Data Analysis of Racial Patterns in the 2016 Election

There has long been suspicion that restrictive election laws have been creating a discriminatory environment. We now have a comprehensive data file of county-level election results.

The goal here is to combine the county-level election results with county-level demographics data to see if we can identify meaningful patterns of discrimination.

Target Variable

We use voting percent = (number of people voting in a county)/(population of the county). We cap this (and other percentages) at 1 to keep anomalies from making modeling impossible.

We regress voting percentage against

- White percentage
- Black percentage
- Asian percentage
- Native (American Indian, Hawaiian, Other) percentage
- Multiracial percentage
- Other Race percentage

First Result: No Interactions

```
Call:
lm(formula = voteperc ~ blackperc + asianperc + multiperc + nativeperc +
    otherperc, data = data1)

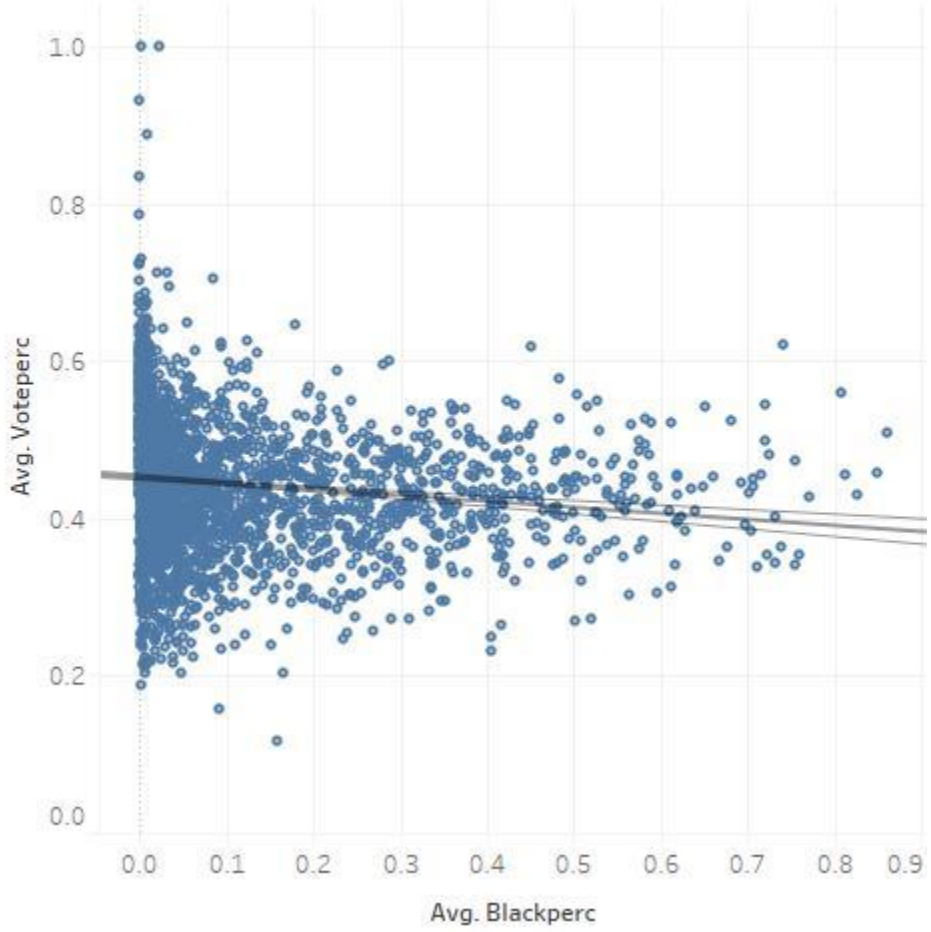
Residuals:
     Min       1Q   Median       3Q      Max
-0.30101 -0.04826 -0.00173  0.04555  0.63311

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.480770   0.002337 205.709  < 2e-16 ***
blackperc   -0.098275   0.009308 -10.558  < 2e-16 ***
asianperc    0.155636   0.054762   2.842  0.00451 **
multiperc   -0.420410   0.078515  -5.355  9.2e-08 ***
nativeperc  -0.194934   0.018793 -10.372  < 2e-16 ***
otherperc   -0.757864   0.038696 -19.585  < 2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

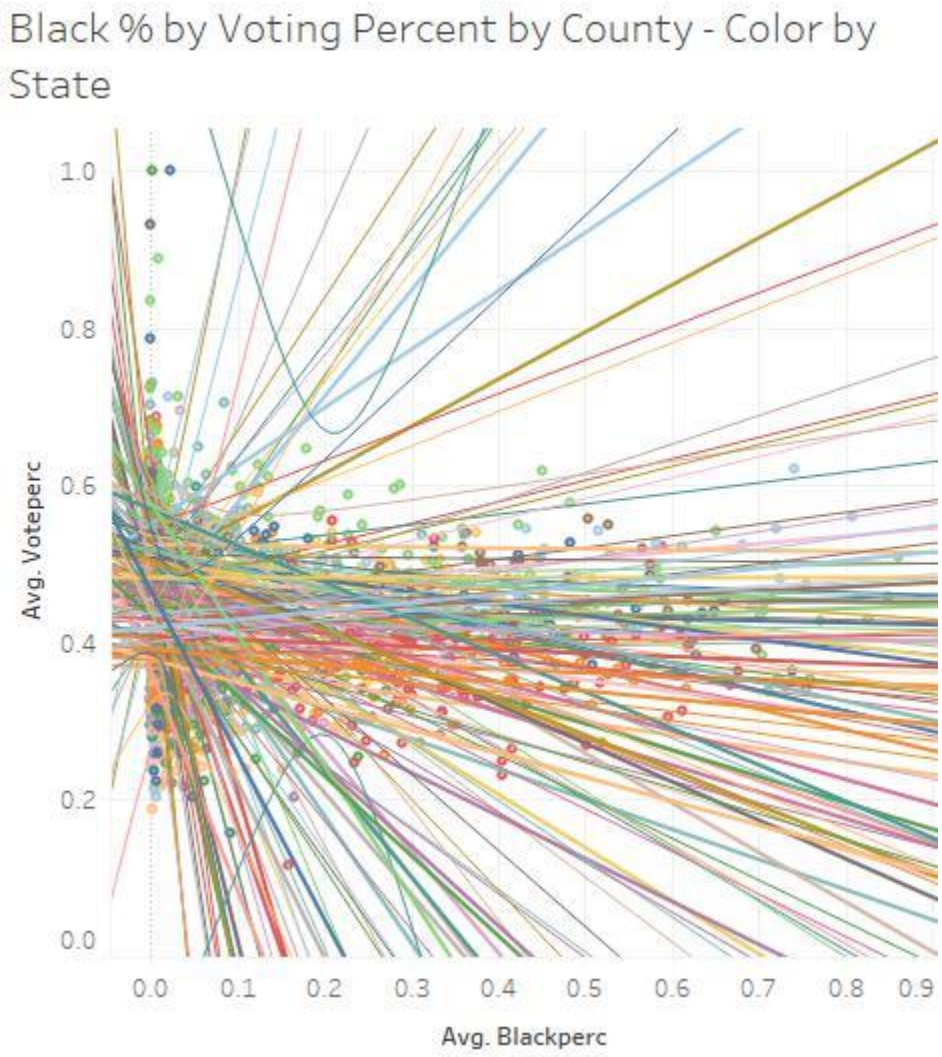
Residual standard error: 0.07459 on 3135 degrees of freedom
Multiple R-squared:  0.1722,  Adjusted R-squared:  0.1709
F-statistic: 130.5 on 5 and 3135 DF,  p-value: < 2.2e-16
```

This is as expected. Note that the racial percentages will add to 100%, so we need to leave one variable out.

Black % by Voting Percent by County



Adding the State Interaction



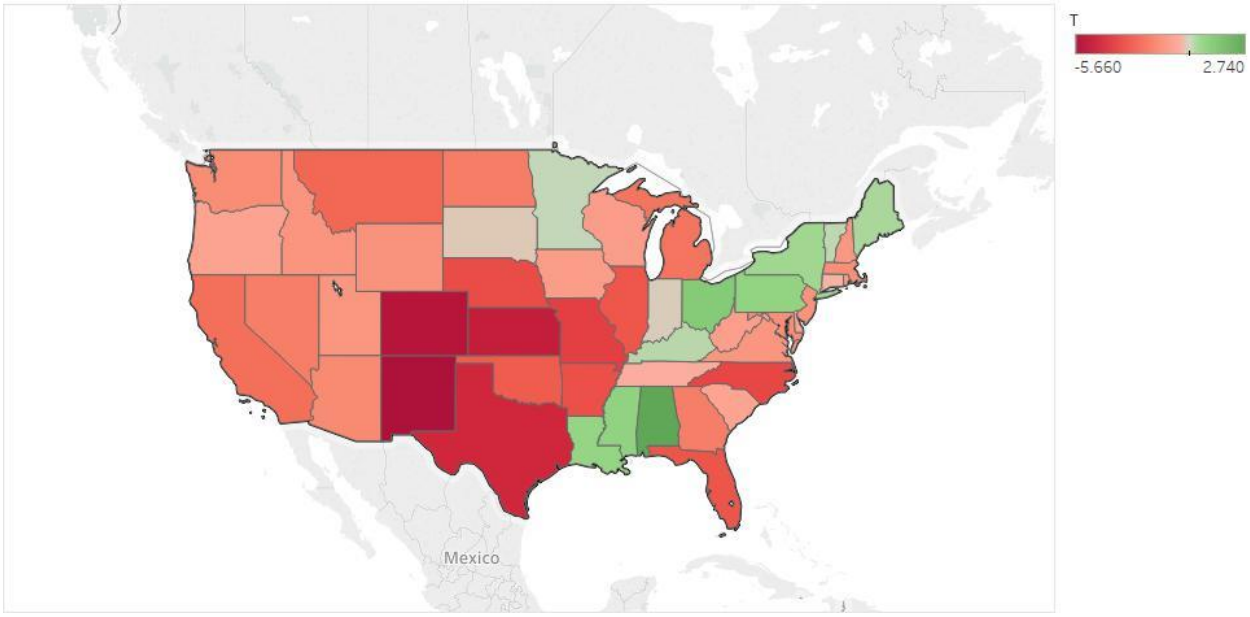
We add a state interaction with the blackperc variable. We save the full report for an appendix, But here we note that

- R2 goes from 0.17 to 0.50
- A number of States have significant interactions:

Bad	Good
AK	AL
AR	
CO	
DE	
FL	
IL	
KS	
MO	
MT	
NC	
NE	
NM	
OK	

TX	

State Effects T-Values : Red is Stong Negative Green is Strong Positive



Political Patterns

We look at the party of the current governor of each state as a variable. We take out AK from this analysis, because AK has the only independent governor and including it makes the D/R comparison harder.

R governors tend to have lower voting rates overall, but there is no interaction with the Black percentage in a county,

```
Call:
lm(formula = voteperc ~ govF * blackperc + asianperc + multiperc +
    nativeperc + otherperc, data = data2_noAK)

Residuals:
     Min       1Q   Median       3Q      Max
-0.28030 -0.04585  0.00006  0.04363  0.53869

Coefficients:
                 Estimate Std. Error t value Pr(>|t|)
(Intercept)      0.511150   0.003527 144.916  < 2e-16 ***
govFR           -0.035881   0.003508 -10.229  < 2e-16 ***
blackperc       -0.086505   0.017489  -4.946 7.98e-07 ***
asianperc        0.139503   0.057212   2.438   0.0148 *
multiperc       -0.629531   0.078409  -8.029 1.39e-15 ***
nativeperc      -0.196985   0.020856  -9.445  < 2e-16 ***
otherperc       -0.749056   0.037103 -20.188  < 2e-16 ***
govFR:blackperc -0.019859   0.020255  -0.980   0.3269
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.07118 on 3086 degrees of freedom
Multiple R-squared:  0.2227,   Adjusted R-squared:  0.2209
F-statistic: 126.3 on 7 and 3086 DF,  p-value: < 2.2e-16
```

Next Steps

There is a lot more that can be done to understand voting patterns. For a start, economic variables like unemployment could figure in. It also looks like Age 65+ has a strong positive effect on voting rates. It may also be worth including Hispanic populations as well. Note that the Age 65+ and Hispanic population variables break the MECE (mutually exclusive completely exhaustive) population breakdown, so parameter interpretation becomes trickier.

Beyond pure analytic work, there is the effort to understand what policies could be driving disparate outcomes.

==Ed Freeman
== Seattle April 2017 Hackathon

State Models

```
Call:
lm(formula = voteperc ~ StateF * blackperc + asianperc + multiperc +
    nativeperc + otherperc, data = data1)

Residuals:
     Min       1Q   Median       3Q      Max
-0.26473 -0.03208 -0.00089  0.03059  0.59703

Coefficients: (1 not defined because of singularities)
                    Estimate Std. Error t value Pr(>|t|)
(Intercept)         0.601899   0.015809  38.073  < 2e-16 ***
StateFAL           -0.166100   0.019183  -8.659  < 2e-16 ***
StateFAR           -0.190278   0.017771 -10.707  < 2e-16 ***
StateFAZ           -0.111422   0.027912  -3.992 6.71e-05 ***
StateFCA           -0.115759   0.018513  -6.253 4.59e-10 ***
StateFCO            0.003192   0.017599   0.181 0.856076
StateFCT           -0.087115   0.040535  -2.149 0.031703 *
StateFDC            1.360996   0.268885   5.062 4.40e-07 ***
StateFDE           -0.013640   0.132023  -0.103 0.917717
StateFFL           -0.065704   0.020218  -3.250 0.001167 **
StateFGA           -0.173398   0.017644  -9.828  < 2e-16 ***
StateFHI           -0.139548   0.054613  -2.555 0.010660 *
StateFIA           -0.075990   0.017201  -4.418 1.03e-05 ***
StateFID           -0.131158   0.018789  -6.981 3.59e-12 ***
StateFIL           -0.119372   0.017048  -7.002 3.09e-12 ***
StateFIN           -0.168352   0.017006  -9.900  < 2e-16 ***
StateFKS           -0.135863   0.016578  -8.195 3.64e-16 ***
StateFKY           -0.167237   0.017055  -9.805  < 2e-16 ***
StateFLA           -0.155370   0.023382  -6.645 3.58e-11 ***
StateFMA           -0.013154   0.028815  -0.457 0.648062
StateFMD           -0.085015   0.024267  -3.503 0.000466 ***
StateFME           -0.044170   0.028440  -1.553 0.120504
StateFMI           -0.088764   0.016999  -5.222 1.89e-07 ***
StateFMN           -0.061655   0.017135  -3.598 0.000326 ***
StateFMO           -0.127489   0.016503  -7.725 1.51e-14 ***
StateFMS           -0.173285   0.021085  -8.219 3.02e-16 ***
StateFMT           -0.048649   0.017935  -2.713 0.006715 **
StateFNC           -0.074703   0.017904  -4.173 3.10e-05 ***
StateFND           -0.062054   0.018177  -3.414 0.000649 ***
StateFNE           -0.088755   0.016773  -5.291 1.30e-07 ***
StateFNH           -0.009419   0.039681  -0.237 0.812392
StateFNJ           -0.094848   0.026825  -3.536 0.000413 ***
StateFNM           -0.033816   0.021212  -1.594 0.110990
StateFNV           -0.093464   0.023794  -3.928 8.75e-05 ***
StateFNY           -0.154652   0.018423  -8.395  < 2e-16 ***
StateFOH           -0.138030   0.017189  -8.030 1.38e-15 ***
StateFOK           -0.137469   0.017062  -8.057 1.11e-15 ***
StateFOR           -0.049203   0.020077  -2.451 0.014312 *
StateFPA           -0.142613   0.017716  -8.050 1.18e-15 ***
StateFRI           -0.066253   0.041661  -1.590 0.111878
StateFSC           -0.135458   0.025873  -5.235 1.76e-07 ***
StateFSD           -0.097240   0.017042  -5.706 1.27e-08 ***
StateFTN           -0.209341   0.016910 -12.379  < 2e-16 ***
StateFTX           -0.175020   0.016160 -10.830  < 2e-16 ***
StateFUT           -0.134462   0.023565  -5.706 1.27e-08 ***
StateFVA           -0.099972   0.017065  -5.858 5.18e-09 ***
StateFVT           -0.097587   0.031676  -3.081 0.002083 **
StateFWA           -0.072338   0.019703  -3.671 0.000245 ***
StateFWI           -0.070702   0.017008  -4.157 3.31e-05 ***
StateFWV           -0.205659   0.018860 -10.904  < 2e-16 ***
StateFWY           -0.094368   0.022429  -4.207 2.66e-05 ***
blackperc          -2.962258   0.553110  -5.356 9.16e-08 ***
asianperc           0.060153   0.057058   1.054 0.291855
multiperc          -0.265798   0.086308  -3.080 0.002091 **
nativeperc         -0.306214   0.017127 -17.879  < 2e-16 ***
otherperc          -0.628229   0.036799 -17.072  < 2e-16 ***
StateFAL:blackperc  3.050901   0.554025   5.507 3.96e-08 ***
StateFAR:blackperc  2.836889   0.554525   5.116 3.32e-07 ***
StateFAZ:blackperc  1.441936   1.103297   1.307 0.191334
StateFCA:blackperc  2.335451   0.594792   3.927 8.81e-05 ***
StateFCO:blackperc  1.381625   0.624306   2.213 0.026968 *
StateFCT:blackperc  2.779815   0.714365   3.891 0.000102 ***
StateFDC:blackperc        NA         NA      NA       NA
StateFDE:blackperc  2.506568   0.829691   3.021 0.002540 **
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StateFFL:blackperc  2.720623   0.558429   4.872 1.16e-06 ***
StateFGA:blackperc  2.909332   0.553757   5.254 1.59e-07 ***
StateFHI:blackperc -0.907335   3.493471  -0.260 0.795095
StateFIA:blackperc  2.591609   0.665708   3.893 0.000101 ***
StateFID:blackperc  0.647801   1.949096   0.332 0.739641
StateFIL:blackperc  2.703600   0.558542   4.840 1.36e-06 ***
StateFIN:blackperc  2.945200   0.569355   5.173 2.46e-07 ***
StateFKS:blackperc  2.071985   0.579349   3.576 0.000354 ***
StateFKY:blackperc  2.988463   0.566748   5.273 1.44e-07 ***
StateFLA:blackperc  2.994781   0.555527   5.391 7.55e-08 ***
StateFMA:blackperc  2.520733   0.629099   4.007 6.30e-05 ***
StateFMD:blackperc  2.854162   0.557563   5.119 3.26e-07 ***
StateFME:blackperc  3.840612   2.634748   1.458 0.145033
StateFMI:blackperc  2.730298   0.561458   4.863 1.22e-06 ***
StateFMN:blackperc  2.992235   0.628960   4.757 2.05e-06 ***
StateFMO:blackperc  2.647387   0.558802   4.738 2.26e-06 ***
StateFMS:blackperc  2.986231   0.554027   5.390 7.58e-08 ***
StateFMT:blackperc -3.663576   2.582300  -1.419 0.156082
StateFNC:blackperc  2.834274   0.554322   5.113 3.37e-07 ***
StateFND:blackperc  0.739427   1.228419   0.602 0.547263
StateFNE:blackperc  1.662568   0.669862   2.482 0.013120 *
StateFNH:blackperc -0.628419   3.186119  -0.197 0.843656
StateFNJ:blackperc  2.776179   0.572569   4.849 1.31e-06 ***
StateFNM:blackperc -1.434854   0.951884  -1.507 0.131817
StateFNV:blackperc  1.860148   0.776299   2.396 0.016627 *
StateFNY:blackperc  3.013134   0.559855   5.382 7.93e-08 ***
StateFOH:blackperc  3.090985   0.562925   5.491 4.33e-08 ***
StateFOK:blackperc  2.413537   0.583195   4.138 3.59e-05 ***
StateFOR:blackperc  2.051911   1.255129   1.635 0.102190
StateFPA:blackperc  3.039125   0.561481   5.413 6.69e-08 ***
StateFRI:blackperc  2.177831   0.991878   2.196 0.028191 *
StateFSC:blackperc  2.921635   0.555916   5.256 1.58e-07 ***
StateFSD:blackperc  2.801388   1.084351   2.583 0.009828 **
StateFTN:blackperc  2.934447   0.555754   5.280 1.38e-07 ***
StateFTX:blackperc  2.709600   0.554839   4.884 1.10e-06 ***
StateFUT:blackperc -0.580180   2.929968  -0.198 0.843046
StateFVA:blackperc  2.924394   0.554415   5.275 1.42e-07 ***
StateFVT:blackperc  3.402212   3.126756   1.088 0.276639
StateFWA:blackperc  1.938870   0.848941   2.284 0.022448 *
StateFWI:blackperc  2.762712   0.588514   4.694 2.79e-06 ***
StateFWV:blackperc  2.672056   0.635525   4.204 2.69e-05 ***
StateFWY:blackperc  0.424369   1.988287   0.213 0.831002
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.05878 on 3036 degrees of freedom
Multiple R-squared:  0.5022,  Adjusted R-squared:  0.4851
F-statistic: 29.45 on 104 and 3036 DF,  p-value: < 2.2e-16

m2a<-lm(formula = voteperc ~ StateF*blackperc + asianperc + multiperc + nativeperc +
    otherperc - blackperc  , data = data1)


Call:
lm(formula = voteperc ~ StateAbbr * blackperc + asianperc + multiperc +
    nativeperc + otherperc - blackperc, data = data1)

Residuals:
     Min       1Q   Median       3Q      Max
-0.26473 -0.03208 -0.00089  0.03059  0.59703

Coefficients: (1 not defined because of singularities)
                     Estimate Std. Error t value Pr(>|t|)
(Intercept)          0.601899   0.015809  38.073  < 2e-16 ***
StateAbbrAL         -0.166100   0.019183  -8.659  < 2e-16 ***
StateAbbrAR         -0.190278   0.017771 -10.707  < 2e-16 ***
StateAbbrAZ         -0.111422   0.027912  -3.992 6.71e-05 ***
StateAbbrCA         -0.115759   0.018513  -6.253 4.59e-10 ***
StateAbbrCO          0.003192   0.017599   0.181 0.856076
StateAbbrCT         -0.087115   0.040535  -2.149 0.031703 *
StateAbbrDC         -0.086758   0.060704  -1.429 0.153050
StateAbbrDE         -0.013640   0.132023  -0.103 0.917717
```

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StateAbbrFL           -0.065704   0.020218  -3.250 0.001167 **
StateAbbrGA           -0.173398   0.017644  -9.828  < 2e-16 ***
StateAbbrHI           -0.139548   0.054613  -2.555 0.010660 *
StateAbbrIA           -0.075990   0.017201  -4.418 1.03e-05 ***
StateAbbrID           -0.131158   0.018789  -6.981 3.59e-12 ***
StateAbbrIL           -0.119372   0.017048  -7.002 3.09e-12 ***
StateAbbrIN           -0.168352   0.017006  -9.900  < 2e-16 ***
StateAbbrKS           -0.135863   0.016578  -8.195 3.64e-16 ***
StateAbbrKY           -0.167237   0.017055  -9.805  < 2e-16 ***
StateAbbrLA           -0.155370   0.023382  -6.645 3.58e-11 ***
StateAbbrMA           -0.013154   0.028815  -0.457 0.648062
StateAbbrMD           -0.085015   0.024267  -3.503 0.000466 ***
StateAbbrME           -0.044170   0.028440  -1.553 0.120504
StateAbbrMI           -0.088764   0.016999  -5.222 1.89e-07 ***
StateAbbrMN           -0.061655   0.017135  -3.598 0.000326 ***
StateAbbrMO           -0.127489   0.016503  -7.725 1.51e-14 ***
StateAbbrMS           -0.173285   0.021085  -8.219 3.02e-16 ***
StateAbbrMT           -0.048649   0.017935  -2.713 0.006715 **
StateAbbrNC           -0.074703   0.017904  -4.173 3.10e-05 ***
StateAbbrND           -0.062054   0.018177  -3.414 0.000649 ***
StateAbbrNE           -0.088755   0.016773  -5.291 1.30e-07 ***
StateAbbrNH           -0.009419   0.039681  -0.237 0.812392
StateAbbrNJ           -0.094848   0.026825  -3.536 0.000413 ***
StateAbbrNM           -0.033816   0.021212  -1.594 0.110990
StateAbbrNV           -0.093464   0.023794  -3.928 8.75e-05 ***
StateAbbrNY           -0.154652   0.018423  -8.395  < 2e-16 ***
StateAbbrOH           -0.138030   0.017189  -8.030 1.38e-15 ***
StateAbbrOK           -0.137469   0.017062  -8.057 1.11e-15 ***
StateAbbrOR           -0.049203   0.020077  -2.451 0.014312 *
StateAbbrPA           -0.142613   0.017716  -8.050 1.18e-15 ***
StateAbbrRI           -0.066253   0.041661  -1.590 0.111878
StateAbbrSC           -0.135458   0.025873  -5.235 1.76e-07 ***
StateAbbrSD           -0.097240   0.017042  -5.706 1.27e-08 ***
StateAbbrTN           -0.209341   0.016910 -12.379  < 2e-16 ***
StateAbbrTX           -0.175020   0.016160 -10.830  < 2e-16 ***
StateAbbrUT           -0.134462   0.023565  -5.706 1.27e-08 ***
StateAbbrVA           -0.099972   0.017065  -5.858 5.18e-09 ***
StateAbbrVT           -0.097587   0.031676  -3.081 0.002083 **
StateAbbrWA           -0.072338   0.019703  -3.671 0.000245 ***
StateAbbrWI           -0.070702   0.017008  -4.157 3.31e-05 ***
StateAbbrWV           -0.205659   0.018860 -10.904  < 2e-16 ***
StateAbbrWY           -0.094368   0.022429  -4.207 2.66e-05 ***
asianperc              0.060153   0.057058   1.054 0.291855
multiperc             -0.265798   0.086308  -3.080 0.002091 **
nativeperc            -0.306214   0.017127 -17.879  < 2e-16 ***
otherperc             -0.628229   0.036799 -17.072  < 2e-16 ***
StateAbbrAK:blackperc -2.962258   0.553110  -5.356 9.16e-08 ***
StateAbbrAL:blackperc  0.088644   0.032392   2.737 0.006244 **
StateAbbrAR:blackperc -0.125369   0.038485  -3.258 0.001136 **
StateAbbrAZ:blackperc -1.520322   0.962069  -1.580 0.114151
StateAbbrCA:blackperc -0.626807   0.263792  -2.376 0.017556 *
StateAbbrCO:blackperc -1.580633   0.293556  -5.384 7.82e-08 ***
StateAbbrCT:blackperc -0.182442   0.456137  -0.400 0.689205
StateAbbrDC:blackperc        NA         NA      NA       NA
StateAbbrDE:blackperc -0.455689   0.621118  -0.734 0.463213
StateAbbrFL:blackperc -0.241635   0.076990  -3.138 0.001714 **
StateAbbrGA:blackperc -0.052925   0.026750  -1.979 0.047960 *
StateAbbrHI:blackperc -3.869593   3.467589  -1.116 0.264540
StateAbbrIA:blackperc -0.370648   0.379407  -0.977 0.328689
StateAbbrID:blackperc -2.314456   1.873106  -1.236 0.216694
StateAbbrIL:blackperc -0.258658   0.084680  -3.055 0.002274 **
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StateAbbrIN:blackperc -0.017058   0.139605  -0.122 0.902759
StateAbbrKS:blackperc -0.890272   0.180496  -4.932 8.56e-07 ***
StateAbbrKY:blackperc  0.026205   0.127391   0.206 0.837033
StateAbbrLA:blackperc  0.032523   0.051076   0.637 0.524333
StateAbbrMA:blackperc -0.441524   0.305690  -1.444 0.148743
StateAbbrMD:blackperc -0.108095   0.073014  -1.480 0.138853
StateAbbrME:blackperc  0.878355   2.577652   0.341 0.733310
StateAbbrMI:blackperc -0.231959   0.104247  -2.225 0.026148 *
StateAbbrMN:blackperc  0.029978   0.322450   0.093 0.925935
StateAbbrMO:blackperc -0.314871   0.084481  -3.727 0.000197 ***
StateAbbrMS:blackperc  0.023974   0.031518   0.761 0.446926
StateAbbrMT:blackperc -6.625834   2.524725  -2.624 0.008724 **
StateAbbrNC:blackperc -0.127984   0.036334  -3.522 0.000434 ***
StateAbbrND:blackperc -2.222830   1.103144  -2.015 0.043993 *
StateAbbrNE:blackperc -1.299690   0.383729  -3.387 0.000716 ***
StateAbbrNH:blackperc -3.590676   3.139958  -1.144 0.252904
StateAbbrNJ:blackperc -0.186079   0.146202  -1.273 0.203202
StateAbbrNM:blackperc -4.397112   0.777141  -5.658 1.67e-08 ***
StateAbbrNV:blackperc -1.102110   0.554148  -1.989 0.046809 *
StateAbbrNY:blackperc  0.050876   0.116686   0.436 0.662861
StateAbbrOH:blackperc  0.128728   0.110992   1.160 0.246224
StateAbbrOK:blackperc -0.548721   0.188452  -2.912 0.003621 **
StateAbbrOR:blackperc -0.910347   1.137237  -0.800 0.423489
StateAbbrPA:blackperc  0.076868   0.107730   0.714 0.475575
StateAbbrRI:blackperc -0.784427   0.825807  -0.950 0.342243
StateAbbrSC:blackperc -0.040623   0.053020  -0.766 0.443631
StateAbbrSD:blackperc -0.160870   0.938968  -0.171 0.863979
StateAbbrTN:blackperc -0.027811   0.057534  -0.483 0.628864
StateAbbrTX:blackperc -0.252658   0.055820  -4.526 6.23e-06 ***
StateAbbrUT:blackperc -3.542438   2.882350  -1.229 0.219163
StateAbbrVA:blackperc -0.037863   0.031158  -1.215 0.224385
StateAbbrVT:blackperc  0.439954   3.081397   0.143 0.886475
StateAbbrWA:blackperc -1.023387   0.665587  -1.538 0.124258
StateAbbrWI:blackperc -0.199546   0.206248  -0.968 0.333369
StateAbbrWV:blackperc -0.290201   0.314584  -0.922 0.356346
StateAbbrWY:blackperc -2.537888   1.911318  -1.328 0.184337
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Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.05878 on 3036 degrees of freedom
Multiple R-squared:  0.5022, Adjusted R-squared:  0.4851
F-statistic: 29.45 on 104 and 3036 DF,  p-value: < 2.2e-16
```