SEM Preliminary

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```r
#bar graph - median household income comes from ACS 2017 5-year estimates
adj <- data.frame(Race = c("Asian", "Black", "Hispanic", "Nat. Am.", "Other", "White"),
                  race_med_inc = c(71865, 32743, 46232, 36017, 42476, 69069),
                  ovr_med_inc = rep(65699, 6))

monsanc.short %>%
  select(race_impute, total_ff) %>%
  filter(!is.na(race_impute)) %>%
  mutate(Race = case_when(
    race_impute=="asian"~"Asian",
    race_impute=="black"~"Black",
    race_impute=="hispanic"~"Hispanic",
    race_impute=="nat. am."~"Nat. Am.",
    race_impute=="other"~"Other",
    race_impute=="white"~"White"
  )) %>%
  select(-race_impute) %>%
  left_join(adj, by = "Race")%>%
  mutate(race_adj = (ovr_med_inc/race_med_inc)) %>%
  group_by(Race) %>%
  summarize(
    `Raw_USD`= mean(total_ff, na.rm = T),
    `Adjusted_USD` = mean(total_ff*race_adj, na.rm = T),
    `Raw_sd` = sd(total_ff, na.rm = T),
    `Adjusted_sd` = sd(total_ff*race_adj, na.rm=T)
  ) %>%
  gather(key = "variable", value= "value", -Race) %>%
  separate(variable, into = c("adjusted", "stat"), sep = "_") %>%
  spread(key = "stat", value = "value") %>%
  mutate(Race = factor(Race, levels =
                         c("Asian", "Hispanic", "White",
                           "Other", "Nat. Am.", "Black")),
         `Income Adjusted` = factor(adjusted, levels = c("Raw", "Adjusted"))) %>%
  select(-adjusted) %>%
ggplot()+
  geom_bar(aes(x=Race, y=USD, fill=`Income Adjusted`),
           stat="identity",
```

```
            position = position_dodge2())+
  geom_text(aes(x=Race, y=USD+25, group=`Income Adjusted`,
                label = round(USD,0)),
            position = position_dodge2(width = 1))+
  labs(title = "Figure 1: Fine/Fee Orders by Race")+
  scale_fill_manual(values = c("#00AFBB", "#FC4E07"))+
  theme_minimal()
```
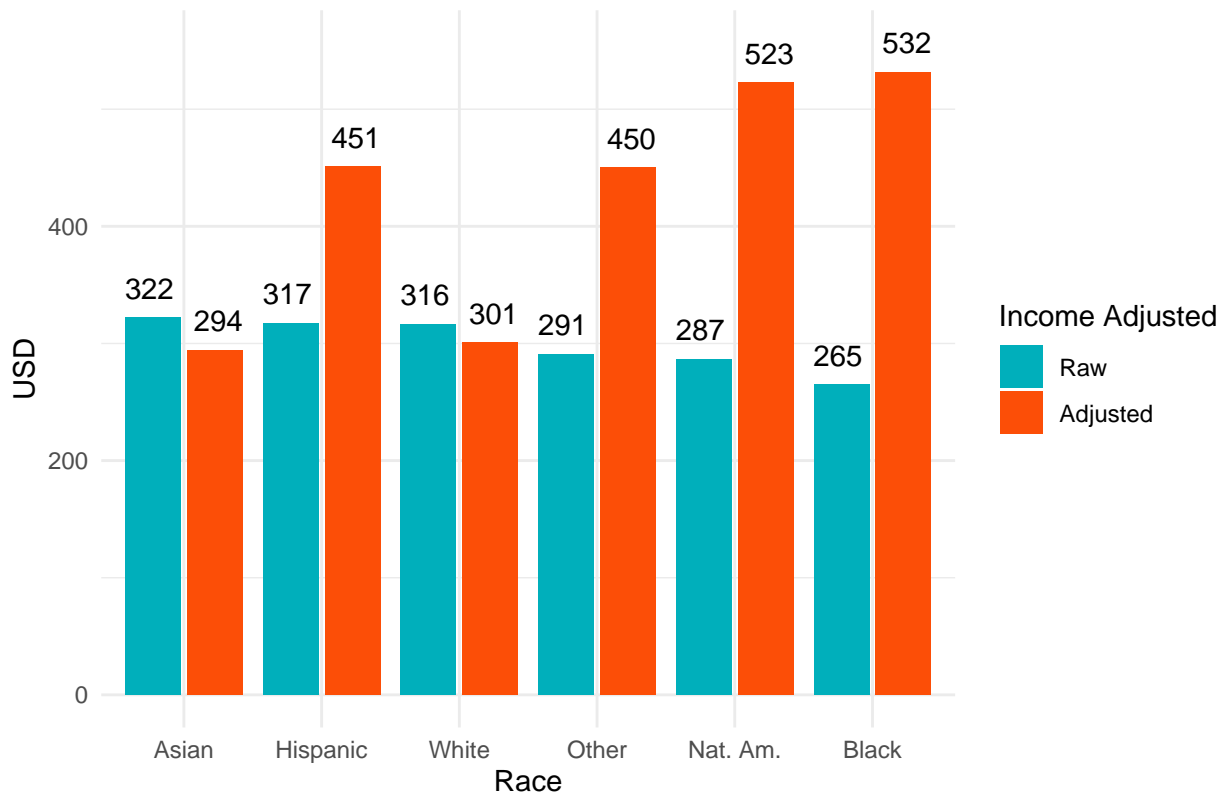
```
## Warning: Column `Race` joining character vector and factor, coercing into
## character vector
```

Figure 1: Fine/Fee Orders by Race


```
#confinement bar graph
monsanc.short %>%
  select(race_impute, conf_minus_stayed) %>%
  filter(!is.na(race_impute)) %>%
  mutate(Race = case_when(
    race_impute=="asian"~"Asian",
    race_impute=="black"~"Black",
    race_impute=="hispanic"~"Hispanic",
    race_impute=="nat. am."~"Nat. Am.",
    race_impute=="other"~"Other",
    race_impute=="white"~"White"
  )) %>%
  select(-race_impute) %>%
```
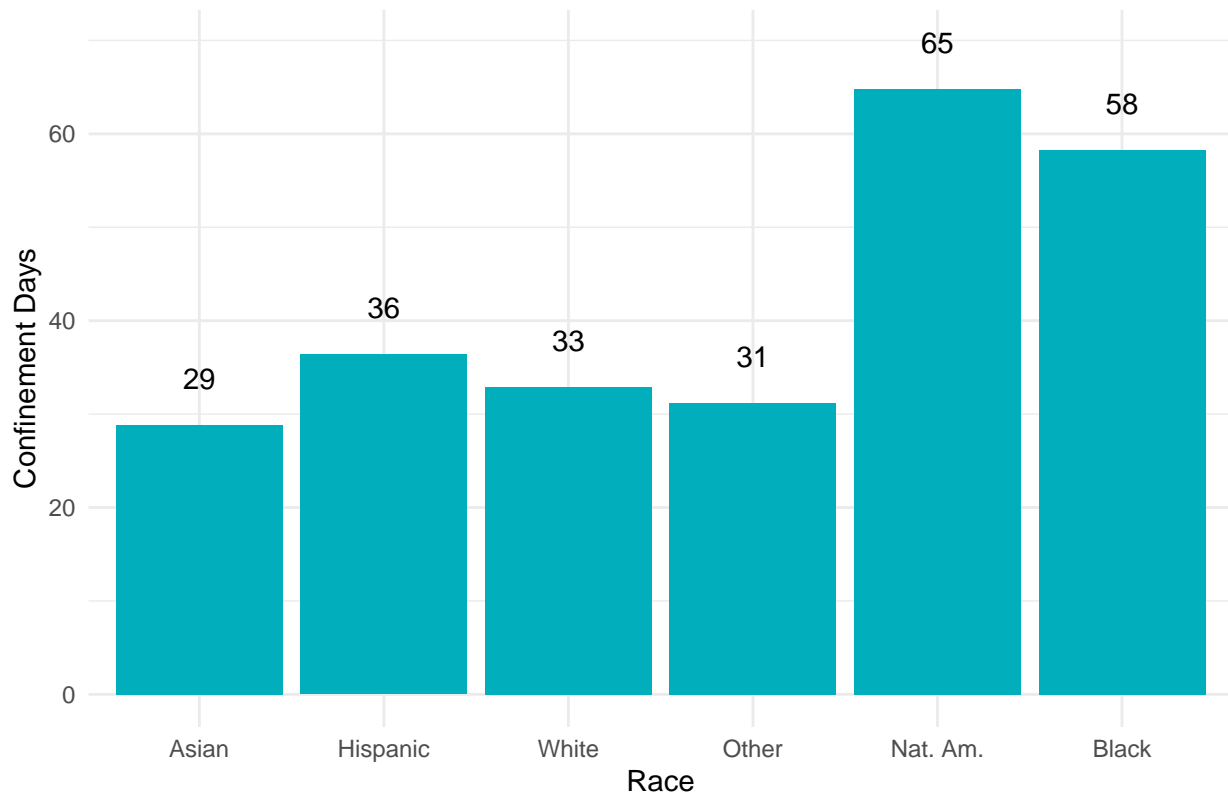
```r
  group_by(Race) %>%
  summarize(
    `Confinement Days`= mean(conf_minus_stayed, na.rm = T),
  ) %>%
  gather(key = "variable", value= "value", -Race) %>%
  separate(variable, into = "stat", sep = "_") %>%
  spread(key = "stat", value = "value") %>%
  mutate(Race = factor(Race, levels =
                          c("Asian", "Hispanic", "White",
                            "Other", "Nat. Am.", "Black"))
  ) %>%
ggplot()+
  geom_bar(aes(x=Race, y=`Confinement Days`),
           fill = "#00AFBB",
           stat="identity",
           position = position_dodge2())+
  geom_text(aes(x=Race, y=`Confinement Days`+5,
                label = round(`Confinement Days`,0)),
            position = position_dodge2(width = 1))+
  labs(title = "Figure 2: Confinement Length by Race")+
  theme_minimal()+
  theme(legend.position = "none")
```

Figure 2: Confinement Length by Race

```
#Multivariate Regression — when all predictors are identical across models
  #equivalent to separate OLS, but more efficient and takes into account error covariance

#multivariate fixed effects regression
mv.fe <- lm(cbind(total_ff_log, conf_minus_stayed_log)~black+hispanic+asian+nativeam+other.race
          male+log(age)+priors+perc_credit+trial_flag+felony+gross.mis+
            drug+alcohol.dui+hunt.fish+other.offense+
            as.factor(filed_county)+as.factor(sentence_year), data = monsanc.short)
summary(mv.fe)
```

```
## Response total_ff_log :
##
## Call:
## lm(formula = total_ff_log ~ black + hispanic + asian + nativeam +
##      other.race + male + log(age) + priors + perc_credit + trial_flag +
##      felony + gross.mis + drug + alcohol.dui + hunt.fish + other.offense +
##      as.factor(filed_county) + as.factor(sentence_year), data = monsanc.short)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -6.483 -0.351  0.249  0.795 90.526
##
## Coefficients:
##                                        Estimate Std. Error t value
## (Intercept)                           5.527e+00  2.807e-02 196.922
## black                                -2.245e-01  3.624e-03 -61.967
## hispanic                              6.696e-02  5.019e-03  13.340
## asian                                 4.259e-02  7.602e-03   5.602
## nativeam                             -3.208e-01  6.613e-03 -48.518
## other.race                           -6.021e-02  9.812e-03  -6.136
## male                                  4.279e-02  2.973e-03  14.395
## log(age)                             -4.205e-02  4.043e-03 -10.402
## priors                               -1.423e-02  1.579e-04 -90.099
## perc_credit                          -2.449e-03  3.149e-05 -77.758
## trial_flagTRUE                       -5.915e-01  1.376e-01  -4.298
## felony                               -5.248e-01  5.898e-03 -88.970
## gross.mis                             5.626e-02  4.757e-03  11.826
## drug                                  3.215e-01  8.814e-03  36.479
## alcohol.dui                           5.657e-01  6.732e-03  84.033
## hunt.fish                            -5.356e-02  1.482e-02  -3.614
## other.offense                         3.238e-01  6.022e-03  53.779
## as.factor(filed_county)Anoka County  -7.434e-01  2.408e-02 -30.878
## as.factor(filed_county)Becker County  2.328e-01  2.821e-02   8.254
## as.factor(filed_county)Beltrami County -1.273e-01 2.614e-02  -4.870
## as.factor(filed_county)Benton County -2.885e-01  3.113e-02  -9.267
## as.factor(filed_county)Big Stone County -1.552e-01 5.979e-02 -2.597
## as.factor(filed_county)Blue Earth County -1.960e-01 2.571e-02 -7.625
```

```
## as.factor(filed_county)Brown County                -1.151e-01  3.244e-02  -3.547
## as.factor(filed_county)Carlton County              -1.075e-01  2.814e-02  -3.819
## as.factor(filed_county)Carver County               -7.573e-02  2.668e-02  -2.838
## as.factor(filed_county)Cass County                 -4.206e-01  2.940e-02 -14.306
## as.factor(filed_county)Chippewa County             -7.416e-02  3.868e-02  -1.918
## as.factor(filed_county)Chisago County              -5.197e-01  2.803e-02 -18.539
## as.factor(filed_county)Clay County                 -5.871e-02  2.602e-02  -2.257
## as.factor(filed_county)Clearwater County           -1.748e-01  4.566e-02  -3.827
## as.factor(filed_county)Cook County                 -4.265e-01  5.337e-02  -7.992
## as.factor(filed_county)Cottonwood County           -1.596e-01  4.149e-02  -3.846
## as.factor(filed_county)Crow Wing County            -2.295e-01  2.616e-02  -8.772
## as.factor(filed_county)Dakota County               -2.305e-01  2.385e-02  -9.663
## as.factor(filed_county)Dodge County                -6.815e-01  3.671e-02 -18.568
## as.factor(filed_county)Douglas County              -4.057e-03  2.978e-02  -0.136
## as.factor(filed_county)Faribault County            -3.518e-02  3.803e-02  -0.925
## as.factor(filed_county)Fillmore County             -2.317e-01  3.652e-02  -6.345
## as.factor(filed_county)Freeborn County             -3.549e-01  2.982e-02 -11.904
## as.factor(filed_county)Goodhue County              -4.993e-01  2.620e-02 -19.060
## as.factor(filed_county)Grant County                -2.004e-01  5.695e-02  -3.519
## as.factor(filed_county)Hennepin County             -8.388e-01  2.352e-02 -35.660
## as.factor(filed_county)Houston County              -4.531e-01  3.459e-02 -13.100
## as.factor(filed_county)Hubbard County              -2.787e-01  3.261e-02  -8.547
## as.factor(filed_county)Isanti County               -4.030e-01  3.039e-02 -13.262
## as.factor(filed_county)Itasca County               -1.099e-01  2.730e-02  -4.028
## as.factor(filed_county)Jackson County              -1.352e-01  4.362e-02  -3.099
## as.factor(filed_county)Kanabec County              -3.109e-01  3.437e-02  -9.044
## as.factor(filed_county)Kandiyohi County            -1.816e-01  2.784e-02  -6.524
## as.factor(filed_county)Kittson County              -5.978e-02  7.729e-02  -0.773
## as.factor(filed_county)Koochiching County          -7.569e-01  3.861e-02 -19.602
## as.factor(filed_county)Lac qui Parle County        -1.991e-01  5.683e-02  -3.503
## as.factor(filed_county)Lake County                 -3.335e-01  4.279e-02  -7.792
## as.factor(filed_county)Lake of the Woods County    -4.094e-01  4.931e-02  -8.303
## as.factor(filed_county)LeSueur County              -2.659e-01  3.254e-02  -8.173
## as.factor(filed_county)Lincoln County              -3.356e-02  6.565e-02  -0.511
## as.factor(filed_county)Lyon County                 -9.158e-02  3.063e-02  -2.990
## as.factor(filed_county)Mahnomen County             -2.149e-01  3.645e-02  -5.896
## as.factor(filed_county)Marshall County             -1.669e-01  4.859e-02  -3.435
## as.factor(filed_county)Martin County               -3.773e-01  3.263e-02 -11.562
## as.factor(filed_county)McLeod County               -4.836e-01  2.920e-02 -16.563
## as.factor(filed_county)Meeker County               -2.569e-02  3.736e-02  -0.687
## as.factor(filed_county)Mille Lacs County            1.027e-01  2.909e-02   3.529
## as.factor(filed_county)Morrison County             -1.368e-01  3.069e-02  -4.458
## as.factor(filed_county)Mower County                -2.690e-01  2.831e-02  -9.504
## as.factor(filed_county)Murray County                1.050e-02  5.485e-02   0.191
## as.factor(filed_county)Nicollet County             -1.775e-01  3.008e-02  -5.903
## as.factor(filed_county)Nobles County               -1.277e-01  3.254e-02  -3.925
## as.factor(filed_county)Norman County               -1.776e-01  5.203e-02  -3.413
## as.factor(filed_county)Olmsted County              -5.445e-01  2.482e-02 -21.942
```

```
## as.factor(filed_county)Otter Tail County      4.917e-02  2.783e-02   1.767
## as.factor(filed_county)Pennington County     -4.271e-01  3.581e-02 -11.927
## as.factor(filed_county)Pine County           -4.560e-01  3.005e-02 -15.174
## as.factor(filed_county)Pipestone County      -6.465e-02  4.923e-02  -1.313
## as.factor(filed_county)Polk County           -1.509e-01  2.895e-02  -5.212
## as.factor(filed_county)Pope County           -2.173e-01  4.239e-02  -5.126
## as.factor(filed_county)Ramsey County         -9.743e-03  2.370e-02  -0.411
## as.factor(filed_county)Red Lake County       -6.585e-01  5.420e-02 -12.150
## as.factor(filed_county)Redwood County         1.574e-02  3.290e-02   0.479
## as.factor(filed_county)Renville County       -7.770e-01  3.402e-02 -22.842
## as.factor(filed_county)Rice County           -2.211e-02  2.736e-02  -0.808
## as.factor(filed_county)Rock County           -1.058e-01  5.295e-02  -1.998
## as.factor(filed_county)Roseau County         -1.235e-01  3.317e-02  -3.722
## as.factor(filed_county)Scott County          -1.299e-01  2.454e-02  -5.291
## as.factor(filed_county)Sherburne County      -3.381e-01  2.640e-02 -12.805
## as.factor(filed_county)Sibley County         -5.327e-01  3.701e-02 -14.395
## as.factor(filed_county)St. Louis County      -2.477e-01  2.425e-02 -10.216
## as.factor(filed_county)Stearns County        -7.324e-02  2.447e-02  -2.993
## as.factor(filed_county)Steele County         -8.943e-02  2.858e-02  -3.130
## as.factor(filed_county)Stevens County        -3.512e-01  4.998e-02  -7.026
## as.factor(filed_county)Swift County          -1.574e-01  4.207e-02  -3.740
## as.factor(filed_county)Todd County            3.121e-02  3.457e-02   0.903
## as.factor(filed_county)Traverse County       -6.652e-01  7.229e-02  -9.203
## as.factor(filed_county)Wabasha County        -5.048e-01  3.218e-02 -15.688
## as.factor(filed_county)Wadena County         -6.258e-02  3.518e-02  -1.779
## as.factor(filed_county)Waseca County         -4.415e-01  3.607e-02 -12.238
## as.factor(filed_county)Washington County     -2.409e-01  2.439e-02  -9.877
## as.factor(filed_county)Watonwan County       -7.244e-02  3.872e-02  -1.871
## as.factor(filed_county)Wilkin County         -2.382e-01  4.323e-02  -5.510
## as.factor(filed_county)Winona County         -3.767e-01  2.773e-02 -13.583
## as.factor(filed_county)Wright County         -6.224e-01  2.582e-02 -24.106
## as.factor(filed_county)Yellow Medicine County -2.945e-02  3.908e-02  -0.754
## as.factor(sentence_year)2011                   4.261e-02  4.601e-03   9.261
## as.factor(sentence_year)2012                   2.582e-02  4.555e-03   5.667
## as.factor(sentence_year)2013                   9.627e-02  4.856e-03  19.826
## as.factor(sentence_year)2014                   1.224e-01  4.660e-03  26.260
## as.factor(sentence_year)2015                   1.656e-01  4.754e-03  34.820
## as.factor(sentence_year)2016                   2.376e-01  6.414e-03  37.052
## as.factor(sentence_year)2017                   4.706e-01  1.139e-02  41.315
## as.factor(sentence_year)2018                   5.778e-01  1.768e-02  32.674
##                                               Pr(>|t|)
## (Intercept)                                   < 2e-16 ***
## black                                         < 2e-16 ***
## hispanic                                      < 2e-16 ***
## asian                                         2.12e-08 ***
## nativeam                                      < 2e-16 ***
## other.race                                    8.49e-10 ***
## male                                          < 2e-16 ***
```

```
## log(age)                                         < 2e-16 ***
## priors                                           < 2e-16 ***
## perc_credit                                      < 2e-16 ***
## trial_flagTRUE                                   1.73e-05 ***
## felony                                           < 2e-16 ***
## gross.mis                                        < 2e-16 ***
## drug                                             < 2e-16 ***
## alcohol.dui                                      < 2e-16 ***
## hunt.fish                                        0.000302 ***
## other.offense                                    < 2e-16 ***
## as.factor(filed_county)Anoka County             < 2e-16 ***
## as.factor(filed_county)Becker County            < 2e-16 ***
## as.factor(filed_county)Beltrami County          1.12e-06 ***
## as.factor(filed_county)Benton County            < 2e-16 ***
## as.factor(filed_county)Big Stone County         0.009417 **
## as.factor(filed_county)Blue Earth County        2.45e-14 ***
## as.factor(filed_county)Brown County             0.000390 ***
## as.factor(filed_county)Carlton County           0.000134 ***
## as.factor(filed_county)Carver County            0.004538 **
## as.factor(filed_county)Cass County              < 2e-16 ***
## as.factor(filed_county)Chippewa County          0.055165 .
## as.factor(filed_county)Chisago County           < 2e-16 ***
## as.factor(filed_county)Clay County              0.024035 *
## as.factor(filed_county)Clearwater County        0.000130 ***
## as.factor(filed_county)Cook County              1.33e-15 ***
## as.factor(filed_county)Cottonwood County        0.000120 ***
## as.factor(filed_county)Crow Wing County         < 2e-16 ***
## as.factor(filed_county)Dakota County            < 2e-16 ***
## as.factor(filed_county)Dodge County             < 2e-16 ***
## as.factor(filed_county)Douglas County           0.891645
## as.factor(filed_county)Faribault County         0.354931
## as.factor(filed_county)Fillmore County          2.23e-10 ***
## as.factor(filed_county)Freeborn County          < 2e-16 ***
## as.factor(filed_county)Goodhue County           < 2e-16 ***
## as.factor(filed_county)Grant County             0.000433 ***
## as.factor(filed_county)Hennepin County          < 2e-16 ***
## as.factor(filed_county)Houston County           < 2e-16 ***
## as.factor(filed_county)Hubbard County           < 2e-16 ***
## as.factor(filed_county)Isanti County            < 2e-16 ***
## as.factor(filed_county)Itasca County            5.63e-05 ***
## as.factor(filed_county)Jackson County           0.001944 **
## as.factor(filed_county)Kanabec County           < 2e-16 ***
## as.factor(filed_county)Kandiyohi County         6.87e-11 ***
## as.factor(filed_county)Kittson County           0.439249
## as.factor(filed_county)Koochiching County       < 2e-16 ***
## as.factor(filed_county)Lac qui Parle County     0.000460 ***
## as.factor(filed_county)Lake County              6.59e-15 ***
## as.factor(filed_county)Lake of the Woods County < 2e-16 ***
```

```
## as.factor(filed_county)LeSueur County        3.01e-16 ***
## as.factor(filed_county)Lincoln County        0.609220
## as.factor(filed_county)Lyon County           0.002787 **
## as.factor(filed_county)Mahnomen County       3.72e-09 ***
## as.factor(filed_county)Marshall County       0.000593 ***
## as.factor(filed_county)Martin County          < 2e-16 ***
## as.factor(filed_county)McLeod County          < 2e-16 ***
## as.factor(filed_county)Meeker County         0.491801
## as.factor(filed_county)Mille Lacs County     0.000417 ***
## as.factor(filed_county)Morrison County       8.26e-06 ***
## as.factor(filed_county)Mower County           < 2e-16 ***
## as.factor(filed_county)Murray County         0.848203
## as.factor(filed_county)Nicollet County       3.58e-09 ***
## as.factor(filed_county)Nobles County         8.67e-05 ***
## as.factor(filed_county)Norman County         0.000641 ***
## as.factor(filed_county)Olmsted County         < 2e-16 ***
## as.factor(filed_county)Otter Tail County     0.077310 .
## as.factor(filed_county)Pennington County      < 2e-16 ***
## as.factor(filed_county)Pine County            < 2e-16 ***
## as.factor(filed_county)Pipestone County      0.189079
## as.factor(filed_county)Polk County           1.87e-07 ***
## as.factor(filed_county)Pope County           2.95e-07 ***
## as.factor(filed_county)Ramsey County         0.680981
## as.factor(filed_county)Red Lake County        < 2e-16 ***
## as.factor(filed_county)Redwood County        0.632251
## as.factor(filed_county)Renville County        < 2e-16 ***
## as.factor(filed_county)Rice County           0.418926
## as.factor(filed_county)Rock County           0.045682 *
## as.factor(filed_county)Roseau County         0.000197 ***
## as.factor(filed_county)Scott County          1.22e-07 ***
## as.factor(filed_county)Sherburne County       < 2e-16 ***
## as.factor(filed_county)Sibley County          < 2e-16 ***
## as.factor(filed_county)St. Louis County       < 2e-16 ***
## as.factor(filed_county)Stearns County        0.002761 **
## as.factor(filed_county)Steele County         0.001750 **
## as.factor(filed_county)Stevens County        2.13e-12 ***
## as.factor(filed_county)Swift County          0.000184 ***
## as.factor(filed_county)Todd County           0.366700
## as.factor(filed_county)Traverse County        < 2e-16 ***
## as.factor(filed_county)Wabasha County         < 2e-16 ***
## as.factor(filed_county)Wadena County         0.075319 .
## as.factor(filed_county)Waseca County          < 2e-16 ***
## as.factor(filed_county)Washington County      < 2e-16 ***
## as.factor(filed_county)Watonwan County       0.061329 .
## as.factor(filed_county)Wilkin County         3.58e-08 ***
## as.factor(filed_county)Winona County          < 2e-16 ***
## as.factor(filed_county)Wright County          < 2e-16 ***
## as.factor(filed_county)Yellow Medicine County 0.451129
```

```
## as.factor(sentence_year)2011                            < 2e-16 ***
## as.factor(sentence_year)2012                           1.45e-08 ***
## as.factor(sentence_year)2013                            < 2e-16 ***
## as.factor(sentence_year)2014                            < 2e-16 ***
## as.factor(sentence_year)2015                            < 2e-16 ***
## as.factor(sentence_year)2016                            < 2e-16 ***
## as.factor(sentence_year)2017                            < 2e-16 ***
## as.factor(sentence_year)2018                            < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.416 on 1146059 degrees of freedom
##   (447941 observations deleted due to missingness)
## Multiple R-squared:  0.1033, Adjusted R-squared:  0.1032
## F-statistic:  1200 on 110 and 1146059 DF,  p-value: < 2.2e-16
##
##
## Response conf_minus_stayed_log :
##
## Call:
## lm(formula = conf_minus_stayed_log ~ black + hispanic + asian +
##     nativeam + other.race + male + log(age) + priors + perc_credit +
##     trial_flag + felony + gross.mis + drug + alcohol.dui + hunt.fish +
##     other.offense + as.factor(filed_county) + as.factor(sentence_year),
##     data = monsanc.short)
##
## Residuals:
##     Min       1Q   Median       3Q      Max
## -193.432   -0.429   -0.170    0.126    9.219
##
## Coefficients:
##                                     Estimate Std. Error  t value
## (Intercept)                        6.789e-01  2.282e-02   29.748
## black                              1.224e-01  2.947e-03   41.543
## hispanic                           5.962e-02  4.081e-03   14.608
## asian                              1.306e-02  6.182e-03    2.112
## nativeam                           3.725e-01  5.377e-03   69.273
## other.race                         4.755e-02  7.979e-03    5.960
## male                               1.556e-01  2.417e-03   64.355
## log(age)                           6.312e-02  3.287e-03   19.200
## priors                             2.717e-02  1.284e-04  211.597
## perc_credit                        5.316e-03  2.561e-05  207.597
## trial_flagTRUE                     1.769e+00  1.119e-01   15.803
## felony                             3.099e+00  4.796e-03  646.236
## gross.mis                          1.691e+00  3.868e-03  437.055
## drug                              -9.525e-01  7.167e-03 -132.897
## alcohol.dui                       -5.198e-01  5.474e-03  -94.962
## hunt.fish                         -1.099e+00  1.205e-02  -91.217
```

9

```
## other.offense                                        -8.988e-01  4.897e-03 -183.564
## as.factor(filed_county)Anoka County                   -1.211e-01  1.958e-02   -6.186
## as.factor(filed_county)Becker County                   2.165e-01  2.294e-02    9.437
## as.factor(filed_county)Beltrami County                 1.653e-01  2.125e-02    7.779
## as.factor(filed_county)Benton County                   1.292e-01  2.532e-02    5.102
## as.factor(filed_county)Big Stone County               -6.910e-02  4.862e-02   -1.421
## as.factor(filed_county)Blue Earth County              -3.221e-01  2.091e-02  -15.407
## as.factor(filed_county)Brown County                   -9.375e-02  2.638e-02   -3.554
## as.factor(filed_county)Carlton County                 -5.780e-02  2.288e-02   -2.526
## as.factor(filed_county)Carver County                  -2.937e-01  2.170e-02  -13.534
## as.factor(filed_county)Cass County                    -3.156e-01  2.391e-02  -13.201
## as.factor(filed_county)Chippewa County                -8.669e-02  3.145e-02   -2.756
## as.factor(filed_county)Chisago County                 -2.318e-01  2.279e-02  -10.171
## as.factor(filed_county)Clay County                    -4.915e-03  2.116e-02   -0.232
## as.factor(filed_county)Clearwater County               6.940e-02  3.713e-02    1.869
## as.factor(filed_county)Cook County                    -3.501e-01  4.340e-02   -8.068
## as.factor(filed_county)Cottonwood County              -1.938e-01  3.374e-02   -5.743
## as.factor(filed_county)Crow Wing County               -3.061e-01  2.127e-02  -14.386
## as.factor(filed_county)Dakota County                  -1.809e-01  1.940e-02   -9.325
## as.factor(filed_county)Dodge County                   -4.280e-01  2.985e-02  -14.338
## as.factor(filed_county)Douglas County                  2.077e-01  2.422e-02    8.575
## as.factor(filed_county)Faribault County               -9.576e-02  3.092e-02   -3.097
## as.factor(filed_county)Fillmore County                -7.943e-02  2.969e-02   -2.675
## as.factor(filed_county)Freeborn County                -1.662e-01  2.425e-02   -6.855
## as.factor(filed_county)Goodhue County                 -2.813e-01  2.130e-02  -13.208
## as.factor(filed_county)Grant County                   -1.140e-01  4.631e-02   -2.463
## as.factor(filed_county)Hennepin County                -1.034e-01  1.913e-02   -5.405
## as.factor(filed_county)Houston County                 -1.926e-01  2.813e-02   -6.849
## as.factor(filed_county)Hubbard County                  1.107e-01  2.651e-02    4.176
## as.factor(filed_county)Isanti County                   5.871e-02  2.471e-02    2.376
## as.factor(filed_county)Itasca County                  -1.002e-01  2.220e-02   -4.513
## as.factor(filed_county)Jackson County                 -2.290e-01  3.547e-02   -6.456
## as.factor(filed_county)Kanabec County                  3.387e-02  2.795e-02    1.212
## as.factor(filed_county)Kandiyohi County                1.485e-01  2.264e-02    6.559
## as.factor(filed_county)Kittson County                 -3.176e-01  6.285e-02   -5.053
## as.factor(filed_county)Koochiching County             -3.352e-01  3.140e-02  -10.677
## as.factor(filed_county)Lac qui Parle County           -7.010e-02  4.621e-02   -1.517
## as.factor(filed_county)Lake County                    -8.539e-02  3.480e-02   -2.454
## as.factor(filed_county)Lake of the Woods County -2.556e-01  4.009e-02   -6.375
## as.factor(filed_county)LeSueur County                 -3.473e-01  2.646e-02  -13.128
## as.factor(filed_county)Lincoln County                 -1.700e-01  5.338e-02   -3.184
## as.factor(filed_county)Lyon County                    -3.939e-02  2.490e-02   -1.582
## as.factor(filed_county)Mahnomen County                -9.179e-02  2.964e-02   -3.097
## as.factor(filed_county)Marshall County                -8.901e-02  3.951e-02   -2.253
## as.factor(filed_county)Martin County                   4.814e-02  2.654e-02    1.814
## as.factor(filed_county)McLeod County                  -8.549e-03  2.374e-02   -0.360
## as.factor(filed_county)Meeker County                   7.278e-02  3.038e-02    2.396
## as.factor(filed_county)Mille Lacs County               1.329e-01  2.366e-02    5.617
```

```
## as.factor(filed_county)Morrison County            1.639e-01  2.495e-02    6.568
## as.factor(filed_county)Mower County               -4.747e-01  2.302e-02  -20.622
## as.factor(filed_county)Murray County              -2.734e-01  4.460e-02   -6.131
## as.factor(filed_county)Nicollet County            -2.898e-01  2.446e-02  -11.849
## as.factor(filed_county)Nobles County              -1.780e-01  2.646e-02   -6.727
## as.factor(filed_county)Norman County              -4.241e-02  4.231e-02   -1.002
## as.factor(filed_county)Olmsted County             -2.602e-01  2.018e-02  -12.894
## as.factor(filed_county)Otter Tail County          -7.689e-03  2.263e-02   -0.340
## as.factor(filed_county)Pennington County          -2.675e-02  2.912e-02   -0.918
## as.factor(filed_county)Pine County                 7.321e-02  2.443e-02    2.996
## as.factor(filed_county)Pipestone County           -3.591e-01  4.003e-02   -8.969
## as.factor(filed_county)Polk County                 4.510e-01  2.354e-02   19.158
## as.factor(filed_county)Pope County                -1.183e-01  3.447e-02   -3.432
## as.factor(filed_county)Ramsey County               2.381e-02  1.927e-02    1.236
## as.factor(filed_county)Red Lake County            -3.536e-01  4.407e-02   -8.023
## as.factor(filed_county)Redwood County              1.345e-01  2.675e-02    5.028
## as.factor(filed_county)Renville County            -6.812e-02  2.766e-02   -2.463
## as.factor(filed_county)Rice County                -2.198e-01  2.225e-02   -9.880
## as.factor(filed_county)Rock County                -2.421e-01  4.305e-02   -5.623
## as.factor(filed_county)Roseau County              -3.004e-01  2.698e-02  -11.136
## as.factor(filed_county)Scott County               -3.557e-01  1.996e-02  -17.821
## as.factor(filed_county)Sherburne County            1.495e-04  2.147e-02    0.007
## as.factor(filed_county)Sibley County              -2.894e-01  3.009e-02   -9.616
## as.factor(filed_county)St. Louis County           -1.736e-01  1.972e-02   -8.805
## as.factor(filed_county)Stearns County              7.914e-02  1.990e-02    3.977
## as.factor(filed_county)Steele County              -9.579e-02  2.324e-02   -4.122
## as.factor(filed_county)Stevens County             -7.395e-03  4.065e-02   -0.182
## as.factor(filed_county)Swift County                9.968e-02  3.421e-02    2.914
## as.factor(filed_county)Todd County                -5.464e-04  2.811e-02   -0.019
## as.factor(filed_county)Traverse County             1.021e-01  5.878e-02    1.737
## as.factor(filed_county)Wabasha County             -4.108e-01  2.617e-02  -15.702
## as.factor(filed_county)Wadena County               3.457e-02  2.861e-02    1.208
## as.factor(filed_county)Waseca County               -3.532e-01  2.933e-02  -12.041
## as.factor(filed_county)Washington County           5.454e-02  1.983e-02    2.750
## as.factor(filed_county)Watonwan County            -2.476e-01  3.148e-02   -7.866
## as.factor(filed_county)Wilkin County              -7.808e-02  3.516e-02   -2.221
## as.factor(filed_county)Winona County              -3.151e-01  2.255e-02  -13.975
## as.factor(filed_county)Wright County               6.670e-02  2.100e-02    3.177
## as.factor(filed_county)Yellow Medicine County     -1.608e-02  3.178e-02   -0.506
## as.factor(sentence_year)2011                       -1.235e-02  3.742e-03   -3.302
## as.factor(sentence_year)2012                       -1.273e-02  3.704e-03   -3.438
## as.factor(sentence_year)2013                       -2.038e-02  3.948e-03   -5.162
## as.factor(sentence_year)2014                       -1.499e-02  3.790e-03   -3.956
## as.factor(sentence_year)2015                       -2.738e-02  3.866e-03   -7.083
## as.factor(sentence_year)2016                        4.753e-02  5.215e-03    9.113
## as.factor(sentence_year)2017                        3.241e-02  9.263e-03    3.499
## as.factor(sentence_year)2018                       -1.721e-01  1.438e-02  -11.967
##                                                   Pr(>|t|)
```

```
## (Intercept)                                     < 2e-16 ***
## black                                           < 2e-16 ***
## hispanic                                        < 2e-16 ***
## asian                                           0.034674 *
## nativeam                                        < 2e-16 ***
## other.race                                      2.53e-09 ***
## male                                            < 2e-16 ***
## log(age)                                        < 2e-16 ***
## priors                                          < 2e-16 ***
## perc_credit                                     < 2e-16 ***
## trial_flagTRUE                                  < 2e-16 ***
## felony                                          < 2e-16 ***
## gross.mis                                       < 2e-16 ***
## drug                                            < 2e-16 ***
## alcohol.dui                                     < 2e-16 ***
## hunt.fish                                       < 2e-16 ***
## other.offense                                   < 2e-16 ***
## as.factor(filed_county)Anoka County            6.18e-10 ***
## as.factor(filed_county)Becker County            < 2e-16 ***
## as.factor(filed_county)Beltrami County         7.34e-15 ***
## as.factor(filed_county)Benton County           3.36e-07 ***
## as.factor(filed_county)Big Stone County        0.155221
## as.factor(filed_county)Blue Earth County        < 2e-16 ***
## as.factor(filed_county)Brown County            0.000380 ***
## as.factor(filed_county)Carlton County          0.011533 *
## as.factor(filed_county)Carver County            < 2e-16 ***
## as.factor(filed_county)Cass County              < 2e-16 ***
## as.factor(filed_county)Chippewa County         0.005843 **
## as.factor(filed_county)Chisago County           < 2e-16 ***
## as.factor(filed_county)Clay County             0.816271
## as.factor(filed_county)Clearwater County       0.061616 .
## as.factor(filed_county)Cook County             7.16e-16 ***
## as.factor(filed_county)Cottonwood County       9.32e-09 ***
## as.factor(filed_county)Crow Wing County         < 2e-16 ***
## as.factor(filed_county)Dakota County            < 2e-16 ***
## as.factor(filed_county)Dodge County             < 2e-16 ***
## as.factor(filed_county)Douglas County           < 2e-16 ***
## as.factor(filed_county)Faribault County        0.001957 **
## as.factor(filed_county)Fillmore County         0.007472 **
## as.factor(filed_county)Freeborn County         7.12e-12 ***
## as.factor(filed_county)Goodhue County           < 2e-16 ***
## as.factor(filed_county)Grant County            0.013795 *
## as.factor(filed_county)Hennepin County         6.47e-08 ***
## as.factor(filed_county)Houston County          7.46e-12 ***
## as.factor(filed_county)Hubbard County          2.96e-05 ***
## as.factor(filed_county)Isanti County           0.017496 *
## as.factor(filed_county)Itasca County           6.41e-06 ***
## as.factor(filed_county)Jackson County          1.08e-10 ***
```

```
## as.factor(filed_county)Kanabec County          0.225619
## as.factor(filed_county)Kandiyohi County        5.41e-11 ***
## as.factor(filed_county)Kittson County          4.35e-07 ***
## as.factor(filed_county)Koochiching County       < 2e-16 ***
## as.factor(filed_county)Lac qui Parle County    0.129284
## as.factor(filed_county)Lake County             0.014130 *
## as.factor(filed_county)Lake of the Woods County 1.83e-10 ***
## as.factor(filed_county)LeSueur County           < 2e-16 ***
## as.factor(filed_county)Lincoln County          0.001454 **
## as.factor(filed_county)Lyon County             0.113699
## as.factor(filed_county)Mahnomen County         0.001955 **
## as.factor(filed_county)Marshall County         0.024267 *
## as.factor(filed_county)Martin County           0.069679 .
## as.factor(filed_county)McLeod County           0.718766
## as.factor(filed_county)Meeker County           0.016594 *
## as.factor(filed_county)Mille Lacs County       1.95e-08 ***
## as.factor(filed_county)Morrison County         5.10e-11 ***
## as.factor(filed_county)Mower County             < 2e-16 ***
## as.factor(filed_county)Murray County           8.76e-10 ***
## as.factor(filed_county)Nicollet County          < 2e-16 ***
## as.factor(filed_county)Nobles County           1.73e-11 ***
## as.factor(filed_county)Norman County           0.316193
## as.factor(filed_county)Olmsted County           < 2e-16 ***
## as.factor(filed_county)Otter Tail County       0.734063
## as.factor(filed_county)Pennington County       0.358374
## as.factor(filed_county)Pine County             0.002735 **
## as.factor(filed_county)Pipestone County         < 2e-16 ***
## as.factor(filed_county)Polk County              < 2e-16 ***
## as.factor(filed_county)Pope County             0.000599 ***
## as.factor(filed_county)Ramsey County           0.216597
## as.factor(filed_county)Red Lake County         1.03e-15 ***
## as.factor(filed_county)Redwood County          4.95e-07 ***
## as.factor(filed_county)Renville County         0.013794 *
## as.factor(filed_county)Rice County              < 2e-16 ***
## as.factor(filed_county)Rock County             1.88e-08 ***
## as.factor(filed_county)Roseau County            < 2e-16 ***
## as.factor(filed_county)Scott County             < 2e-16 ***
## as.factor(filed_county)Sherburne County        0.994444
## as.factor(filed_county)Sibley County            < 2e-16 ***
## as.factor(filed_county)St. Louis County         < 2e-16 ***
## as.factor(filed_county)Stearns County          6.97e-05 ***
## as.factor(filed_county)Steele County           3.75e-05 ***
## as.factor(filed_county)Stevens County          0.855628
## as.factor(filed_county)Swift County            0.003569 **
## as.factor(filed_county)Todd County             0.984495
## as.factor(filed_county)Traverse County         0.082397 .
## as.factor(filed_county)Wabasha County           < 2e-16 ***
## as.factor(filed_county)Wadena County           0.226916
```

```
## as.factor(filed_county)Waseca County             < 2e-16 ***
## as.factor(filed_county)Washington County       0.005952 **
## as.factor(filed_county)Watonwan County         3.66e-15 ***
## as.factor(filed_county)Wilkin County           0.026346 *
## as.factor(filed_county)Winona County            < 2e-16 ***
## as.factor(filed_county)Wright County           0.001488 **
## as.factor(filed_county)Yellow Medicine County  0.612868
## as.factor(sentence_year)2011                    0.000961 ***
## as.factor(sentence_year)2012                    0.000587 ***
## as.factor(sentence_year)2013                    2.45e-07 ***
## as.factor(sentence_year)2014                    7.61e-05 ***
## as.factor(sentence_year)2015                    1.41e-12 ***
## as.factor(sentence_year)2016                     < 2e-16 ***
## as.factor(sentence_year)2017                    0.000467 ***
## as.factor(sentence_year)2018                     < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.151 on 1146059 degrees of freedom
##   (447941 observations deleted due to missingness)
## Multiple R-squared:  0.5026, Adjusted R-squared:  0.5026
## F-statistic: 1.053e+04 on 110 and 1146059 DF,  p-value: < 2.2e-16
```

```r
#descriptive stats for mv.fe model
monsanc.short$miss <- seq_len(nrow(monsanc.short)) %in% na.action(mv.fe)

#descriptive statistics for variables in analysis
ds <- monsanc.short %>%
  filter(miss==FALSE) %>%
  select(total_ff, conf_minus_stayed,
         white,black,hispanic,asian,nativeam,other.race,
         male,age,priors,trial_flag,
         felony,gross.mis,mis, petty.mis,
         violent,drug,alcohol.dui,hunt.fish,other.offense,
         cap_ratio) %>%
  gather() %>%
  group_by(key) %>%
  summarize(
    mean = round(mean(value, na.rm=T),2),
    sd = round(sd(value, na.rm=T),2),
    min = min(value, na.rm=T),
    max = max(value, na.rm=T)
  )

print(ds, n = Inf)
```

```
## # A tibble: 22 x 5
##    key                 mean     sd   min     max
```

```
##    <chr>              <dbl>  <dbl> <dbl>    <dbl>
## 1 age                32.0   11.5   15      115
## 2 alcohol.dui         0.16   0.36    0        1
## 3 asian               0.03   0.18    0        1
## 4 black               0.23   0.42    0        1
## 5 cap_ratio           0.75   0.15  0.2     1.15
## 6 conf_minus_stayed  40.4   357.     0    44087
## 7 drug                0.04   0.19    0        1
## 8 felony              0.08   0.26    0        1
## 9 gross.mis           0.11   0.31    0        1
## 10 hispanic           0.08   0.28    0        1
## 11 hunt.fish          0.01   0.1     0        1
## 12 male               0.71   0.45    0        1
## 13 mis                0.82   0.39    0        1
## 14 nativeam           0.05   0.22    0        1
## 15 other.offense      0.74   0.44    0        1
## 16 other.race         0.02   0.14    0        1
## 17 petty.mis          0      0       0        0
## 18 priors             7.52   8.88    0      168
## 19 total_ff          303.   222.     0     1000
## 20 trial_flag         0      0.01    0        1
## 21 violent            0.06   0.24    0        1
## 22 white              0.580  0.49    0        1
```

```r
#FE instrumental Variables Regression
iv.fe <- ivreg(total_ff_log~conf_minus_stayed_log+
                black+hispanic+asian+nativeam+other.race+male+log(age)+
                 priors+perc_credit+trial_flag+felony+gross.mis+
                 drug+alcohol.dui+hunt.fish+other.offense+
                 as.factor(filed_county)+as.factor(sentence_year)|
                cap_ratio+black+hispanic+asian+nativeam+other.race+male+log(age)+
                 priors+perc_credit+trial_flag+felony+gross.mis+
                 drug+alcohol.dui+hunt.fish+other.offense+
                 as.factor(filed_county)+as.factor(sentence_year),
            data = monsanc.short)

summary(iv.fe, diagnostics=T)
```

```
##
## Call:
## ivreg(formula = total_ff_log ~ conf_minus_stayed_log + black +
##     hispanic + asian + nativeam + other.race + male + log(age) +
##     priors + perc_credit + trial_flag + felony + gross.mis +
##     drug + alcohol.dui + hunt.fish + other.offense + as.factor(filed_county) +
##     as.factor(sentence_year) | cap_ratio + black + hispanic +
##     asian + nativeam + other.race + male + log(age) + priors +
##     perc_credit + trial_flag + felony + gross.mis + drug + alcohol.dui +
##     hunt.fish + other.offense + as.factor(filed_county) + as.factor(sentence_year),
```

```
##       data = monsanc.short)
##
## Residuals:
##       Min       1Q   Median       3Q      Max
## -819.0702   -2.0091   -0.5717    0.8761   39.3213
##
## Coefficients:
##                                             Estimate Std. Error t value
## (Intercept)                                  8.76471    1.66906   5.251
## conf_minus_stayed_log                       -4.76022    2.45247  -1.941
## black                                        0.35737    0.30101   1.187
## hispanic                                     0.34811    0.14599   2.384
## asian                                        0.10266    0.04252   2.414
## nativeam                                     1.45437    0.91649   1.587
## other.race                                   0.15721    0.11819   1.330
## male                                         0.78209    0.38113   2.052
## log(age)                                     0.25751    0.15556   1.655
## priors                                       0.11617    0.06731   1.726
## perc_credit                                  0.02255    0.01287   1.753
## trial_flagTRUE                               7.69503    4.30580   1.787
## felony                                      14.24217    7.61087   1.871
## gross.mis                                    8.10299    4.14664   1.954
## drug                                        -4.23483    2.34873  -1.803
## alcohol.dui                                 -1.91046    1.27655  -1.497
## hunt.fish                                   -5.30396    2.70618  -1.960
## other.offense                               -3.95986    2.20843  -1.793
## as.factor(filed_county)Anoka County         -1.31587    0.30886  -4.260
## as.factor(filed_county)Becker County         1.26988    0.54473   2.331
## as.factor(filed_county)Beltrami County       0.66494    0.42013   1.583
## as.factor(filed_county)Benton County         0.32775    0.33949   0.965
## as.factor(filed_county)Big Stone County     -0.49771    0.28929  -1.720
## as.factor(filed_county)Blue Earth County    -1.72525    0.79368  -2.174
## as.factor(filed_county)Brown County         -0.55694    0.25896  -2.151
## as.factor(filed_county)Carlton County       -0.37893    0.17729  -2.137
## as.factor(filed_county)Carver County        -1.47088    0.72513  -2.028
## as.factor(filed_county)Cass County          -1.93195    0.78942  -2.447
## as.factor(filed_county)Chippewa County      -0.48206    0.25725  -1.874
## as.factor(filed_county)Chisago County       -1.62639    0.58014  -2.803
## as.factor(filed_county)Clay County          -0.07863    0.10033  -0.784
## as.factor(filed_county)Clearwater County     0.14358    0.23821   0.603
## as.factor(filed_county)Cook County          -1.65982    0.71019  -2.337
## as.factor(filed_county)Cottonwood County    -1.07568    0.49918  -2.155
## as.factor(filed_county)Crow Wing County     -1.68635    0.75713  -2.227
## as.factor(filed_county)Dakota County        -1.08883    0.45143  -2.412
## as.factor(filed_county)Dodge County         -2.71021    1.05372  -2.572
## as.factor(filed_county)Douglas County        0.99988    0.52990   1.887
## as.factor(filed_county)Faribault County     -0.48478    0.27351  -1.772
## as.factor(filed_county)Fillmore County      -0.60569    0.23751  -2.550
```

```
## as.factor(filed_county)Freeborn County          -1.15179    0.42555  -2.707
## as.factor(filed_county)Goodhue County           -1.83324    0.69393  -2.642
## as.factor(filed_county)Hennepin County          -1.33104    0.26717  -4.982
## as.factor(filed_county)Houston County           -1.38083    0.49653  -2.781
## as.factor(filed_county)Hubbard County            0.26023    0.30312   0.858
## as.factor(filed_county)Isanti County            -0.11784    0.18816  -0.626
## as.factor(filed_county)Itasca County            -0.58375    0.26580  -2.196
## as.factor(filed_county)Jackson County           -1.21557    0.58254  -2.087
## as.factor(filed_county)Kanabec County           -0.14247    0.15699  -0.908
## as.factor(filed_county)Kandiyohi County          0.52443    0.37888   1.384
## as.factor(filed_county)Kittson County           -1.56386    0.82870  -1.887
## as.factor(filed_county)Koochiching County       -2.35777    0.83765  -2.815
## as.factor(filed_county)Lac qui Parle County     -0.51601    0.27654  -1.866
## as.factor(filed_county)Lake County              -0.73489    0.26334  -2.791
## as.factor(filed_county)Lake of the Woods County -1.62512    0.65372  -2.486
## as.factor(filed_county)Lincoln County           -0.83777    0.48398  -1.731
## as.factor(filed_county)Lyon County              -0.27714    0.15130  -1.832
## as.factor(filed_county)Marshall County          -0.58552    0.28434  -2.059
## as.factor(filed_county)Martin County            -0.14966    0.17201  -0.870
## as.factor(filed_county)McLeod County            -0.52433    0.11388  -4.604
## as.factor(filed_county)Meeker County             0.32159    0.22873   1.406
## as.factor(filed_county)Mille Lacs County         0.73537    0.34435   2.136
## as.factor(filed_county)Morrison County           0.64754    0.42145   1.536
## as.factor(filed_county)Mower County             -2.52715    1.16769  -2.164
## as.factor(filed_county)Murray County            -1.28666    0.70100  -1.835
## as.factor(filed_county)Nicollet County          -1.55508    0.71868  -2.164
## as.factor(filed_county)Nobles County            -0.98175    0.45715  -2.148
## as.factor(filed_county)Norman County            -0.36884    0.22274  -1.656
## as.factor(filed_county)Olmsted County           -1.77694    0.64153  -2.770
## as.factor(filed_county)Otter Tail County         0.01790    0.10797   0.166
## as.factor(filed_county)Pennington County        -0.55756    0.15273  -3.651
## as.factor(filed_county)Pine County              -0.10612    0.21405  -0.496
## as.factor(filed_county)Pipestone County         -1.77386    0.90093  -1.969
## as.factor(filed_county)Polk County               1.99828    1.11248   1.796
## as.factor(filed_county)Pope County              -0.77721    0.33048  -2.352
## as.factor(filed_county)Ramsey County             0.12045    0.11280   1.068
## as.factor(filed_county)Red Lake County          -2.32782    0.88454  -2.632
## as.factor(filed_county)Redwood County            0.66552    0.35691   1.865
## as.factor(filed_county)Renville County          -1.10576    0.21462  -5.152
## as.factor(filed_county)Rice County              -1.06437    0.54710  -1.945
## as.factor(filed_county)Rock County              -1.24573    0.62565  -1.991
## as.factor(filed_county)Roseau County            -1.54971    0.74510  -2.080
## as.factor(filed_county)Scott County             -1.81926    0.87505  -2.079
## as.factor(filed_county)Sherburne County         -0.32752    0.10145  -3.228
## as.factor(filed_county)Sibley County            -1.90173    0.71972  -2.642
## as.factor(filed_county)St. Louis County         -1.06979    0.43438  -2.463
## as.factor(filed_county)Stearns County            0.30709    0.21756   1.412
## as.factor(filed_county)Steele County            -0.54175    0.25696  -2.108
```

```
## as.factor(filed_county)Stevens County            -0.38047    0.19215  -1.980
## as.factor(filed_county)Swift County              0.32658    0.29690   1.100
## as.factor(filed_county)Todd County               0.03363    0.13256   0.254
## as.factor(filed_county)Traverse County          -0.18569    0.36846  -0.504
## as.factor(filed_county)Wabasha County           -2.45323    1.01068  -2.427
## as.factor(filed_county)Wadena County             0.10987    0.16196   0.678
## as.factor(filed_county)Waseca County            -2.12033    0.87534  -2.422
## as.factor(filed_county)Washington County         0.01916    0.16300   0.118
## as.factor(filed_county)Watonwan County          -1.25059    0.62363  -2.005
## as.factor(filed_county)Wilkin County            -0.60605    0.25112  -2.413
## as.factor(filed_county)Winona County            -1.88495    0.78478  -2.402
## as.factor(filed_county)Wright County            -0.29848    0.19382  -1.540
## as.factor(filed_county)Yellow Medicine County   -0.09142    0.15370  -0.595
## as.factor(sentence_year)2011                     -0.02025    0.03639  -0.557
## as.factor(sentence_year)2012                     -0.04208    0.03867  -1.088
## as.factor(sentence_year)2013                     -0.01405    0.05950  -0.236
## as.factor(sentence_year)2014                      0.04104    0.04547   0.903
## as.factor(sentence_year)2015                      0.02543    0.07432   0.342
## as.factor(sentence_year)2016                      0.45397    0.11398   3.983
## as.factor(sentence_year)2017                      0.60296    0.08031   7.508
##                                                 Pr(>|t|)
## (Intercept)                                     1.51e-07 ***
## conf_minus_stayed_log                           0.052259 .
## black                                           0.235140
## hispanic                                        0.017107 *
## asian                                           0.015777 *
## nativeam                                        0.112536
## other.race                                      0.183494
## male                                            0.040165 *
## log(age)                                        0.097847 .
## priors                                          0.084343 .
## perc_credit                                     0.079665 .
## trial_flagTRUE                                  0.073917 .
## felony                                          0.061305 .
## gross.mis                                       0.050688 .
## drug                                            0.071384 .
## alcohol.dui                                     0.134503
## hunt.fish                                       0.050003 .
## other.offense                                   0.072963 .
## as.factor(filed_county)Anoka County             2.04e-05 ***
## as.factor(filed_county)Becker County            0.019742 *
## as.factor(filed_county)Beltrami County          0.113489
## as.factor(filed_county)Benton County            0.334336
## as.factor(filed_county)Big Stone County         0.085346 .
## as.factor(filed_county)Blue Earth County        0.029725 *
## as.factor(filed_county)Brown County             0.031506 *
## as.factor(filed_county)Carlton County           0.032571 *
## as.factor(filed_county)Carver County            0.042516 *
```

18

```
## as.factor(filed_county)Cass County                0.014393 *
## as.factor(filed_county)Chippewa County            0.060940 .
## as.factor(filed_county)Chisago County             0.005056 **
## as.factor(filed_county)Clay County                0.433225
## as.factor(filed_county)Clearwater County          0.546684
## as.factor(filed_county)Cook County                0.019431 *
## as.factor(filed_county)Cottonwood County          0.031171 *
## as.factor(filed_county)Crow Wing County           0.025929 *
## as.factor(filed_county)Dakota County              0.015867 *
## as.factor(filed_county)Dodge County               0.010110 *
## as.factor(filed_county)Douglas County             0.059169 .
## as.factor(filed_county)Faribault County           0.076324 .
## as.factor(filed_county)Fillmore County            0.010767 *
## as.factor(filed_county)Freeborn County            0.006798 **
## as.factor(filed_county)Goodhue County             0.008247 **
## as.factor(filed_county)Hennepin County            6.29e-07 ***
## as.factor(filed_county)Houston County             0.005420 **
## as.factor(filed_county)Hubbard County             0.390617
## as.factor(filed_county)Isanti County              0.531152
## as.factor(filed_county)Itasca County              0.028079 *
## as.factor(filed_county)Jackson County             0.036919 *
## as.factor(filed_county)Kanabec County             0.364130
## as.factor(filed_county)Kandiyohi County           0.166314
## as.factor(filed_county)Kittson County             0.059145 .
## as.factor(filed_county)Koochiching County         0.004882 **
## as.factor(filed_county)Lac qui Parle County       0.062046 .
## as.factor(filed_county)Lake County                0.005261 **
## as.factor(filed_county)Lake of the Woods County   0.012920 *
## as.factor(filed_county)Lincoln County             0.083451 .
## as.factor(filed_county)Lyon County                0.066994 .
## as.factor(filed_county)Marshall County            0.039474 *
## as.factor(filed_county)Martin County              0.384285
## as.factor(filed_county)McLeod County              4.14e-06 ***
## as.factor(filed_county)Meeker County              0.159740
## as.factor(filed_county)Mille Lacs County          0.032719 *
## as.factor(filed_county)Morrison County            0.124426
## as.factor(filed_county)Mower County               0.030446 *
## as.factor(filed_county)Murray County              0.066437 .
## as.factor(filed_county)Nicollet County            0.030480 *
## as.factor(filed_county)Nobles County              0.031749 *
## as.factor(filed_county)Norman County              0.097743 .
## as.factor(filed_county)Olmsted County             0.005609 **
## as.factor(filed_county)Otter Tail County          0.868319
## as.factor(filed_county)Pennington County          0.000262 ***
## as.factor(filed_county)Pine County                0.620051
## as.factor(filed_county)Pipestone County           0.048963 *
## as.factor(filed_county)Polk County                0.072456 .
## as.factor(filed_county)Pope County                0.018683 *
```

```
## as.factor(filed_county)Ramsey County              0.285596
## as.factor(filed_county)Red Lake County            0.008497 **
## as.factor(filed_county)Redwood County             0.062226 .
## as.factor(filed_county)Renville County            2.58e-07 ***
## as.factor(filed_county)Rice County                0.051716 .
## as.factor(filed_county)Rock County                0.046470 *
## as.factor(filed_county)Roseau County              0.037539 *
## as.factor(filed_county)Scott County               0.037616 *
## as.factor(filed_county)Sherburne County           0.001245 **
## as.factor(filed_county)Sibley County              0.008234 **
## as.factor(filed_county)St. Louis County           0.013786 *
## as.factor(filed_county)Stearns County             0.158092
## as.factor(filed_county)Steele County              0.035003 *
## as.factor(filed_county)Stevens County             0.047692 *
## as.factor(filed_county)Swift County               0.271343
## as.factor(filed_county)Todd County                0.799742
## as.factor(filed_county)Traverse County            0.614277
## as.factor(filed_county)Wabasha County             0.015211 *
## as.factor(filed_county)Wadena County              0.497543
## as.factor(filed_county)Waseca County              0.015423 *
## as.factor(filed_county)Washington County          0.906415
## as.factor(filed_county)Watonwan County            0.044925 *
## as.factor(filed_county)Wilkin County              0.015805 *
## as.factor(filed_county)Winona County              0.016311 *
## as.factor(filed_county)Wright County              0.123556
## as.factor(filed_county)Yellow Medicine County     0.552004
## as.factor(sentence_year)2011                      0.577777
## as.factor(sentence_year)2012                      0.276464
## as.factor(sentence_year)2013                      0.813315
## as.factor(sentence_year)2014                      0.366710
## as.factor(sentence_year)2015                      0.732198
## as.factor(sentence_year)2016                      6.81e-05 ***
## as.factor(sentence_year)2017                      6.01e-14 ***
##
## Diagnostic tests:
##                       df1      df2 statistic  p-value
## Weak instruments        1 1131759     3.694   0.0546 .
## Wu-Hausman              1 1131758    51.876 5.92e-13 ***
## Sargan                  0      NA        NA       NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.423 on 1131759 degrees of freedom
## Multiple R-Squared: -12.1,   Adjusted R-squared: -12.1
## Wald test: 84.01 on 107 and 1131759 DF,  p-value: < 2.2e-16
```

```r
monsanc.short$missiv <- seq_len(nrow(monsanc.short)) %in% na.action(iv.fe)
```

```r
#FE OLS
fe.ols <- lm(total_ff_log~conf_minus_stayed_log+
                black+hispanic+asian+nativeam+other.race+male+log(age)+
                priors+perc_credit+trial_flag+felony+gross.mis+
                drug+alcohol.dui+hunt.fish+other.offense+
             as.factor(filed_county)+as.factor(sentence_year),
           data = monsanc.short[monsanc.short$missiv==F,])

summary(fe.ols)
```

```
##
## Call:
## lm(formula = total_ff_log ~ conf_minus_stayed_log + black + hispanic +
##     asian + nativeam + other.race + male + log(age) + priors +
##     perc_credit + trial_flag + felony + gross.mis + drug + alcohol.dui +
##     hunt.fish + other.offense + as.factor(filed_county) + as.factor(sentence_year),
##     data = monsanc.short[monsanc.short$missiv == F, ])
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -6.516 -0.346  0.245  0.790 50.244
##
## Coefficients:
##                                          Estimate Std. Error  t value
## (Intercept)                             5.672e+00  2.781e-02  203.953
## conf_minus_stayed_log                  -2.060e-01  1.142e-03 -180.328
## black                                  -2.010e-01  3.600e-03  -55.842
## hispanic                                7.939e-02  4.987e-03   15.920
## asian                                   4.530e-02  7.536e-03    6.011
## nativeam                               -2.469e-01  6.614e-03  -37.327
## other.race                             -5.075e-02  9.749e-03   -5.205
## male                                    7.466e-02  2.961e-03   25.216
## log(age)                               -2.991e-02  4.016e-03   -7.448
## priors                                 -8.810e-03  1.604e-04  -54.932
## perc_credit                            -1.342e-03  3.173e-05  -42.281
## trial_flagTRUE                         -2.395e-01  1.373e-01   -1.745
## felony                                  1.089e-01  6.854e-03   15.885
## gross.mis                               4.028e-01  5.103e-03   78.929
## drug                                    1.263e-01  8.824e-03   14.312
## alcohol.dui                             4.596e-01  6.715e-03   68.439
## hunt.fish                              -2.797e-01  1.483e-02  -18.858
## other.offense                           1.410e-01  6.071e-03   23.218
## as.factor(filed_county)Anoka County    -7.686e-01  2.382e-02  -32.267
## as.factor(filed_county)Becker County    2.785e-01  2.790e-02    9.981
## as.factor(filed_county)Beltrami County -9.270e-02  2.585e-02   -3.586
## as.factor(filed_county)Benton County   -2.624e-01  3.078e-02   -8.526
## as.factor(filed_county)Big Stone County -1.708e-01  5.918e-02   -2.885
```

```
## as.factor(filed_county)Blue Earth County            -2.628e-01  2.543e-02  -10.335
## as.factor(filed_county)Brown County                 -1.352e-01  3.207e-02   -4.214
## as.factor(filed_county)Carlton County               -1.179e-01  2.785e-02   -4.232
## as.factor(filed_county)Carver County                -1.378e-01  2.639e-02   -5.221
## as.factor(filed_county)Cass County                  -4.811e-01  2.912e-02  -16.522
## as.factor(filed_county)Chippewa County              -9.202e-02  3.829e-02   -2.403
## as.factor(filed_county)Chisago County               -5.678e-01  2.774e-02  -20.466
## as.factor(filed_county)Clay County                  -5.966e-02  2.573e-02   -2.318
## as.factor(filed_county)Clearwater County            -1.558e-01  4.521e-02   -3.446
## as.factor(filed_county)Cook County                  -4.466e-01  7.180e-02   -6.220
## as.factor(filed_county)Cottonwood County            -1.971e-01  4.104e-02   -4.802
## as.factor(filed_county)Crow Wing County             -2.928e-01  2.588e-02  -11.311
## as.factor(filed_county)Dakota County                -2.679e-01  2.360e-02  -11.354
## as.factor(filed_county)Dodge County                 -7.710e-01  3.631e-02  -21.233
## as.factor(filed_county)Douglas County                3.902e-02  2.947e-02    1.324
## as.factor(filed_county)Faribault County             -5.509e-02  3.760e-02   -1.465
## as.factor(filed_county)Fillmore County              -2.494e-01  3.609e-02   -6.910
## as.factor(filed_county)Freeborn County              -3.906e-01  2.948e-02  -13.249
## as.factor(filed_county)Goodhue County               -5.582e-01  2.592e-02  -21.536
## as.factor(filed_county)Hennepin County              -8.641e-01  2.327e-02  -37.134
## as.factor(filed_county)Houston County               -4.923e-01  3.421e-02  -14.392
## as.factor(filed_county)Hubbard County               -2.524e-01  3.229e-02   -7.815
## as.factor(filed_county)Isanti County                -3.921e-01  3.007e-02  -13.039
## as.factor(filed_county)Itasca County                -1.301e-01  2.701e-02   -4.817
## as.factor(filed_county)Jackson County               -1.793e-01  4.313e-02   -4.158
## as.factor(filed_county)Kanabec County               -3.009e-01  3.398e-02   -8.855
## as.factor(filed_county)Kandiyohi County             -1.506e-01  2.756e-02   -5.464
## as.factor(filed_county)Kittson County               -1.266e-01  7.636e-02   -1.658
## as.factor(filed_county)Koochiching County           -8.268e-01  3.821e-02  -21.639
## as.factor(filed_county)Lac qui Parle County         -2.007e-01  5.627e-02   -3.566
## as.factor(filed_county)Lake County                  -3.523e-01  4.229e-02   -8.331
## as.factor(filed_county)Lake of the Woods County     -4.631e-01  4.876e-02   -9.497
## as.factor(filed_county)Lincoln County               -6.995e-02  6.486e-02   -1.079
## as.factor(filed_county)Lyon County                  -1.002e-01  3.030e-02   -3.306
## as.factor(filed_county)Marshall County              -1.865e-01  4.801e-02   -3.884
## as.factor(filed_county)Martin County                -3.688e-01  3.227e-02  -11.428
## as.factor(filed_county)McLeod County                -4.860e-01  2.888e-02  -16.831
## as.factor(filed_county)Meeker County                -9.317e-03  3.698e-02   -0.252
## as.factor(filed_county)Mille Lacs County             1.304e-01  2.877e-02    4.533
## as.factor(filed_county)Morrison County              -1.040e-01  3.034e-02   -3.427
## as.factor(filed_county)Mower County                 -3.682e-01  2.799e-02  -13.151
## as.factor(filed_county)Murray County                -4.505e-02  5.430e-02   -0.830
## as.factor(filed_county)Nicollet County              -2.378e-01  2.974e-02   -7.995
## as.factor(filed_county)Nobles County                -1.651e-01  3.219e-02   -5.129
## as.factor(filed_county)Norman County                -1.877e-01  5.163e-02   -3.636
## as.factor(filed_county)Olmsted County               -5.988e-01  2.455e-02  -24.395
## as.factor(filed_county)Otter Tail County             4.758e-02  2.753e-02    1.728
## as.factor(filed_county)Pennington County            -4.342e-01  3.546e-02  -12.245
```

```
## as.factor(filed_county)Pine County             -4.410e-01  2.973e-02  -14.834
## as.factor(filed_county)Pipestone County        -1.381e-01  4.877e-02   -2.832
## as.factor(filed_county)Polk County             -5.726e-02  2.865e-02   -1.998
## as.factor(filed_county)Pope County             -2.431e-01  4.197e-02   -5.793
## as.factor(filed_county)Ramsey County           -3.504e-03  2.345e-02   -0.149
## as.factor(filed_county)Red Lake County         -7.314e-01  5.371e-02  -13.618
## as.factor(filed_county)Redwood County           4.564e-02  3.257e-02    1.401
## as.factor(filed_county)Renville County         -7.895e-01  3.367e-02  -23.447
## as.factor(filed_county)Rice County             -6.730e-02  2.707e-02   -2.486
## as.factor(filed_county)Rock County             -1.470e-01  5.243e-02   -2.803
## as.factor(filed_county)Roseau County           -1.864e-01  3.281e-02   -5.680
## as.factor(filed_county)Scott County            -2.037e-01  2.428e-02   -8.390
## as.factor(filed_county)Sherburne County        -3.371e-01  2.612e-02  -12.905
## as.factor(filed_county)Sibley County           -5.914e-01  3.659e-02  -16.165
## as.factor(filed_county)St. Louis County        -2.819e-01  2.399e-02  -11.749
## as.factor(filed_county)Stearns County          -5.738e-02  2.420e-02   -2.371
## as.factor(filed_county)Steele County           -1.101e-01  2.825e-02   -3.898
## as.factor(filed_county)Stevens County          -3.544e-01  4.941e-02   -7.172
## as.factor(filed_county)Swift County            -1.361e-01  4.164e-02   -3.268
## as.factor(filed_county)Todd County              3.000e-02  3.417e-02    0.878
## as.factor(filed_county)Traverse County         -6.351e-01  7.164e-02   -8.865
## as.factor(filed_county)Wabasha County          -5.904e-01  3.181e-02  -18.560
## as.factor(filed_county)Wadena County           -5.649e-02  3.479e-02   -1.624
## as.factor(filed_county)Waseca County           -5.152e-01  3.565e-02  -14.451
## as.factor(filed_county)Washington County       -2.287e-01  2.413e-02   -9.479
## as.factor(filed_county)Watonwan County         -1.258e-01  3.827e-02   -3.287
## as.factor(filed_county)Wilkin County           -2.560e-01  4.277e-02   -5.984
## as.factor(filed_county)Winona County           -4.411e-01  2.744e-02  -16.075
## as.factor(filed_county)Wright County           -6.078e-01  2.555e-02  -23.791
## as.factor(filed_county)Yellow Medicine County  -2.969e-02  3.869e-02   -0.767
## as.factor(sentence_year)2011                     3.879e-02  4.563e-03    8.501
## as.factor(sentence_year)2012                     2.193e-02  4.516e-03    4.857
## as.factor(sentence_year)2013                     9.087e-02  4.812e-03   18.883
## as.factor(sentence_year)2014                     1.186e-01  4.620e-03   25.679
## as.factor(sentence_year)2015                     1.592e-01  4.715e-03   33.765
## as.factor(sentence_year)2016                     2.473e-01  6.358e-03   38.898
## as.factor(sentence_year)2017                     4.779e-01  1.128e-02   42.380
##                                                Pr(>|t|)
## (Intercept)                                    < 2e-16 ***
## conf_minus_stayed_log                          < 2e-16 ***
## black                                          < 2e-16 ***
## hispanic                                       < 2e-16 ***
## asian                                          1.85e-09 ***
## nativeam                                       < 2e-16 ***
## other.race                                     1.94e-07 ***
## male                                           < 2e-16 ***
## log(age)                                       9.46e-14 ***
## priors                                         < 2e-16 ***
```

```
## perc_credit                                         < 2e-16 ***
## trial_flagTRUE                                       0.081026 .
## felony                                               < 2e-16 ***
## gross.mis                                            < 2e-16 ***
## drug                                                 < 2e-16 ***
## alcohol.dui                                          < 2e-16 ***
## hunt.fish                                            < 2e-16 ***
## other.offense                                        < 2e-16 ***
## as.factor(filed_county)Anoka County                  < 2e-16 ***
## as.factor(filed_county)Becker County                 < 2e-16 ***
## as.factor(filed_county)Beltrami County               0.000336 ***
## as.factor(filed_county)Benton County                 < 2e-16 ***
## as.factor(filed_county)Big Stone County              0.003910 **
## as.factor(filed_county)Blue Earth County             < 2e-16 ***
## as.factor(filed_county)Brown County                  2.51e-05 ***
## as.factor(filed_county)Carlton County                2.32e-05 ***
## as.factor(filed_county)Carver County                 1.78e-07 ***
## as.factor(filed_county)Cass County                   < 2e-16 ***
## as.factor(filed_county)Chippewa County               0.016265 *
## as.factor(filed_county)Chisago County                < 2e-16 ***
## as.factor(filed_county)Clay County                   0.020428 *
## as.factor(filed_county)Clearwater County             0.000569 ***
## as.factor(filed_county)Cook County                   4.96e-10 ***
## as.factor(filed_county)Cottonwood County             1.57e-06 ***
## as.factor(filed_county)Crow Wing County              < 2e-16 ***
## as.factor(filed_county)Dakota County                 < 2e-16 ***
## as.factor(filed_county)Dodge County                  < 2e-16 ***
## as.factor(filed_county)Douglas County                0.185415
## as.factor(filed_county)Faribault County              0.142887
## as.factor(filed_county)Fillmore County               4.86e-12 ***
## as.factor(filed_county)Freeborn County               < 2e-16 ***
## as.factor(filed_county)Goodhue County                < 2e-16 ***
## as.factor(filed_county)Hennepin County               < 2e-16 ***
## as.factor(filed_county)Houston County                < 2e-16 ***
## as.factor(filed_county)Hubbard County                5.52e-15 ***
## as.factor(filed_county)Isanti County                 < 2e-16 ***
## as.factor(filed_county)Itasca County                 1.46e-06 ***
## as.factor(filed_county)Jackson County                3.20e-05 ***
## as.factor(filed_county)Kanabec County                < 2e-16 ***
## as.factor(filed_county)Kandiyohi County              4.64e-08 ***
## as.factor(filed_county)Kittson County                0.097383 .
## as.factor(filed_county)Koochiching County            < 2e-16 ***
## as.factor(filed_county)Lac qui Parle County          0.000363 ***
## as.factor(filed_county)Lake County                   < 2e-16 ***
## as.factor(filed_county)Lake of the Woods County      < 2e-16 ***
## as.factor(filed_county)Lincoln County                0.280773
## as.factor(filed_county)Lyon County                   0.000947 ***
## as.factor(filed_county)Marshall County               0.000103 ***
```

```
## as.factor(filed_county)Martin County            < 2e-16 ***
## as.factor(filed_county)McLeod County            < 2e-16 ***
## as.factor(filed_county)Meeker County           0.801068
## as.factor(filed_county)Mille Lacs County       5.82e-06 ***
## as.factor(filed_county)Morrison County         0.000611 ***
## as.factor(filed_county)Mower County             < 2e-16 ***
## as.factor(filed_county)Murray County           0.406787
## as.factor(filed_county)Nicollet County         1.30e-15 ***
## as.factor(filed_county)Nobles County           2.91e-07 ***
## as.factor(filed_county)Norman County           0.000277 ***
## as.factor(filed_county)Olmsted County           < 2e-16 ***
## as.factor(filed_county)Otter Tail County       0.083945 .
## as.factor(filed_county)Pennington County        < 2e-16 ***
## as.factor(filed_county)Pine County              < 2e-16 ***
## as.factor(filed_county)Pipestone County        0.004625 **
## as.factor(filed_county)Polk County             0.045668 *
## as.factor(filed_county)Pope County             6.92e-09 ***
## as.factor(filed_county)Ramsey County           0.881206
## as.factor(filed_county)Red Lake County          < 2e-16 ***
## as.factor(filed_county)Redwood County          0.161116
## as.factor(filed_county)Renville County          < 2e-16 ***
## as.factor(filed_county)Rice County             0.012911 *
## as.factor(filed_county)Rock County             0.005058 **
## as.factor(filed_county)Roseau County           1.34e-08 ***
## as.factor(filed_county)Scott County             < 2e-16 ***
## as.factor(filed_county)Sherburne County         < 2e-16 ***
## as.factor(filed_county)Sibley County            < 2e-16 ***
## as.factor(filed_county)St. Louis County         < 2e-16 ***
## as.factor(filed_county)Stearns County          0.017756 *
## as.factor(filed_county)Steele County           9.68e-05 ***
## as.factor(filed_county)Stevens County          7.40e-13 ***
## as.factor(filed_county)Swift County            0.001082 **
## as.factor(filed_county)Todd County             0.379999
## as.factor(filed_county)Traverse County          < 2e-16 ***
## as.factor(filed_county)Wabasha County           < 2e-16 ***
## as.factor(filed_county)Wadena County           0.104424
## as.factor(filed_county)Waseca County            < 2e-16 ***
## as.factor(filed_county)Washington County        < 2e-16 ***
## as.factor(filed_county)Watonwan County         0.001012 **
## as.factor(filed_county)Wilkin County           2.17e-09 ***
## as.factor(filed_county)Winona County            < 2e-16 ***
## as.factor(filed_county)Wright County            < 2e-16 ***
## as.factor(filed_county)Yellow Medicine County  0.442828
## as.factor(sentence_year)2011                     < 2e-16 ***
## as.factor(sentence_year)2012                    1.19e-06 ***
## as.factor(sentence_year)2013                     < 2e-16 ***
## as.factor(sentence_year)2014                     < 2e-16 ***
## as.factor(sentence_year)2015                     < 2e-16 ***
```

```
## as.factor(sentence_year)2016                          < 2e-16 ***
## as.factor(sentence_year)2017                          < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.398 on 1131759 degrees of freedom
## Multiple R-squared:  0.129,  Adjusted R-squared:  0.129
## F-statistic:  1567 on 107 and 1131759 DF,  p-value: < 2.2e-16
```

```r
#IV F test
# First Stage
first_stage <- lm(conf_minus_stayed_log~cap_ratio+
                  black+hispanic+asian+nativeam+other.race+male+log(age)+
                  priors+perc_credit+trial_flag+felony+gross.mis+
                  drug+alcohol.dui+hunt.fish+other.offense+
                  as.factor(filed_county)+as.factor(sentence_year),
                  data=monsanc.short[monsanc.short$missiv==F,])

waldtest(first_stage, .~.-cap_ratio)
```

```
## Wald test
##
## Model 1: conf_minus_stayed_log ~ cap_ratio + black + hispanic + asian +
##     nativeam + other.race + male + log(age) + priors + perc_credit +
##     trial_flag + felony + gross.mis + drug + alcohol.dui + hunt.fish +
##     other.offense + as.factor(filed_county) + as.factor(sentence_year)
## Model 2: conf_minus_stayed_log ~ black + hispanic + asian + nativeam +
##     other.race + male + log(age) + priors + perc_credit + trial_flag +
##     felony + gross.mis + drug + alcohol.dui + hunt.fish + other.offense +
##     as.factor(filed_county) + as.factor(sentence_year)
##   Res.Df Df     F  Pr(>F)
## 1 1131759
## 2 1131760 -1 3.694 0.05461 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Felony Level Analysis

```r
mv.fe.f <- lm(cbind(total_ff_log, conf_minus_stayed_log)~black+hispanic+asian+nativeam+other.ra
          male+log(age)+priors+perc_credit+trial_flag+severity_conv+chpoints_final+
             drug+alcohol.dui+hunt.fish+other.offense+
          as.factor(filed_county)+as.factor(sentence_year), data = monsanc.felony)
summary(mv.fe.f)
```

```
## Response total_ff_log :
##
## Call:
## lm(formula = total_ff_log ~ black + hispanic + asian + nativeam +
```

```
##       other.race + male + log(age) + priors + perc_credit + trial_flag +
##       severity_conv + chpoints_final + drug + alcohol.dui + hunt.fish +
##       other.offense + as.factor(filed_county) + as.factor(sentence_year),
##       data = monsanc.felony)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.5985 -0.5622  0.1766  0.9121  5.7164
##
## Coefficients:
##                                           Estimate Std. Error t value
## (Intercept)                              5.6759902  0.1308839  43.367
## black                                   -0.1034531  0.0188762  -5.481
## hispanic                                -0.1210839  0.0307982  -3.932
## asian                                   -0.0177567  0.0439597  -0.404
## nativeam                                -0.1265752  0.0296341  -4.271
## other.race                              -0.0259004  0.0571327  -0.453
## male                                     0.1370712  0.0186555   7.347
## log(age)                                 0.0290565  0.0231199   1.257
## priors                                  -0.0019984  0.0007939  -2.517
## perc_credit                             -0.0005667  0.0001128  -5.022
## trial_flagTRUE                           0.9802490  0.2194699   4.466
## severity_conv                           -0.0321796  0.0036637  -8.783
## chpoints_final                          -0.1395941  0.0037990 -36.745
## drug                                    -0.0444559  0.0188071  -2.364
## alcohol.dui                              0.2749015  0.0335370   8.197
## hunt.fish                                0.1089879  0.8240325   0.132
## other.offense                           -0.1588271  0.0188511  -8.425
## as.factor(filed_county)Anoka County     -2.6300151  0.1063127 -24.738
## as.factor(filed_county)Becker County     0.3053772  0.1289597   2.368
## as.factor(filed_county)Beltrami County   0.0312395  0.1195391   0.261
## as.factor(filed_county)Benton County    -1.4250414  0.1262963 -11.283
## as.factor(filed_county)Big Stone County -0.1736623  0.2848850  -0.610
## as.factor(filed_county)Blue Earth County -0.2587191 0.1154751  -2.240
## as.factor(filed_county)Brown County      0.3042403  0.1568595   1.940
## as.factor(filed_county)Carlton County   -0.0239920  0.1267661  -0.189
## as.factor(filed_county)Carver County     0.2158949  0.1231843   1.753
## as.factor(filed_county)Cass County      -1.2011003  0.1281288  -9.374
## as.factor(filed_county)Chippewa County   0.1734260  0.1705674   1.017
## as.factor(filed_county)Chisago County   -0.4491103  0.1270042  -3.536
## as.factor(filed_county)Clay County       0.0192322  0.1199611   0.160
## as.factor(filed_county)Clearwater County -0.4004298 0.1850887  -2.163
## as.factor(filed_county)Cook County      -0.8654280  0.2849462  -3.037
## as.factor(filed_county)Cottonwood County -0.5820343 0.1775860  -3.277
## as.factor(filed_county)Crow Wing County  0.1024628  0.1177715   0.870
## as.factor(filed_county)Dakota County     0.3815904  0.1033849   3.691
## as.factor(filed_county)Dodge County     -2.1234474  0.1672161 -12.699
## as.factor(filed_county)Douglas County   -0.1864459  0.1324969  -1.407
```

```
## as.factor(filed_county)Faribault County              0.0759781  0.1568846    0.484
## as.factor(filed_county)Fillmore County              -0.2318476  0.1843309   -1.258
## as.factor(filed_county)Freeborn County              -0.4230284  0.1313549   -3.220
## as.factor(filed_county)Goodhue County               -0.2022280  0.1204902   -1.678
## as.factor(filed_county)Grant County                 -0.3368770  0.3119801   -1.080
## as.factor(filed_county)Hennepin County              -3.1487971  0.1020943  -30.842
## as.factor(filed_county)Houston County               -0.8657200  0.1602720   -5.402
## as.factor(filed_county)Hubbard County               -0.3380366  0.1455359   -2.323
## as.factor(filed_county)Isanti County                -0.9387173  0.1341933   -6.995
## as.factor(filed_county)Itasca County                 0.0424018  0.1153310    0.368
## as.factor(filed_county)Jackson County                0.3404052  0.2065036    1.648
## as.factor(filed_county)Kanabec County               -0.3145615  0.1405131   -2.239
## as.factor(filed_county)Kandiyohi County              0.3589474  0.1240809    2.893
## as.factor(filed_county)Kittson County               -0.0293786  0.3724996   -0.079
## as.factor(filed_county)Koochiching County           -0.7627073  0.1837503   -4.151
## as.factor(filed_county)Lac qui Parle County         -0.1820051  0.2623122   -0.694
## as.factor(filed_county)Lake County                  -0.6790849  0.2276036   -2.984
## as.factor(filed_county)Lake of the Woods County -0.9725744  0.3264293   -2.979
## as.factor(filed_county)LeSueur County               -0.1943704  0.1533943   -1.267
## as.factor(filed_county)Lincoln County                0.4417385  0.3502103    1.261
## as.factor(filed_county)Lyon County                   0.5828916  0.1398898    4.167
## as.factor(filed_county)Mahnomen County              -0.0116729  0.1547229   -0.075
## as.factor(filed_county)Marshall County               0.1735872  0.2135696    0.813
## as.factor(filed_county)Martin County                -0.6182453  0.1481254   -4.174
## as.factor(filed_county)McLeod County                -1.4507356  0.1286013  -11.281
## as.factor(filed_county)Meeker County                 0.2118715  0.1529212    1.385
## as.factor(filed_county)Mille Lacs County             0.1233017  0.1221295    1.010
## as.factor(filed_county)Morrison County              -0.3141697  0.1298105   -2.420
## as.factor(filed_county)Mower County                 -1.6736065  0.1269909  -13.179
## as.factor(filed_county)Murray County                 0.2314827  0.2231873    1.037
## as.factor(filed_county)Nicollet County               0.2408311  0.1576355    1.528
## as.factor(filed_county)Nobles County                -0.1456706  0.1508714   -0.966
## as.factor(filed_county)Norman County                 0.0838180  0.2622848    0.320
## as.factor(filed_county)Olmsted County               -1.6854972  0.1072990  -15.708
## as.factor(filed_county)Otter Tail County             0.4086301  0.1252484    3.263
## as.factor(filed_county)Pennington County            -0.2716761  0.1548685   -1.754
## as.factor(filed_county)Pine County                  -0.6711382  0.1242335   -5.402
## as.factor(filed_county)Pipestone County             -0.0642842  0.2272311   -0.283
## as.factor(filed_county)Polk County                   0.0581704  0.1167477    0.498
## as.factor(filed_county)Pope County                  -0.3791874  0.2258612   -1.679
## as.factor(filed_county)Ramsey County                -0.3873420  0.1028467   -3.766
## as.factor(filed_county)Red Lake County              -0.0756565  0.2992206   -0.253
## as.factor(filed_county)Redwood County               -0.0357625  0.1428184   -0.250
## as.factor(filed_county)Renville County              -1.5417665  0.1642923   -9.384
## as.factor(filed_county)Rice County                   0.4806895  0.1205454    3.988
## as.factor(filed_county)Rock County                   0.4730932  0.3164395    1.495
## as.factor(filed_county)Roseau County                 0.1594920  0.1594755    1.000
## as.factor(filed_county)Scott County                 -0.2783523  0.1087612   -2.559
```

```
## as.factor(filed_county)Sherburne County           -0.5775376  0.1143453  -5.051
## as.factor(filed_county)Sibley County              -0.8709549  0.1748087  -4.982
## as.factor(filed_county)St. Louis County           -0.2167507  0.1053694  -2.057
## as.factor(filed_county)Stearns County             -0.1718272  0.1062711  -1.617
## as.factor(filed_county)Steele County               0.1769550  0.1276742   1.386
## as.factor(filed_county)Stevens County             -0.1471111  0.2451055  -0.600
## as.factor(filed_county)Swift County                0.0299646  0.2027990   0.148
## as.factor(filed_county)Todd County                 0.1751154  0.1626056   1.077
## as.factor(filed_county)Traverse County            -1.0378429  0.2576726  -4.028
## as.factor(filed_county)Wabasha County             -1.5407422  0.1578555  -9.760
## as.factor(filed_county)Wadena County               0.2265615  0.1599783   1.416
## as.factor(filed_county)Waseca County              -1.2179716  0.1565994  -7.778
## as.factor(filed_county)Washington County          -0.6816135  0.1079059  -6.317
## as.factor(filed_county)Watonwan County            -0.1694929  0.1756078  -0.965
## as.factor(filed_county)Wilkin County              -0.7603370  0.2673465  -2.844
## as.factor(filed_county)Winona County              -0.5554708  0.1207266  -4.601
## as.factor(filed_county)Wright County              -1.2562993  0.1125976 -11.157
## as.factor(filed_county)Yellow Medicine County      0.3408632  0.1770494   1.925
## as.factor(sentence_year)2011                       0.0072080  0.0261606   0.276
## as.factor(sentence_year)2012                       0.0043800  0.0256686   0.171
## as.factor(sentence_year)2013                       0.1142584  0.0267141   4.277
## as.factor(sentence_year)2014                       0.2800633  0.0259664  10.786
## as.factor(sentence_year)2015                       0.3975541  0.0251598  15.801
## as.factor(sentence_year)2016                       0.4428272  0.0297895  14.865
## as.factor(sentence_year)2017                       0.2947073  0.0608282   4.845
## as.factor(sentence_year)2018                       0.2767339  0.1420036   1.949
##                                                    Pr(>|t|)
## (Intercept)                                        < 2e-16 ***
## black                                              4.26e-08 ***
## hispanic                                           8.45e-05 ***
## asian                                              0.686264
## nativeam                                           1.95e-05 ***
## other.race                                         0.650307
## male                                               2.05e-13 ***
## log(age)                                           0.208841
## priors                                             0.011830 *
## perc_credit                                        5.12e-07 ***
## trial_flagTRUE                                     7.97e-06 ***
## severity_conv                                      < 2e-16 ***
## chpoints_final                                     < 2e-16 ***
## drug                                               0.018093 *
## alcohol.dui                                        2.52e-16 ***
## hunt.fish                                          0.894778
## other.offense                                      < 2e-16 ***
## as.factor(filed_county)Anoka County                < 2e-16 ***
## as.factor(filed_county)Becker County               0.017888 *
## as.factor(filed_county)Beltrami County             0.793837
## as.factor(filed_county)Benton County               < 2e-16 ***
```

```
## as.factor(filed_county)Big Stone County          0.542138
## as.factor(filed_county)Blue Earth County         0.025064 *
## as.factor(filed_county)Brown County              0.052437 .
## as.factor(filed_county)Carlton County            0.849888
## as.factor(filed_county)Carver County             0.079673 .
## as.factor(filed_county)Cass County                < 2e-16 ***
## as.factor(filed_county)Chippewa County           0.309272
## as.factor(filed_county)Chisago County            0.000406 ***
## as.factor(filed_county)Clay County               0.872630
## as.factor(filed_county)Clearwater County         0.030511 *
## as.factor(filed_county)Cook County               0.002389 **
## as.factor(filed_county)Cottonwood County         0.001048 **
## as.factor(filed_county)Crow Wing County          0.384297
## as.factor(filed_county)Dakota County             0.000224 ***
## as.factor(filed_county)Dodge County               < 2e-16 ***
## as.factor(filed_county)Douglas County            0.159382
## as.factor(filed_county)Faribault County          0.628180
## as.factor(filed_county)Fillmore County           0.208477
## as.factor(filed_county)Freeborn County           0.001280 **
## as.factor(filed_county)Goodhue County            0.093279 .
## as.factor(filed_county)Grant County              0.280235
## as.factor(filed_county)Hennepin County            < 2e-16 ***
## as.factor(filed_county)Houston County            6.63e-08 ***
## as.factor(filed_county)Hubbard County            0.020199 *
## as.factor(filed_county)Isanti County             2.68e-12 ***
## as.factor(filed_county)Itasca County             0.713133
## as.factor(filed_county)Jackson County            0.099271 .
## as.factor(filed_county)Kanabec County            0.025182 *
## as.factor(filed_county)Kandiyohi County          0.003819 **
## as.factor(filed_county)Kittson County            0.937137
## as.factor(filed_county)Koochiching County        3.32e-05 ***
## as.factor(filed_county)Lac qui Parle County      0.487780
## as.factor(filed_county)Lake County               0.002850 **
## as.factor(filed_county)Lake of the Woods County 0.002889 **
## as.factor(filed_county)LeSueur County            0.205114
## as.factor(filed_county)Lincoln County            0.207187
## as.factor(filed_county)Lyon County               3.09e-05 ***
## as.factor(filed_county)Mahnomen County           0.939862
## as.factor(filed_county)Marshall County           0.416342
## as.factor(filed_county)Martin County             3.00e-05 ***
## as.factor(filed_county)McLeod County              < 2e-16 ***
## as.factor(filed_county)Meeker County             0.165907
## as.factor(filed_county)Mille Lacs County         0.312692
## as.factor(filed_county)Morrison County           0.015514 *
## as.factor(filed_county)Mower County               < 2e-16 ***
## as.factor(filed_county)Murray County             0.299662
## as.factor(filed_county)Nicollet County           0.126575
## as.factor(filed_county)Nobles County             0.334285
```

```
## as.factor(filed_county)Norman County            0.749296
## as.factor(filed_county)Olmsted County           < 2e-16 ***
## as.factor(filed_county)Otter Tail County        0.001105 **
## as.factor(filed_county)Pennington County        0.079395 .
## as.factor(filed_county)Pine County              6.61e-08 ***
## as.factor(filed_county)Pipestone County         0.777253
## as.factor(filed_county)Polk County              0.618305
## as.factor(filed_county)Pope County              0.093187 .
## as.factor(filed_county)Ramsey County            0.000166 ***
## as.factor(filed_county)Red Lake County          0.800389
## as.factor(filed_county)Redwood County           0.802275
## as.factor(filed_county)Renville County          < 2e-16 ***
## as.factor(filed_county)Rice County              6.68e-05 ***
## as.factor(filed_county)Rock County              0.134907
## as.factor(filed_county)Roseau County            0.317265
## as.factor(filed_county)Scott County             0.010491 *
## as.factor(filed_county)Sherburne County         4.41e-07 ***
## as.factor(filed_county)Sibley County            6.30e-07 ***
## as.factor(filed_county)St. Louis County         0.039686 *
## as.factor(filed_county)Stearns County           0.105911
## as.factor(filed_county)Steele County            0.165756
## as.factor(filed_county)Stevens County           0.548379
## as.factor(filed_county)Swift County             0.882536
## as.factor(filed_county)Todd County              0.281515
## as.factor(filed_county)Traverse County          5.64e-05 ***
## as.factor(filed_county)Wabasha County           < 2e-16 ***
## as.factor(filed_county)Wadena County            0.156722
## as.factor(filed_county)Waseca County            7.52e-15 ***
## as.factor(filed_county)Washington County        2.69e-10 ***
## as.factor(filed_county)Watonwan County          0.334460
## as.factor(filed_county)Wilkin County            0.004457 **
## as.factor(filed_county)Winona County            4.21e-06 ***
## as.factor(filed_county)Wright County            < 2e-16 ***
## as.factor(filed_county)Yellow Medicine County   0.054204 .
## as.factor(sentence_year)2011                     0.782912
## as.factor(sentence_year)2012                     0.864509
## as.factor(sentence_year)2013                     1.90e-05 ***
## as.factor(sentence_year)2014                     < 2e-16 ***
## as.factor(sentence_year)2015                     < 2e-16 ***
## as.factor(sentence_year)2016                     < 2e-16 ***
## as.factor(sentence_year)2017                     1.27e-06 ***
## as.factor(sentence_year)2018                     0.051327 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.643 on 56108 degrees of freedom
##   (70308 observations deleted due to missingness)
## Multiple R-squared:  0.3969, Adjusted R-squared:  0.3957
```

```
## F-statistic: 335.7 on 110 and 56108 DF,  p-value: < 2.2e-16
##
##
## Response conf_minus_stayed_log :
##
## Call:
## lm(formula = conf_minus_stayed_log ~ black + hispanic + asian +
##     nativeam + other.race + male + log(age) + priors + perc_credit +
##     trial_flag + severity_conv + chpoints_final + drug + alcohol.dui +
##     hunt.fish + other.offense + as.factor(filed_county) + as.factor(sentence_year),
##     data = monsanc.felony)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -11.0092  -0.6959   0.2089   0.9837   6.9090
##
## Coefficients:
##                                           Estimate Std. Error t value
## (Intercept)                              2.5660190  0.1223286  20.976
## black                                    0.0865694  0.0176423   4.907
## hispanic                                 0.2380675  0.0287851   8.271
## asian                                    0.0699617  0.0410863   1.703
## nativeam                                 0.1903733  0.0276971   6.873
## other.race                              -0.0210292  0.0533982  -0.394
## male                                     0.3833002  0.0174361  21.983
## log(age)                                -0.2091880  0.0216087  -9.681
## priors                                   0.0069580  0.0007420   9.378
## perc_credit                              0.0006274  0.0001055   5.949
## trial_flagTRUE                          -0.1235217  0.2051242  -0.602
## severity_conv                            0.4742958  0.0034242 138.512
## chpoints_final                           0.5472364  0.0035507 154.121
## drug                                     0.0971438  0.0175777   5.527
## alcohol.dui                              0.5838067  0.0313448  18.625
## hunt.fish                                1.2359432  0.7701694   1.605
## other.offense                           -0.0045389  0.0176188  -0.258
## as.factor(filed_county)Anoka County     -0.7301348  0.0993635  -7.348
## as.factor(filed_county)Becker County     0.0254449  0.1205302   0.211
## as.factor(filed_county)Beltrami County  -0.1718205  0.1117254  -1.538
## as.factor(filed_county)Benton County    -0.3004590  0.1180409  -2.545
## as.factor(filed_county)Big Stone County  0.1149648  0.2662635   0.432
## as.factor(filed_county)Blue Earth County -1.1536729  0.1079271 -10.689
## as.factor(filed_county)Brown County     -0.8505807  0.1466063  -5.802
## as.factor(filed_county)Carlton County   -0.4722001  0.1184800  -3.985
## as.factor(filed_county)Carver County    -0.8906659  0.1151323  -7.736
## as.factor(filed_county)Cass County      -0.9623932  0.1197536  -8.036
## as.factor(filed_county)Chippewa County  -0.1141637  0.1594183  -0.716
## as.factor(filed_county)Chisago County   -0.6564963  0.1187026  -5.531
## as.factor(filed_county)Clay County      -0.0898664  0.1121198  -0.802
```

```
## as.factor(filed_county)Clearwater County          -0.5124164  0.1729903  -2.962
## as.factor(filed_county)Cook County                -0.9319058  0.2663206  -3.499
## as.factor(filed_county)Cottonwood County          -0.6315793  0.1659780  -3.805
## as.factor(filed_county)Crow Wing County           -1.1186416  0.1100734 -10.163
## as.factor(filed_county)Dakota County              -0.8766581  0.0966271  -9.073
## as.factor(filed_county)Dodge County               -1.2419218  0.1562860  -7.946
## as.factor(filed_county)Douglas County              0.1285216  0.1238362   1.038
## as.factor(filed_county)Faribault County           -0.3905489  0.1466298  -2.664
## as.factor(filed_county)Fillmore County            -0.1170541  0.1722821  -0.679
## as.factor(filed_county)Freeborn County            -0.6109907  0.1227689  -4.977
## as.factor(filed_county)Goodhue County             -0.5468094  0.1126143  -4.856
## as.factor(filed_county)Grant County                0.2762646  0.2915875   0.947
## as.factor(filed_county)Hennepin County            -0.7142770  0.0954209  -7.486
## as.factor(filed_county)Houston County             -1.0455765  0.1497958  -6.980
## as.factor(filed_county)Hubbard County             -0.1617181  0.1360230  -1.189
## as.factor(filed_county)Isanti County               0.0013405  0.1254217   0.011
## as.factor(filed_county)Itasca County              -0.5922040  0.1077923  -5.494
## as.factor(filed_county)Jackson County             -1.0569439  0.1930054  -5.476
## as.factor(filed_county)Kanabec County              0.0647797  0.1313284   0.493
## as.factor(filed_county)Kandiyohi County            0.0806601  0.1159704   0.696
## as.factor(filed_county)Kittson County             -0.1011321  0.3481511  -0.290
## as.factor(filed_county)Koochiching County         -1.8645823  0.1717394 -10.857
## as.factor(filed_county)Lac qui Parle County       -0.7978966  0.2451661  -3.255
## as.factor(filed_county)Lake County                -0.7042435  0.2127263  -3.311
## as.factor(filed_county)Lake of the Woods County   -1.1994651  0.3050922  -3.931
## as.factor(filed_county)LeSueur County             -1.0990892  0.1433676  -7.666
## as.factor(filed_county)Lincoln County              0.3081312  0.3273187   0.941
## as.factor(filed_county)Lyon County                 0.0643715  0.1307458   0.492
## as.factor(filed_county)Mahnomen County            -0.2932274  0.1446094  -2.028
## as.factor(filed_county)Marshall County            -0.4169885  0.1996096  -2.089
## as.factor(filed_county)Martin County              -0.2644551  0.1384432  -1.910
## as.factor(filed_county)McLeod County              -0.4004413  0.1201952  -3.332
## as.factor(filed_county)Meeker County              -0.0748848  0.1429255  -0.524
## as.factor(filed_county)Mille Lacs County          -0.2254105  0.1141464  -1.975
## as.factor(filed_county)Morrison County            -0.1655464  0.1213254  -1.364
## as.factor(filed_county)Mower County               -1.9956313  0.1186901 -16.814
## as.factor(filed_county)Murray County              -0.1565185  0.2085986  -0.750
## as.factor(filed_county)Nicollet County            -0.7575453  0.1473316  -5.142
## as.factor(filed_county)Nobles County              -0.3823387  0.1410097  -2.711
## as.factor(filed_county)Norman County              -0.0745815  0.2451405  -0.304
## as.factor(filed_county)Olmsted County             -0.8078500  0.1002853  -8.056
## as.factor(filed_county)Otter Tail County          -0.2943988  0.1170615  -2.515
## as.factor(filed_county)Pennington County          -0.5398179  0.1447455  -3.729
## as.factor(filed_county)Pine County                -0.0232109  0.1161129  -0.200
## as.factor(filed_county)Pipestone County           -0.8676261  0.2123781  -4.085
## as.factor(filed_county)Polk County                 0.2164211  0.1091164   1.983
## as.factor(filed_county)Pope County                -0.0158777  0.2110977  -0.075
## as.factor(filed_county)Ramsey County              -0.5928632  0.0961241  -6.168
```

```
## as.factor(filed_county)Red Lake County           -0.1541997  0.2796620  -0.551
## as.factor(filed_county)Redwood County            -0.1738893  0.1334830  -1.303
## as.factor(filed_county)Renville County           -1.2427700  0.1535533  -8.093
## as.factor(filed_county)Rice County               -0.4751991  0.1126659  -4.218
## as.factor(filed_county)Rock County               -1.1839924  0.2957554  -4.003
## as.factor(filed_county)Roseau County             -0.5646677  0.1490514  -3.788
## as.factor(filed_county)Scott County              -1.1855477  0.1016520 -11.663
## as.factor(filed_county)Sherburne County          -0.2091078  0.1068711  -1.957
## as.factor(filed_county)Sibley County             -0.7675727  0.1633822  -4.698
## as.factor(filed_county)St. Louis County          -1.1156524  0.0984819 -11.328
## as.factor(filed_county)Stearns County            -0.5498480  0.0993247  -5.536
## as.factor(filed_county)Steele County             -0.4996635  0.1193287  -4.187
## as.factor(filed_county)Stevens County             0.1716721  0.2290841   0.749
## as.factor(filed_county)Swift County              -0.0311026  0.1895430  -0.164
## as.factor(filed_county)Todd County               -0.0595600  0.1519769  -0.392
## as.factor(filed_county)Traverse County           -0.1908202  0.2408298  -0.792
## as.factor(filed_county)Wabasha County            -0.8625415  0.1475372  -5.846
## as.factor(filed_county)Wadena County             -0.2292073  0.1495213  -1.533
## as.factor(filed_county)Waseca County             -1.5823334  0.1463632 -10.811
## as.factor(filed_county)Washington County         -0.3757484  0.1008526  -3.726
## as.factor(filed_county)Watonwan County           -0.5771104  0.1641291  -3.516
## as.factor(filed_county)Wilkin County             -0.2700245  0.2498714  -1.081
## as.factor(filed_county)Winona County             -1.2612928  0.1128352 -11.178
## as.factor(filed_county)Wright County             -0.4462196  0.1052377  -4.240
## as.factor(filed_county)Yellow Medicine County    -0.6440281  0.1654765  -3.892
## as.factor(sentence_year)2011                      -0.0669256  0.0244506  -2.737
## as.factor(sentence_year)2012                      -0.0235133  0.0239908  -0.980
## as.factor(sentence_year)2013                       0.0345416  0.0249680   1.383
## as.factor(sentence_year)2014                      -0.0125962  0.0242691  -0.519
## as.factor(sentence_year)2015                       0.1375147  0.0235152   5.848
## as.factor(sentence_year)2016                       0.0322009  0.0278423   1.157
## as.factor(sentence_year)2017                       0.1374646  0.0568521   2.418
## as.factor(sentence_year)2018                       0.4396723  0.1327215   3.313
##                                                   Pr(>|t|)
## (Intercept)                                        < 2e-16 ***
## black                                             9.28e-07 ***
## hispanic                                           < 2e-16 ***
## asian                                             0.088611 .
## nativeam                                          6.33e-12 ***
## other.race                                        0.693716
## male                                               < 2e-16 ***
## log(age)                                           < 2e-16 ***
## priors                                             < 2e-16 ***
## perc_credit                                       2.71e-09 ***
## trial_flagTRUE                                    0.547057
## severity_conv                                      < 2e-16 ***
## chpoints_final                                     < 2e-16 ***
## drug                                              3.28e-08 ***
```

```
## alcohol.dui                                        < 2e-16 ***
## hunt.fish                                          0.108551
## other.offense                                      0.796702
## as.factor(filed_county)Anoka County                2.04e-13 ***
## as.factor(filed_county)Becker County               0.832804
## as.factor(filed_county)Beltrami County             0.124083
## as.factor(filed_county)Benton County               0.010919 *
## as.factor(filed_county)Big Stone County            0.665910
## as.factor(filed_county)Blue Earth County            < 2e-16 ***
## as.factor(filed_county)Brown County                6.60e-09 ***
## as.factor(filed_county)Carlton County              6.74e-05 ***
## as.factor(filed_county)Carver County               1.04e-14 ***
## as.factor(filed_county)Cass County                 9.43e-16 ***
## as.factor(filed_county)Chippewa County             0.473916
## as.factor(filed_county)Chisago County              3.21e-08 ***
## as.factor(filed_county)Clay County                 0.422833
## as.factor(filed_county)Clearwater County           0.003057 **
## as.factor(filed_county)Cook County                 0.000467 ***
## as.factor(filed_county)Cottonwood County           0.000142 ***
## as.factor(filed_county)Crow Wing County             < 2e-16 ***
## as.factor(filed_county)Dakota County                < 2e-16 ***
## as.factor(filed_county)Dodge County                1.95e-15 ***
## as.factor(filed_county)Douglas County              0.299351
## as.factor(filed_county)Faribault County            0.007735 **
## as.factor(filed_county)Fillmore County             0.496866
## as.factor(filed_county)Freeborn County             6.48e-07 ***
## as.factor(filed_county)Goodhue County              1.20e-06 ***
## as.factor(filed_county)Grant County                0.343414
## as.factor(filed_county)Hennepin County             7.23e-14 ***
## as.factor(filed_county)Houston County              2.98e-12 ***
## as.factor(filed_county)Hubbard County              0.234483
## as.factor(filed_county)Isanti County               0.991472
## as.factor(filed_county)Itasca County               3.95e-08 ***
## as.factor(filed_county)Jackson County              4.36e-08 ***
## as.factor(filed_county)Kanabec County              0.621827
## as.factor(filed_county)Kandiyohi County            0.486730
## as.factor(filed_county)Kittson County              0.771447
## as.factor(filed_county)Koochiching County           < 2e-16 ***
## as.factor(filed_county)Lac qui Parle County        0.001137 **
## as.factor(filed_county)Lake County                 0.000932 ***
## as.factor(filed_county)Lake of the Woods County 8.45e-05 ***
## as.factor(filed_county)LeSueur County              1.80e-14 ***
## as.factor(filed_county)Lincoln County              0.346514
## as.factor(filed_county)Lyon County                 0.622480
## as.factor(filed_county)Mahnomen County             0.042594 *
## as.factor(filed_county)Marshall County             0.036710 *
## as.factor(filed_county)Martin County               0.056112 .
## as.factor(filed_county)McLeod County               0.000864 ***
```

```
## as.factor(filed_county)Meeker County            0.600320
## as.factor(filed_county)Mille Lacs County        0.048302 *
## as.factor(filed_county)Morrison County          0.172421
## as.factor(filed_county)Mower County              < 2e-16 ***
## as.factor(filed_county)Murray County            0.453057
## as.factor(filed_county)Nicollet County          2.73e-07 ***
## as.factor(filed_county)Nobles County            0.006701 **
## as.factor(filed_county)Norman County            0.760946
## as.factor(filed_county)Olmsted County           8.07e-16 ***
## as.factor(filed_county)Otter Tail County        0.011909 *
## as.factor(filed_county)Pennington County        0.000192 ***
## as.factor(filed_county)Pine County              0.841560
## as.factor(filed_county)Pipestone County         4.41e-05 ***
## as.factor(filed_county)Polk County              0.047328 *
## as.factor(filed_county)Pope County              0.940044
## as.factor(filed_county)Ramsey County            6.98e-10 ***
## as.factor(filed_county)Red Lake County          0.581376
## as.factor(filed_county)Redwood County           0.192680
## as.factor(filed_county)Renville County          5.92e-16 ***
## as.factor(filed_county)Rice County              2.47e-05 ***
## as.factor(filed_county)Rock County              6.25e-05 ***
## as.factor(filed_county)Roseau County            0.000152 ***
## as.factor(filed_county)Scott County             < 2e-16 ***
## as.factor(filed_county)Sherburne County         0.050395 .
## as.factor(filed_county)Sibley County            2.63e-06 ***
## as.factor(filed_county)St. Louis County         < 2e-16 ***
## as.factor(filed_county)Stearns County           3.11e-08 ***
## as.factor(filed_county)Steele County            2.83e-05 ***
## as.factor(filed_county)Stevens County           0.453628
## as.factor(filed_county)Swift County             0.869659
## as.factor(filed_county)Todd County              0.695132
## as.factor(filed_county)Traverse County          0.428163
## as.factor(filed_county)Wabasha County           5.06e-09 ***
## as.factor(filed_county)Wadena County            0.125296
## as.factor(filed_county)Waseca County            < 2e-16 ***
## as.factor(filed_county)Washington County        0.000195 ***
## as.factor(filed_county)Watonwan County          0.000438 ***
## as.factor(filed_county)Wilkin County            0.279856
## as.factor(filed_county)Winona County            < 2e-16 ***
## as.factor(filed_county)Wright County            2.24e-05 ***
## as.factor(filed_county)Yellow Medicine County   9.96e-05 ***
## as.factor(sentence_year)2011                     0.006199 **
## as.factor(sentence_year)2012                     0.327043
## as.factor(sentence_year)2013                     0.166536
## as.factor(sentence_year)2014                     0.603747
## as.factor(sentence_year)2015                     5.01e-09 ***
## as.factor(sentence_year)2016                     0.247464
## as.factor(sentence_year)2017                     0.015612 *
```

```
## as.factor(sentence_year)2018                    0.000924 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.536 on 56108 degrees of freedom
##   (70308 observations deleted due to missingness)
## Multiple R-squared:  0.5707, Adjusted R-squared:  0.5698
## F-statistic: 677.9 on 110 and 56108 DF,  p-value: < 2.2e-16
```

```
#FE instrumental Variables Regression
iv.fe.f <- ivreg(total_ff_log~conf_minus_stayed_log+
                black+hispanic+asian+nativeam+other.race+male+log(age)+
                 priors+perc_credit+trial_flag+severity_conv+chpoints_final+
                 drug+alcohol.dui+hunt.fish+other.offense+
                 as.factor(filed_county)+as.factor(sentence_year)|
                cap_ratio+black+hispanic+asian+nativeam+other.race+male+log(age)+
                 priors+perc_credit+trial_flag+severity_conv+chpoints_final+
                 drug+alcohol.dui+hunt.fish+other.offense+
                 as.factor(filed_county)+as.factor(sentence_year),
          data = monsanc.felony)

summary(iv.fe.f, diagnostics=T)
```

```
##
## Call:
## ivreg(formula = total_ff_log ~ conf_minus_stayed_log + black +
##     hispanic + asian + nativeam + other.race + male + log(age) +
##     priors + perc_credit + trial_flag + severity_conv + chpoints_final +
##     drug + alcohol.dui + hunt.fish + other.offense + as.factor(filed_county) +
##     as.factor(sentence_year) | cap_ratio + black + hispanic +
##     asian + nativeam + other.race + male + log(age) + priors +
##     perc_credit + trial_flag + severity_conv + chpoints_final +
##     drug + alcohol.dui + hunt.fish + other.offense + as.factor(filed_county) +
##     as.factor(sentence_year), data = monsanc.felony)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -21.0847  -1.6326   0.3544   1.9721  10.8879
##
## Coefficients:
##                                    Estimate Std. Error t value
## (Intercept)                        9.9472052  1.9174761   5.188
## conf_minus_stayed_log             -1.6601103  0.7405126  -2.242
## black                              0.0379561  0.0720608   0.527
## hispanic                           0.2600517  0.1783396   1.458
## asian                              0.0943677  0.0936393   1.008
## nativeam                           0.1885324  0.1526150   1.235
## other.race                        -0.0705342  0.1048643  -0.673
```

```
## male                                                0.7725749  0.2856380   2.705
## log(age)                                           -0.3230147  0.1614881  -2.000
## priors                                              0.0095334  0.0053272   1.790
## perc_credit                                         0.0004337  0.0004910   0.883
## trial_flagTRUE                                      0.7107262  0.4156146   1.710
## severity_conv                                       0.7561343  0.3517904   2.149
## chpoints_final                                      0.7695515  0.4054324   1.898
## drug                                                0.1181419  0.0794034   1.488
## alcohol.dui                                         1.2537274  0.4419675   2.837
## hunt.fish                                           2.1657767  1.7451204   1.241
## other.offense                                      -0.1645735  0.0342178  -4.810
## as.factor(filed_county)Anoka County                -3.8362467  0.5734826  -6.689
## as.factor(filed_county)Becker County                0.3474866  0.2329830   1.491
## as.factor(filed_county)Beltrami County             -0.2533783  0.2503820  -1.012
## as.factor(filed_county)Benton County               -1.9299659  0.3194714  -6.041
## as.factor(filed_county)Big Stone County             0.0173160  0.5201034   0.033
## as.factor(filed_county)Blue Earth County           -2.1719261  0.8768179  -2.477
## as.factor(filed_county)Brown County                -1.1060787  0.6893140  -1.605
## as.factor(filed_county)Carlton County              -0.8059320  0.4171612  -1.932
## as.factor(filed_county)Carver County               -1.2589344  0.6939637  -1.814
## as.factor(filed_county)Cass County                 -2.7978723  0.7495572  -3.733
## as.factor(filed_county)Chippewa County             -0.0392786  0.3214827  -0.122
## as.factor(filed_county)Chisago County              -1.5380901  0.5366400  -2.866
## as.factor(filed_county)Clay County                 -0.1288370  0.2259622  -0.570
## as.factor(filed_county)Clearwater County           -1.2518525  0.5058101  -2.475
## as.factor(filed_county)Cook County                 -1.4721385  0.7478009  -1.969
## as.factor(filed_county)Cottonwood County           -1.6290855  0.5657051  -2.880
## as.factor(filed_county)Crow Wing County            -1.7564745  0.8559605  -2.052
## as.factor(filed_county)Dakota County               -1.0640156  0.6719798  -1.583
## as.factor(filed_county)Dodge County                -4.1469820  0.9426285  -4.399
## as.factor(filed_county)Douglas County               0.0271400  0.2570265   0.106
## as.factor(filed_county)Faribault County            -0.5689290  0.4029881  -1.412
## as.factor(filed_county)Fillmore County             -0.4269412  0.3431010  -1.244
## as.factor(filed_county)Freeborn County             -1.4290867  0.5068847  -2.819
## as.factor(filed_county)Goodhue County              -1.1078008  0.4581085  -2.418
## as.factor(filed_county)Hennepin County             -4.3343561  0.5590310  -7.753
## as.factor(filed_county)Houston County              -2.6062699  0.8298321  -3.141
## as.factor(filed_county)Hubbard County              -0.6068455  0.2883568  -2.104
## as.factor(filed_county)Isanti County               -0.9361341  0.2417109  -3.873
## as.factor(filed_county)Itasca County               -0.9411194  0.4854980  -1.938
## as.factor(filed_county)Jackson County              -1.4128877  0.8659240  -1.632
## as.factor(filed_county)Kanabec County              -0.2059602  0.2576452  -0.799
## as.factor(filed_county)Kandiyohi County             0.4979888  0.2320426   2.146
## as.factor(filed_county)Kittson County              -0.1952456  0.6749715  -0.289
## as.factor(filed_county)Koochiching County          -3.8582402  1.4197646  -2.718
## as.factor(filed_county)Lac qui Parle County        -1.5063495  0.7567162  -1.991
## as.factor(filed_county)Lake County                 -1.8475665  0.6629421  -2.787
## as.factor(filed_county)Lake of the Woods County -2.9647937  1.0654945  -2.783
```

```
## as.factor(filed_county)Lincoln County            0.9526473   0.6707283    1.420
## as.factor(filed_county)Lyon County               0.6811880   0.2558896    2.662
## as.factor(filed_county)Marshall County          -0.5184165   0.4933593   -1.051
## as.factor(filed_county)Martin County            -1.0565964   0.3306140   -3.196
## as.factor(filed_county)McLeod County            -2.1137723   0.3755655   -5.628
## as.factor(filed_county)Meeker County             0.1035684   0.2796089    0.370
## as.factor(filed_county)Mille Lacs County        -0.2246675   0.2700461   -0.832
## as.factor(filed_county)Morrison County          -0.5883017   0.2637869   -2.230
## as.factor(filed_county)Mower County             -5.0012824   1.4987972   -3.337
## as.factor(filed_county)Murray County            -0.0275928   0.4182480   -0.066
## as.factor(filed_county)Nicollet County          -1.0142731   0.6273722   -1.617
## as.factor(filed_county)Nobles County            -0.7792882   0.3908978   -1.994
## as.factor(filed_county)Norman County            -0.0389600   0.4755631   -0.082
## as.factor(filed_county)Olmsted County           -3.0228593   0.6275320   -4.817
## as.factor(filed_county)Otter Tail County        -0.0799347   0.3140962   -0.254
## as.factor(filed_county)Pennington County        -1.1685025   0.4873779   -2.398
## as.factor(filed_county)Pine County              -0.7155192   0.2246762   -3.185
## as.factor(filed_county)Pipestone County         -1.5024600   0.7607618   -1.975
## as.factor(filed_county)Polk County               0.4175546   0.2644806    1.579
## as.factor(filed_county)Pope County              -0.4138054   0.4094046   -1.011
## as.factor(filed_county)Ramsey County            -1.3694873   0.4759515   -2.877
## as.factor(filed_county)Red Lake County          -0.3336247   0.5511521   -0.605
## as.factor(filed_county)Redwood County           -0.3238662   0.2877018   -1.126
## as.factor(filed_county)Renville County          -3.6027883   0.9654191   -3.732
## as.factor(filed_county)Rice County              -0.3067749   0.4128014   -0.743
## as.factor(filed_county)Rock County              -1.4913443   1.0457910   -1.426
## as.factor(filed_county)Roseau County            -0.7768781   0.5066919   -1.533
## as.factor(filed_county)Scott County             -2.2528030   0.9018454   -2.498
## as.factor(filed_county)Sherburne County         -0.9240518   0.2574039   -3.590
## as.factor(filed_county)Sibley County            -2.1393533   0.6462033   -3.311
## as.factor(filed_county)St. Louis County         -2.0715363   0.8491985   -2.439
## as.factor(filed_county)Stearns County           -1.0818751   0.4486658   -2.411
## as.factor(filed_county)Steele County            -0.6493878   0.4340252   -1.496
## as.factor(filed_county)Stevens County            0.1367299   0.4592875    0.298
## as.factor(filed_county)Swift County             -0.0204212   0.3659528   -0.056
## as.factor(filed_county)Todd County               0.0768303   0.2961185    0.259
## as.factor(filed_county)Traverse County          -1.3122677   0.4968100   -2.641
## as.factor(filed_county)Wabasha County           -2.9715364   0.6981853   -4.256
## as.factor(filed_county)Wadena County            -0.1530341   0.3340933   -0.458
## as.factor(filed_county)Waseca County            -3.8437475   1.2044676   -3.191
## as.factor(filed_county)Washington County        -1.3056037   0.3385408   -3.857
## as.factor(filed_county)Watonwan County          -1.1383275   0.5324079   -2.138
## as.factor(filed_county)Wilkin County            -1.2057174   0.5210129   -2.314
## as.factor(filed_county)Winona County            -2.6481980   0.9579809   -2.764
## as.factor(filed_county)Wright County            -1.9975725   0.3882775   -5.145
## as.factor(filed_county)Yellow Medicine County   -0.7280141   0.5734867   -1.269
## as.factor(sentence_year)2011                     -0.1027621   0.0686821   -1.496
## as.factor(sentence_year)2012                     -0.0324746   0.0495995   -0.655
```

```
## as.factor(sentence_year)2013                      0.1657558  0.0532312   3.114
## as.factor(sentence_year)2014                      0.2608182  0.0480237   5.431
## as.factor(sentence_year)2015                      0.6324375  0.1107493   5.711
## as.factor(sentence_year)2016                      0.4991043  0.0582508   8.568
## as.factor(sentence_year)2017                      0.4988955  0.1424954   3.501
##                                                   Pr(>|t|)
## (Intercept)                                       2.14e-07 ***
## conf_minus_stayed_log                             0.024976 *
## black                                             0.598388
## hispanic                                          0.144796
## asian                                             0.313565
## nativeam                                          0.216707
## other.race                                        0.501190
## male                                              0.006838 **
## log(age)                                          0.045479 *
## priors                                            0.073528 .
## perc_credit                                       0.377124
## trial_flagTRUE                                    0.087260 .
## severity_conv                                     0.031608 *
## chpoints_final                                    0.057688 .
## drug                                              0.136791
## alcohol.dui                                       0.004560 **
## hunt.fish                                         0.214594
## other.offense                                     1.52e-06 ***
## as.factor(filed_county)Anoka County               2.26e-11 ***
## as.factor(filed_county)Becker County              0.135844
## as.factor(filed_county)Beltrami County            0.311558
## as.factor(filed_county)Benton County              1.54e-09 ***
## as.factor(filed_county)Big Stone County           0.973441
## as.factor(filed_county)Blue Earth County          0.013250 *
## as.factor(filed_county)Brown County               0.108586
## as.factor(filed_county)Carlton County             0.053372 .
## as.factor(filed_county)Carver County              0.069664 .
## as.factor(filed_county)Cass County                0.000190 ***
## as.factor(filed_county)Chippewa County            0.902757
## as.factor(filed_county)Chisago County             0.004157 **
## as.factor(filed_county)Clay County                0.568564
## as.factor(filed_county)Clearwater County          0.013329 *
## as.factor(filed_county)Cook County                0.049001 *
## as.factor(filed_county)Cottonwood County          0.003982 **
## as.factor(filed_county)Crow Wing County           0.040169 *
## as.factor(filed_county)Dakota County              0.113335
## as.factor(filed_county)Dodge County               1.09e-05 ***
## as.factor(filed_county)Douglas County             0.915906
## as.factor(filed_county)Faribault County           0.158022
## as.factor(filed_county)Fillmore County            0.213372
## as.factor(filed_county)Freeborn County            0.004814 **
## as.factor(filed_county)Goodhue County             0.015600 *
```

```
## as.factor(filed_county)Hennepin County          9.10e-15 ***
## as.factor(filed_county)Houston County           0.001686 **
## as.factor(filed_county)Hubbard County           0.035340 *
## as.factor(filed_county)Isanti County            0.000108 ***
## as.factor(filed_county)Itasca County            0.052572 .
## as.factor(filed_county)Jackson County           0.102758
## as.factor(filed_county)Kanabec County           0.424065
## as.factor(filed_county)Kandiyohi County         0.031869 *
## as.factor(filed_county)Kittson County           0.772380
## as.factor(filed_county)Koochiching County       0.006579 **
## as.factor(filed_county)Lac qui Parle County     0.046525 *
## as.factor(filed_county)Lake County              0.005323 **
## as.factor(filed_county)Lake of the Woods County 0.005395 **
## as.factor(filed_county)Lincoln County           0.155521
## as.factor(filed_county)Lyon County              0.007769 **
## as.factor(filed_county)Marshall County          0.293360
## as.factor(filed_county)Martin County            0.001395 **
## as.factor(filed_county)McLeod County            1.83e-08 ***
## as.factor(filed_county)Meeker County            0.711083
## as.factor(filed_county)Mille Lacs County        0.405435
## as.factor(filed_county)Morrison County          0.025737 *
## as.factor(filed_county)Mower County             0.000848 ***
## as.factor(filed_county)Murray County            0.947400
## as.factor(filed_county)Nicollet County          0.105949
## as.factor(filed_county)Nobles County            0.046202 *
## as.factor(filed_county)Norman County            0.934708
## as.factor(filed_county)Olmsted County           1.46e-06 ***
## as.factor(filed_county)Otter Tail County        0.799117
## as.factor(filed_county)Pennington County        0.016509 *
## as.factor(filed_county)Pine County              0.001450 **
## as.factor(filed_county)Pipestone County         0.048280 *
## as.factor(filed_county)Polk County              0.114394
## as.factor(filed_county)Pope County              0.312141
## as.factor(filed_county)Ramsey County            0.004012 **
## as.factor(filed_county)Red Lake County          0.544967
## as.factor(filed_county)Redwood County           0.260297
## as.factor(filed_county)Renville County          0.000190 ***
## as.factor(filed_county)Rice County              0.457392
## as.factor(filed_county)Rock County              0.153861
## as.factor(filed_county)Roseau County            0.125223
## as.factor(filed_county)Scott County             0.012493 *
## as.factor(filed_county)Sherburne County         0.000331 ***
## as.factor(filed_county)Sibley County            0.000931 ***
## as.factor(filed_county)St. Louis County         0.014715 *
## as.factor(filed_county)Stearns County           0.015898 *
## as.factor(filed_county)Steele County            0.134608
## as.factor(filed_county)Stevens County           0.765933
## as.factor(filed_county)Swift County             0.955499
```

```
## as.factor(filed_county)Todd County                0.795283
## as.factor(filed_county)Traverse County            0.008259 **
## as.factor(filed_county)Wabasha County             2.08e-05 ***
## as.factor(filed_county)Wadena County              0.646913
## as.factor(filed_county)Waseca County              0.001417 **
## as.factor(filed_county)Washington County          0.000115 ***
## as.factor(filed_county)Watonwan County            0.032515 *
## as.factor(filed_county)Wilkin County              0.020662 *
## as.factor(filed_county)Winona County              0.005705 **
## as.factor(filed_county)Wright County              2.69e-07 ***
## as.factor(filed_county)Yellow Medicine County     0.204285
## as.factor(sentence_year)2011                      0.134607
## as.factor(sentence_year)2012                      0.512640
## as.factor(sentence_year)2013                      0.001847 **
## as.factor(sentence_year)2014                      5.63e-08 ***
## as.factor(sentence_year)2015                      1.13e-08 ***
## as.factor(sentence_year)2016                       < 2e-16 ***
## as.factor(sentence_year)2017                      0.000464 ***
##
## Diagnostic tests:
##                    df1   df2 statistic  p-value
## Weak instruments     1 55533     6.792  0.00916 **
## Wu-Hausman           1 55532    15.220 9.58e-05 ***
## Sargan               0    NA        NA       NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.96 on 55533 degrees of freedom
## Multiple R-Squared: -0.9476, Adjusted R-squared: -0.9513
## Wald test: 105.9 on 107 and 55533 DF,  p-value: < 2.2e-16
```

```r
monsanc.felony$missiv <- seq_len(nrow(monsanc.felony)) %in% na.action(iv.fe.f)

#FE OLS
fe.ols.f <- lm(total_ff_log~conf_minus_stayed_log+
                black+hispanic+asian+nativeam+other.race+male+log(age)+
                priors+perc_credit+trial_flag+severity_conv+chpoints_final+
                drug+alcohol.dui+hunt.fish+other.offense+
             as.factor(filed_county)+as.factor(sentence_year),
          data = monsanc.felony[monsanc.felony$missiv==F,])

summary(fe.ols.f)
```

```
##
## Call:
## lm(formula = total_ff_log ~ conf_minus_stayed_log + black + hispanic +
##     asian + nativeam + other.race + male + log(age) + priors +
##     perc_credit + trial_flag + severity_conv + chpoints_final +
```

```
##       drug + alcohol.dui + hunt.fish + other.offense + as.factor(filed_county) +
##       as.factor(sentence_year), data = monsanc.felony[monsanc.felony$missiv ==
##       F, ])
##
## Residuals:
##     Min      1Q   Median      3Q      Max
## -6.5948 -0.5649   0.1787   0.9127   5.5634
##
## Coefficients:
##                                                Estimate Std. Error t value
## (Intercept)                                   5.8239835  0.1317363  44.209
## conf_minus_stayed_log                        -0.0555372  0.0045491 -12.208
## black                                        -0.0996181  0.0189382  -5.260
## hispanic                                     -0.1070241  0.0309807  -3.455
## asian                                        -0.0135695  0.0440487  -0.308
## nativeam                                     -0.1209853  0.0298631  -4.051
## other.race                                   -0.0282347  0.0572364  -0.493
## male                                          0.1579880  0.0188503   8.381
## log(age)                                      0.0149534  0.0232650   0.643
## priors                                       -0.0015826  0.0007982  -1.983
## perc_credit                                  -0.0005345  0.0001131  -4.725
## trial_flagTRUE                                0.9363195  0.2235233   4.189
## severity_conv                                -0.0060038  0.0042742  -1.405
## chpoints_final                               -0.1088296  0.0045603 -23.864
## drug                                         -0.0373059  0.0189123  -1.973
## alcohol.dui                                   0.3051445  0.0338558   9.013
## hunt.fish                                     0.1767874  0.8245307   0.214
## other.offense                                -0.1588314  0.0189517  -8.381
## as.factor(filed_county)Anoka County          -2.6649420  0.1064440 -25.036
## as.factor(filed_county)Becker County          0.3083968  0.1290391   2.390
## as.factor(filed_county)Beltrami County        0.0235078  0.1196177   0.197
## as.factor(filed_county)Benton County         -1.4441217  0.1264284 -11.422
## as.factor(filed_county)Big Stone County      -0.1667435  0.2850508  -0.585
## as.factor(filed_county)Blue Earth County     -0.3262761  0.1157124  -2.820
## as.factor(filed_county)Brown County           0.2563307  0.1569990   1.633
## as.factor(filed_county)Carlton County        -0.0494273  0.1268591  -0.390
## as.factor(filed_county)Carver County          0.1657461  0.1233999   1.343
## as.factor(filed_county)Cass County           -1.2526077  0.1282853  -9.764
## as.factor(filed_county)Chippewa County        0.1608799  0.1710610   0.940
## as.factor(filed_county)Chisago County        -0.4863119  0.1271665  -3.824
## as.factor(filed_county)Clay County            0.0144511  0.1200325   0.120
## as.factor(filed_county)Clearwater County     -0.4275887  0.1852139  -2.309
## as.factor(filed_county)Cook County           -0.8293382  0.3813394  -2.175
## as.factor(filed_county)Cottonwood County     -0.6180477  0.1777135  -3.478
## as.factor(filed_county)Crow Wing County       0.0403763  0.1179735   0.342
## as.factor(filed_county)Dakota County          0.3350219  0.1035334   3.236
## as.factor(filed_county)Dodge County          -2.2119876  0.1677577 -13.186
## as.factor(filed_county)Douglas County        -0.1796734  0.1325760  -1.355
```

```
## as.factor(filed_county)Faribault County          0.0536420  0.1569866    0.342
## as.factor(filed_county)Fillmore County          -0.2394262  0.1844392   -1.298
## as.factor(filed_county)Freeborn County          -0.4578867  0.1315364   -3.481
## as.factor(filed_county)Goodhue County           -0.2336089  0.1205869   -1.937
## as.factor(filed_county)Hennepin County          -3.1904421  0.1022111  -31.214
## as.factor(filed_county)Houston County           -0.9208718  0.1607199   -5.730
## as.factor(filed_county)Hubbard County           -0.3464988  0.1456228   -2.379
## as.factor(filed_county)Isanti County            -0.9398848  0.1342727   -7.000
## as.factor(filed_county)Itasca County             0.0097193  0.1154297    0.084
## as.factor(filed_county)Jackson County            0.2815232  0.2066799    1.362
## as.factor(filed_county)Kanabec County           -0.3105263  0.1405953   -2.209
## as.factor(filed_county)Kandiyohi County          0.3628095  0.1241596    2.922
## as.factor(filed_county)Kittson County           -0.0353694  0.3727160   -0.095
## as.factor(filed_county)Koochiching County       -0.8665899  0.1840527   -4.708
## as.factor(filed_county)Lac qui Parle County     -0.2255326  0.2624898   -0.859
## as.factor(filed_county)Lake County              -0.7186558  0.2277586   -3.155
## as.factor(filed_county)Lake of the Woods County -1.0393544  0.3266641   -3.182
## as.factor(filed_county)Lincoln County            0.4585681  0.3504164    1.309
## as.factor(filed_county)Lyon County               0.5870563  0.1400895    4.191
## as.factor(filed_county)Marshall County           0.1509648  0.2137022    0.706
## as.factor(filed_county)Martin County            -0.6335116  0.1482177   -4.274
## as.factor(filed_county)McLeod County            -1.4731929  0.1286899  -11.448
## as.factor(filed_county)Meeker County             0.2029657  0.1532251    1.325
## as.factor(filed_county)Mille Lacs County         0.1139676  0.1223468    0.932
## as.factor(filed_county)Morrison County          -0.3236549  0.1298886   -2.492
## as.factor(filed_county)Mower County             -1.7917324  0.1274970  -14.053
## as.factor(filed_county)Murray County             0.2225993  0.2233185    0.997
## as.factor(filed_county)Nicollet County           0.1979609  0.1577654    1.255
## as.factor(filed_county)Nobles County            -0.1718915  0.1513581   -1.136
## as.factor(filed_county)Norman County             0.0794409  0.2624371    0.303
## as.factor(filed_county)Olmsted County           -1.7291933  0.1074287  -16.096
## as.factor(filed_county)Otter Tail County         0.3932590  0.1254213    3.136
## as.factor(filed_county)Pennington County        -0.3025006  0.1549780   -1.952
## as.factor(filed_county)Pine County              -0.6776109  0.1244341   -5.446
## as.factor(filed_county)Pipestone County         -0.1128899  0.2273973   -0.496
## as.factor(filed_county)Polk County               0.0699710  0.1168208    0.599
## as.factor(filed_county)Pope County              -0.3936324  0.2273752   -1.731
## as.factor(filed_county)Ramsey County            -0.4195058  0.1029492   -4.075
## as.factor(filed_county)Red Lake County          -0.0836231  0.2993952   -0.279
## as.factor(filed_county)Redwood County           -0.0446866  0.1429048   -0.313
## as.factor(filed_county)Renville County          -1.6115722  0.1644861   -9.798
## as.factor(filed_county)Rice County               0.4539769  0.1206360    3.763
## as.factor(filed_county)Rock County               0.4086071  0.3166690    1.290
## as.factor(filed_county)Roseau County             0.1275795  0.1595894    0.799
## as.factor(filed_county)Scott County             -0.3453198  0.1089752   -3.169
## as.factor(filed_county)Sherburne County         -0.5894898  0.1144164   -5.152
## as.factor(filed_county)Sibley County            -0.9175496  0.1753864   -5.232
## as.factor(filed_county)St. Louis County         -0.2780142  0.1055692   -2.633
```

```
## as.factor(filed_county)Stearns County         -0.2026103  0.1063683  -1.905
## as.factor(filed_county)Steele County           0.1482173  0.1277704   1.160
## as.factor(filed_county)Stevens County         -0.1377744  0.2452485  -0.562
## as.factor(filed_county)Swift County            0.0279368  0.2029172   0.138
## as.factor(filed_county)Todd County             0.1715040  0.1627006   1.054
## as.factor(filed_county)Traverse County        -0.9524233  0.2601161  -3.662
## as.factor(filed_county)Wabasha County         -1.5898061  0.1579964 -10.062
## as.factor(filed_county)Wadena County           0.2133528  0.1600748   1.333
## as.factor(filed_county)Waseca County          -1.3064291  0.1568563  -8.329
## as.factor(filed_county)Washington County      -0.7050578  0.1080143  -6.527
## as.factor(filed_county)Watonwan County        -0.2116143  0.1761728  -1.201
## as.factor(filed_county)Wilkin County          -0.7746159  0.2675045  -2.896
## as.factor(filed_county)Winona County          -0.6265884  0.1209341  -5.181
## as.factor(filed_county)Wright County          -1.2802051  0.1127153 -11.358
## as.factor(filed_county)Yellow Medicine County  0.3048087  0.1771768   1.720
## as.factor(sentence_year)2011                   0.0051624  0.0262732   0.196
## as.factor(sentence_year)2012                   0.0055167  0.0257750   0.214
## as.factor(sentence_year)2013                   0.1171967  0.0268233   4.369
## as.factor(sentence_year)2014                   0.2827966  0.0260765  10.845
## as.factor(sentence_year)2015                   0.4136612  0.0252907  16.356
## as.factor(sentence_year)2016                   0.4509461  0.0299121  15.076
## as.factor(sentence_year)2017                   0.3032672  0.0612462   4.952
##                                                Pr(>|t|)
## (Intercept)                                    < 2e-16 ***
## conf_minus_stayed_log                          < 2e-16 ***
## black                                          1.44e-07 ***
## hispanic                                       0.000552 ***
## asian                                          0.758040
## nativeam                                       5.10e-05 ***
## other.race                                     0.621804
## male                                           < 2e-16 ***
## log(age)                                       0.520392
## priors                                         0.047412 *
## perc_credit                                    2.30e-06 ***
## trial_flagTRUE                                 2.81e-05 ***
## severity_conv                                  0.160124
## chpoints_final                                 < 2e-16 ***
## drug                                           0.048549 *
## alcohol.dui                                    < 2e-16 ***
## hunt.fish                                      0.830228
## other.offense                                  < 2e-16 ***
## as.factor(filed_county)Anoka County            < 2e-16 ***
## as.factor(filed_county)Becker County           0.016854 *
## as.factor(filed_county)Beltrami County         0.844200
## as.factor(filed_county)Benton County           < 2e-16 ***
## as.factor(filed_county)Big Stone County        0.558577
## as.factor(filed_county)Blue Earth County       0.004808 **
## as.factor(filed_county)Brown County            0.102540
```

```
## as.factor(filed_county)Carlton County            0.696816
## as.factor(filed_county)Carver County             0.179225
## as.factor(filed_county)Cass County                < 2e-16 ***
## as.factor(filed_county)Chippewa County           0.346974
## as.factor(filed_county)Chisago County            0.000131 ***
## as.factor(filed_county)Clay County               0.904172
## as.factor(filed_county)Clearwater County         0.020968 *
## as.factor(filed_county)Cook County               0.029649 *
## as.factor(filed_county)Cottonwood County         0.000506 ***
## as.factor(filed_county)Crow Wing County          0.732165
## as.factor(filed_county)Dakota County             0.001213 **
## as.factor(filed_county)Dodge County               < 2e-16 ***
## as.factor(filed_county)Douglas County            0.175344
## as.factor(filed_county)Faribault County          0.732580
## as.factor(filed_county)Fillmore County           0.194248
## as.factor(filed_county)Freeborn County           0.000500 ***
## as.factor(filed_county)Goodhue County            0.052718 .
## as.factor(filed_county)Hennepin County            < 2e-16 ***
## as.factor(filed_county)Houston County            1.01e-08 ***
## as.factor(filed_county)Hubbard County            0.017343 *
## as.factor(filed_county)Isanti County             2.59e-12 ***
## as.factor(filed_county)Itasca County             0.932897
## as.factor(filed_county)Jackson County            0.173165
## as.factor(filed_county)Kanabec County            0.027203 *
## as.factor(filed_county)Kandiyohi County          0.003478 **
## as.factor(filed_county)Kittson County            0.924397
## as.factor(filed_county)Koochiching County        2.50e-06 ***
## as.factor(filed_county)Lac qui Parle County      0.390231
## as.factor(filed_county)Lake County               0.001604 **
## as.factor(filed_county)Lake of the Woods County 0.001465 **
## as.factor(filed_county)Lincoln County            0.190663
## as.factor(filed_county)Lyon County               2.79e-05 ***
## as.factor(filed_county)Marshall County           0.479926
## as.factor(filed_county)Martin County             1.92e-05 ***
## as.factor(filed_county)McLeod County              < 2e-16 ***
## as.factor(filed_county)Meeker County             0.185301
## as.factor(filed_county)Mille Lacs County         0.351592
## as.factor(filed_county)Morrison County           0.012713 *
## as.factor(filed_county)Mower County               < 2e-16 ***
## as.factor(filed_county)Murray County             0.318876
## as.factor(filed_county)Nicollet County           0.209564
## as.factor(filed_county)Nobles County             0.256103
## as.factor(filed_county)Norman County             0.762116
## as.factor(filed_county)Olmsted County             < 2e-16 ***
## as.factor(filed_county)Otter Tail County         0.001716 **
## as.factor(filed_county)Pennington County         0.050956 .
## as.factor(filed_county)Pine County               5.19e-08 ***
## as.factor(filed_county)Pipestone County          0.619583
```

```
## as.factor(filed_county)Polk County           0.549202
## as.factor(filed_county)Pope County           0.083421 .
## as.factor(filed_county)Ramsey County         4.61e-05 ***
## as.factor(filed_county)Red Lake County       0.780010
## as.factor(filed_county)Redwood County        0.754509
## as.factor(filed_county)Renville County        < 2e-16 ***
## as.factor(filed_county)Rice County           0.000168 ***
## as.factor(filed_county)Rock County           0.196942
## as.factor(filed_county)Roseau County         0.424048
## as.factor(filed_county)Scott County          0.001532 **
## as.factor(filed_county)Sherburne County      2.58e-07 ***
## as.factor(filed_county)Sibley County         1.69e-07 ***
## as.factor(filed_county)St. Louis County      0.008454 **
## as.factor(filed_county)Stearns County        0.056811 .
## as.factor(filed_county)Steele County         0.246042
## as.factor(filed_county)Stevens County        0.574272
## as.factor(filed_county)Swift County          0.890497
## as.factor(filed_county)Todd County           0.291838
## as.factor(filed_county)Traverse County       0.000251 ***
## as.factor(filed_county)Wabasha County         < 2e-16 ***
## as.factor(filed_county)Wadena County         0.182592
## as.factor(filed_county)Waseca County          < 2e-16 ***
## as.factor(filed_county)Washington County     6.75e-11 ***
## as.factor(filed_county)Watonwan County       0.229689
## as.factor(filed_county)Wilkin County         0.003784 **
## as.factor(filed_county)Winona County         2.21e-07 ***
## as.factor(filed_county)Wright County          < 2e-16 ***
## as.factor(filed_county)Yellow Medicine County 0.085372 .
## as.factor(sentence_year)2011                  0.844229
## as.factor(sentence_year)2012                  0.830523
## as.factor(sentence_year)2013                  1.25e-05 ***
## as.factor(sentence_year)2014                   < 2e-16 ***
## as.factor(sentence_year)2015                   < 2e-16 ***
## as.factor(sentence_year)2016                   < 2e-16 ***
## as.factor(sentence_year)2017                  7.38e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.644 on 55533 degrees of freedom
## Multiple R-squared:  0.399,  Adjusted R-squared:  0.3978
## F-statistic: 344.5 on 107 and 55533 DF,  p-value: < 2.2e-16
```

```
#IV F test
# First Stage
first_stage.f <- lm(conf_minus_stayed_log~cap_ratio+
                black+hispanic+asian+nativeam+other.race+male+log(age)+
                priors+perc_credit+trial_flag+severity_conv+chpoints_final+
                drug+alcohol.dui+hunt.fish+other.offense+
```

```
                          as.factor(filed_county)+as.factor(sentence_year),
                      data=monsanc.felony[monsanc.felony$missiv==F,])

waldtest(first_stage.f, .~.-cap_ratio)
```

```
## Wald test
##
## Model 1: conf_minus_stayed_log ~ cap_ratio + black + hispanic + asian +
##     nativeam + other.race + male + log(age) + priors + perc_credit +
##     trial_flag + severity_conv + chpoints_final + drug + alcohol.dui +
##     hunt.fish + other.offense + as.factor(filed_county) + as.factor(sentence_year)
## Model 2: conf_minus_stayed_log ~ black + hispanic + asian + nativeam +
##     other.race + male + log(age) + priors + perc_credit + trial_flag +
##     severity_conv + chpoints_final + drug + alcohol.dui + hunt.fish +
##     other.offense + as.factor(filed_county) + as.factor(sentence_year)
##   Res.Df Df      F  Pr(>F)
## 1  55533
## 2  55534 -1 6.7918 0.00916 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```