostly in the north, west, and southwest sections of the city. The next largest correlation is low disadvantage index and low crime, concentrated mostly in Center City, the northwest, and the far northeast. The census tracts that have the highest levels of disadvantage are mostly within North Philadelphia include tracts 69, 165, 147, 177.01, and 176.02. The tracts with the highest levels of crime are in Center City or in North Philadelphia include tracts 178, 350, 111, 1, and 255. All of these tracts listed are in the category of high crime and high disadvantage. However, several neighborhoods have mismatched disadvantage and crime levels, meaning that these neighborhoods have either low disadvantage and high crime or high disadvantage and low crime.

## **Discussion**

With a positive relationship between disadvantage and crime of 0.39, it can be gathered that neighborhoods with high disadvantage will most likely have high crime. However, there are several exceptions to this within the City of Philadelphia. Areas that have high disadvantage but have low crime include the neighborhoods of Oxford Circle, Rawnhurst, and parts of Olney. This could be due to the popularity of these neighborhoods with recent immigrants, who may have moved to the country with little and are working towards building wealth. Some areas have the inverse, with low disadvantage but high crime. Point Breeze, West Oak Lane, and Center City are areas that experience this phenomenon. The cause for high crime in areas such as Center City could be due to the area's vast amount of commercial space, which attracts many people from throughout the city. For the most part, most neighborhoods follow the expectation that high disadvantages are equal to high crime. If the data were to be improved upon at all, the inclusion of more factors of disadvantage and a broader range of crime definitions would make a more accurate map.

## Tables and Figures

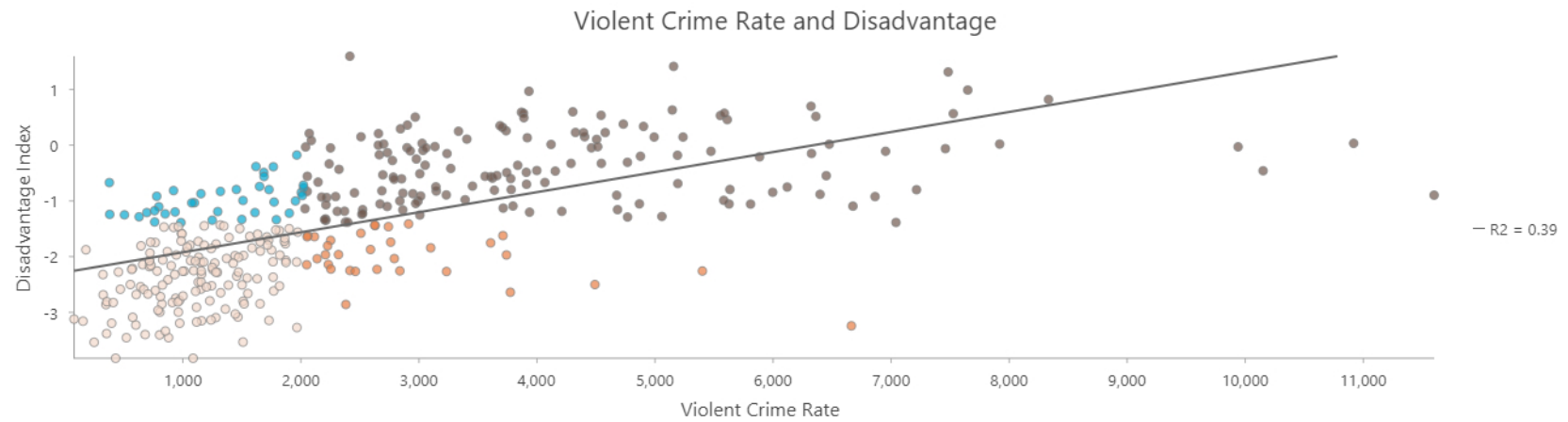
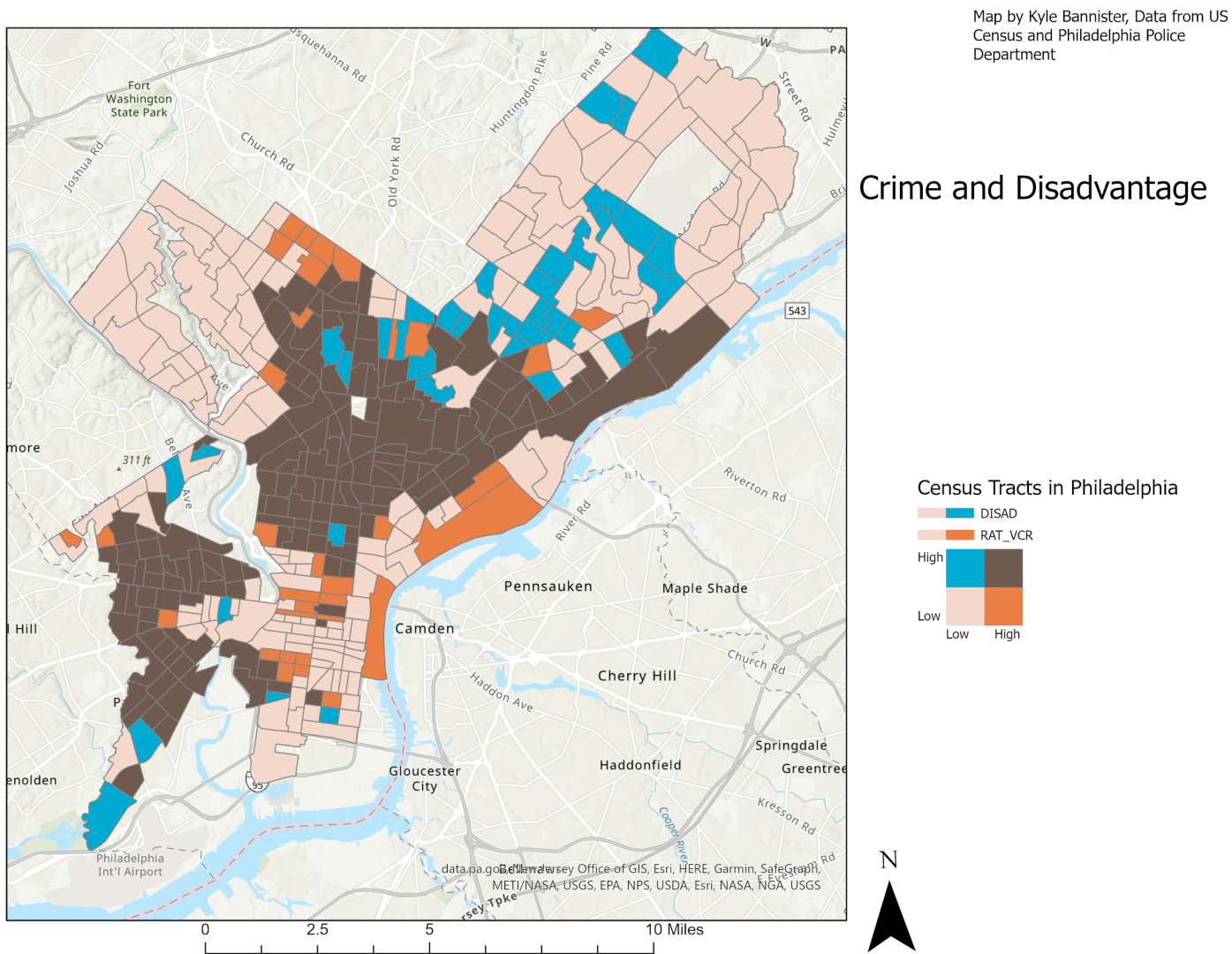


Figure 1 . Scatterplot of Violent Crime Rate and Disadvantage by Census Tract in Philadelphia



**Figure 2**  
 Bivariate Choropleth Map of the relationship between disadvantage (DISAD) and crime (RAT\_VCR) by census tract within the City of Philadelphia.