Lab3: Reducing Crime

w203 Lab3

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Exploratory Data Analysis

Perform an exploratory analysis to understand understand the determinants of crime and to generate policy suggestions that are applicable to local government.

Setup

First, we load the necessary libraries.

```r
library(stargazer)
```

```
##
## Please cite as:
##  Hlavac, Marek (2018). stargazer: Well-Formatted Regression and Summary Statistics Tables.
##  R package version 5.2.1. https://CRAN.R-project.org/package=stargazer
```

```r
library(corrplot)
```

```
## corrplot 0.84 loaded
```

Then we load the dataset, which is in the same directory as this RMD.

```r
# Load the data
rawCrimeData = read.csv("crime_v2.csv")
str(rawCrimeData)
```

```
## 'data.frame':    97 obs. of  25 variables:
##  $ county  : int  1 3 5 7 9 11 13 15 17 19 ...
##  $ year    : int  87 87 87 87 87 87 87 87 87 87 ...
##  $ crmrte  : num  0.0356 0.0153 0.013 0.0268 0.0106 ...
##  $ prbarr  : num  0.298 0.132 0.444 0.365 0.518 ...
##  $ prbconv : Factor w/ 92 levels "","`","0.068376102",..: 63 89 13 62 52 3 59 78 42 86 ...
##  $ prbpris : num  0.436 0.45 0.6 0.435 0.443 ...
##  $ avgsen  : num  6.71 6.35 6.76 7.14 8.22 ...
##  $ polpc   : num  0.001828 0.000746 0.001234 0.00153 0.00086 ...
##  $ density : num  2.423 1.046 0.413 0.492 0.547 ...
##  $ taxpc   : num  31 26.9 34.8 42.9 28.1 ...
##  $ west    : int  0 0 1 0 1 1 0 0 0 0 ...
##  $ central : int  1 1 0 1 0 0 0 0 0 0 ...
##  $ urban   : int  0 0 0 0 0 0 0 0 0 0 ...
##  $ pctmin80: num  20.22 7.92 3.16 47.92 1.8 ...
##  $ wcon    : num  281 255 227 375 292 ...
##  $ wtuc    : num  409 376 372 398 377 ...
##  $ wtrd    : num  221 196 229 191 207 ...
##  $ wfir    : num  453 259 306 281 289 ...
##  $ wser    : num  274 192 210 257 215 ...
##  $ wmfg    : num  335 300 238 282 291 ...
```

```
##  $ wfed    : num  478 410 359 412 377 ...
##  $ wsta    : num  292 363 332 328 367 ...
##  $ wloc    : num  312 301 281 299 343 ...
##  $ mix     : num  0.0802 0.0302 0.4651 0.2736 0.0601 ...
##  $ pctymle : num  0.0779 0.0826 0.0721 0.0735 0.0707 ...
```

The dataset contains 25 columns (variables) and 97 rows

Data Quality/Clean-up

```r
apply(!is.na(rawCrimeData[,]), MARGIN = 2, mean)
```

```
##    county      year    crmrte    prbarr   prbconv   prbpris    avgsen 
## 0.9381443 0.9381443 0.9381443 0.9381443 1.0000000 0.9381443 0.9381443 
##     polpc   density     taxpc      west   central     urban   pctmin80 
## 0.9381443 0.9381443 0.9381443 0.9381443 0.9381443 0.9381443 0.9381443 
##      wcon      wtuc      wtrd      wfir      wser      wmfg      wfed 
## 0.9381443 0.9381443 0.9381443 0.9381443 0.9381443 0.9381443 0.9381443 
##      wsta      wloc       mix   pctymle 
## 0.9381443 0.9381443 0.9381443 0.9381443
```

the dataset contains few NA that we'll need to fix before proceeding further.

```r
complete.cases(rawCrimeData)
```

```
##  [1]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [12]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [23]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [34]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [45]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [56]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [67]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [78]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [89]  TRUE  TRUE  TRUE FALSE FALSE FALSE FALSE FALSE FALSE
```

```r
crimeData <- rawCrimeData[complete.cases(rawCrimeData), ]
apply(!is.na(crimeData[,]), MARGIN = 2, mean)
```

```
##   county     year   crmrte   prbarr  prbconv  prbpris   avgsen    polpc 
##        1        1        1        1        1        1        1        1 
##  density    taxpc     west  central    urban pctmin80     wcon     wtuc 
##        1        1        1        1        1        1        1        1 
##     wtrd     wfir     wser     wmfg     wfed     wsta     wloc      mix 
##        1        1        1        1        1        1        1        1 
##  pctymle 
##        1
```

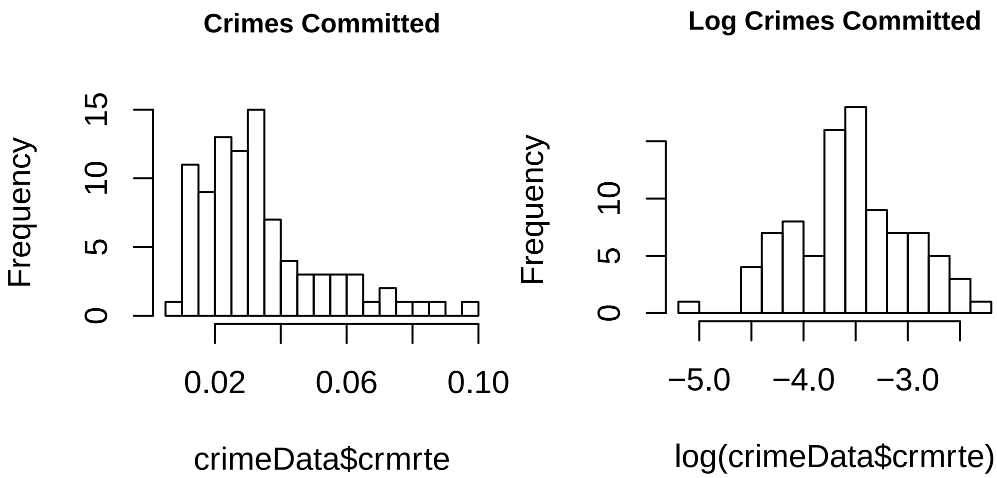
now we're good to go.

Univariate Variable Analysis of Key Variables

crmrte: crimes committed per person

Looking at the histogram of crime per person, the distribution appear to be positelvey skewed. Applying `log()` on crime shows the histogram to appear normally distributed.

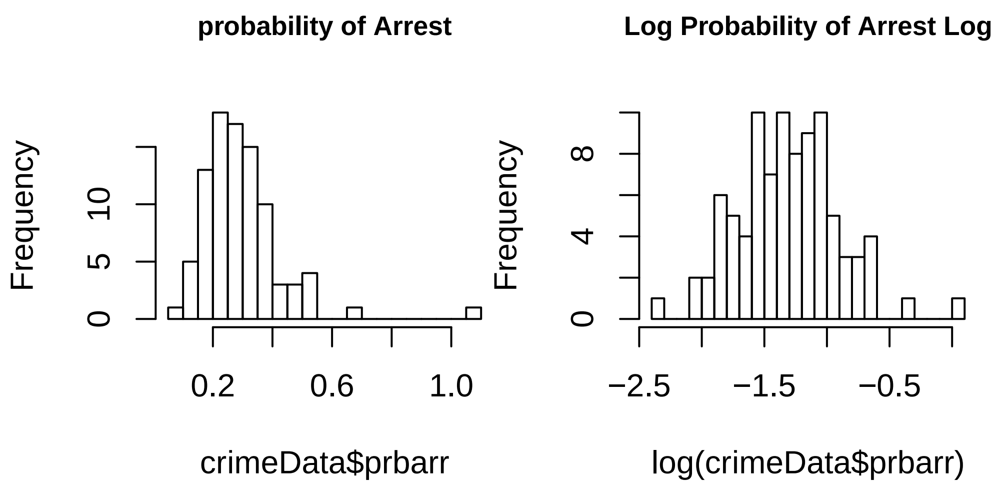
```
hist(crimeData$crmrte, breaks=20, main = "Crimes Committed", cex.main=0.8)
hist(log(crimeData$crmrte), breaks=20, main = "Log Crimes Committed", cex.main=0.8)
```



prbarr: probability of arrest

Looking at the histogram of arrest per person, the distribution appear to be positelvey skewed. Applying `log()` shows the histogram to appear *less* normally distributed.

```
hist(crimeData$prbarr, breaks=20, main = "probability of Arrest", cex.main=0.8)
hist(log(crimeData$prbarr), breaks=20, main = "Log Probability of Arrest Log", cex.main=0.8)
```



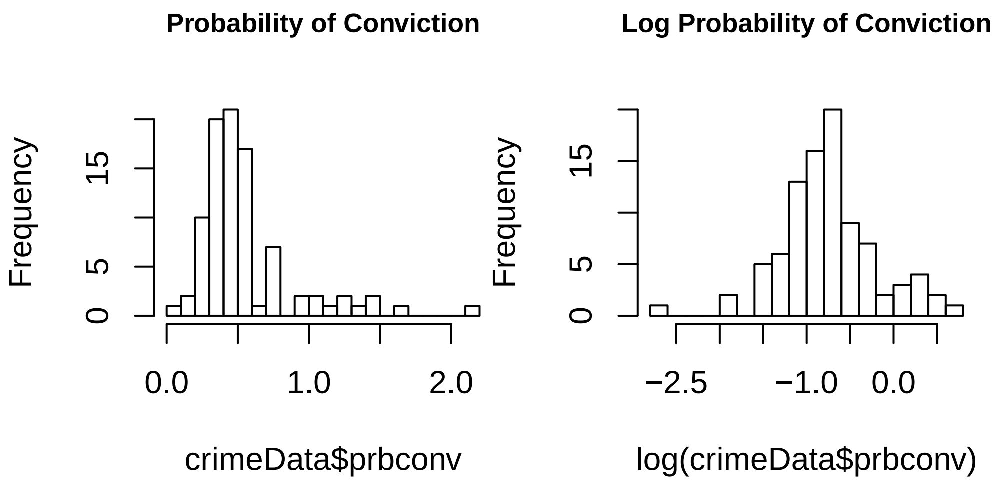
prbconv: probability of conviction

First, we'll need to concert the field from Factor to numeric for further analysis.

```r
crimeData$prbconv <- as.numeric(as.character(crimeData$prbconv))
```

Looking at the histogram of probability of conviction, the distribution appear to be positelvey skewed. Applying `log()` shows the histogram to appear normally distributed.

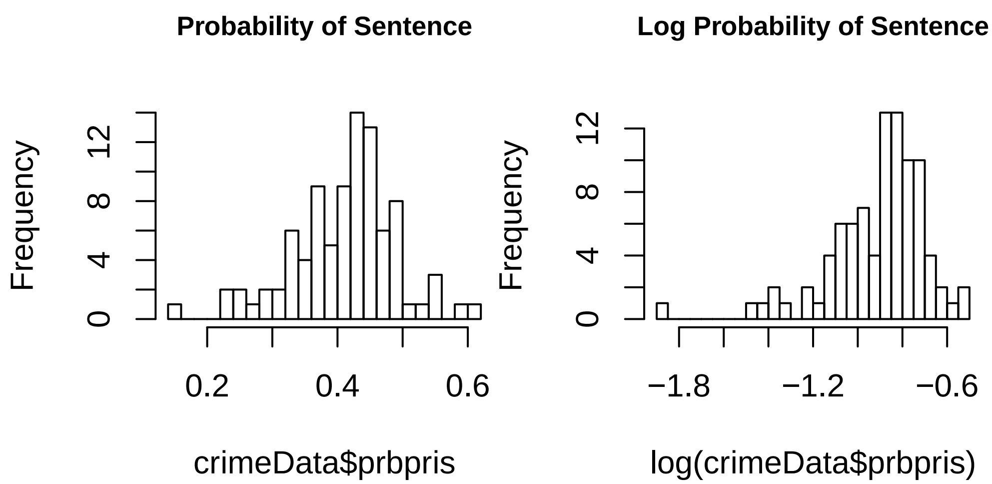
```r
crimeData$prbconv <- as.numeric(as.character(crimeData$prbconv))
hist(crimeData$prbconv, breaks=20, main = "Probability of Conviction",  cex.main=0.8)
hist(log(crimeData$prbconv), breaks=20, main = "Log Probability of Conviction",  cex.main=0.8)
```



prbpris: of prison sentence

Looking at the histogram of probability of sentence, the distribution appear to be relatively normal. Applying `log()` shows the histogram to appear *less* normally distributed.

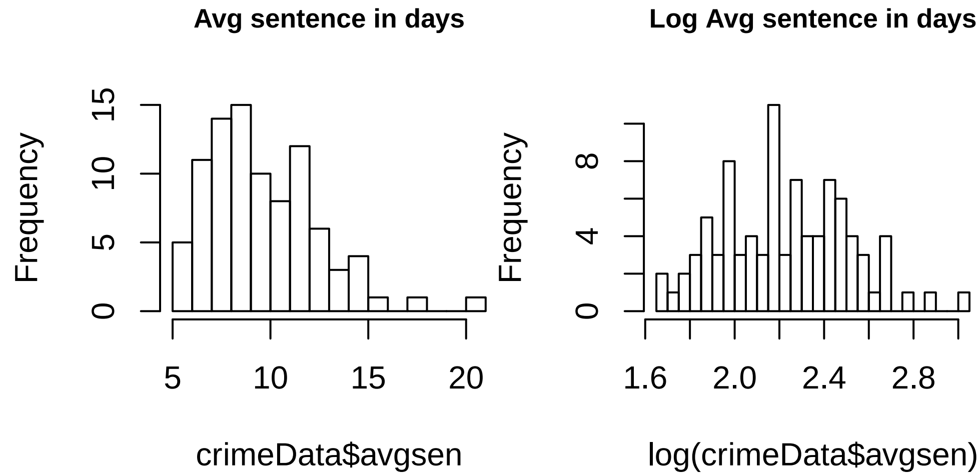
```r
hist(crimeData$prbpris, breaks=20, main = "Probability of Sentence",  cex.main=0.8)
hist(log(crimeData$prbpris), breaks=20, main = "Log Probability of Sentence",  cex.main=0.8)
```



avgsen: avg. sentence, days

Looking at the histogram of probability of sentence, the distribution appear to be positevely skewed. Applying `log()` shows the histogram to appear *more* normally distributed.

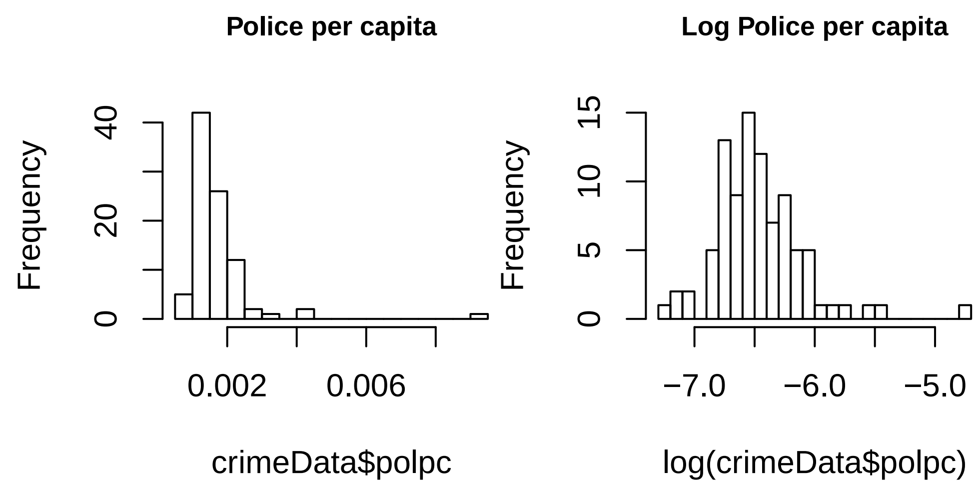
```
hist(crimeData$avgsen, breaks=20, main = "Avg sentence in days", cex.main=0.8)
hist(log(crimeData$avgsen), breaks=20, main = "Log Avg sentence in days", cex.main=0.8)
```



polpc: police per capita

Looking at the histogram of probability of sentence, the distribution appear to be positevely skewed. Applying `log()` shows the histogram to appear *more* normally distributed.

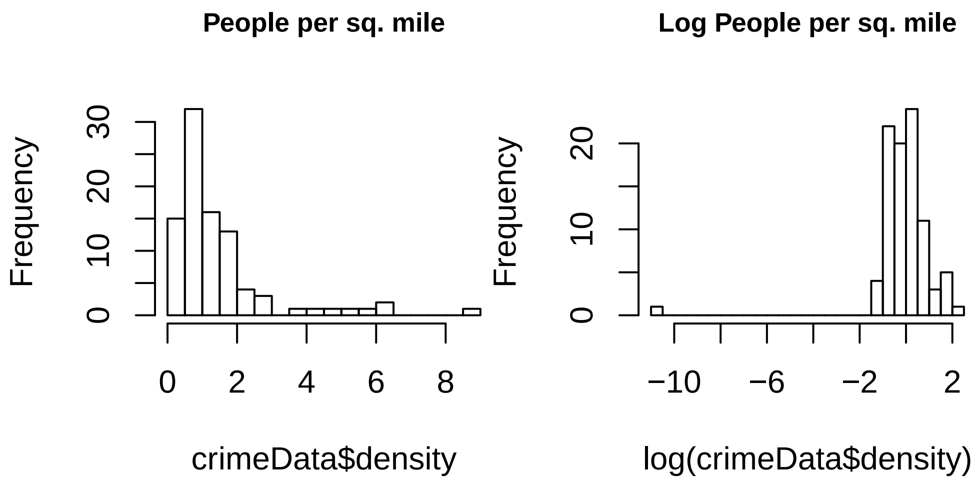
```
hist(crimeData$polpc, breaks=20, main = "Police per capita", cex.main=0.8)
hist(log(crimeData$polpc), breaks=20, main = "Log Police per capita", cex.main=0.8)
```



density: people per sq. mile

Looking at the histogram of probability of sentence, the distribution appear to be positevely skewed. Applying `log()` shows the histogram to appear *more* normally distributed, with one outlier.

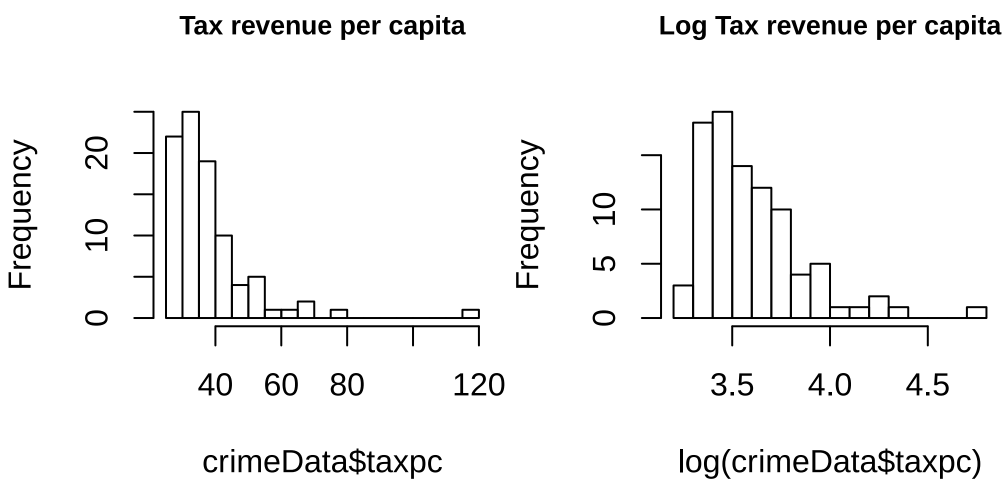
```
hist(crimeData$density, breaks=20, main = "People per sq. mile", cex.main=0.8)
hist(log(crimeData$density), breaks=20, main = "Log People per sq. mile", cex.main=0.8)
```



taxpc: tax revenue per capita

Looking at the histogram of probability of sentence, the distribution appear to be positevely skewed. Applying `log()` shows the histogram to appear slightly positevely skewed.

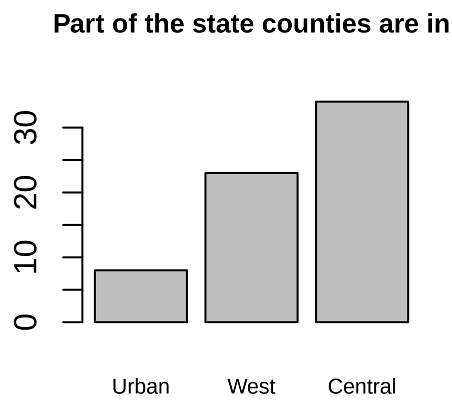
```r
hist(crimeData$taxpc, breaks=20, main = "Tax revenue per capita", cex.main=0.8)
hist(log(crimeData$taxpc), breaks=20, main = "Log Tax revenue per capita", cex.main=0.8)
```



taxpc: tax revenue per capita

Looking at the histogram of probability of sentence, the distribution appear to be positevely skewed. Applying `log()` shows the histogram to appear slightly positevely skewed.

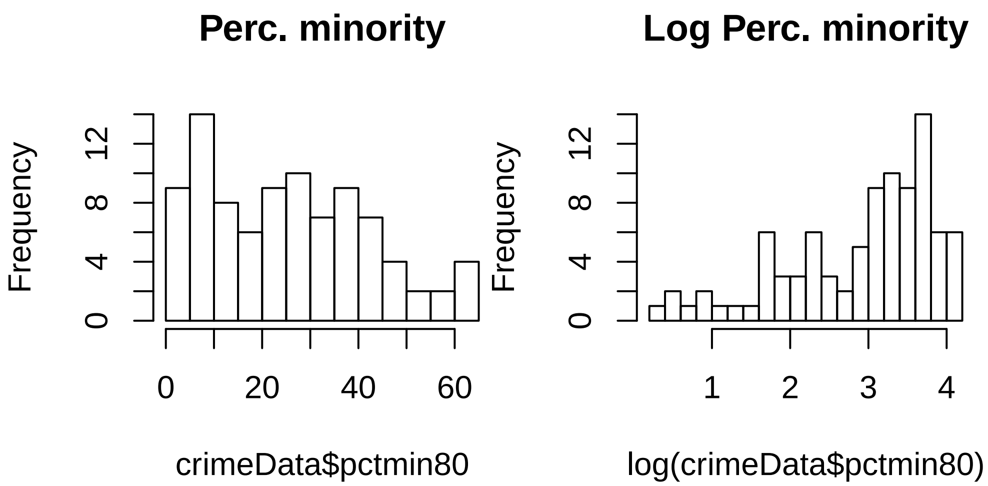
```
barplot(c(sum(crimeData$urban), sum(crimeData$west), sum(crimeData$central)),
  names.arg = c("Urban", "West", "Central"), main = "Part of the state counties are in", cex.main=0.8, c
```



pctmin80: perc. minority, 1980

Looking at the histogram of probability of sentence, the distribution appear to be slightly positevely skewed. Applying `log()` shows the histogram to appear negatively skewed.

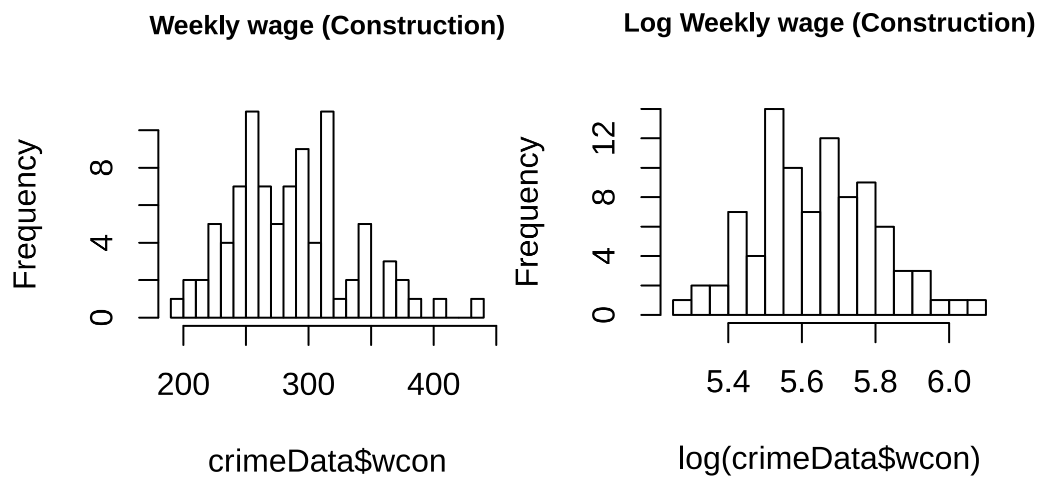
```
hist(crimeData$pctmin80, breaks=20, main = "Perc. minority")
hist(log(crimeData$pctmin80), breaks=20, main = "Log Perc. minority")
```



wcon: weekly wage, construction

Looking at the histogram of probability of sentence, the distribution appear to be slightly positevely skewed. Applying `log()` shows the histogram to appear normally distributed

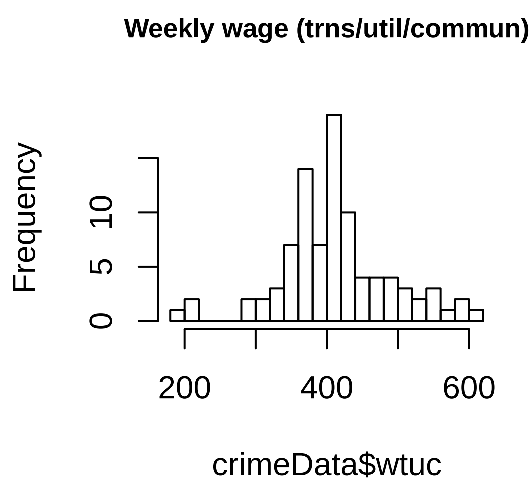
```
hist(crimeData$wcon, breaks=20, main = "Weekly wage (Construction)", cex.main=.8)
hist(log(crimeData$wcon), breaks=20, main = "Log Weekly wage (Construction)", cex.main=.8)
```



wtuc: wkly wge, trns, util, commun

Looking at the histogram, the distribution appear to be normally distribbuted.

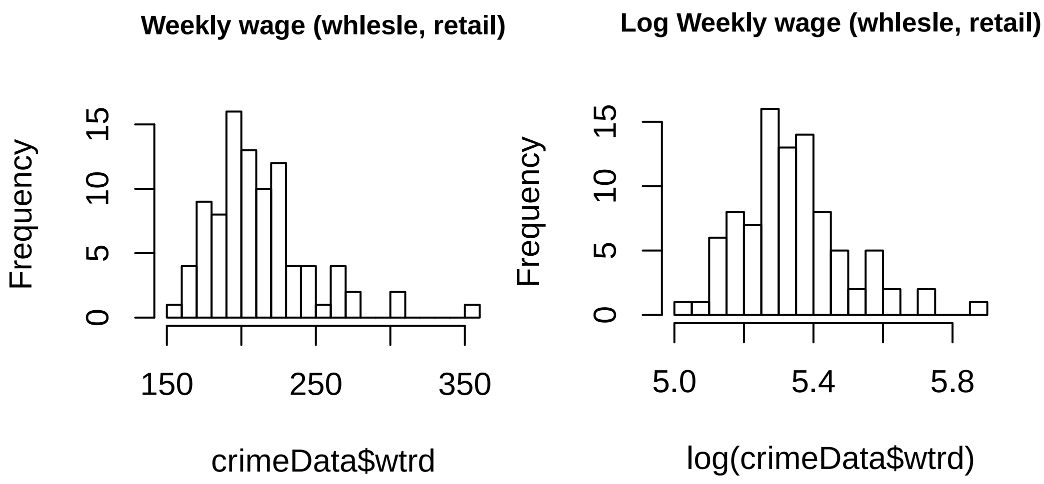
```
hist(crimeData$wtuc, breaks=20, main = "Weekly wage (trns/util/commun)", cex.main=.8)
```



wtrd: wkly wge, whlesle, retail trade

Looking at the histogram, the distribution appear to be positvely skewed. Applying `log()` shows the histogram to appear normally distributed

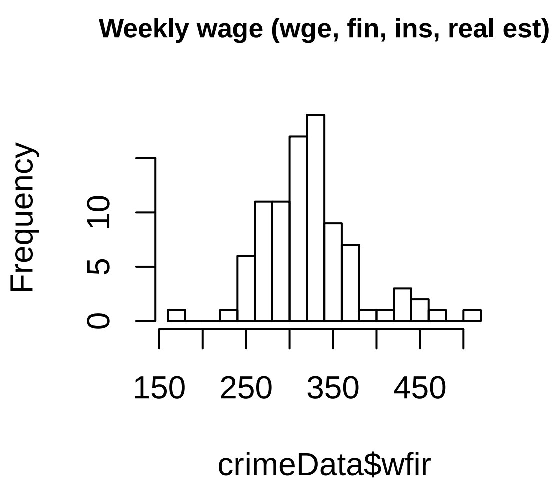
```
hist(crimeData$wtrd, breaks=20, main = "Weekly wage (whlesle, retail)", cex.main=.8)
hist(log(crimeData$wtrd), breaks=20, main = "Log Weekly wage (whlesle, retail)", cex.main=.8)
```



wfir: wkly wge, fin, ins, real est

Looking at the histogram, the distribution appear to be normally distribbuted.

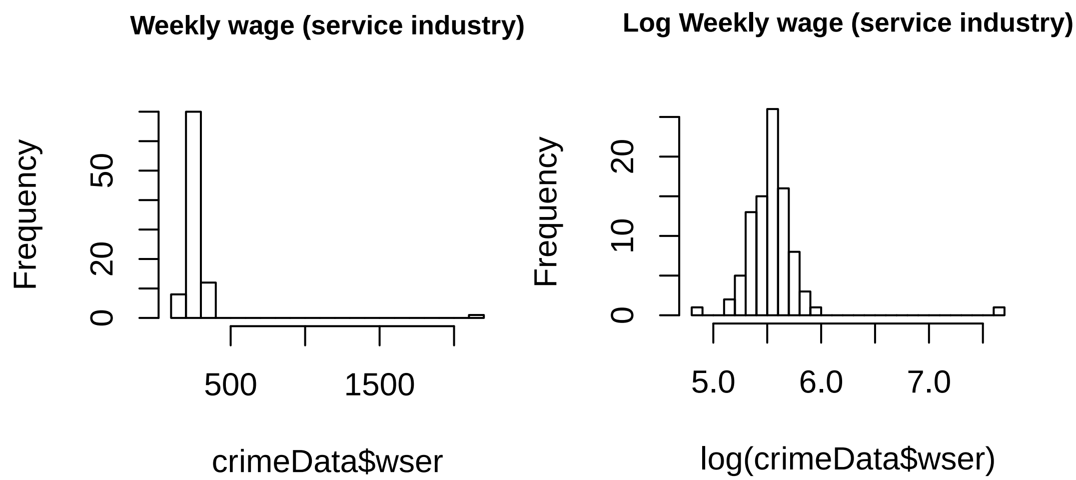
```
hist(crimeData$wfir, breaks=20, main = "Weekly wage (wge, fin, ins, real est)", cex.main=.8)
```



wser: wkly wge, service industry

Looking at the histogram, the distribution appear to be positvely skewed. Applying `log()` shows the histogram to appear normally distributed with one outlier.

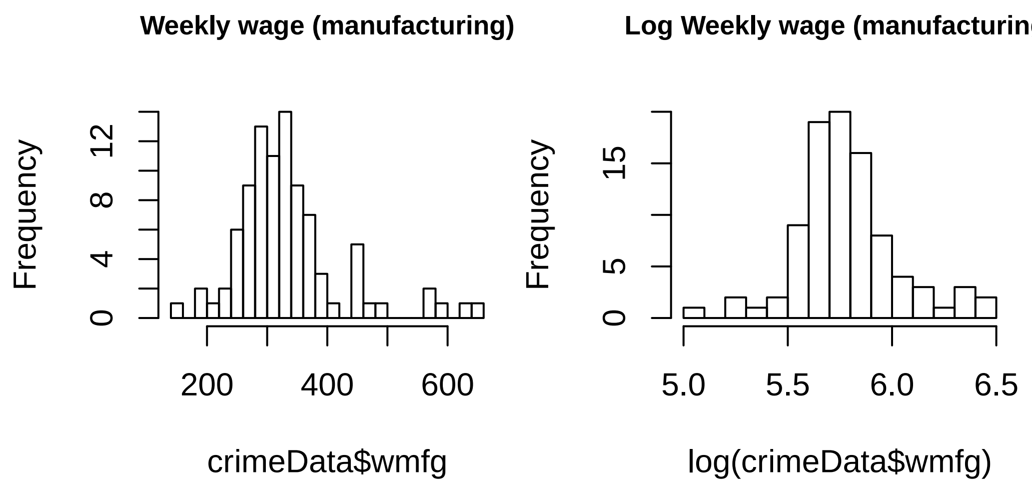
```
hist(crimeData$wser, breaks=20, main = "Weekly wage (service industry)", cex.main=.8)
hist(log(crimeData$wser), breaks=20, main = "Log Weekly wage (service industry)", cex.main=.8)
```



wmfg: wkly wge, manufacturing

Looking at the histogram, the distribution appear to be slighly positvely skewed. Applying `log()` shows the histogram to appear normally distributed.

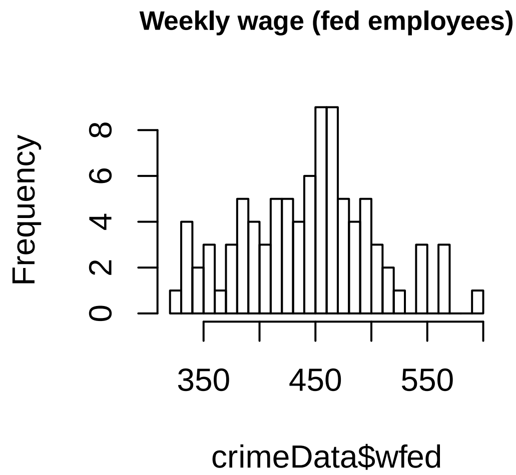
```
hist(crimeData$wmfg, breaks=20, main = "Weekly wage (manufacturing)", cex.main=.8)
hist(log(crimeData$wmfg), breaks=20, main = "Log Weekly wage (manufacturing)", cex.main=.8)
```

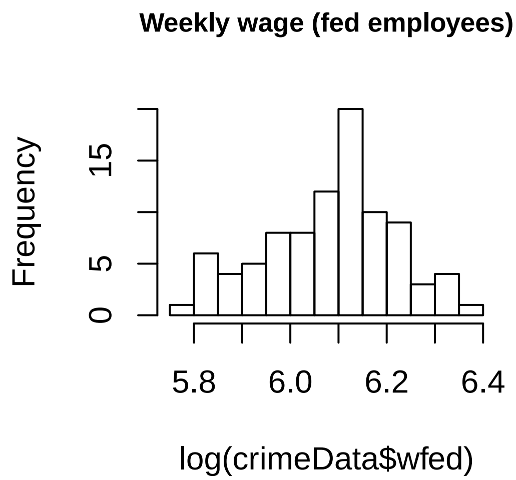


wfed: wkly wge, fed employees

Applying `log()` shows the histogram to appear normally distributed.

```
hist(crimeData$wfed, breaks=20, main = "Weekly wage (fed employees)", cex.main=.8)
hist(log(crimeData$wfed), breaks=20, main = "Weekly wage (fed employees)", cex.main=.8)
```

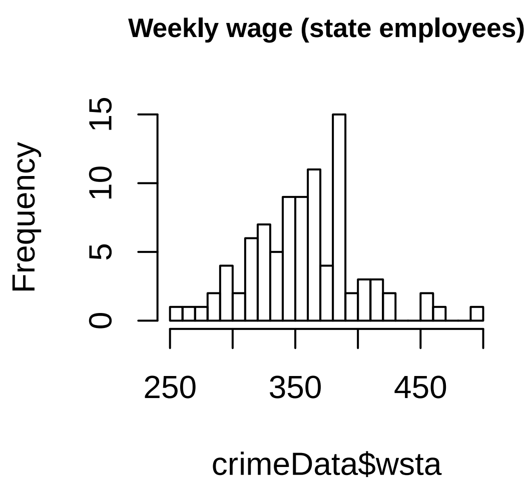


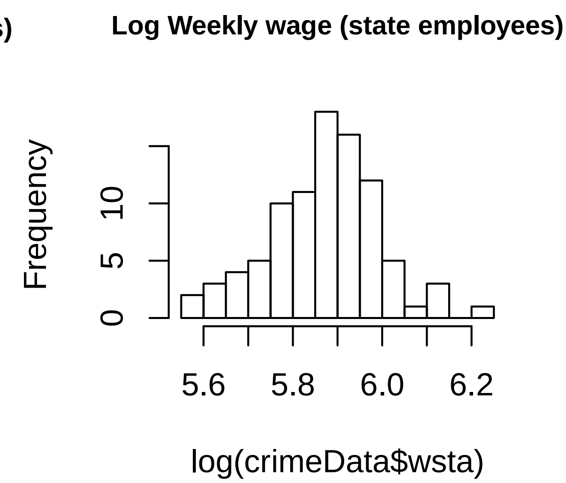


wsta: wkly wge, state employees

Looking at the histogram, the distribution appear to be slighly positvely skewed. Applying `log()` shows the histogram to appear normally distributed.

```
hist(crimeData$wsta, breaks=20, main = "Weekly wage (state employees)", cex.main=.8)
hist(log(crimeData$wsta), breaks=20, main = "Log Weekly wage (state employees)", cex.main=.8)
```

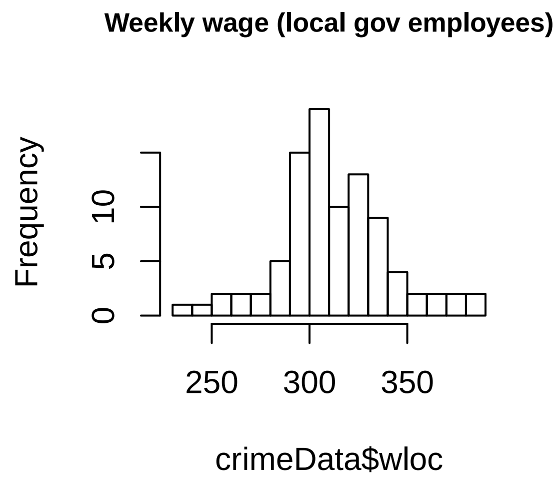




wloc: wkly wge, local gov emps

Looking at the histogram, the distribution appear to be slighly normally distributed.

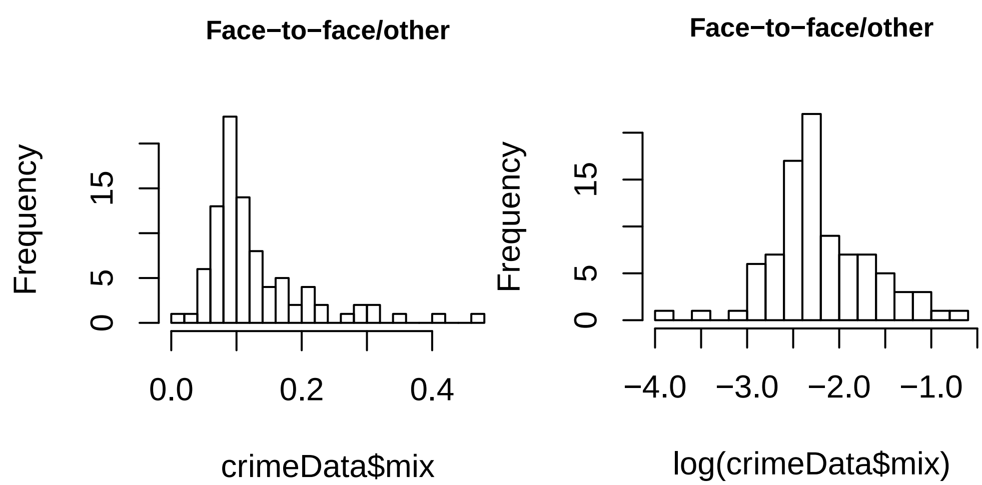
```
hist(crimeData$wloc, breaks=20, main = "Weekly wage (local gov employees)", cex.main=.8)
```



mix: offense mix: face-to-face/other

Looking at the histogram, the distribution appear to be slighly positvely skewed. Applying `log()` shows the histogram to appear normally distributed.

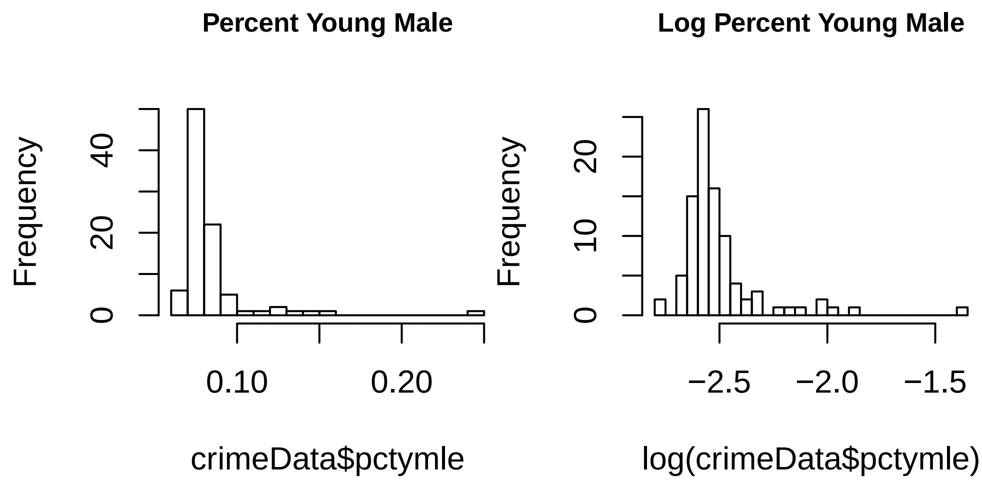
```
hist(crimeData$mix, breaks=20, main = "Face-to-face/other", cex.main=.8)
hist(log(crimeData$mix), breaks=20, main = "Face-to-face/other", cex.main=.8)
```



pctymle: percent young male

Looking at the histogram, the distribution appear to be positvely skewed. Applying `log()` shows the histogram to appear positvely skewed with one outlier.

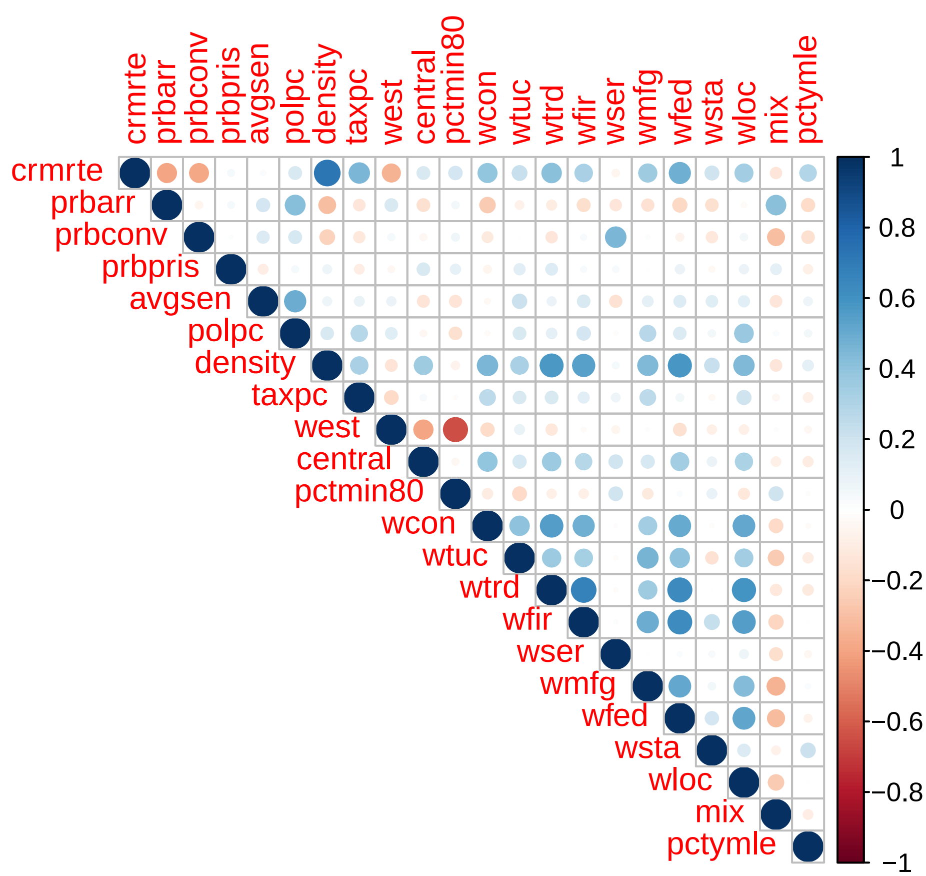
```
hist(crimeData$pctymle, breaks=20, main = "Percent Young Male", cex.main=.8)
hist(log(crimeData$pctymle), breaks=20, main = "Log Percent Young Male", cex.main=.8)
```



Analysis of Key Relationships

It is very imperative to realize the relationship between crime rate and all the data available to us. We'll use `corrplot` to make the exploration of key relationships clearer.

```
corrplot(cor(crimeData[ , (names(crimeData) %in% c("crmrte", "prbarr", "prbconv", "prbpris", "avgsen",
```



The above plot indicates the following *positive* relationships with crime rate:

1. Density (density).
2. Tax revenue per capita (taxpc).
3. All wage varibles.
4. Young Male (pctymle)

The above plot also indicates the following *negative* relationships with crime rate:

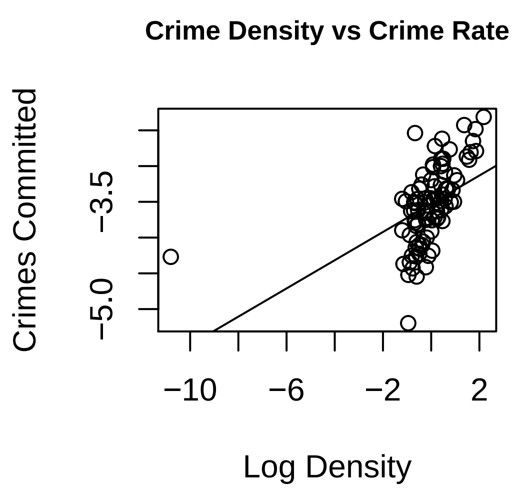
1. Probabiliy of Arrest (prbarr)
2. Probablity of Conviction (prbconv)
3. West region of NC (west)

Crimes Committed per person (crmrte) & People per sq. (density)

As you can see from the correlation plot below, there is a positive linear relationship between crime rate and density.

```
plot(log(crimeData$density), log(crimeData$crmrte),
    main="Crime Density vs Crime Rate",
    xlab="Log Density",
    ylab="Crimes Committed", cex.main=0.8)
abline(lm(log(crimeData$crmrte) ~ log(crimeData$density)))
cor(crimeData$crmrte, crimeData$density)
```

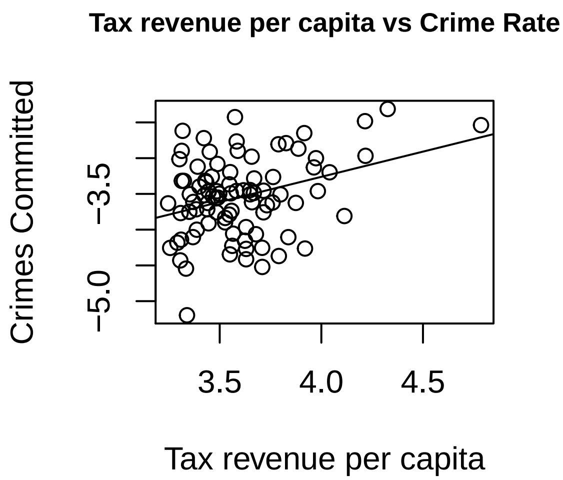
```
## [1] 0.7289632
```



Crimes Committed per person (crmrte) & Tax revenue per capita (taxpc)

```
plot(log(crimeData$taxpc), log(crimeData$crmrte),
    main="Tax revenue per capita vs Crime Rate",
    xlab="Tax revenue per capita",
    ylab="Crimes Committed", cex.main=0.8)
abline(lm(log(crimeData$crmrte) ~ log(crimeData$taxpc)))
cor(crimeData$crmrte, crimeData$taxpc)
```

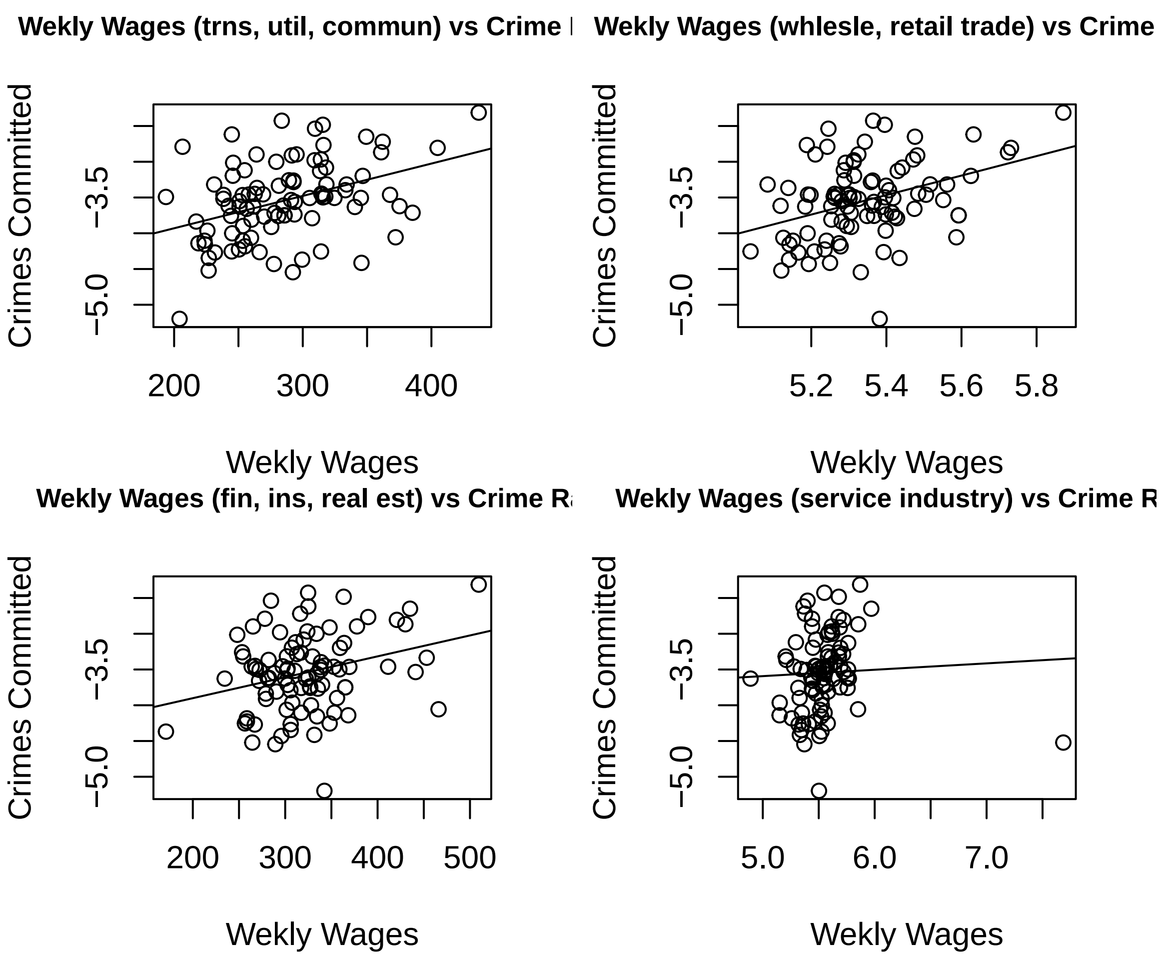
```
## [1] 0.4509798
```

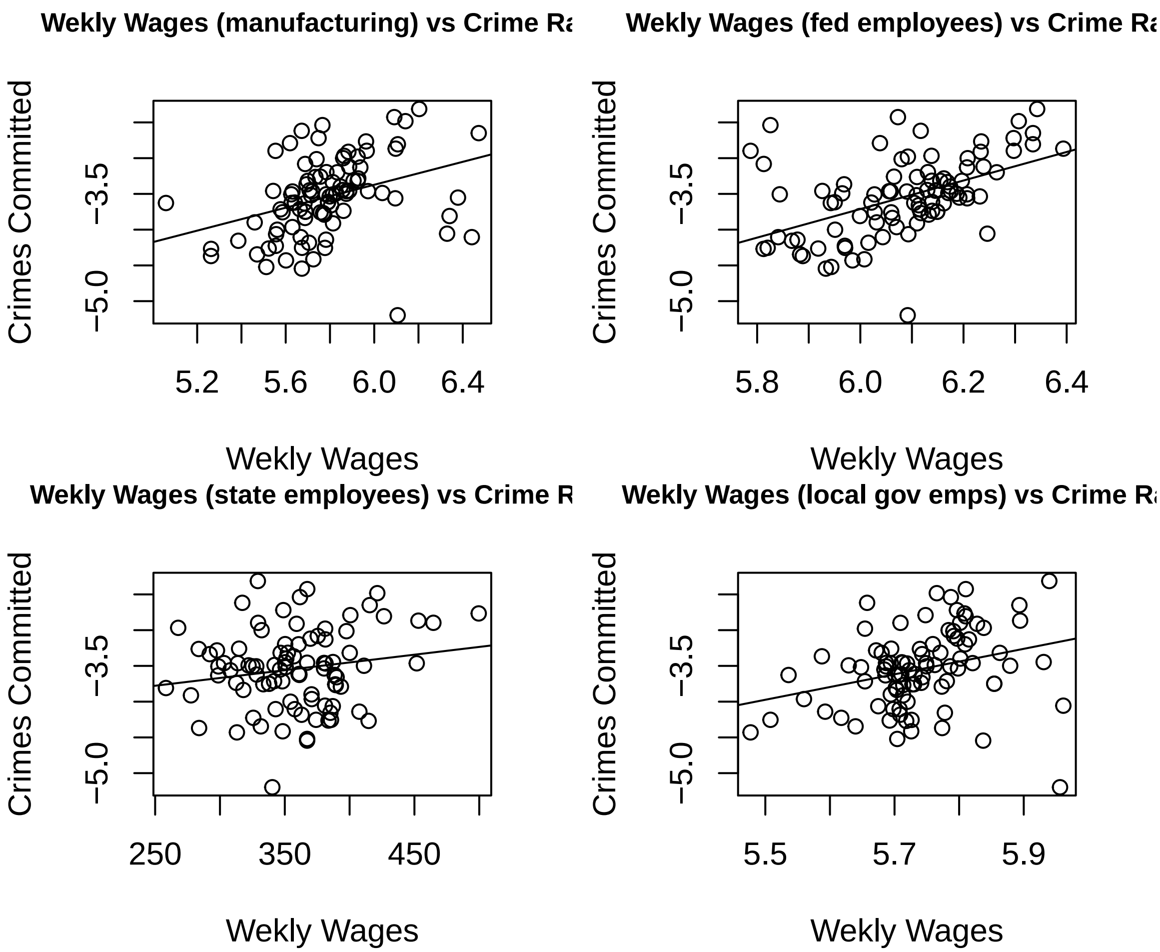


Crimes Committed per person (crmrte) & Wages

```r
plot(crimeData$wcon, log(crimeData$crmrte),
    main="Wekly Wages (trns, util, commun) vs Crime Rate",
    xlab="Wekly Wages",
    ylab="Crimes Committed", cex.main=0.8)
abline(lm(log(crimeData$crmrte) ~ crimeData$wcon))

plot(log(crimeData$wtrd), log(crimeData$crmrte),
    main="Wekly Wages (whlesle, retail trade) vs Crime Rate",
    xlab="Wekly Wages",
    ylab="Crimes Committed", cex.main=0.8)
abline(lm(log(crimeData$crmrte) ~ log(crimeData$wtrd)))

plot(crimeData$wfir, log(crimeData$crmrte),
    main="Wekly Wages (fin, ins, real est) vs Crime Rate",
    xlab="Wekly Wages",
    ylab="Crimes Committed", cex.main=0.8)
abline(lm(log(crimeData$crmrte) ~ crimeData$wfir))

plot(log(crimeData$wser), log(crimeData$crmrte),
    main="Wekly Wages (service industry) vs Crime Rate",
    xlab="Wekly Wages",
    ylab="Crimes Committed", cex.main=0.8)
abline(lm(log(crimeData$crmrte) ~ log(crimeData$wser)))

plot(log(crimeData$wmfg), log(crimeData$crmrte),
    main="Wekly Wages (manufacturing) vs Crime Rate",
    xlab="Wekly Wages",
    ylab="Crimes Committed", cex.main=0.8)
abline(lm(log(crimeData$crmrte) ~ log(crimeData$wmfg)))

plot(log(crimeData$wfed), log(crimeData$crmrte),
    main="Wekly Wages (fed employees) vs Crime Rate",
    xlab="Wekly Wages",
    ylab="Crimes Committed", cex.main=0.8)
abline(lm(log(crimeData$crmrte) ~ log(crimeData$wfed)))
```

```r
plot(crimeData$wsta, log(crimeData$crmrte),
    main="Wekly Wages (state employees) vs Crime Rate",
    xlab="Wekly Wages",
    ylab="Crimes Committed", cex.main=0.8)
abline(lm(log(crimeData$crmrte) ~ crimeData$wsta))

plot(log(crimeData$wloc), log(crimeData$crmrte),
    main="Wekly Wages (local gov emps) vs Crime Rate",
    xlab="Wekly Wages",
    ylab="Crimes Committed", cex.main=0.8)
abline(lm(log(crimeData$crmrte) ~ log(crimeData$wloc)))
```

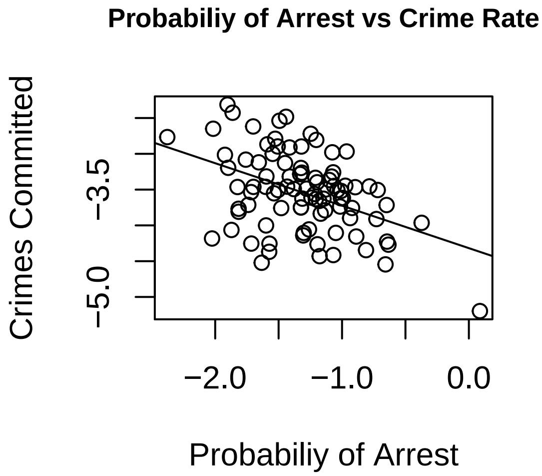




Crimes Committed per person (crmrte) & Probabiliy of Arrest (prbarr)

```
plot(log(crimeData$prbarr), log(crimeData$crmrte),
    main="Probabiliy of Arrest vs Crime Rate",
    xlab="Probabiliy of Arrest",
    ylab="Crimes Committed", cex.main=0.8)
abline(lm(log(crimeData$crmrte) ~ log(crimeData$prbarr)))
cor(crimeData$crmrte, crimeData$prbarr)
```

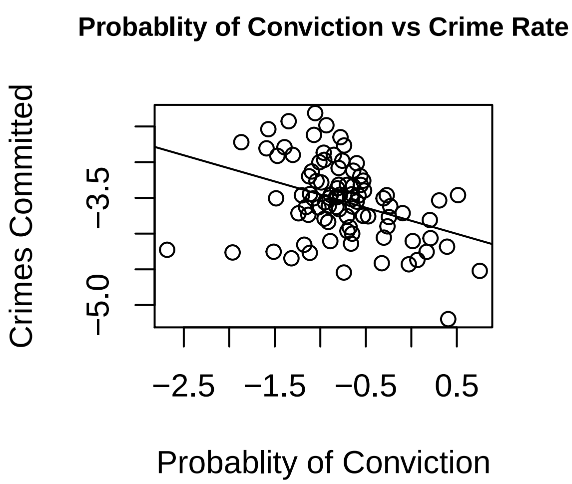
```
## [1] -0.3933297
```



Crimes Committed per person (crmrte) & Tax revenue per capita (prbconv)

```
plot(log(crimeData$prbconv), log(crimeData$crmrte),
    main="Probablity of Conviction vs Crime Rate",
    xlab="Probablity of Conviction",
    ylab="Crimes Committed", cex.main=0.8)
abline(lm(log(crimeData$crmrte) ~ log(crimeData$prbconv)))
cor(crimeData$crmrte, crimeData$prbconv)
```

```
## [1] -0.3859724
```



Proposed Models

Model 1: with only the explanatory variables

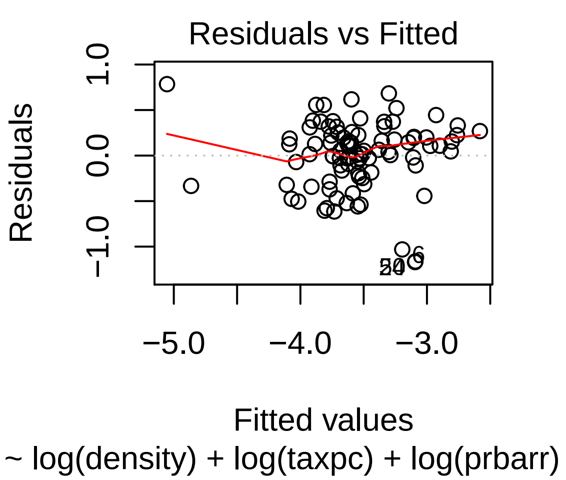
Using a combination of key positive and negative attributes to crime rate, we're recommending the following model:

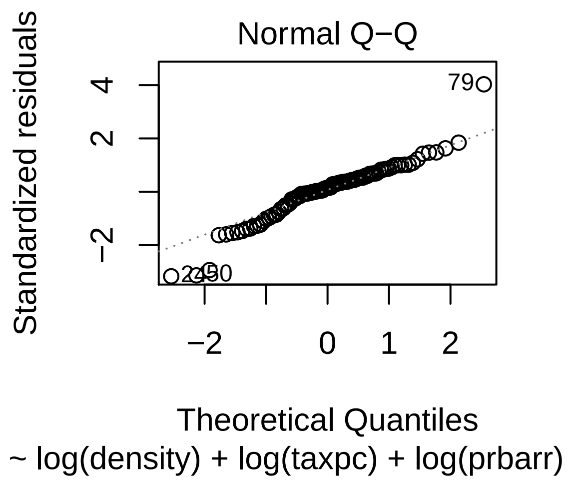
$crimeDeterm = \beta_0 + \beta_1 \cdot log(density) + \beta_2 \cdot log(taxpc) + \beta_3 \cdot log(prbarr) + \beta_4 \cdot log(prbconv) + \beta_5 \cdot log(pctymle)$

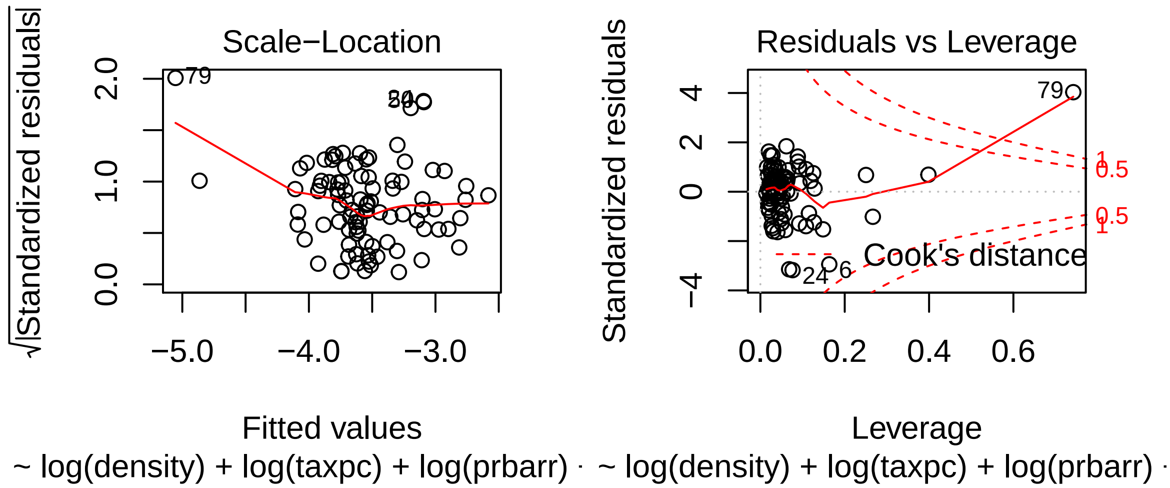
```
model1 <- lm(log(crmrte) ~ log(density) + log(taxpc) + log(prbarr) + log(prbconv)
             + log(pctymle), data=crimeData)
summary(model1)
```

```
##
## Call:
## lm(formula = log(crmrte) ~ log(density) + log(taxpc) + log(prbarr) +
##     log(prbconv) + log(pctymle), data = crimeData)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.17009 -0.18998  0.05217  0.22241  0.78454
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -5.27049    0.77309  -6.817 1.27e-09 ***
## log(density)  0.12180    0.03208   3.797 0.000274 ***
## log(taxpc)    0.41512    0.16111   2.577 0.011705 *
## log(prbarr)  -0.47872    0.11901  -4.023 0.000124 ***
## log(prbconv) -0.35278    0.08166  -4.320 4.21e-05 ***
## log(pctymle)  0.25870    0.22800   1.135 0.259713
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.383 on 85 degrees of freedom
## Multiple R-squared:  0.5354, Adjusted R-squared:  0.5081
## F-statistic: 19.59 on 5 and 85 DF,  p-value: 6.212e-13
```

```
plot(model1)
```







Model 2: with key explanatory variables and only covariates

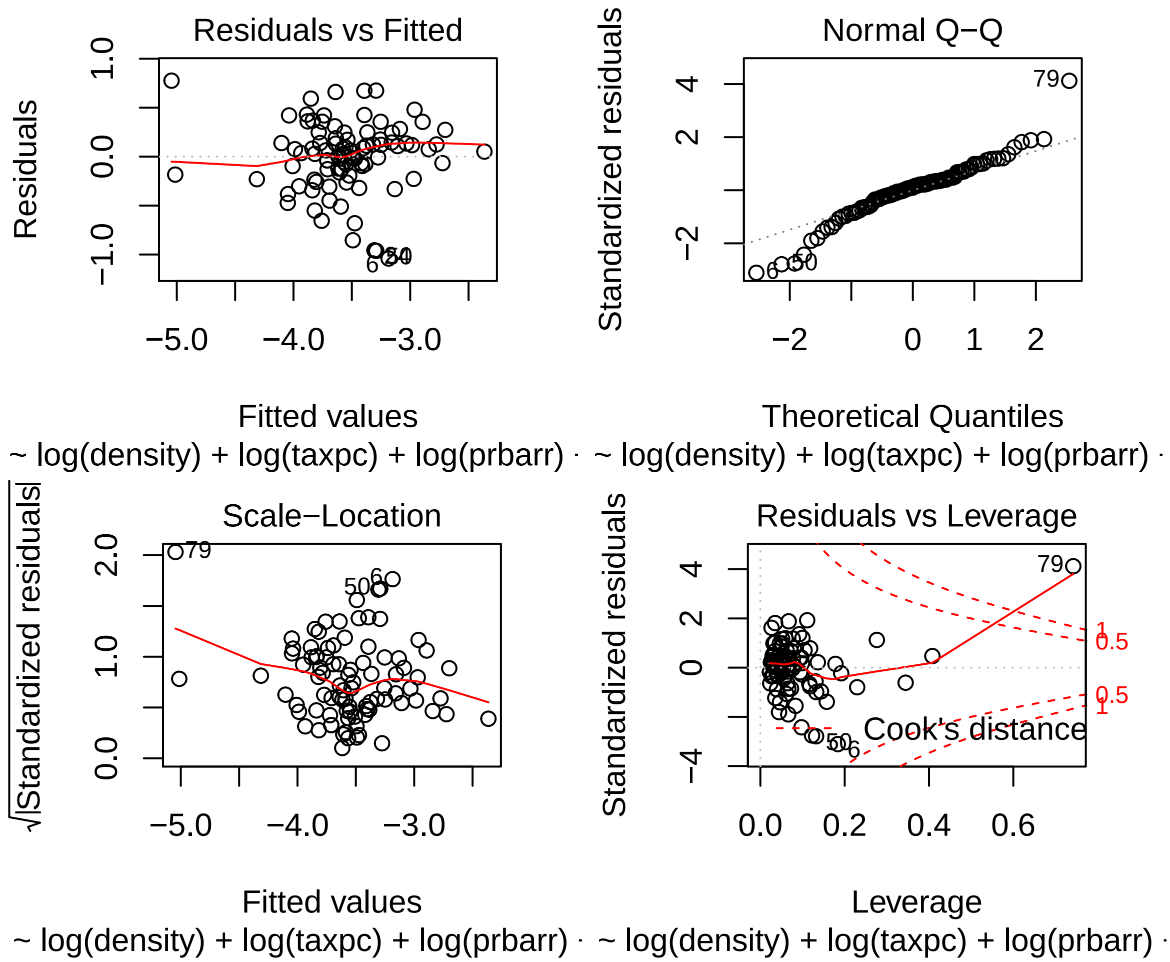
In this model, we'll include the variables (avgsen, mix), as we think they will contribute to the accuracy of your results without introducing substantial bias.

$crimeDeterm = \beta_0 + \beta_1 \cdot log(density) + \beta_2 \cdot log(taxpc) + \beta_3 \cdot log(prbarr) + \beta_4 \cdot log(prbconv) + \beta_5 \cdot log(pctymle) + \beta_6 \cot log(avgsen) +$

```r
model2 <- lm(log(crmrte) ~ log(density) + log(taxpc) + log(prbarr) + log(prbconv)
             + log(pctymle) + log(avgsen) + log(mix), data=crimeData)
summary(model2)
```

```
##
## Call:
## lm(formula = log(crmrte) ~ log(density) + log(taxpc) + log(prbarr) +
##     log(prbconv) + log(pctymle) + log(avgsen) + log(mix), data = crimeData)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.04133 -0.17272  0.03557  0.18088  0.77601
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -4.57642    0.84429  -5.420 5.71e-07 ***
## log(density)  0.14290    0.03216   4.443 2.72e-05 ***
## log(taxpc)    0.43437    0.15707   2.765  0.00700 **
## log(prbarr)  -0.59111    0.12448  -4.748 8.47e-06 ***
## log(prbconv) -0.26492    0.08512  -3.112  0.00255 **
## log(pctymle)  0.33420    0.22370   1.494  0.13898
## log(avgsen)  -0.04673    0.14307  -0.327  0.74477
## log(mix)      0.24922    0.09205   2.708  0.00823 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3707 on 83 degrees of freedom
## Multiple R-squared:  0.575,  Adjusted R-squared:  0.5392
## F-statistic: 16.04 on 7 and 83 DF,  p-value: 3.657e-13
```

```r
plot(model2)
```



Model 3: includes the previous covariates, and most, if not all, other covariates

In this model, we'll include all the data available to us to demonstrate the robustness of of results to model specification.

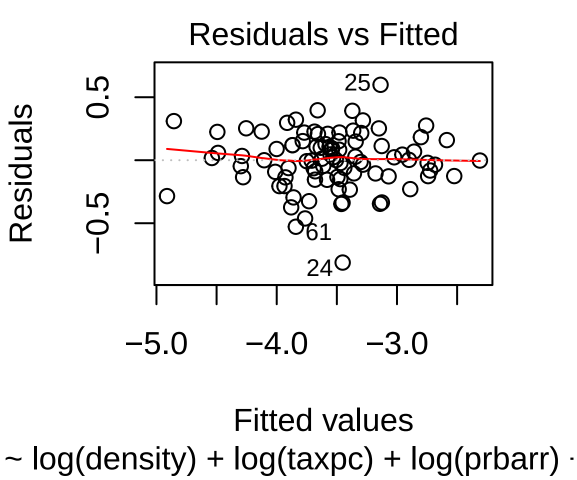
$$crimeDeterm = \beta_0 + \beta_1 \cdot log(density) + \beta_2 \cdot log(taxpc) + \beta_3 \cdot log(prbarr) + \beta_4 \cdot log(prbconv) + \beta_5 \cdot log(pctymle) + \beta_6 \cdot log(avgsen) + \beta_7 \cdot$$

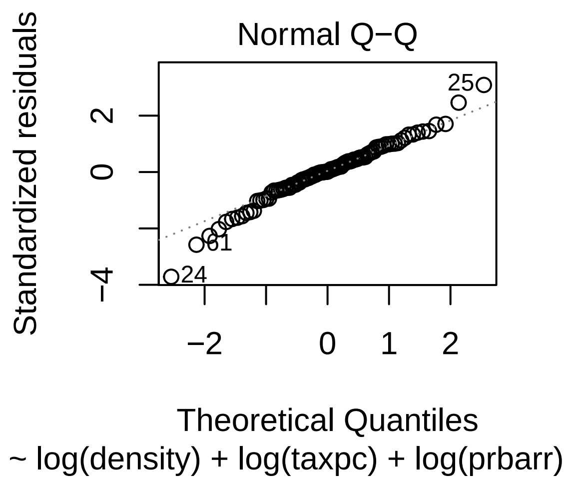
```r
model3 <- lm(log(crmrte) ~ log(density) + log(taxpc) + log(prbarr) + log(prbconv)
             + log(pctymle) + log(avgsen) + log(mix) + log(prbpris) + log(polpc)
             + log(pctmin80) + log(wcon) + log(wtrd) + wfir + log(wser) + log(wmfg)
             + log(wfed) + log(wsta) + wloc, data=crimeData)
summary(model3)
```

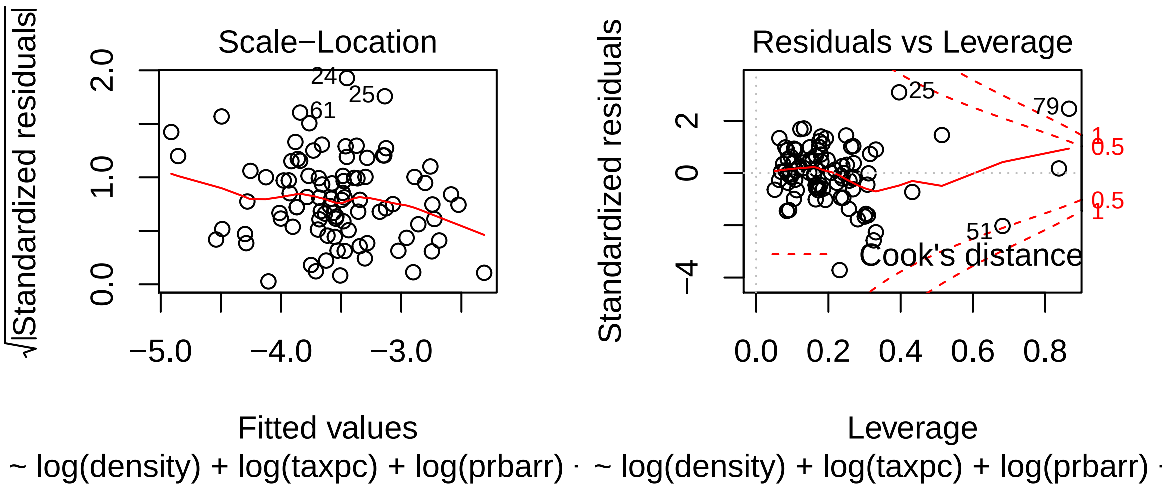
```
##
## Call:
## lm(formula = log(crmrte) ~ log(density) + log(taxpc) + log(prbarr) +
##     log(prbconv) + log(pctymle) + log(avgsen) + log(mix) + log(prbpris) +
##     log(polpc) + log(pctmin80) + log(wcon) + log(wtrd) + wfir +
##     log(wser) + log(wmfg) + log(wfed) + log(wsta) + wloc, data = crimeData)
```

```
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.81225 -0.12715  0.00293  0.14931  0.59861
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -7.074e+00  2.935e+00  -2.410  0.01852 *
## log(density)   1.306e-01  3.127e-02   4.175 8.24e-05 ***
## log(taxpc)     5.837e-02  1.361e-01   0.429  0.66929
## log(prbarr)   -5.376e-01  8.715e-02  -6.168 3.62e-08 ***
## log(prbconv)  -3.022e-01  6.668e-02  -4.532 2.27e-05 ***
## log(pctymle)   1.612e-01  1.703e-01   0.946  0.34708
## log(avgsen)   -2.993e-01  1.165e-01  -2.570  0.01224 *
## log(mix)       6.474e-02  7.158e-02   0.904  0.36879
## log(prbpris)  -3.134e-01  1.444e-01  -2.171  0.03326 *
## log(polpc)     4.777e-01  1.126e-01   4.241 6.51e-05 ***
## log(pctmin80)  2.278e-01  3.330e-02   6.841 2.17e-09 ***
## log(wcon)      2.293e-01  2.222e-01   1.032  0.30568
## log(wtrd)      4.131e-01  3.036e-01   1.361  0.17781
## wfir          -1.347e-03  7.957e-04  -1.693  0.09469 .
## log(wser)     -3.086e-01  1.102e-01  -2.801  0.00654 **
## log(wmfg)      8.056e-02  1.548e-01   0.520  0.60436
## log(wfed)      6.546e-01  3.402e-01   1.924  0.05827 .
## log(wsta)     -6.868e-03  2.660e-01  -0.026  0.97947
## wloc          -2.877e-05  1.420e-03  -0.020  0.98389
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2493 on 72 degrees of freedom
## Multiple R-squared:  0.8333, Adjusted R-squared:  0.7916
## F-statistic:    20 on 18 and 72 DF,  p-value: < 2.2e-16
```

```
plot(model3)
```







Models Regressions

```r
stargazer(model1, model2, model3, type = "text")
```

```
##
## ===========================================================================================
##                                       Dependent variable:
##                         -------------------------------------------------------------------
##                                           log(crmrte)
##                               (1)                   (2)                    (3)
## -------------------------------------------------------------------------------------------
## log(density)              0.122***              0.143***               0.131***
##                           (0.032)               (0.032)                (0.031)
##
## log(taxpc)                0.415**               0.434***                0.058
##                           (0.161)               (0.157)                (0.136)
##
## log(prbarr)              -0.479***             -0.591***              -0.538***
##                           (0.119)               (0.124)                (0.087)
##
## log(prbconv)             -0.353***             -0.265***              -0.302***
##                           (0.082)               (0.085)                (0.067)
##
## log(pctymle)               0.259                 0.334                  0.161
##                           (0.228)               (0.224)                (0.170)
##
## log(avgsen)                                     -0.047                 -0.299**
##                                                 (0.143)                (0.116)
##
## log(mix)                                        0.249***                0.065
##                                                 (0.092)                (0.072)
##
## log(prbpris)                                                          -0.313**
##                                                                        (0.144)
##
## log(polpc)                                                             0.478***
```

```
##                                                                        (0.113)
##
## log(pctmin80)                                                          0.228***
##                                                                        (0.033)
##
## log(wcon)                                                               0.229
##                                                                        (0.222)
##
## log(wtrd)                                                               0.413
##                                                                        (0.304)
##
## wfir                                                                   -0.001*
##                                                                        (0.001)
##
## log(wser)                                                             -0.309***
##                                                                        (0.110)
##
## log(wmfg)                                                               0.081
##                                                                        (0.155)
##
## log(wfed)                                                              0.655*
##                                                                        (0.340)
##
## log(wsta)                                                              -0.007
##                                                                        (0.266)
##
## wloc                                                                  -0.00003
##                                                                        (0.001)
##
## Constant                  -5.270***           -4.576***               -7.074**
##                            (0.773)             (0.844)                (2.935)
##
## -------------------------------------------------------------------------------------------
## Observations                 91                  91                      91
## R2                         0.535               0.575                   0.833
## Adjusted R2                0.508               0.539                   0.792
## Residual Std. Error    0.383 (df = 85)     0.371 (df = 83)         0.249 (df = 72)
## F Statistic        19.593*** (df = 5; 85) 16.044*** (df = 7; 83) 19.997*** (df = 18; 72)
## ===========================================================================================
## Note:                                                        *p<0.1; **p<0.05; ***p<0.01
```