Labor Market Analysis

Revised Econometric Model

Marjorie Blanco, Joe Thomson, Haodi Tu

Research Questions

1) How do earnings vary by education level?
2) How does the premium for education vary by gender?

Revised Model

$Earning = \beta_0 + Divorced * \beta_1 + NeverMarried * \beta_2 + Female * \beta_3 + RaceBlack * \beta_4 + RaceOther * \beta_5 +$

$SomeCollege * \beta_6 + Associate * \beta_7 + Bachelor * \beta_8 + Master * \beta_9 + Professional * \beta_1 0 + Doctoral * \beta_1 1 + Age * \beta_1 2$

```
##
## Call:
## lm(formula = PERNP ~ Widowed + Divorced + Separated + NeverMarried +
##      Female + RaceBlack + RaceOther + SomeCollege + Associate +
##      Bachelor + Master + Professional + Doctoral + AGEP, data = ss16ppr)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -43683  -9228  -2919   5341  98762
##
## Coefficients:
##               Estimate Std. Error t value         Pr(>|t|)
## (Intercept)  12598.97    1110.28  11.348 < 0.0000000000000002 ***
## Widowed       1104.92    1888.02   0.585         0.558422
## Divorced     -1078.74     571.98  -1.886         0.059353 .
## Separated    -1833.17    1489.22  -1.231         0.218393
## NeverMarried -2974.75     520.48  -5.715       0.00000001155 ***
## Female       -4868.47     432.66 -11.252 < 0.0000000000000002 ***
## RaceBlack    -1178.01     591.36  -1.992         0.046421 *
## RaceOther    -2141.04     579.98  -3.692         0.000225 ***
## SomeCollege   4241.63     694.73   6.105       0.00000000110 ***
## Associate     4150.43     688.45   6.029       0.00000000177 ***
## Bachelor     12337.16     587.07  21.015 < 0.0000000000000002 ***
## Master       17795.40     812.61  21.899 < 0.0000000000000002 ***
## Professional 28133.37    1476.36  19.056 < 0.0000000000000002 ***
## Doctoral     35674.46    1617.08  22.061 < 0.0000000000000002 ***
## AGEP           284.94      21.12  13.488 < 0.0000000000000002 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 14920 on 5179 degrees of freedom
## Multiple R-squared:  0.2466, Adjusted R-squared:  0.2446
## F-statistic: 121.1 on 14 and 5179 DF,  p-value: < 0.00000000000000022
```

- Coefficients Explanation
  - Holding gender, race, education and age constant, married people makes \$1104.92 more than people who widowed on average.

- Holding gender, race, education and age constant, married people makes \$1078.74 more than people who divorced on average.
- Holding gender, race, education and age constant, married people makes \$1833.17 more than people who separated on average.
- Holding gender, race, education and age constant, married people makes \$2974.75 more than people who never married on average.
- Holding marriage, race, education and age constant, male makes \$4868.47 more than female on average.
- Holding marriage, gender, education and age constant, White makes \$1178.01 more than Black on average.
- Holding marriage, gender, education and age constant, White makes \$2141.04 more than Other race on average.
- Holding marriage, gender, race and age constant, people have high school education makes \$4241.63 less than people have some college education on average.
- Holding marriage, gender, race and age constant, people have high school education makes \$4150.43 less than people have associate education on average.
- Holding marriage, gender, race and age constant, people have high school education makes \$12337.16 less than people have bachelor's degree on average.
- Holding marriage, gender, race and age constant, people have high school education makes \$17795.4 less than people have master's degree on average.
- Holding marriage, gender, race and age constant, people have high school education makes \$28133.37 less than people have Professional education on average.
- Holding marriage, gender, race and age constant, people have high school education makes \$35674.46 less than people have doctor's degree on average.
- Holding marriage, gender, race and education constant, people make \$284.94 more as age increases on average between the age of 18 to 64.

$H0$: Variance is unchanging in the residual $H1$: Variance is changing in the residual
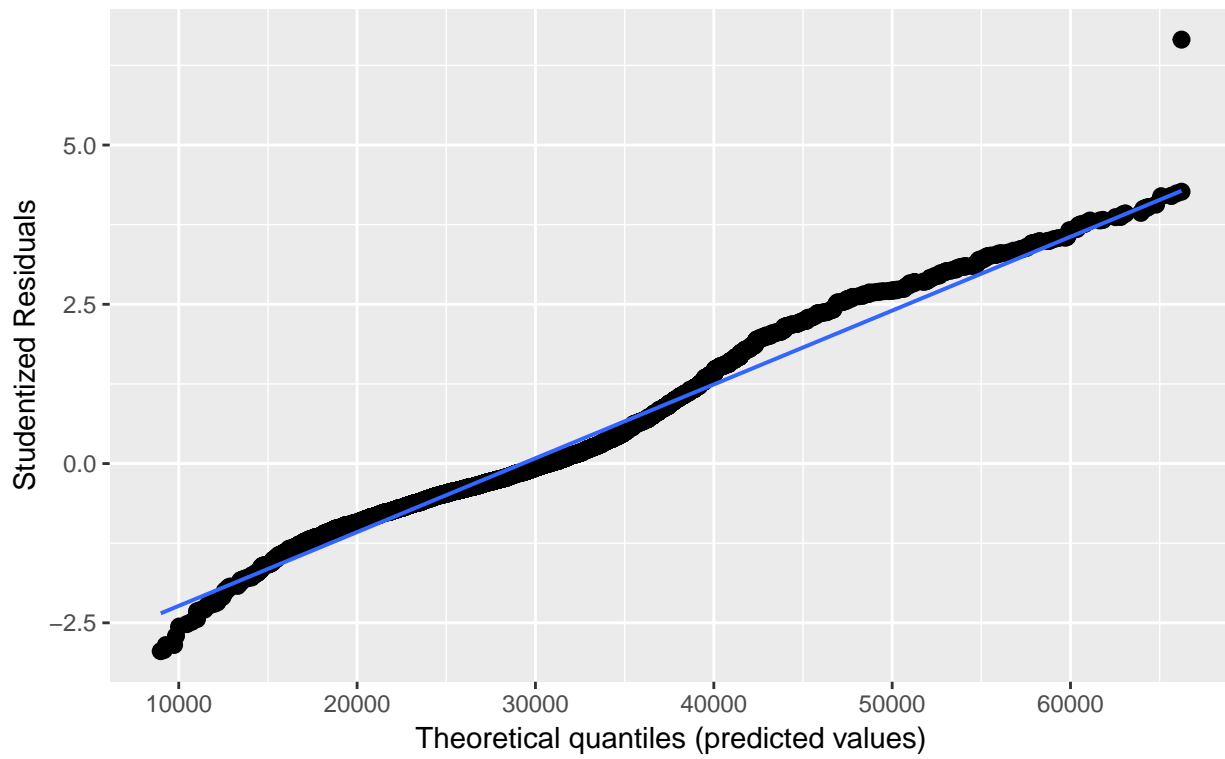
[[1]]

Variance Inflation Factors (multicollinearity)
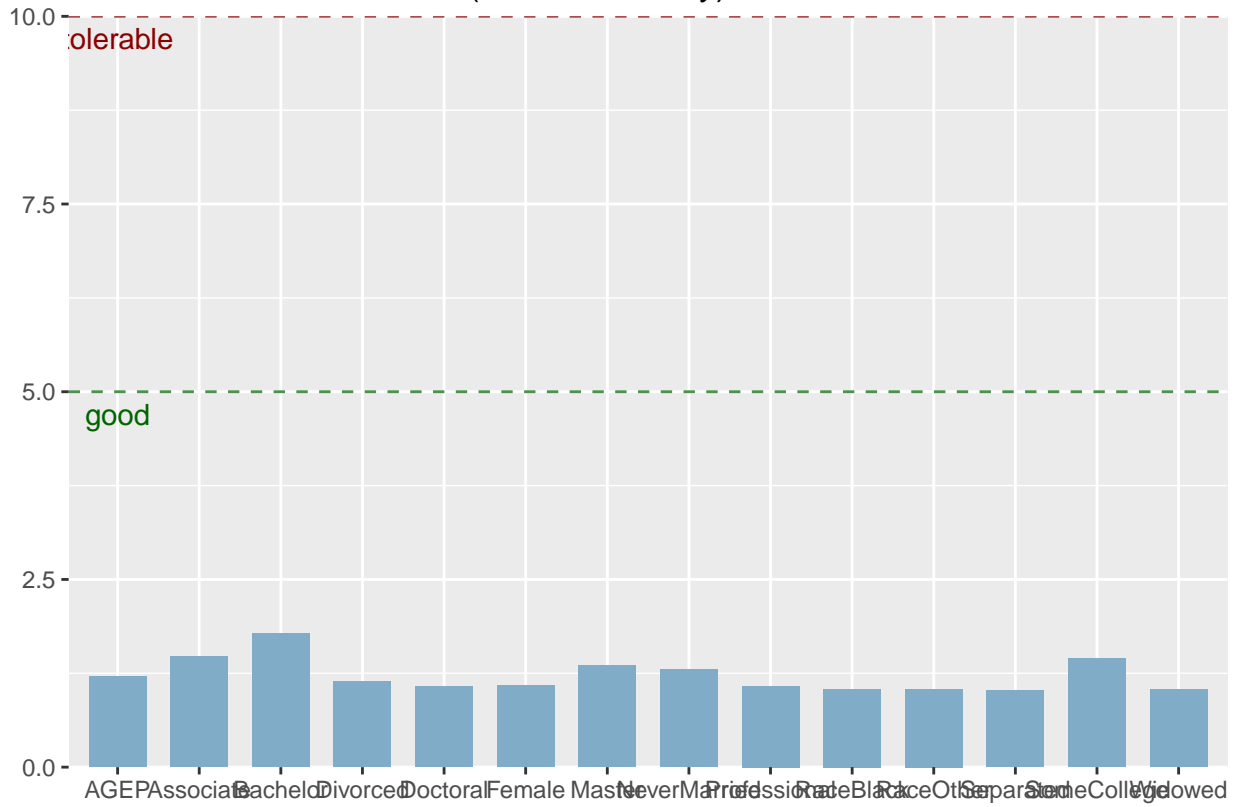

```
##
## [[2]]
```

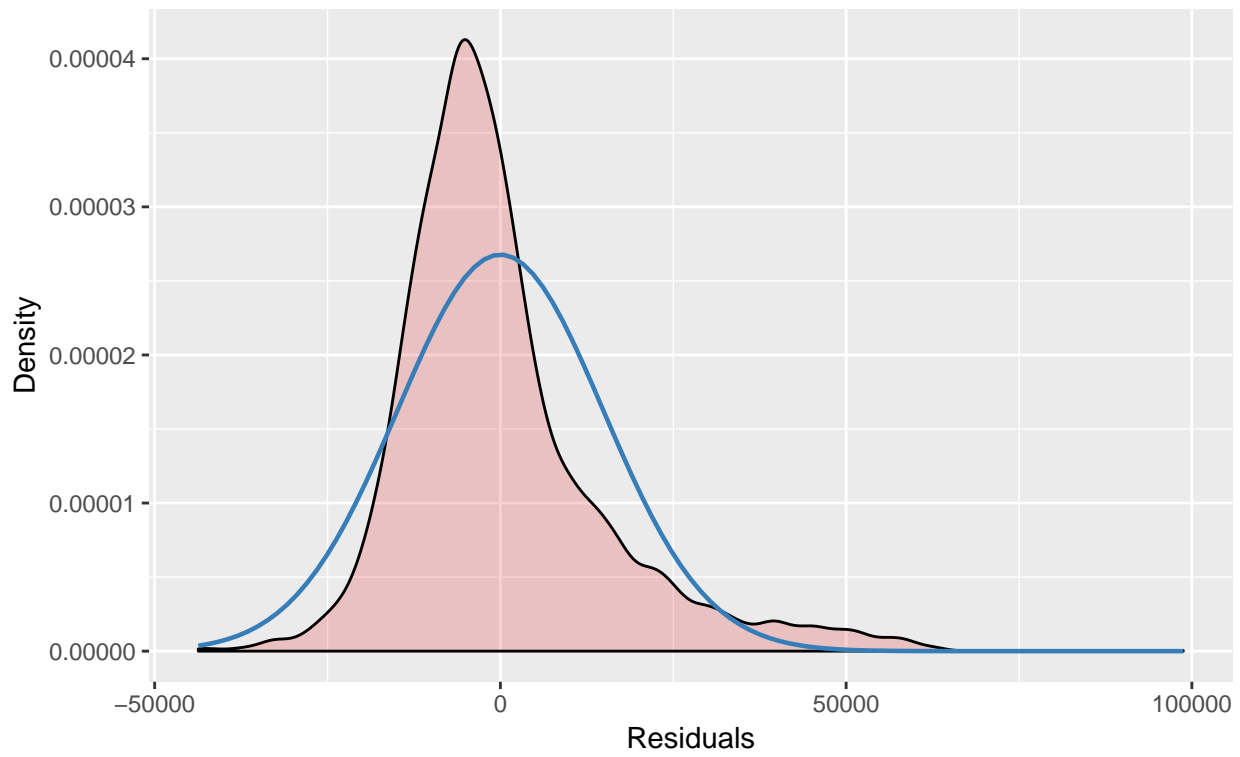## Non–normality of residuals and outliers
Dots should be plotted along the line


```
## 
## [[3]]
```

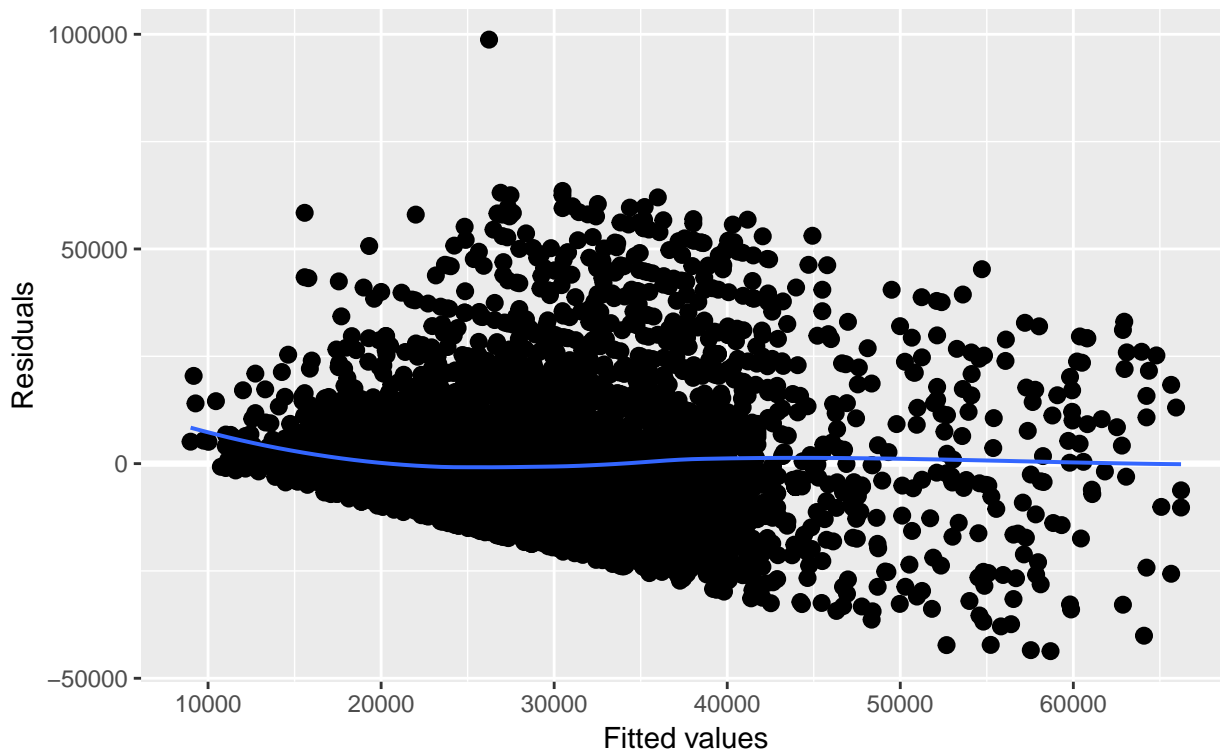## Non–normality of residuals
Distribution should look like normal curve


```
## 
## [[4]]
```

Homoscedasticity (constant variance of residuals)
Amount and distance of points scattered above/below line is equal or randomly sprea


```
##
##  studentized Breusch-Pagan test
##
## data:  Model_1
## BP = 297.55, df = 14, p-value < 0.00000000000000022
```

The p-Value < 0.05 which indicates that the null hypothesis (the variance is unchanging in the residual) can be rejected and therefore heterscedasticity exists.

```
##
## Call:
## lm(formula = residuals(Model_1) * residuals(Model_1) ~ Widowed +
##     Divorced + Separated + NeverMarried + Female + RaceBlack +
##     RaceOther + SomeCollege + Associate + Bachelor + Master +
##     Professional + Doctoral + AGEP, data = ss16ppr)
##
## Residuals:
##       Min         1Q     Median         3Q        Max
## -620286278 -187332480  -89004449   -6623206 9554893533
##
## Coefficients:
##               Estimate Std. Error t value          Pr(>|t|)
## (Intercept)  -22272288   35096119  -0.635            0.5257
## Widowed       10526294   59680719   0.176            0.8600
## Divorced      -9634464   18080343  -0.533            0.5941
## Separated    -74925738   47074515  -1.592            0.1115
## NeverMarried -41219294   16452372  -2.505            0.0123 *
## Female       -86614125   13676418  -6.333  0.00000000026057555 ***
```

```
## RaceBlack      -30492334    18693117  -1.631                        0.1029
## RaceOther      -56411117    18333200  -3.077                        0.0021 **
## SomeCollege     54139584    21960626   2.465                        0.0137 *
## Associate       38592334    21762198   1.773                        0.0762 .
## Bachelor       167802881    18557574   9.042 < 0.0000000000000002 ***
## Master         240588080    25686793   9.366 < 0.0000000000000002 ***
## Professional   363259303    46668182   7.784  0.00000000000000843 ***
## Doctoral       283832422    51116425   5.553  0.00000002953675723 ***
## AGEP             4843548      667752   7.254  0.0000000000046605 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 471600000 on 5179 degrees of freedom
## Multiple R-squared:  0.05729,    Adjusted R-squared:  0.05474
## F-statistic: 22.48 on 14 and 5179 DF,  p-value: < 0.00000000000000022

##              (Intercept)      Widowed     Divorced    Separated NeverMarried
## (Intercept)  1007933.05    58087.062  -81847.4203   -49419.377  -267638.579
## Widowed         58087.06 3995751.368  105877.9224   111739.704    61877.649
## Divorced       -81847.42  105877.922  349056.7354   102495.813    95360.449
## Separated      -49419.38  111739.704  102495.8126  1565899.963    91581.434
## NeverMarried  -267638.58   61877.649   95360.4487    91581.434   242152.106
## Female         -24269.36  -37296.786  -22584.5663    -9502.521     3535.426
## RaceBlack      -54050.20    4154.512    -261.2336    -1778.827    -1474.294
## RaceOther      -43361.05  -17198.587    3064.7362    28165.922    -2030.508
## SomeCollege   -164587.00    5864.731    2716.6330   -30536.341    -9191.626
## Associate     -156276.57   28238.641   14270.5777    26369.734    16901.438
## Bachelor      -140253.26   58869.676   15822.7991    22192.750    11420.935
## Master         -98238.23   19298.737    4166.7095   -29561.887     4120.858
## Professional  -178405.52   47377.351   -9202.0646    36275.425   -25373.156
## Doctoral       -51307.89  115905.356   47855.5908   140337.165    29949.062
## AGEP           -18128.79   -3587.834    -293.0243    -1156.124     3781.175
##                   Female    RaceBlack    RaceOther  SomeCollege    Associate
## (Intercept)  -24269.3559 -54050.20464  -43361.053 -164587.002  -156276.572
## Widowed      -37296.7857   4154.51196  -17198.587    5864.731    28238.641
## Divorced     -22584.5663   -261.23364    3064.736    2716.633    14270.578
## Separated     -9502.5212  -1778.82702   28165.922  -30536.341    26369.734
## NeverMarried   3535.4265  -1474.29397   -2030.508   -9191.626    16901.438
## Female       194048.3723  -8630.04524   -8397.285  -29487.201   -42117.858
## RaceBlack     -8630.0452 315761.19749   66096.740  -10264.752    -6036.723
## RaceOther     -8397.2851  66096.74016  278637.804    3569.363    -4820.559
## SomeCollege  -29487.2014 -10264.75223    3569.363  332091.081   125594.576
## Associate    -42117.8578  -6036.72309   -4820.559  125594.576   319016.024
## Bachelor     -78511.6369   6202.41918  -10349.806  130275.001   135533.527
## Master       -92998.9918  -6855.66175   28720.700  131019.704   135614.524
## Professional -48793.0798  28726.41028   17513.253  130357.805   129838.545
## Doctoral     -37589.1845    758.93490   80827.611  112338.880   124924.530
## AGEP           -787.2688    -97.32446    -420.435    1437.587     1046.660
##                 Bachelor       Master Professional     Doctoral
## (Intercept)  -140253.2646 -98238.2349  -178405.520  -51307.8937
## Widowed        58869.6759  19298.7370    47377.351  115905.3561
## Divorced       15822.7991   4166.7095    -9202.065   47855.5908
## Separated      22192.7500 -29561.8868    36275.425  140337.1654
## NeverMarried   11420.9348   4120.8577   -25373.156   29949.0622
## Female        -78511.6369 -92998.9918   -48793.080  -37589.1845
## RaceBlack       6202.4192  -6855.6618    28726.410     758.9349
## RaceOther     -10349.8064  28720.6998    17513.253   80827.6113
```

```
## SomeCollege    130275.0011 131019.7043    130357.805   112338.8799
## Associate      135533.5269 135614.5236    129838.545   124924.5305
## Bachelor       307695.2759 152567.2493    140083.610   133715.9622
## Master         152567.2493 847427.5870    140245.690   140031.3156
## Professional   140083.6102 140245.6899   4394423.380   124345.5782
## Doctoral       133715.9622 140031.3156    124345.578  4770075.3429
## AGEP               949.8206    127.4089      1732.881    -2150.9231
##                        AGEP
## (Intercept)   -18128.78819
## Widowed        -3587.83358
## Divorced        -293.02429
## Separated      -1156.12421
## NeverMarried    3781.17492
## Female          -787.26885
## RaceBlack        -97.32446
## RaceOther       -420.43504
## SomeCollege     1437.58685
## Associate       1046.66000
## Bachelor         949.82059
## Master           127.40891
## Professional    1732.88105
## Doctoral       -2150.92312
## AGEP             413.64705


##   (Intercept)        Widowed        Divorced      Separated NeverMarried
##    1003.95869     1998.93756       590.81024     1251.35925     492.08953
##        Female      RaceBlack       RaceOther    SomeCollege      Associate
##     440.50922      561.92633       527.86154      576.27344     564.81504
##      Bachelor         Master    Professional       Doctoral           AGEP
##     554.70287      920.55830     2096.28800     2184.05022      20.33831
```
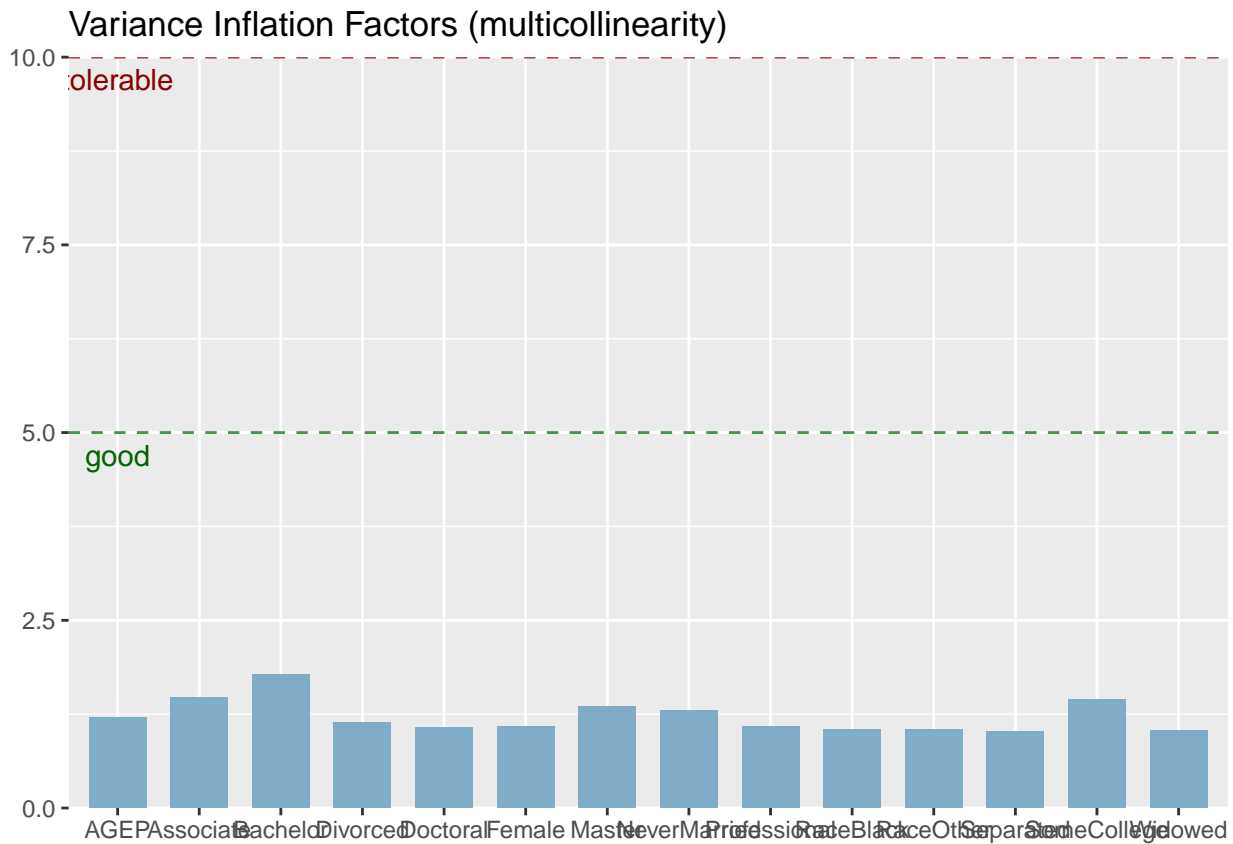
Revised Logarithmic Model

```
##
## Call:
## lm(formula = log(PERNP, base = exp(1)) ~ Widowed + Divorced +
##     Separated + NeverMarried + Female + RaceBlack + RaceOther +
##     SomeCollege + Associate + Bachelor + Master + Professional +
##     Doctoral + AGEP, data = ss16ppr)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.56195 -0.30715 -0.03111  0.27690  1.69792
##
## Coefficients:
##               Estimate Std. Error t value          Pr(>|t|)
## (Intercept)  9.5841704  0.0331471 289.140 < 0.0000000000000002 ***
## Widowed      0.0167914  0.0563665   0.298          0.765794
## Divorced    -0.0391735  0.0170763  -2.294          0.021829 *
## Separated   -0.0437489  0.0444603  -0.984          0.325162
## NeverMarried -0.1033310 0.0155387  -6.650    0.0000000000323503 ***
## Female      -0.1380595  0.0129169 -10.688 < 0.0000000000000002 ***
## RaceBlack   -0.0278297  0.0176550  -1.576          0.115017
## RaceOther   -0.0570606  0.0173151  -3.295          0.000989 ***
## SomeCollege  0.1505241  0.0207411   7.257    0.0000000000004534 ***
## Associate    0.1546604  0.0205537   7.525    0.0000000000000619 ***
```

8

```
## Bachelor       0.4214137  0.0175270   24.044 < 0.0000000000000002 ***
## Master         0.5748312  0.0242603   23.694 < 0.0000000000000002 ***
## Professional   0.8187333  0.0440766   18.575 < 0.0000000000000002 ***
## Doctoral       0.9597258  0.0482778   19.879 < 0.0000000000000002 ***
## AGEP           0.0092656  0.0006307   14.692 < 0.0000000000000002 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4454 on 5179 degrees of freedom
## Multiple R-squared:  0.2556, Adjusted R-squared:  0.2536
## F-statistic:    127 on 14 and 5179 DF,  p-value: < 0.0000000000000022
```

- Coefficients Explanation

  - Holding gender, race, education and age constant, married people makes $1.69% more than people who widowed on average.
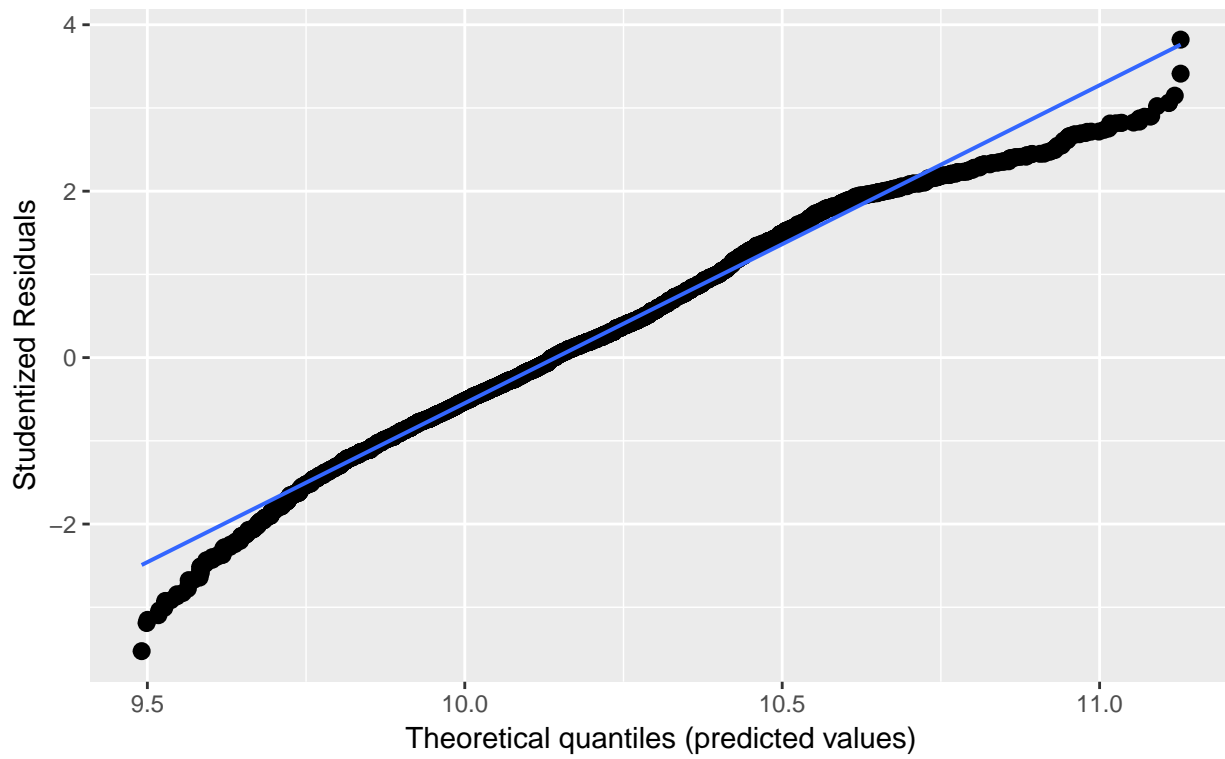
```
## [[1]]
```


Variance Inflation Factors (multicollinearity)

```
##
## [[2]]
```
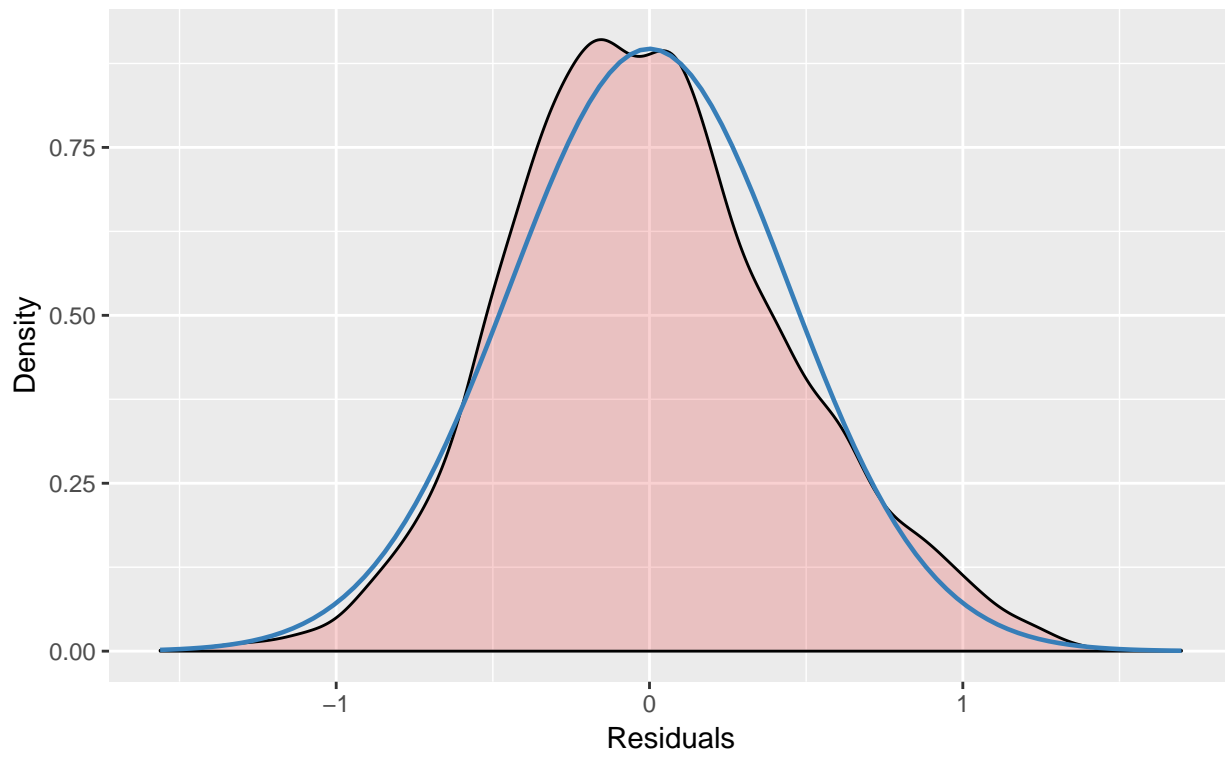
Non−normality of residuals and outliers
Dots should be plotted along the line


```
##
## [[3]]
```

Non–normality of residuals
Distribution should look like normal curve


```
## 
## [[4]]
```

Homoscedasticity (constant variance of residuals)
Amount and distance of points scattered above/below line is equal or randomly spread