Race Paper Final

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Package Preamble

```
library(readr)
library(readxl)
library(tidyr)
library(stringr)
library(dplyr)
library(ggplot2)
library(sem)
library(AER)
library(stargazer)
library(tvthemes)
library(kableExtra)
library(dotwhisker)

#felony only runs
#Figure 2: identify dotted line as white
#first stage in appendix
```

Data Munging

Analysis with Gross Misdemeanor and Felony Highest Charge Cases

```
monsanc.short <- read_csv("Data/monsanc.short.csv")
```

```
## Warning: One or more parsing issues, call `problems()` on your data frame for details,
## e.g.:
##   dat <- vroom(...)
##   problems(dat)
```

```
## Rows: 192155 Columns: 174
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr   (32): current_case_number, current_case_status_desc, case_wcl_type_des...
## dbl  (130): case_mkey, file_year, fine_ordered, fine_outstanding, fine_colle...
## lgl    (7): incident_id, hf_flag, petty_flag, misdem_flag, intersection, int...
```

```
## dttm   (4): case_filed_date, case_first_final_disposition_date, current_case...
## date   (1): birth_date
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

Table 1: Descriptive Statistics

```
monsanc.ds <- as.data.frame(monsanc.short[,c("conf_minus_stayed_ts",
                                             "total_ff",
                                      "prob_days",
                                     "white", "black", "hispanic",
                                     "asian", "nativeam",
                                     "other.race", "race.miss",
                                     "male", "age", "trial_flag",
                                     "priors", "pubdef", "perc_credit",
                                     "perc_stayed",
                                     "felony_flag", "gm_flag",
                                     "violent_flag", "drug_flag","alcohol_flag",
                                     "filed_district_01", "filed_district_02",
                                     "filed_district_03",
                                     "filed_district_04", "filed_district_05",
                                     "filed_district_06", "filed_district_07",
                                     "filed_district_08", "filed_district_09",
                                     "filed_district_10",
                                     "sentence_year_2004","sentence_year_2005",
                                     "sentence_year_2006","sentence_year_2007",
                                     "sentence_year_2008","sentence_year_2009",
                                     "sentence_year_2010","sentence_year_2011",
                                     "sentence_year_2012",
                                     "sentence_year_2013", "sentence_year_2014",
                                     "sentence_year_2015", "sentence_year_2016",
                                     "sentence_year_2017",
                                     "cap_ratio")])

stargazer(monsanc.ds,
          covariate.labels = c("Incarceration Days",
                               "Total Fine/Fee Order",
                               "Probation Days",
                                 "White", "Black", "Hispanic",
                                 "Asian", "Native American",
                                 "Other Race", "Missing Race",
                                 "Male", "Age", "Trial",
                                 "Priors", "Public Defender",
                                 "Percent Credit", "Percent Stayed",
                                 "Felony", "Gross Misdemeanor",
                                 "Violent", "Drug","Alcohol/DUI",
```

```
                                "Judicial District 1", "Judicial District 2",
                                "Judicial District 3", "Judicial District 4",
                                "Judicial District 5", "Judicial District 6",
                                "Judicial District 7", "Judicial District 8",
                                "Judicial District 9",
                                "Judicial District 10",
                                "Year - 2004", "Year - 2005",
                                "Year - 2006", "Year - 2007",
                                "Year - 2008", "Year - 2009",
                                "Year - 2010",
                                "Year - 2011", "Year - 2012",
                                "Year - 2013", "Year - 2014", "Year - 2015",
                                "Year - 2016", "Year - 2017",
                                "County-Level Capacity Ratio"),
          type="latex",
          style="asr",
          title="Descriptive Statistics for Variables SCAO and VERA Jail Data",
          summary=T,
          median=T,
          header = F)
```

Figure 1: Punishment Amounts by Race and Type

```
#faceted bar graph
fig1 <- monsanc.short %>%
  select(race_impute, total_ff,
         conf_minus_stayed_ts, prob_days) %>%
 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"
  )) %>%
  filter(!is.na(Race)) %>%
  select(-race_impute) %>%
  group_by(Race) %>%
  summarize(LFO = mean(total_ff, na.rm = T),
            Incarceration = mean(conf_minus_stayed_ts, na.rm = T),
            Probation = mean(prob_days, na.rm = T)) %>%
  mutate(Race = factor(Race,
                       levels = c("White", "Black",
                                  "Hispanic", "Asian",
                                  "Nat. Am.", "Other"))) %>%
  pivot_longer(cols = c("LFO", "Incarceration", "Probation"),
               names_to = "punishment",
```

Table 1: Descriptive Statistics for Variables SCAO and VERA Jail Data

Statistic	N	Mean	St. Dev.	Min	Median	Max
Incarceration Days	192,155	198.950	835.039	0	10	62,050
Total Fine/Fee Order	192,155	433.390	917.983	0.000	250.160	318,082.700
Probation Days	192,155	761.887	882.966	0	730	7,300
White	192,155	0.609	0.488	0	1	1
Black	192,155	0.162	0.368	0	0	1
Hispanic	192,155	0.057	0.233	0	0	1
Asian	192,155	0.021	0.143	0	0	1
Native American	192,155	0.059	0.236	0	0	1
Other Race	192,155	0.013	0.112	0	0	1
Missing Race	192,155	0.079	0.269	0	0	1
Male	192,155	0.785	0.411	0	1	1
Age	192,155	33.455	11.247	15	31	100
Trial	192,155	0.0004	0.019	0	0	1
Priors	192,155	2.977	4.015	0	2	84
Public Defender	192,155	0.595	0.491	0	1	1
Percent Credit	192,155	14.251	30.374	0.000	0.274	100.000
Percent Stayed	192,155	43.680	45.792	0.000	0.000	100.000
Felony	192,155	0.350	0.477	0	0	1
Gross Misdemeanor	192,155	0.618	0.486	0	1	1
Violent	192,155	0.197	0.397	0	0	1
Drug	192,155	0.131	0.337	0	0	1
Alcohol/DUI	192,155	0.314	0.464	0	0	1
Judicial District 1	192,155	0.142	0.349	0	0	1
Judicial District 2	192,155	0.081	0.273	0	0	1
Judicial District 3	192,155	0.093	0.290	0	0	1
Judicial District 4	192,155	0.217	0.413	0	0	1
Judicial District 5	192,155	0.065	0.247	0	0	1
Judicial District 6	192,155	0.061	0.239	0	0	1
Judicial District 7	192,155	0.099	0.298	0	0	1
Judicial District 8	192,155	0.032	0.175	0	0	1
Judicial District 9	192,155	0.083	0.276	0	0	1
Judicial District 10	192,155	0.128	0.334	0	0	1
Year - 2004	192,155	0.039	0.193	0	0	1
Year - 2005	192,155	0.082	0.274	0	0	1
Year - 2006	192,155	0.127	0.333	0	0	1
Year - 2007	192,155	0.155	0.362	0	0	1
Year - 2008	192,155	0.052	0.222	0	0	1
Year - 2009	192,155	0.008	0.090	0	0	1
Year - 2010	192,155	0.002	0.048	0	0	1
Year - 2011	192,155	0.029	0.169	0	0	1
Year - 2012	192,155	0.033	0.178	0	0	1
Year - 2013	192,155	0.121	0.326	0	0	1
Year - 2014	192,155	0.172	0.378	0	0	1
Year - 2015	192,155	0.103	0.304	0	0	1
Year - 2016	192,155	0.069	0.254	0	0	1
Year - 2017	192,155	0.008	0.090	0	0	1
County-Level Capacity Ratio	192,155	0.793	0.221	0.200	0.811	2.267

```
                values_to = "amount") %>%
  ggplot()+
  geom_bar(aes(x=Race, y=amount, fill = Race),
           color = "black",
           stat="identity",
           position = position_dodge2())+
  geom_text(aes(x=Race, y=amount+25,
              label = round(amount,0)),
            position = position_dodge2(width = 1))+
  facet_wrap(~punishment)+
  labs(title = "Figure 1: Punishment Amounts by Defendant Race",
       subtitle = "MN SCAO 2011-2015",
       y = "Amount (Days/USD/Days)")+
  tvthemes::scale_fill_westeros(palette = "Stark")+
  theme_classic()+
  theme(legend.position = "none"#,
        #text=element_text(family="Times New Roman")
        )

fig1
```

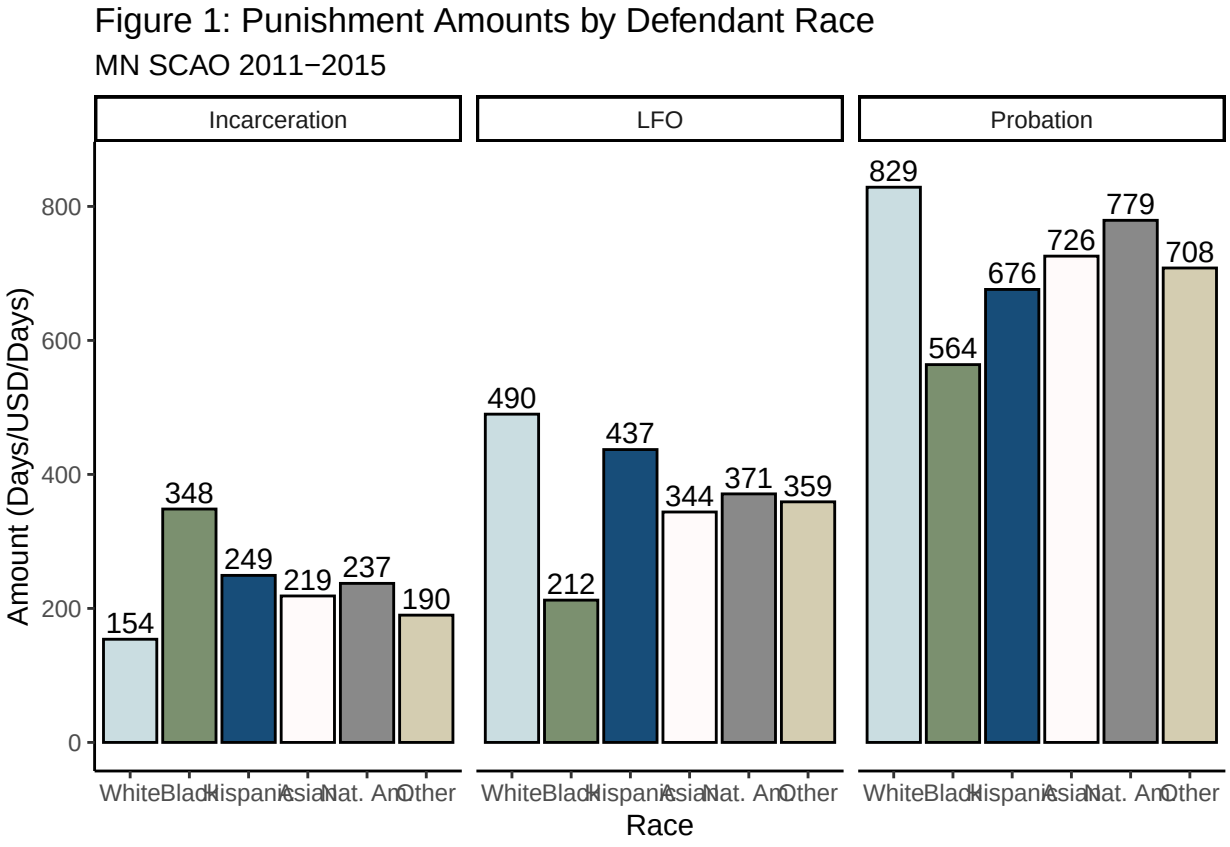


Table 2: Multivariate Regression of Punishment

$$Y_{ik} = \alpha_k + \sum \pi_{jk} Race_{ij} + \sum \beta_{jk} X_{ij} + \theta_{dk} + \lambda_{tk} + \epsilon_{ik}$$

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

#multivariate regression
mv <- lm(cbind(log(conf_minus_stayed_ts_log+1),
               log(prob_days+1),
               log(total_ff+1))~
                 black+hispanic+asian+nativeam+other.race+
                 race.miss+
                 male+log(age)+
                  priors+pubdef+perc_credit+
           perc_stayed+trial_flag+
                 felony_flag+gm_flag+
                 violent_flag+drug_flag+alcohol_flag+
                 filed_district+
                 as.factor(sentence_year),
         data = monsanc.short)

summary(mv)
```

```
## Response log(conf_minus_stayed_ts_log + 1) :
##
## Call:
## lm(formula = `log(conf_minus_stayed_ts_log + 1)` ~ black + hispanic +
##     asian + nativeam + other.race + race.miss + male + log(age) +
##     priors + pubdef + perc_credit + perc_stayed + trial_flag +
##     felony_flag + gm_flag + violent_flag + drug_flag + alcohol_flag +
##     filed_district + as.factor(sentence_year), data = monsanc.short)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2.3250 -0.6240  0.1805  0.5788  2.2837
##
## Coefficients:
##                                Estimate Std. Error  t value Pr(>|t|)
## (Intercept)                   7.747e-01  2.055e-02   37.706  < 2e-16 ***
## black                         3.715e-03  4.956e-03    0.750  0.45343
## hispanic                      3.414e-02  7.139e-03    4.782 1.74e-06 ***
## asian                        -2.866e-02  1.153e-02   -2.486  0.01293 *
## nativeam                      9.826e-02  7.191e-03   13.665  < 2e-16 ***
## other.race                   -4.551e-02  1.447e-02   -3.145  0.00166 **
## race.miss                    -1.344e-01  6.208e-03  -21.650  < 2e-16 ***
## male                          2.222e-01  4.002e-03   55.515  < 2e-16 ***
## log(age)                      8.414e-02  5.138e-03   16.377  < 2e-16 ***
## priors                        2.092e-02  4.337e-04   48.241  < 2e-16 ***
```

```
## pubdef                           1.162e-01  3.614e-03   32.146  < 2e-16 ***
## perc_credit                     -9.774e-03  5.991e-05 -163.130  < 2e-16 ***
## perc_stayed                     -5.095e-03  4.914e-05 -103.694  < 2e-16 ***
## trial_flag                       4.700e-01  8.322e-02    5.648 1.63e-08 ***
## felony_flag                      5.096e-02  5.655e-03    9.011  < 2e-16 ***
## gm_flag                         -2.875e-01  5.524e-03  -52.034  < 2e-16 ***
## violent_flag                     9.629e-02  4.841e-03   19.893  < 2e-16 ***
## drug_flag                       -6.086e-02  5.623e-03  -10.825  < 2e-16 ***
## alcohol_flag                     3.478e-01  4.323e-03   80.449  < 2e-16 ***
## filed_district02                 4.207e-01  7.520e-03   55.949  < 2e-16 ***
## filed_district03                -1.161e-03  7.021e-03   -0.165  0.86862
## filed_district04                 3.437e-01  6.239e-03   55.085  < 2e-16 ***
## filed_district05                 1.386e-01  7.962e-03   17.405  < 2e-16 ***
## filed_district06                -9.576e-03  8.224e-03   -1.164  0.24430
## filed_district07                 4.765e-01  7.055e-03   67.532  < 2e-16 ***
## filed_district08                 3.167e-01  1.027e-02   30.831  < 2e-16 ***
## filed_district09                 3.099e-01  7.556e-03   41.011  < 2e-16 ***
## filed_district10                 3.300e-01  6.564e-03   50.278  < 2e-16 ***
## as.factor(sentence_year)2005 -7.747e-02  1.001e-02   -7.736 1.03e-14 ***
## as.factor(sentence_year)2006 -1.555e-01  9.516e-03  -16.342  < 2e-16 ***
## as.factor(sentence_year)2007 -2.185e-01  9.463e-03  -23.095  < 2e-16 ***
## as.factor(sentence_year)2008 -2.830e-01  1.125e-02  -25.158  < 2e-16 ***
## as.factor(sentence_year)2009 -2.932e-01  1.988e-02  -14.751  < 2e-16 ***
## as.factor(sentence_year)2010 -3.235e-01  3.446e-02   -9.386  < 2e-16 ***
## as.factor(sentence_year)2011 -3.607e-01  1.283e-02  -28.102  < 2e-16 ***
## as.factor(sentence_year)2012 -3.789e-01  1.246e-02  -30.415  < 2e-16 ***
## as.factor(sentence_year)2013 -3.512e-01  9.893e-03  -35.500  < 2e-16 ***
## as.factor(sentence_year)2014 -4.021e-01  9.628e-03  -41.760  < 2e-16 ***
## as.factor(sentence_year)2015 -4.006e-01  1.020e-02  -39.275  < 2e-16 ***
## as.factor(sentence_year)2016 -4.453e-01  1.082e-02  -41.168  < 2e-16 ***
## as.factor(sentence_year)2017 -3.390e-01  1.999e-02  -16.957  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7079 on 192114 degrees of freedom
## Multiple R-squared:  0.2687, Adjusted R-squared:  0.2686
## F-statistic:  1765 on 40 and 192114 DF,  p-value: < 2.2e-16
##
##
## Response log(prob_days + 1) :
##
## Call:
## lm(formula = `log(prob_days + 1)` ~ black + hispanic + asian +
##     nativeam + other.race + race.miss + male + log(age) + priors +
##     pubdef + perc_credit + perc_stayed + trial_flag + felony_flag +
##     gm_flag + violent_flag + drug_flag + alcohol_flag + filed_district +
##     as.factor(sentence_year), data = monsanc.short)
##
```

```
## Residuals:
##     Min      1Q  Median      3Q     Max
## -9.6135 -1.5760  0.3494  1.8212  8.7894
##
## Coefficients:
##                                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)                     2.6054690  0.0735869  35.407  < 2e-16 ***
## black                          -0.2089697  0.0177500 -11.773  < 2e-16 ***
## hispanic                       -0.3388478  0.0255709 -13.251  < 2e-16 ***
## asian                           0.0822783  0.0412959   1.992  0.04633 *
## nativeam                       -0.2304067  0.0257546  -8.946  < 2e-16 ***
## other.race                     -0.0124129  0.0518281  -0.240  0.81072
## race.miss                       0.0415446  0.0222350   1.868  0.06170 .
## male                           -0.5913992  0.0143351 -41.255  < 2e-16 ***
## log(age)                       -0.4465255  0.0184026 -24.264  < 2e-16 ***
## priors                         -0.0479442  0.0015532 -30.867  < 2e-16 ***
## pubdef                         -0.0124729  0.0129458  -0.963  0.33531
## perc_credit                     0.0103471  0.0002146  48.217  < 2e-16 ***
## perc_stayed                     0.0191103  0.0001760 108.586  < 2e-16 ***
## trial_flag                     -0.9281100  0.2980525  -3.114  0.00185 **
## felony_flag                     1.1547271  0.0202558  57.007  < 2e-16 ***
## gm_flag                         0.9618783  0.0197866  48.613  < 2e-16 ***
## violent_flag                    0.2808576  0.0173373  16.200  < 2e-16 ***
## drug_flag                       0.9029102  0.0201384  44.835  < 2e-16 ***
## alcohol_flag                    1.4870127  0.0154828  96.043  < 2e-16 ***
## filed_district02               -1.4017656  0.0269347 -52.043  < 2e-16 ***
## filed_district03               -0.3047171  0.0251468 -12.118  < 2e-16 ***
## filed_district04               -2.0765759  0.0223479 -92.920  < 2e-16 ***
## filed_district05               -0.3131094  0.0285184 -10.979  < 2e-16 ***
## filed_district06               -0.6676371  0.0294570 -22.665  < 2e-16 ***
## filed_district07               -0.7072016  0.0252698 -27.986  < 2e-16 ***
## filed_district08               -0.2328811  0.0367908  -6.330 2.46e-10 ***
## filed_district09               -0.3944672  0.0270644 -14.575  < 2e-16 ***
## filed_district10               -0.2513156  0.0235103 -10.690  < 2e-16 ***
## as.factor(sentence_year)2005    0.9589958  0.0358668  26.738  < 2e-16 ***
## as.factor(sentence_year)2006    1.4405176  0.0340822  42.266  < 2e-16 ***
## as.factor(sentence_year)2007    2.1703744  0.0338924  64.037  < 2e-16 ***
## as.factor(sentence_year)2008    2.7470814  0.0402871  68.188  < 2e-16 ***
## as.factor(sentence_year)2009    2.4963595  0.0712010  35.061  < 2e-16 ***
## as.factor(sentence_year)2010    2.1984531  0.1234297  17.811  < 2e-16 ***
## as.factor(sentence_year)2011    3.1588507  0.0459679  68.719  < 2e-16 ***
## as.factor(sentence_year)2012    3.1283446  0.0446170  70.116  < 2e-16 ***
## as.factor(sentence_year)2013    3.1654652  0.0354325  89.338  < 2e-16 ***
## as.factor(sentence_year)2014    3.1972040  0.0344844  92.714  < 2e-16 ***
## as.factor(sentence_year)2015    3.0991858  0.0365294  84.841  < 2e-16 ***
## as.factor(sentence_year)2016    3.0437276  0.0387427  78.563  < 2e-16 ***
## as.factor(sentence_year)2017    2.2543882  0.0715964  31.487  < 2e-16 ***
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.536 on 192114 degrees of freedom
## Multiple R-squared:  0.376,  Adjusted R-squared:  0.3759
## F-statistic:  2894 on 40 and 192114 DF,  p-value: < 2.2e-16
##
##
## Response log(total_ff + 1) :
##
## Call:
## lm(formula = `log(total_ff + 1)` ~ black + hispanic + asian +
##     nativeam + other.race + race.miss + male + log(age) + priors +
##     pubdef + perc_credit + perc_stayed + trial_flag + felony_flag +
##     gm_flag + violent_flag + drug_flag + alcohol_flag + filed_district +
##     as.factor(sentence_year), data = monsanc.short)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.5126 -0.5374  0.4763  1.2874  8.4253
##
## Coefficients:
##                               Estimate Std. Error  t value Pr(>|t|)
## (Intercept)                  5.7923100  0.0577206  100.351  < 2e-16 ***
## black                       -0.6306964  0.0139229  -45.299  < 2e-16 ***
## hispanic                    -0.2389838  0.0200574  -11.915  < 2e-16 ***
## asian                       -0.0718643  0.0323920   -2.219 0.026516 *
## nativeam                    -0.6155530  0.0202016  -30.471  < 2e-16 ***
## other.race                  -0.2304793  0.0406533   -5.669 1.44e-08 ***
## race.miss                   -0.0576275  0.0174409   -3.304 0.000953 ***
## male                        -0.0110647  0.0112442   -0.984 0.325100
## log(age)                    -0.0608478  0.0144348   -4.215 2.49e-05 ***
## priors                      -0.0488170  0.0012183  -40.068  < 2e-16 ***
## pubdef                      -0.7557085  0.0101545  -74.421  < 2e-16 ***
## perc_credit                  0.0016452  0.0001683    9.774  < 2e-16 ***
## perc_stayed                  0.0096896  0.0001380   70.190  < 2e-16 ***
## trial_flag                   0.4906342  0.2337884    2.099 0.035851 *
## felony_flag                  0.2601586  0.0158884   16.374  < 2e-16 ***
## gm_flag                      0.5532641  0.0155203   35.648  < 2e-16 ***
## violent_flag                -0.0029134  0.0135992   -0.214 0.830368
## drug_flag                    0.2684913  0.0157963   16.997  < 2e-16 ***
## alcohol_flag                 0.5408613  0.0121445   44.536  < 2e-16 ***
## filed_district02            -1.1320428  0.0211272  -53.582  < 2e-16 ***
## filed_district03            -0.8733208  0.0197248  -44.275  < 2e-16 ***
## filed_district04            -1.8208668  0.0175294 -103.875  < 2e-16 ***
## filed_district05            -0.3045880  0.0223695  -13.616  < 2e-16 ***
## filed_district06            -0.5646840  0.0231057  -24.439  < 2e-16 ***
## filed_district07            -0.4424184  0.0198213  -22.320  < 2e-16 ***
## filed_district08            -0.5070940  0.0288582  -17.572  < 2e-16 ***
```

```
## filed_district09             -0.5054336  0.0212290  -23.809  < 2e-16 ***
## filed_district10             -1.1349212  0.0184412  -61.543  < 2e-16 ***
## as.factor(sentence_year)2005 -0.3948946  0.0281334  -14.036  < 2e-16 ***
## as.factor(sentence_year)2006 -0.4910448  0.0267336  -18.368  < 2e-16 ***
## as.factor(sentence_year)2007 -0.5040109  0.0265848  -18.959  < 2e-16 ***
## as.factor(sentence_year)2008 -0.5118782  0.0316007  -16.198  < 2e-16 ***
## as.factor(sentence_year)2009 -0.4854768  0.0558491   -8.693  < 2e-16 ***
## as.factor(sentence_year)2010 -0.1297855  0.0968166   -1.341 0.180075
## as.factor(sentence_year)2011 -0.1147064  0.0360566   -3.181 0.001466 **
## as.factor(sentence_year)2012 -0.1028951  0.0349969   -2.940 0.003281 **
## as.factor(sentence_year)2013  0.0358778  0.0277928    1.291 0.196738
## as.factor(sentence_year)2014  0.2021884  0.0270491    7.475 7.76e-14 ***
## as.factor(sentence_year)2015  0.2924397  0.0286532   10.206  < 2e-16 ***
## as.factor(sentence_year)2016  0.2826334  0.0303892    9.300  < 2e-16 ***
## as.factor(sentence_year)2017  0.2684945  0.0561593    4.781 1.75e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.989 on 192114 degrees of freedom
## Multiple R-squared:  0.2485, Adjusted R-squared:  0.2483
## F-statistic:  1588 on 40 and 192114 DF,  p-value: < 2.2e-16
```

```
conf_model <- lm(log(conf_minus_stayed_ts+1)~
                 black+hispanic+asian+nativeam+other.race+
                 race.miss+
                 male+log(age)+
                  priors+pubdef+perc_credit+
           perc_stayed+trial_flag+
                 felony_flag+gm_flag+
                 violent_flag+drug_flag+alcohol_flag+
                 filed_district+
                 as.factor(sentence_year),
         data = monsanc.short)

prob_model <- lm(log(prob_days+1)~
                  black+hispanic+asian+nativeam+other.race+
                 race.miss+
                 male+log(age)+
                  priors+pubdef+perc_credit+
           perc_stayed+trial_flag+
                 felony_flag+gm_flag+
                 violent_flag+drug_flag+alcohol_flag+
                 filed_district+
                 as.factor(sentence_year),
         data = monsanc.short)

lfo_model <- lm(log(total_ff+1)~
                  black+hispanic+asian+nativeam+other.race+
```

```
                race.miss+
                male+log(age)+
                 priors+pubdef+perc_credit+
           perc_stayed+trial_flag+
                felony_flag+gm_flag+
                violent_flag+drug_flag+alcohol_flag+
                filed_district+
                as.factor(sentence_year),
         data = monsanc.short)
```

```
#stargazer regression table

stargazer(conf_model, lfo_model, prob_model,
           type = "latex",
          title = "Multivariate Model of Punishment, Minnesota 2004-2017",
          covariate.labels = c("Black", "Hispanic", "Asian",
                               "Native American", "Other Race",
                               "Missing Race", "Male", "log(Age)",
                               "Prior Convictions", "Public Defender",
                               "Percent Credit", "Percent Stayed",
                               "Trial",
                               "Felony", "Gross Misdemeanor",
                               "Violent", "Drug", "Alcohol/DUI"),
          model.numbers = FALSE,
          header = FALSE,
          dep.var.caption  = "Punishment Outcome",
          dep.var.labels = c("log(Incarceration)",
                             "log(LFO)",
                             "log(Probation)"),
          column.labels = c("Coef(SE)", "Coef(SE)", "Coef(SE)"),
          single.row = TRUE,
          font.size="footnotesize",
          no.space = T,
          column.sep.width = "1pt",
          align = TRUE,
          omit.stat = c("ser"),
          omit = c("filed_district", "sentence_year"),
          star.cutoffs = c(.05, .01, .001),
          star.char = c("*","**","***"),
          add.lines = list(c("District FE", "Yes", "Yes", "Yes"),
                           c("Sentence Year FE", "Yes", "Yes", "Yes")))
```

Table 3: Instrumental Variable Models of Punishment

$$I_i = \alpha + \phi_1 CR_d + \sum \beta_j X_{ij} + \theta_d + \lambda_t + \epsilon_i$$

$$Y_{ik} = \alpha + \phi_{2k} CR_d + \sum \pi_{jk} Race_{ij} + \sum \beta_{jk} X_{ij} + \theta_{dk} + \lambda_{tk} + \epsilon_{ik}$$

Table 2: Multivariate Model of Punishment, Minnesota 2004-2017

	Punishment Outcome		
	log(Incarceration) Coef(SE)	log(LFO) Coef(SE)	log(Probation) Coef(SE)
Black	0.124^{***} (0.014)	-0.631^{***} (0.014)	-0.209^{***} (0.018)
Hispanic	0.158^{***} (0.020)	-0.239^{***} (0.020)	-0.339^{***} (0.026)
Asian	-0.079^{*} (0.033)	-0.072^{*} (0.032)	0.082^{*} (0.041)
Native American	0.327^{***} (0.021)	-0.616^{***} (0.020)	-0.230^{***} (0.026)
Other Race	-0.103^{*} (0.041)	-0.230^{***} (0.041)	-0.012 (0.052)
Missing Race	-0.314^{***} (0.018)	-0.058^{***} (0.017)	0.042 (0.022)
Male	0.700^{***} (0.011)	-0.011 (0.011)	-0.591^{***} (0.014)
log(Age)	0.339^{***} (0.015)	-0.061^{***} (0.014)	-0.447^{***} (0.018)
Prior Convictions	0.069^{***} (0.001)	-0.049^{***} (0.001)	-0.048^{***} (0.002)
Public Defender	0.384^{***} (0.010)	-0.756^{***} (0.010)	-0.012 (0.013)
Percent Credit	-0.030^{***} (0.0002)	0.002^{***} (0.0002)	0.010^{***} (0.0002)
Percent Stayed	-0.019^{***} (0.0001)	0.010^{***} (0.0001)	0.019^{***} (0.0002)
Trial	2.166^{***} (0.237)	0.491^{*} (0.234)	-0.928^{**} (0.298)
Felony	0.129^{***} (0.016)	0.260^{***} (0.016)	1.155^{***} (0.020)
Gross Misdemeanor	-1.054^{***} (0.016)	0.553^{***} (0.016)	0.962^{***} (0.020)
Violent	0.390^{***} (0.014)	-0.003 (0.014)	0.281^{***} (0.017)
Drug	-0.212^{***} (0.016)	0.268^{***} (0.016)	0.903^{***} (0.020)
Alcohol/DUI	0.956^{***} (0.012)	0.541^{***} (0.012)	1.487^{***} (0.015)
Constant	1.792^{***} (0.059)	5.792^{***} (0.058)	2.605^{***} (0.074)
District FE	*Yes*	*Yes*	*Yes*
Sentence Year FE	*Yes*	*Yes*	*Yes*
Observations	192,155	192,155	192,155
R^2	0.331	0.248	0.376
Adjusted R^2	0.331	0.248	0.376
F Statistic (df = 40; 192114)	$2{,}374.771^{***}$	$1{,}588.104^{***}$	$2{,}893.814^{***}$

Note: *p<0.05; **p<0.01; ***p<0.001

$$\delta_k = \frac{\phi_{2k}}{\phi_1}$$

```
#instrumental Variables Regression

#LFO
iv.ff <- ivreg(total_ff_log~conf_minus_stayed_ts_log+
                 black+hispanic+asian+nativeam+other.race+
                 race.miss+
                 male+log(age)+
                  priors+pubdef+perc_credit+
                 perc_stayed+
                 trial_flag+
                 felony_flag+gm_flag+
                 violent_flag+drug_flag+alcohol_flag+
                 filed_district+
                 as.factor(sentence_year)|
               .-conf_minus_stayed_ts_log+cap_ratio,
             data = monsanc.short)

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

```
##
## Call:
## ivreg(formula = total_ff_log ~ conf_minus_stayed_ts_log + black +
##     hispanic + asian + nativeam + other.race + race.miss + male +
##     log(age) + priors + pubdef + perc_credit + perc_stayed +
##     trial_flag + felony_flag + gm_flag + violent_flag + drug_flag +
##     alcohol_flag + filed_district + as.factor(sentence_year) |
##     . - conf_minus_stayed_ts_log + cap_ratio, data = monsanc.short)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -27.6926  -5.4948   0.4936   5.6240  28.1852
##
## Coefficients:
##                              Estimate Std. Error t value Pr(>|t|)
## (Intercept)                  12.18879    2.02940   6.006 1.90e-09 ***
## conf_minus_stayed_ts_log     -3.56979    1.12623  -3.170 0.001526 **
## black                        -0.18751    0.14910  -1.258 0.208538
## hispanic                      0.32428    0.19272   1.683 0.092449 .
## asian                        -0.35356    0.14969  -2.362 0.018181 *
## nativeam                      0.55284    0.37619   1.470 0.141679
## other.race                   -0.59648    0.19023  -3.136 0.001715 **
## race.miss                    -1.17943    0.35981  -3.278 0.001046 **
## male                          2.48745    0.78936   3.151 0.001626 **
## log(age)                      1.15029    0.38585   2.981 0.002872 **
## priors                        0.19902    0.07832   2.541 0.011052 *
```

```
## pubdef                          0.61562    0.43428   1.418 0.156324
## perc_credit                    -0.10390    0.03330  -3.120 0.001810 **
## perc_stayed                    -0.05867    0.02157  -2.720 0.006536 **
## trial_flag                      8.22446    2.59019   3.175 0.001497 **
## felony_flag                     0.71914    0.15639   4.598 4.26e-06 ***
## gm_flag                        -3.20893    1.18833  -2.700 0.006927 **
## violent_flag                    1.38881    0.44198   3.142 0.001677 **
## drug_flag                      -0.48766    0.24568  -1.985 0.047155 *
## alcohol_flag                    3.95309    1.07747   3.669 0.000244 ***
## filed_district02                4.47665    1.77122   2.527 0.011491 *
## filed_district03               -0.08394    0.25962  -0.323 0.746453
## filed_district04                1.93191    1.18575   1.629 0.103257
## filed_district05                1.80371    0.67032   2.691 0.007129 **
## filed_district06                0.59003    0.37429   1.576 0.114940
## filed_district07                4.98229    1.71302   2.908 0.003632 **
## filed_district08                3.32992    1.21528   2.740 0.006144 **
## filed_district09                3.38544    1.23006   2.752 0.005919 **
## filed_district10                2.67899    1.20520   2.223 0.026226 *
## as.factor(sentence_year)2005 -1.12773    0.25377  -4.444 8.84e-06 ***
## as.factor(sentence_year)2006 -2.28703    0.57527  -3.976 7.02e-05 ***
## as.factor(sentence_year)2007 -3.02090    0.80018  -3.775 0.000160 ***
## as.factor(sentence_year)2008 -3.59126    0.97859  -3.670 0.000243 ***
## as.factor(sentence_year)2009 -3.54760    0.98813  -3.590 0.000331 ***
## as.factor(sentence_year)2010 -3.35905    1.08054  -3.109 0.001879 **
## as.factor(sentence_year)2011 -4.08494    1.25972  -3.243 0.001184 **
## as.factor(sentence_year)2012 -4.12255    1.27481  -3.234 0.001222 **
## as.factor(sentence_year)2013 -3.74718    1.19798  -3.128 0.001761 **
## as.factor(sentence_year)2014 -4.12575    1.36912  -3.013 0.002583 **
## as.factor(sentence_year)2015 -3.91978    1.33317  -2.940 0.003280 **
## as.factor(sentence_year)2016 -4.29511    1.44864  -2.965 0.003028 **
## as.factor(sentence_year)2017 -2.89395    1.01934  -2.839 0.004525 **
##
## Diagnostic tests:
##                     df1    df2 statistic p-value
## Weak instruments      1 192113     10.58 0.00114 **
## Wu-Hausman            1 192112    136.08 < 2e-16 ***
## Sargan                0     NA        NA      NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.396 on 192113 degrees of freedom
## Multiple R-Squared: -9.392,  Adjusted R-squared: -9.394
## Wald test: 112.3 on 41 and 192113 DF,  p-value: < 2.2e-16
```

```
#Probation
iv.prob <- ivreg(prob_days_log~conf_minus_stayed_ts_log+
                 black+hispanic+asian+nativeam+other.race+
                 race.miss+
```

```
                male+log(age)+
                priors+pubdef+perc_credit+
                perc_stayed+
                trial_flag+
                felony_flag+gm_flag+
                violent_flag+drug_flag+alcohol_flag+
                filed_district+
                as.factor(sentence_year)|
              .-conf_minus_stayed_ts_log+cap_ratio,
            data = monsanc.short)

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

```
##
## Call:
## ivreg(formula = prob_days_log ~ conf_minus_stayed_ts_log + black +
##     hispanic + asian + nativeam + other.race + race.miss + male +
##     log(age) + priors + pubdef + perc_credit + perc_stayed +
##     trial_flag + felony_flag + gm_flag + violent_flag + drug_flag +
##     alcohol_flag + filed_district + as.factor(sentence_year) |
##     . - conf_minus_stayed_ts_log + cap_ratio, data = monsanc.short)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -24.18832  -3.90022   0.04407   4.23382  22.77085
##
## Coefficients:
##                              Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 -1.50633    1.65146  -0.912 0.361708
## conf_minus_stayed_ts_log     2.29474    0.91649   2.504 0.012286 *
## black                       -0.49386    0.12133  -4.070 4.70e-05 ***
## hispanic                    -0.70092    0.15683  -4.469 7.85e-06 ***
## asian                        0.26336    0.12181   2.162 0.030621 *
## nativeam                    -0.98148    0.30613  -3.206 0.001346 **
## other.race                   0.22286    0.15480   1.440 0.149967
## race.miss                    0.76266    0.29280   2.605 0.009196 **
## male                        -2.19750    0.64236  -3.421 0.000624 ***
## log(age)                    -1.22507    0.31399  -3.902 9.56e-05 ***
## priors                      -0.20726    0.06374  -3.252 0.001147 **
## pubdef                      -0.89399    0.35341  -2.530 0.011419 *
## perc_credit                  0.07819    0.02710   2.885 0.003912 **
## perc_stayed                  0.06305    0.01756   3.592 0.000329 ***
## trial_flag                  -5.89958    2.10782  -2.799 0.005128 **
## felony_flag                  0.85968    0.12727   6.755 1.43e-11 ***
## gm_flag                      3.38030    0.96703   3.496 0.000473 ***
## violent_flag                -0.61378    0.35967  -1.707 0.087915 .
## drug_flag                    1.38898    0.19993   6.947 3.73e-12 ***
```

```
## alcohol_flag                -0.70644    0.87681  -0.806 0.420418
## filed_district02            -5.00716    1.44137  -3.474 0.000513 ***
## filed_district03            -0.81215    0.21127  -3.844 0.000121 ***
## filed_district04            -4.48894    0.96493  -4.652 3.29e-06 ***
## filed_district05            -1.66837    0.54549  -3.058 0.002225 **
## filed_district06            -1.40991    0.30459  -4.629 3.68e-06 ***
## filed_district07            -4.19432    1.39400  -3.009 0.002623 **
## filed_district08            -2.69940    0.98896  -2.730 0.006343 **
## filed_district09            -2.89561    1.00099  -2.893 0.003819 **
## filed_district10            -2.70298    0.98075  -2.756 0.005851 **
## as.factor(sentence_year)2005  1.43008    0.20651   6.925 4.37e-12 ***
## as.factor(sentence_year)2006  2.59502    0.46813   5.543 2.97e-08 ***
## as.factor(sentence_year)2007  3.78829    0.65116   5.818 5.97e-09 ***
## as.factor(sentence_year)2008  4.72658    0.79635   5.935 2.94e-09 ***
## as.factor(sentence_year)2009  4.46476    0.80411   5.552 2.82e-08 ***
## as.factor(sentence_year)2010  4.27430    0.87931   4.861 1.17e-06 ***
## as.factor(sentence_year)2011  5.71100    1.02512   5.571 2.54e-08 ***
## as.factor(sentence_year)2012  5.71227    1.03741   5.506 3.67e-08 ***
## as.factor(sentence_year)2013  5.59730    0.97488   5.742 9.40e-09 ***
## as.factor(sentence_year)2014  5.97930    1.11414   5.367 8.03e-08 ***
## as.factor(sentence_year)2015  5.80689    1.08489   5.352 8.68e-08 ***
## as.factor(sentence_year)2016  5.98640    1.17886   5.078 3.82e-07 ***
## as.factor(sentence_year)2017  4.28728    0.82951   5.168 2.36e-07 ***
##
## Diagnostic tests:
##                     df1    df2 statistic p-value
## Weak instruments      1 192113     10.58 0.00114 **
## Wu-Hausman            1 192112     57.62 3.2e-14 ***
## Sargan                0     NA        NA      NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 6.019 on 192113 degrees of freedom
## Multiple R-Squared: -2.516,  Adjusted R-squared: -2.517
## Wald test: 501.3 on 41 and 192113 DF,  p-value: < 2.2e-16
```

```
#exogeneity checks

ppcor::pcor.test(y = monsanc.short$cap_ratio_lead[!is.na(monsanc.short$cap_ratio_lead)],
                 x = monsanc.short$total_ff_log[!is.na(monsanc.short$cap_ratio_lead)],
                 z = monsanc.short$cap_ratio[!is.na(monsanc.short$cap_ratio_lead)],
                 method = "pearson")
```

```
##      estimate       p.value statistic      n gp  Method
## 1 -0.05857807 1.785028e-144 -25.61592 190574  1 pearson
```

```
ppcor::pcor.test(y = monsanc.short$cap_ratio_lead[!is.na(monsanc.short$cap_ratio_lead)],
                 x = monsanc.short$prob_days_log[!is.na(monsanc.short$cap_ratio_lead)],
                 z = monsanc.short$cap_ratio[!is.na(monsanc.short$cap_ratio_lead)],
```

```
                 method = "pearson")
```

```
##      estimate       p.value statistic      n gp  Method
## 1 -0.06670763 7.592092e-187 -29.18585 190574  1 pearson
```

```
stargazer(iv.ff, iv.prob,
          type = "latex",
          title = "IV 2SLS Models of Punishment, Minnesota 2004-2017",
          covariate.labels = c("log(Incarceration)",
                               "Black", "Hispanic", "Asian",
                               "Native American", "Other Race",
                               "Missing Race", "Male", "log(Age)",
                               "Prior Convictions", "Public Defender",
                               "Percent Credit", "Percent Stayed",
                               "Trial",
                               "Felony", "Gross Misdemeanor",
                               "Violent", "Drug", "Alcohol/DUI"),
          model.numbers = FALSE,
          header = FALSE,
         dep.var.caption  = "Punishment Outcome",
          dep.var.labels = c("log(LFO)",
                             "log(Probation)"),
          column.labels = c("Coef(SE)", "Coef(SE)"),
          single.row = TRUE,
          font.size="footnotesize",
          no.space = T,
          column.sep.width = "1pt",
          align = TRUE,
          omit = c("filed_district", "sentence_year"),
          omit.stat = c("adj.rsq", "rsq", "ser"),
          star.cutoffs = c(.05, .01, .001),
          star.char = c("*","**","***"),
          add.lines = list(c("District FE", "Yes", "Yes", "Yes"),
                           c("Sentence Year FE", "Yes", "Yes", "Yes"),
                           c("IV F(Incar.)", "10.58^{**}", "10.58^{**}"),
                           c("IV Wu-Hausman", "136.08^{***}", "57.62^{***}")),
          notes = "IV: County-Level Jail Capacity Ratio")
```

Figure 2: Coefficient Plot

```
conf_coef_mv <- broom::tidy(conf_model) %>%
  filter(str_detect(term, pattern = "black|hispanic|asian|nativeam|other.race")) %>%
  relabel_predictors(c(
    black = "Black",
    hispanic = "Hispanic",
    asian = "Asian",
    nativeam = "Native American",
```

Table 3: IV 2SLS Models of Punishment, Minnesota 2004-2017

	Punishment Outcome	
	log(LFO) Coef(SE)	log(Probation) Coef(SE)
log(Incarceration)	-3.570^{**} (1.126)	2.295^{*} (0.916)
Black	-0.188 (0.149)	-0.494^{***} (0.121)
Hispanic	0.324 (0.193)	-0.701^{***} (0.157)
Asian	-0.354^{*} (0.150)	0.263^{*} (0.122)
Native American	0.553 (0.376)	-0.981^{**} (0.306)
Other Race	-0.596^{**} (0.190)	0.223 (0.155)
Missing Race	-1.179^{**} (0.360)	0.763^{**} (0.293)
Male	2.487^{**} (0.789)	-2.198^{***} (0.642)
log(Age)	1.150^{**} (0.386)	-1.225^{***} (0.314)
Prior Convictions	0.199^{*} (0.078)	-0.207^{**} (0.064)
Public Defender	0.616 (0.434)	-0.894^{*} (0.353)
Percent Credit	-0.104^{**} (0.033)	0.078^{**} (0.027)
Percent Stayed	-0.059^{**} (0.022)	0.063^{***} (0.018)
Trial	8.224^{**} (2.590)	-5.900^{**} (2.108)
Felony	0.719^{***} (0.156)	0.860^{***} (0.127)
Gross Misdemeanor	-3.209^{**} (1.188)	3.380^{***} (0.967)
Violent	1.389^{**} (0.442)	-0.614 (0.360)
Drug	-0.488^{*} (0.246)	1.389^{***} (0.200)
Alcohol/DUI	3.953^{***} (1.077)	-0.706 (0.877)
Constant	12.189^{***} (2.029)	-1.506 (1.651)
District FE	*Yes*	*Yes*
Sentence Year FE	*Yes*	*Yes*
IV F(Incar.)	10.58^{**}	10.58^{**}
IV Wu-Hausman	136.08^{***}	57.62^{***}
Observations	192,155	192,155

Note: *p<0.05; **p<0.01; ***p<0.001
IV: County-Level Jail Capacity Ratio

```
    other.race = "Other Race"
  )) %>%
  mutate(model = "MV",
         punishment = "Incarceration")

prob_coef_mv <- broom::tidy(prob_model) %>%
  filter(str_detect(term, pattern = "black|hispanic|asian|nativeam|other.race")) %>%
  relabel_predictors(c(
    black = "Black",
    hispanic = "Hispanic",
    asian = "Asian",
    nativeam = "Native American",
    other.race = "Other Race"
  )) %>%
  mutate(model = "MV",
         punishment = "Probation")

lfo_coef_mv <- broom::tidy(lfo_model) %>%
  filter(str_detect(term, pattern = "black|hispanic|asian|nativeam|other.race")) %>%
  relabel_predictors(c(
    black = "Black",
    hispanic = "Hispanic",
    asian = "Asian",
    nativeam = "Native American",
    other.race = "Other Race"
  )) %>%
  mutate(model = "MV",
         punishment = "LFO")

prob_coef_iv <- broom::tidy(iv.prob) %>%
  filter(str_detect(term, pattern = "black|hispanic|asian|nativeam|other.race")) %>%
  relabel_predictors(c(
    black = "Black",
    hispanic = "Hispanic",
    asian = "Asian",
    nativeam = "Native American",
    other.race = "Other Race"
  )) %>%
  mutate(model = "IV",
         punishment = "Probation")

lfo_coef_iv <- broom::tidy(iv.ff) %>%
  filter(str_detect(term, pattern = "black|hispanic|asian|nativeam|other.race")) %>%
  relabel_predictors(c(
    black = "Black",
    hispanic = "Hispanic",
    asian = "Asian",
```

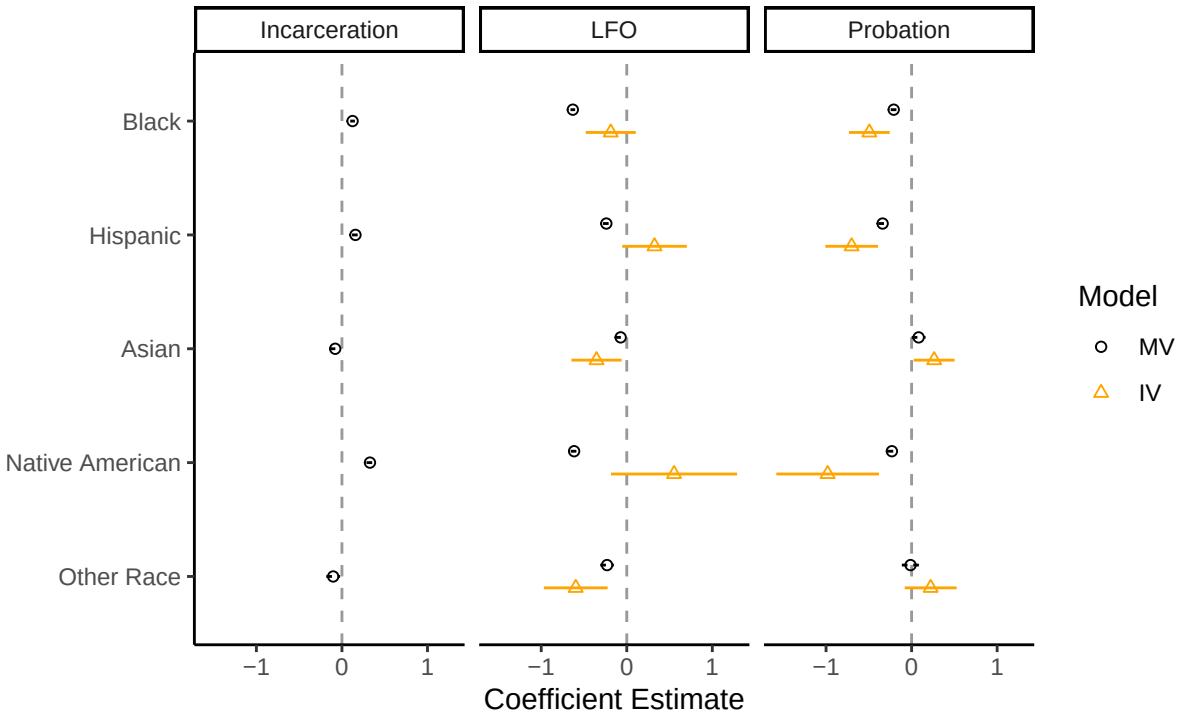
```
    nativeam = "Native American",
    other.race = "Other Race"
  )) %>%
  mutate(model = "IV",
         punishment = "LFO")

mv_coef <- rbind(conf_coef_mv,
                 prob_coef_mv,
                 lfo_coef_mv,
                 prob_coef_iv,
                 lfo_coef_iv) %>%
  mutate(model = factor(model, levels = c("MV", "IV")))

dwplot(mv_coef,
       vline = geom_vline(
         xintercept = 0,
         colour = "grey60",
         linetype = 2),
         dot_args = list(aes(shape = model)),
    whisker_args = list(aes(linetype = model))) +
  theme_classic()+
  #theme(text=element_text(family="Times New Roman"))+
facet_wrap(~punishment)+
  labs(x = "Coefficient Estimate",
       y = "",
       title = "Figure 2: Coefficient Plots for MV and IV Punishment Models",
       subtitle = "MV = Multivariate, IV = Instrumental Variable",
       caption = "Dotted line represents the referent group - White defendants.") +
  guides(shape = guide_legend("Model"),
         colour = guide_legend("Model"))+
    scale_colour_manual(
         values = c("black", "orange"),
         name = "Model",
         breaks = c("MV", "IV"),
         labels = c("MV", "IV")) +
    scale_shape_manual(
      values = c(1,2),
        name = "Model",
        breaks = c("MV", "IV"),
        labels = c("MV", "IV"))
```

Figure 2: Coefficient Plots for MV and IV Punishment Models

MV = Multivariate, IV = Instrumental Variable



Dotted line represents the referent group − White defendants.

Appendix

Robustness Models without Regional Jails

Table A1: Multivariate Model of Punishment w/o Regional Jails

```
conf_model_rj <- lm(log(conf_minus_stayed_ts+1)~
                  black+hispanic+asian+nativeam+other.race+
                  race.miss+
                  male+log(age)+
                   priors+pubdef+perc_credit+
            perc_stayed+trial_flag+
                  felony_flag+gm_flag+
                  violent_flag+drug_flag+alcohol_flag+
                  filed_district+
                  as.factor(sentence_year),
          data = monsanc.short[monsanc.short$regional_jail==0,])

prob_model_rj <- lm(log(prob_days+1)~
                   black+hispanic+asian+nativeam+other.race+
                  race.miss+
                  male+log(age)+
                   priors+pubdef+perc_credit+
```

```
           perc_stayed+trial_flag+
                 felony_flag+gm_flag+
                 violent_flag+drug_flag+alcohol_flag+
                 filed_district+
                 as.factor(sentence_year),
          data = monsanc.short[monsanc.short$regional_jail==0,])

lfo_model_rj <- lm(log(total_ff+1)~
                  black+hispanic+asian+nativeam+other.race+
                 race.miss+
                 male+log(age)+
                  priors+pubdef+perc_credit+
           perc_stayed+trial_flag+
                 felony_flag+gm_flag+
                 violent_flag+drug_flag+alcohol_flag+
                 filed_district+
                 as.factor(sentence_year),
          data = monsanc.short[monsanc.short$regional_jail==0,])
```

```
#stargazer regression table

stargazer(conf_model_rj, lfo_model_rj, prob_model_rj,
           type = "latex",
          title = "Multivariate Model of Punishment w/o Regional Jail Counties, Minnesota 2004-
          covariate.labels = c("Black", "Hispanic", "Asian",
                               "Native American", "Other Race",
                               "Missing Race", "Male", "log(Age)",
                               "Prior Convictions", "Public Defender",
                               "Percent Credit", "Percent Stayed",
                               "Trial",
                               "Felony", "Gross Misdemeanor",
                               "Violent", "Drug", "Alcohol/DUI"),
          model.numbers = FALSE,
          header = FALSE,
          dep.var.caption  = "Punishment Outcome",
          dep.var.labels = c("log(Incarceration)",
                             "log(LFO)",
                             "log(Probation)"),
          column.labels = c("Coef(SE)", "Coef(SE)", "Coef(SE)"),
          single.row = TRUE,
          font.size="footnotesize",
          no.space = T,
          column.sep.width = "1pt",
          align = TRUE,
          omit.stat = c("ser"),
          omit = c("filed_district", "sentence_year"),
          star.cutoffs = c(.05, .01, .001),
```

```
          star.char = c("*","**","***"),
          add.lines = list(c("District FE", "Yes", "Yes", "Yes"),
                           c("Sentence Year FE", "Yes", "Yes", "Yes")))
```

Table 4: Multivariate Model of Punishment w/o Regional Jail Counties, Minnesota 2004-2017

	Punishment Outcome		
	log(Incarceration) Coef(SE)	log(LFO) Coef(SE)	log(Probation) Coef(SE)
Black	0.115^{***} (0.014)	-0.630^{***} (0.014)	-0.198^{***} (0.018)
Hispanic	0.123^{***} (0.021)	-0.236^{***} (0.021)	-0.311^{***} (0.027)
Asian	-0.090^{**} (0.033)	-0.077^{*} (0.033)	0.078 (0.042)
Native American	0.351^{***} (0.021)	-0.609^{***} (0.021)	-0.222^{***} (0.026)
Other Race	-0.105^{*} (0.042)	-0.235^{***} (0.042)	0.005 (0.053)
Missing Race	-0.313^{***} (0.018)	-0.062^{***} (0.018)	0.044 (0.023)
Male	0.700^{***} (0.012)	-0.008 (0.012)	-0.592^{***} (0.015)
log(Age)	0.340^{***} (0.015)	-0.064^{***} (0.015)	-0.434^{***} (0.019)
Prior Convictions	0.070^{***} (0.001)	-0.048^{***} (0.001)	-0.048^{***} (0.002)
Public Defender	0.382^{***} (0.011)	-0.781^{***} (0.010)	-0.006 (0.013)
Percent Credit	-0.029^{***} (0.0002)	0.002^{***} (0.0002)	0.010^{***} (0.0002)
Percent Stayed	-0.019^{***} (0.0001)	0.010^{***} (0.0001)	0.019^{***} (0.0002)
Trial	2.175^{***} (0.237)	0.512^{*} (0.234)	-0.949^{**} (0.296)
Felony	0.130^{***} (0.017)	0.258^{***} (0.016)	1.166^{***} (0.021)
Gross Misdemeanor	-1.081^{***} (0.016)	0.567^{***} (0.016)	0.981^{***} (0.020)
Violent	0.392^{***} (0.014)	-0.003 (0.014)	0.289^{***} (0.018)
Drug	-0.252^{***} (0.016)	0.260^{***} (0.016)	0.935^{***} (0.021)
Alcohol/DUI	0.957^{***} (0.013)	0.529^{***} (0.012)	1.518^{***} (0.016)
Constant	1.806^{***} (0.060)	5.841^{***} (0.059)	2.528^{***} (0.075)
District FE	*Yes*	*Yes*	*Yes*
Sentence Year FE	*Yes*	*Yes*	*Yes*
Observations	183,309	183,309	183,309
R^2	0.332	0.249	0.383
Adjusted R^2	0.332	0.249	0.383
F Statistic (df = 40; 183268)	$2{,}276.849^{***}$	$1{,}521.321^{***}$	$2{,}850.065^{***}$

Note: *p<0.05; **p<0.01; ***p<0.001

Table A2: Instrumental Variable Model of Punishment w/o Regional Jails

```
#instrumental Variables Regression

#LFO
iv.ff.rj <- ivreg(total_ff_log~conf_minus_stayed_ts_log+
                  black+hispanic+asian+nativeam+other.race+
                  race.miss+
                  male+log(age)+
                   priors+pubdef+perc_credit+
                  perc_stayed+
                  trial_flag+
                  felony_flag+gm_flag+
                  violent_flag+drug_flag+alcohol_flag+
```

```
                filed_district+
                as.factor(sentence_year)|
              .-conf_minus_stayed_ts_log+cap_ratio,
            data = monsanc.short[monsanc.short$regional_jail==0,])

summary(iv.ff.rj, diagnostics=T)
```

```
##
## Call:
## ivreg(formula = total_ff_log ~ conf_minus_stayed_ts_log + black +
##     hispanic + asian + nativeam + other.race + race.miss + male +
##     log(age) + priors + pubdef + perc_credit + perc_stayed +
##     trial_flag + felony_flag + gm_flag + violent_flag + drug_flag +
##     alcohol_flag + filed_district + as.factor(sentence_year) |
##     . - conf_minus_stayed_ts_log + cap_ratio, data = monsanc.short[monsanc.short$regional_ja
##     0, ])
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -48.0596  -9.2105  -0.5517   9.2017  43.6645
##
## Coefficients:
##                               Estimate Std. Error t value Pr(>|t|)
## (Intercept)                   -4.97967    5.34452  -0.932 0.351475
## conf_minus_stayed_ts_log       5.99234    2.95285   2.029 0.042425 *
## black                         -1.32187    0.35175  -3.758 0.000171 ***
## hispanic                      -0.97379    0.38580  -2.524 0.011602 *
## asian                          0.46043    0.33398   1.379 0.168011
## nativeam                      -2.71493    1.04566  -2.596 0.009422 **
## other.race                     0.39255    0.40180   0.977 0.328578
## race.miss                      1.81438    0.93129   1.948 0.051386 .
## male                          -4.20128    2.06757  -2.032 0.042156 *
## log(age)                      -2.10251    1.00892  -2.084 0.037168 *
## priors                        -0.46494    0.20566  -2.261 0.023777 *
## pubdef                        -3.06922    1.12938  -2.718 0.006576 **
## perc_credit                    0.17848    0.08704   2.050 0.040322 *
## perc_stayed                    0.12204    0.05538   2.204 0.027532 *
## trial_flag                   -12.52082    6.58281  -1.902 0.057167 .
## felony_flag                   -0.52326    0.39819  -1.314 0.188809
## gm_flag                        7.04300    3.19274   2.206 0.027389 *
## violent_flag                  -2.35224    1.16093  -2.026 0.042749 *
## drug_flag                      1.77278    0.75220   2.357 0.018435 *
## alcohol_flag                  -5.20464    2.82648  -1.841 0.065567 .
## filed_district02             -10.47755    4.61119  -2.272 0.023075 *
## filed_district03              -2.04455    0.56759  -3.602 0.000316 ***
## filed_district04              -8.03316    3.06171  -2.624 0.008697 **
## filed_district05              -3.48787    1.52805  -2.283 0.022457 *
```

```
## filed_district06              -2.38735    0.91189  -2.618 0.008845 **
## filed_district07              -9.36750    4.40204  -2.128 0.033339 *
## filed_district08              -7.05328    3.21481  -2.194 0.028237 *
## filed_district09              -5.87765    2.64332  -2.224 0.026178 *
## filed_district10              -7.44184    3.11252  -2.391 0.016806 *
## as.factor(sentence_year)2005   0.73421    0.59457   1.235 0.216882
## as.factor(sentence_year)2006   2.42369    1.46342   1.656 0.097687 .
## as.factor(sentence_year)2007   3.65630    2.07885   1.759 0.078612 .
## as.factor(sentence_year)2008   4.65303    2.57261   1.809 0.070502 .
## as.factor(sentence_year)2009   4.92742    2.72119   1.811 0.070180 .
## as.factor(sentence_year)2010   5.32286    2.76097   1.928 0.053870 .
## as.factor(sentence_year)2011   6.50794    3.29606   1.974 0.048331 *
## as.factor(sentence_year)2012   6.55684    3.31458   1.978 0.047910 *
## as.factor(sentence_year)2013   6.38700    3.15652   2.023 0.043030 *
## as.factor(sentence_year)2014   7.47156    3.60524   2.072 0.038228 *
## as.factor(sentence_year)2015   7.35429    3.50288   2.100 0.035774 *
## as.factor(sentence_year)2016   7.94660    3.80181   2.090 0.036600 *
## as.factor(sentence_year)2017   5.52751    2.63844   2.095 0.036173 *
##
## Diagnostic tests:
##                     df1    df2 statistic p-value
## Weak instruments      1 183267     4.287  0.0384 *
## Wu-Hausman            1 183266   159.444  <2e-16 ***
## Sargan                0     NA        NA      NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 12.3 on 183267 degrees of freedom
## Multiple R-Squared: -27.6,   Adjusted R-squared: -27.6
## Wald test: 39.06 on 41 and 183267 DF,  p-value: < 2.2e-16
```

```
#Probation
iv.prob.rj <- ivreg(prob_days_log~conf_minus_stayed_ts_log+
                  black+hispanic+asian+nativeam+other.race+
                  race.miss+
                  male+log(age)+
                  priors+pubdef+perc_credit+
                  perc_stayed+
                  trial_flag+
                  felony_flag+gm_flag+
                  violent_flag+drug_flag+alcohol_flag+
                  filed_district+
                  as.factor(sentence_year)|
                .-conf_minus_stayed_ts_log+cap_ratio,
              data = monsanc.short[monsanc.short$regional_jail==0,])

summary(iv.prob.rj, diagnostics=T)
```

```
##
## Call:
## ivreg(formula = prob_days_log ~ conf_minus_stayed_ts_log + black +
##     hispanic + asian + nativeam + other.race + race.miss + male +
##     log(age) + priors + pubdef + perc_credit + perc_stayed +
##     trial_flag + felony_flag + gm_flag + violent_flag + drug_flag +
##     alcohol_flag + filed_district + as.factor(sentence_year) |
##     . - conf_minus_stayed_ts_log + cap_ratio, data = monsanc.short[monsanc.short$regional_ja
##     0, ])
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -38.164  -7.889   1.059   7.933  37.847
##
## Coefficients:
##                                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)                      12.17732    4.40167   2.767  0.00567 **
## conf_minus_stayed_ts_log         -5.34384    2.43193  -2.197  0.02800 *
## black                             0.41863    0.28970   1.445  0.14844
## hispanic                          0.34655    0.31774   1.091  0.27543
## asian                            -0.40078    0.27506  -1.457  0.14510
## nativeam                          1.65599    0.86119   1.923  0.05449 .
## other.race                       -0.55410    0.33091  -1.674  0.09404 .
## race.miss                        -1.62926    0.76700  -2.124  0.03365 *
## male                              3.14744    1.70282   1.848  0.06455 .
## log(age)                          1.38433    0.83093   1.666  0.09572 .
## priors                            0.32433    0.16938   1.915  0.05552 .
## pubdef                            2.03443    0.93014   2.187  0.02873 *
## perc_credit                      -0.14706    0.07169  -2.051  0.04022 *
## perc_stayed                      -0.08145    0.04561  -1.786  0.07412 .
## trial_flag                       10.67306    5.42151   1.969  0.04899 *
## felony_flag                       1.86256    0.32794   5.680 1.35e-08 ***
## gm_flag                          -4.79404    2.62950  -1.823  0.06828 .
## violent_flag                      2.38425    0.95613   2.494  0.01264 *
## drug_flag                        -0.41433    0.61950  -0.669  0.50361
## alcohol_flag                      6.63083    2.32785   2.848  0.00439 **
## filed_district02                  6.94553    3.79771   1.829  0.06742 .
## filed_district03                  0.73063    0.46746   1.563  0.11806
## filed_district04                  3.47869    2.52158   1.380  0.16772
## filed_district05                  2.36698    1.25848   1.881  0.06000 .
## filed_district06                  0.97323    0.75102   1.296  0.19502
## filed_district07                  7.29774    3.62546   2.013  0.04413 *
## filed_district08                  5.65881    2.64767   2.137  0.03258 *
## filed_district09                  4.51516    2.17701   2.074  0.03808 *
## filed_district10                  5.39010    2.56343   2.103  0.03549 *
## as.factor(sentence_year)2005     -0.06192    0.48968  -0.126  0.89937
## as.factor(sentence_year)2006     -1.24653    1.20525  -1.034  0.30102
## as.factor(sentence_year)2007     -1.59264    1.71211  -0.930  0.35226
```

```
## as.factor(sentence_year)2008 -1.88690    2.11877  -0.891  0.37316
## as.factor(sentence_year)2009 -2.38121    2.24114  -1.063  0.28801
## as.factor(sentence_year)2010 -2.63355    2.27390  -1.158  0.24680
## as.factor(sentence_year)2011 -2.78051    2.71459  -1.024  0.30570
## as.factor(sentence_year)2012 -2.84820    2.72984  -1.043  0.29678
## as.factor(sentence_year)2013 -2.51908    2.59966  -0.969  0.33255
## as.factor(sentence_year)2014 -3.30363    2.96923  -1.113  0.26587
## as.factor(sentence_year)2015 -3.22077    2.88492  -1.116  0.26425
## as.factor(sentence_year)2016 -3.82548    3.13112  -1.222  0.22180
## as.factor(sentence_year)2017 -2.47410    2.17298  -1.139  0.25488
##
## Diagnostic tests:
##                     df1    df2 statistic p-value
## Weak instruments      1 183267     4.287  0.0384 *
## Wu-Hausman            1 183266    74.985  <2e-16 ***
## Sargan                0     NA        NA      NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 10.13 on 183267 degrees of freedom
## Multiple R-Squared: -8.949,  Adjusted R-squared: -8.951
## Wald test: 172.4 on 41 and 183267 DF,  p-value: < 2.2e-16
```

```
stargazer(iv.ff.rj, iv.prob.rj,
          type = "latex",
          title = "IV 2SLS Models of Punishment w/o Regional Jail Counties, Minnesota 2004-201
          covariate.labels = c("log(Incarceration)",
                               "Black", "Hispanic", "Asian",
                               "Native American", "Other Race",
                               "Missing Race", "Male", "log(Age)",
                               "Prior Convictions", "Public Defender",
                               "Percent Credit", "Percent Stayed",
                               "Trial",
                               "Felony", "Gross Misdemeanor",
                               "Violent", "Drug", "Alcohol/DUI"),
          model.numbers = FALSE,
          header = FALSE,
         dep.var.caption  = "Punishment Outcome",
          dep.var.labels = c("log(LFO)",
                             "log(Probation)"),
          column.labels = c("Coef(SE)", "Coef(SE)"),
          single.row = TRUE,
          font.size="footnotesize",
          no.space = T,
          column.sep.width = "1pt",
          align = TRUE,
          omit = c("filed_district", "sentence_year"),
          omit.stat = c("adj.rsq", "rsq", "ser"),
```

```
        star.cutoffs = c(.05, .01, .001),
        star.char = c("*","**","***"),
        add.lines = list(c("District FE", "Yes", "Yes", "Yes"),
                         c("Sentence Year FE", "Yes", "Yes", "Yes"),
                         c("IV F(Incar.)", "4.29^{*}", "4.29^{*}"),
                         c("IV Wu-Hausman", "159.444^{***}",
                           "74.99^{***}")),
        notes = "IV: County-Level Jail Capacity Ratio")
```

Table 5: IV 2SLS Models of Punishment w/o Regional Jail Counties, Minnesota 2004-2017

	Punishment Outcome	
	log(LFO) Coef(SE)	log(Probation) Coef(SE)
log(Incarceration)	5.992* (2.953)	−5.344* (2.432)
Black	−1.322*** (0.352)	0.419 (0.290)
Hispanic	−0.974* (0.386)	0.347 (0.318)
Asian	0.460 (0.334)	−0.401 (0.275)
Native American	−2.715** (1.046)	1.656 (0.861)
Other Race	0.393 (0.402)	−0.554 (0.331)
Missing Race	1.814 (0.931)	−1.629* (0.767)
Male	−4.201* (2.068)	3.147 (1.703)
log(Age)	−2.103* (1.009)	1.384 (0.831)
Prior Convictions	−0.465* (0.206)	0.324 (0.169)
Public Defender	−3.069** (1.129)	2.034* (0.930)
Percent Credit	0.178* (0.087)	−0.147* (0.072)
Percent Stayed	0.122* (0.055)	−0.081 (0.046)
Trial	−12.521 (6.583)	10.673* (5.422)
Felony	−0.523 (0.398)	1.863*** (0.328)
Gross Misdemeanor	7.043* (3.193)	−4.794 (2.629)
Violent	−2.352* (1.161)	2.384* (0.956)
Drug	1.773* (0.752)	−0.414 (0.620)
Alcohol/DUI	−5.205 (2.826)	6.631** (2.328)
Constant	−4.980 (5.345)	12.177** (4.402)
District FE	*Yes*	*Yes*
Sentence Year FE	*Yes*	*Yes*
IV F(Incar.)	4.29*	4.29*
IV Wu-Hausman	159.444***	74.99***
Observations	183,309	183,309

Note: *p<0.05; **p<0.01; ***p<0.001
IV: County-Level Jail Capacity Ratio