North Carolina Crime Rate Analysis

Jeffrey Dubish
Jonathan Dykstra
Deep Mehta

Hetvi Pasad
Neha Sharma
Priyanka Sharma

Research Question and Purpose

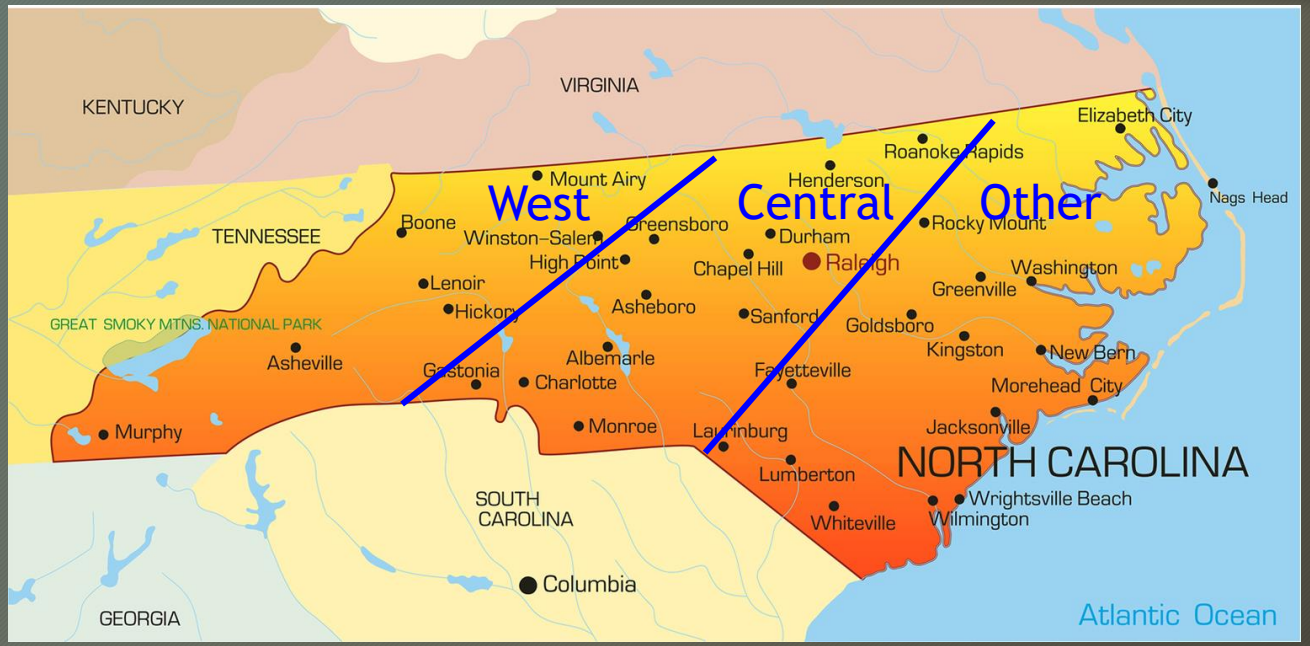
Research Question:

What factors impact crime in North Carolina over time?

Purpose:

Understanding what impacts crime rate increase can help governments (federal, state, and local) determine where to allocate police assets, economic assistance programs, and city planning.

North Carolina : Cross-Section of America



-Population: 10,146,000 (9th)

-Density: 80.6/sq. Km (15th)

-Median Income: $50.800 (38th)

-Size: 139,390 sq km (28th)

Data

Recorded data: Out of 630 Data Points - 90 counties, spanning 7 years, and 22 variables

Crime data was recorded using FBI standards and criteria: 1981-1987.

Limitations: Data is from the 80s.

Data

- County identifier-I.V.
- Year: From 1981 to 1987 – C.V. /I.V
- Crimes committed per person – D.V.
- Probability of arrest – I.V.
- Probability of conviction – I.V.
- Probability of prison sentence – I.V.
- Average sentence in days – I.V.
- Police per capita – I.V.
- Density: people per sq. mile – C.V. /I.V
- Tax revenue per capita – I.V.
- Region: West, Central, Other – C.V. /I.V
- Metropolitan: Yes or No – C.V. /I.V
- Percentage minority – I.V.
- Percentage of young males – I.V.

Weekly Wages:

- Manufacturing – I.V.
- Federal employees – I.V.
- State employees – I.V.
- Local governments employees – I.V.
- Construction – I.V.
- Transportation, utilities, and communication – I.V.
- Whole sales and retail trade – I.V.
- Finance, insurance and real estate – I.V.
- Service industry – I.V.
- Overall mix – I.V.

Data Cleaning

- Created two aggregate variables
  - Weekly Average Federal Wages
  - Weekly Average Private Sector Wages
- Used Consumer Pricing Index to set all wages equal to 1980.
- Removed 11 outliers, including one whole county, Pender County.
- Merged County names to data.
- Created mean of year over year for Crime, Police per Capita, and Wages.

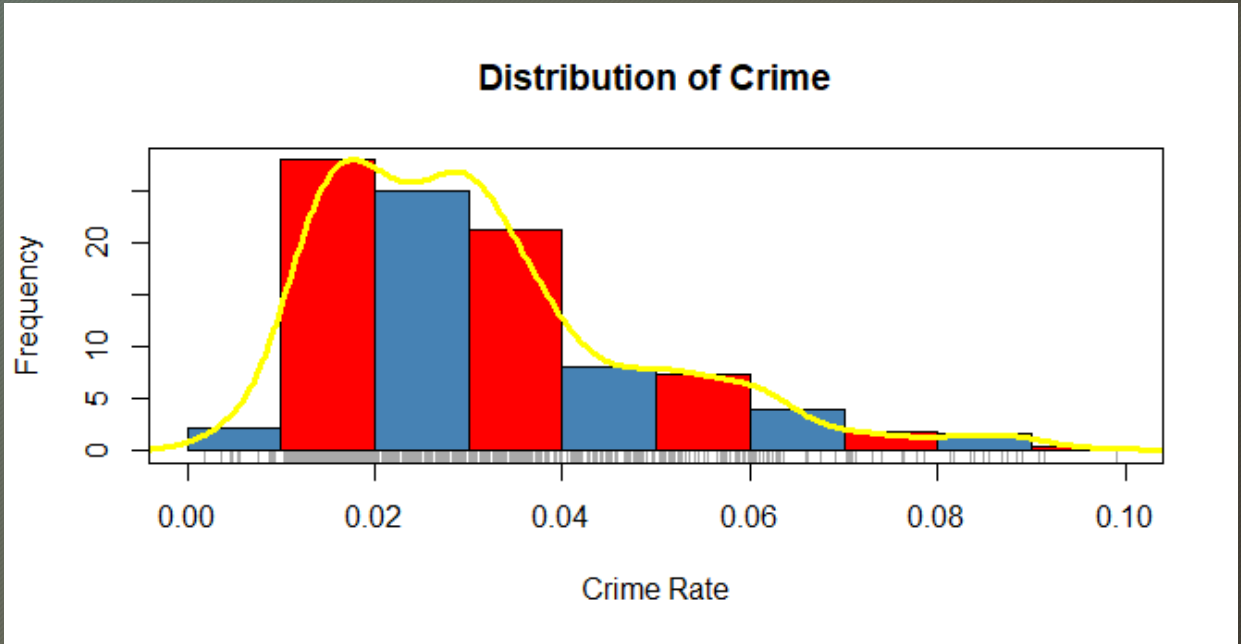
Hypotheses

H1: Crime Rate has an inverse correlation with Police per Capita.

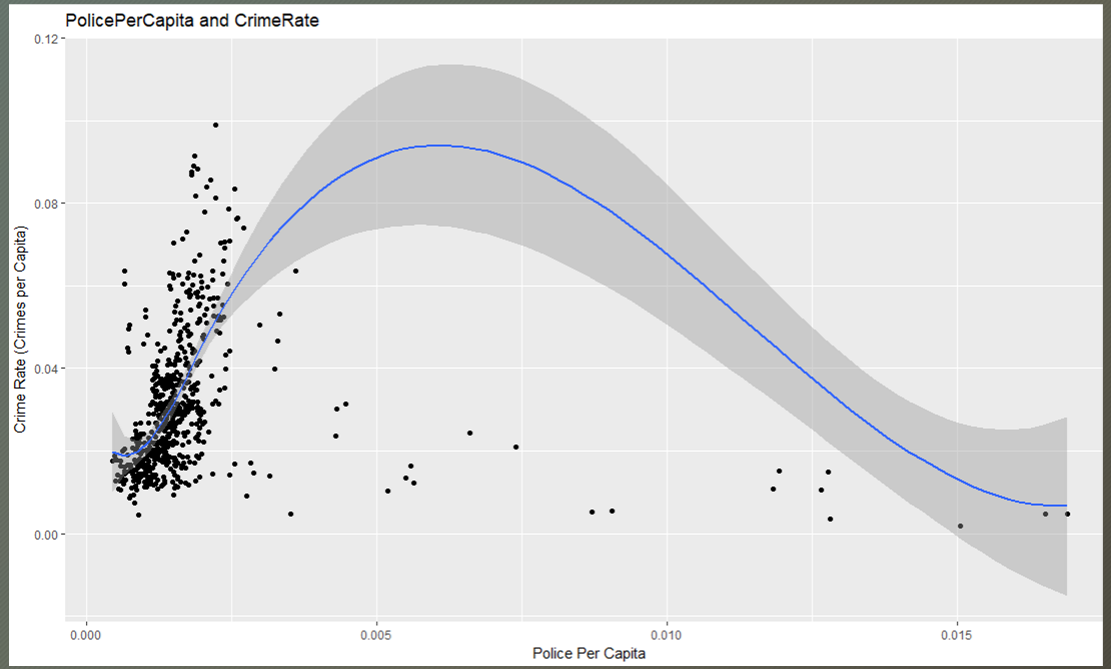
H2: Crime Rate has an inverse correlation with Population Density.

H3: Crime Rate has an inverse correlation with Wages.

Univariate Analysis



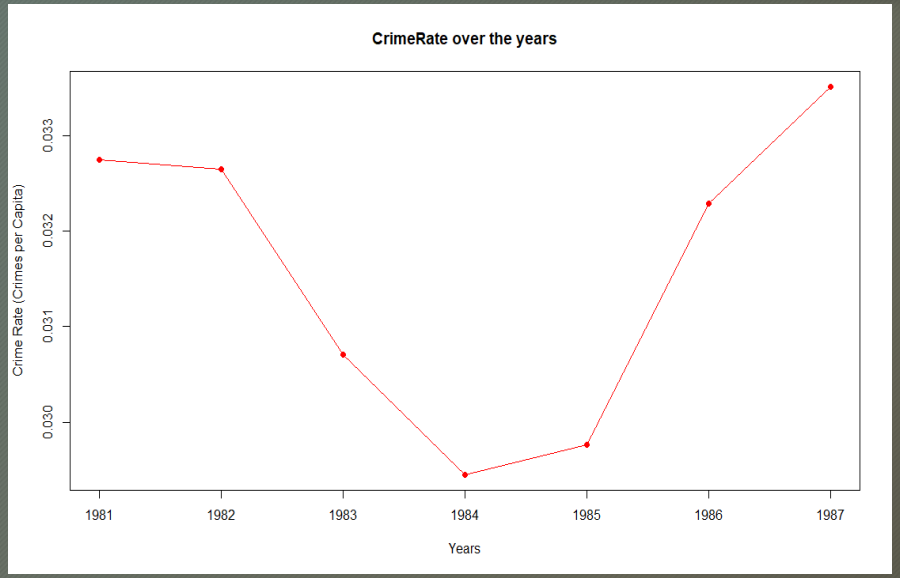
Hypothesis 1 - Crime Rate vs Police per Capita

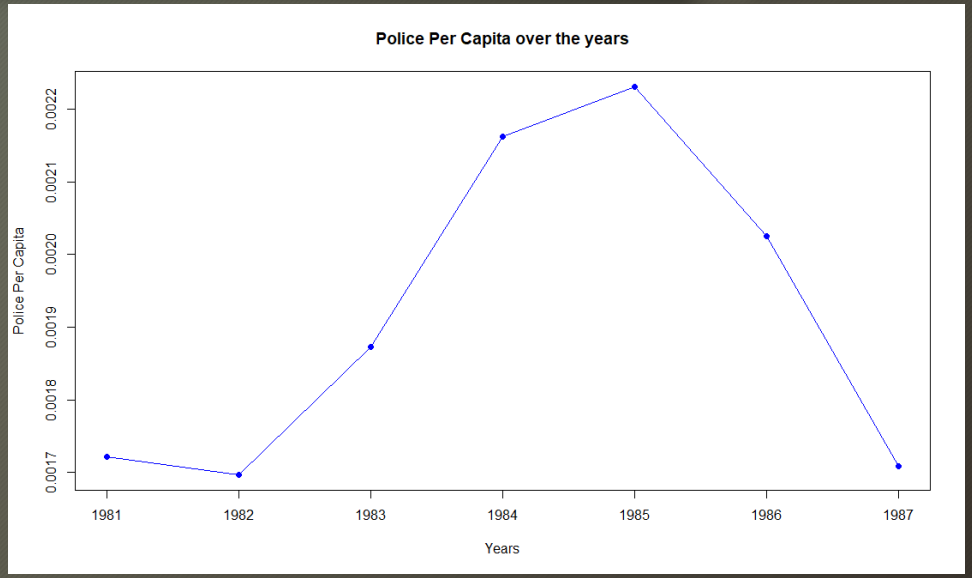


First attempt to correlate the variables.

After closer review, we realized our data was too cluttered.

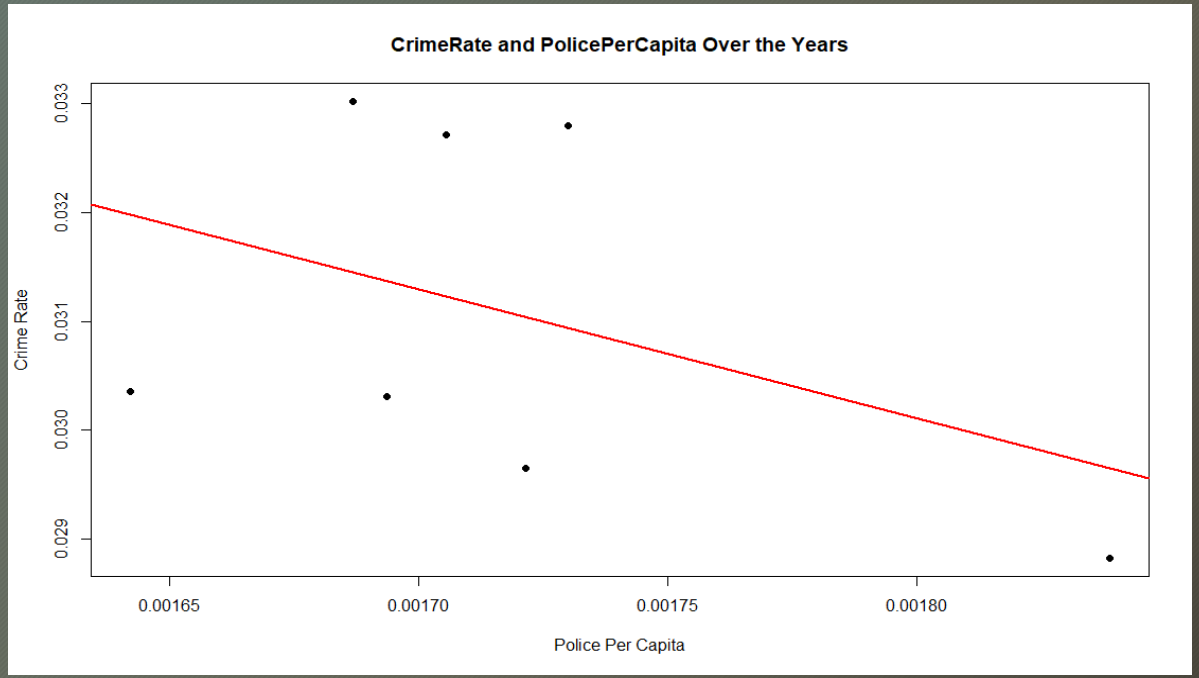
Hypothesis 1 - Crime Rate vs Police per Capita





Yearly rates indicated a visual trend that we needed to investigate to confirm.

Crime Rate and Police per Capita by year

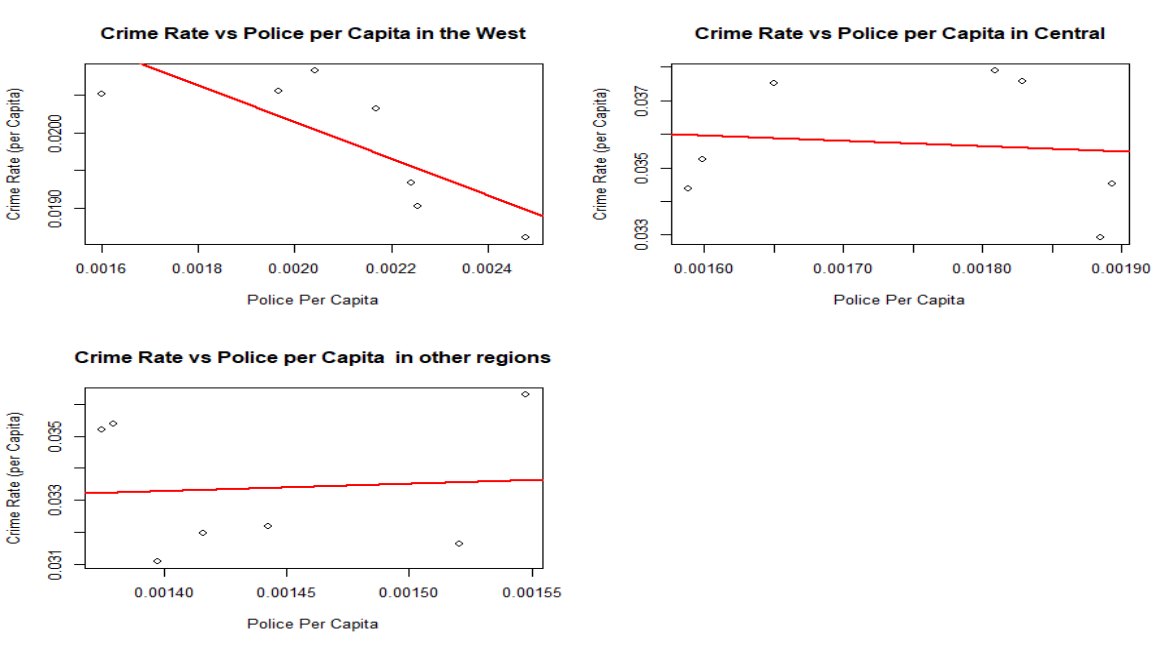


INFERENCE:

From smaller value of p-value (i.e. 7.381e-09 at 99% confidence interval), we conclude that there is a relationship between Crime Rate and Police per Capita.

Crime Rate and Police per Capita has a negative correlation with a value of -0.42.

Hypothesis 1.1 - Crime Rate vs Police per Capita



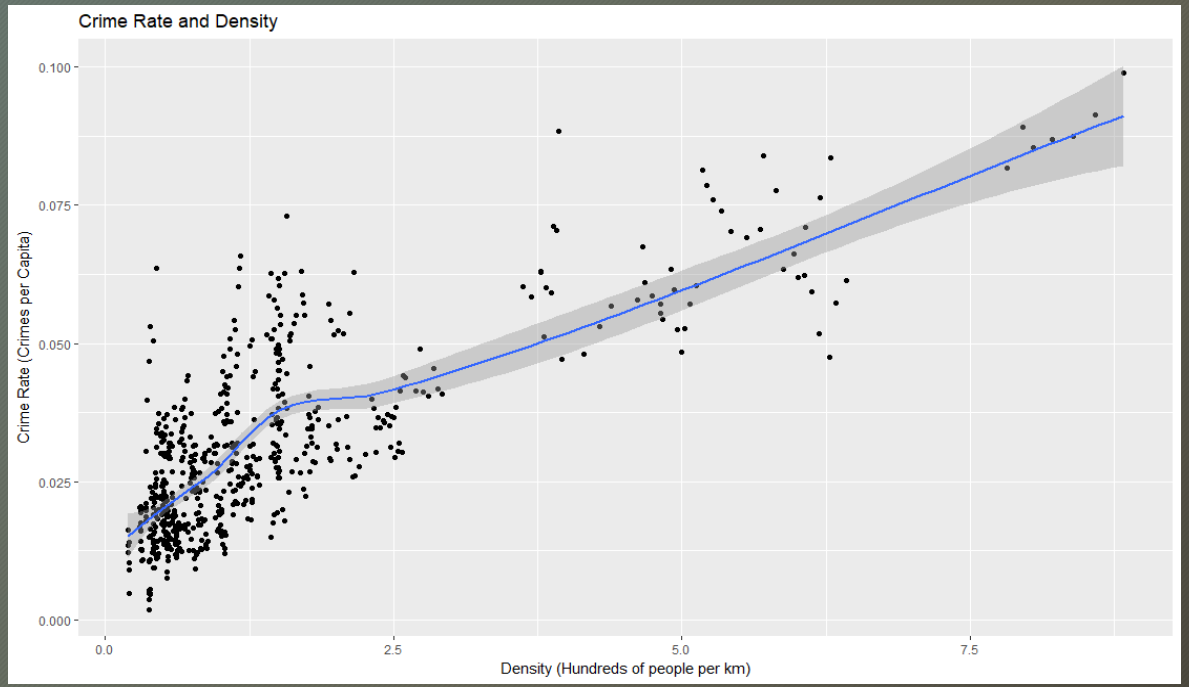
INFERENCE:

Crime Rate and Police per Capita in West has a negative correlation with a value of -0.77.

Crime Rate and Police per Capita in Central has a negative correlation with a value of -0.107.

Crime Rate and Police per Capita in Other regions has a positive correlation with a value of 0.07.

Hypothesis 2 - Crime Rate vs Population Density



INFERENCE:

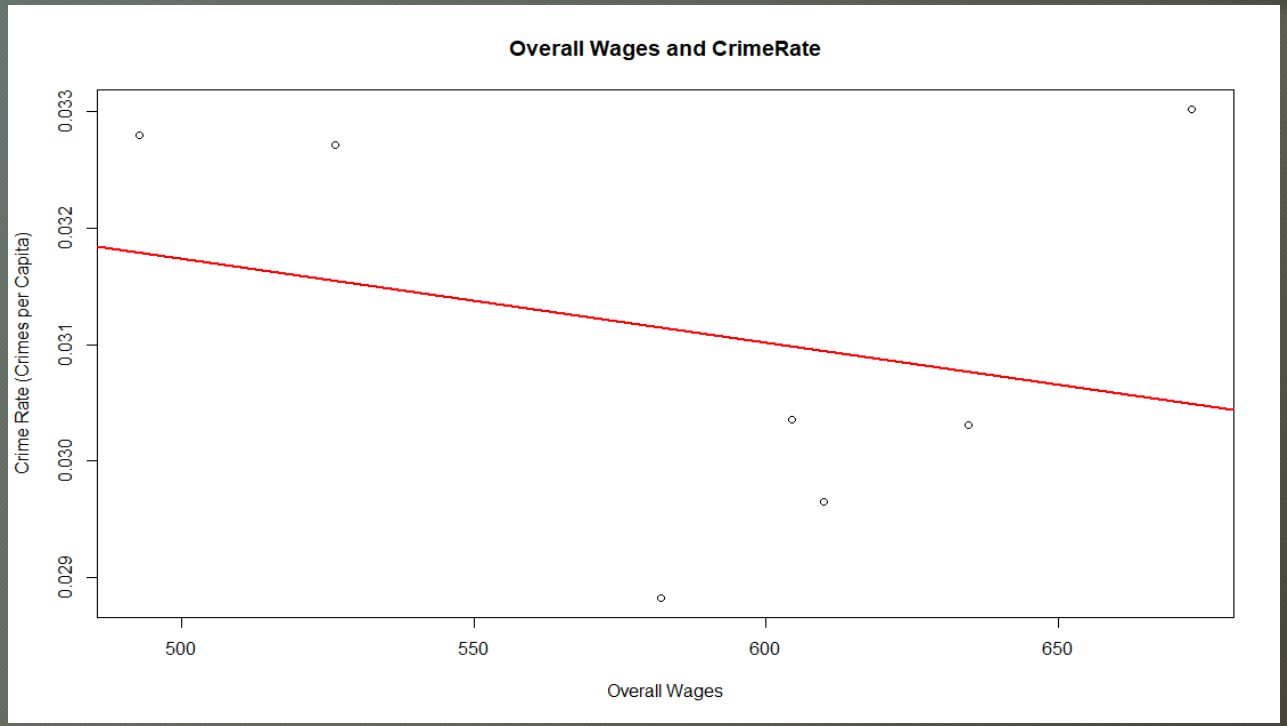
From smaller value of p-value(i.e. 2.2e-16 at 99% confidence interval), we conclude that there is a relationship between Crime Rate and Density.

Crime Rate and Density have a strong linear positive correlation with a value of 0.75.

With increase of 100 people per sq mile, there is an increase of 0.008 to the Crime Rate.

Density accounts for 56% of variation of crime rate.

Hypothesis 3 - Crime Rate vs Wage

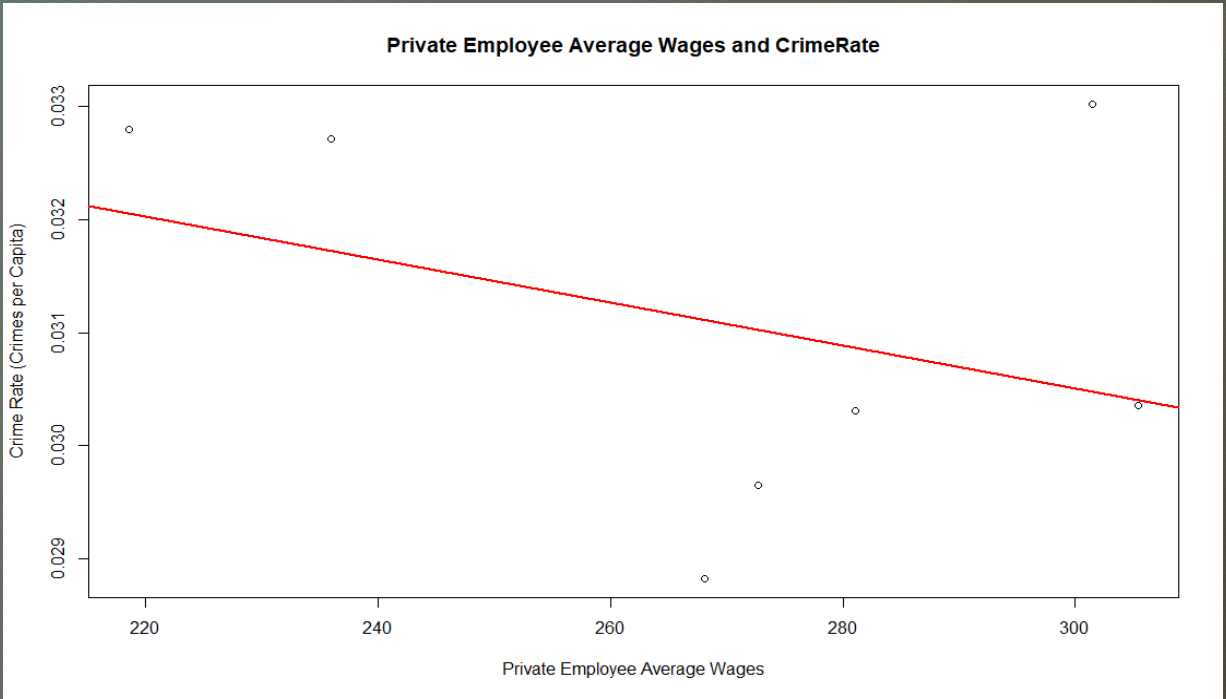


INFERENCE:

From smaller value of p-value(i.e. 5.436e-09 at 99% confidence interval), we conclude that there is a relationship between Crime Rate and Wage.

Crime Rate and Wage have a negative correlation with a value of -0.266.

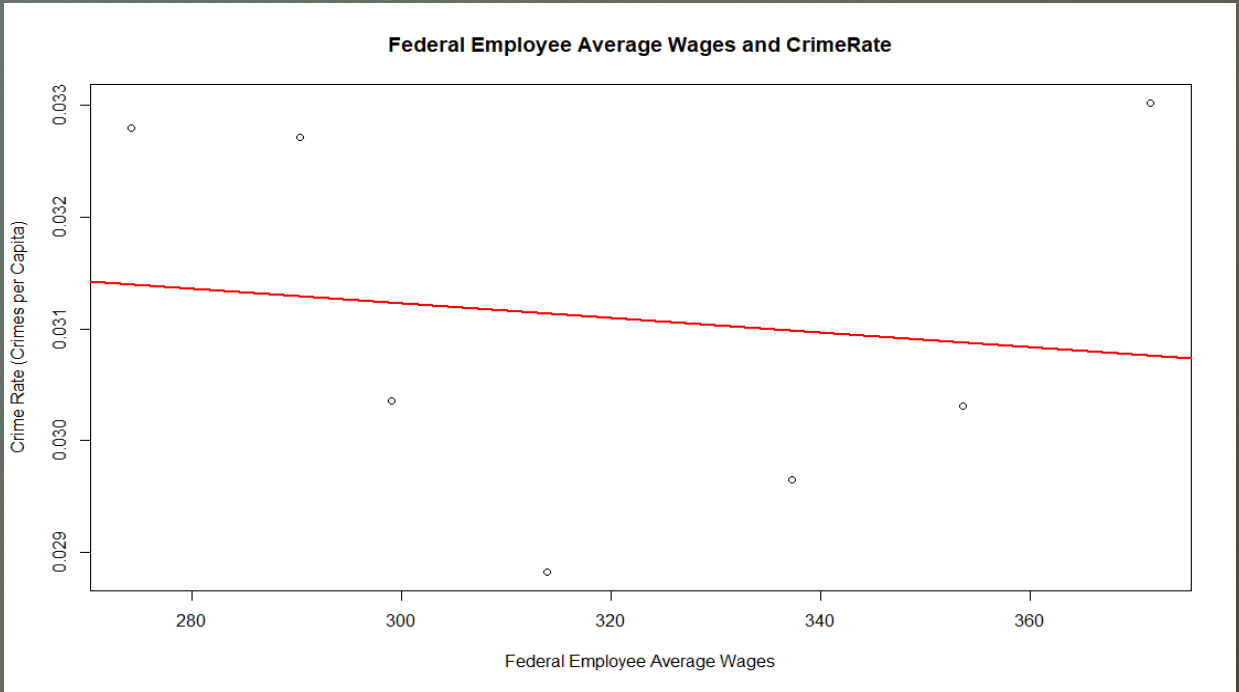
Hypothesis 3 - Crime Rate vs Private Sector Wages



INFERENCE:

Crime Rate and Private Employee Average Wage have a negative correlation with a value of -0.266.

Hypothesis 3 - Crime Rate vs Federal Wages



INFERENCE:

Crime Rate and Federal Employee Average Wage have a negative correlation with a value of -0.134.

Model

We can predict 66% of the Crime Rate from Police Per Capita, Density, Probability of Arrest and Probability of Conviction.

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.0294590  0.0012821  22.977  < 2e-16 ***
polpc        1.7010997  0.3372423   5.044 6.01e-07 ***
density      0.0076432  0.0003117  24.524  < 2e-16 ***
prbarr      -0.0302575  0.0035373  -8.554  < 2e-16 ***
prbconv     -0.0046467  0.0006597  -7.043 5.05e-12 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.009872 on 614 degrees of freedom
Multiple R-squared:  0.6603,    Adjusted R-squared:  0.658
F-statistic: 298.3 on 4 and 614 DF,  p-value: < 2.2e-16

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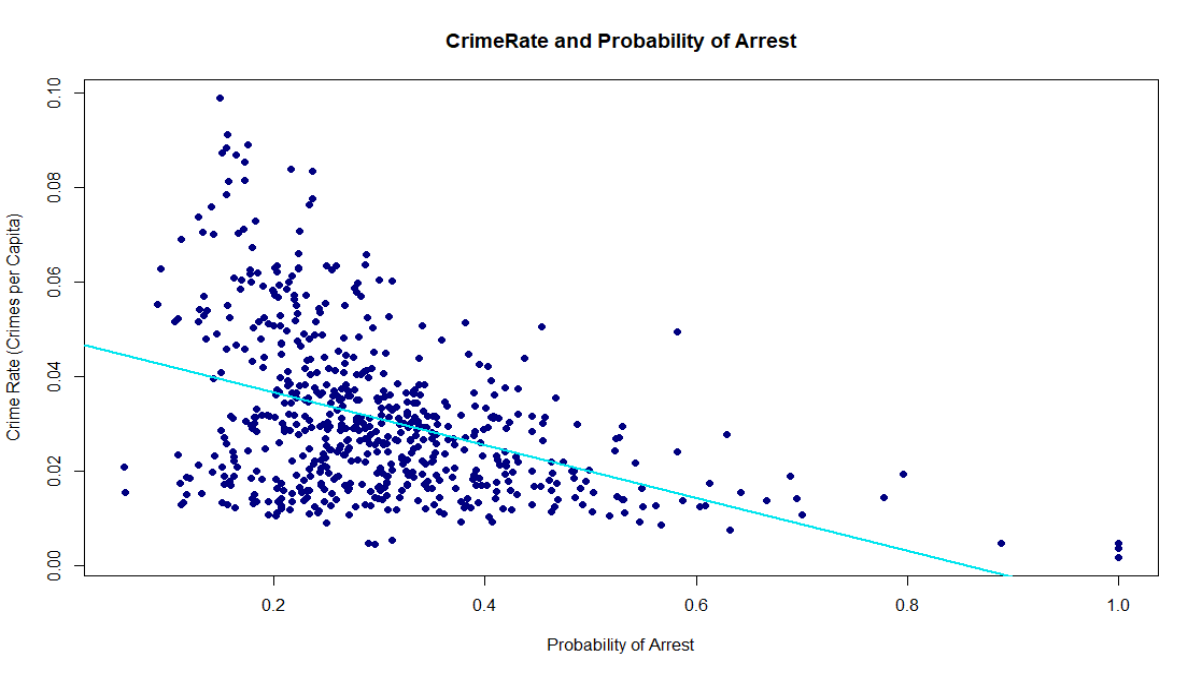
Finding - Crime Rate vs Probability of Arrest



INFERENCE:

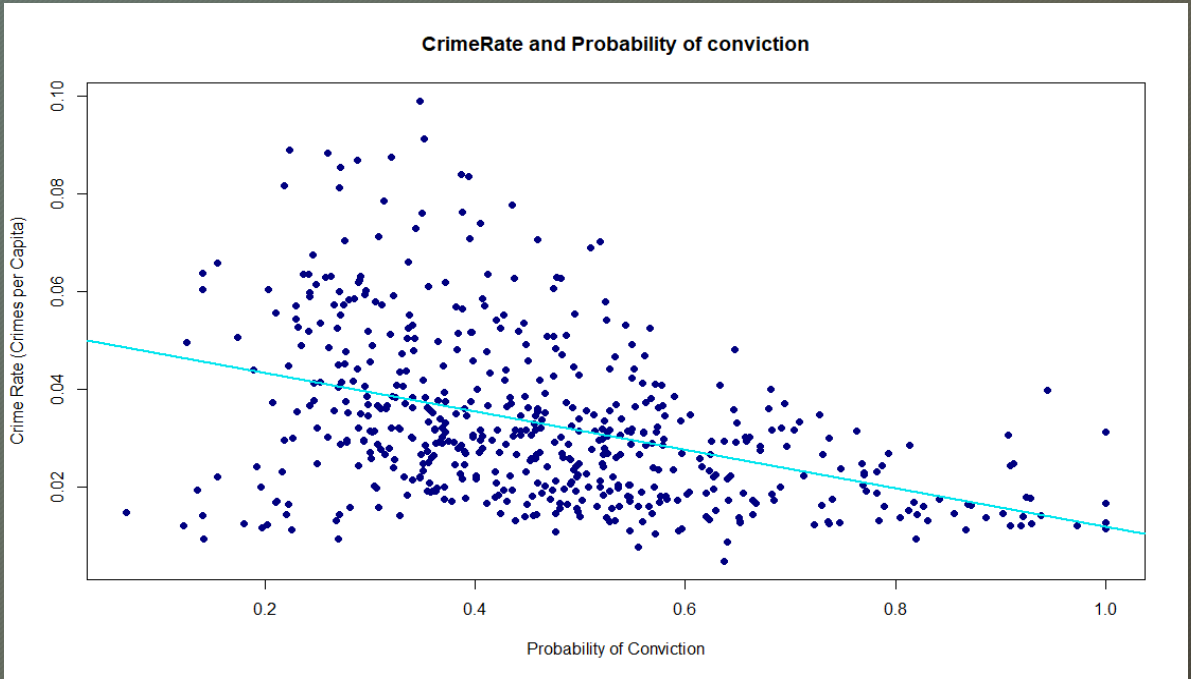
Small p-value: there is a relationship between Crime Rate and Density.

Probability of Arrest and Crime Rate are negatively correlated with a value of -0.39.

With an increase of Probability of Arrest by 1 unit, Crime Rate decreases by 0.04 units.

Probability of Arrest explains 15% of the variation in Crime Rate.

Finding - Crime Rate vs Probability of Conviction



INFERENCE:

From small p-value, there is a relationship between Crime Rate and Density.

Probability of Arrest and Crime Rate are negatively correlated with a value of -0.41.

With increase of Probability of Conviction by 1 unit, Crime Rate decreases by 0.039 units.

Probability of Arrest explains 17% of the variation in Crime Rate.

Hypotheses Conclusions

H1: Crime Rate has an inverse correlation with Police per Capita
Confirmed at 99% Confidence when aggregated and tested annually.

H2: Crime Rate has a positive correlation with Population Density
Confirmed at 99% Confidence.

H3: Crime Rate has an inverse correlation with Wages
Confirmed at 99% Confidence.

Research's Purpose Conclusion

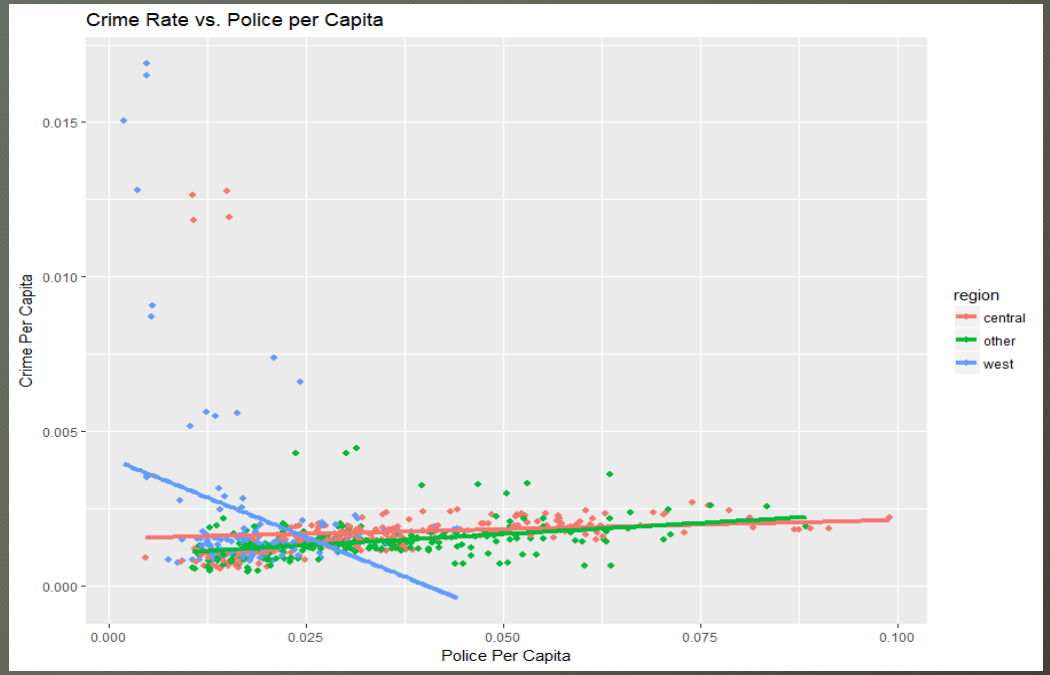
To best reduce crime rates, government officials should be mindful to provide a larger police presence and provide adequate levels of residential zoning space to allow for a decrease in population density.

Earnings/wages provide little relation to crime rates which suggests that economic incentive programs may have a less measurable impact on crime rates.

Additional Slides

1. Hypothesis 1 - Crime Rate vs. Police per Capita - Regional Trends
2. Hypothesis 2 - Density over years

Hypothesis 1 - Crime Rate vs Police per Capita



Crime Rate and Density over the years