```r
library(VIM)
```

```
## Loading required package: colorspace
```

```
## Loading required package: grid
```

```
## VIM is ready to use.
```

```
## Suggestions and bug-reports can be submitted at: https://github.com/statistikat/VIM/issues
```

```
##
## Attaching package: 'VIM'
```

```
## The following object is masked from 'package:datasets':
##
##     sleep
```

```r
library(stats)
library(labelled) # Used to remove value labels
library(mice) # Used to impute data
```

```
##
## Attaching package: 'mice'
```

```
## The following object is masked from 'package:stats':
##
##     filter
```

```
## The following objects are masked from 'package:base':
##
##     cbind, rbind
```

```r
## Abridged dataset with relevant columns
# abdata <- data[c('maeduc', 'paeduc', 'educ', 'paocc10', 'sibs', 'incom16', 'family16', 'race', 'sex',
abdata <- read.csv('filtered_data.csv')
abdata$mobility <- ifelse(abdata$maeduc < abdata$paeduc, abdata$educ - abdata$paeduc, abdata$educ - abda
abdata$pared <- ifelse(abdata$maeduc < abdata$paeduc, abdata$paeduc, abdata$maeduc) ## Higher education
abdata$race <- ifelse(abdata$race == 1, 0, 1) ## Set race to be White as 0, black or other POC as 1
abdata$attain <- ifelse(abdata$educ >= 13, 1, 0)
non_impute <- na.omit(abdata) ## Used for linear analysis

imputed <- read.csv("imputed_data.csv") ## Used for causal analysis
imputed$mobility <- ifelse(imputed$maeduc < imputed$paeduc, imputed$educ - imputed$paeduc, imputed$educ
imputed$pared <- ifelse(imputed$maeduc < imputed$paeduc, imputed$paeduc, imputed$maeduc) ## Higher educ
imputed$race <- ifelse(imputed$race == 1, 0, 1) ## Set race to be White as 0, black or other POC as 1
imputed$attain <- ifelse(imputed$educ >= 13, 1, 0)
```

```r
## Form terciles for parental education, ** FOR JUST NON-IMPUTED DATA **
low_thresh <- quantile(non_impute$pared, 0.33)
high_thresh <- quantile(non_impute$pared, 0.66)

low_dat_non <- subset(non_impute, pared < low_thresh)
med_dat_non <- subset(non_impute, pared >= low_thresh & pared <= high_thresh)
high_dat_non <- subset(non_impute, pared > high_thresh)

## Get sizes of the corresponding datasets
nrow(low_dat_non)
```

```
## [1] 7699
```

```r
nrow(med_dat_non)
```

```
## [1] 9977
```

```r
nrow(high_dat_non)
```

```
## [1] 8419
```

```r
## Form terciles for parental education, ** FOR JUST IMPUTED DATA **
low_thresh <- quantile(imputed$pared, 0.33)
high_thresh <- quantile(imputed$pared, 0.66)

low_dat <- subset(imputed, pared < low_thresh)
med_dat <- subset(imputed, pared >= low_thresh & pared <= high_thresh)
high_dat <- subset(imputed, pared > high_thresh)

## Get sizes of the corresponding datasets
nrow(low_dat)
```

```
## [1] 15062
```

```r
nrow(med_dat)
```

```
## [1] 19120
```

```r
nrow(high_dat)
```

```
## [1] 15509
```

```r
## Form cohorts
cohort1940 = subset(imputed, cohort >= 1940 & cohort < 1948)
cohort1948 = subset(imputed, cohort >= 1948 & cohort < 1956)
cohort1956 = subset(imputed, cohort >= 1956 & cohort < 1964)
cohort1964 = subset(imputed, cohort >= 1964 & cohort < 1972)
cohort1972 = subset(imputed, cohort >= 1972 & cohort < 1980)
cohort1980 = subset(imputed, cohort >= 1980 & cohort < 1988)
```

```r
cohort1988 = subset(imputed, cohort >= 1988)

## Sizes of each cohort
nrow(cohort1940)
```

```
## [1] 7099
```

```r
nrow(cohort1948)
```

```
## [1] 9008
```

```r
nrow(cohort1956)
```

```
## [1] 9209
```

```r
nrow(cohort1964)
```

```
## [1] 6256
```

```r
nrow(cohort1972)
```

```
## [1] 4130
```

```r
nrow(cohort1980)
```

```
## [1] 2487
```

```r
nrow(cohort1988)
```

```
## [1] 1045
```

```r
## Linear Analysis - replicate Table 3 here and Appendix Tables 1 and 2

## Models to replicate Table 3 here
## Full Model 1
total_model1 <- lm(mobility ~ race + sex + race:sex, data = non_impute)
summary(total_model1)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex, data = non_impute)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -17.5563  -1.5563  -0.3907   2.4437  17.8542
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.72179    0.07370  23.363  < 2e-16 ***
## race        -0.25119    0.19185  -1.309 0.190451
## sex         -0.16553    0.04571  -3.621 0.000294 ***
## race:sex     0.50311    0.11684   4.306 1.67e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.386 on 26091 degrees of freedom
## Multiple R-squared:  0.004111,   Adjusted R-squared:  0.003997
## F-statistic:  35.9 on 3 and 26091 DF,  p-value: < 2.2e-16
```

```r
## Full Model 2
total_model2 <- lm(mobility ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16, data
summary(total_model2)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16, data = non_impute)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -14.9957  -1.6549  -0.1904   1.5913  11.9776
##
## Coefficients:
##               Estimate Std. Error  t value Pr(>|t|)
## (Intercept)  9.926e+00  1.029e-01   96.457  < 2e-16 ***
## race        -6.415e-01  1.435e-01   -4.471 7.81e-06 ***
## sex         -2.116e-01  3.410e-02   -6.205 5.56e-10 ***
## pared       -6.427e-01  4.670e-03 -137.638  < 2e-16 ***
## paocc10     -2.896e-05  4.918e-06   -5.889 3.92e-09 ***
## family16    -7.089e-02  1.534e-02   -4.623 3.80e-06 ***
## sibs        -1.620e-01  5.861e-03  -27.645  < 2e-16 ***
## incom16      1.702e-01  2.027e-02    8.397  < 2e-16 ***
## race:sex     5.111e-01  8.714e-02    5.865 4.53e-09 ***
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.525 on 26086 degrees of freedom
## Multiple R-squared:  0.4463, Adjusted R-squared:  0.4461
## F-statistic:  2628 on 8 and 26086 DF,  p-value: < 2.2e-16
```

```
## Full Model 3
total_model3 <- lm(mobility ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16 + coh
summary(total_model3)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16 + cohort + I(cohort^2) + race:cohort +
##     race:I(cohort^2) + sex:cohort + sex:I(cohort^2) + race:sex:cohort +
##     race:sex:I(cohort^2), data = non_impute)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -15.1022  -1.6585  -0.1738   1.5728  11.6422
##
## Coefficients:
##                          Estimate Std. Error  t value Pr(>|t|)
## (Intercept)          -3.750e+03  5.467e+02   -6.859 7.10e-12 ***
## race                 -3.294e+03  1.427e+03   -2.308   0.0210 *
## sex                   1.383e+03  3.393e+02    4.076 4.60e-05 ***
## pared                -6.681e-01  4.973e-03 -134.336  < 2e-16 ***
## paocc10              -3.717e-05  4.896e-06   -7.592 3.25e-14 ***
## family16             -6.881e-02  1.526e-02   -4.510 6.50e-06 ***
## sibs                 -1.628e-01  5.831e-03  -27.924  < 2e-16 ***
## incom16               1.811e-01  2.012e-02    9.002  < 2e-16 ***
## cohort                3.871e+00  5.608e-01    6.903 5.21e-12 ***
## I(cohort^2)          -9.962e-04  1.438e-04   -6.928 4.36e-12 ***
## race:sex              3.027e+01  8.721e+02    0.035   0.9723
## race:cohort           3.337e+00  1.461e+00    2.284   0.0224 *
## race:I(cohort^2)     -8.452e-04  3.739e-04   -2.260   0.0238 *
## sex:cohort           -1.434e+00  3.480e-01   -4.121 3.78e-05 ***
## sex:I(cohort^2)       3.718e-04  8.924e-05    4.166 3.11e-05 ***
## race:sex:cohort      -1.707e-02  8.928e-01   -0.019   0.9847
## race:sex:I(cohort^2)  9.158e-07  2.285e-04    0.004   0.9968
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.504 on 26078 degrees of freedom
## Multiple R-squared:  0.4558, Adjusted R-squared:  0.4554
## F-statistic:  1365 on 16 and 26078 DF,  p-value: < 2.2e-16
```

```
## Full Model 4
total_model4 <- lm(mobility ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16 + coh
summary(total_model4)
```

```
##
## Call:
```

```
## lm(formula = mobility ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16 + cohort + I(cohort^2) + race:cohort +
##     race:I(cohort^2) + sex:cohort + sex:I(cohort^2) + race:sex:cohort +
##     race:sex:I(cohort^2) + pared:cohort + pared:I(cohort^2) +
##     pared:race + pared:race:cohort + pared:race:I(cohort^2) +
##     pared:sex + pared:sex:cohort + pared:sex:I(cohort^2) + pared:race:sex +
##     pared:race:sex:cohort + pared:race:sex:I(cohort^2), data = non_impute)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -15.1133  -1.6568  -0.1712   1.5698  11.4188
##
## Coefficients:
##                               Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 -6.979e+03  1.867e+03  -3.738 0.000186 ***
## race                        -1.304e+03  3.639e+03  -0.358 0.720016
## sex                          3.443e+03  1.152e+03   2.989 0.002798 **
## pared                        2.475e+02  1.437e+02   1.722 0.085121 .
## paocc10                     -3.715e-05  4.925e-06  -7.542 4.78e-14 ***
## family16                    -6.904e-02  1.526e-02  -4.524 6.09e-06 ***
## sibs                        -1.632e-01  5.838e-03 -27.950  < 2e-16 ***
## incom16                      1.807e-01  2.013e-02   8.979  < 2e-16 ***
## cohort                       7.201e+00  1.919e+00   3.752 0.000176 ***
## I(cohort^2)                 -1.855e-03  4.932e-04  -3.760 0.000170 ***
## race:sex                    -1.889e+03  2.248e+03  -0.840 0.400839
## race:cohort                  1.241e+00  3.734e+00   0.332 0.739669
## race:I(cohort^2)            -2.937e-04  9.578e-04  -0.307 0.759094
## sex:cohort                  -3.556e+00  1.184e+00  -3.004 0.002665 **
## sex:I(cohort^2)              9.182e-04  3.041e-04   3.019 0.002538 **
## pared:cohort                -2.556e-01  1.475e-01  -1.732 0.083242 .
## pared:I(cohort^2)            6.581e-05  3.786e-05   1.738 0.082187 .
## race:pared                   6.707e+01  3.101e+02   0.216 0.828771
## sex:pared                   -1.639e+02  8.945e+01  -1.832 0.066909 .
## race:sex:cohort              1.979e+00  2.306e+00   0.858 0.390889
## race:sex:I(cohort^2)        -5.179e-04  5.916e-04  -0.875 0.381384
## race:pared:cohort           -6.239e-02  3.176e-01  -0.196 0.844267
## race:pared:I(cohort^2)       1.439e-05  8.132e-05   0.177 0.859549
## sex:pared:cohort             1.686e-01  9.181e-02   1.836 0.066300 .
## sex:pared:I(cohort^2)       -4.336e-05  2.356e-05  -1.841 0.065673 .
## race:sex:pared               4.403e+01  1.929e+02   0.228 0.819494
## race:sex:pared:cohort       -4.841e-02  1.976e-01  -0.245 0.806454
## race:sex:pared:I(cohort^2)   1.323e-05  5.059e-05   0.261 0.793744
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.503 on 26067 degrees of freedom
## Multiple R-squared:  0.4565, Adjusted R-squared:  0.4559
## F-statistic: 810.9 on 27 and 26067 DF,  p-value: < 2.2e-16
```

```
## Over the terciles, replicate appendix tables 1 and 2 using model 3

## Linear Regression Models for Attainment Appendix 1 Re-Analysis
low_model3 <- lm(mobility ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16 + cohor
summary(low_model3)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16 + cohort + I(cohort^2) + race:cohort +
##     race:I(cohort^2) + sex:cohort + sex:I(cohort^2) + race:sex:cohort +
##     race:sex:I(cohort^2), data = low_dat_non)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -12.7441  -1.5032  -0.1008   1.4166  11.2200
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)          -6.569e+03  1.389e+03  -4.731 2.27e-06 ***
## race                 -1.793e+03  2.700e+03  -0.664 0.506754
## sex                   2.879e+03  8.346e+02   3.449 0.000565 ***
## pared                -6.850e-01  1.335e-02 -51.321  < 2e-16 ***
## paocc10               5.348e-05  9.949e-06   5.375 7.87e-08 ***
## family16              6.479e-03  2.680e-02   0.242 0.808946
## sibs                 -1.529e-01  9.813e-03 -15.581  < 2e-16 ***
## incom16               2.226e-01  3.976e-02   5.599 2.23e-08 ***
## cohort                6.773e+00  1.430e+00   4.736 2.21e-06 ***
## I(cohort^2)          -1.743e-03  3.682e-04  -4.735 2.23e-06 ***
## race:sex             -1.165e+03  1.632e+03  -0.714 0.475314
## race:cohort           1.779e+00  2.773e+00   0.642 0.521015
## race:I(cohort^2)     -4.413e-04  7.117e-04  -0.620 0.535268
## sex:cohort           -2.973e+00  8.594e-01  -3.459 0.000544 ***
## sex:I(cohort^2)       7.674e-04  2.212e-04   3.469 0.000525 ***
## race:sex:cohort       1.217e+00  1.676e+00   0.726 0.467916
## race:sex:I(cohort^2) -3.173e-04  4.303e-04  -0.738 0.460835
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.817 on 7682 degrees of freedom
## Multiple R-squared:  0.2705, Adjusted R-squared:  0.269
## F-statistic:   178 on 16 and 7682 DF,  p-value: < 2.2e-16
```

```
med_model3 <- lm(mobility ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16 + cohor
summary(med_model3)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16 + cohort + I(cohort^2) + race:cohort +
##     race:I(cohort^2) + sex:cohort + sex:I(cohort^2) + race:sex:cohort +
##     race:sex:I(cohort^2), data = med_dat_non)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -14.4551  -1.6675  -0.5573   1.7238   7.9058
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)          -2.169e+03  9.770e+02  -2.220 0.026413 *
```

```
## race                 -2.439e+03  2.796e+03  -0.872 0.383090
## sex                   4.773e+02  6.034e+02   0.791 0.428983
## pared                -2.700e-01  7.801e-02  -3.461 0.000540 ***
## paocc10              -6.592e-05  7.847e-06  -8.401  < 2e-16 ***
## family16             -9.395e-02  2.453e-02  -3.830 0.000129 ***
## sibs                 -1.684e-01  9.759e-03 -17.251  < 2e-16 ***
## incom16               1.115e-01  3.305e-02   3.372 0.000748 ***
## cohort                2.263e+00  1.001e+00   2.260 0.023839 *
## I(cohort^2)          -5.882e-04  2.565e-04  -2.294 0.021834 *
## race:sex             -1.179e+02  1.729e+03  -0.068 0.945639
## race:cohort           2.467e+00  2.859e+00   0.863 0.388268
## race:I(cohort^2)     -6.238e-04  7.309e-04  -0.853 0.393427
## sex:cohort           -5.155e-01  6.182e-01  -0.834 0.404425
## sex:I(cohort^2)       1.388e-04  1.584e-04   0.876 0.380941
## race:sex:cohort       1.289e-01  1.767e+00   0.073 0.941841
## race:sex:I(cohort^2) -3.504e-05  4.516e-04  -0.078 0.938155
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.379 on 9960 degrees of freedom
## Multiple R-squared:  0.05645,    Adjusted R-squared:  0.05494
## F-statistic: 37.24 on 16 and 9960 DF,  p-value: < 2.2e-16
```

```
high_model3 <- lm(mobility ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16 + coho
summary(high_model3)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16 + cohort + I(cohort^2) + race:cohort +
##     race:I(cohort^2) + sex:cohort + sex:I(cohort^2) + race:sex:cohort +
##     race:sex:I(cohort^2), data = high_dat_non)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -15.3262  -1.6191   0.0815   1.4799   7.3700
##
## Coefficients:
##                        Estimate Std. Error t value Pr(>|t|)
## (Intercept)          -2.931e+03  9.517e+02  -3.080  0.00207 **
## race                  1.128e+03  2.864e+03   0.394  0.69354
## sex                   8.803e+02  5.947e+02   1.480  0.13885
## pared                -6.928e-01  1.439e-02 -48.147  < 2e-16 ***
## paocc10              -8.705e-05  8.399e-06 -10.364  < 2e-16 ***
## family16             -1.466e-01  2.905e-02  -5.045 4.62e-07 ***
## sibs                 -1.576e-01  1.176e-02 -13.408  < 2e-16 ***
## incom16               1.810e-01  3.196e-02   5.664 1.52e-08 ***
## cohort                3.031e+00  9.732e-01   3.115  0.00185 **
## I(cohort^2)          -7.807e-04  2.488e-04  -3.138  0.00171 **
## race:sex             -2.059e+03  1.773e+03  -1.161  0.24556
## race:cohort          -1.144e+00  2.922e+00  -0.391  0.69558
## race:I(cohort^2)      2.897e-04  7.456e-04   0.389  0.69759
## sex:cohort           -9.192e-01  6.082e-01  -1.511  0.13076
## sex:I(cohort^2)       2.398e-04  1.555e-04   1.542  0.12313
```

```
## race:sex:cohort       2.096e+00  1.809e+00   1.158  0.24675
## race:sex:I(cohort^2) -5.332e-04  4.615e-04  -1.155  0.24796
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.303 on 8402 degrees of freedom
## Multiple R-squared:  0.2353, Adjusted R-squared:  0.2339
## F-statistic: 161.6 on 16 and 8402 DF,  p-value: < 2.2e-16
```

```
## Logistic Regression Models for Attainment (Appendix 2 Re-Analysis)
low_logmodel3 <- glm(attain ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16 + coh
summary(low_logmodel3)
```

```
##
## Call:
## glm(formula = attain ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16 + cohort + I(cohort^2) + race:cohort +
##     race:I(cohort^2) + sex:cohort + sex:I(cohort^2) + race:sex:cohort +
##     race:sex:I(cohort^2), family = binomial, data = low_dat_non)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.6340  -0.8583  -0.6384   1.2055   2.6645
##
## Coefficients:
##                         Estimate Std. Error z value Pr(>|z|)
## (Intercept)          -4.523e+03  1.172e+03  -3.859 0.000114 ***
## race                  2.162e+03  2.473e+03   0.874 0.382085
## sex                   2.365e+03  7.087e+02   3.337 0.000847 ***
## pared                 1.075e-01  1.186e-02   9.062  < 2e-16 ***
## paocc10              -2.565e-07  8.275e-06  -0.031 0.975277
## family16              2.114e-02  2.139e-02   0.988 0.323085
## sibs                 -1.103e-01  9.244e-03 -11.930  < 2e-16 ***
## incom16               6.738e-02  3.283e-02   2.052 0.040137 *
## cohort                4.666e+00  1.207e+00   3.867 0.000110 ***
## I(cohort^2)          -1.203e-03  3.106e-04  -3.875 0.000107 ***
## race:sex             -2.791e+03  1.495e+03  -1.867 0.061858 .
## race:cohort          -2.250e+00  2.536e+00  -0.887 0.375107
## race:I(cohort^2)      5.851e-04  6.503e-04   0.900 0.368309
## sex:cohort           -2.452e+00  7.293e-01  -3.362 0.000773 ***
## sex:I(cohort^2)       6.355e-04  1.876e-04   3.387 0.000706 ***
## race:sex:cohort       2.878e+00  1.533e+00   1.878 0.060416 .
## race:sex:I(cohort^2) -7.416e-04  3.929e-04  -1.888 0.059057 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 9210.8  on 7698  degrees of freedom
## Residual deviance: 8581.5  on 7682  degrees of freedom
## AIC: 8615.5
##
## Number of Fisher Scoring iterations: 4
```

```r
med_logmodel3 <- glm(attain ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16 + coh
summary(med_logmodel3)
```

```
##
## Call:
## glm(formula = attain ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16 + cohort + I(cohort^2) + race:cohort +
##     race:I(cohort^2) + sex:cohort + sex:I(cohort^2) + race:sex:cohort +
##     race:sex:I(cohort^2), family = binomial, data = med_dat_non)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.0524  -1.1977   0.7863   1.0714   2.1593
##
## Coefficients:
##                         Estimate Std. Error z value Pr(>|z|)
## (Intercept)          -1.248e+03  8.501e+02  -1.468    0.142
## race                 -3.170e+03  2.541e+03  -1.248    0.212
## sex                   2.728e+02  5.305e+02   0.514    0.607
## pared                 8.261e-01  7.422e-02  11.131  < 2e-16 ***
## paocc10              -5.035e-05  6.883e-06  -7.315 2.58e-13 ***
## family16             -1.718e-02  2.133e-02  -0.806    0.420
## sibs                 -1.204e-01  8.881e-03 -13.556  < 2e-16 ***
## incom16               1.339e-01  2.887e-02   4.637 3.53e-06 ***
## cohort                1.293e+00  8.711e-01   1.484    0.138
## I(cohort^2)          -3.373e-04  2.231e-04  -1.512    0.131
## race:sex              6.869e+02  1.569e+03   0.438    0.662
## race:cohort           3.222e+00  2.598e+00   1.240    0.215
## race:I(cohort^2)     -8.186e-04  6.638e-04  -1.233    0.218
## sex:cohort           -3.009e-01  5.436e-01  -0.553    0.580
## sex:I(cohort^2)       8.249e-05  1.392e-04   0.592    0.554
## race:sex:cohort      -6.908e-01  1.604e+00  -0.431    0.667
## race:sex:I(cohort^2)  1.737e-04  4.097e-04   0.424    0.672
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 13734  on 9976  degrees of freedom
## Residual deviance: 13158  on 9960  degrees of freedom
## AIC: 13192
##
## Number of Fisher Scoring iterations: 4
```

```r
high_logmodel3 <- glm(attain ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16 + col
summary(high_logmodel3)
```

```
##
## Call:
## glm(formula = attain ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16 + cohort + I(cohort^2) + race:cohort +
##     race:I(cohort^2) + sex:cohort + sex:I(cohort^2) + race:sex:cohort +
```

```
##     race:sex:I(cohort^2), family = binomial, data = high_dat_non)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.6009   0.3470   0.5009   0.6575   1.9091
##
## Coefficients:
##                         Estimate Std. Error z value Pr(>|z|)
## (Intercept)          -2.563e+03  1.056e+03  -2.426 0.015253 *
## race                  4.348e+02  2.978e+03   0.146 0.883920
## sex                   8.980e+02  6.655e+02   1.349 0.177221
## pared                 2.165e-01  1.947e-02  11.119  < 2e-16 ***
## paocc10              -7.310e-05  9.653e-06  -7.572 3.66e-14 ***
## family16             -9.933e-02  2.965e-02  -3.350 0.000808 ***
## sibs                 -1.169e-01  1.253e-02  -9.330  < 2e-16 ***
## incom16               2.921e-01  3.764e-02   7.762 8.39e-15 ***
## cohort                2.631e+00  1.081e+00   2.433 0.014954 *
## I(cohort^2)          -6.756e-04  2.766e-04  -2.443 0.014585 *
## race:sex             -2.095e+03  1.876e+03  -1.117 0.264104
## race:cohort          -4.556e-01  3.041e+00  -0.150 0.880926
## race:I(cohort^2)      1.193e-04  7.764e-04   0.154 0.877929
## sex:cohort           -9.336e-01  6.813e-01  -1.370 0.170561
## sex:I(cohort^2)       2.426e-04  1.744e-04   1.391 0.164110
## race:sex:cohort       2.151e+00  1.915e+00   1.123 0.261505
## race:sex:I(cohort^2) -5.519e-04  4.889e-04  -1.129 0.258963
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 7782.4  on 8418  degrees of freedom
## Residual deviance: 7182.2  on 8402  degrees of freedom
## AIC: 7216.2
##
## Number of Fisher Scoring iterations: 5
```

```r
## Causal Analysis

## Full Model 1 and 2 for Low Tercile
low_model1 <- lm(mobility ~ race + sex + race:sex, data = low_dat)
low_race1 = as.numeric(coefficients((low_model1))[2])
low_race1err = summary(low_model1)$coefficients["race","Std. Error"]
low_race1
```

```
## [1] -0.5202674
```

```r
low_race1err
```

```
## [1] 0.20669
```

```r
summary(low_model1)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex, data = low_dat)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -14.1246  -1.9734   0.0266   2.0266  16.3004
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  4.24720    0.10570  40.183  < 2e-16 ***
## race        -0.52027    0.20669  -2.517 0.011842 *
## sex         -0.27378    0.06454  -4.242 2.23e-05 ***
## race:sex     0.47259    0.12386   3.816 0.000136 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.34 on 15058 degrees of freedom
## Multiple R-squared:  0.002349,   Adjusted R-squared:  0.00215
## F-statistic: 11.82 on 3 and 15058 DF,  p-value: 9.994e-08
```

```r
low_model4 <- lm(mobility ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16, data =
low_race4 = as.numeric(coefficients((low_model4))[2])
low_race4err = summary(low_model4)$coefficients["race","Std. Error"]
low_race4
```

```
## [1] -0.8334597
```

```r
low_race4err
```

```
## [1] 0.1793577
```

```r
summary(low_model4)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16, data = low_dat)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -12.8668  -1.5544   0.0193   1.5163  12.4680
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  9.012e+00  1.449e-01  62.201  < 2e-16 ***
## race        -8.335e-01  1.794e-01  -4.647 3.40e-06 ***
## sex         -1.583e-01  5.582e-02  -2.836  0.00458 **
## pared       -6.486e-01  9.162e-03 -70.790  < 2e-16 ***
## paocc10      5.619e-05  7.292e-06   7.706 1.38e-14 ***
## family16    -7.538e-02  1.218e-02  -6.189 6.22e-10 ***
## sibs        -1.259e-01  6.724e-03 -18.729  < 2e-16 ***
## incom16      1.792e-01  2.780e-02   6.446 1.18e-10 ***
## race:sex     6.078e-01  1.071e-01   5.676 1.41e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.887 on 15053 degrees of freedom
## Multiple R-squared:  0.255,  Adjusted R-squared:  0.2546
## F-statistic: 644.1 on 8 and 15053 DF,  p-value: < 2.2e-16
```

```r
## Full Model 1 and 2 for Medium Tercile
med_model1 <- lm(mobility ~ race + sex + race:sex, data = med_dat)
med_race1 = as.numeric(coefficients((med_model1))[2])
med_race1err = summary(med_model1)$coefficients["race","Std. Error"]
med_race1
```

```
## [1] -0.6163042
```

```r
med_race1err
```

```
## [1] 0.1563038
```

```r
summary(med_model1)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex, data = med_dat)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -14.2643  -1.4365  -0.4365   1.7357   7.0691
##
```

```
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.60860    0.06489  24.788  < 2e-16 ***
## race        -0.61630    0.15630  -3.943 8.08e-05 ***
## sex         -0.17213    0.04024  -4.278 1.90e-05 ***
## race:sex     0.14145    0.09451   1.497    0.135
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.505 on 19116 degrees of freedom
## Multiple R-squared:  0.004811,   Adjusted R-squared:  0.004655
## F-statistic:  30.8 on 3 and 19116 DF,  p-value: < 2.2e-16
```

```
med_model4 <- lm(mobility ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16, data =
med_race4 = as.numeric(coefficients((med_model4))[2])
med_race4err = summary(med_model4)$coefficients["race","Std. Error"]
med_race4
```

```
## [1] -0.2816896
```

```
med_race4err
```

```
## [1] 0.153871
```

```
summary(med_model4)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16, data = med_dat)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -14.1517  -1.5407  -0.5501   1.6505   8.8977
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  5.706e+00  7.086e-01   8.053 8.55e-16 ***
## race        -2.817e-01  1.539e-01  -1.831   0.0672 .
## sex         -1.548e-01  3.948e-02  -3.921 8.84e-05 ***
## pared       -2.945e-01  5.796e-02  -5.081 3.79e-07 ***
## paocc10     -4.560e-05  5.774e-06  -7.898 2.99e-15 ***
## family16    -1.043e-01  1.012e-02 -10.309  < 2e-16 ***
## sibs        -1.419e-01  6.465e-03 -21.946  < 2e-16 ***
## incom16      1.199e-01  2.264e-02   5.297 1.19e-07 ***
## race:sex     1.594e-01  9.270e-02   1.719   0.0856 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.457 on 19111 degrees of freedom
## Multiple R-squared:  0.04314,    Adjusted R-squared:  0.04274
## F-statistic: 107.7 on 8 and 19111 DF,  p-value: < 2.2e-16
```

```r
## Full Model 1 and 2 for High Tercile
high_model1 <- lm(mobility ~ race + sex + race:sex, data = high_dat)
high_race1 = as.numeric(coefficients((high_model1))[2])
high_race1err = summary(high_model1)$coefficients["race","Std. Error"]
high_race1
```

```
## [1] -0.4399113
```

```r
high_race1err
```

```
## [1] 0.1892782
```

```r
summary(high_model1)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex, data = high_dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -18.941  -1.941   0.059   1.200   7.200
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.78384    0.07806 -10.041  < 2e-16 ***
## race        -0.43991    0.18928  -2.324  0.02013 *
## sex         -0.13759    0.04838  -2.844  0.00446 **
## race:sex     0.16083    0.11491   1.400  0.16164
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.721 on 15505 degrees of freedom
## Multiple R-squared:  0.00126,    Adjusted R-squared:  0.001067
## F-statistic:  6.52 on 3 and 15505 DF,  p-value: 0.0002105
```

```r
high_model4 <- lm(mobility ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16, data =
high_race4 = as.numeric(coefficients((high_model4))[2])
high_race4err = summary(high_model4)$coefficients["race","Std. Error"]
high_race4
```

```
## [1] -0.07917473
```

```r
high_race4err
```

```
## [1] 0.1668871
```

```r
summary(high_model4)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16, data = high_dat)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -15.1425  -1.7149   0.0866   1.5595   8.1751
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.077e+01  2.027e-01  53.132  < 2e-16 ***
## race        -7.917e-02  1.669e-01  -0.474 0.635207
## sex         -1.440e-01  4.255e-02  -3.384 0.000715 ***
## pared       -6.896e-01  1.084e-02 -63.639  < 2e-16 ***
## paocc10     -8.643e-05  6.303e-06 -13.713  < 2e-16 ***
## family16    -1.717e-01  1.165e-02 -14.741  < 2e-16 ***
## sibs        -1.404e-01  7.844e-03 -17.902  < 2e-16 ***
## incom16      1.906e-01  2.334e-02   8.167 3.41e-16 ***
## race:sex     1.023e-01  1.010e-01   1.013 0.311281
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.391 on 15500 degrees of freedom
## Multiple R-squared:  0.2289, Adjusted R-squared:  0.2285
## F-statistic: 575.2 on 8 and 15500 DF,  p-value: < 2.2e-16
```

```
## Full Model 1 and 2 for Each Cohort

## 1940
co1940_model1 <- lm(mobility ~ race + sex + race:sex, data = cohort1940)
co1940_race1 = as.numeric(coefficients((co1940_model1))[2])
co1940_race1err = summary(co1940_model1)$coefficients["race","Std. Error"]
co1940_race1
```

```
## [1] -0.5759783
```

```
co1940_race1err
```

```
## [1] 0.3687375
```

```
summary(co1940_model1)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex, data = cohort1940)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -21.5354  -1.9807  -0.5354   2.0193  17.2296
##
## Coefficients:
```

```
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  2.42610    0.13993  17.339  < 2e-16 ***
## race        -0.57598    0.36874  -1.562    0.118
## sex         -0.44536    0.08637  -5.156 2.59e-07 ***
## race:sex     0.90550    0.22227   4.074 4.67e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.334 on 7095 degrees of freedom
## Multiple R-squared:  0.01265,    Adjusted R-squared:  0.01223
## F-statistic:  30.3 on 3 and 7095 DF,  p-value: < 2.2e-16
```

```
co1940_model4 <- lm(mobility ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16, data
co1940_race4 = as.numeric(coefficients((co1940_model4))[2])
co1940_race4err = summary(co1940_model4)$coefficients["race","Std. Error"]
co1940_race4
```

```
## [1] -0.7163434
```

```
co1940_race4err
```

```
## [1] 0.2869917
```

```
summary(co1940_model4)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16, data = cohort1940)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -15.1258  -1.6079  -0.2181   1.6480  11.9745
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.054e+01  2.042e-01  51.600  < 2e-16 ***
## race        -7.163e-01  2.870e-01  -2.496  0.01258 *
## sex         -4.752e-01  6.691e-02  -7.102 1.35e-12 ***
## pared       -6.614e-01  9.855e-03 -67.113  < 2e-16 ***
## paocc10     -4.901e-05  9.711e-06  -5.047 4.60e-07 ***
## family16    -8.909e-02  1.844e-02  -4.831 1.39e-06 ***
## sibs        -1.598e-01  1.047e-02 -15.258  < 2e-16 ***
## incom16      2.175e-01  3.888e-02   5.594 2.30e-08 ***
## race:sex     5.503e-01  1.724e-01   3.192  0.00142 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.582 on 7090 degrees of freedom
## Multiple R-squared:  0.4081, Adjusted R-squared:  0.4074
## F-statistic:   611 on 8 and 7090 DF,  p-value: < 2.2e-16
```

```r
## 1948
co1948_model1 <- lm(mobility ~ race + sex + race:sex, data = cohort1948)
co1948_race1 = as.numeric(coefficients((co1948_model1))[2])
co1948_race1err = summary(co1948_model1)$coefficients["race","Std. Error"]
co1948_race1
```

```
## [1] 0.6742248
```

```r
co1948_race1err
```

```
## [1] 0.2965273
```

```r
summary(co1948_model1)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex, data = cohort1948)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -16.2783  -1.4560  -0.3585   2.5440  14.6415
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.55350    0.12201  12.733   <2e-16 ***
## race         0.67422    0.29653   2.274    0.023 *
## sex         -0.09748    0.07595  -1.284    0.199
## race:sex     0.12275    0.17788   0.690    0.490
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.241 on 9004 degrees of freedom
## Multiple R-squared:  0.01096,    Adjusted R-squared:  0.01063
## F-statistic: 33.25 on 3 and 9004 DF,  p-value: < 2.2e-16
```

```r
co1948_model4 <- lm(mobility ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16, data
co1948_race4 = as.numeric(coefficients((co1948_model4))[2])
co1948_race4err = summary(co1948_model4)$coefficients["race","Std. Error"]
co1948_race4
```

```
## [1] 0.02018466
```

```r
co1948_race4err
```

```
## [1] 0.2292343
```

```r
summary(co1948_model4)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16, data = cohort1948)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -14.1125  -1.6261  -0.1598   1.5905   8.8463
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.064e+01  1.811e-01  58.743  < 2e-16 ***
## race         2.018e-02  2.292e-01   0.088 0.929837
## sex         -2.027e-01  5.841e-02  -3.471 0.000521 ***
## pared       -6.573e-01  8.617e-03 -76.280  < 2e-16 ***
## paocc10     -6.077e-05  8.400e-06  -7.235 5.05e-13 ***
## family16    -1.423e-01  1.610e-02  -8.836  < 2e-16 ***
## sibs        -1.301e-01  8.885e-03 -14.643  < 2e-16 ***
## incom16      8.133e-02  3.319e-02   2.451 0.014283 *
## race:sex     7.530e-02  1.367e-01   0.551 0.581826
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.491 on 8999 degrees of freedom
## Multiple R-squared:  0.4162, Adjusted R-squared:  0.4157
## F-statistic:   802 on 8 and 8999 DF,  p-value: < 2.2e-16
```

```
## 1956
co1956_model1 <- lm(mobility ~ race + sex + race:sex, data = cohort1956)
co1956_race1 = as.numeric(coefficients((co1956_model1))[2])
co1956_race1err = summary(co1956_model1)$coefficients["race","Std. Error"]
co1956_race1
```

```
## [1] 0.5973452
```

```
co1956_race1err
```

```
## [1] 0.2727793
```

```
summary(co1956_model1)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex, data = cohort1956)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -15.535  -1.773  -0.773   2.196  17.227
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.74208    0.12255   6.055 1.45e-09 ***
```

```
## race         0.59735    0.27278   2.190   0.0286 *
## sex          0.03088    0.07562   0.408   0.6830
## race:sex     0.16452    0.16417   1.002   0.3163
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.198 on 9205 degrees of freedom
## Multiple R-squared:  0.01244,    Adjusted R-squared:  0.01212
## F-statistic: 38.66 on 3 and 9205 DF,  p-value: < 2.2e-16
```

```
co1956_model4 <- lm(mobility ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16, data
co1956_race4 = as.numeric(coefficients((co1956_model4))[2])
co1956_race4err = summary(co1956_model4)$coefficients["race","Std. Error"]
co1956_race4
```

```
## [1] -0.07696256
```

```
co1956_race4err
```

```
## [1] 0.2049015
```

```
summary(co1956_model4)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16, data = cohort1956)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -13.4013  -1.5461  -0.2283   1.5029   9.7364
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  9.952e+00  1.745e-01  57.023  < 2e-16 ***
## race        -7.696e-02  2.049e-01  -0.376 0.707217
## sex          2.524e-02  5.652e-02   0.447 0.655236
## pared       -6.686e-01  8.178e-03 -81.752  < 2e-16 ***
## paocc10     -6.545e-05  8.127e-06  -8.054 9.04e-16 ***
## family16    -8.775e-02  1.443e-02  -6.081 1.25e-09 ***
## sibs        -9.523e-02  9.075e-03 -10.494  < 2e-16 ***
## incom16      1.127e-01  3.106e-02   3.630 0.000285 ***
## race:sex     1.263e-01  1.227e-01   1.029 0.303419
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.389 on 9200 degrees of freedom
## Multiple R-squared:  0.4493, Adjusted R-squared:  0.4488
## F-statistic: 938.3 on 8 and 9200 DF,  p-value: < 2.2e-16
```

```r
## 1964
co1964_model1 <- lm(mobility ~ race + sex + race:sex, data = cohort1964)
co1964_race1 = as.numeric(coefficients((co1964_model1))[2])
co1964_race1err = summary(co1964_model1)$coefficients["race","Std. Error"]
co1964_race1
```

```
## [1] 0.7132222
```

```r
co1964_race1err
```

```
## [1] 0.3143394
```

```r
summary(co1964_model1)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex, data = cohort1964)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -16.5307  -1.6159  -0.5307   1.4693  18.8006
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.44546    0.15800   2.819  0.00483 **
## race         0.71322    0.31434   2.269  0.02330 *
## sex          0.08521    0.09762   0.873  0.38275
## race:sex    -0.06485    0.19006  -0.341  0.73294
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.289 on 6252 degrees of freedom
## Multiple R-squared:  0.006946,   Adjusted R-squared:  0.00647
## F-statistic: 14.58 on 3 and 6252 DF,  p-value: 1.852e-09
```

```r
co1964_model4 <- lm(mobility ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16, data
co1964_race4 = as.numeric(coefficients((co1964_model4))[2])
co1964_race4err = summary(co1964_model4)$coefficients["race","Std. Error"]
co1964_race4
```

```
## [1] -0.1915251
```

```r
co1964_race4err
```

```
## [1] 0.2370265
```

```r
summary(co1964_model4)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16, data = cohort1964)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -13.9472  -1.6023  -0.1491   1.5973  11.0527
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  9.947e+00  2.176e-01  45.717  < 2e-16 ***
## race        -1.915e-01  2.370e-01  -0.808 0.419103
## sex          3.506e-02  7.333e-02   0.478 0.632612
## pared       -6.612e-01  1.001e-02 -66.069  < 2e-16 ***
## paocc10     -6.010e-05  1.015e-05  -5.925  3.3e-09 ***
## family16    -1.382e-01  1.699e-02  -8.133  5.0e-16 ***
## sibs        -1.025e-01  1.078e-02  -9.514  < 2e-16 ***
## incom16      1.323e-01  3.752e-02   3.526 0.000426 ***
## race:sex     1.408e-01  1.428e-01   0.986 0.324067
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.469 on 6247 degrees of freedom
## Multiple R-squared:  0.4409, Adjusted R-squared:  0.4402
## F-statistic: 615.9 on 8 and 6247 DF,  p-value: < 2.2e-16
```

```
## 1972
co1972_model1 <- lm(mobility ~ race + sex + race:sex, data = cohort1972)
co1972_race1 = as.numeric(coefficients((co1972_model1))[2])
co1972_race1err = summary(co1972_model1)$coefficients["race","Std. Error"]
co1972_race1
```

```
## [1] 0.8290306
```

```
co1972_race1err
```

```
## [1] 0.3820907
```

```
summary(co1972_model1)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex, data = cohort1972)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -12.9319  -2.1436  -0.1436   1.8564  16.0681
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -0.1696     0.2047  -0.829   0.4073
```

```
## race          0.8290     0.3821   2.170   0.0301 *
## sex           0.3132     0.1265   2.476   0.0133 *
## race:sex     -0.1770     0.2306  -0.767   0.4429
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.37 on 4126 degrees of freedom
## Multiple R-squared:  0.007547,   Adjusted R-squared:  0.006826
## F-statistic: 10.46 on 3 and 4126 DF,  p-value: 7.487e-07
```

```
co1972_model4 <- lm(mobility ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16, data
co1972_race4 = as.numeric(coefficients((co1972_model4))[2])
co1972_race4err = summary(co1972_model4)$coefficients["race","Std. Error"]
co1972_race4
```

```
## [1] -0.2305133
```

```
co1972_race4err
```

```
## [1] 0.2879502
```

```
summary(co1972_model4)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16, data = cohort1972)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -13.1454  -1.5929  -0.1068   1.6169  10.4665
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  9.236e+00  2.660e-01  34.724  < 2e-16 ***
## race        -2.305e-01  2.880e-01  -0.801   0.4234
## sex          2.150e-01  9.480e-02   2.268   0.0234 *
## pared       -6.425e-01  1.175e-02 -54.675  < 2e-16 ***
## paocc10     -5.069e-05  1.267e-05  -4.000 6.43e-05 ***
## family16    -1.189e-01  2.053e-02  -5.791 7.50e-09 ***
## sibs        -1.309e-01  1.401e-02  -9.340  < 2e-16 ***
## incom16      1.832e-01  4.522e-02   4.050 5.22e-05 ***
## race:sex     1.005e-01  1.726e-01   0.583   0.5602
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.519 on 4121 degrees of freedom
## Multiple R-squared:  0.4462, Adjusted R-squared:  0.4451
## F-statistic:   415 on 8 and 4121 DF,  p-value: < 2.2e-16
```

```r
## 1980
co1980_model1 <- lm(mobility ~ race + sex + race:sex, data = cohort1980)
co1980_race1 = as.numeric(coefficients((co1980_model1))[2])
co1980_race1err = summary(co1980_model1)$coefficients["race","Std. Error"]
co1980_race1
```

```
## [1] 1.668288
```

```r
co1980_race1err
```

```
## [1] 0.4817222
```

```r
summary(co1980_model1)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex, data = cohort1980)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -11.8434  -1.8550  -0.4514   2.1566  15.1937
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -0.7646     0.2738  -2.793 0.005265 **
## race          1.6683     0.4817   3.463 0.000543 ***
## sex           0.6080     0.1675   3.629 0.000290 ***
## race:sex     -0.6567     0.2902  -2.263 0.023722 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.373 on 2483 degrees of freedom
## Multiple R-squared:  0.01332,    Adjusted R-squared:  0.01213
## F-statistic: 11.18 on 3 and 2483 DF,  p-value: 2.765e-07
```

```r
co1980_model4 <- lm(mobility ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16, data
co1980_race4 = as.numeric(coefficients((co1980_model4))[2])
co1980_race4err = summary(co1980_model4)$coefficients["race","Std. Error"]
co1980_race4
```

```
## [1] 0.508019
```

```r
co1980_race4err
```

```
## [1] 0.369294
```

```r
summary(co1980_model4)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16, data = cohort1980)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -12.9410  -1.7063  -0.0239   1.6948   9.1633
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  9.433e+00  3.750e-01  25.154  < 2e-16 ***
## race         5.080e-01  3.693e-01   1.376 0.169055
## sex          3.460e-01  1.279e-01   2.705 0.006875 **
## pared       -6.684e-01  1.628e-02 -41.045  < 2e-16 ***
## paocc10     -3.265e-05  1.665e-05  -1.961 0.049960 *
## family16    -1.283e-01  2.603e-02  -4.928 8.87e-07 ***
## sibs        -1.645e-01  2.005e-02  -8.208 3.59e-16 ***
## incom16      2.129e-01  5.858e-02   3.634 0.000285 ***
## race:sex    -2.860e-01  2.215e-01  -1.291 0.196762
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.572 on 2478 degrees of freedom
## Multiple R-squared:  0.4274, Adjusted R-squared:  0.4256
## F-statistic: 231.2 on 8 and 2478 DF,  p-value: < 2.2e-16
```

```
## 1988
co1988_model1 <- lm(mobility ~ race + sex + race:sex, data = cohort1988)
co1988_race1 = as.numeric(coefficients((co1988_model1))[2])
co1988_race1err = summary(co1988_model1)$coefficients["race","Std. Error"]
co1988_race1
```

```
## [1] -0.1797642
```

```
co1988_race1err
```

```
## [1] 0.6608205
```

```
summary(co1988_model1)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex, data = cohort1988)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -9.8412 -1.8412  0.1588  2.1588 15.1588
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.33585    0.41036  -0.818    0.413
```

```
## race        -0.17976    0.66082  -0.272    0.786
## sex          0.08854    0.25029   0.354    0.724
## race:sex     0.35811    0.40171   0.891    0.373
##
## Residual standard error: 3.136 on 1041 degrees of freedom
## Multiple R-squared:  0.005613,   Adjusted R-squared:  0.002747
## F-statistic: 1.959 on 3 and 1041 DF,  p-value: 0.1185
```

```
co1988_model4 <- lm(mobility ~ race + sex + race:sex + pared + paocc10 + family16 + sibs + incom16, data
co1988_race4 = as.numeric(coefficients((co1988_model4))[2])
co1988_race4err = summary(co1988_model4)$coefficients["race","Std. Error"]
co1988_race4
```

```
## [1] -0.2549469
```

```
co1988_race4err
```

```
## [1] 0.4931088
```

```
summary(co1988_model4)
```

```
##
## Call:
## lm(formula = mobility ~ race + sex + race:sex + pared + paocc10 +
##     family16 + sibs + incom16, data = cohort1988)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -12.0712  -1.5563   0.1009   1.4364   6.6537
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  9.806e+00  5.345e-01  18.347  < 2e-16 ***
## race        -2.549e-01  4.931e-01  -0.517  0.60525
## sex          6.311e-02  1.867e-01   0.338  0.73544
## pared       -6.818e-01  2.400e-02 -28.412  < 2e-16 ***
## paocc10     -3.032e-05  2.288e-05  -1.325  0.18545
## family16    -9.601e-02  3.490e-02  -2.751  0.00604 **
## sibs        -6.701e-02  2.596e-02  -2.582  0.00997 **
## incom16      1.955e-01  7.786e-02   2.512  0.01217 *
## race:sex     8.335e-02  2.993e-01   0.278  0.78070
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.332 on 1036 degrees of freedom
## Multiple R-squared:  0.4527, Adjusted R-squared:  0.4484
## F-statistic: 107.1 on 8 and 1036 DF,  p-value: < 2.2e-16
```