Lab 4:Crime Reduction Thoughts

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August 9, 2017

```
library(car)
library(corrplot)
library(lmtest)
```

```
## Loading required package: zoo
```

```
##
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```
library(sandwich)
library(stargazer)
```

```
##
## Please cite as:
```

```
##  Hlavac, Marek (2015). stargazer: Well-Formatted Regression and Summary Statistics Tables.
```

```
##  R package version 5.2. http://CRAN.R-project.org/package=stargazer
```

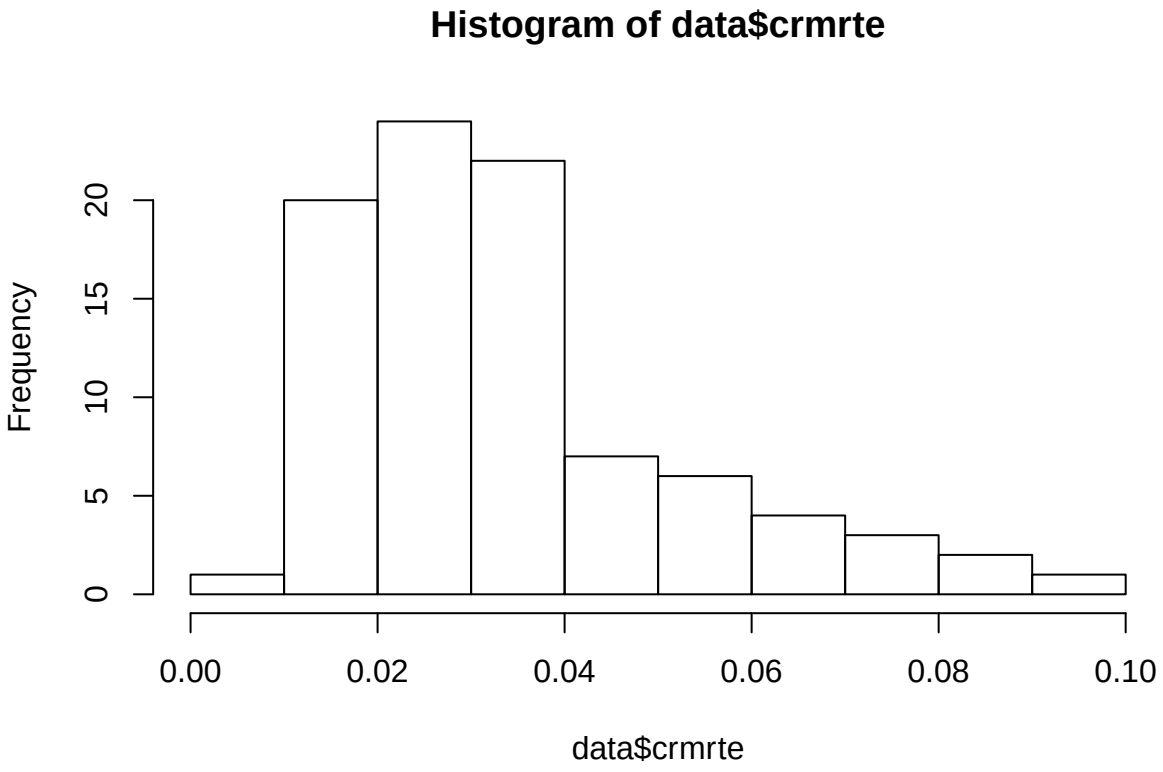
Transformed Dataset

```
#copied Aaron's (checked that this incorporates what Kim did too, I added mean of wages from all categories)
data = read.csv("crime.csv")
data$crmrte_log = log(data$crmrte)
data$crmrte_1K_log = log(data$crmrte *10^3)
data$polpc_1M_log = log(data$polpc * 10^6)
data$density_1K_log = log(data$density * 10^3)
data$taxpc_log = log(data$taxpc)
data$pctmin80 = data$pctmin80 / 100
data$wtotal = (data$wcon + data$wtuc + data$wtrd + data$wfir +
               data$wser + data$wmfg + data$wfed + data$wsta + data$wloc)
data$w_mean = (data$wcon + data$wtuc + data$wtrd + data$wfir +
               data$wser + data$wmfg + data$wfed + data$wsta + data$wloc)/9
sort(colnames(data))
```

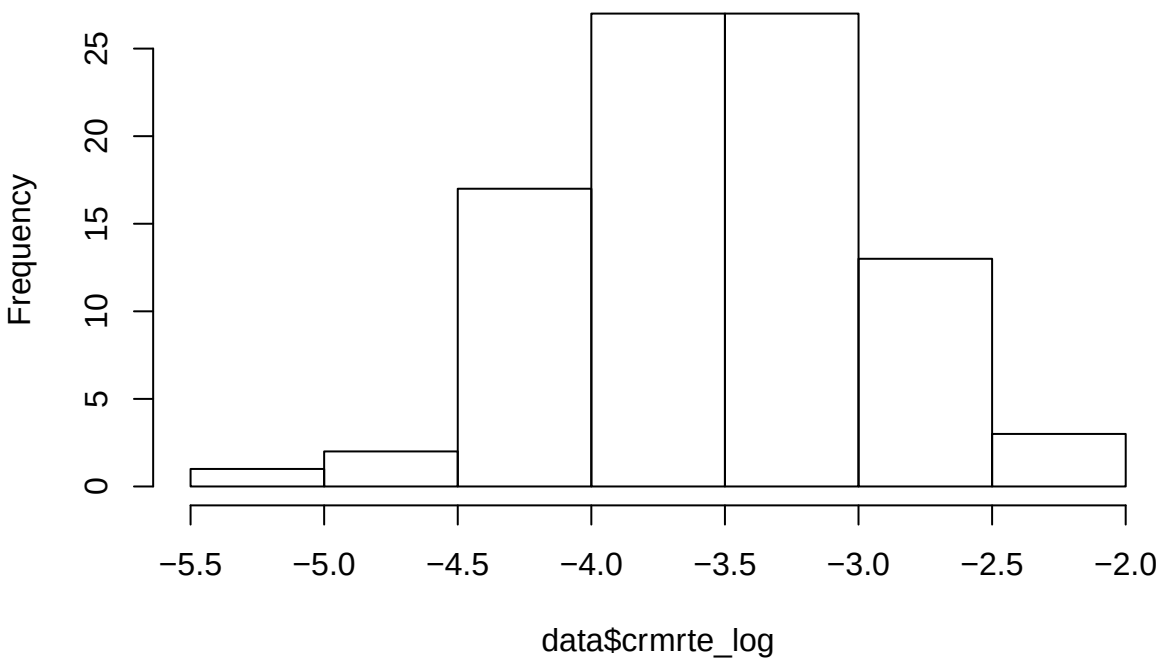
```
##  [1] "avgsen"         "central"        "county"         "crmrte"
##  [5] "crmrte_1K_log"  "crmrte_log"     "density"        "density_1K_log"
##  [9] "mix"            "pctmin80"       "pctymle"        "polpc"
## [13] "polpc_1M_log"   "prbarr"         "prbconv"        "prbpris"
## [17] "taxpc"          "taxpc_log"      "urban"          "w_mean"
## [21] "wcon"           "west"           "wfed"           "wfir"
## [25] "wloc"           "wmfg"           "wser"           "wsta"
## [29] "wtotal"         "wtrd"           "wtuc"           "X"
## [33] "year"
```

Yes, beautiful, needed that X 1K

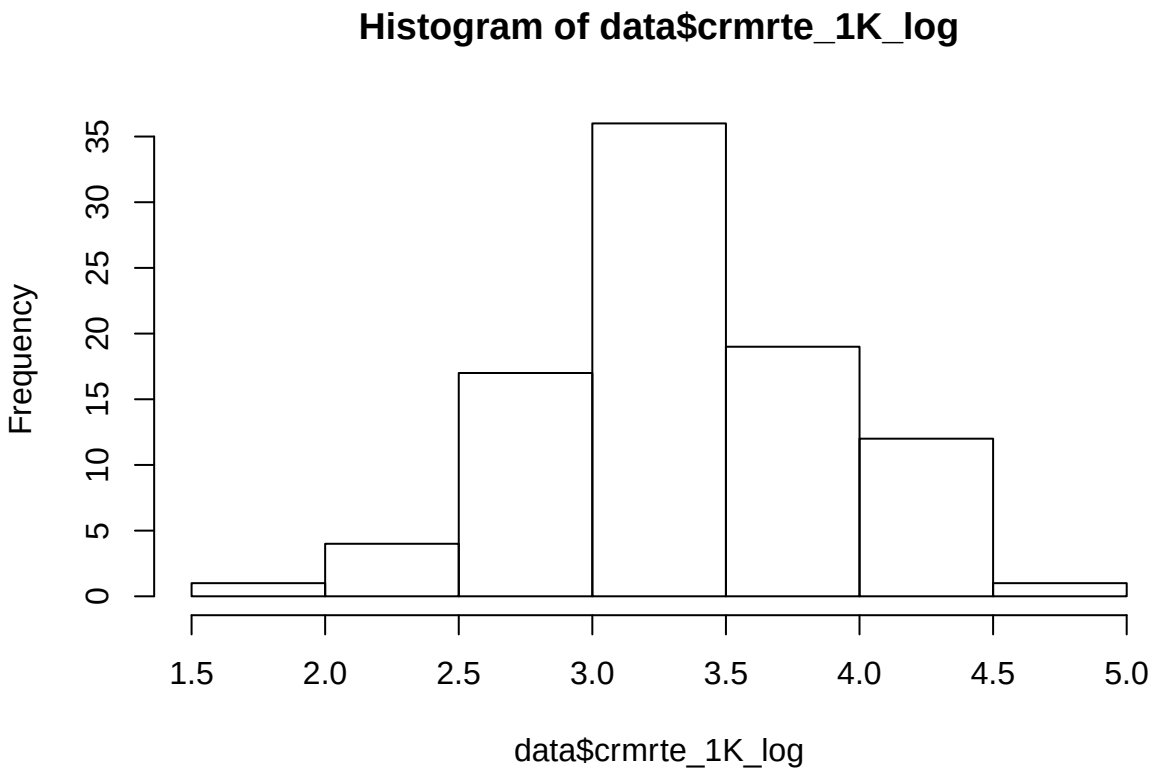
```
hist(data$crmrte)
```



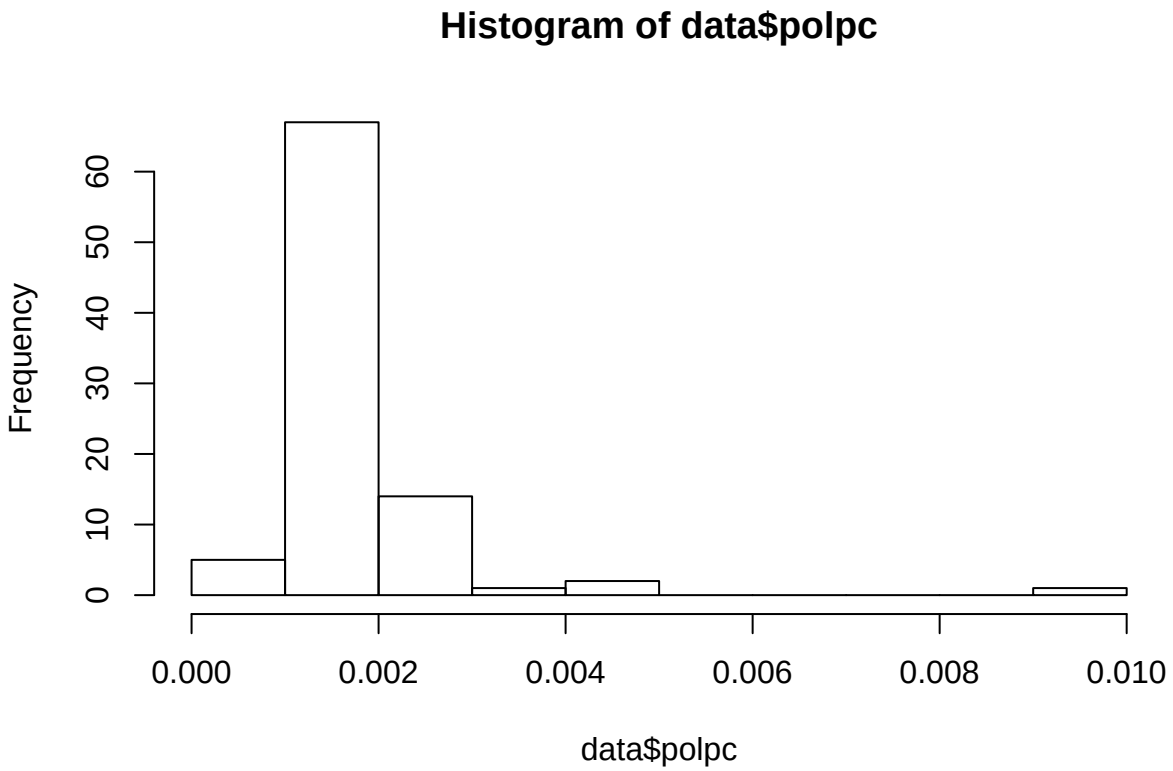

```
hist(data$crmrte_log)
```



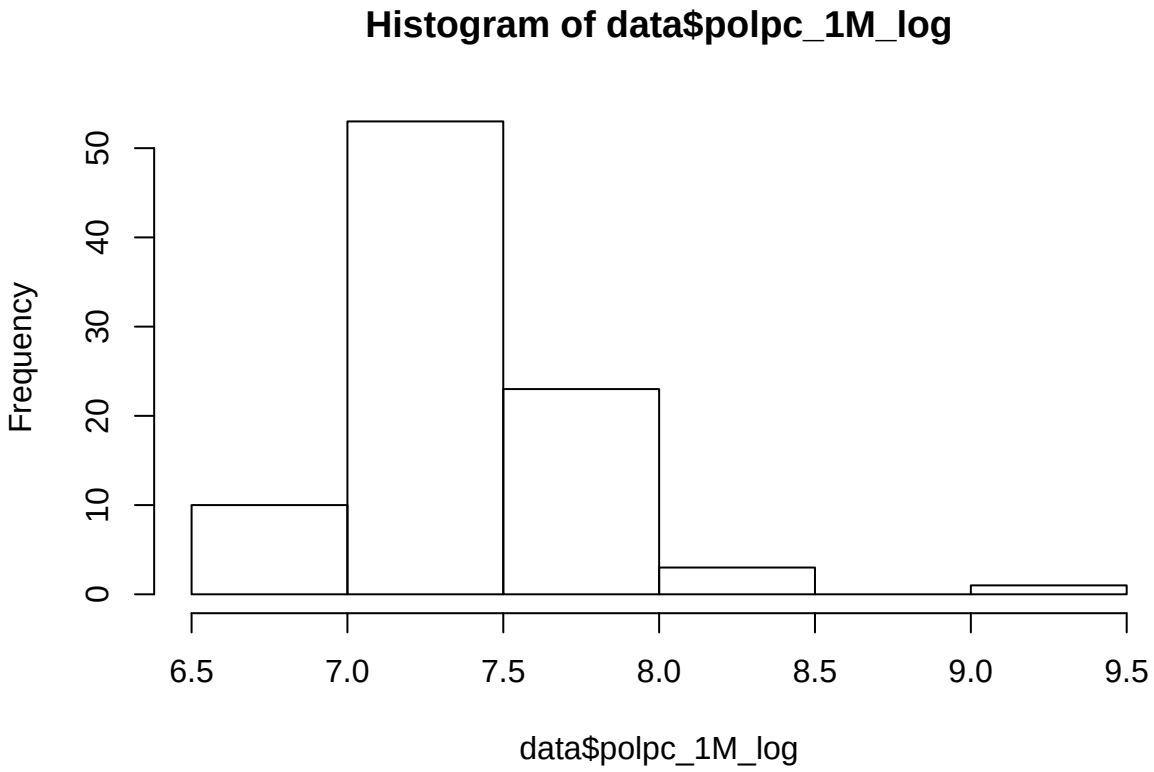

```
hist(data$crmrte_1K_log)
```




```r
hist(data$polpc)
```

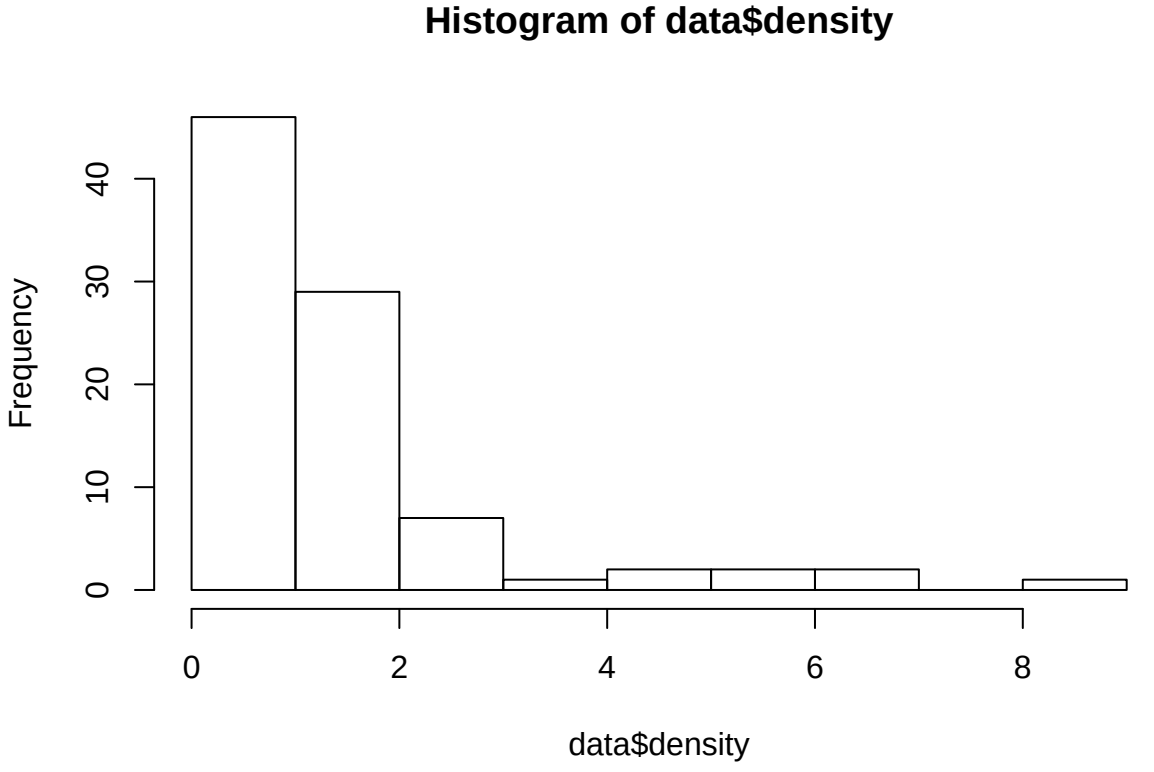



```r
#looks better below, agreed
hist(data$polpc_1M_log)
```

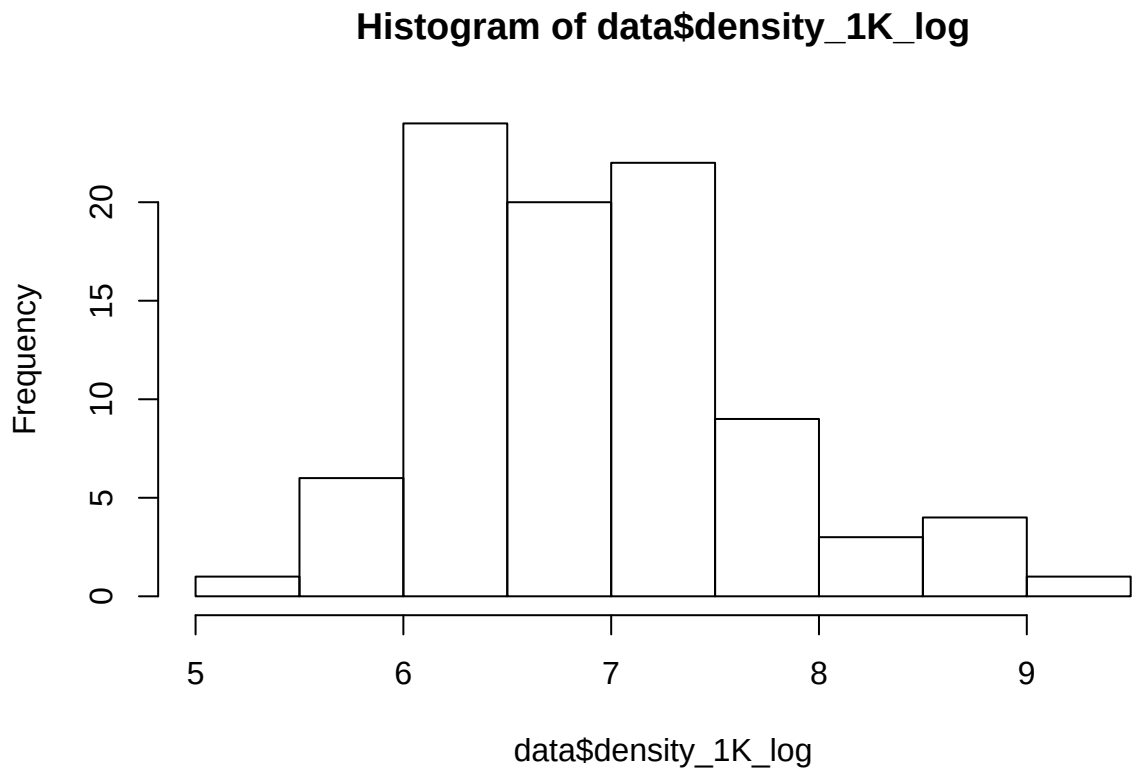


Great!

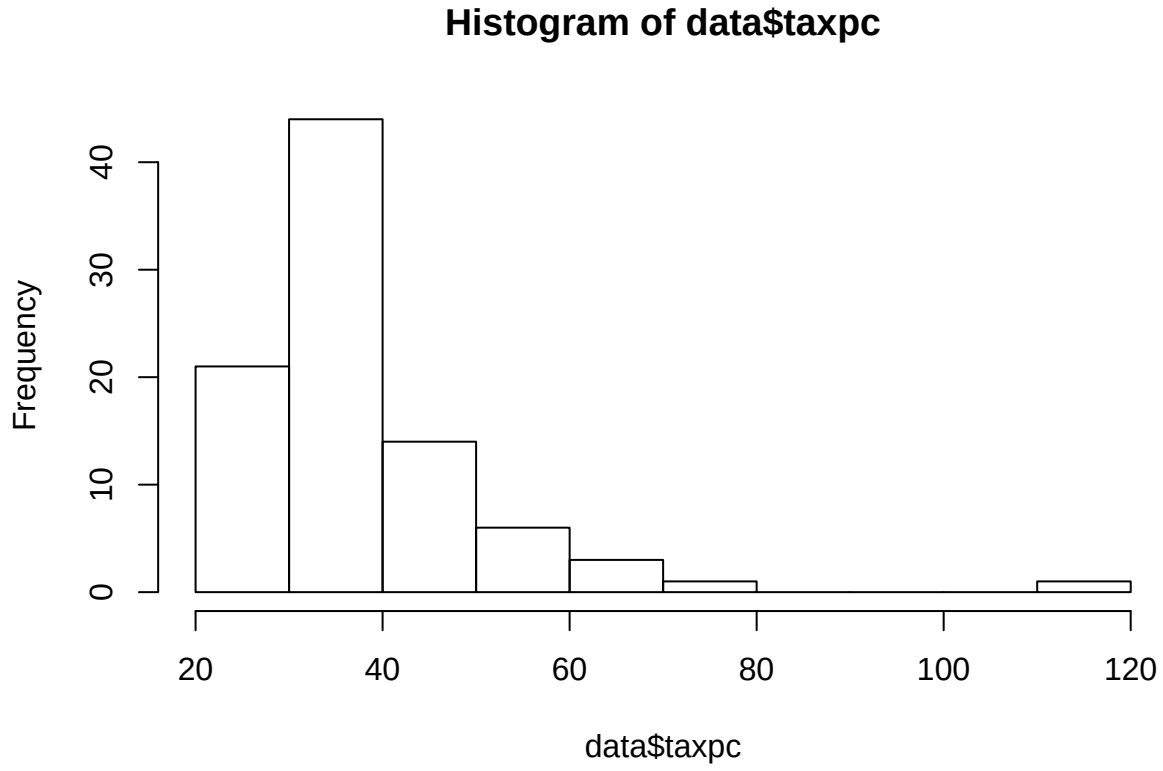
```
hist(data$density)
```



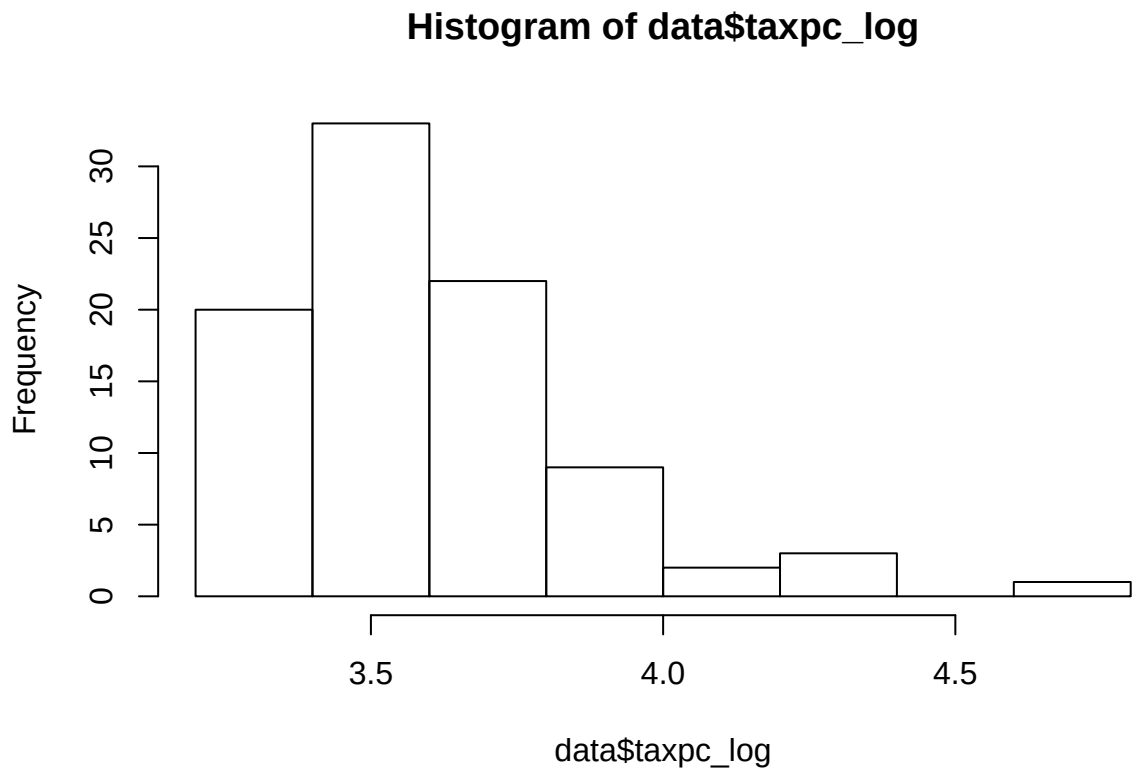

```
hist(data$density_1K_log)
```



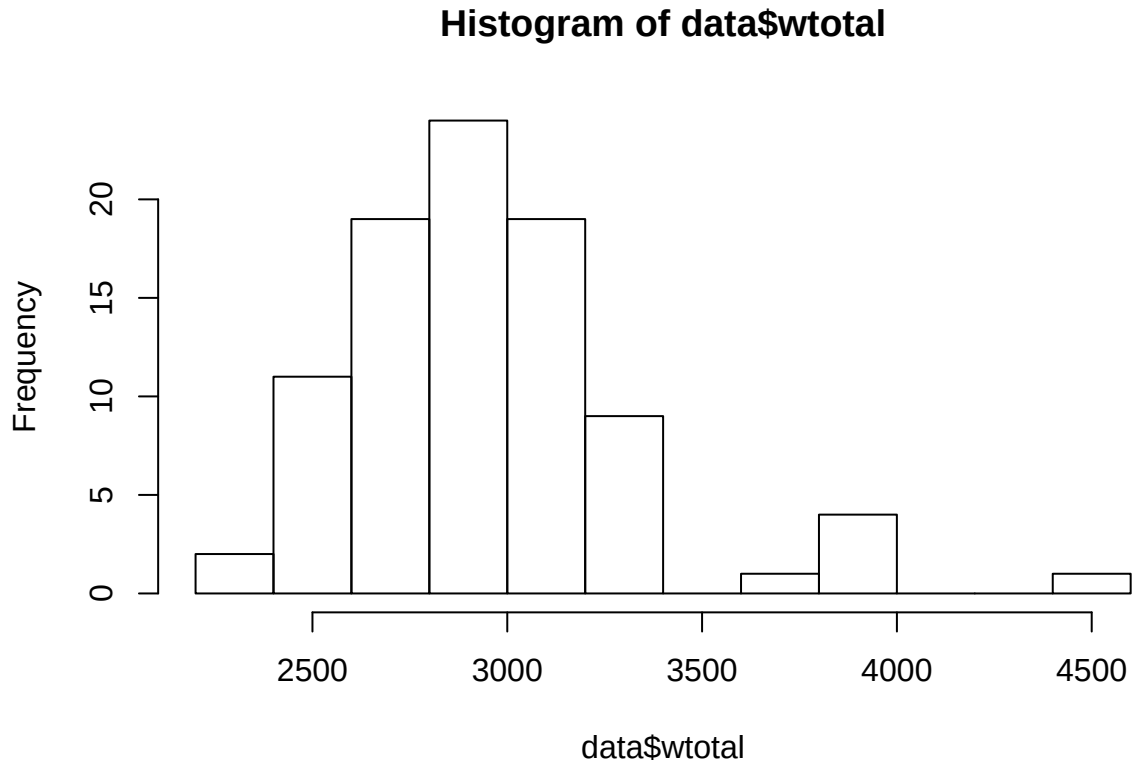

```
hist(data$taxpc)
```



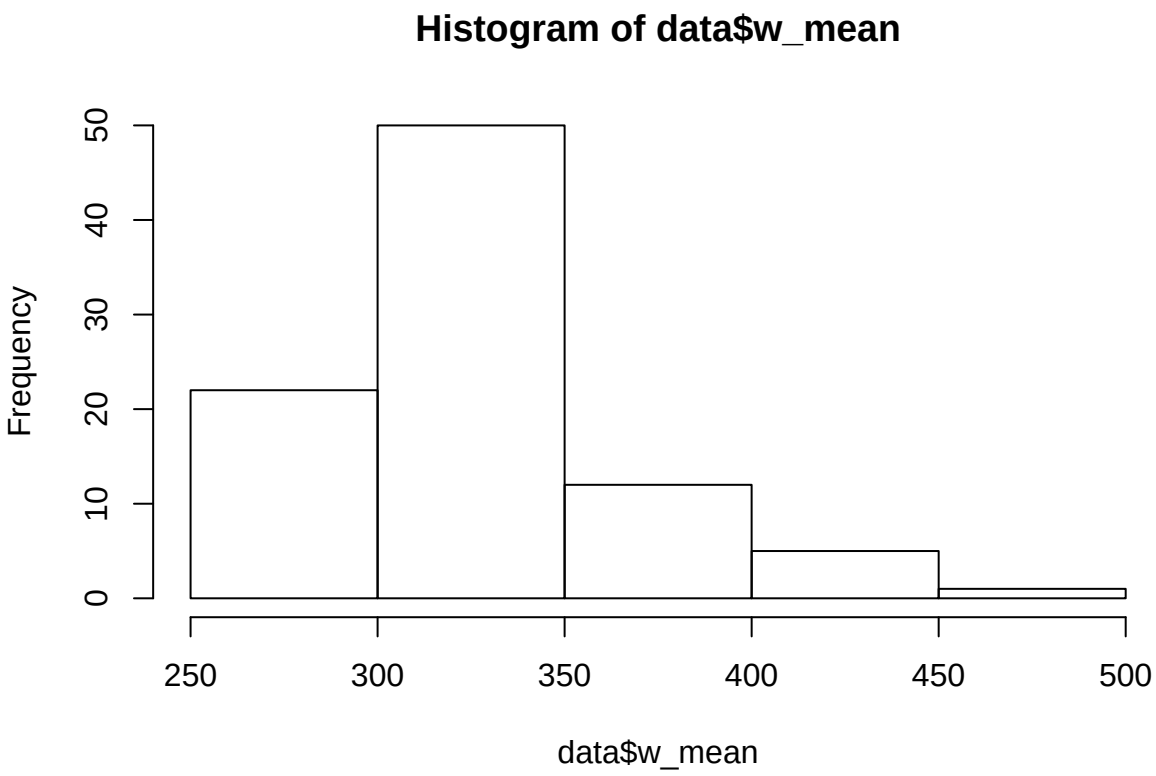

```
hist(data$taxpc_log)
```




```
hist(data$wtotal)
```

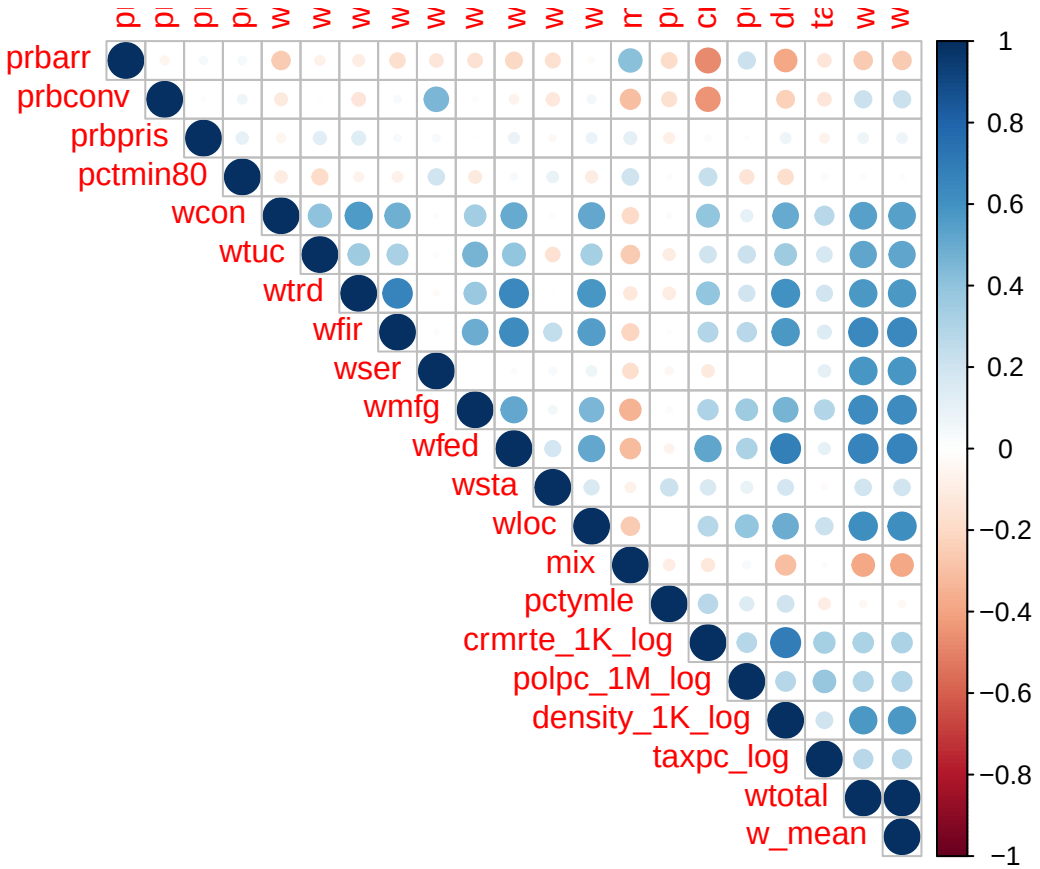



```
hist(data$w_mean)
```



All the correlations from before the transformations hold and total wages and mean of wages from each category look identical.

```
corrplot(cor(data[ , (names(data) %in% c("crmrte_1K_log", "prbarr", "prbconv", "prbpris", "polpc_1M_log", "ta
                                         "density_1K_log", "wcon", "wtuc", "wtrd", "wfir", "wser", "wmfg", "
```



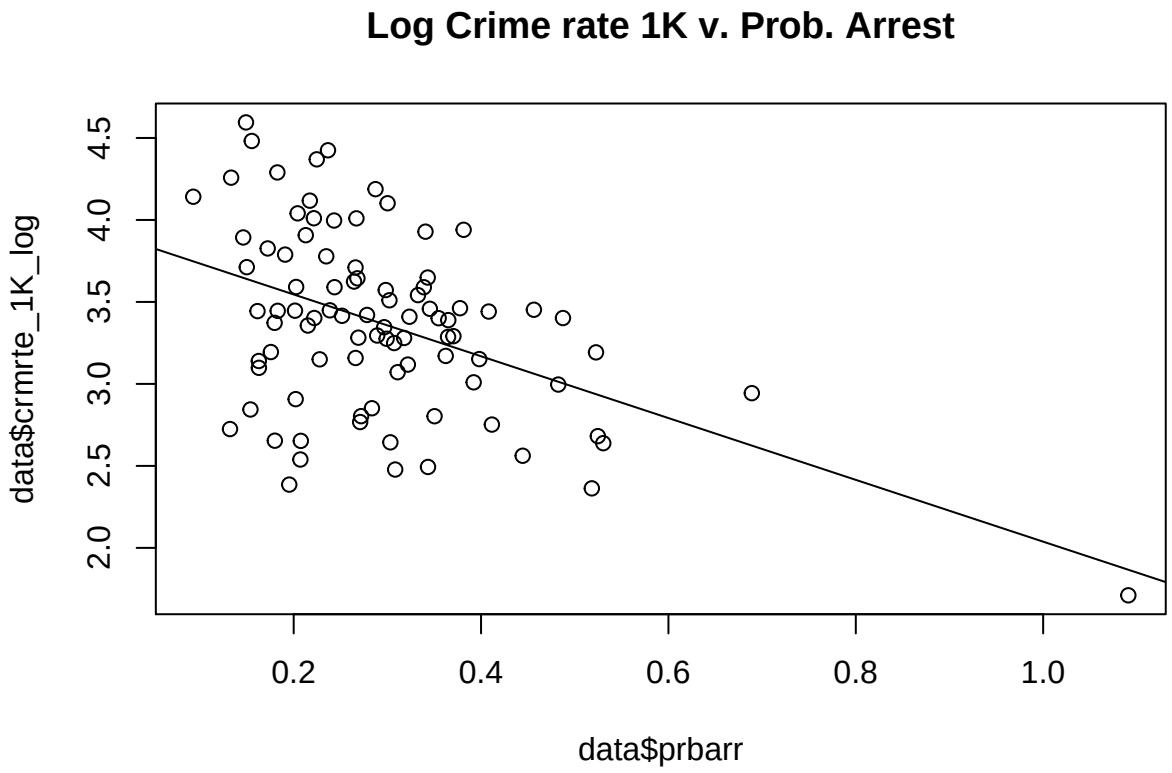
Scatterplot Matricies are too much - see individual charts below.

```
#scatterplotMatrix(data[ , (names(data) %in% c("crmrte_1K_log", "polpc_1M_log", "prbarr", "prbconv", "prbpris
```

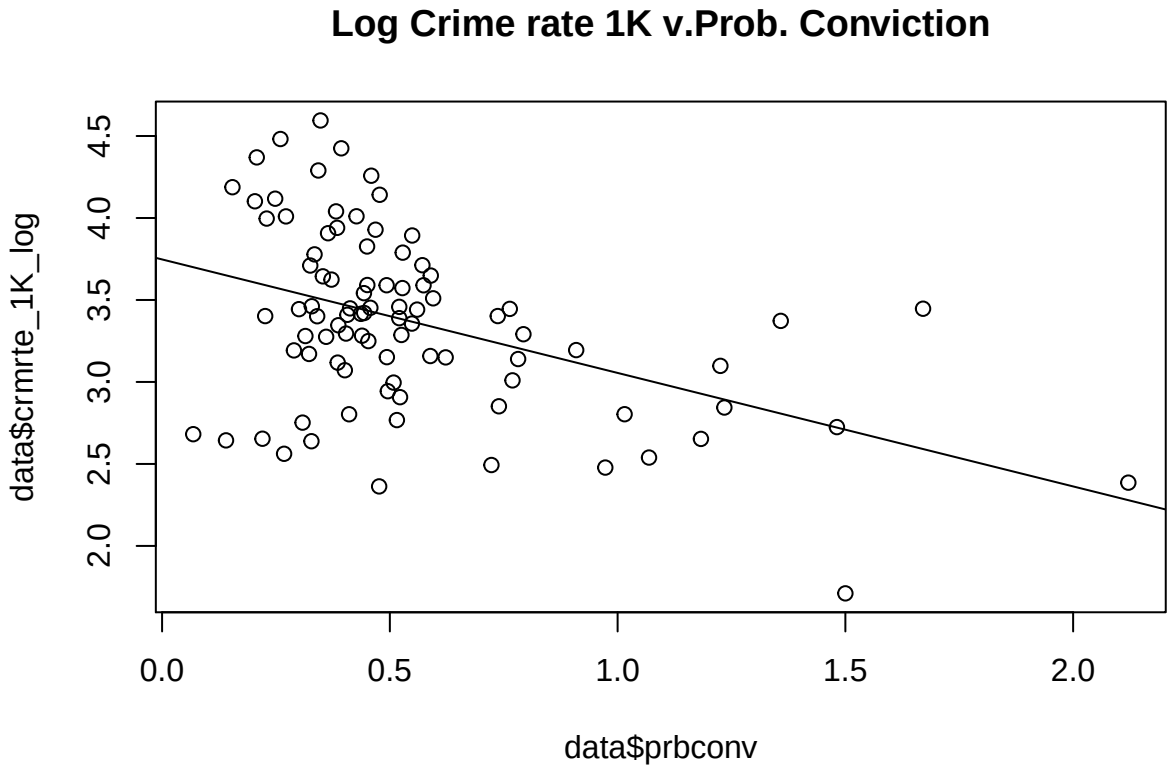
```
#scatterplotMatrix(data[ , (names(data) %in% c("crmrte_1K_log","wcon", "wtuc", "wtrd", "wfir", "wser", "wmfg"
```

It seems like the relationships between Log crime rate 1K and other variables of interest are linear.

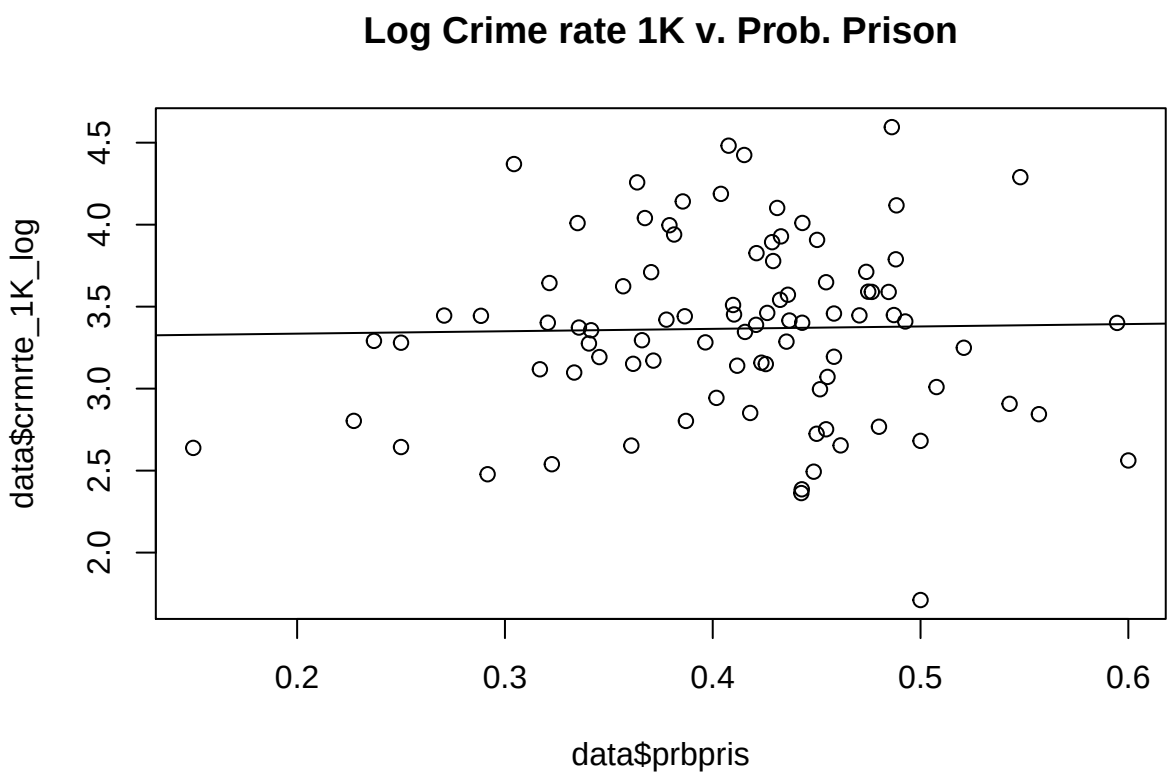
```
plot(data$prbarr,data$crmrte_1K_log, main="Log Crime rate 1K v. Prob. Arrest")
abline(lm(data$crmrte_1K_log ~ data$prbarr))
```



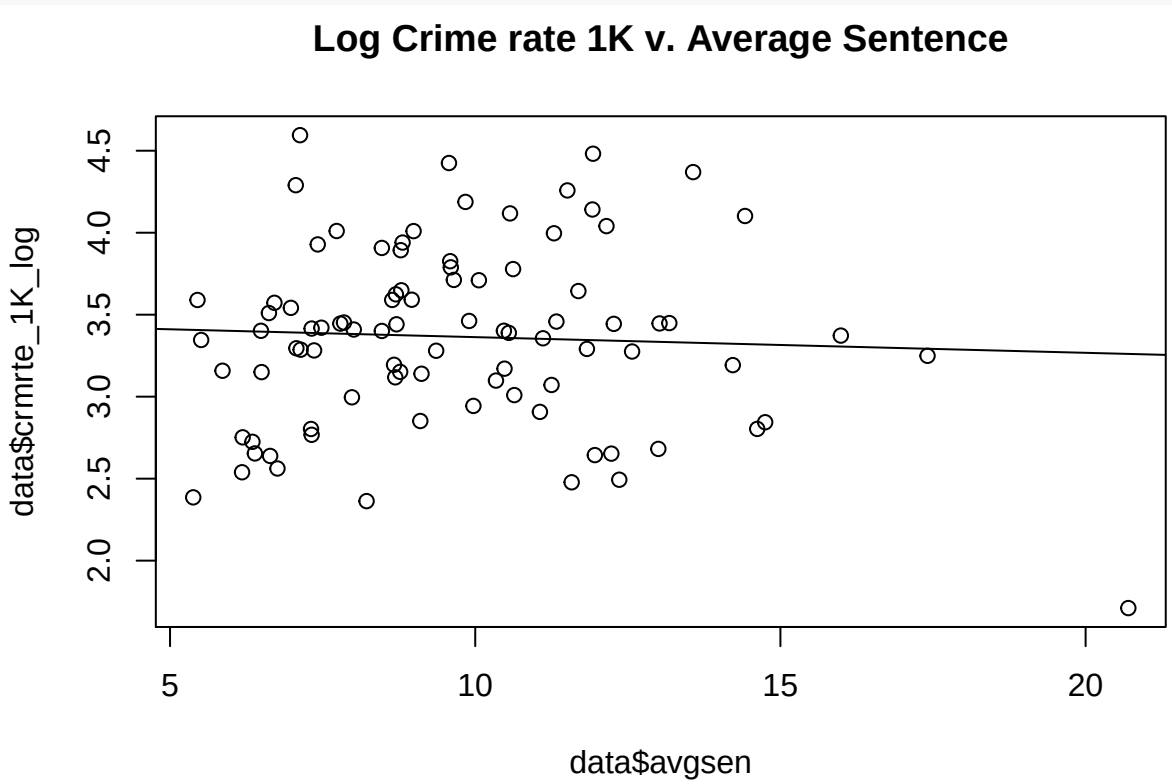

```
plot(data$prbconv,data$crmrte_1K_log, main="Log Crime rate 1K v.Prob. Conviction")
abline(lm(data$crmrte_1K_log ~ data$prbconv))
```



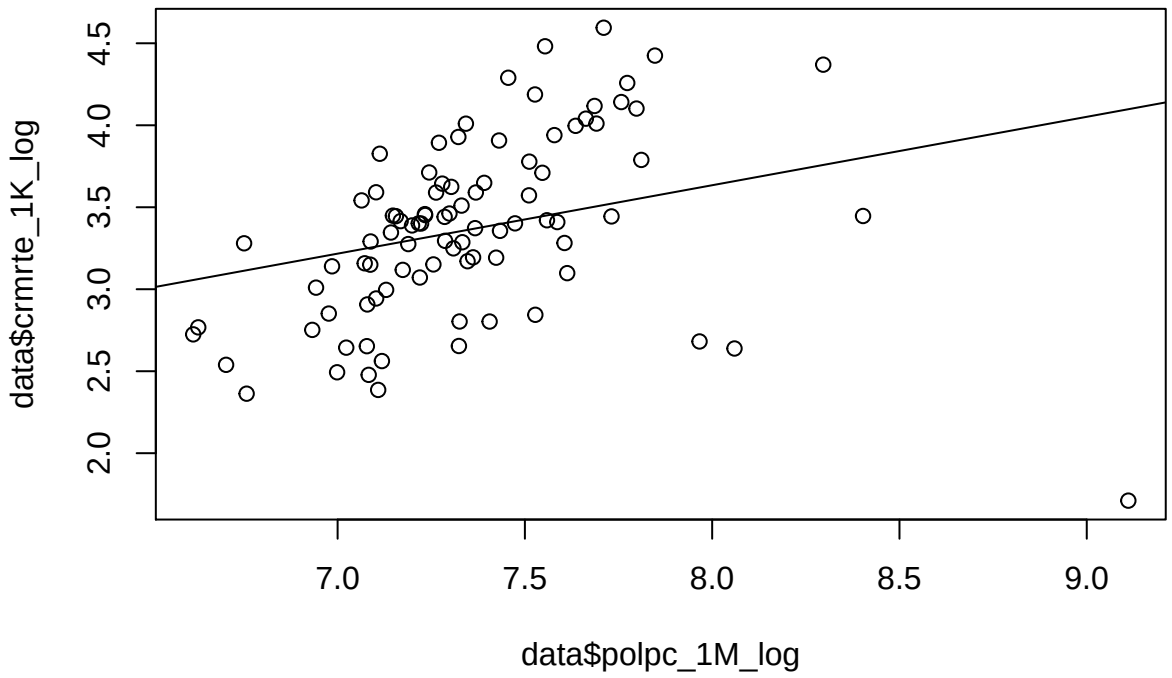
```r
plot(data$prbpris,data$crmrte_1K_log, main="Log Crime rate 1K v. Prob. Prison")
abline(lm(data$crmrte_1K_log ~ data$prbpris))
```




```r
plot(data$avgsen,data$crmrte_1K_log, main="Log Crime rate 1K v. Average Sentence")
abline(lm(data$crmrte_1K_log ~ data$avgsen))
```



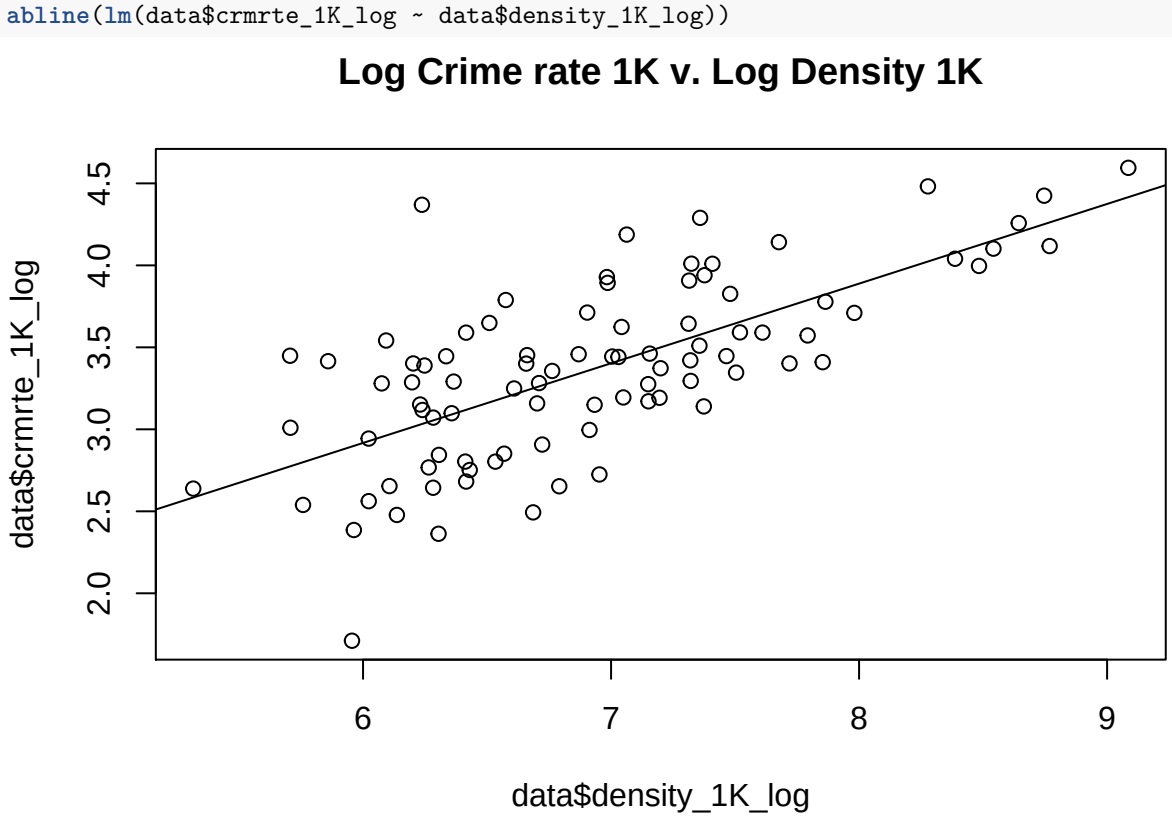

```r
plot(data$polpc_1M_log,data$crmrte_1K_log, main= "Log Crime rate 1K v. Log Police per 1M Capita (R=0.28)" )
abline(lm(data$crmrte_1K_log ~ data$polpc_1M_log))
```



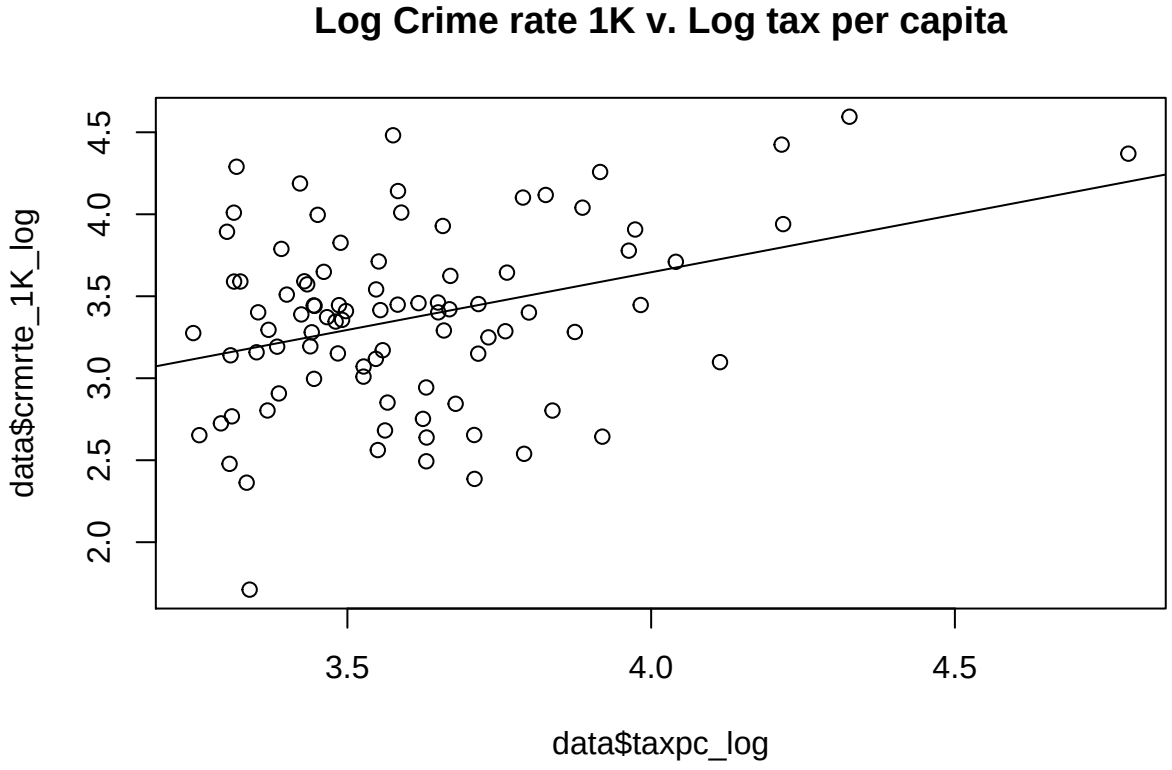

```
cor(data$crmrte_1K_log,data$polpc_1M_log)
```

```
## [1] 0.2845396
```

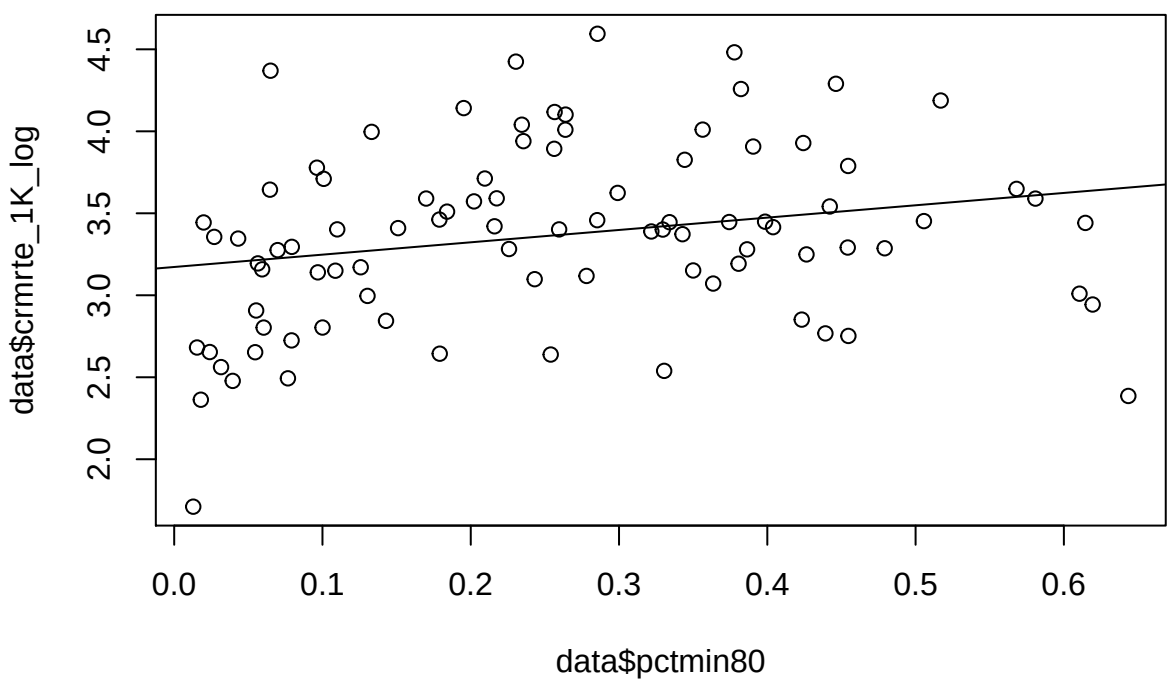
```
plot(data$density_1K_log,data$crmrte_1K_log, main="Log Crime rate 1K v. Log Density 1K")
abline(lm(data$crmrte_1K_log ~ data$density_1K_log))
```




```
plot(data$taxpc_log,data$crmrte_1K_log, main="Log Crime rate 1K v. Log tax per capita")
abline(lm(data$crmrte_1K_log ~ data$taxpc_log))
```



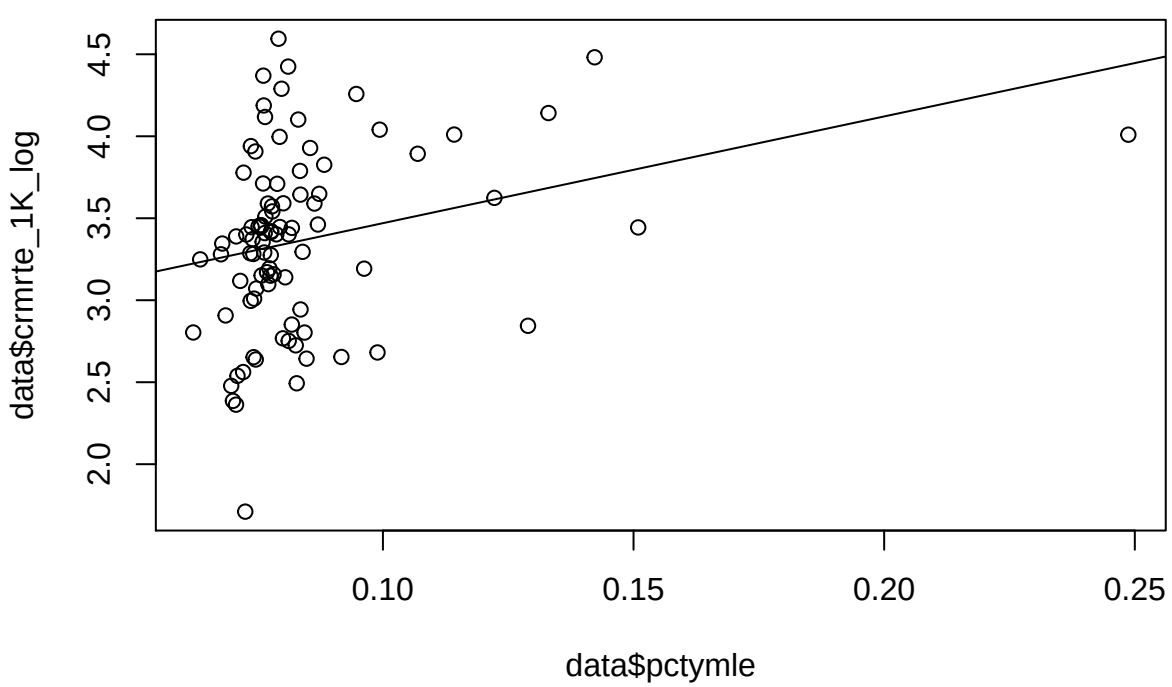

```
plot(data$pctmin80,data$crmrte_1K_log, main="Log Crime rate 1K v. Percent Minority, (R=0.23)")
abline(lm(data$crmrte_1K_log ~ data$pctmin80))
```




```
cor(data$crmrte_1K_log,data$pctmin80 )
```

```
## [1] 0.2329182
```

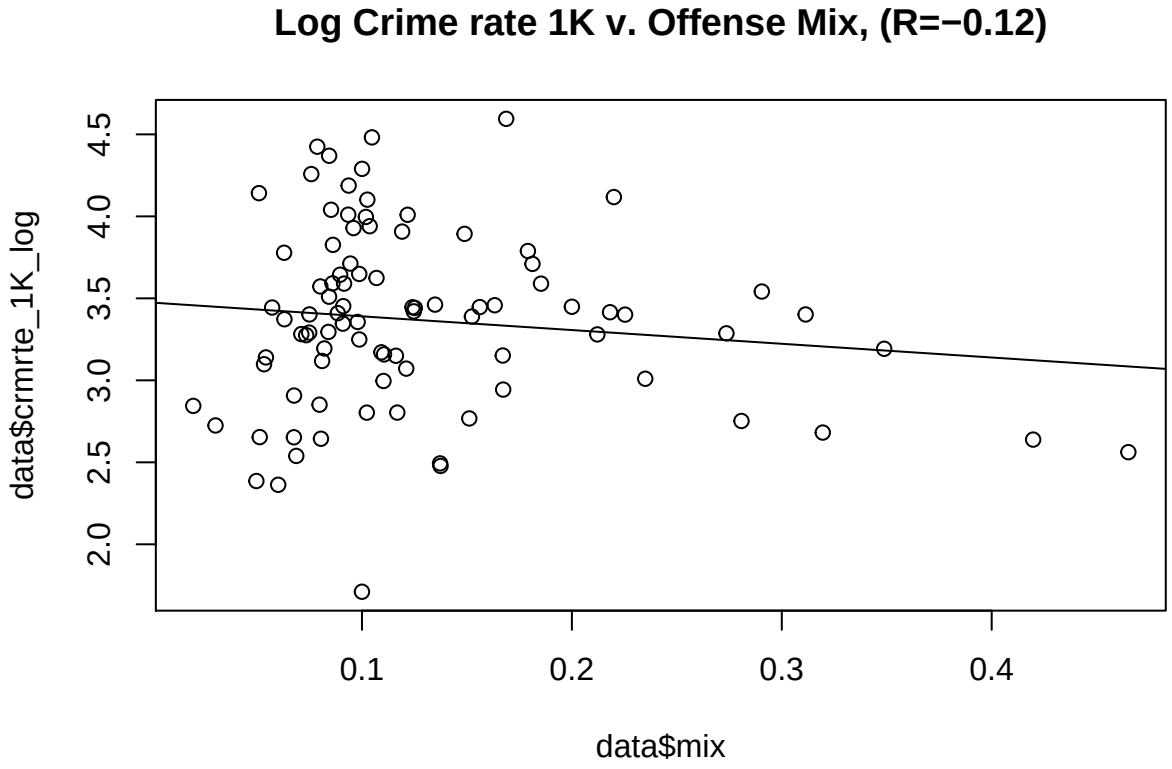
```
plot(data$pctymle,data$crmrte_1K_log, main="Log Crime rate 1K v. Percent Young Male, (R=0.28)")
abline(lm(data$crmrte_1K_log ~ data$pctymle))
```




```
cor(data$crmrte_1K_log,data$pctymle )
```

```
## [1] 0.2781547
```

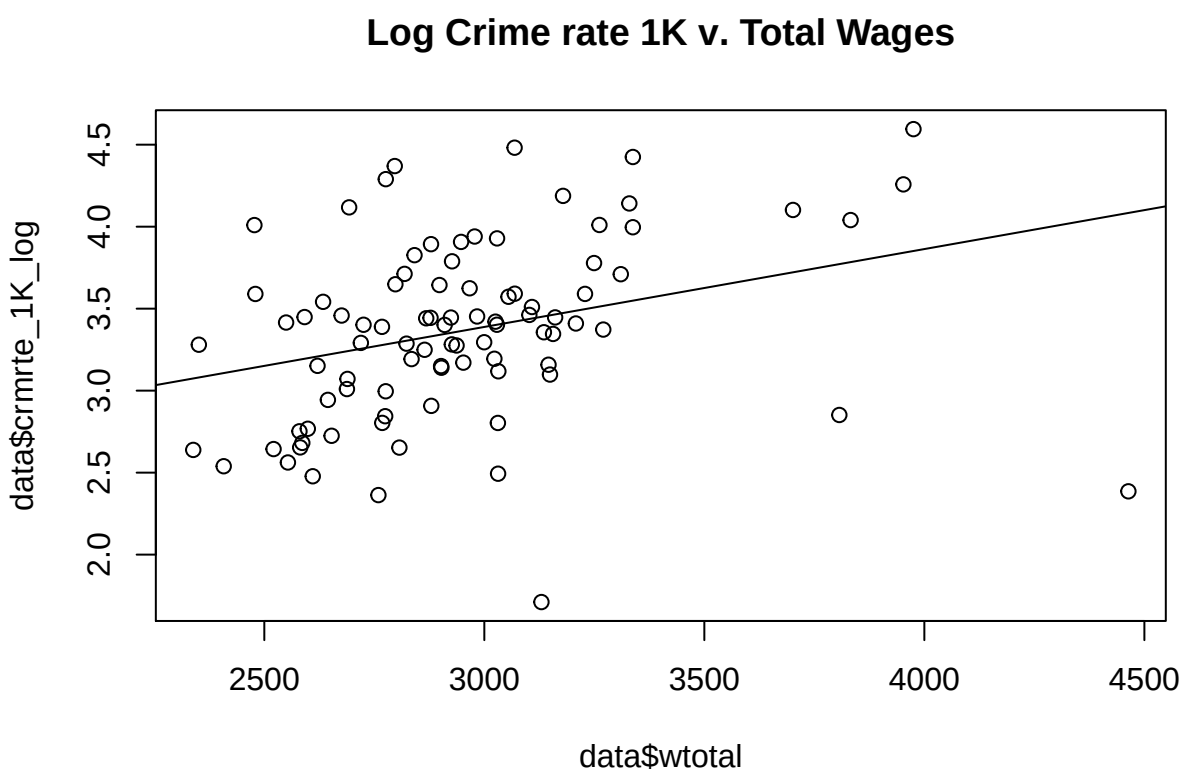
```
plot(data$mix,data$crmrte_1K_log, main="Log Crime rate 1K v. Offense Mix, (R=-0.12)")
abline(lm(data$crmrte_1K_log ~ data$mix))
```



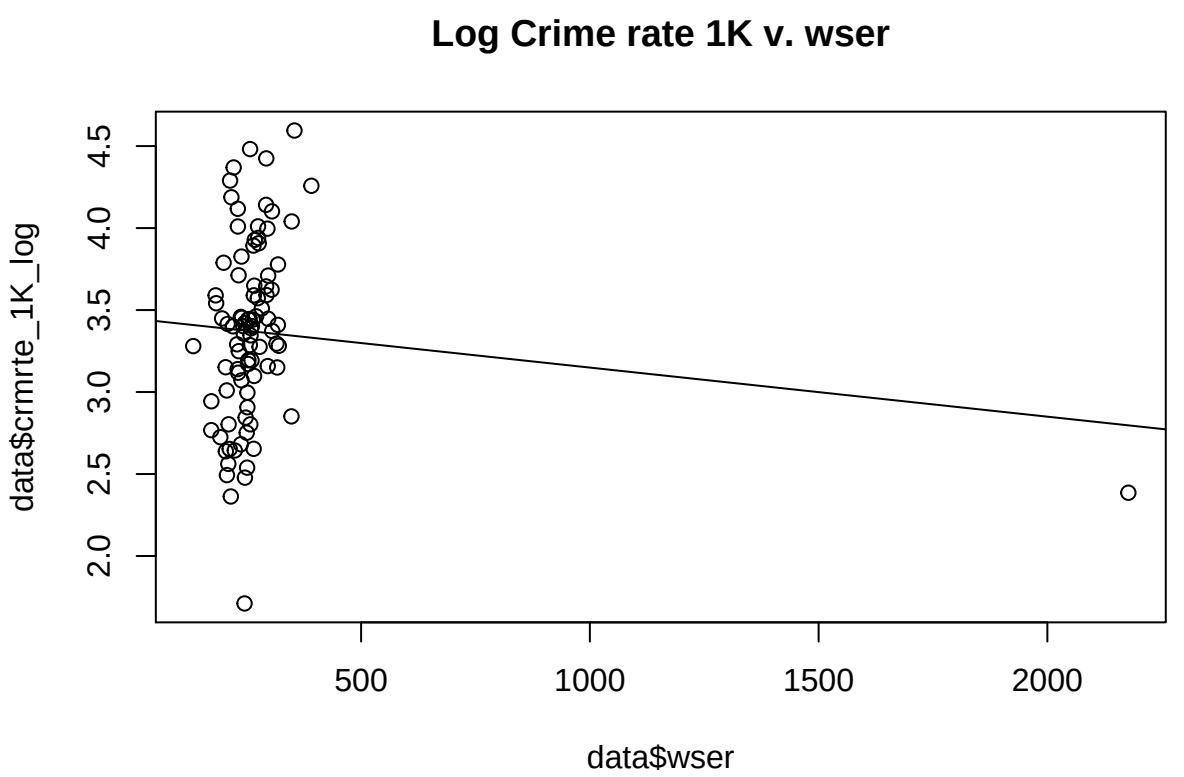

```
cor(data$crmrte_1K_log,data$mix )
```

```
## [1] -0.1247345
```

```
plot(data$wtotal,data$crmrte_1K_log, main="Log Crime rate 1K v. Total Wages")
abline(lm(data$crmrte_1K_log ~ data$wtotal))
```




```
plot(data$wser,data$crmrte_1K_log, main="Log Crime rate 1K v. wser")
abline(lm(data$crmrte_1K_log ~ data$wser))
```



Modeling conclusions:

The best way to look at models is to go to the stargazer summaries because the far left column tells you what variables are included..there's one on line 200 in RMD..and one on line 256.

-we can achieve adjusted R squared of 0.84 -surprisingly, wages dont seem to matter for model anymore (i did do linearHypothesis test) -density can surprisingly be excluded (you can get 0.75 ish with exclusion of density), but its probably better to include it -if you exclude density, then the wages categories become significant and bump model to 0.78 R2 (but the individual contributions of wages are not practically significant at all)

Further messing around to be certain but preliminary findings:

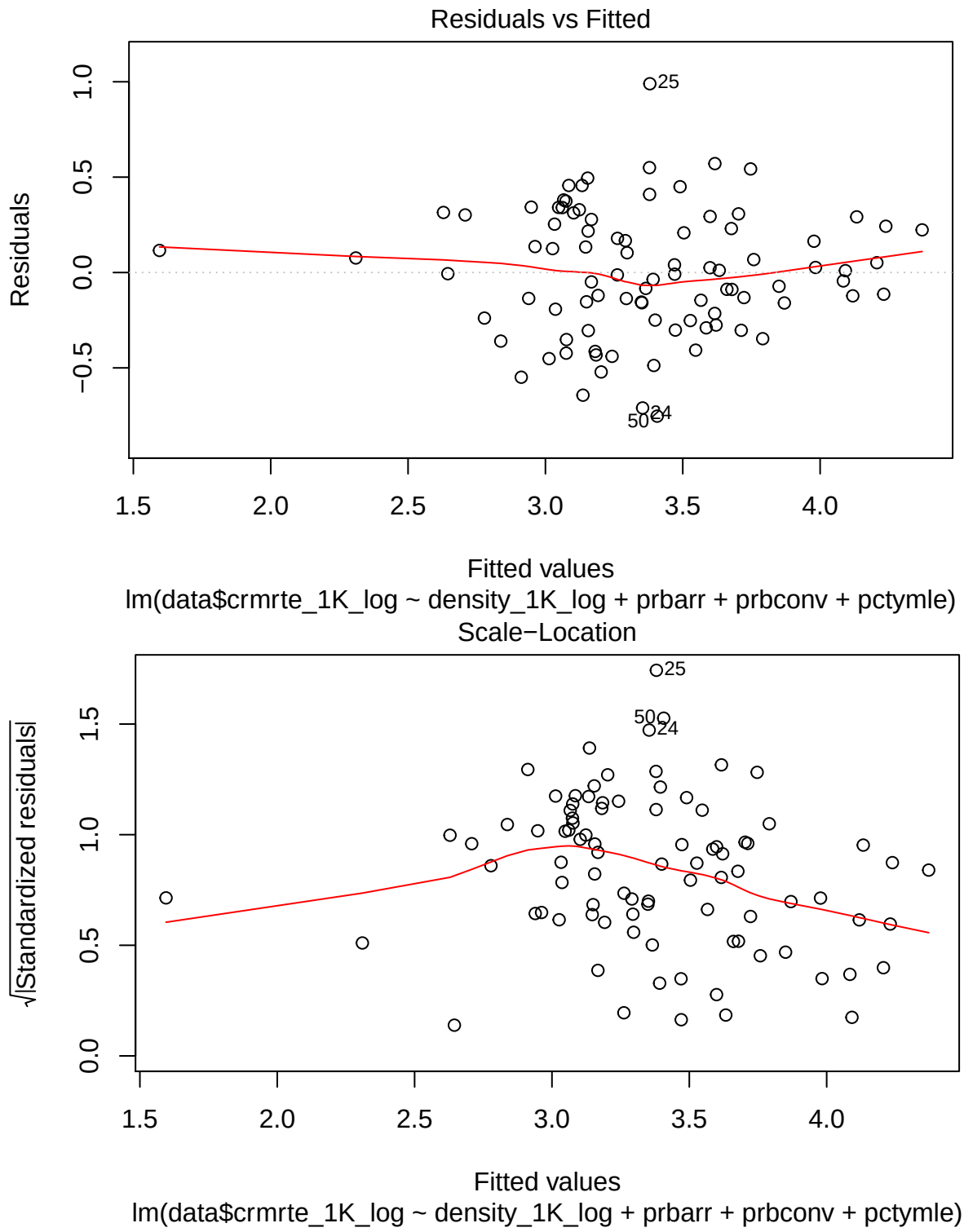
-percent young male doesnt matter -seems like models benefit quite a bit from including police per capita and both prob arrest and conviction

Right now i'm leaning towards model6

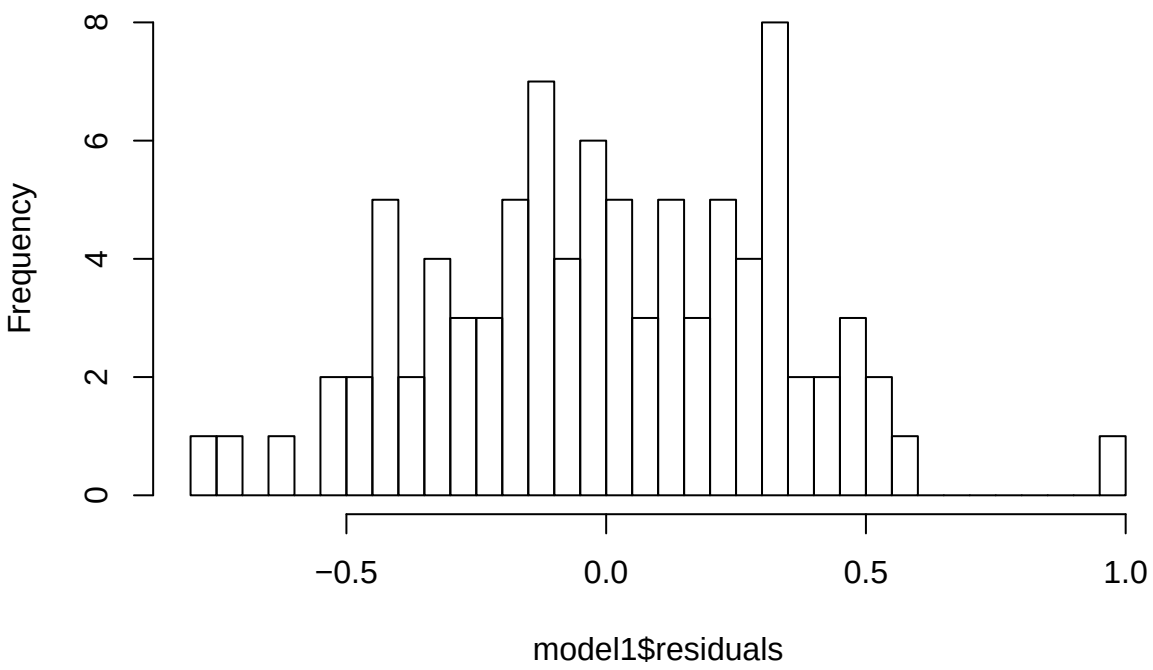
```
model1 = lm(data$crmrte_1K_log ~ density_1K_log+prbarr +prbconv+ pctymle, data = data)
summary(model1)
```

```
##
## Call:
## lm(formula = data$crmrte_1K_log ~ density_1K_log + prbarr + prbconv +
##     pctymle, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.75303 -0.23287 -0.00751  0.25071  0.98956
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.4958     0.4329   3.455 0.000861 ***
## density_1K_log   0.3411     0.0515   6.624 3.01e-09 ***
## prbarr          -1.1624     0.2857  -4.069 0.000105 ***
## prbconv         -0.5230     0.1055  -4.957 3.61e-06 ***
## pctymle          1.6596     1.5716   1.056 0.293987
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3347 on 85 degrees of freedom
## Multiple R-squared:  0.6446, Adjusted R-squared:  0.6279
## F-statistic: 38.55 on 4 and 85 DF,  p-value: < 2.2e-16
```

```
plot(model1)
```




```
hist(model1$residuals, breaks = 50)
```




```
coeftest(model1, vcov = vcovHC)
```

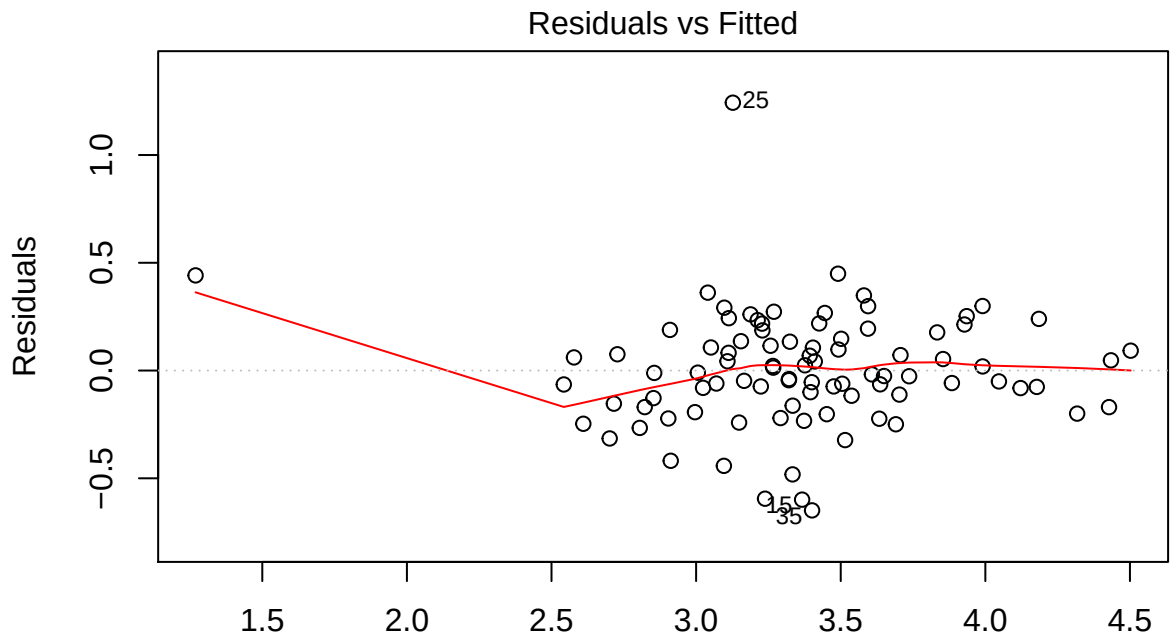
```
##
## t test of coefficients:
##
##                 Estimate Std. Error t value  Pr(>|t|)
## (Intercept)     1.495837   0.501070  2.9853 0.0036995 **
## density_1K_log  0.341124   0.053859  6.3336 1.091e-08 ***
## prbarr         -1.162418   0.295280 -3.9367 0.0001685 ***
## prbconv        -0.523006   0.118806 -4.4022 3.098e-05 ***
## pctymle         1.659561   0.946738  1.7529 0.0832203 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

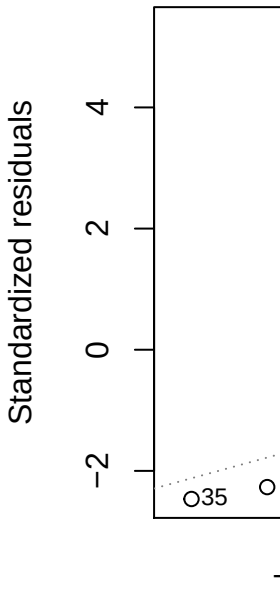
```
#vcovHC(model1)
(se.model1 = sqrt(diag(vcovHC(model1))))
```

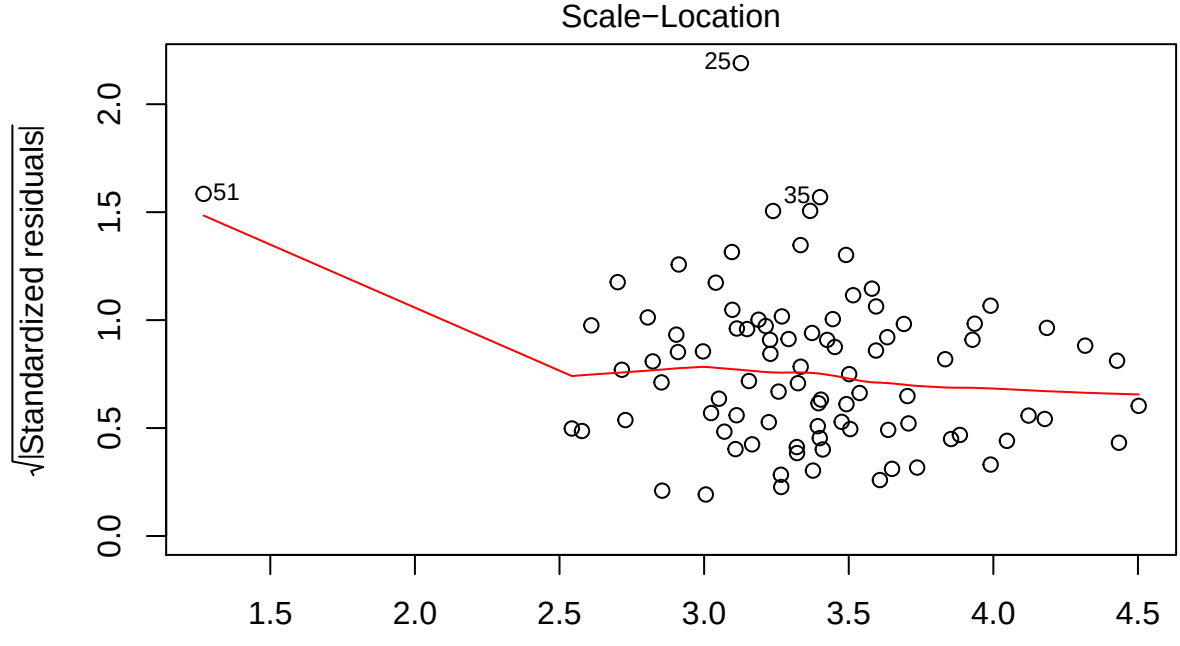
```
##    (Intercept) density_1K_log         prbarr        prbconv        pctymle
##     0.50106995     0.05385929     0.29528008     0.11880569     0.94673807
```

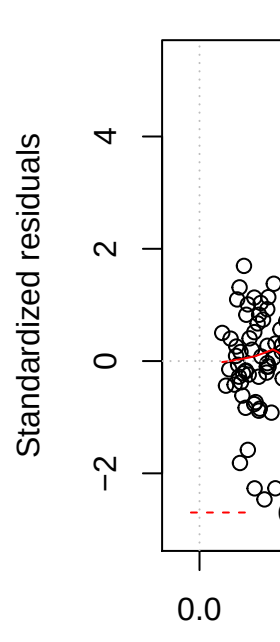
Below, added in minority

```
model2 = lm(data$crmrte_1K_log ~ density_1K_log+prbarr +prbconv+ pctymle+pctmin80, data = data)
#summary(model2)
plot(model2)
```

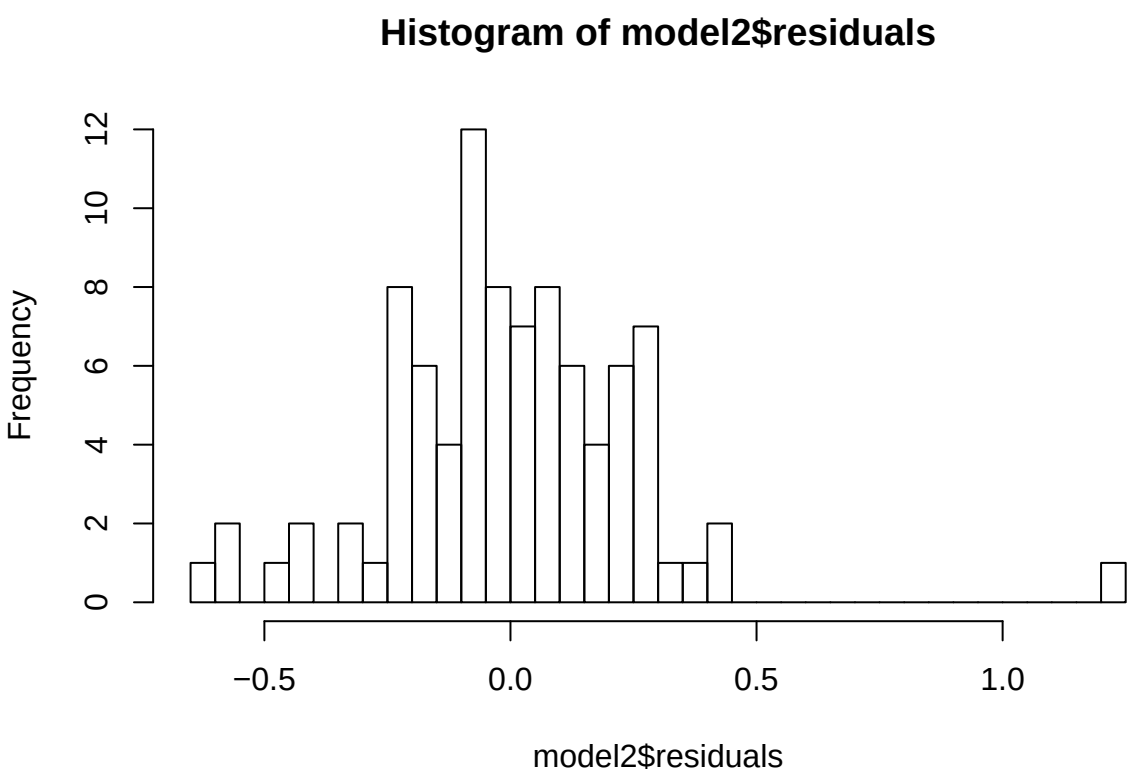









```
hist(model2$residuals, breaks = 50)
```



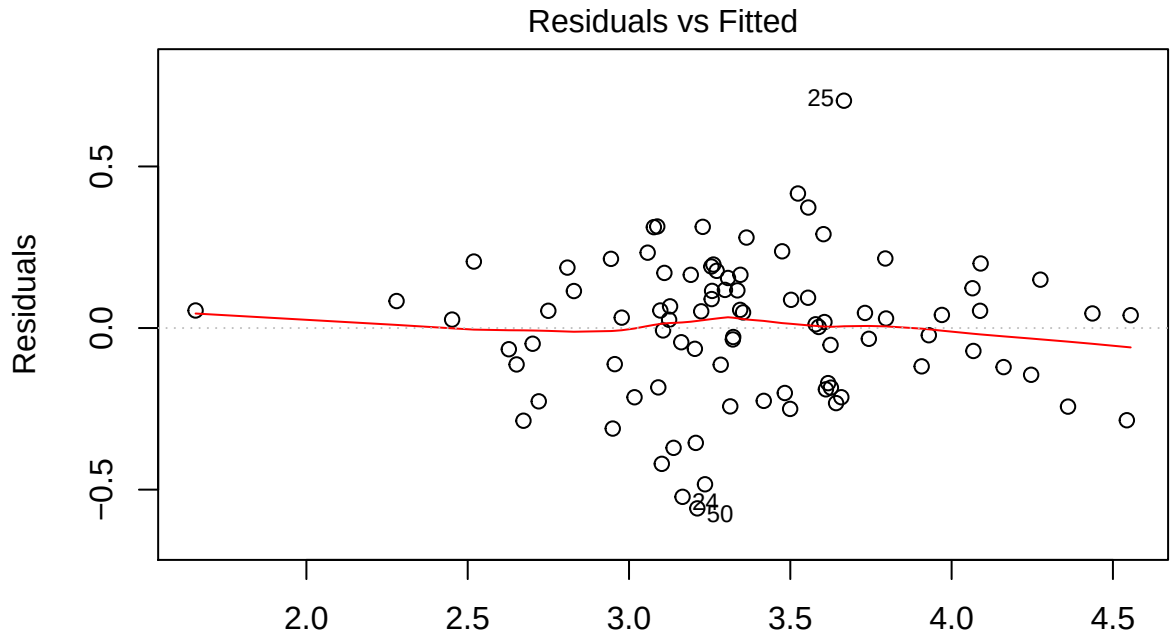

```
coeftest(model2, vcov = vcovHC)
```

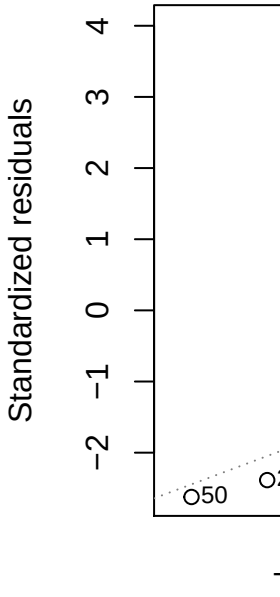
```
##
## t test of coefficients:
##
##                Estimate Std. Error t value  Pr(>|t|)
## (Intercept)     0.89481    0.66494  1.3457  0.182024
## density_1K_log  0.38621    0.05763  6.7016 2.218e-09 ***
## prbarr         -1.14180    0.62444 -1.8285  0.071019 .
## prbconv        -0.53618    0.16358 -3.2778  0.001523 **
## pctymle         1.50512    0.73932  2.0358  0.044920 *
## pctmin80        1.17823    0.22387  5.2631 1.068e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

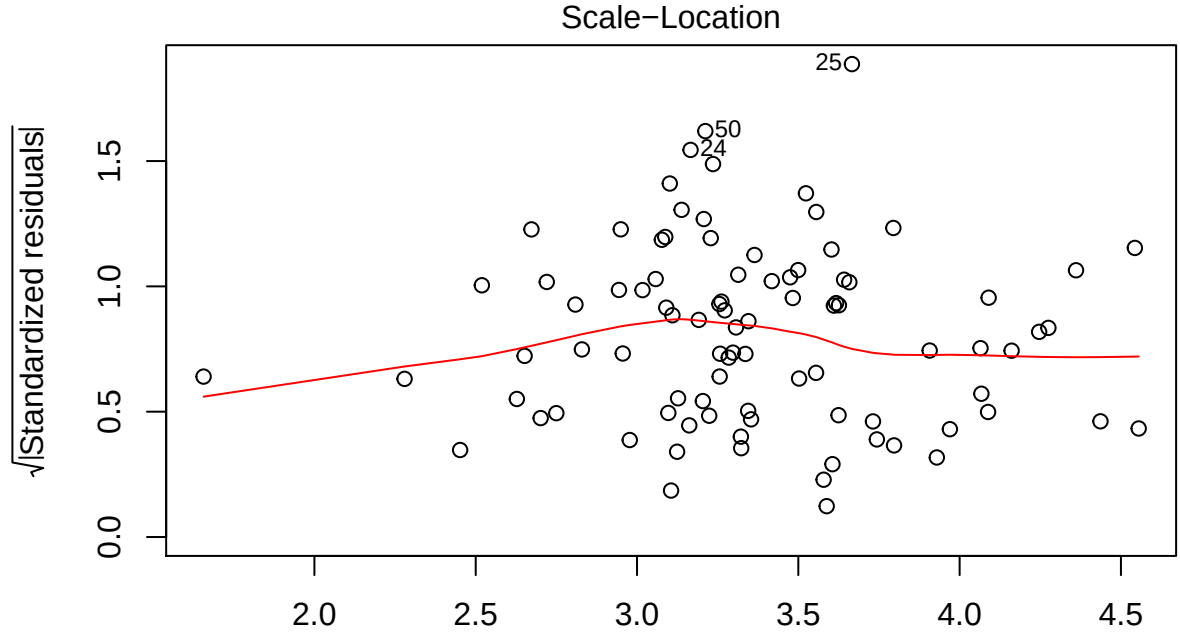
```
#vcovHC(model2)
se.model2 = sqrt(diag(vcovHC(model2)))
```

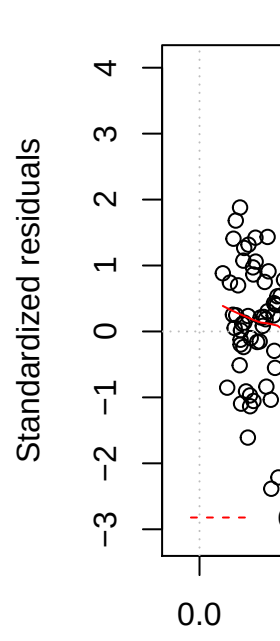
This model below is model2 with the transformed polic per capita

```
model3 = lm(data$crmrte_1K_log ~ density_1K_log+prbarr +prbconv+ pctymle+pctmin80+polpc_1M_log, data = data)
#summary(model3)
plot(model3)
```

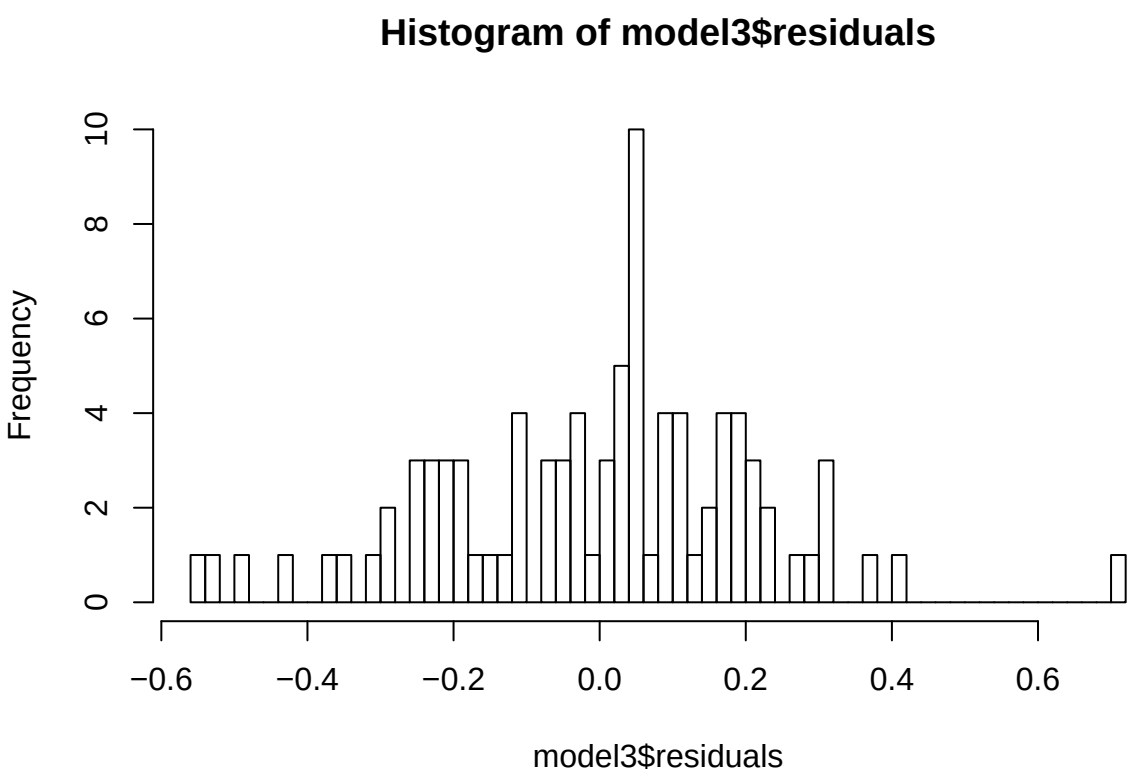









```
hist(model3$residuals, breaks = 50)
```



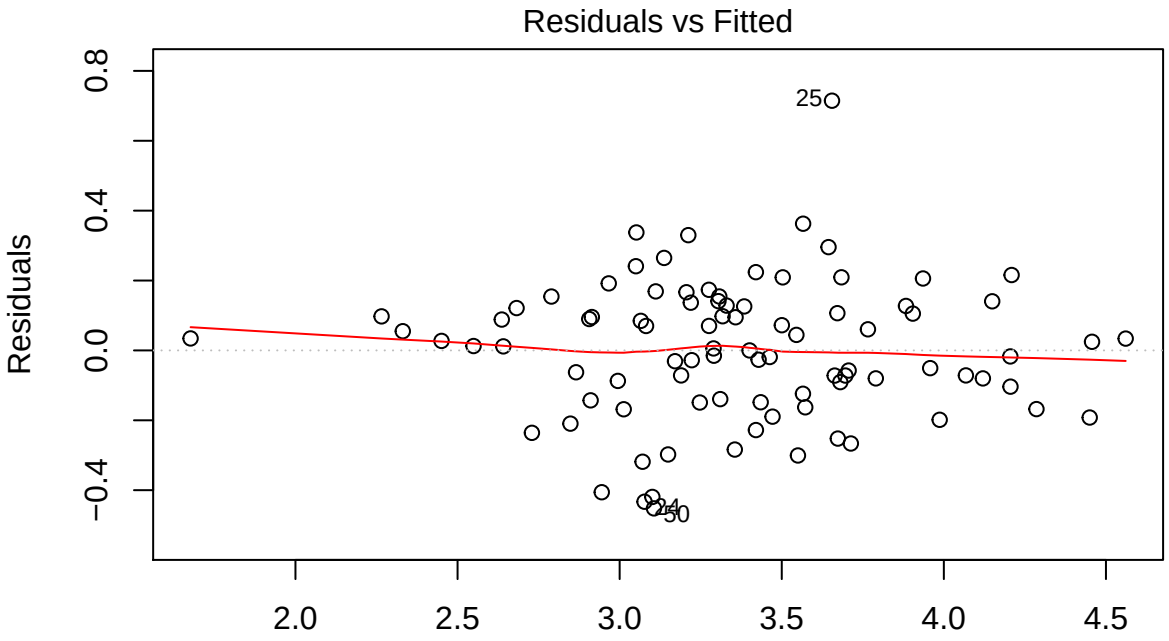

```
coeftest(model3, vcov = vcovHC)
```

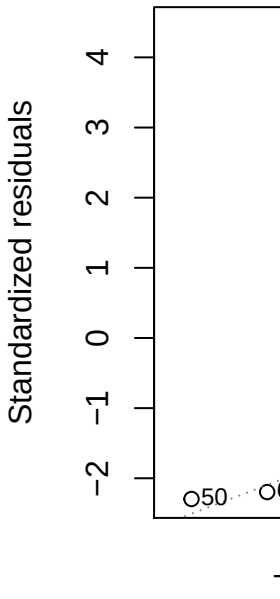
```
##
## t test of coefficients:
##
##                 Estimate Std. Error t value  Pr(>|t|)
## (Intercept)    -1.497286   0.600865 -2.4919  0.014697 *
## density_1K_log  0.291274   0.064846  4.4918 2.263e-05 ***
## prbarr         -1.663389   0.312333 -5.3257 8.438e-07 ***
## prbconv        -0.607604   0.107197 -5.6681 2.036e-07 ***
## pctymle         0.418323   2.096464  0.1995  0.842331
## pctmin80        1.274366   0.152906  8.3343 1.402e-12 ***
## polpc_1M_log    0.449832   0.139652  3.2211  0.001825 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

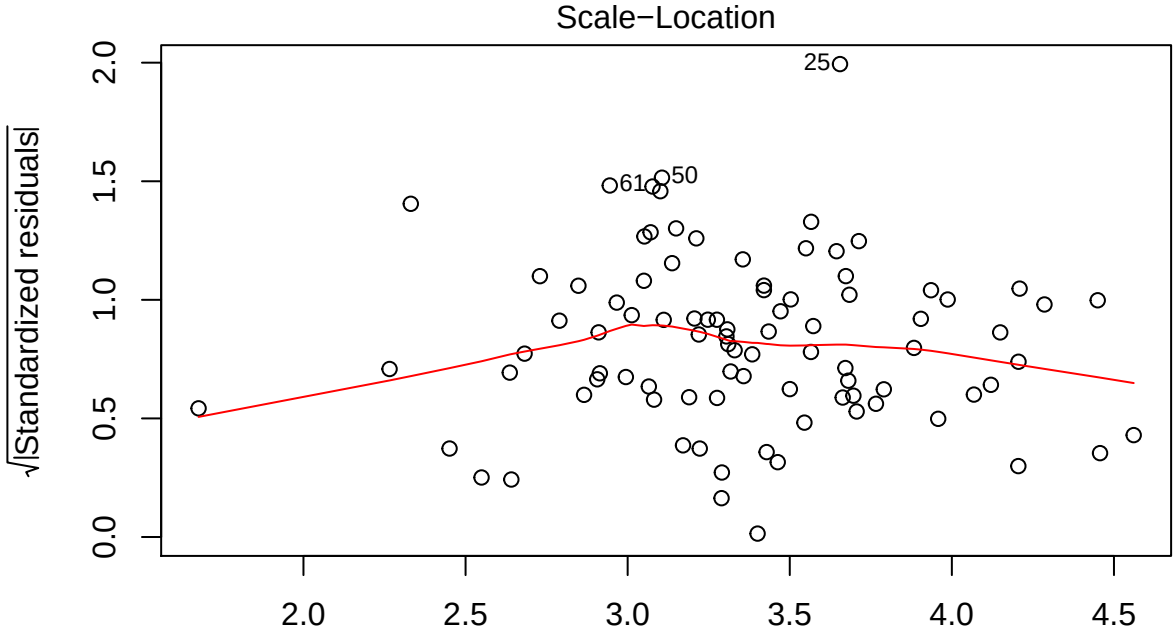
```
#vcovHC(model3)
se.model3 = sqrt(diag(vcovHC(model3)))
```

This model is model 3 with all the kinds of employment included:

```
model4 = lm(data$crmrte_1K_log ~ density_1K_log+prbarr +prbconv+ pctymle+pctmin80+polpc_1M_log+wcon+wtuc+wtrd
#summary(model4)
plot(model4)
```

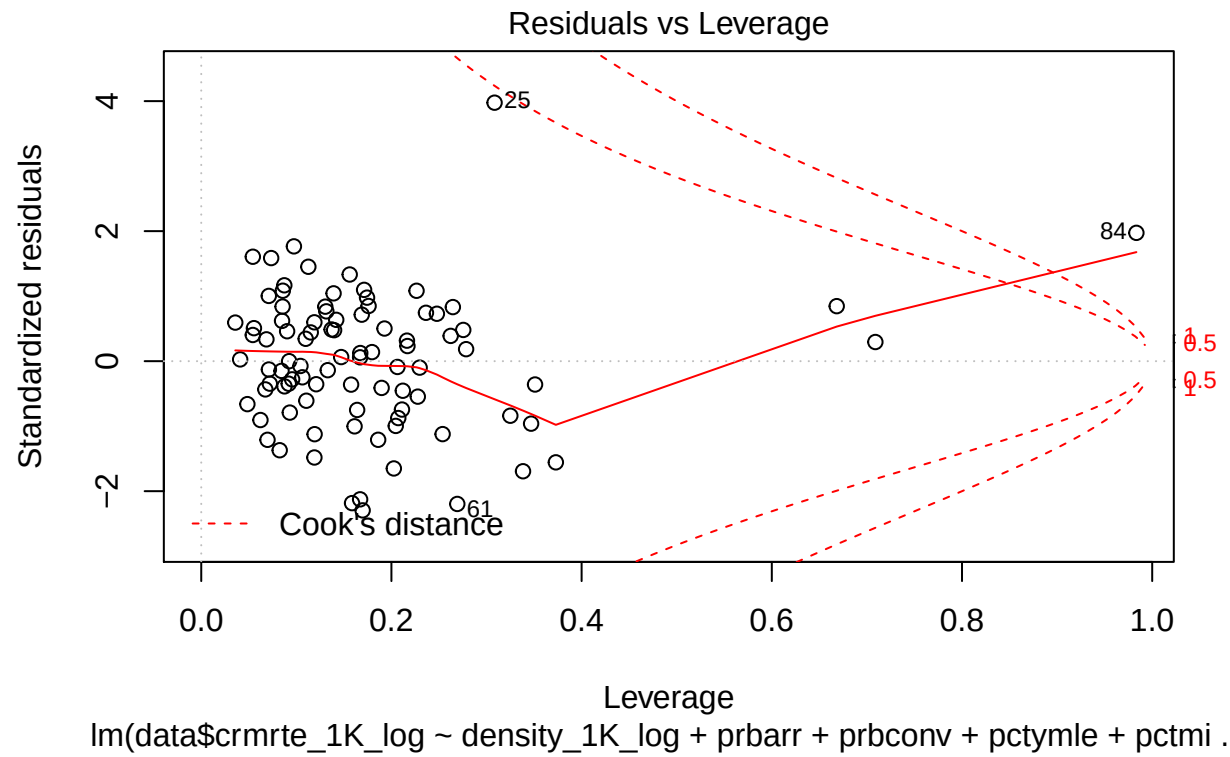




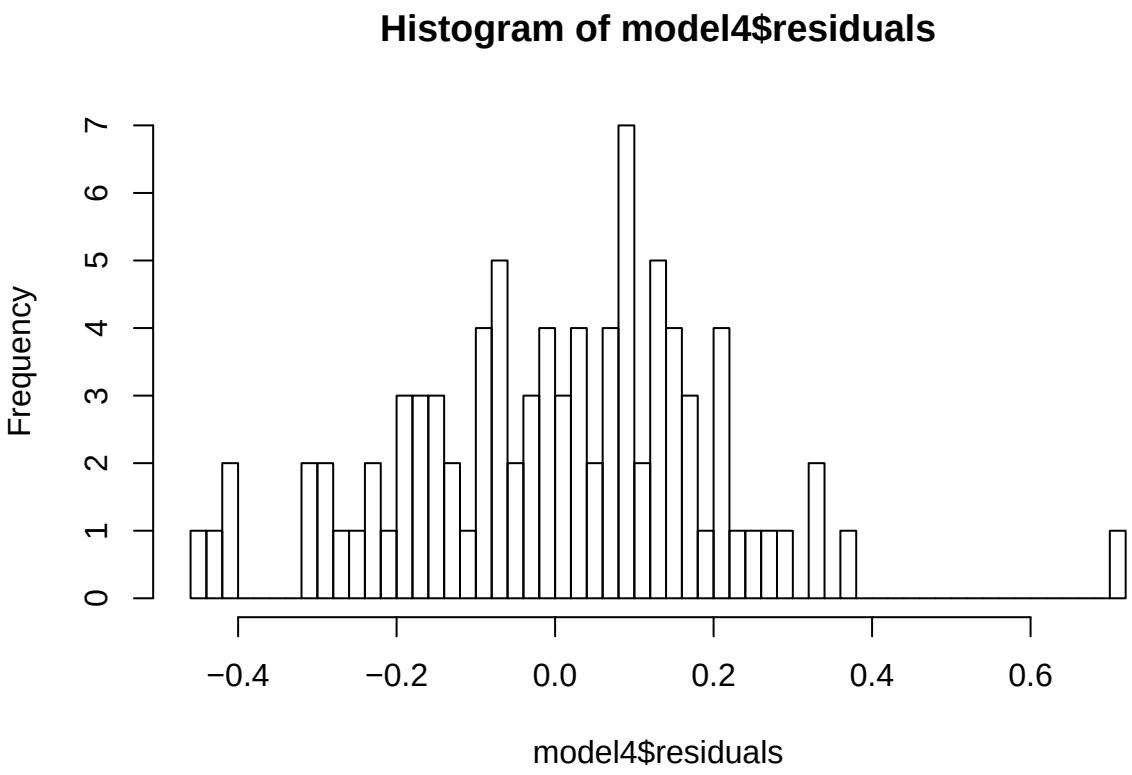



```
## Warning in sqrt(crit * p * (1 - hh)/hh): NaNs produced

## Warning in sqrt(crit * p * (1 - hh)/hh): NaNs produced
```




```
hist(model4$residuals, breaks = 50)
```




```
coeftest(model4, vcov = vcovHC)
```

```
##
## t test of coefficients:
##
##                   Estimate  Std. Error t value  Pr(>|t|)
## (Intercept)    -1.5243e+00  8.2336e-01 -1.8513 0.0681203 .
## density_1K_log  2.8028e-01  7.0052e-02  4.0010 0.0001481 ***
## prbarr         -1.7404e+00  3.4271e-01 -5.0785 2.753e-06 ***
```

```
## prbconv        -5.2976e-01  1.2117e-01 -4.3720 3.960e-05 ***
## pctymle         1.1725e+00  1.6036e+00  0.7312 0.4669715
## pctmin80        1.3395e+00  1.6181e-01  8.2783 3.854e-12 ***
## polpc_1M_log    4.6263e-01  1.7587e-01  2.6305 0.0103679 *
## wcon            5.6843e-04  7.5091e-04  0.7570 0.4514616
## wtuc            4.4261e-05  4.1046e-04  0.1078 0.9144220
## wtrd            6.5539e-04  1.0947e-03  0.5987 0.5511983
## wfir           -1.5050e-03  8.4022e-04 -1.7912 0.0773540 .
## wmfg           -7.1987e-05  3.4695e-04 -0.2075 0.8362005
## wfed            6.6007e-04  9.5917e-04  0.6882 0.4934964
## wsta           -9.7119e-04  6.7006e-04 -1.4494 0.1514501
## wloc            7.0616e-04  1.7180e-03  0.4110 0.6822275
## wser           -2.4325e-04  1.6258e-03 -0.1496 0.8814731
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#vcovHC(model4)
se.model4 = sqrt(diag(vcovHC(model4)))
```

```
linearHypothesis(model4, c("wcon = 0", "wtuc = 0", "wtrd = 0", "wfir = 0", "wmfg = 0", "wfed = 0", "wsta = 0"
```

```
## Linear hypothesis test
##
## Hypothesis:
## wcon = 0
## wtuc = 0
## wtrd = 0
## wfir = 0
## wmfg = 0
## wfed = 0
## wsta = 0
## wloc = 0
##
## Model 1: restricted model
## Model 2: data$crmrte_1K_log ~ density_1K_log + prbarr + prbconv + pctymle +
##     pctmin80 + polpc_1M_log + wcon + wtuc + wtrd + wfir + wmfg +
##     wfed + wsta + wloc + wser
##
## Note: Coefficient covariance matrix supplied.
##
##   Res.Df Df      F Pr(>F)
## 1     82
## 2     74  8 0.9856 0.4542
```

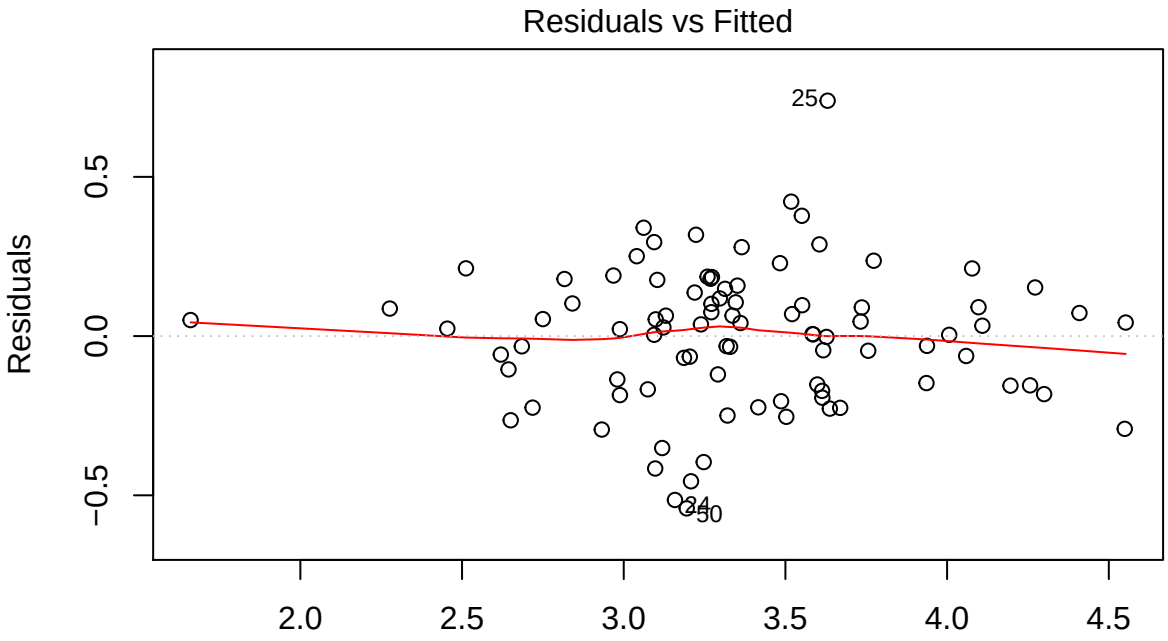
```
stargazer(model1, model2, model3, model4,type="text",
se=list(se.model1, se.model2, se.model3, se.model4),star.cutoffs=c(0.05, 0.01, 0.001))
```

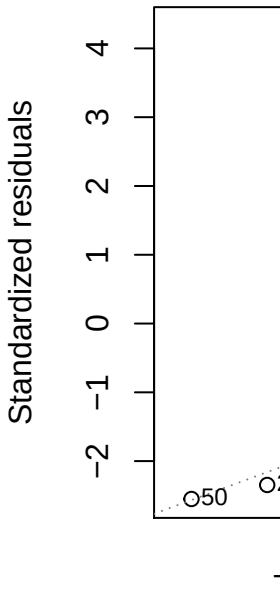
```
##
## ===============================================================================================
##                                                 Dependent variable:
##                     ----------------------------------------------------------------------------
##                                                     crmrte_1K_log
##                              (1)                    (2)                    (3)                    (4)
## -----------------------------------------------------------------------------------------------
## density_1K_log            0.341***               0.386***               0.291***               0.280***
##                           (0.054)                (0.058)                (0.065)                (0.070)
##
## prbarr                   -1.162***               -1.142                 -1.663***              -1.740***
##                           (0.295)                (0.624)                (0.312)                (0.343)
##
## prbconv                  -0.523***               -0.536**               -0.608***              -0.530***
```

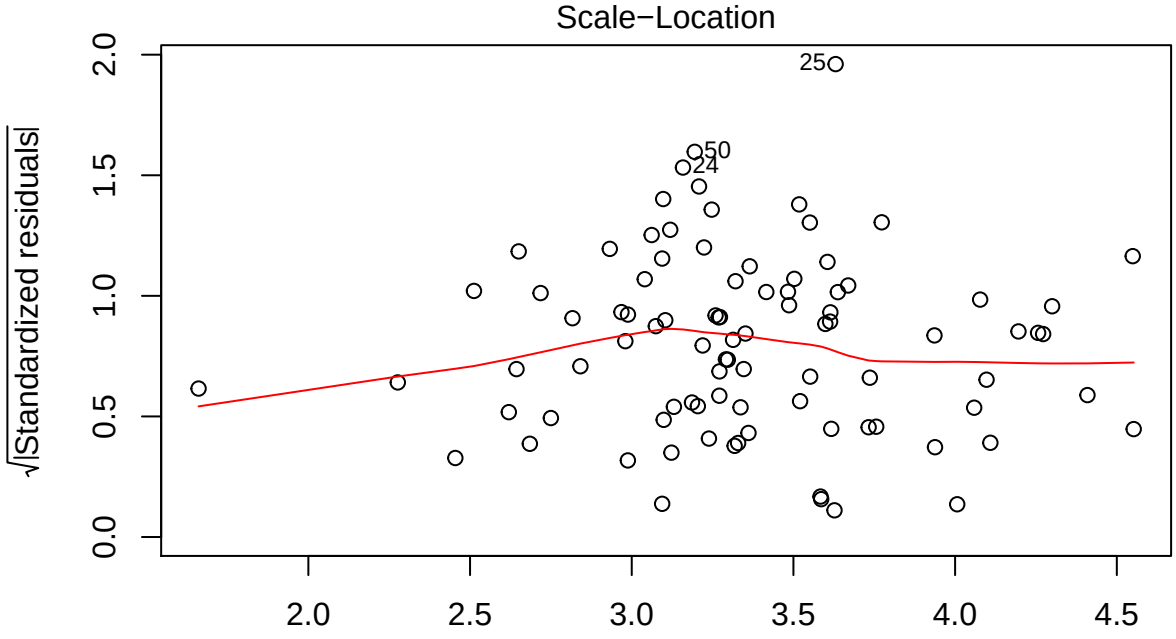
```
##                           (0.119)          (0.164)          (0.107)          (0.121)
##
## pctymle                    1.660            1.505*           0.418            1.173
##                           (0.947)          (0.739)          (2.096)          (1.604)
##
## pctmin80                                   1.178***         1.274***         1.340***
##                                            (0.224)          (0.153)          (0.162)
##
## polpc_1M_log                                                0.450**          0.463**
##                                                             (0.140)          (0.176)
##
## wcon                                                                         0.001
##                                                                             (0.001)
##
## wtuc                                                                         0.00004
##                                                                             (0.0004)
##
## wtrd                                                                         0.001
##                                                                             (0.001)
##
## wfir                                                                        -0.002
##                                                                             (0.001)
##
## wmfg                                                                        -0.0001
##                                                                             (0.0003)
##
## wfed                                                                         0.001
##                                                                             (0.001)
##
## wsta                                                                        -0.001
##                                                                             (0.001)
##
## wloc                                                                         0.001
##                                                                             (0.002)
##
## wser                                                                        -0.0002
##                                                                             (0.002)
##
## Constant                  1.496**          0.895            -1.497*          -1.524
##                           (0.501)          (0.665)          (0.601)          (0.823)
##
## ------------------------------------------------------------------------------------------------------------
## Observations                90               90               90               90
## R2                         0.645            0.774            0.844            0.871
## Adjusted R2                0.628            0.760            0.832            0.845
## Residual Std. Error    0.335 (df = 85)  0.269 (df = 84)  0.225 (df = 83)  0.216 (df = 7
## F Statistic         38.549*** (df = 4; 85) 57.386*** (df = 5; 84) 74.695*** (df = 6; 83) 33.307*** (df = 1
## ============================================================================================================
## Note:                                                                  *p<0.05; **p<0.01; ***p
```

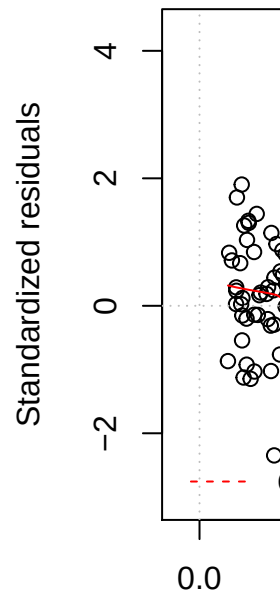
This model below (5) is model3 with just federal worker wage included.

```
model5 = lm(data$crmrte_1K_log ~ density_1K_log+prbarr +prbconv+ pctymle+pctmin80+polpc_1M_log+wfed, data = d
#summary(model5)
plot(model5)
```

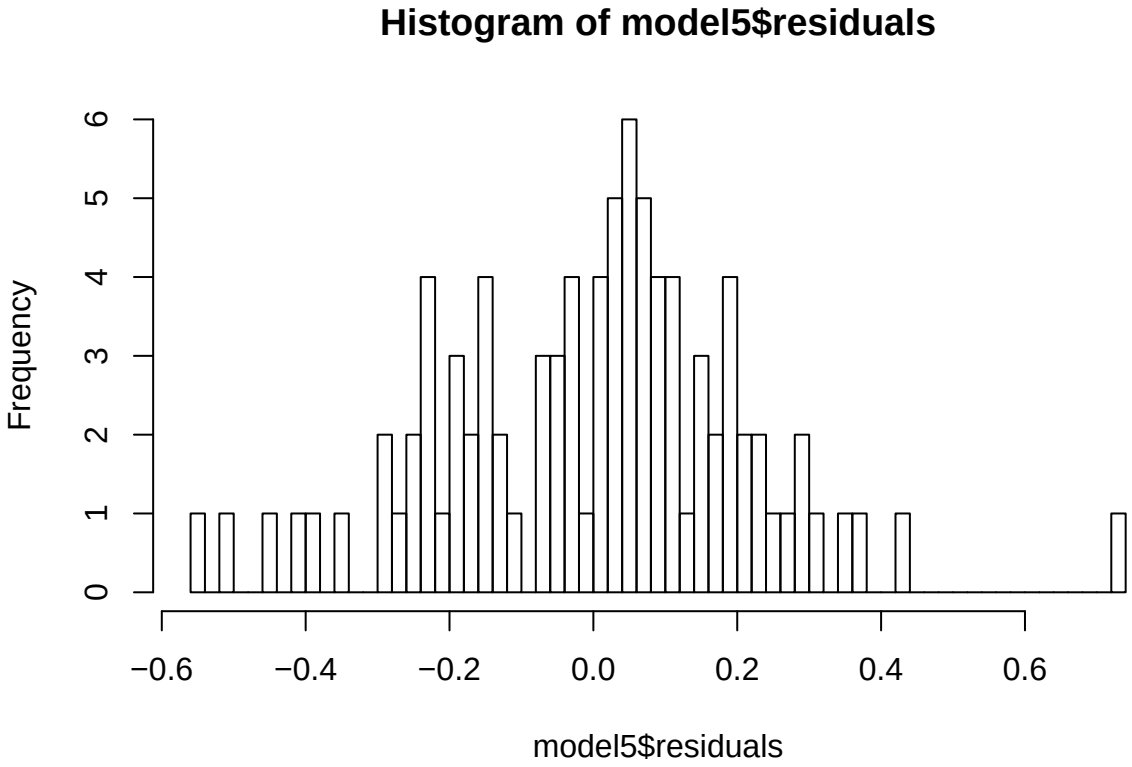









```
hist(model5$residuals, breaks = 50)
```



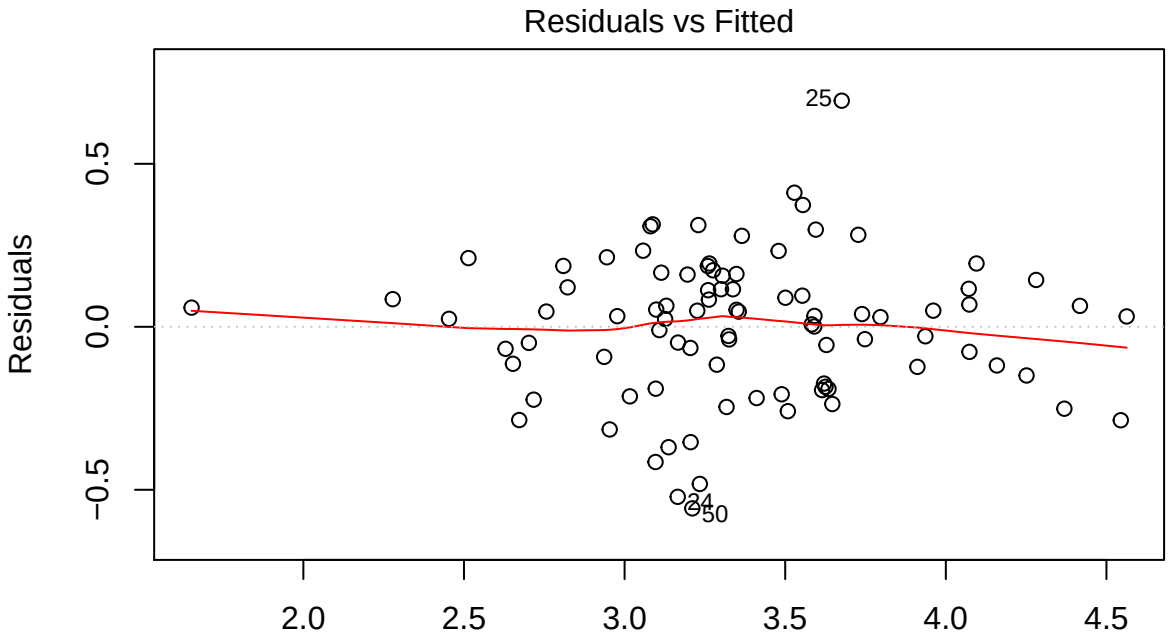

```
coeftest(model5, vcov = vcovHC)
```

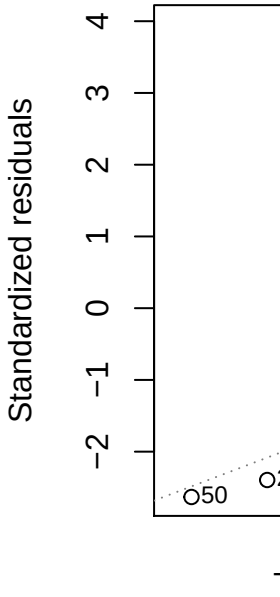
```
##
## t test of coefficients:
##
##                   Estimate  Std. Error t value  Pr(>|t|)
## (Intercept)    -1.44931653  0.65880208 -2.1999  0.030626 *
## density_1K_log  0.26639476  0.05545651  4.8037 6.934e-06 ***
## prbarr         -1.66153486  0.33554939 -4.9517 3.878e-06 ***
## prbconv        -0.61239187  0.10562656 -5.7977 1.211e-07 ***
## pctymle         0.67089631  2.40371156  0.2791  0.780864
## pctmin80        1.24720499  0.14805278  8.4241 1.007e-12 ***
## polpc_1M_log    0.43809216  0.16483422  2.6578  0.009454 **
## wfed            0.00044852  0.00086332  0.5195  0.604790
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

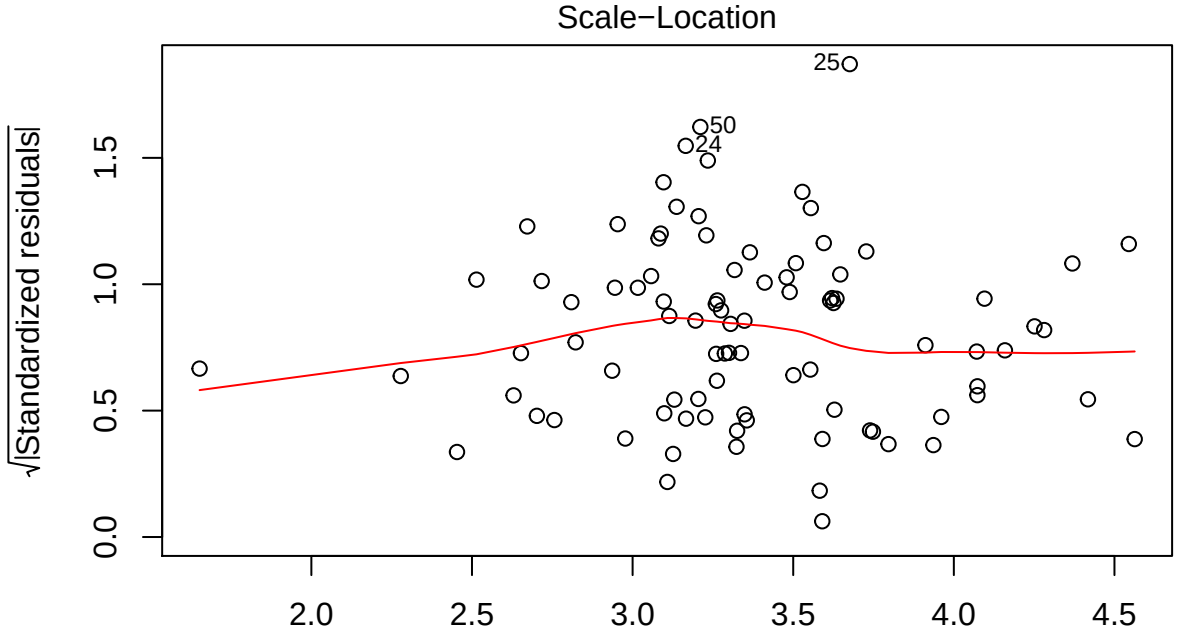
```
#vcovHC(model5)
se.model5 = sqrt(diag(vcovHC(model5)))
```

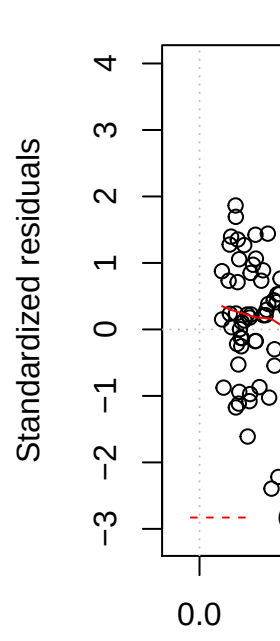
This model below (6) is model3 with percent young male excluded.

```
model6 = lm(data$crmrte_1K_log ~ density_1K_log+prbarr +prbconv+pctmin80+polpc_1M_log, data = data)
#summary(model6)
plot(model6)
```

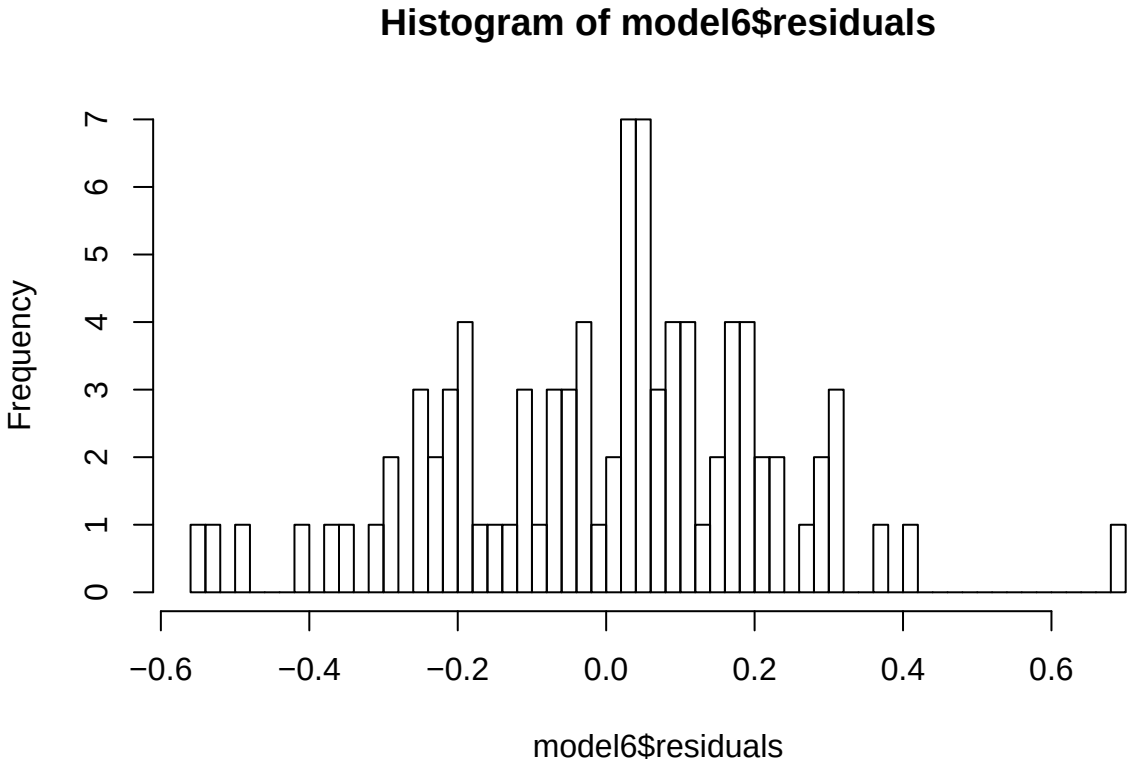









```
hist(model6$residuals, breaks = 50)
```

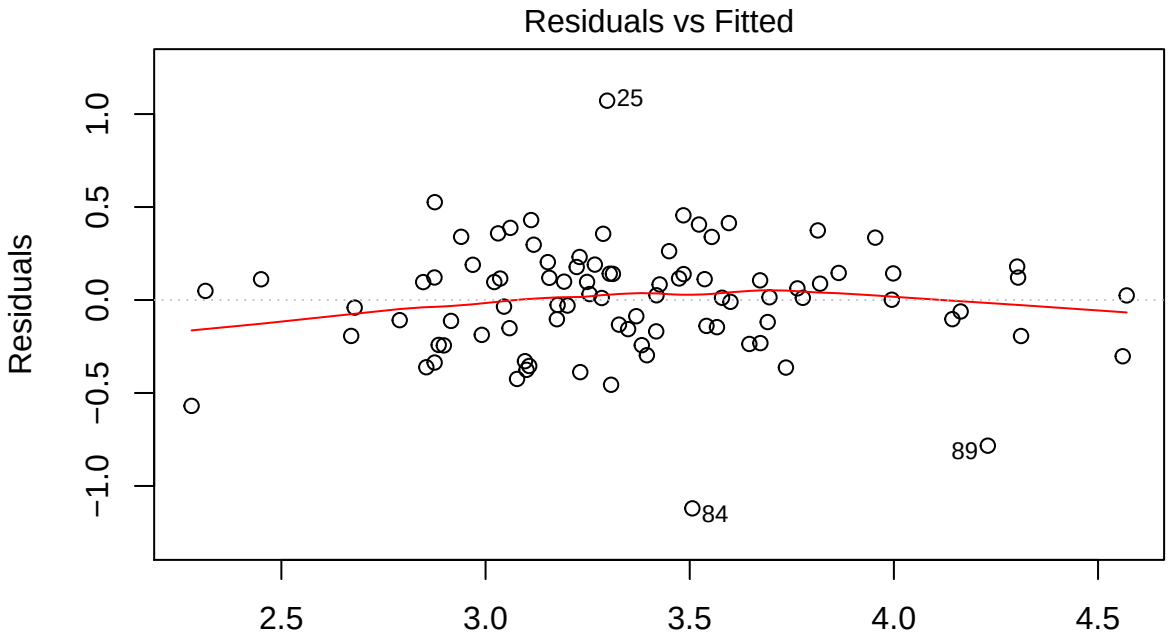


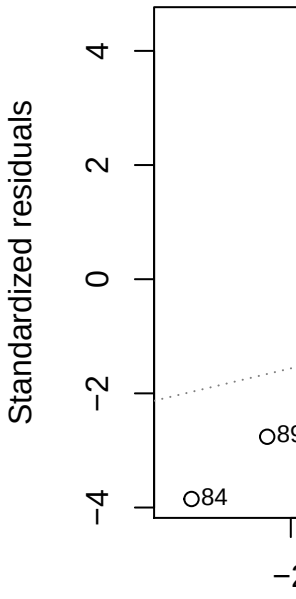

```
coeftest(model6, vcov = vcovHC)
```

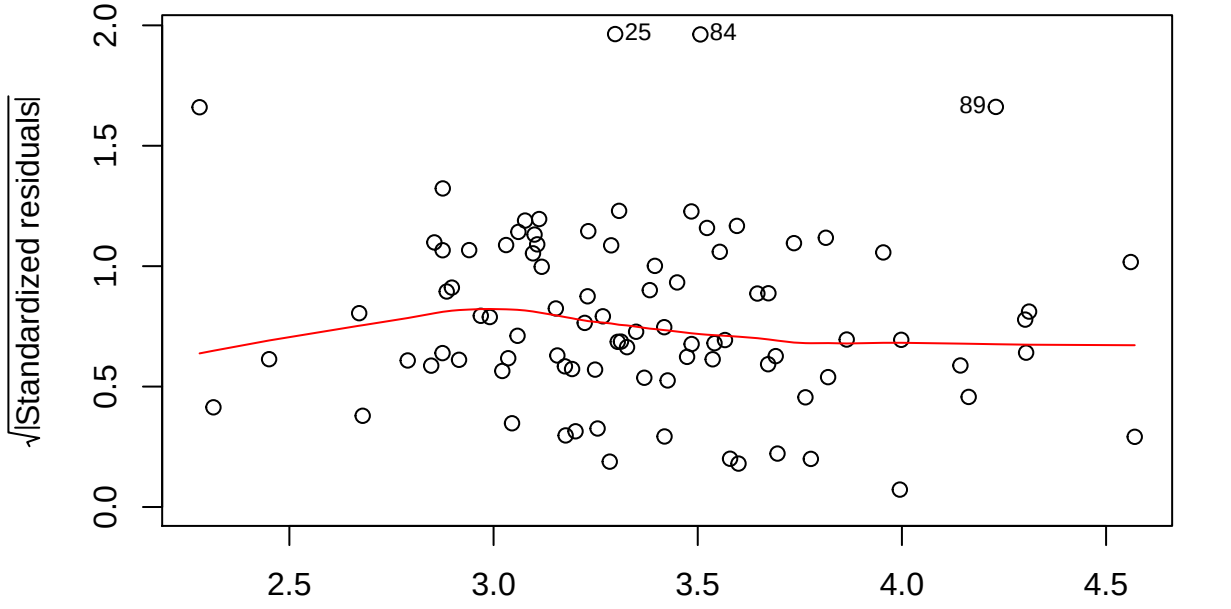
```
##
## t test of coefficients:
##
##                 Estimate Std. Error t value  Pr(>|t|)
## (Intercept)    -1.493838   0.600417 -2.4880 0.0148224 *
## density_1K_log  0.291715   0.063965  4.5605 1.722e-05 ***
## prbarr         -1.678919   0.285219 -5.8864 7.848e-08 ***
## prbconv        -0.612226   0.102938 -5.9475 6.040e-08 ***
## pctmin80        1.276361   0.151828  8.4066 9.274e-13 ***
## polpc_1M_log    0.454625   0.129769  3.5033 0.0007391 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

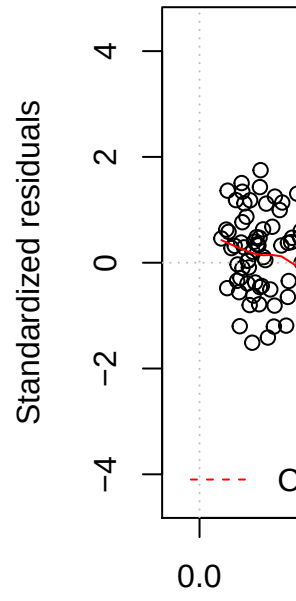
```
#vcovHC(model6)
se.model6 = sqrt(diag(vcovHC(model6)))
```

```
model7 = lm(data$crmrte_1K_log ~ density_1K_log+prbarr +pctmin80+polpc_1M_log, data = data)
#summary(model7)
plot(model7)
```

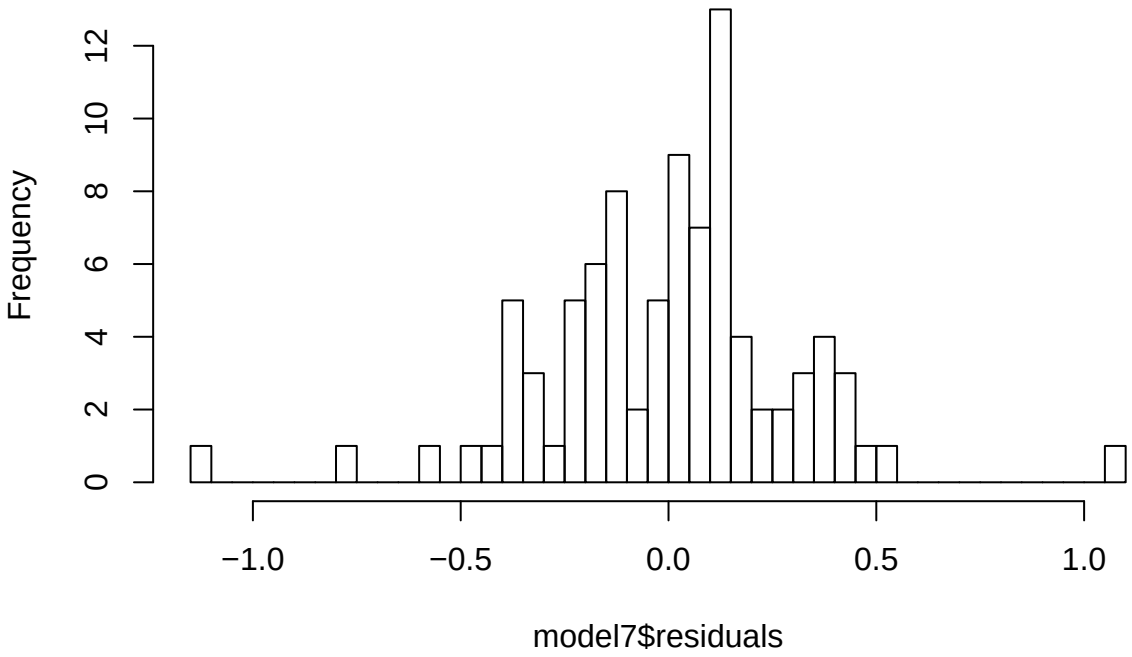









```
hist(model7$residuals, breaks = 50)
```

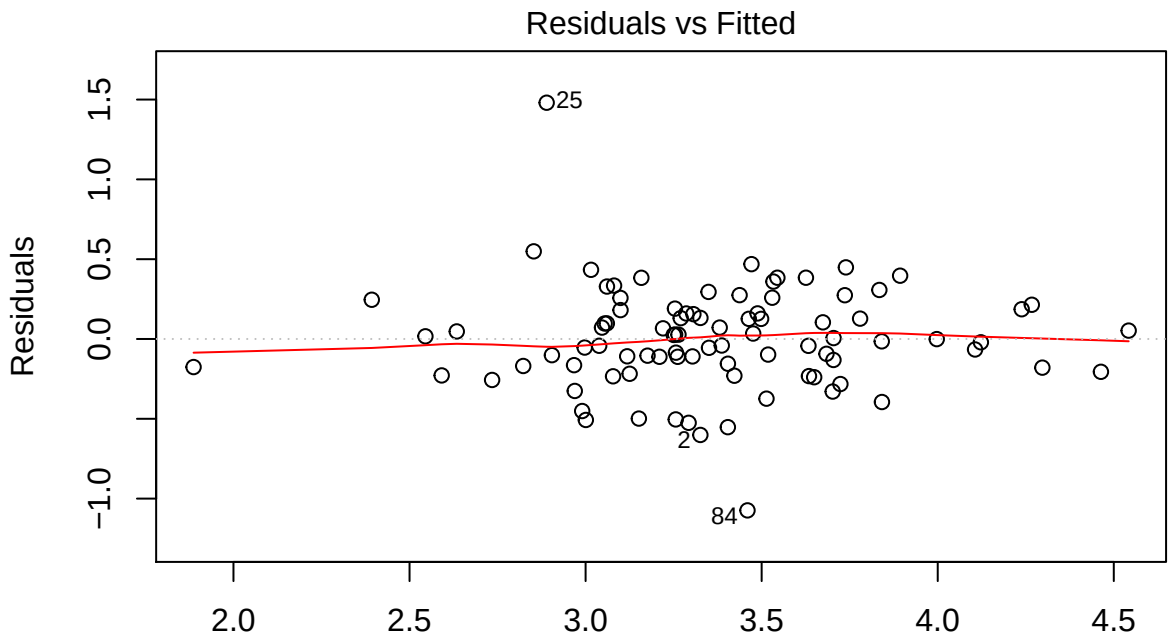


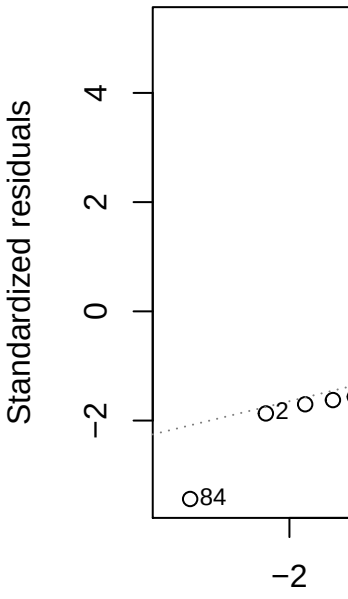

```
coeftest(model7, vcov = vcovHC)
```

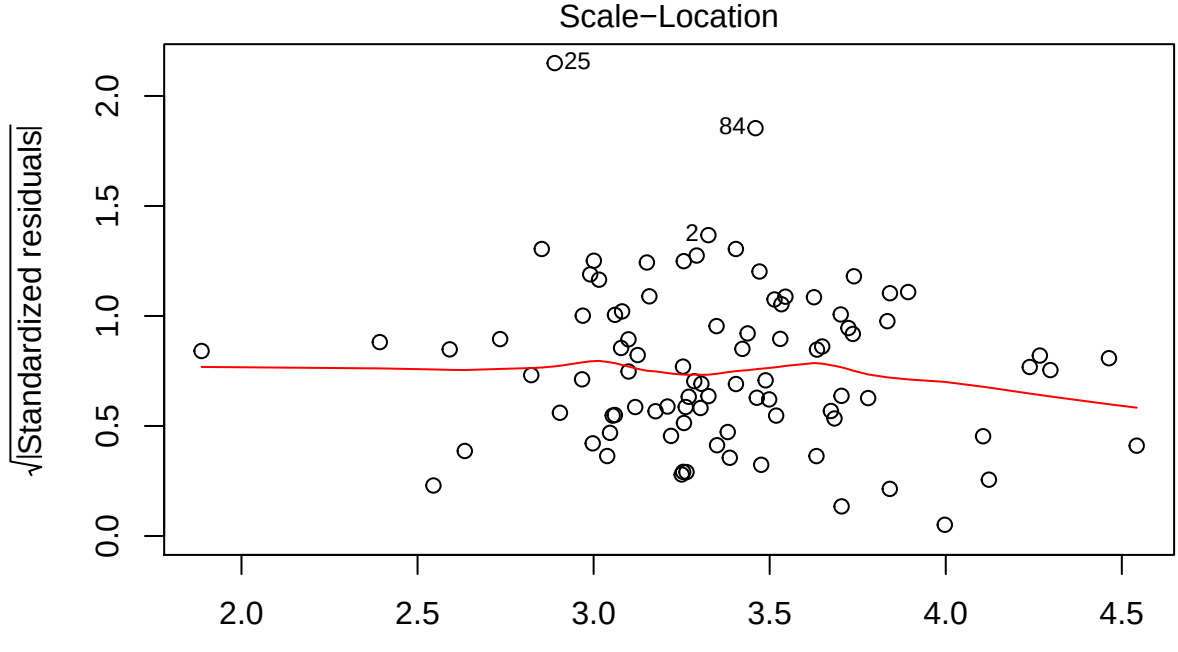
```
##
## t test of coefficients:
##
##                 Estimate Std. Error t value  Pr(>|t|)
## (Intercept)    -1.975460   1.417207 -1.3939    0.1670
## density_1K_log  0.391800   0.074566  5.2544 1.085e-06 ***
## prbarr         -1.318135   0.618979 -2.1295    0.0361 *
## pctmin80        1.233537   0.269461  4.5778 1.592e-05 ***
## polpc_1M_log    0.367069   0.233681  1.5708    0.1199
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

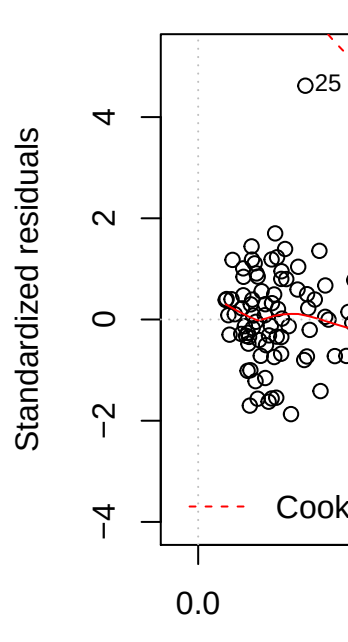
```
#vcovHC(model7)
se.model7 = sqrt(diag(vcovHC(model7)))
```

```
model8 = lm(data$crmrte_1K_log ~ density_1K_log+prbarr +pctmin80, data = data)
#summary(model8)
plot(model8)
```

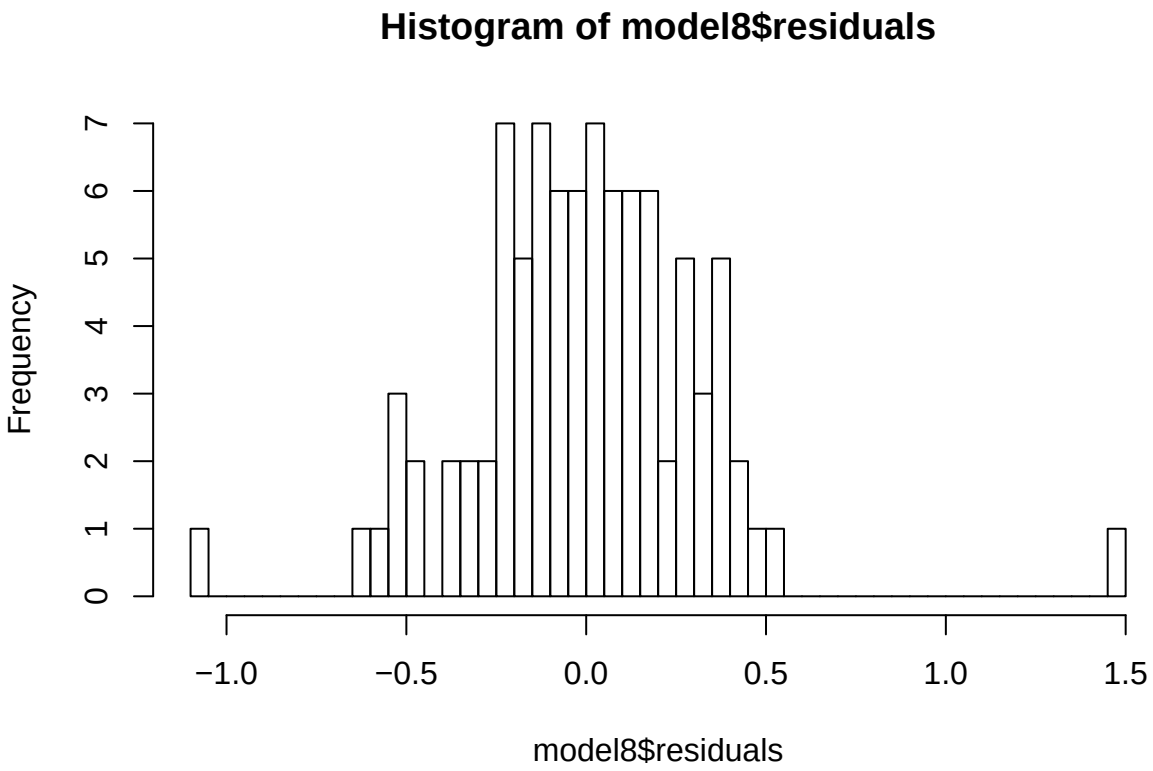









```
hist(model8$residuals, breaks = 50)
```




```
coeftest(model8, vcov = vcovHC)
```

```
##
## t test of coefficients:
##
##                Estimate Std. Error t value  Pr(>|t|)
## (Intercept)     0.11953    0.47662  0.2508  0.802569
## density_1K_log  0.46573    0.05438  8.5643 3.793e-13 ***
## prbarr         -0.93622    0.30344 -3.0853  0.002735 **
## pctmin80        1.15925    0.26972  4.2979 4.524e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

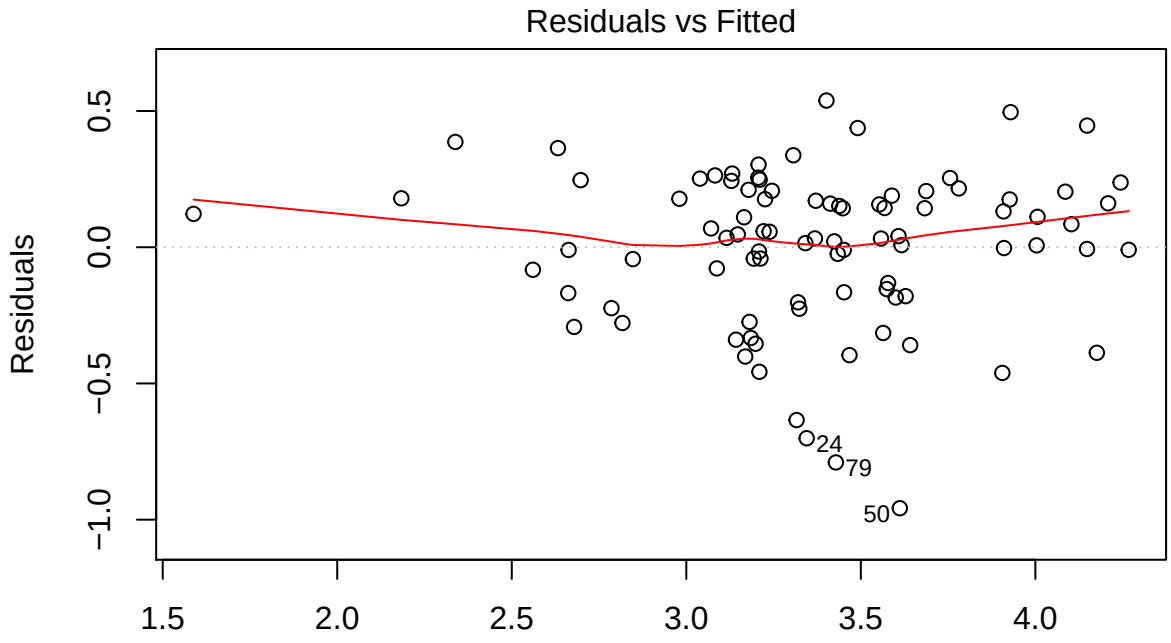
```
#vcovHC(model8)
se.model8 = sqrt(diag(vcovHC(model8)))
```

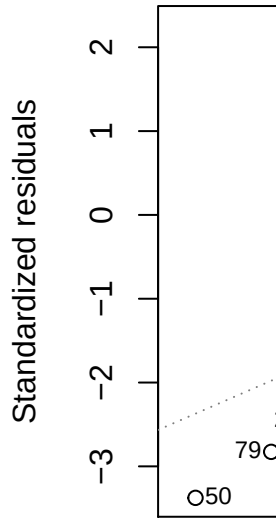
```
stargazer(model1, model2, model3, model6, model7, model8,type="text",
se=list(se.model1, se.model2, se.model3, se.model6, se.model7, se.model8),star.cutoffs=c(0.05, 0.01, 0.001))
```

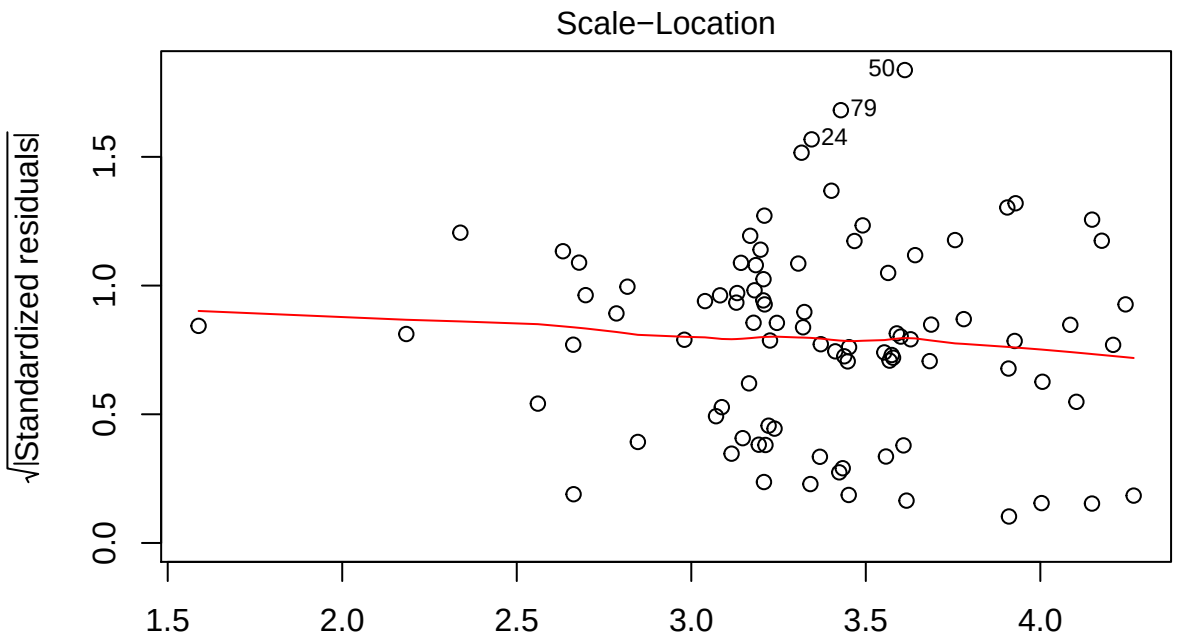
```
##
## ===============================================================================================
##                                                                  Dependent variable:
##                     ------------------------------------------------------------------------
##                                                                      crmrte_1K_log
##                             (1)                 (2)                 (3)                 (4)
## -----------------------------------------------------------------------------------------------
## density_1K_log           0.341***            0.386***            0.291***            0.292***
##                          (0.054)             (0.058)             (0.065)             (0.064)
##
## prbarr                  -1.162***             -1.142             -1.663***           -1.679***
##                          (0.295)             (0.624)             (0.312)             (0.285)
##
## prbconv                 -0.523***           -0.536**            -0.608***           -0.612***
##                          (0.119)             (0.164)             (0.107)             (0.103)
##
## pctymle                   1.660               1.505*              0.418
```

```
##                           (0.947)           (0.739)           (2.096)
##
## pctmin80                                   1.178***          1.274***          1.276***
##                                            (0.224)           (0.153)           (0.152)
##
## polpc_1M_log                                                 0.450**           0.455***
##                                                              (0.140)           (0.130)
##
## Constant                  1.496**           0.895             -1.497*           -1.494*
##                           (0.501)           (0.665)           (0.601)           (0.600)
##
## ------------------------------------------------------------------------------------------------------------
## Observations                90                90                90                90
## R2                         0.645             0.774             0.844             0.843
## Adjusted R2                0.628             0.760             0.832             0.834
## Residual Std. Error    0.335 (df = 85)   0.269 (df = 84)   0.225 (df = 83)   0.223 (df = 84
## F Statistic         38.549*** (df = 4; 85) 57.386*** (df = 5; 84) 74.695*** (df = 6; 83) 90.516*** (df = 5
## ============================================================================================================
## Note:
```

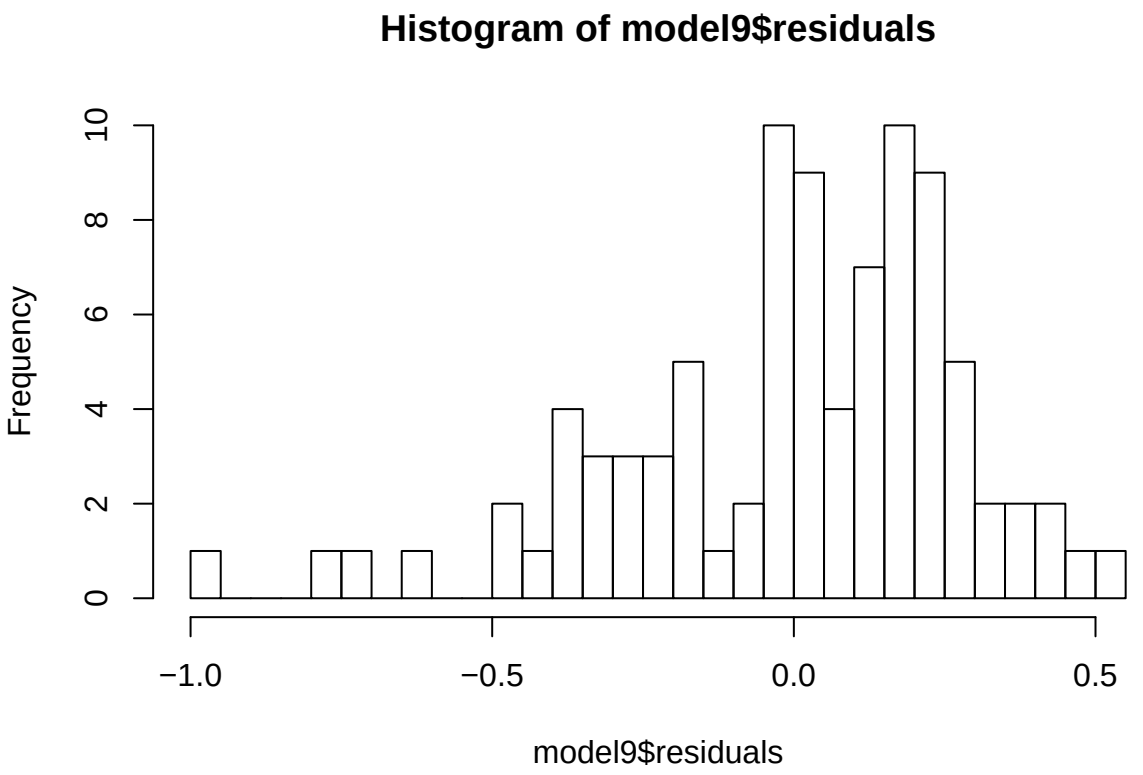
```
model9 = lm(data$crmrte_1K_log ~ prbarr +prbconv+ pctymle+pctmin80+polpc_1M_log, data = data)
#summary(model9)
plot(model9)
```








```
hist(model9$residuals, breaks = 50)
```




```
coeftest(model9, vcov = vcovHC)
```

```
##
## t test of coefficients:
##
##              Estimate Std. Error t value  Pr(>|t|)
## (Intercept)  -0.82946    0.73091 -1.1348    0.2597
## prbarr       -2.44327    0.27826 -8.7805 1.642e-13 ***
## prbconv      -0.76776    0.10711 -7.1678 2.728e-10 ***
```

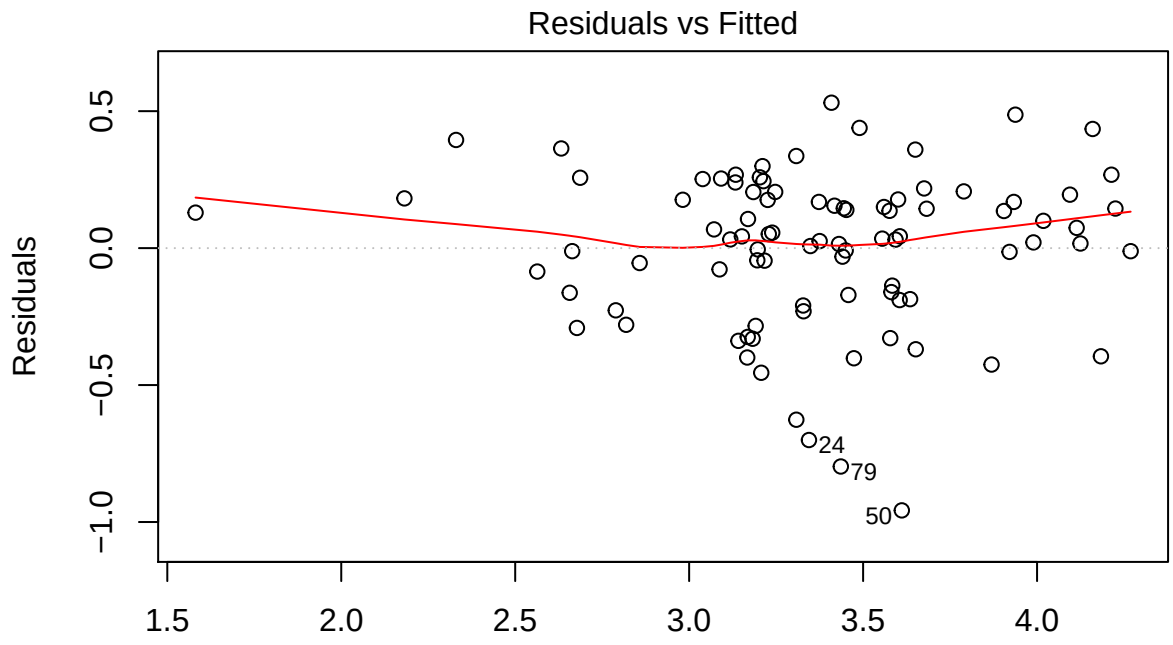
```
## pctymle       0.65841    2.53554  0.2597    0.7958
## pctmin80      1.16882    0.18770  6.2271 1.800e-08 ***
## polpc_1M_log  0.67744    0.10306  6.5731 3.928e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

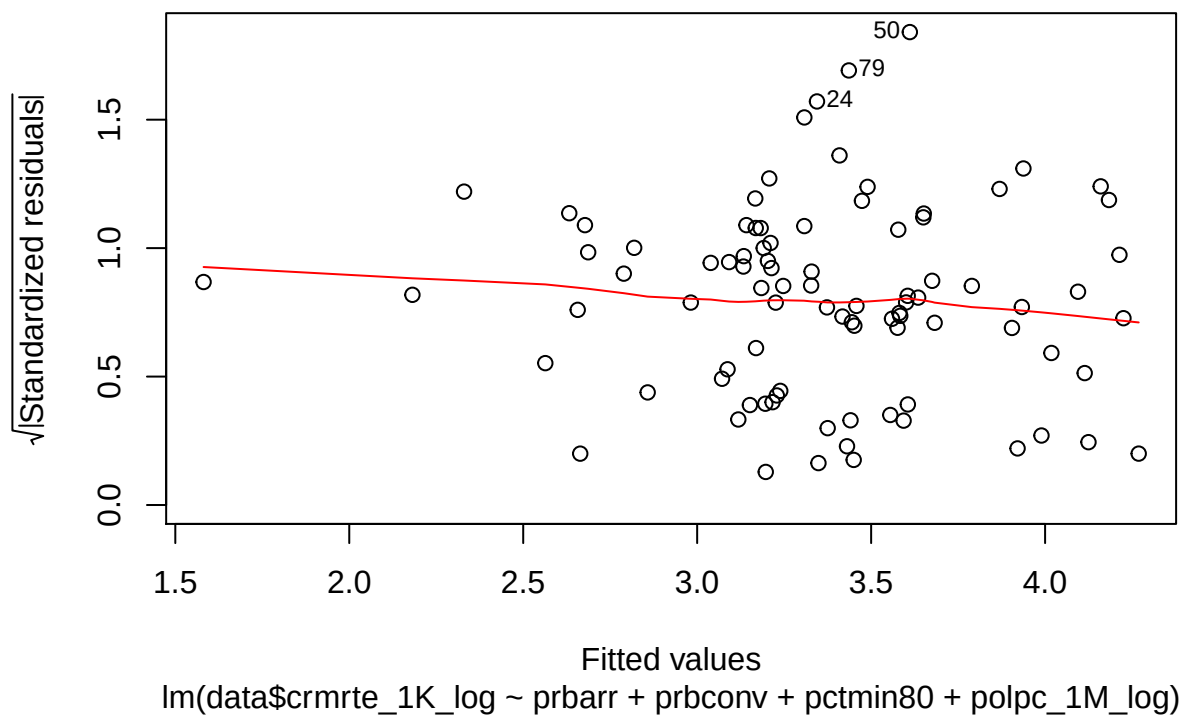
```
#vcovHC(model9)
se.model9 = sqrt(diag(vcovHC(model9)))
```

```
stargazer(model3, model6, model7, model8, model9, type="text",
se=list(se.model3, se.model6, se.model7, se.model8, se.model9),star.cutoffs=c(0.05, 0.01, 0.001))
```

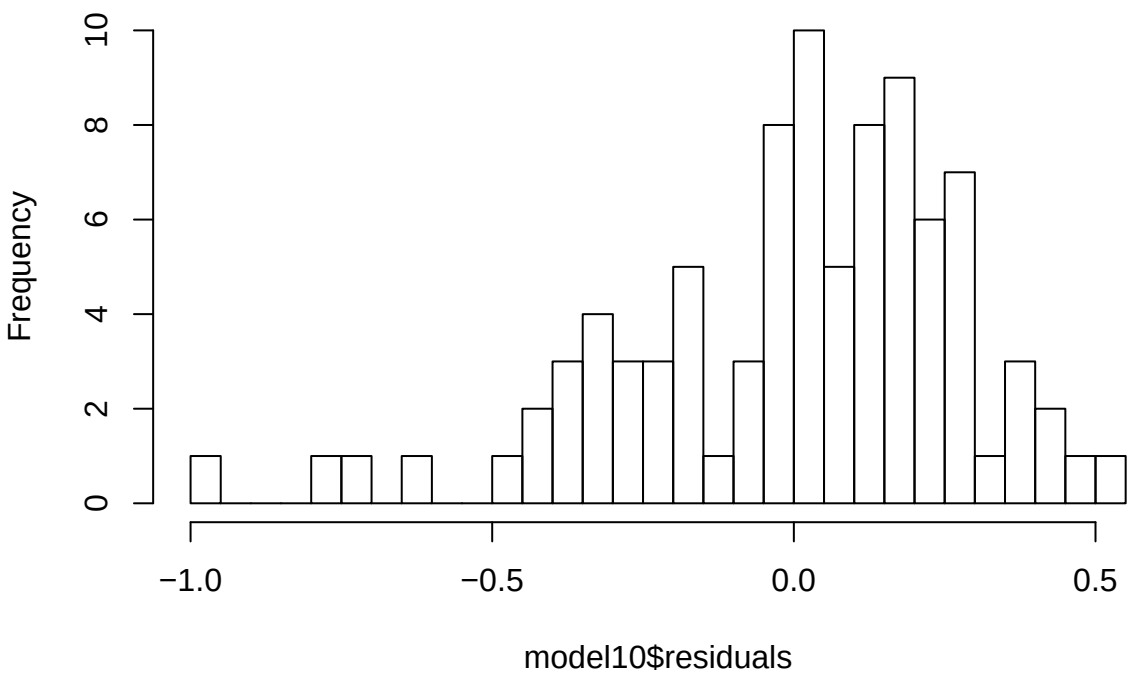
```
##
## ===============================================================================================
##                                                  Dependent variable:
##                     ---------------------------------------------------------------------------
##                                                      crmrte_1K_log
##                               (1)                    (2)                  (3)                  (4)
## -----------------------------------------------------------------------------------------------
## density_1K_log             0.291***               0.292***             0.392***             0.466***
##                            (0.065)                (0.064)              (0.075)              (0.054)
##
## prbarr                    -1.663***              -1.679***             -1.318*              -0.936**
##                            (0.312)                (0.285)              (0.619)              (0.303)
##
## prbconv                   -0.608***              -0.612***
##                            (0.107)                (0.103)
##
## pctymle                     0.418
##                            (2.096)
##
## pctmin80                   1.274***               1.276***             1.234***             1.159***
##                            (0.153)                (0.152)              (0.269)              (0.270)
##
## polpc_1M_log               0.450**                0.455***              0.367
##                            (0.140)                (0.130)              (0.234)
##
## Constant                   -1.497*                -1.494*               -1.975               0.120
##                            (0.601)                (0.600)              (1.417)              (0.477)
##
## -----------------------------------------------------------------------------------------------
## Observations                 90                     90                   90                   90
## R2                          0.844                  0.843                0.703                0.654
## Adjusted R2                 0.832                  0.834                0.689                0.642
## Residual Std. Error    0.225 (df = 83)        0.223 (df = 84)      0.306 (df = 85)      0.329 (df = 86
## F Statistic         74.695*** (df = 6; 83) 90.516*** (df = 5; 84) 50.216*** (df = 4; 85) 54.096*** (df = 3
## ===============================================================================================
## Note:                                                                                         *
```

```
model10 = lm(data$crmrte_1K_log ~ prbarr +prbconv+pctmin80+polpc_1M_log, data = data)
#summary(model10)
plot(model10)
```






```
hist(model10$residuals, breaks = 50)
```




```
coeftest(model10, vcov = vcovHC)
```

```
##
## t test of coefficients:
##
##               Estimate Std. Error t value  Pr(>|t|)
## (Intercept)  -0.822437   0.736426 -1.1168    0.2672
## prbarr       -2.469594   0.269214 -9.1734 2.406e-14 ***
## prbconv      -0.775426   0.104616 -7.4121 8.499e-11 ***
## pctmin80      1.171711   0.185401  6.3199 1.158e-08 ***
## polpc_1M_log  0.685529   0.097882  7.0036 5.462e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

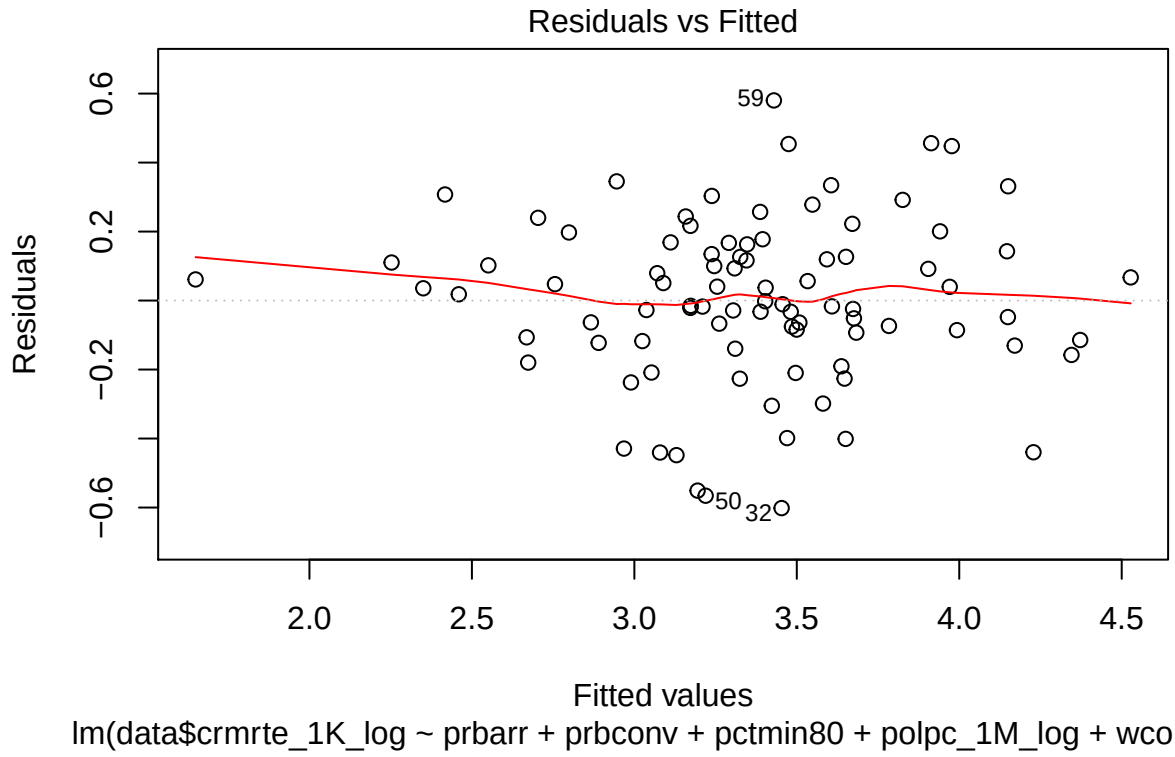
```
#vcovHC(model10)
se.model10 = sqrt(diag(vcovHC(model10)))
```

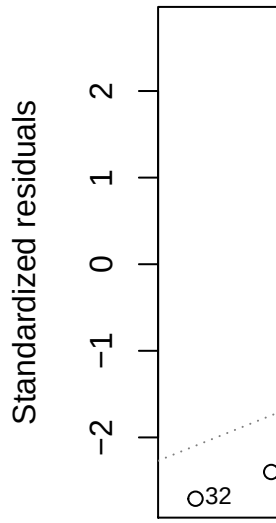
```
stargazer(model3, model6, model7, model8, model9, model10,type="text",
se=list(se.model3, se.model6, se.model7, se.model8, se.model9, se.model10),star.cutoffs=c(0.05, 0.01, 0.001))
```

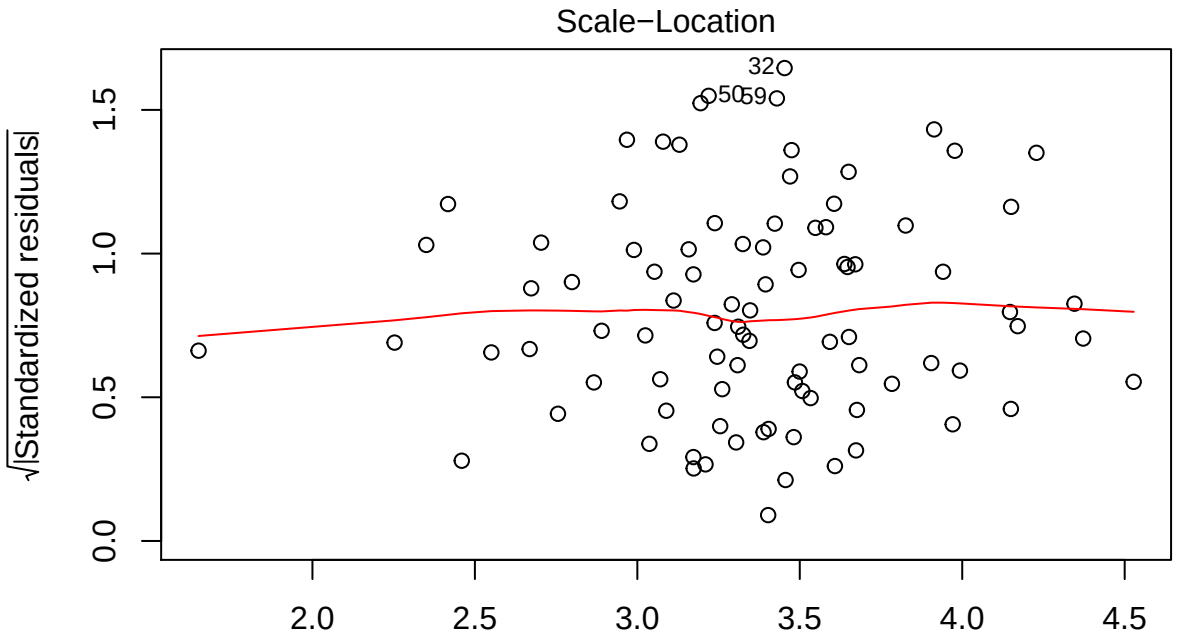
```
##
## ===============================================================================================
##                                                                Dependent variable:
##                     ------------------------------------------------------------------------
##                                                                    crmrte_1K_log
##                               (1)                  (2)                  (3)                  (4)
## -----------------------------------------------------------------------------------------------
## density_1K_log             0.291***             0.292***             0.392***             0.466***
##                            (0.065)              (0.064)              (0.075)              (0.054)
##
## prbarr                    -1.663***            -1.679***             -1.318*             -0.936**
##                            (0.312)              (0.285)              (0.619)              (0.303)
##
## prbconv                   -0.608***            -0.612***
##                            (0.107)              (0.103)
##
```

```
## pctymle                    0.418
##                           (2.096)
##
## pctmin80                  1.274***          1.276***          1.234***          1.159***
##                           (0.153)           (0.152)           (0.269)           (0.270)
##
## polpc_1M_log              0.450**           0.455***           0.367
##                           (0.140)           (0.130)           (0.234)
##
## Constant                  -1.497*           -1.494*           -1.975            0.120
##                           (0.601)           (0.600)           (1.417)           (0.477)
##
## ------------------------------------------------------------------------------------------------------------
## Observations                 90                90                90                90
## R2                         0.844             0.843             0.703             0.654
## Adjusted R2                0.832             0.834             0.689             0.642
## Residual Std. Error    0.225 (df = 83)   0.223 (df = 84)   0.306 (df = 85)   0.329 (df = 86
## F Statistic         74.695*** (df = 6; 83) 90.516*** (df = 5; 84) 50.216*** (df = 4; 85) 54.096*** (df = 3
## ============================================================================================================
## Note:
```

```
model11 = lm(data$crmrte_1K_log ~ prbarr +prbconv+pctmin80+polpc_1M_log+wcon+wtuc+wtrd+wfir+wmfg+wfed+wsta+wl
#summary(model11)
plot(model11)
```

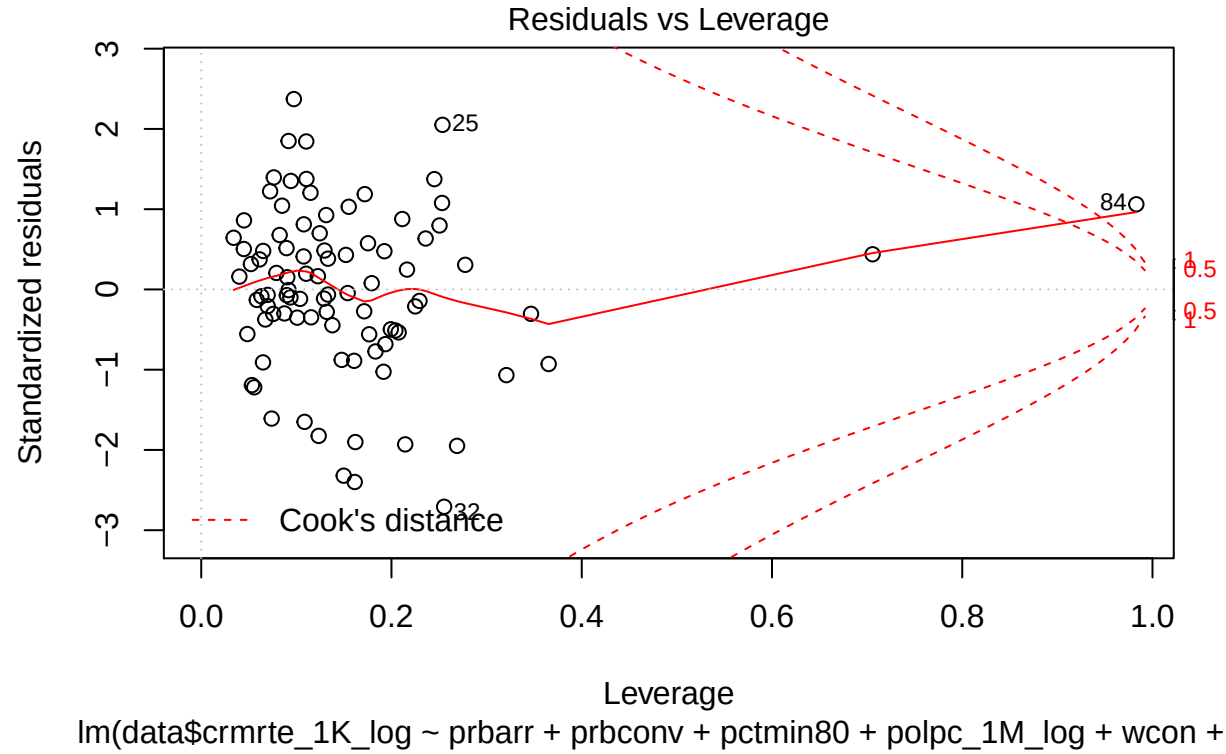




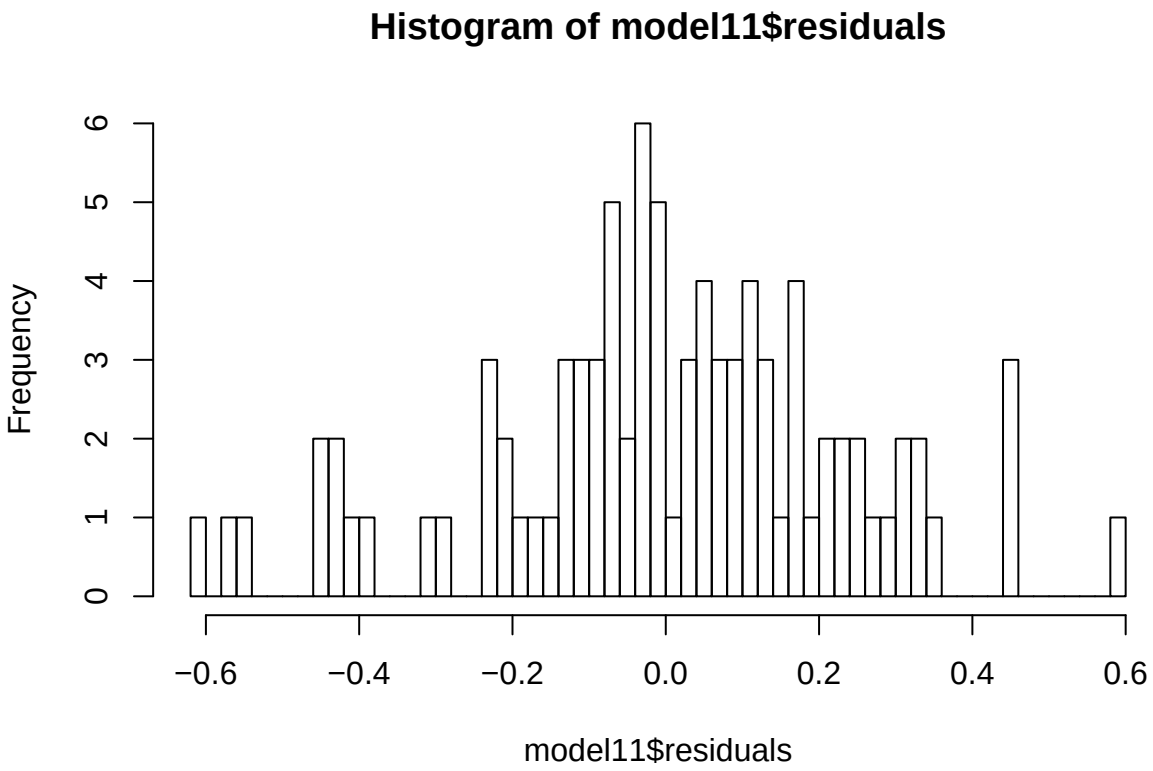



```
## Warning in sqrt(crit * p * (1 - hh)/hh): NaNs produced

## Warning in sqrt(crit * p * (1 - hh)/hh): NaNs produced
```




```
hist(model11$residuals, breaks = 50)
```




```
coeftest(model11, vcov = vcovHC)
```

```
##
## t test of coefficients:
##
##                 Estimate  Std. Error t value  Pr(>|t|)
## (Intercept)  -1.0012e+00  7.5026e-01 -1.3345 0.1860116
## prbarr       -2.2657e+00  2.7366e-01 -8.2790 3.216e-12 ***
## prbconv      -7.0168e-01  1.1306e-01 -6.2061 2.632e-08 ***
## pctmin80      1.1915e+00  1.8210e-01  6.5433 6.283e-09 ***
## polpc_1M_log  5.5062e-01  1.4578e-01  3.7771 0.0003132 ***
## wcon          5.7789e-04  7.6194e-04  0.7584 0.4505298
## wtuc          6.1259e-05  4.9093e-04  0.1248 0.9010270
## wtrd          1.4891e-03  1.2503e-03  1.1910 0.2373442
## wfir         -1.0503e-03  9.7864e-04 -1.0732 0.2865769
## wmfg          1.3441e-05  4.0958e-04  0.0328 0.9739068
## wfed          1.8267e-03  9.6458e-04  1.8938 0.0620559 .
## wsta         -9.3939e-04  7.9649e-04 -1.1794 0.2419129
## wloc          1.4813e-03  1.9299e-03  0.7675 0.4451429
## wser         -1.4729e-04  1.0320e-03 -0.1427 0.8868930
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#vcovHC(model11)
se.model11 = sqrt(diag(vcovHC(model11)))
```

```
stargazer(model10, model11,type="text",
se=list(se.model10, se.model11),star.cutoffs=c(0.05, 0.01, 0.001))
```

```
##
## ===============================================================
##                                 Dependent variable:
##                     ------------------------------------------
##                                      crmrte_1K_log
##                               (1)                    (2)
## ---------------------------------------------------------------
```

```
## prbarr                    -2.470***              -2.266***
##                            (0.269)                (0.274)
##
## prbconv                   -0.775***              -0.702***
##                            (0.105)                (0.113)
##
## pctmin80                   1.172***               1.192***
##                            (0.185)                (0.182)
##
## polpc_1M_log               0.686***               0.551***
##                            (0.098)                (0.146)
##
## wcon                                               0.001
##                                                   (0.001)
##
## wtuc                                              0.0001
##                                                  (0.0005)
##
## wtrd                                               0.001
##                                                   (0.001)
##
## wfir                                              -0.001
##                                                   (0.001)
##
## wmfg                                              0.00001
##                                                  (0.0004)
##
## wfed                                               0.002
##                                                   (0.001)
##
## wsta                                              -0.001
##                                                   (0.001)
##
## wloc                                               0.001
##                                                   (0.002)
##
## wser                                              -0.0001
##                                                   (0.001)
##
## Constant                   -0.822                 -1.001
##                           (0.736)                (0.750)
##
## ------------------------------------------------------------------
## Observations                 90                     90
## R2                          0.734                  0.812
## Adjusted R2                 0.722                  0.780
## Residual Std. Error    0.290 (df = 85)        0.257 (df = 76)
## F Statistic         58.655*** (df = 4; 85) 25.253*** (df = 13; 76)
## ==================================================================
## Note:                                *p<0.05; **p<0.01; ***p<0.001
```

```
linearHypothesis(model11, c("wcon = 0", "wtuc = 0", "wtrd = 0", "wfir = 0", "wmfg = 0", "wfed = 0", "wsta = 0
```

```
## Linear hypothesis test
##
## Hypothesis:
## wcon = 0
## wtuc = 0
## wtrd = 0
## wfir = 0
```

```
## wmfg = 0
## wfed = 0
## wsta = 0
## wloc = 0
##
## Model 1: restricted model
## Model 2: data$crmrte_1K_log ~ prbarr + prbconv + pctmin80 + polpc_1M_log +
##     wcon + wtuc + wtrd + wfir + wmfg + wfed + wsta + wloc + wser
##
## Note: Coefficient covariance matrix supplied.
##
##   Res.Df Df      F Pr(>F)
## 1     84
## 2     76  8 2.2669 0.0313 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```