

Crime Rate in American Cities

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## **Abstract**

Previous studies have done research on the effect of educational attainment and the effect of unemployment on crime rate. The purpose of this study is to see if factors such as number of police, education level of the civilian population, unemployment rate, income per capita, and ethnic composition of a population have an effect on crime rate per 100,000 population. A sample of 20 cities from five geographical locations in the United States was taken. Data used for the model was from the year 2016. According to the data collected, there was no significance between income per capita and the crime rate ( $p=.296$ ). However, there was a significant relationship between the percentage with bachelor's degree and crime rate ( $p=.028$ ). Crime rate seems to be the highest at Midwest region ( $M=610.7$ ) and lowest in Northeast region ( $M=382.7$ ). Heteroscedasticity was tested for with the White's General Heteroscedasticity Test. Shortcomings include small sample size.

## Crime Rate in American Cities

Crime can affect the social and economic aspect of a city. The crime rate of a city tells us the health of a city as well as the direction a city is moving. A high crime rate leads to a low quality of life and low economic growth. The purpose of this study is to see which factors influence crime rate in a city. By understanding which factors lead to an increase or decrease in crime rate, researchers can better the quality of life of those living in cities. We hypothesize that factors such as number of police, education level of the civilian population, unemployment rate, income per capita, and ethnic composition of a population have an effect on crime rate. We predict that all the explanatory variables listed previously will have a significant impact on crime rate.

In this research we took a sample of 20 cities from five geographical locations in the United States. The five regions are Midwest, South Central, West, South East, and North East. We picked four cities in each region and collected the cities' crime rate per 100,000 population as well as the number of police in each city, income per capita of each city, educational attainment of the civilians, ethnic composition of the city, and unemployment rate of each city. After collecting the data we ran regressions between each explanatory variable to the crime rate. The regressions were run by the method of ordinary least squares (OLS). Heteroscedasticity was tested for with the White's General Heteroscedasticity Test. We forecast that unemployment rate will have the most significant effect on crime rate because people turn to crime when there is no other option for income.

### **Literature Review**

Two professors from separate universities, Winter-Ebmer from the University of Linz and Raphael from the University of California at Berkeley (1998) jointly looked at the relationship between the rise of crime rates and the rise of unemployment rates. After conducting their research and compiling their data, one obvious hypothesis was left. Crime rate and unemployment go in tandem and have a positive relationship with one another. To put this more plainly, a citizen will eventually turn to methods of income that are not completely legal when they are unemployed instead of looking for work. This is happening because looking for work while unemployed requires a higher effort than it would for illegal activities for income. Both Winter-Ebmer and Raphael (1998) landed on crime rate as the dependent variable. This was broken down into two separate parts, property crime and violent crime. In the end it was concluded that there was a positive relationship with unemployment and property crimes (burglary, larceny). The relationship among violent crime and unemployment was not so clearly positive, it was actually negative when rape and murder was considered. Our study can be considered very similar with their analysis. We look at the relationship between unemployment and crime rate but not such that crime rate is unemployment driven. We also look into the data for number of police officers within the city and educational levels of individuals of that city.

Similarly, a student named Alma Gonzalez (2015) from New York University wrote a thesis paper about education, the secret to crime rate reduction. This thesis paper explains the positive impact education has on reduction of crime rates in national state levels. Mostly focused on students with a college level graduated education and varying levels of educational attainments. After many studies and data analysis, Alma Gonzalez (2015) has determined that the results show the increased college graduation rates corresponds to a significant decrease in

crime rate around the states levels. The 5% increase in college graduation rate reduces the homicide rate by 18.7%. That is a big difference between the percentage rate.

### **The Model**

The purpose of this study is to see which factors influence crime rate in a city. By understanding what influences crime rate, we can help reduce crime, thus increasing the quality of life in American cities. We used 2016's data for the model because we were unable to find more recent data. The data was collected from [www.city-data.com](http://www.city-data.com) and uploaded to the software called Eviews. The data was divided into five geographical locations: Midwest, South Central, West, South East, and North East. We picked four cities in each region and collected the cities' crime rate per 100,000 population as well as the number of police in each city, income per capita of each city, high school graduation rate, percent of the population that has bachelors degree, ethnic composition of the city, and unemployment rate of each city. The crime rate was an average of different types of crime such as robberies, assaults, burglaries, theft, arson, rape, murder, etc. The U.S. national average for crime was 280.5 based on city-data.com crime index. Any city that had a higher average than 280.5 was classified as having a crime rate above the national average. The percent minority variable is the non-white population of a city. The percent with Bachelor's degree variable is the total percentage of a city's population that holds a 4 year degree. The high school graduation rate is the percentage of a city's population that holds a high school degree only.

We observed data from twenty cities and calculated their means, medians, standard deviations, Jarque-Bera values, and R-squared values. Next, we ran regressions between each explanatory variable to the crime rate. The regressions were run by the method of ordinary least

squares (OLS). Heteroscedasticity was tested for with the White's General Heteroscedasticity Test. Graphs were constructed based on seven independent variables (x) against the dependant variable (y). After acquiring the regression lines we prompted command for each independent variable such as `LS ycr c x`. Then we compared the values and figured which ones are significant or not. The following command: `LS ycr C police INPERCAP HIGHSCGLGRDRAT BSDEG MINORITY UNEMPLOYMENT`, was used to see if the explanatory variables were multicollinear.

We expect the parameters for the variables of police, income per capita, high school graduation rate, and percent with bachelor's degree to be negative because as these variables increase the crime rate should decrease. Educational attainment, number of police, and income should lead to a decrease in crime rate because these factors enhance the quality of life in most societies. We expect the parameters for the variables unemployment and percent minorities to be negative because as these variables increase the crime rate should also increase. As the percent minorities increase in a city we expect the crime rate to increase because many of these minorities that live in the cities have less opportunity.

### **The Data**

A meta-analysis was conducted and all data was put on an Excel spreadsheet (see Table 1). The mean number of police for the 20 cities part of the observation was 5,186.95 with a standard deviation of 8,898.70 (see Table 2). Mean income per capita for the 20 cities was \$35,123.90 with a standard deviation of \$12,222.83. High school graduation rate had a mean of 22.39 with a standard deviation of 6.13. Percent of population with a bachelor's degree had a mean of 23.68 percent with a standard deviation of 6.86 percent. Mean for percent minority was

56.74 with a standard deviation of 18.12. Unemployment rate had a mean of 4.21 with a standard deviation of 1.17. Crime rate per 100,000 had a mean of 470.32 and standard deviation of 146.35.

There was a negative trend in the number of police and the crime rate. As the number of police increase, the crime rate decreases. This trend can also be seen with income per capita variable and percent with bachelor's degree variable. In contrast, there were positive relationships between crime rate and high school graduation rate, percent minorities, and the unemployment rate.

Our research had many shortcomings, one of which being sample size. We had twenty observations because crime rate of certain states weren't available. For example, we first included the city of Charlotte as an observation, but the crime rate for Charlotte was not available, thus we had to drop it as an observation. The issue of dropping observations was consistent throughout our research because many cities did not have data accessible on crime rate. Since we had a small sample size, many of the regression results were insignificant even though there was a clear pattern in the regression line. For examples, the income per capita was insignificant because  $p=0.296$ , but the regression was downward sloping (see Chart 3). We expected the crime rate would go down if the income per capita goes up, but this did not happen. The reason for a downward sloping regression line for income per capita and crime rate could be do to the fact that we did not have enough observations. If we had a larger sample size, our results for crime rate based on income per capita would have been significant.

## **Regression Results**

There is a negative trend between number of police and crime rate per 100,000 (see Chart 1). The crime rate is decreasing when the number of police is increasing. We expected that the crime rate would decrease if the number of police increases. The regression for number of police and crime rate has a very low t-statistic of  $-0.769$ ,  $p=0.452$ . The F-statistic is  $0.591$  and it has a standard error which equals to  $0.004$ . The R-squared is  $0.032$ . As a result, the regression line is not the best fit because the R-squared value is not close 1.

In comparison, the income per capita effects on crime rate has similar results as the number of police effects on crime rate (see Chart 3). The R-squared is  $0.060$ , so the regression line is not the best fit. The slope of the regression line equals to  $-0.003$ . This negative coefficient is in agreement to our expectations that as income per capita increases, the crime rate should decrease. But the effect of income per capita on crime rate is insignificant ( $p=0.296$ ).

We dropped an outlier for the number police on crime rate. The outlier was 40,000 police officers for the city of Manhattan in New York. All the other cities had around 12,000 police or less. After dropping Manhattan from the regression, the p value increased to  $0.938$  and the R-squared decreased to  $0.0003$ . However, the coefficient sign, which was negative, remained the same. Thus, dropping an outlier from the number of police and crime rate regression model did not change the results.

Education plays a huge role in the city of America. In chart 4, one would expect the crime rate to decrease if the high school graduation rate were to increase. However, our results show that as the high school graduation rate increases, the crime rate increases as well. We expected a negative slope for our regression. But, the slope is positive  $11.48$  with the p value of  $0.032$ . Also, this regression has a very low R-squared value of  $0.231$  (see Chart 4). Therefore, the



relationship between the crime rate and the high school graduation rate is significant. On the other hand, as the percent with bachelor's degree increases, the crime rate decreases (see Chart 5). The p value is significant at 0.028 and the coefficient is negative, which is what we expected. The R-squared value is very low at 0.242.

According to chart 6, as the percent of minorities in cities increase, the crime rate also increases. This is not insignificant at 5% alpha but at 10% alpha, the p value is equal to 0.072. Furthermore, the geographical location is selected as the dummy variable. The Midwest region has the highest crime rate (M=610.7) and the North East has the lowest crime rate among all the region (M=382.7) (see Chart 2). Jarque-Bera test was used to test for normality of each variable. The number of police variable had a high value of 119.035 on the Jarque-Bera test, making the bell curve less normal. All the other explanatory variables as well as the dependent variable of crime rate had low Jarque-Bera scores, making those bell curves closer to normal.

In addition, as the unemployment increases, the crime rate is increasing (see Chart 7). The R-squared is equal to 0.392 and  $p=0.003$ . After getting rid of an outlier, the unemployment rate for Detroit at 7.8%, the regression became insignificant at 0.197. The regression line was still upward sloping after getting rid of an outlier and the R-squared decreased 0.096. By getting rid of the outlier, the regression line became less fit for the model.

We ran six variables against the crime rate variable and we found that only the unemployment variable had significant effect on crime rate. The p value for the unemployment variable became equal to 0.046 and the R-squared became 0.537. When we ran percentage of bachelor's degree, high school graduation, and the percent of minorities in a city to the crime rate independently, all three variables were significant at 5% and 10% alpha. But, when we ran the

six variables together to crime rate, the three variables of percent minority, bachelor's degree attainment, and the percentage of high school graduation had insignificant p values suggesting that there was an issue with multicollinearity in the model.

We tested for heteroskedasticity using White's General Heteroscedasticity Test, we failed to reject the null hypothesis because the Chi-Squared had a very low value of 0.705. Observed R-squared equaled 3.792. Therefore, we fail to reject the null hypothesis of homoscedasticity. But, we can trust the standard error from table 5, because we are controlling for homoscedasticity,

### **Summary and Conclusion**

In our results there was a significant effect of high school graduation rate on crime rate. As high school graduation rate increased the crime rate increased in our model. This positive relationship between high school graduation rate and crime rate can have many reasons. One reason why there is a positive relationship between high school graduation and crime rate is that a high school degree does mean a person will be employed. High school degree does not have the same weight today as it had a decade ago. Our data is collected in 2016, and today a bachelor's degree is more valuable than a high school degree. If we had a large sample size we probably would not have faced this problem. Also the unemployment rate plays a huge role in crime rate. Having higher percentage of unemployment rate leads to a greater crime rate. The data also shows that the more minorities moving into the city creates more crime related problems. When we have higher income per capita crime rate decreases because of economic growth, investments and more jobs. Crime rate seems to be the highest at Midwest region (M=610.7) and lowest in Northeast region (M=382.7).

Previous studies have found similar results to our research. Winter-Ebmer and Raphael (1998) found that crime rate and unemployment have a positive relationship. Similar to our results, the two researchers found a significant effect of unemployment on crime rate. In accordance to our study, Alma Gonzalez (2015) found that as the number of college graduates increase, crime rates decrease.

## Appendices

## Bibliography

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