Kyle Nabors Worked with Ricardo

1. |
    a. For this pooled OLS regression, we are going to use three dependent variables vio (violent crime rate per 100,000), rob (robbery rate per 100,000), and mur (murder rate per 100,000). We will use the following regression formulas. Results can be seen in Table 1.
        i. $vio_{it} = b_o + b_1\ shall_{it} + b_2\ year_{it} + b_3\ avginc_{it} + b_4\ pm1029_{it} + b_5\ density + b_6\ pop + e_{it}$
        ii. $rob_{it} = b_o + b_1\ shall_{it} + b_2\ year_{it} + b_3\ avginc_{it} + b_4\ pm1029_{it} + b_5\ density + b_6\ pop + e_{it}$
        iii. $mur_{it} = b_o + b_1\ shall_{it} + b_2\ year_{it} + b_3\ avginc_{it} + b_4\ pm1029_{it} + b_5\ density + b_6\ pop + e_{it}$
    b. Now using the same data but preforming a random-effect regression we use the following formulas. Results can be seen in Table 2.
        i. $vio_{it} = b_o + b_1\ shall_{it} + b_2\ year_{it} + b_3\ avginc_{it} + b_4\ pm1029_{it} + b_5\ density + b_6\ pop + a_i + e_{it}$
        ii. $rob_{it} = b_o + b_1\ shall_{it} + b_2\ year_{it} + b_3\ avginc_{it} + b_4\ pm1029_{it} + b_5\ density + b_6\ pop + a_i + e_{it}$
        iii. $mur_{it} = b_o + b_1\ shall_{it} + b_2\ year_{it} + b_3\ avginc_{it} + b_4\ pm1029_{it} + b_5\ density + b_6\ pop + a_i + e_{it}$
    c. Now using the same data but preforming a fixed-effect regression we use the following formulas. Results can be seen in Table 3
        i. $vio_{it} = b_o + b_1\ shall_{it} + b_2\ year_{it} + b_3\ avginc_{it} + b_4\ pm1029_{it} + b_5\ density + b_6\ pop + a_i + e_{it}$
        ii. $rob_{it} = b_o + b_1\ shall_{it} + b_2\ year_{it} + b_3\ avginc_{it} + b_4\ pm1029_{it} + b_5\ density + b_6\ pop + a_i + e_{it}$
        iii. $mur_{it} = b_o + b_1\ shall_{it} + b_2\ year_{it} + b_3\ avginc_{it} + b_4\ pm1029_{it} + b_5\ density + b_6\ pop + a_i + e_{it}$
    d. For regressions a, we find a large effect and a high significance for most of our regressors especially for murder rate. This contrasts with our random regression which have no statistical significance and our fixed effect regression which shows very little statistical significance. Based on these results it is likely our pooled OLS regression and our random effect regression gives us inconsistent estimators.
    e. The results for our Hausman test can be seen in Table 4, Table 5, and Table 6. Based on these results all our tests reject the null hypothesis of being consistent. Based on this all our results are inconsistent. The requirements for using the Hausman test is that the data be homoscedastic and not be serially correlated.
2. |
    a. Our three regression results from the following equations can be seen in Table 7
        i. $Fatalityrate_{it} = = b_o + b_1\ sb\_usage_{it} + b_2\ drinkage21_{it} + b_3\ drinkage21_{it} * speed70_{it} + a_i + e_{it}$
        ii. $Fatalityrate_{it} = = b_o + b_1\ sb\_usage_{it} + b_2\ drinkage21_{it} + b_3\ drinkage21_{it} * speed70_{it} + a_i + \lambda_t + e_{it}$
        iii. $Fatalityrate_{it} = = b_o + b_1\ sb\_usage_{it} + b_2\ drinkage21_{it} + b_3\ drinkage21_{it} * speed70_{it} + a_i + \lambda_t + \eta_i t + e_{it}$

b. Using the comparison seen in Table 8 and our previous results we can conclude that speed limit has no significant effect on DUI. In our results in part A we see that drinking age * Speed 70 has no statistical significance. Based on these two results we conclude that lowering the speed limit has no significant effect on DUI.

c. Results can be seen in Table 9

   i. $\Delta \text{Fatalityrate}_{it}$ = = $b_o + b_1\, \Delta \text{sb\_usage}_{it} + b_2\, \Delta \text{drinkage21}_{it} + b_3\, \Delta(\text{drinkage21}_{it} * \text{speed70}_{it)}$ $+ e_{it}$

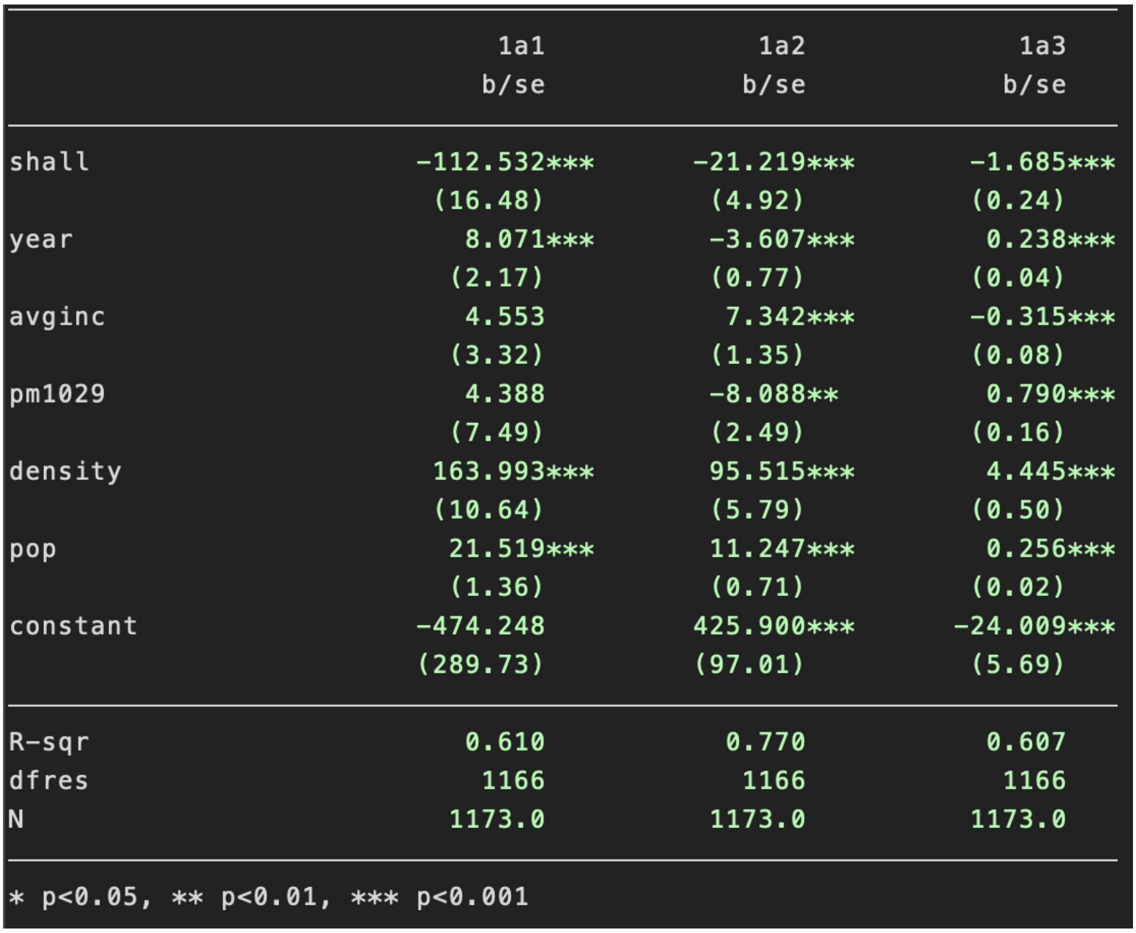
   ii. $\Delta \text{Fatalityrate}_{it}$ = = $b_o + b_1\, \Delta \text{sb\_usage}_{it} + b_2\, \Delta \text{drinkage21}_{it} + b_3\, \Delta(\text{drinkage21}_{it} * \text{speed70}_{it})$ $+ \Delta\lambda_t + e_{it}$

   iii. $\Delta \text{Fatalityrate}_{it}$ = = $b_o + b_1\, \Delta \text{sb\_usage}_{it} + b_2\, \Delta \text{drinkage21}_{it} + b_3\, \Delta(\text{drinkage21}_{it} * \text{speed70}_{it})$ $+ \Delta\lambda_t + \eta_i + e_{it}$

d. To test for strict exogeneity we compare our coefficients from our FE and FD regressions. For our first regression given that they are significantly different from each other and cannot be explained by sampling variability we conclude that strict exogeneity is violated. For our model two and three our coefficients are not as significant different meaning there is possibility for strict exogeneity to hold but given that they are different we cannot make any definite conclusions without further analysis.

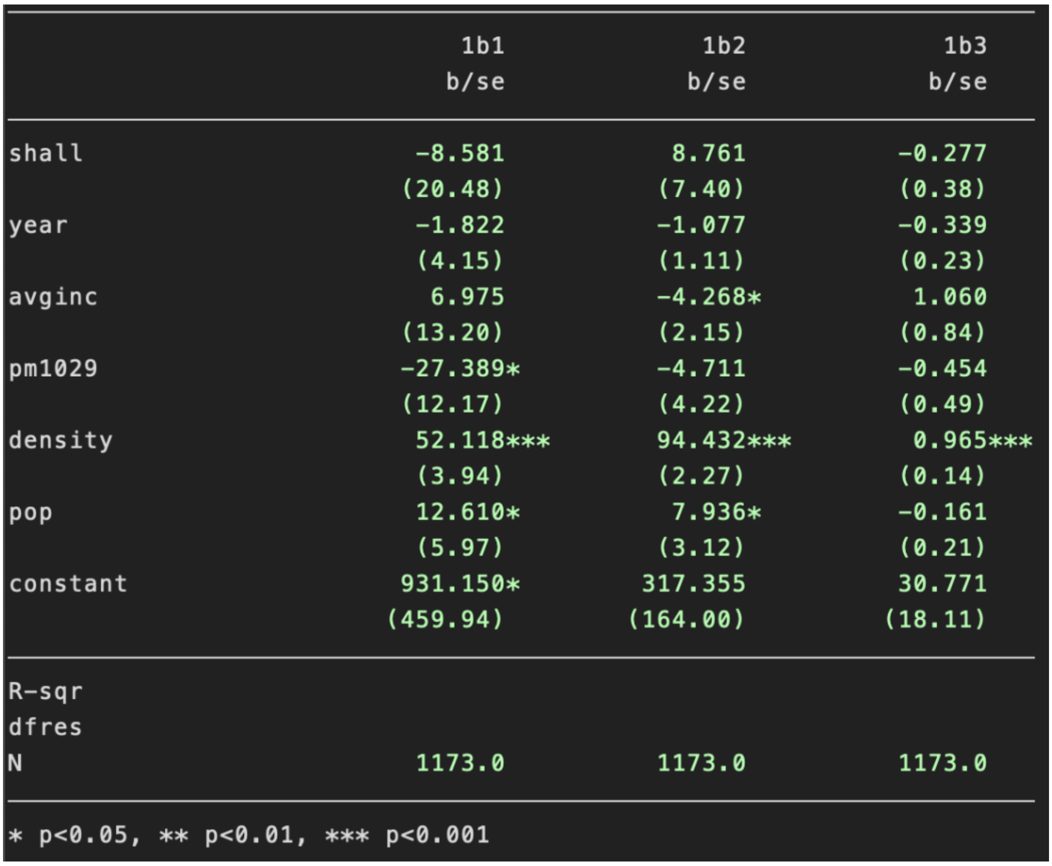
Appendix:

Table 1:



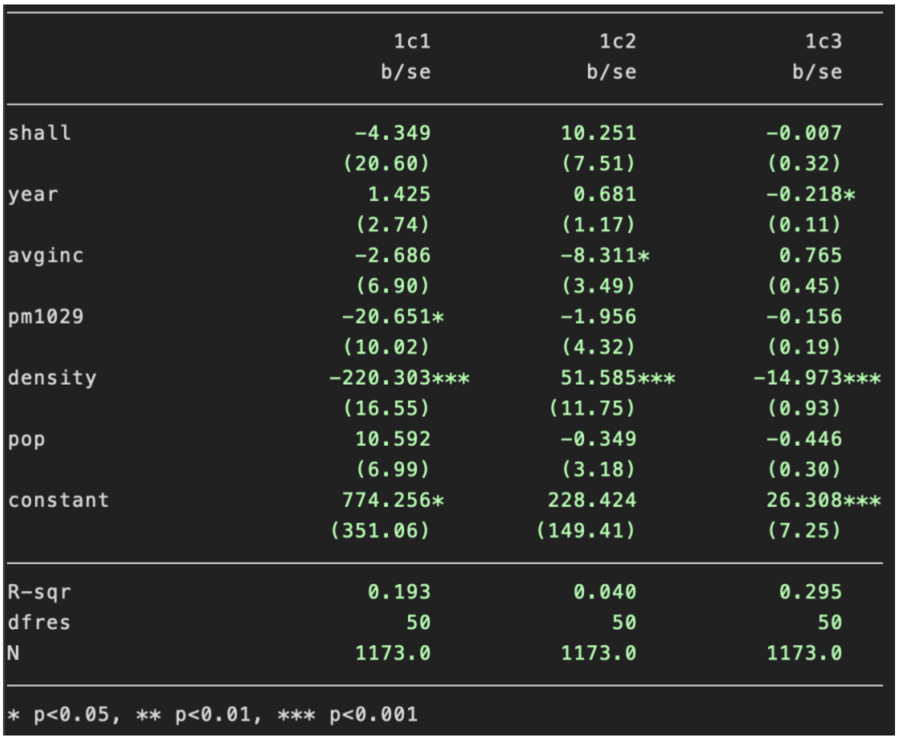
```
------------------------------------------------------------
                          1a1             1a2             1a3
                         b/se            b/se            b/se
------------------------------------------------------------
shall             -112.532***      -21.219***       -1.685***
                      (16.48)          (4.92)          (0.24)
year                 8.071***       -3.607***        0.238***
                       (2.17)          (0.77)          (0.04)
avginc                  4.553        7.342***       -0.315***
                       (3.32)          (1.35)          (0.08)
pm1029                  4.388        -8.088**        0.790***
                       (7.49)          (2.49)          (0.16)
density            163.993***       95.515***        4.445***
                      (10.64)          (5.79)          (0.50)
pop                 21.519***       11.247***        0.256***
                       (1.36)          (0.71)          (0.02)
constant             -474.248      425.900***      -24.009***
                     (289.73)         (97.01)          (5.69)
------------------------------------------------------------
R-sqr                   0.610           0.770           0.607
dfres                    1166            1166            1166
N                      1173.0          1173.0          1173.0
------------------------------------------------------------
* p<0.05, ** p<0.01, *** p<0.001
```

Table 2:



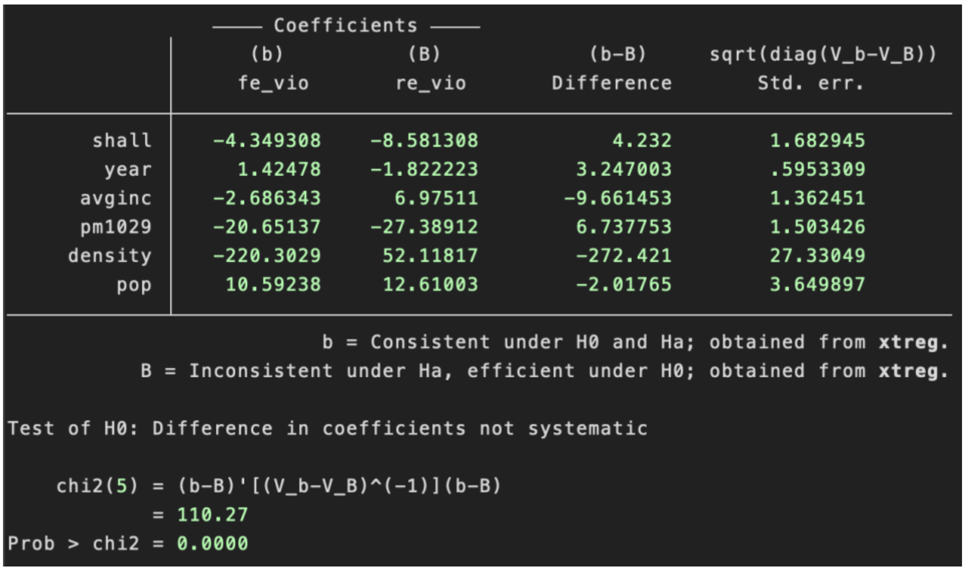
```
------------------------------------------------------------
                          1b1             1b2             1b3
                         b/se            b/se            b/se
------------------------------------------------------------
shall                  -8.581           8.761          -0.277
                      (20.48)          (7.40)          (0.38)
year                   -1.822          -1.077          -0.339
                       (4.15)          (1.11)          (0.23)
avginc                  6.975         -4.268*           1.060
                      (13.20)          (2.15)          (0.84)
pm1029               -27.389*          -4.711          -0.454
                      (12.17)          (4.22)          (0.49)
density             52.118***       94.432***        0.965***
                       (3.94)          (2.27)          (0.14)
pop                   12.610*          7.936*          -0.161
                       (5.97)          (3.12)          (0.21)
constant             931.150*         317.355          30.771
                     (459.94)        (164.00)         (18.11)
------------------------------------------------------------
R-sqr
dfres
N                      1173.0          1173.0          1173.0
------------------------------------------------------------
* p<0.05, ** p<0.01, *** p<0.001
```

Table 3:



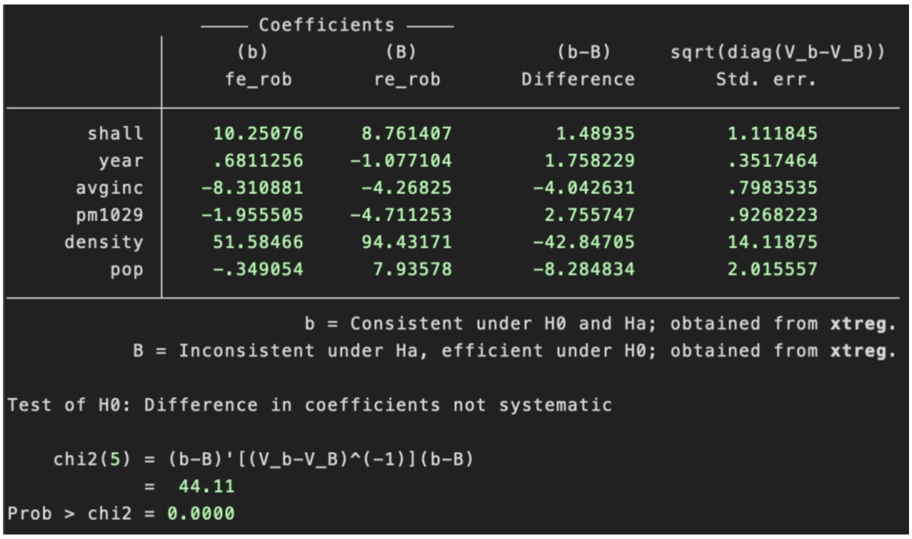
```
--------------------------------------------------------------------
                         lc1             lc2             lc3
                         b/se            b/se            b/se
--------------------------------------------------------------------
shall                  -4.349          10.251          -0.007
                      (20.60)          (7.51)          (0.32)
year                    1.425           0.681          -0.218*
                       (2.74)          (1.17)          (0.11)
avginc                 -2.686          -8.311*          0.765
                       (6.90)          (3.49)          (0.45)
pm1029                -20.651*         -1.956          -0.156
                      (10.02)          (4.32)          (0.19)
density              -220.303***       51.585***      -14.973***
                      (16.55)         (11.75)          (0.93)
pop                    10.592          -0.349          -0.446
                       (6.99)          (3.18)          (0.30)
constant              774.256*        228.424          26.308***
                     (351.06)        (149.41)          (7.25)
--------------------------------------------------------------------
R-sqr                   0.193           0.040           0.295
dfres                      50              50              50
N                      1173.0          1173.0          1173.0
--------------------------------------------------------------------
* p<0.05, ** p<0.01, *** p<0.001
```

Table 4:



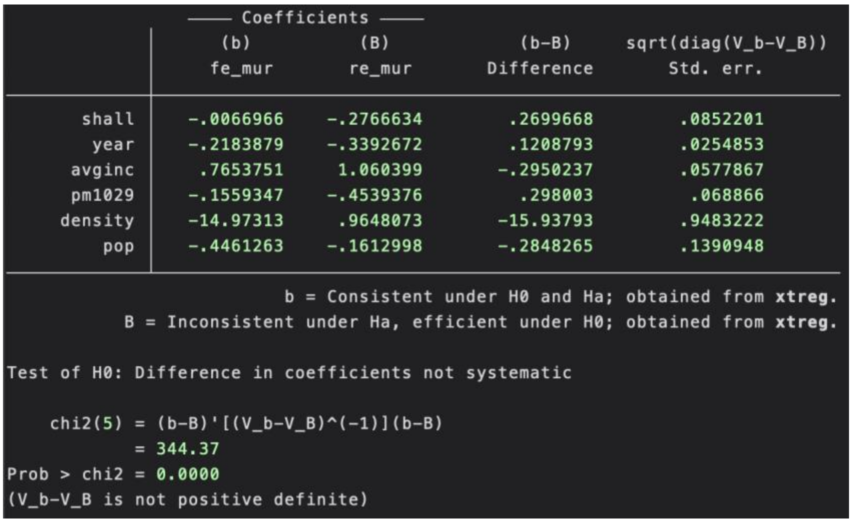
```
             |     ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |     fe_vio       re_vio        Difference       Std. err.
-------------+----------------------------------------------------------------
       shall |   -4.349308    -8.581308          4.232        1.682945
        year |     1.42478    -1.822223       3.247003        .5953309
      avginc |   -2.686343      6.97511      -9.661453        1.362451
      pm1029 |   -20.65137    -27.38912       6.737753        1.503426
     density |   -220.3029     52.11817       -272.421        27.33049
         pop |    10.59238     12.61003       -2.01765        3.649897
------------------------------------------------------------------------------
                          b = Consistent under H0 and Ha; obtained from xtreg.
           B = Inconsistent under Ha, efficient under H0; obtained from xtreg.

Test of H0: Difference in coefficients not systematic

    chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
            = 110.27
Prob > chi2 = 0.0000
```

Table 5:



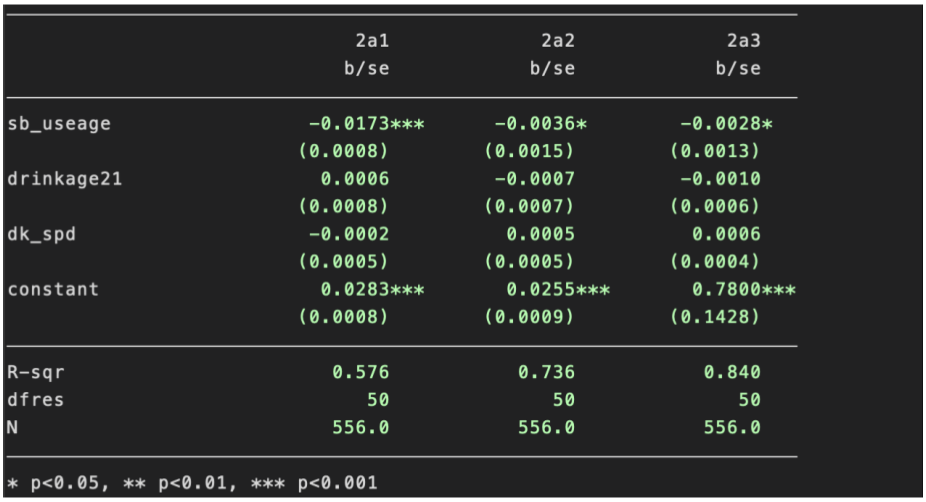
```
             |     ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |     fe_rob       re_rob        Difference       Std. err.
-------------+----------------------------------------------------------------
       shall |    10.25076     8.761407        1.48935        1.111845
        year |    .6811256    -1.077104       1.758229        .3517464
      avginc |   -8.310881     -4.26825      -4.042631        .7983535
      pm1029 |   -1.955505    -4.711253       2.755747        .9268223
     density |    51.58466     94.43171      -42.84705        14.11875
         pop |    -.349054      7.93578      -8.284834        2.015557
------------------------------------------------------------------------------
                          b = Consistent under H0 and Ha; obtained from xtreg.
           B = Inconsistent under Ha, efficient under H0; obtained from xtreg.

Test of H0: Difference in coefficients not systematic

    chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
            =  44.11
Prob > chi2 = 0.0000
```

Table 6:



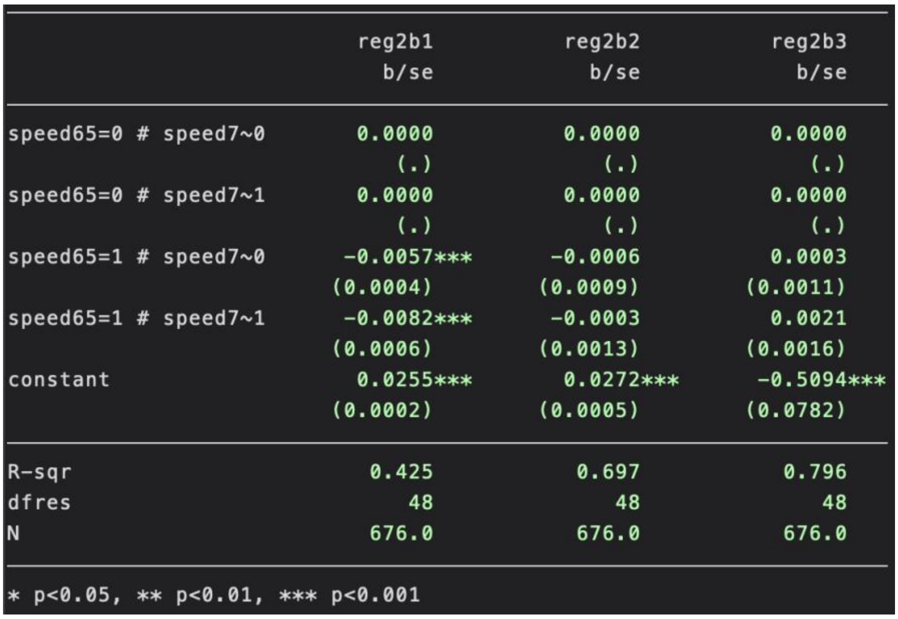
```
                 ──── Coefficients ────
             │      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             │    fe_mur       re_mur        Difference       Std. err.
─────────────┼────────────────────────────────────────────────────────────────
       shall │   -.0066966    -.2766634        .2699668        .0852201
        year │   -.2183879    -.3392672        .1208793        .0254853
      avginc │    .7653751     1.060399       -.2950237        .0577867
      pm1029 │   -.1559347    -.4539376         .298003         .068866
     density │   -14.97313     .9648073       -15.93793        .9483222
         pop │   -.4461263    -.1612998       -.2848265        .1390948
─────────────┴────────────────────────────────────────────────────────────────
                          b = Consistent under H0 and Ha; obtained from xtreg.
           B = Inconsistent under Ha, efficient under H0; obtained from xtreg.

Test of H0: Difference in coefficients not systematic

    chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
            = 344.37
Prob > chi2 = 0.0000
(V_b-V_B is not positive definite)
```

Table 7:



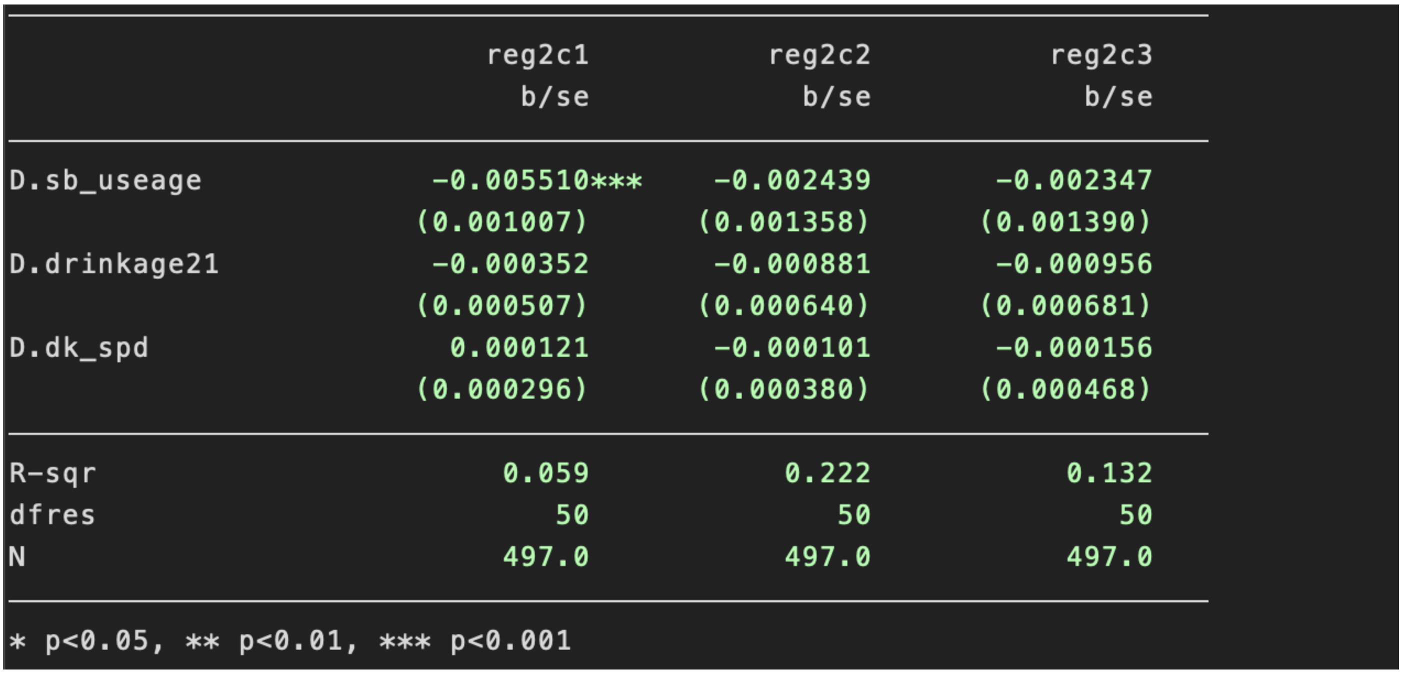
```
────────────────────────────────────────────────────────────
                              2a1            2a2            2a3
                             b/se           b/se           b/se
────────────────────────────────────────────────────────────
sb_useage               -0.0173***      -0.0036*       -0.0028*
                        (0.0008)        (0.0015)       (0.0013)
drinkage21               0.0006         -0.0007        -0.0010
                        (0.0008)        (0.0007)       (0.0006)
dk_spd                  -0.0002          0.0005         0.0006
                        (0.0005)        (0.0005)       (0.0004)
constant                 0.0283***       0.0255***      0.7800***
                        (0.0008)        (0.0009)       (0.1428)
────────────────────────────────────────────────────────────
R-sqr                      0.576           0.736          0.840
dfres                         50              50             50
N                          556.0           556.0          556.0
────────────────────────────────────────────────────────────
* p<0.05, ** p<0.01, *** p<0.001
```

Table 8:



```
────────────────────────────────────────────────────────────
                            reg2b1          reg2b2          reg2b3
                              b/se            b/se            b/se
────────────────────────────────────────────────────────────
speed65=0 # speed7~0        0.0000          0.0000          0.0000
                               (.)             (.)             (.)
speed65=0 # speed7~1        0.0000          0.0000          0.0000
                               (.)             (.)             (.)
speed65=1 # speed7~0      -0.0057***      -0.0006          0.0003
                          (0.0004)        (0.0009)        (0.0011)
speed65=1 # speed7~1      -0.0082***      -0.0003          0.0021
                          (0.0006)        (0.0013)        (0.0016)
constant                    0.0255***       0.0272***     -0.5094***
                          (0.0002)        (0.0005)        (0.0782)
────────────────────────────────────────────────────────────
R-sqr                        0.425           0.697           0.796
dfres                           48              48              48
N                            676.0           676.0           676.0
────────────────────────────────────────────────────────────
* p<0.05, ** p<0.01, *** p<0.001
```

Table 9:



```
----------------------------------------------------------------------
                      reg2c1          reg2c2          reg2c3
                        b/se            b/se            b/se
----------------------------------------------------------------------
D.sb_useage      -0.005510***       -0.002439       -0.002347
                 (0.001007)      (0.001358)      (0.001390)
D.drinkage21     -0.000352       -0.000881       -0.000956
                 (0.000507)      (0.000640)      (0.000681)
D.dk_spd          0.000121       -0.000101       -0.000156
                 (0.000296)      (0.000380)      (0.000468)
----------------------------------------------------------------------
R-sqr                0.059           0.222           0.132
dfres                   50              50              50
N                    497.0           497.0           497.0
----------------------------------------------------------------------
* p<0.05, ** p<0.01, *** p<0.001
```