Homework #4

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3/1/2018

I will be using the Guns dataset from the ’AER" package in R. The dataset contains information collected in 51 US states (Including the District of Columbia) over a 23 year period in order to determine if more guns is correlated with less crime. I specifically chose to use the violent variable which contains the number of violent crime incidents for every 100,000 people in a given population.

Exploring The Data

```
library(AER)
data (Guns)

str(Guns)
```

```
## 'data.frame':    1173 obs. of  13 variables:
##  $ year      : Factor w/ 23 levels "1977","1978",..: 1 2 3 4 5 6 7 8 9 10 ...
##  $ violent   : num  414 419 413 448 470 ...
##  $ murder    : num  14.2 13.3 13.2 13.2 11.9 10.6 9.2 9.4 9.8 10.1 ...
##  $ robbery   : num  96.8 99.1 109.5 132.1 126.5 ...
##  $ prisoners : int  83 94 144 141 149 183 215 243 256 267 ...
##  $ afam      : num  8.38 8.35 8.33 8.41 8.48 ...
##  $ cauc      : num  55.1 55.1 55.1 54.9 54.9 ...
##  $ male      : num  18.2 18 17.8 17.7 17.7 ...
##  $ population: num  3.78 3.83 3.87 3.9 3.92 ...
##  $ income    : num  9563 9932 9877 9541 9548 ...
##  $ density   : num  0.0746 0.0756 0.0762 0.0768 0.0772 ...
##  $ state     : Factor w/ 51 levels "Alabama","Alaska",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ law       : Factor w/ 2 levels "no","yes": 1 1 1 1 1 1 1 1 1 1 ...
```

Converting factors to numeric

```
head(Guns)
```

```
##   year violent murder robbery prisoners     afam     cauc     male
## 1 1977   414.4   14.2    96.8        83 8.384873 55.12291 18.17441
## 2 1978   419.1   13.3    99.1        94 8.352101 55.14367 17.99408
## 3 1979   413.3   13.2   109.5       144 8.329575 55.13586 17.83934
## 4 1980   448.5   13.2   132.1       141 8.408386 54.91259 17.73420
## 5 1981   470.5   11.9   126.5       149 8.483435 54.92513 17.67372
## 6 1982   447.7   10.6   112.0       183 8.514000 54.89621 17.51052
##   population   income   density   state law
## 1   3.780403 9563.148 0.0745524 Alabama  no
## 2   3.831838 9932.000 0.0755667 Alabama  no
## 3   3.866248 9877.028 0.0762453 Alabama  no
## 4   3.900368 9541.428 0.0768288 Alabama  no
## 5   3.918531 9548.351 0.0771866 Alabama  no
## 6   3.925229 9478.919 0.0773185 Alabama  no
```

```
Guns$state <- as.numeric(Guns$state)
Guns$law <- as.numeric(Guns$law)
str(Guns)
```

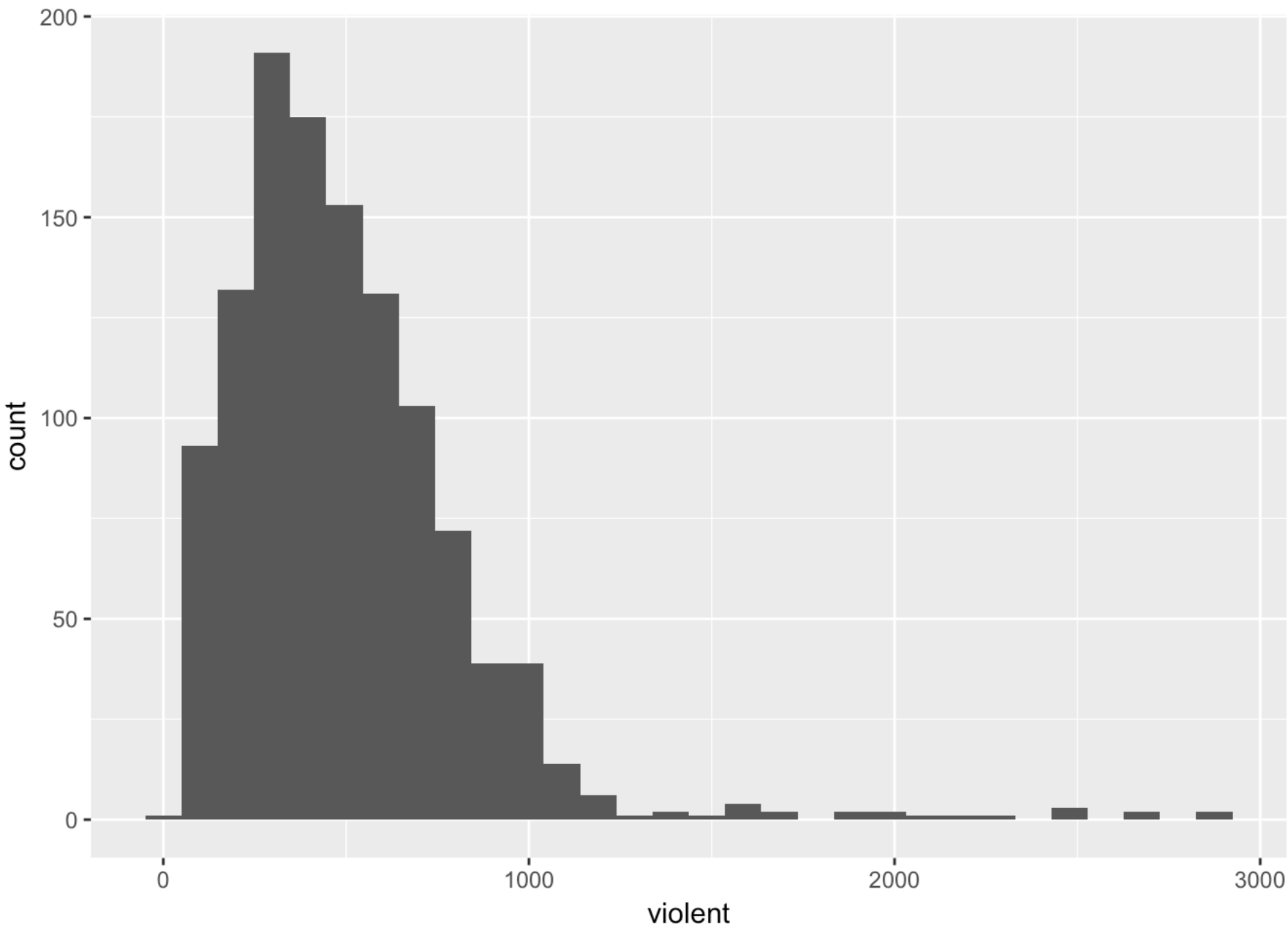
```
## 'data.frame':    1173 obs. of  13 variables:
##  $ year      : Factor w/ 23 levels "1977","1978",..: 1 2 3 4 5 6 7 8 9 10 ...
##  $ violent   : num  414 419 413 448 470 ...
##  $ murder    : num  14.2 13.3 13.2 13.2 11.9 10.6 9.2 9.4 9.8 10.1 ...
##  $ robbery   : num  96.8 99.1 109.5 132.1 126.5 ...
##  $ prisoners : int  83 94 144 141 149 183 215 243 256 267 ...
##  $ afam      : num  8.38 8.35 8.33 8.41 8.48 ...
##  $ cauc      : num  55.1 55.1 55.1 54.9 54.9 ...
##  $ male      : num  18.2 18 17.8 17.7 17.7 ...
##  $ population: num  3.78 3.83 3.87 3.9 3.92 ...
##  $ income    : num  9563 9932 9877 9541 9548 ...
##  $ density   : num  0.0746 0.0756 0.0762 0.0768 0.0772 ...
##  $ state     : num  1 1 1 1 1 1 1 1 1 1 ...
##  $ law       : num  1 1 1 1 1 1 1 1 1 1 ...
```

What has the most influence on violent crime rates?

Descriptive Analysis

```
library(ggplot2)
ggplot (Guns, aes(x =violent)) + geom_histogram()
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



Here it seems to show that most states do not have extremely high and frequent rates of violent crime. Lower rates of violent crime are most frequent.

Simple Regression:the relationship between violent crime rate and having a shall carry law in effect

```
m1 <- lm(violent~ law, data = Guns)
```

```
summary(m1)
```

```
##
## Call:
## lm(formula = violent ~ law, data = Guns)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -495.24 -228.84  -63.64  134.06 2379.56
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   703.42      29.29  24.017  < 2e-16 ***
## law          -161.19      22.27  -7.236 8.32e-13 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 327.2 on 1171 degrees of freedom
## Multiple R-squared:  0.0428, Adjusted R-squared:  0.04199
## F-statistic: 52.36 on 1 and 1171 DF,  p-value: 8.319e-13
```

On average, states without the shall carry law in effect have a violent crime rate of 703.42. The rate of violent crimes is reduced per year that a shall carry law is in effect by -161.19.

The relationship between violent crime rate and % of males aged 10-29

```
m2 <- lm(violent ~ male, data = Guns)
summary(m2)
```

```
##
## Call:
## lm(formula = violent ~ male, data = Guns)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -489.60 -212.18  -51.65  149.53 2352.46
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 1029.558     89.892  11.453  < 2e-16 ***
## male         -32.739      5.558  -5.891 5.02e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 329.6 on 1171 degrees of freedom
## Multiple R-squared:  0.02878,    Adjusted R-squared:  0.02795
## F-statistic:  34.7 on 1 and 1171 DF,  p-value: 5.021e-09
```

Although, I would not consider this to be accurate in reality, the data seems to show that levels of violent crime are reduced by -32.739 for each percent of the state population that is male and between the ages of 10-29.

Multiple Regression:relationship of violent crime rate, %of young males & shall carry law in effect

```
m3 <- lm(violent ~ male + law, data = Guns)
summary (m3)
```

```
##
## Call:
## lm(formula = violent ~ male + law, data = Guns)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -515.07 -217.05  -49.77  135.15 2270.62
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 1532.547    101.473  15.103   <2e-16 ***
## male         -47.454      5.575  -8.512   <2e-16 ***
## law         -214.294     22.507  -9.521   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 317.6 on 1170 degrees of freedom
## Multiple R-squared:  0.09862,    Adjusted R-squared:  0.09708
## F-statistic: 64.01 on 2 and 1170 DF,  p-value: < 2.2e-16
```

Controlling for shall carry law in effect, a one percent increase in population of young males should reduce rate of violent crimes by -47.454. Controlling for percent of young males in a population, each year that the shall carry gun law is in effect should reduce the rate of violent crimes by -214.294.

Tables

```
library(texreg)
```

```
## Version:  1.36.23
## Date:     2017-03-03
## Author:   Philip Leifeld (University of Glasgow)
##
## Please cite the JSS article in your publications -- see citation("texreg").
```

```
screenreg(list(m1, m2, m3))
```

```
##
## ================================================
##                Model 1      Model 2      Model 3
## ------------------------------------------------
## (Intercept)    703.42 ***  1029.56 ***  1532.55 ***
##                 (29.29)      (89.89)     (101.47)
## law           -161.19 ***                -214.29 ***
##                 (22.27)                  (22.51)
## male                       -32.74 ***   -47.45 ***
##                             (5.56)       (5.58)
## ------------------------------------------------
## R^2               0.04         0.03         0.10
## Adj. R^2          0.04         0.03         0.10
## Num. obs.      1173         1173         1173
## RMSE            327.18       329.57       317.64
## ================================================
## *** p < 0.001, ** p < 0.01, * p < 0.05
```

Model 1: IV = Shall Carry Law Model 2: IV = % of Young Males per Population Model 3: IV = Both

```
m4 <- lm(violent ~ male*law, data = Guns)
summary(m4)
```

```
##
## Call:
## lm(formula = violent ~ male * law, data = Guns)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -511.50 -217.55  -49.83  134.88 2275.00
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1345.84     282.68   4.761 2.17e-06 ***
## male          -35.48      17.82  -1.991   0.0467 *
## law           -58.80     220.87  -0.266   0.7901
## male:law      -10.07      14.23  -0.708   0.4793
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 317.7 on 1169 degrees of freedom
## Multiple R-squared:  0.09901,    Adjusted R-squared:  0.09669
## F-statistic: 42.82 on 3 and 1169 DF,  p-value: < 2.2e-16
```

This shows that there is no interaction between the % of young males in a population and having a shall carry law in effect because there is no statistical significance.