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ARE256B: Applied Econometrics II
6 March 2024
Problem Set Four:

Question One: Gun Control and Violence: Pooled OLS, Random Effects or Fixed Effects?
Using the gun control data set (Guns and its description Guns_Description are on Canvas), we are interested in the relationship between "shall-carry" laws and violent crime rates, rob- bery rates and murder rates, i.e. we have three different dependent variables. You have a state-level panel for 1977-1999. Perform the following regressions and tabulate the coefficient estimates for "shall-carry" laws as well as their standard errors.
Write down the regression equation for each regression you perform.

A. Perform the pooled OLS regression of each of the three dependent variables on the dummy variable for "shall-carry" law, time trend and other control variables from the dataset. Choose the control variables to include and explain your choice.

Control variables and explanation of choice:

The control variables that I decided to include were density, average income, and population. Given the dependent variables violent crime rate, robbery rate, and murder rate, it makes sense to include each of these right-hand side variables as a control.

- Population density: The intuition behind this control is that a higher population density creates more opportunities for crime to occur between people in a given geographic area.
- Average income: For this control, we might hypothesize that lower income demographics will be more prone to committing any of these three types of crime.
- Population: This control gets at a similar hypothesis to population density; more people *overall* will correspond to higher rates of crime.

Regression equations:

$$Violent\ Crime\ Rate_{it} = \beta_0 + \beta_1(shall_{it}) + \beta_2(year_{it}) + \beta_3(density_{it}) + \beta_3(avginc_{it}) + \beta_5(pop_{it}) + \epsilon_{it}$$

Linear regression

Number of obs	=	1,173
F(5, 1167)	=	156.88
Prob > F	=	0.0000
R-squared	=	0.6094
Root MSE	=	209.36

vio	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
shall	-111.9296	16.22195	-6.90	0.000	-143.757	-80.10211
year	7.103581	1.237489	5.74	0.000	4.675629	9.531533
avginc	4.36877	3.371511	1.30	0.195	-2.246131	10.98367
density	163.7426	10.58664	15.47	0.000	142.9716	184.5135
pop	21.47085	1.353044	15.87	0.000	18.81618	24.12552
_cons	-315.8604	87.99076	-3.59	0.000	-488.4981	-143.2226

$$Robbery\ Rate_{it} = \beta_0 + \beta_1(shall_{it}) + \beta_2(year_{it}) + \beta_3(density_{it}) + \beta_3(avginc_{it}) + \beta_5(pop_{it}) + \epsilon_{it}$$

Linear regression

Number of obs	=	1,173
F(5, 1167)	=	190.07
Prob > F	=	0.0000
R-squared	=	0.7680
Root MSE	=	82.312

rob	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
shall	-22.32884	4.920613	-4.54	0.000	-31.98308	-12.6746
year	-1.824314	.4454408	-4.10	0.000	-2.698268	-.9503596
avginc	7.681378	1.384179	5.55	0.000	4.965621	10.39714
density	95.97615	5.753169	16.68	0.000	84.68843	107.2639
pop	11.33618	.730431	15.52	0.000	9.903075	12.76928
_cons	133.9735	34.32646	3.90	0.000	66.62499	201.3219

$$Murder\ Rate_{it} = \beta_0 + \beta_1(shall_{it}) + \beta_2(year_{it}) + \beta_3(density_{it}) + \beta_3(avginc_{it}) + \beta_5(pop_{it}) + \epsilon_{it}$$

Linear regression

Number of obs	=	1,173
F(5, 1167)	=	68.02
Prob > F	=	0.0000
R-squared	=	0.5989
Root MSE	=	4.7745

mur	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
shall	-1.576891	.2438062	-6.47	0.000	-2.055239	-1.098544
year	.0635691	.0260916	2.44	0.015	.0123775	.1147607
avginc	-.3480876	.0889933	-3.91	0.000	-.5226924	-.1734828
density	4.399601	.4972174	8.85	0.000	3.424061	5.375141
pop	.2473563	.0226771	10.91	0.000	.2028638	.2918488
_cons	4.491434	1.950869	2.30	0.021	.6638312	8.319037

B. Perform the random-effects regression of each of the three dependent variables on the dummy variable for “shall-carry” law and the same control variables you included in (a).

$$Violent\ Crime\ Rate_{it} = \beta_0 + \beta_1(shall_{it}) + \beta_2(year_{it}) + \beta_3(density_{it}) + \beta_3(avginc_{it}) + \beta_5(pop_{it}) + \epsilon_{it}$$

Random-effects GLS regression
Group variable: **stateid**

Number of obs	=	1,173
Number of groups	=	51

R-squared:
Within = **0.1237**
Between = **0.6248**
Overall = **0.5377**

Obs per group:
min = 23
avg = 23.0
max = 23

Wald chi2(**5**) = 198.09
Prob > chi2 = 0.0000

corr(u_i, X) = **0** (assumed)

(Std. err. adjusted for **51** clusters in **stateid**)

vio	Coefficient	Robust std. err.	z	P>|z|	[95% conf.	interval]
shall	-22.41008	19.33862	-1.16	0.247	-60.31307	15.49292
year	4.893376	2.323572	2.11	0.035	.339258	9.447493
avginc	6.158246	13.64521	0.45	0.652	-20.58588	32.90237
density	51.84012	3.932795	13.18	0.000	44.13198	59.54825
pop	12.15078	6.421486	1.89	0.058	-.4351041	24.73666
_cons	-83.39012	92.21494	-0.90	0.366	-264.1281	97.34785
sigma_u	186.2457					
sigma_e	99.444973					
rho	.77815117	(fraction of variance due to u_i)				

$$Robbery\ Rate_{it} = \ \beta_0 + \beta_1(shall_{it}) + \beta_2(year_{it}) + \ \beta_3(density_{it}) + \ \beta_3(avginc_{it}) + \beta_5(pop_{it}) + \epsilon_{it}$$

```
Random-effects GLS regression                   Number of obs     =      1,173
Group variable: stateid                         Number of groups  =         51

R-squared:                                      Obs per group:
     Within  = 0.0260                                         min =         23
     Between = 0.7878                                         avg =       23.0
     Overall = 0.7238                                         max =         23

                                                Wald chi2(5)      =    2240.51
corr(u_i, X) = 0 (assumed)                      Prob > chi2       =     0.0000
```

rob	Coefficient	Robust std. err.	z	P>|z|	[95% conf.	interval]
shall	6.425249	6.99307	0.92	0.358	-7.280916	20.13141
year	.068409	.5382528	0.13	0.899	-.9865472	1.123365
avginc	-4.37719	2.075687	-2.11	0.035	-8.445462	-.3089175
density	94.37252	2.409419	39.17	0.000	89.65015	99.0949
pop	7.903892	3.217958	2.46	0.014	1.59681	14.21097
_cons	143.0246	44.05293	3.25	0.001	56.68241	229.3667
sigma_u	66.455606					
sigma_e	49.069013					
rho	.64716776	(fraction of variance due to u_i)				

$$Murder\ Rate_{it} = \ \beta_0 + \beta_1(shall_{it}) + \beta_2(year_{it}) + \ \beta_3(density_{it}) + \ \beta_3(avginc_{it}) + \beta_5(pop_{it}) + \epsilon_{it}$$

```
Random-effects GLS regression                   Number of obs     =      1,173
Group variable: stateid                         Number of groups  =         51

R-squared:                                      Obs per group:
     Within  = 0.0632                                         min =         23
     Between = 0.2654                                         avg =       23.0
     Overall = 0.2278                                         max =         23

                                                Wald chi2(5)      =     253.80
corr(u_i, X) = 0 (assumed)                      Prob > chi2       =     0.0000

                                 (Std. err. adjusted for 51 clusters in stateid)
```

mur	Coefficient	Robust std. err.	z	P>|z|	[95% conf.	interval]
shall	-.4895847	.4710299	-1.04	0.299	-1.412786	.4336169
year	-.2306936	.1122332	-2.06	0.040	-.4506666	-.0107206
avginc	1.059402	.8368017	1.27	0.206	-.5806989	2.699503
density	.8358834	.1457137	5.74	0.000	.5502898	1.121477
pop	-.1754474	.2118185	-0.83	0.408	-.5906041	.2397093
_cons	14.09579	1.522192	9.26	0.000	11.11235	17.07923
sigma_u	3.250556					
sigma_e	2.7540148					
rho	.58213224	(fraction of variance due to u_i)				

C. Perform the fixed-effects regression of each of the three dependent variables on the dummy variable for “shall-carry” law and the same control variables you included in (a). Make sure to compute robust standard errors.

$$Violent\ Crime\ Rate_{it} = \beta_0 + \beta_1(shall_{it}) + \beta_2(year_{it}) + \beta_3(density_{it}) + \beta_3(avginc_{it}) + \beta_5(pop_{it}) + \alpha_t + \epsilon_{it}$$

```
Fixed-effects (within) regression               Number of obs     =      1,173
Group variable: stateid                         Number of groups  =         51

R-squared:                                      Obs per group:
     Within  = 0.1864                                         min =         23
     Between = 0.4096                                         avg =       23.0
     Overall = 0.3363                                         max =         23

                                                F(5, 50)          =     338.08
corr(u_i, Xb) = -0.8983                         Prob > F          =     0.0000

------------------------------------------------------------------------------
             |               Robust
         vio | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
       shall |  -14.70016   18.96909    -0.77   0.442    -52.80069    23.40037
        year |   6.604454   1.841158     3.59   0.001     2.906379    10.30253
      avginc |  -3.805232   7.020479    -0.54   0.590    -17.90628    10.29581
     density |  -230.9971   14.67264   -15.74   0.000    -260.4679   -201.5262
         pop |   9.719052    7.25606     1.34   0.186    -4.855173    24.29328
       _cons |   12.18994   95.14375     0.13   0.899    -178.9119    203.2918
-------------+----------------------------------------------------------------
     sigma_u |  584.49363
     sigma_e |  99.444973
         rho |   .9718672   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

$$Robbery\ Rate_{it} = \beta_0 + \beta_1(shall_{it}) + \beta_2(year_{it}) + \beta_3(density_{it}) + \beta_3(avginc_{it}) + \beta_5(pop_{it}) + \alpha_t + \epsilon_{it}$$

```
Fixed-effects (within) regression               Number of obs     =      1,173
Group variable: stateid                         Number of groups  =         51

R-squared:                                      Obs per group:
     Within  = 0.0394                                         min =         23
     Between = 0.4952                                         avg =       23.0
     Overall = 0.4556                                         max =         23

                                                F(5, 50)          =      81.29
corr(u_i, Xb) = 0.4040                          Prob > F          =     0.0000

                               (Std. err. adjusted for 51 clusters in stateid)
------------------------------------------------------------------------------
             |               Robust
         rob | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
       shall |   9.270621   7.171637     1.29   0.202    -5.134036    23.67528
        year |   1.171596   .6898839     1.70   0.096    -.2140769    2.557268
      avginc |   -8.41683   3.437469    -2.45   0.018    -15.32119   -1.512471
     density |   50.57201    11.0238     4.59   0.000     28.43006    72.71396
         pop |  -.4317503   3.209083    -0.13   0.894    -6.877383    6.013882
       _cons |   156.2628   36.40361     4.29   0.000     83.14399    229.3816
-------------+----------------------------------------------------------------
     sigma_u |  128.38588
     sigma_e |  49.069013
         rho |  .87254216   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

$$Murder\ Rate_{it} = \beta_0 + \beta_1(shall_{it}) + \beta_2(year_{it}) + \beta_3(density_{it}) + \beta_3(avginc_{it}) + \beta_5(pop_{it}) + \alpha_t + \epsilon_{it}$$

```
Fixed-effects (within) regression               Number of obs     =      1,173
Group variable: stateid                         Number of groups  =         51

R-squared:                                      Obs per group:
     Within  = 0.2950                                         min =         23
     Between = 0.7563                                         avg =       23.0
     Overall = 0.5829                                         max =         23

                                                F(5, 50)          =    4677.35
corr(u_i, Xb) = -0.9876                         Prob > F          =     0.0000

                               (Std. err. adjusted for 51 clusters in stateid)
------------------------------------------------------------------------------
             |               Robust
         mur | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
       shall |   -.084854   .3041394    -0.28   0.781     -.695736    .5260279
        year |  -.1792772    .076204    -2.35   0.023    -.3323374    -.026217
      avginc |   .7569266   .4471818     1.69   0.097    -.1412645    1.655118
     density |  -15.05388   .8655281   -17.39   0.000    -16.79234   -13.31541
         pop |  -.4527206   .2977387    -1.52   0.135    -1.050746    .1453051
       _cons |   20.55347   1.576796    13.03   0.000     17.38639    23.72056
-------------+----------------------------------------------------------------
     sigma_u |  26.008852
     sigma_e |  2.7540148
         rho |  .98891214   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

D. Compare the results in (a) through (c) in light of the differences between the estimators you considered.

Comparing these three types of models, the effects of the three dependent variables are the most pronounced in the models from part a. The reason for this is that there are neither fixed, nor random effects for the regression model to attribute variation in murder, robbery, and violent crime rates. Then going to b and c, there are much smaller coefficient estimates as a result of including the fixed and random effects.

E. Perform the Hausman test to test the random effects assumption. Can you use the regression you performed in (c)? Under what assumptions is the Hausman test command in Stata valid?

Violent Crime:

	Coefficients (b) fe_vio	(B) re_vio	(b-B) Difference	sqrt(diag(V_b-V_B)) Std. err.
shall	-14.70016	-22.41008	7.709912	1.528026
year	6.604454	4.893376	1.711078	.320757
avginc	-3.805232	6.158246	-9.963478	1.350373
density	-230.9971	51.84012	-282.8372	27.41538
pop	9.719052	12.15078	-2.431725	3.694035

```
                 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(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
            = 117.06
Prob > chi2 = 0.0000
```

Robbery:

	Coefficients (b) fe_rob	(B) re_rob	(b-B) Difference	sqrt(diag(V_b-V_B)) Std. err.
shall	9.270621	6.425249	2.845372	.9753652
year	1.171596	.068409	1.103187	.1864474
avginc	-8.41683	-4.37719	-4.039641	.7841576
density	50.57201	94.37252	-43.80052	14.03074
pop	-.4317503	7.903892	-8.335642	2.014373

```
                 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(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
            =  45.33
Prob > chi2 = 0.0000
(V_b-V_B is not positive definite)
```

Murder:

	Coefficients (b) fe_mur	(B) re_mur	(b-B) Difference	sqrt(diag(V_b-V_B)) Std. err.
shall	-.084854	-.4895847	.4047307	.0721358
year	-.1792772	-.2306936	.0514164	.0131869
avginc	.7569266	1.059402	-.3024757	.0557182
density	-15.05388	.8358834	-15.88976	.9371
pop	-.4527206	-.1754474	-.2772732	.1375422

```
                 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(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
            = 342.31
Prob > chi2 = 0.0000
(V_b-V_B is not positive definite)
```

The model runs in part c cannot directly be used to perform the Hausman test, the vce (robust) code must be deleted first. The Hausman test is only valid if there is homoscedasticity of α_i, u_i and serial uncorrelatedness of u_{it}.

Question Two: Seat Belt Usage: First-Difference or Fixed-Effects?
In this problem you will use the seat belt data set (SeatBelts and its description Seats-Belts_Description are on Canvas), which is a state-level panel from 1983-1997.
Write down the regression equation for each regression you perform.

1. (a) perform the fixed effects regression of fatality rate on seat belt usage, drinkage21, and interaction of drinkage21 and high speed (drinkage21 $*$ speed70) as well as including time fixed effects and including time fixed effects and state-level time trends. Tabulate your estimates of the coefficient on seat belt usage in each case as well as its robust standard errors.

Note: drkspeed = drinkage21 $*$ speed70

Model One: Does not include time or state fixed effect.

$$fatalityrate_{it} = \beta_0 + \alpha_i + \beta_1(sbusage_{it}) + \beta_2(drinkage21_{it}) + \beta_3(drkspeed_{it}) + \epsilon_{it}$$

```
Fixed-effects (within) regression               Number of obs     =        556
Group variable: fips                            Number of groups  =         51

R-squared:                                      Obs per group:
     Within  = 0.5758                                         min =          8
     Between = 0.0024                                         avg =       10.9
     Overall = 0.1573                                         max =         15

                                                F(3, 50)          =     165.62
corr(u_i, Xb) = -0.2170                         Prob > F          =     0.0000

                                  (Std. err. adjusted for 51 clusters in fips)
------------------------------------------------------------------------------
             |               Robust
fatalityrate | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
   sb_useage |  -.0173485   .0008312   -20.87   0.000     -.019018   -.015679
  drinkage21 |    .000648   .0008175     0.79   0.432    -.0009939   .0022899
   drk_speed |  -.0002339   .0004745    -0.49   0.624     -.001187   .0007193
       _cons |   .0283424    .000768    36.91   0.000     .0267999    .029885
-------------+----------------------------------------------------------------
     sigma_u |  .00446959
     sigma_e |  .00207147
         rho |  .82318424   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Model Two: Time fixed effect.

$$fatalityrate_{it} = \beta_0 + \alpha_i + \beta_1(sbusage_{it}) + \beta_2(drinkage21_{it}) + \beta_3(drkspeed_{it}) + \delta_t + \epsilon_{it}$$

```
Fixed-effects (within) regression               Number of obs     =        556
Group variable: fips                            Number of groups  =         51

R-squared:                                      Obs per group:
     Within  = 0.7360                                         min =          8
     Between = 0.0095                                         avg =       10.9
     Overall = 0.2633                                         max =         15

                                                F(17, 50)         =      49.31
corr(u_i, Xb) = -0.0467                         Prob > F          =     0.0000

                                 (Std. err. adjusted for 51 clusters in fips)
```

fatalityrate	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
sb_useage	-.0035785	.0014582	-2.45	0.018	-.0065074	-.0006497
drinkage21	-.000684	.0006614	-1.03	0.306	-.0020124	.0006444
drk_speed	.0004758	.0004919	0.97	0.338	-.0005122	.0014638

Model Three: Time and state fixed effects.

$$fatalityrate_{it} = \beta_0 + \beta_1(sbusage_{it}) + \beta_2(drinkage21_{it}) + \beta_3(drkspeed_{it}) + \alpha_i + \eta_i(c.year * fips) + \epsilon_{it}$$

```
Fixed-effects (within) regression               Number of obs     =        556
Group variable: fips                            Number of groups  =         51

R-squared:                                      Obs per group:
     Within  = 0.8397                                         min =          8
     Between = 0.1192                                         avg =       10.9
     Overall = 0.0629                                         max =         15

                                                F(17, 50)         =          .
corr(u_i, Xb) = -1.0000                         Prob > F          =          .

                                 (Std. err. adjusted for 51 clusters in fips)
```

fatalityrate	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
sb_useage	-.0028138	.0013163	-2.14	0.037	-.0054576	-.00017
drinkage21	-.0009654	.0005839	-1.65	0.105	-.0021382	.0002074
drk_speed	.0005785	.0004352	1.33	0.190	-.0002956	.0014526

2. (b) Do lower speed limits reduce fatality risk of among young DUI (drivers under influence)?

Whether lower speed limits reduce the fatality risk among young people who are driving under the influence depends on the year in which the accident occurred as well as the state. Examining the regression model that regresses fatality rate on the interaction term speed65*speed70, the marginal effect of this indicator is negative in some cases, which we interpret as a higher speed being associated with a *decrease* in the fatality rate, while in other cases it is positive, so a higher speed *increases the fatality rate.*

fatalityrate	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
speed65# speed70						
0 1	0	(empty)				
1 0	.0003376	.0011295	0.30	0.766	-.0019336	.0026087
1 1	.0020622	.0015629	1.32	0.193	-.0010803	.0052047
fips#c.year						
1	.0004888	.0000461	10.59	0.000	.000396	.0005816
2	-.0000974	.0000502	-1.94	0.058	-.0001984	3.53e-06
4	-.0004344	5.81e-09	-7.5e+04	0.000	-.0004344	-.0004344
5	.0001982	.000052	3.81	0.000	.0000936	.0003027
6	.0004483	.0001114	4.02	0.000	.0002243	.0006722
8	.0004766	.000052	9.17	0.000	.0003721	.0005811
9	.0002729	.0001111	2.46	0.018	.0000494	.0004963
10	.0004672	.000052	8.99	0.000	.0003627	.0005718

To further elaborate on this point, Alabama (FIPS = 01) the presence of highways with a speed limit = 65 MPH, and highways with a speed limit greater than or equal to 70 MPH, is associated with a 0.0048 % increase in fatality rate. Conversely, in Arizona (FIPS = 03) the presence of highways with a speed limit = 65 MPH, and highways with a speed limit greater than or equal to 70 MPH, is associated with a 0.0043 % decrease in fatality rate.

Overall, the impact of high-speed roadways on fatalities depends on both the year and the state.

3. (c) perform the first-difference regression of all three cases in (a).
   Hint: In order to perform these regressions correctly, first write down the first-difference equation with time fixed effects and state-level time trends before you go to Stata to write down the regression as regress D. (____).

Regression models:

Case one:

$$fatalityrate_{it} = \alpha_i + \beta_1(sbusage_{it}) + \beta_2(drinkage21_{it}) + \beta_3(drkspeed_{it}) + \epsilon_{it}$$

$$fatalityrate_{it-1} = \alpha_i + \beta_1(sbusage_{i,t-1}) + \beta_2(drinkage21_{i,t-1}) + \beta_3(drkspeed_{i,t-1}) + \epsilon_{it}$$

$$\Delta fatalityrate_i = \alpha_i + \beta_1(\Delta sbusage_i) + \beta_2(\Delta drinkage21_{i,t-1}) + \beta_3(\Delta drkspeed_{i,t-1}) + \epsilon_{it}$$

FD model:

Linear regression

Number of obs	= 497
F(3, 494)	= 10.10
Prob > F	= 0.0000
R-squared	= 0.0588
Root MSE	= .00189

D. fatalityrate	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
sb_useage D1.	-.0055101	.0011506	-4.79	0.000	-.0077707	-.0032494
drinkage21 D1.	-.0002309	.0005915	-0.39	0.696	-.0013931	.0009312
yy D1.	0	(omitted)				
yn D1.	-.0001211	.0002937	-0.41	0.680	-.0006981	.0004559
ny D1.	0	(omitted)				
nn D1.	0	(omitted)				

FE model:

Fixed-effects (within) regression
Group variable: **fips**

Number of obs	= 556
Number of groups	= 51

R-squared:
Within = **0.5758**
Between = **0.0024**
Overall = **0.1573**

Obs per group:
min = 8
avg = 10.9
max = 15

F(**3, 50**) = 165.62
corr(u_i, Xb) = **-0.2170**
Prob > F = 0.0000

(Std. err. adjusted for **51** clusters in **fips**)

fatalityrate	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
sb_useage	-.0173485	.0008312	-20.87	0.000	-.019018	-.015679
drinkage21	.000648	.0008175	0.79	0.432	-.0009939	.0022899
yy	-.0002339	.0004745	-0.49	0.624	-.001187	.0007193
yn	0	(omitted)				
ny	0	(omitted)				
nn	0	(omitted)				
_cons	.0283424	.000768	36.91	0.000	.0267999	.029885
sigma_u	.00446959					
sigma_e	.00207147					
rho	.82318424	(fraction of variance due to u_i)				

Case two: (Time fixed effect)

$$fatalityrate_{it} = \alpha_i + \beta_1(sbusage_{it}) + \beta_2(drinkage21_{it}) + \beta_3(drkspeed_{it}) + \epsilon_{it}$$

$$fatalityrate_{it-1} = \alpha_i + \beta_1\left(sbusage_{i,t-1}\right) + \beta_2\left(drinkage21_{i,t-1}\right) + \beta_3\left(drkspeed_{i,t-1}\right) + \epsilon_{it}$$

$$\Delta fatalityrate_{it} = \alpha_i + \beta_1(\Delta sbusage_{it}) + \beta_2\left(\Delta drinkage21_{i,t}\right) + \beta_3\left(\Delta drkspeed_{i,t}\right) + \epsilon_{it}$$

FD model:

Linear regression

Number of obs = 497
F(16, 481) = 7.92
Prob > F = 0.0000
R-squared = 0.2222
Root MSE = .00175

D. fatalityrate	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
sb_useage D1.	-.0024382	.0012557	-1.94	0.053	-.0049054	.0000291
drinkage21 D1.	-.0008808	.0005734	-1.54	0.125	-.0020076	.0002459
yy D1.	-.000101	.0003714	-0.27	0.786	-.0008307	.0006287
yn D1.	0	(omitted)				
ny D1.	0	(omitted)				
nn D1.	0	(omitted)				
year 1985	-.0011357	.0005284	-2.15	0.032	-.002174	-.0000975
1986	.0009568	.000471	2.03	0.043	.0000313	.0018823
1987	-.0004326	.0003574	-1.21	0.227	-.0011349	.0002697
1988	-.0007349	.000328	-2.24	0.026	-.0013794	-.0000903
1989	-.0016834	.0003286	-5.12	0.000	-.0023291	-.0010377
1990	-.0007526	.0003684	-2.04	0.042	-.0014764	-.0000287
1991	-.0012167	.0002974	-4.09	0.000	-.001801	-.0006324
1992	-.0014083	.000254	-5.54	0.000	-.0019073	-.0009092
1993	-.0001077	.0002171	-0.50	0.620	-.0005343	.0003189
1994	-.0003648	.000295	-1.24	0.217	-.0009445	.0002149
1995	.0002281	.0002325	0.98	0.327	-.0002288	.000685
1996	-.0004402	.000221	-1.99	0.047	-.0008744	-5.90e-06
1997	-.0001702	.0002328	-0.73	0.465	-.0006277	.0002873

FE Model

Fixed-effects (within) regression
Group variable: **fips**

Number of obs = 556
Number of groups = 51

R-squared:
Within = 0.7360
Between = 0.0095
Overall = 0.2633

Obs per group:
min = 8
avg = 10.9
max = 15

F(17, 50) = 49.31
Prob > F = 0.0000

corr(u_i, Xb) = -0.0467

(Std. err. adjusted for **51** clusters in **fips**)

fatalityrate	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
sb_useage	-.0035785	.0014582	-2.45	0.018	-.0065074	-.0006497
drinkage21	-.000684	.0006614	-1.03	0.306	-.0020124	.0006444
yy	.0004758	.0004919	0.97	0.338	-.0005122	.0014638
yn	0	(omitted)				
ny	0	(omitted)				
nn	0	(omitted)				
year						
1984	.0002749	.0010085	0.27	0.786	-.0017508	.0023006
1985	.000291	.0010622	0.27	0.785	-.0018425	.0024244
1986	.001197	.0010585	1.13	0.264	-.000929	.003323
1987	.0007536	.0010732	0.70	0.486	-.001402	.0029092
1988	.0002449	.0010508	0.23	0.817	-.0018657	.0023555
1989	-.0014578	.0011285	-1.29	0.202	-.0037245	.0008089
1990	-.0021375	.0011009	-1.94	0.058	-.0043486	.0000737
1991	-.0032841	.0011611	-2.83	0.007	-.0056164	-.0009519
1992	-.0046496	.001166	-3.99	0.000	-.0069916	-.0023076
1993	-.0047263	.0011849	-3.99	0.000	-.0071062	-.0023464
1994	-.0050606	.0012341	-4.10	0.000	-.0075394	-.0025818
1995	-.0050223	.0012157	-4.13	0.000	-.0074641	-.0025805
1996	-.0054638	.0012768	-4.28	0.000	-.0080283	-.0028992
1997	-.0056171	.0013015	-4.32	0.000	-.0082313	-.0030029
_cons	.0255237	.0009378	27.22	0.000	.02364	.0274074
sigma_u	.00418229					
sigma_e	.00165757					
rho	.86424605	(fraction of variance due to u_i)				

Case three: (Time and state fixed effects)

$$fatalityrate_{it} = \beta_1(sbusage_{it}) + \beta_2(drinkage21_{it}) + \beta_3(drkspeed_{it}) + \alpha_i + \eta_i(year) + \epsilon_{it}$$

$$fatalityrate_{it-1} = \beta_1(sbusage_{i,t-1}) + \beta_2(drinkage21_{i,t-1}) + \beta_3(drkspeed_{i,t-1}) + \alpha_{i,t-1} + \eta_i(year) + \epsilon_{it}$$

$$\Delta fatalityrate_{it} = \beta_1(\Delta sbusage_{it}) + \beta_2(\Delta drinkage21_{i,t}) + \beta_3(\Delta drkspeed_{i,t}) + \eta_i(year_{it}) + \alpha_{i,} + \epsilon_{it}$$

FD model:

Linear regression

Number of obs	=	497
F(54, 443)	=	2.42
Prob > F	=	0.0000
R-squared	=	0.1527
Root MSE	=	.0019

D. fatalityrate	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
sb_useage D1.	-.0024594	.0012874	-1.91	0.057	-.0049896	.0000709
drinkage21 D1.	-.0003367	.0006038	-0.56	0.577	-.0015233	.0008499
yy D1.	.000733	.0003629	2.02	0.044	.0000198	.0014462
yn D1.	0	(omitted)				
ny D1.	0	(omitted)				
nn D1.	0	(omitted)				
fips#c.year						
1	-2.09e-07	3.79e-07	-0.55	0.581	-9.54e-07	5.35e-07
2	-4.65e-07	7.91e-07	-0.59	0.556	-2.02e-06	1.09e-06
4	-2.28e-07	3.87e-07	-0.59	0.557	-9.89e-07	5.34e-07
5	-3.54e-07	2.17e-07	-1.64	0.102	-7.80e-07	7.10e-08
6	-4.29e-07	1.42e-07	-3.01	0.003	-7.09e-07	-1.49e-07
8	-2.55e-07	1.72e-07	-1.48	0.140	-5.93e-07	8.36e-08
9	-1.89e-07	2.68e-07	-0.70	0.482	-7.16e-07	3.38e-07
10	-2.05e-07	7.18e-07	-0.29	0.775	-1.62e-06	1.21e-06
11	3.13e-07	6.13e-07	0.51	0.610	-8.93e-07	1.52e-06
12	-4.68e-07	2.08e-07	-2.25	0.025	-8.77e-07	-5.90e-08
13	-4.60e-07	2.77e-07	-1.66	0.098	-1.00e-06	8.50e-08
15	-2.77e-08	3.19e-07	-0.09	0.931	-6.56e-07	6.00e-07
16	-5.33e-07	2.47e-07	-2.16	0.032	-1.02e-06	-4.69e-08
17	-2.68e-07	1.96e-07	-1.37	0.172	-6.53e-07	1.17e-07
18	-4.91e-07	2.69e-07	-1.83	0.068	-1.02e-06	3.74e-08
19	-2.10e-07	2.92e-07	-0.72	0.472	-7.83e-07	3.63e-07
20	-2.78e-07	2.04e-07	-1.36	0.175	-6.79e-07	1.24e-07
21	-2.13e-07	2.39e-07	-0.89	0.373	-6.82e-07	2.56e-07
22	-2.53e-07	2.88e-07	-0.88	0.381	-8.20e-07	3.14e-07
23	-2.01e-07	2.48e-07	-0.81	0.418	-6.88e-07	2.86e-07
24	-3.12e-07	1.39e-07	-2.25	0.025	-5.85e-07	-3.90e-08
25	-4.01e-07	1.54e-07	-2.61	0.009	-7.03e-07	-9.89e-08
26	-2.77e-07	1.60e-07	-1.73	0.085	-5.92e-07	3.82e-08
27	-1.99e-07	1.98e-07	-1.00	0.316	-5.87e-07	1.90e-07
28	-2.53e-07	3.15e-07	-0.80	0.422	-8.73e-07	3.67e-07
29	-2.27e-07	5.23e-07	-0.43	0.664	-1.25e-06	8.01e-07
30	-8.76e-08	4.13e-07	-0.21	0.832	-8.99e-07	7.24e-07
31	-1.27e-07	2.81e-07	-0.45	0.651	-6.79e-07	4.25e-07
32	-5.21e-07	4.58e-07	-1.14	0.255	-1.42e-06	3.78e-07
33	-4.47e-07	2.29e-07	-1.95	0.051	-8.97e-07	2.56e-09
34	-1.66e-07	1.54e-07	-1.08	0.281	-4.69e-07	1.36e-07
35	-6.36e-07	2.49e-07	-2.55	0.011	-1.13e-06	-1.46e-07
36	-3.16e-07	1.61e-07	-1.96	0.051	-6.32e-07	7.91e-10
37	-4.09e-07	2.27e-07	-1.81	0.072	-8.55e-07	3.61e-08
38	-2.64e-07	3.57e-07	-0.74	0.460	-9.65e-07	4.37e-07
39	-2.19e-07	1.53e-07	-1.44	0.152	-5.19e-07	8.09e-08
40	-1.07e-07	2.37e-07	-0.45	0.651	-5.73e-07	3.59e-07
41	-5.40e-07	3.10e-07	-1.74	0.082	-1.15e-06	6.95e-08
42	-3.84e-07	2.09e-07	-1.83	0.067	-7.94e-07	2.73e-08
44	-4.56e-08	1.94e-07	-0.23	0.815	-4.28e-07	3.37e-07
45	-4.54e-07	2.60e-07	-1.74	0.082	-9.65e-07	5.79e-08
46	-2.48e-07	3.90e-07	-0.64	0.526	-1.01e-06	5.19e-07
47	-3.24e-07	1.15e-07	-2.82	0.005	-5.50e-07	-9.79e-08
48	-2.09e-07	2.90e-07	-0.72	0.472	-7.78e-07	3.61e-07
49	-5.80e-08	2.74e-07	-0.21	0.833	-5.97e-07	4.81e-07
50	-4.35e-07	5.70e-07	-0.76	0.446	-1.55e-06	6.85e-07
51	-2.12e-07	2.46e-07	-0.86	0.390	-6.95e-07	2.72e-07
53	-2.71e-07	2.24e-07	-1.21	0.229	-7.12e-07	1.71e-07
54	-7.18e-07	4.97e-07	-1.44	0.149	-1.70e-06	2.59e-07
55	-2.44e-07	2.61e-07	-0.93	0.351	-7.57e-07	2.70e-07
56	-2.06e-07	5.15e-07	-0.40	0.689	-1.22e-06	8.06e-07

FE model:

```
Fixed-effects (within) regression               Number of obs     =        556
Group variable: fips                            Number of groups  =         51

R-squared:                                      Obs per group:
     Within  = 0.7971                                         min =          8
     Between = 0.1963                                         avg =       10.9
     Overall = 0.1052                                         max =         15

                                                F(4, 50)          =          .
corr(u_i, Xb) = -1.0000                         Prob > F          =          .

                                  (Std. err. adjusted for 51 clusters in fips)
```

fatalityrate	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
sb_useage	-.0044294	.0014182	-3.12	0.003	-.007278	-.0015808
drinkage21	.0002634	.0006349	0.41	0.680	-.0010118	.0015385
yy	.0020038	.0003568	5.62	0.000	.001287	.0027205
yn	0	(omitted)				
ny	0	(omitted)				
nn	0	(omitted)				
fips#c.year						
1	-.0006116	.0000679	-9.00	0.000	-.0007481	-.0004752
2	-.0011773	.0000324	-36.32	0.000	-.0012424	-.0011122
4	-.0004438	.0000612	-7.26	0.000	-.0005667	-.000321
5	-.0009738	.0000374	-26.06	0.000	-.0010488	-.0008987
6	-.000998	.0000827	-12.07	0.000	-.0011642	-.0008319
8	-.0003909	.0000181	-21.64	0.000	-.0004272	-.0003546
9	-.0002549	7.43e-06	-34.31	0.000	-.0002698	-.00024
10	-.0003616	.0000191	-18.95	0.000	-.0003999	-.0003233
11	.0005817	.0000297	19.58	0.000	.000522	.0006414
12	-.0011329	.0000535	-21.16	0.000	-.0012404	-.0010253
13	-.001003	.0000815	-12.30	0.000	-.0011668	-.0008393
15	-.0001405	.0000412	-3.41	0.001	-.0002233	-.0000576
16	-.0013638	.0000709	-19.23	0.000	-.0015062	-.0012213
17	-.0005507	.0000555	-9.93	0.000	-.0006621	-.0004393
18	-.0008468	.0000458	-18.48	0.000	-.0009389	-.0007548
19	-.0004316	.000058	-7.45	0.000	-.000548	-.0003152
20	-.0006858	.000064	-10.71	0.000	-.0008144	-.0005572
21	-.0005057	.0000577	-8.76	0.000	-.0006216	-.0003898
22	-.0003316	.0000608	-5.46	0.000	-.0004536	-.0002095
23	-.0004771	.0000496	-9.61	0.000	-.0005768	-.0003774
24	-.0007231	.0000394	-18.34	0.000	-.0008023	-.0006439
25	-.0008142	.0000376	-21.64	0.000	-.0008898	-.0007387
26	-.0004984	.0000467	-10.68	0.000	-.0005922	-.0004047
27	-.0002759	.0000535	-5.15	0.000	-.0003835	-.0001684
28	-.0006204	.0001007	-6.16	0.000	-.0008227	-.0004181
29	-.0008507	.0000721	-11.80	0.000	-.0009956	-.0007059
30	-.0003884	.0000779	-4.99	0.000	-.0005448	-.000232
31	-.0004423	.0000701	-6.31	0.000	-.0005831	-.0003015
32	-.0009648	.0000879	-10.97	0.000	-.0011415	-.0007882
33	-.0008651	.0000375	-23.06	0.000	-.0009405	-.0007898
34	-.0004118	.0000437	-9.42	0.000	-.0004996	-.000324
35	-.0013143	.0001034	-12.71	0.000	-.001522	-.0011066
36	-.0007623	.0000476	-16.01	0.000	-.0008579	-.0006667
37	-.0009813	.0000532	-18.45	0.000	-.0010881	-.0008745
38	-.0005292	.0000422	-12.54	0.000	-.000614	-.0004444
39	-.0006081	.0000748	-8.13	0.000	-.0007583	-.0004578
40	-.0002427	.0000565	-4.29	0.000	-.0003562	-.0001292
41	-.0007626	.0000679	-11.23	0.000	-.0008989	-.0006262
42	-.0006817	.0000297	-22.94	0.000	-.0007414	-.000622
44	-.0000537	.0000772	-0.70	0.490	-.0002086	.0001013
45	-.0009567	.0000753	-12.70	0.000	-.001108	-.0008054
46	-.0004505	.0000863	-5.22	0.000	-.0006237	-.0002772
47	-.0004704	.0000347	-13.56	0.000	-.0005401	-.0004007
48	-.0005036	.0000714	-7.05	0.000	-.000647	-.0003602
49	-.0003013	.0000917	-3.28	0.002	-.0004855	-.000117
50	-.0006623	.000074	-8.96	0.000	-.0008108	-.0005137
51	-.0005893	.000056	-10.52	0.000	-.0007018	-.0004768
53	-.0006986	.0000771	-9.07	0.000	-.0008534	-.0005438
54	-.0012921	.0000436	-29.66	0.000	-.0013796	-.0012046
55	-.0005313	.0000356	-14.94	0.000	-.0006028	-.0004599
56	-.0002554	.0001092	-2.34	0.023	-.0004747	-.0000361
_cons	1.271754	.1074714	11.83	0.000	1.055891	1.487617
sigma_u	.70700164					
sigma_e	.00151157					
rho	.99999543	(fraction of variance due to u_i)				

4. (d) compare your results in (a) and (c). Do you have any suggestive evidence for or against strict exogeneity?

In all three cases, we see from the regression output that the difference between the fixed effect and the first differences coefficient estimates is larger than the standard errors (i.e., the difference between the two estimators cannot be explained by sampling variability, so there is evidence that strict exogeneity is violated.

```
*------------------------------------------------
*Title: Problem Set Four
*VirenePS3.do
*date: 3.5.2024
* Name: Josh Virene*
* ARE256B- Applied Econometrics II
* Purpose: The purpose of this script is to accomplish the tasks that
are outlined in the problem set four assignment
* -----------------------------------------------

*------------------------------------------------
*Program Setup
*------------------------------------------------
clear all
set more off

* set working directory:
global path = "C:\Users\jwvirene\Desktop\VirenePS4"
cd $path
pwd // to verify directory was changed

* import the dataset upon which we run the analysis:
use "C:\Users\jwvirene\Desktop\VirenePS4\Guns.dta", clear

*------------------------------------------------
*Program Setup
*------------------------------------------------
version 14              // Set Version number for backward
compatibility
set more off            // Disable partitioned output
set linesize 80         // Line size limit to make output more
readable
capture log close       // Close existing log files
log using ps4, replace // Open log file
*------------------------------------------------

* preview dataset (if needed)
browse
* we want to know the variable names:
ds

*------------------------------------------------
* Question One: Gun Control and Violence: Pooled OLS, Random Effects
or Fixed Effects?
*------------------------------------------------

// first we use xtset to establish that this is panel data
xtset stateid year, yearly

// a) running the three pooled ols regression models (regular
```

```
regressions)
regress vio shall year avginc density pop, robust
regress rob shall year avginc density pop, robust
regress mur shall year avginc density pop, robust

// b) running the random effects regression models
xtreg vio shall year avginc density pop, re vce(robust)
xtreg rob shall year avginc density pop, re vce(robust)
xtreg mur shall year avginc density pop, re vce(robust)

// c) running the fixed effects regression models
xtreg vio shall year avginc density pop, fe vce(robust)
xtreg rob shall year avginc density pop, fe vce(robust)
xtreg mur shall year avginc density pop, fe vce(robust)

// d) no code necessary

// e) Performing the Hausman test to evaluate the random effects
assumption

// violence
xtreg vio shall year avginc density pop, re
estimates store re_vio
xtreg vio shall year avginc density pop, fe
estimates store fe_vio
hausman fe_vio re_vio, sigmamore

// robbery
xtreg rob shall year avginc density pop, re
estimates store re_rob
xtreg rob shall year avginc density pop, fe
estimates store fe_rob
hausman fe_rob re_rob, sigmamore

// murder
xtreg mur shall year avginc density pop, re
estimates store re_mur
xtreg mur shall year avginc density pop, fe
estimates store fe_mur
hausman fe_mur re_mur, sigmamore

*--------------------------------------------------
* Question Two: Seat Belt Usage: First-Difference or Fixed-Effects?
*--------------------------------------------------
use "C:\Users\jwvirene\Desktop\VirenePS4\SeatBelts.dta", clear // load
in the new dataset on seatbelt data
xtset fips year, yearly
browse
// a) running the three different regression models
generate drk_speed = drinkage21*speed70 // interaction term
```

```
xtreg fatalityrate sb_useage drinkage21 drk_speed, fe vce(robust) //
first regression, no time or state effects
xtreg fatalityrate sb_useage drinkage21 drk_speed i.year, fe
vce(robust) // second regression, only time effect
xtreg fatalityrate sb_useage drinkage21 drk_speed i.year c.year#fips,
fe vce(robust) // third regression, time & state

// b) determining if lower speed limits reduce fatality risk of among
young DUI (drivers under influence)
xtreg fatalityrate speed65#speed70 if ba08 == 0, fe vce(robust)
xtreg fatalityrate speed65#speed70 i.year if ba08 == 0, fe vce(robust)
xtreg fatalityrate speed65#speed70 i.year c.year#fips if ba08 == 0, fe
vce(robust)

// comment on how these are interpreted: The model only runs if ba08 =
0, meaning that blood alcohol limit was not <= 0.08%, so we only run
regression for those who drove under the influence. The interaction
term speed65#speed70 = 1 if 65 / higher & 70 / higher speed limit, so
these give the effect of a higher speed limit on fatality rate

// c)
// creating year dummies; we omitted 1983 because this is our base
year, so we need it for the first difference estimation between 1983
and 1984

gen yy  = (drinkage21==1 & speed70==1)
gen yn  = (drinkage21==1 & speed70==0)
gen ny  = (drinkage21==0 & speed70==1)
gen nn  = (drinkage21==0 & speed70==0)


// case one model first difference
reg D.fatalityrate D.sb_useage D.drinkage21 D.yy D.yn D.ny D.nn,
nocons vce(robust)
xtreg fatalityrate sb_useage drinkage21 yy yn ny nn, fe vce(robust)

// case two model first difference
reg D.fatalityrate D.sb_useage D.drinkage21 D.yy D.yn D.ny D.nn
i.year, nocons vce(robust)
xtreg fatalityrate sb_useage drinkage21 yy yn ny nn i.year, fe
vce(robust)

// case three model first difference
reg D.fatalityrate D.sb_useage D.drinkage21 D.yy D.yn D.ny D.nn
c.year#fips, nocons vce(robust)
xtreg fatalityrate sb_useage drinkage21 yy yn ny nn c.year#fips, fe
vce(robust)
```

```
*--------------------------------------------------

log close

translate "$path\ps4.smcl" ///
          "$path\ps4.pdf", translator(smcl2pdf)

exit
```

Statistics/Data analysis

```
      name:  <unnamed>
       log:  C:\Users\jwvirene\Desktop\VirenePS4\ps4.smcl
  log type:  smcl
 opened on:  15 Mar 2024, 11:34:11

1 . *--------------------------------------------------
2 .
3 . * preview dataset (if needed)
4 . browse

5 . * we want to know the variable names:
6 . ds
  year         rob          pw1064       avginc       shall
  vio          incarc_rate  pm1029       density
  mur          pb1064       pop          stateid

7 .
8 . *--------------------------------------------------
9 . * Question One: Gun Control and Violence: Pooled OLS, Random Effects or Fixed Effect
  > s?
10. *--------------------------------------------------
11.
12. // first we use xtset to establish that this is panel data
13. xtset stateid year, yearly

  Panel variable: stateid (strongly balanced)
   Time variable: year, 77 to 99
           Delta: 1 year

14.
15. // a) running the three pooled ols regression models (regular regressions)
16. regress vio shall year avginc density pop, robust

  Linear regression                               Number of obs     =      1,173
                                                  F(5, 1167)        =     156.88
                                                  Prob > F          =     0.0000
                                                  R-squared         =     0.6094
                                                  Root MSE          =     209.36

  ------------------------------------------------------------------------------
               |               Robust
           vio | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
  -------------+----------------------------------------------------------------
         shall |  -111.9296   16.22195    -6.90   0.000     -143.757   -80.10211
          year |   7.103581   1.237489     5.74   0.000     4.675629    9.531533
        avginc |    4.36877   3.371511     1.30   0.195    -2.246131    10.98367
       density |   163.7426   10.58664    15.47   0.000     142.9716    184.5135
           pop |   21.47085   1.353044    15.87   0.000     18.81618    24.12552
         _cons |  -315.8604   87.99076    -3.59   0.000    -488.4981   -143.2226
  ------------------------------------------------------------------------------

17. regress rob shall year avginc density pop, robust

  Linear regression                               Number of obs     =      1,173
                                                  F(5, 1167)        =     190.07
                                                  Prob > F          =     0.0000
                                                  R-squared         =     0.7680
                                                  Root MSE          =     82.312

  ------------------------------------------------------------------------------
               |               Robust
           rob | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
  -------------+----------------------------------------------------------------
         shall |  -22.32884   4.920613    -4.54   0.000    -31.98308    -12.6746
          year |  -1.824314   .4454408    -4.10   0.000    -2.698268   -.9503596
        avginc |   7.681378   1.384179     5.55   0.000     4.965621    10.39714
       density |   95.97615   5.753169    16.68   0.000     84.68843    107.2639
           pop |   11.33618    .730431    15.52   0.000     9.903075    12.76928
         _cons |   133.9735   34.32646     3.90   0.000     66.62499    201.3219
  ------------------------------------------------------------------------------
```

```
18. regress mur shall year avginc density pop, robust

  Linear regression                               Number of obs     =      1,173
                                                  F(5, 1167)        =      68.02
                                                  Prob > F          =     0.0000
                                                  R-squared         =     0.5989
                                                  Root MSE          =     4.7745

------------------------------------------------------------------------------
             |               Robust
         mur | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
       shall |  -1.576891   .2438062    -6.47   0.000    -2.055239   -1.098544
        year |   .0635691   .0260916     2.44   0.015     .0123775    .1147607
      avginc |  -.3480876   .0889933    -3.91   0.000    -.5226924   -.1734828
     density |   4.399601   .4972174     8.85   0.000     3.424061    5.375141
         pop |   .2473563   .0226771    10.91   0.000     .2028638    .2918488
       _cons |   4.491434   1.950869     2.30   0.021     .6638312    8.319037
------------------------------------------------------------------------------

19.
20. // b) running the random effects regression models
21. xtreg vio shall year avginc density pop, re vce(robust)

  Random-effects GLS regression                   Number of obs     =      1,173
  Group variable: stateid                         Number of groups  =         51

  R-squared:                                      Obs per group:
       Within  = 0.1237                                         min =         23
       Between = 0.6248                                         avg =       23.0
       Overall = 0.5377                                         max =         23

                                                  Wald chi2(5)      =     198.09
  corr(u_i, X) = 0 (assumed)                      Prob > chi2       =     0.0000

                                   (Std. err. adjusted for 51 clusters in stateid)
------------------------------------------------------------------------------
             |               Robust
         vio | Coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
       shall |  -22.41008   19.33862    -1.16   0.247    -60.31307    15.49292
        year |   4.893376   2.323572     2.11   0.035      .339258    9.447493
      avginc |   6.158246   13.64521     0.45   0.652    -20.58588    32.90237
     density |   51.84012   3.932795    13.18   0.000     44.13198    59.54825
         pop |   12.15078   6.421486     1.89   0.058    -.4351041    24.73666
       _cons |  -83.39012   92.21494    -0.90   0.366    -264.1281    97.34785
-------------+----------------------------------------------------------------
     sigma_u |   186.2457
     sigma_e |  99.444973
         rho |  .77815117   (fraction of variance due to u_i)
------------------------------------------------------------------------------

22. xtreg rob shall year avginc density pop, re vce(robust)

  Random-effects GLS regression                   Number of obs     =      1,173
  Group variable: stateid                         Number of groups  =         51

  R-squared:                                      Obs per group:
       Within  = 0.0260                                         min =         23
       Between = 0.7878                                         avg =       23.0
       Overall = 0.7238                                         max =         23

                                                  Wald chi2(5)      =    2240.51
  corr(u_i, X) = 0 (assumed)                      Prob > chi2       =     0.0000
```

(Std. err. adjusted for **51** clusters in **stateid**)

rob	Coefficient	Robust std. err.	z	P>|z|	[95% conf.	interval]
shall	6.425249	6.99307	0.92	0.358	-7.280916	20.13141
year	.068409	.5382528	0.13	0.899	-.9865472	1.123365
avginc	-4.37719	2.075687	-2.11	0.035	-8.445462	-.3089175
density	94.37252	2.409419	39.17	0.000	89.65015	99.0949
pop	7.903892	3.217958	2.46	0.014	1.59681	14.21097
_cons	143.0246	44.05293	3.25	0.001	56.68241	229.3667
sigma_u	66.455606					
sigma_e	49.069013					
rho	.64716776	(fraction of variance due to u_i)				

23. xtreg mur shall year avginc density pop, re vce(robust)

```
Random-effects GLS regression                   Number of obs     =      1,173
Group variable: stateid                         Number of groups  =         51

R-squared:                                      Obs per group:
     Within  = 0.0632                                         min =         23
     Between = 0.2654                                         avg =       23.0
     Overall = 0.2278                                         max =         23

                                                Wald chi2(5)      =     253.80
corr(u_i, X) = 0 (assumed)                      Prob > chi2       =     0.0000
```

(Std. err. adjusted for **51** clusters in **stateid**)

mur	Coefficient	Robust std. err.	z	P>|z|	[95% conf.	interval]
shall	-.4895847	.4710299	-1.04	0.299	-1.412786	.4336169
year	-.2306936	.1122332	-2.06	0.040	-.4506666	-.0107206
avginc	1.059402	.8368017	1.27	0.206	-.5806989	2.699503
density	.8358834	.1457137	5.74	0.000	.5502898	1.121477
pop	-.1754474	.2118185	-0.83	0.408	-.5906041	.2397093
_cons	14.09579	1.522192	9.26	0.000	11.11235	17.07923
sigma_u	3.250556					
sigma_e	2.7540148					
rho	.58213224	(fraction of variance due to u_i)				

24.
25. // c) running the fixed effects regression models
26. xtreg vio shall year avginc density pop, fe vce(robust)

```
Fixed-effects (within) regression               Number of obs     =      1,173
Group variable: stateid                         Number of groups  =         51

R-squared:                                      Obs per group:
     Within  = 0.1864                                         min =         23
     Between = 0.4096                                         avg =       23.0
     Overall = 0.3363                                         max =         23

                                                F(5, 50)          =     338.08
corr(u_i, Xb) = -0.8983                         Prob > F          =     0.0000
```

(Std. err. adjusted for **51** clusters in **stateid**)

vio	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
shall	-14.70016	18.96909	-0.77	0.442	-52.80069	23.40037
year	6.604454	1.841158	3.59	0.001	2.906379	10.30253
avginc	-3.805232	7.020479	-0.54	0.590	-17.90628	10.29581
density	-230.9971	14.67264	-15.74	0.000	-260.4679	-201.5262
pop	9.719052	7.25606	1.34	0.186	-4.855173	24.29328
_cons	12.18994	95.14375	0.13	0.899	-178.9119	203.2918
sigma_u	584.49363					
sigma_e	99.444973					
rho	.9718672	(fraction of variance due to u_i)				

27. xtreg rob shall year avginc density pop, fe vce(robust)

```
Fixed-effects (within) regression               Number of obs     =      1,173
Group variable: stateid                         Number of groups  =         51

R-squared:                                      Obs per group:
     Within  = 0.0394                                         min =         23
     Between = 0.4952                                         avg =       23.0
     Overall = 0.4556                                         max =         23

                                                F(5, 50)          =      81.29
corr(u_i, Xb) = 0.4040                          Prob > F          =     0.0000
```

(Std. err. adjusted for **51** clusters in **stateid**)

rob	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
shall	9.270621	7.171637	1.29	0.202	-5.134036	23.67528
year	1.171596	.6898839	1.70	0.096	-.2140769	2.557268
avginc	-8.41683	3.437469	-2.45	0.018	-15.32119	-1.512471
density	50.57201	11.0238	4.59	0.000	28.43006	72.71396
pop	-.4317503	3.209083	-0.13	0.894	-6.877383	6.013882
_cons	156.2628	36.40361	4.29	0.000	83.14399	229.3816
sigma_u	128.38588					
sigma_e	49.069013					
rho	.87254216	(fraction of variance due to u_i)				

28. xtreg mur shall year avginc density pop, fe vce(robust)

```
Fixed-effects (within) regression               Number of obs     =      1,173
Group variable: stateid                         Number of groups  =         51

R-squared:                                      Obs per group:
     Within  = 0.2950                                         min =         23
     Between = 0.7563                                         avg =       23.0
     Overall = 0.5829                                         max =         23

                                                F(5, 50)          =    4677.35
corr(u_i, Xb) = -0.9876                         Prob > F          =     0.0000
```

(Std. err. adjusted for **51** clusters in **stateid**)

mur	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
shall	-.084854	.3041394	-0.28	0.781	-.695736	.5260279
year	-.1792772	.076204	-2.35	0.023	-.3323374	-.026217
avginc	.7569266	.4471818	1.69	0.097	-.1412645	1.655118
density	-15.05388	.8655281	-17.39	0.000	-16.79234	-13.31541
pop	-.4527206	.2977387	-1.52	0.135	-1.050746	.1453051
_cons	20.55347	1.576796	13.03	0.000	17.38639	23.72056

```
     sigma_u    26.008852
     sigma_e    2.7540148
         rho    .98891214   (fraction of variance due to u_i)
------------------------------------------------------------------------------

 29.
 30. // d) no code necessary
 31.
 32. // e) Performing the Hausman test to evaluate the random effects assumption
 33.
 34. // violence
 35. xtreg vio shall year avginc density pop, re

Random-effects GLS regression                   Number of obs     =      1,173
Group variable: stateid                         Number of groups  =         51

R-squared:                                      Obs per group:
     Within  = 0.1237                                         min =         23
     Between = 0.6248                                         avg =       23.0
     Overall = 0.5377                                         max =         23

                                                Wald chi2(5)      =     203.57
corr(u_i, X) = 0 (assumed)                      Prob > chi2       =     0.0000

------------------------------------------------------------------------------
         vio | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
       shall |  -22.41008   11.80126    -1.90   0.058    -45.54012    .7199727
        year |   4.893376   1.000642     4.89   0.000     2.932154    6.854597
      avginc |   6.158246   3.888565     1.58   0.113    -1.463201    13.77969
     density |   51.84012   17.14947     3.02   0.003     18.22778    85.45245
         pop |   12.15078   3.714081     3.27   0.001     4.871313    19.43024
       _cons |  -83.39012   57.79864    -1.44   0.149    -196.6734    29.89313
-------------+----------------------------------------------------------------
     sigma_u |   186.2457
     sigma_e |  99.444973
         rho |  .77815117   (fraction of variance due to u_i)
------------------------------------------------------------------------------

 36. estimates store re_vio

 37. xtreg vio shall year avginc density pop, fe

Fixed-effects (within) regression               Number of obs     =      1,173
Group variable: stateid                         Number of groups  =         51

R-squared:                                      Obs per group:
     Within  = 0.1864                                         min =         23
     Between = 0.4096                                         avg =       23.0
     Overall = 0.3363                                         max =         23

                                                F(5, 1117)        =      51.17
corr(u_i, Xb) = -0.8983                         Prob > F          =     0.0000

------------------------------------------------------------------------------
         vio | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
       shall |  -14.70016   11.30657    -1.30   0.194    -36.88467    7.484338
        year |   6.604454   .9984119     6.61   0.000      4.64548    8.563428
      avginc |  -3.805232    3.91116    -0.97   0.331    -11.47928    3.868816
     density |  -230.9971   30.72536    -7.52   0.000     -291.283   -170.7111
         pop |   9.719052   4.977214     1.95   0.051    -.0466908    19.48479
       _cons |   12.18994   49.24403     0.25   0.805    -84.43128    108.8112
-------------+----------------------------------------------------------------
     sigma_u |  584.49363
     sigma_e |  99.444973
         rho |   .9718672   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(50, 1117) = 81.10                   Prob > F = 0.0000
```

```
38. estimates store fe_vio

39. hausman fe_vio re_vio, sigmamore

  Note: the rank of the differenced variance matrix (4) does not equal the number of
          coefficients being tested (5); be sure this is what you expect, or there may
          be problems computing the test.  Examine the output of your estimators for
          anything unexpected and possibly consider scaling your variables so that the
          coefficients are on a similar scale.

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |     fe_vio       re_vio       Difference       Std. err.
-------------+----------------------------------------------------------------
       shall |   -14.70016    -22.41008        7.709912        1.528026
        year |    6.604454     4.893376        1.711078         .320757
      avginc |   -3.805232     6.158246       -9.963478        1.350373
     density |   -230.9971     51.84012       -282.8372        27.41538
         pop |    9.719052     12.15078       -2.431725        3.694035
------------------------------------------------------------------------------
                          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(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
              = 117.06
  Prob > chi2 = 0.0000

40.
41. // robbery
42. xtreg rob shall year avginc density pop, re

  Random-effects GLS regression                   Number of obs     =      1,173
  Group variable: stateid                         Number of groups  =         51

  R-squared:                                      Obs per group:
       Within  = 0.0260                                         min =         23
       Between = 0.7878                                         avg =       23.0
       Overall = 0.7238                                         max =         23

                                                  Wald chi2(5)      =     244.57
  corr(u_i, X) = 0 (assumed)                      Prob > chi2       =     0.0000

------------------------------------------------------------------------------
         rob | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
       shall |   6.425249   5.596493     1.15   0.251    -4.543675    17.39417
        year |    .068409   .4657042     0.15   0.883    -.8443544    .9811724
      avginc |   -4.37719   1.801882    -2.43   0.015    -7.908814   -.8455654
     density |   94.37252   6.438762    14.66   0.000     81.75278    106.9923
         pop |   7.903892   1.481897     5.33   0.000     4.999428    10.80836
       _cons |   143.0246    25.9131     5.52   0.000     92.23581    193.8133
-------------+----------------------------------------------------------------
     sigma_u |  66.455606
     sigma_e |  49.069013
         rho |  .64716776   (fraction of variance due to u_i)
------------------------------------------------------------------------------

43. estimates store re_rob
```

```
44. xtreg rob shall year avginc density pop, fe

  Fixed-effects (within) regression               Number of obs     =      1,173
  Group variable: stateid                         Number of groups  =         51

  R-squared:                                      Obs per group:
       Within  = 0.0394                                         min =         23
       Between = 0.4952                                         avg =       23.0
       Overall = 0.4556                                         max =         23

                                                  F(5, 1117)        =       9.16
  corr(u_i, Xb) = 0.4040                          Prob > F          =     0.0000

  ------------------------------------------------------------------------------
           rob | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
  -------------+----------------------------------------------------------------
         shall |   9.270621   5.578986     1.66   0.097    -1.675851    20.21709
          year |   1.171596   .4926452     2.38   0.018     .2049815     2.13821
        avginc |   -8.41683   1.929879    -4.36   0.000    -12.20343   -4.630234
       density |   50.57201   15.16078     3.34   0.001      20.8252    80.31882
           pop |  -.4317503   2.455901    -0.18   0.860    -5.250449    4.386948
         _cons |   156.2628   24.29842     6.43   0.000     108.5871    203.9385
  -------------+----------------------------------------------------------------
       sigma_u |  128.38588
       sigma_e |  49.069013
           rho |  .87254216   (fraction of variance due to u_i)
  ------------------------------------------------------------------------------
  F test that all u_i=0: F(50, 1117) = 43.34                  Prob > F = 0.0000

45. estimates store fe_rob

46. hausman fe_rob re_rob, sigmamore

  Note: the rank of the differenced variance matrix (4) does not equal the number of
          coefficients being tested (5); be sure this is what you expect, or there may
          be problems computing the test.  Examine the output of your estimators for
          anything unexpected and possibly consider scaling your variables so that the
          coefficients are on a similar scale.

                   ---- Coefficients ----
               |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
               |     fe_rob       re_rob       Difference       Std. err.
  -------------+----------------------------------------------------------------
         shall |    9.270621     6.425249        2.845372        .9753652
          year |    1.171596      .068409        1.103187        .1864474
        avginc |    -8.41683     -4.37719       -4.039641        .7841576
       density |    50.57201     94.37252       -43.80052        14.03074
           pop |   -.4317503     7.903892       -8.335642        2.014373
  ------------------------------------------------------------------------------
                          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(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
              =  45.33
  Prob > chi2 = 0.0000
  (V_b-V_B is not positive definite)

47.
```

```
48. // murder
49. xtreg mur shall year avginc density pop, re

  Random-effects GLS regression                   Number of obs     =      1,173
  Group variable: stateid                         Number of groups  =         51

  R-squared:                                      Obs per group:
       Within  = 0.0632                                         min =         23
       Between = 0.2654                                         avg =       23.0
       Overall = 0.2278                                         max =         23

                                                  Wald chi2(5)      =     110.10
  corr(u_i, X) = 0 (assumed)                      Prob > chi2       =     0.0000

  ------------------------------------------------------------------------------
           mur | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
  -------------+----------------------------------------------------------------
         shall |  -.4895847   .3647782    -1.34   0.180    -1.204537    .2253674
          year |  -.2306936   .0300707    -7.67   0.000     -.289631   -.1717561
        avginc |   1.059402   .1159332     9.14   0.000     .8321773    1.286627
       density |   .8358834   .3780224     2.21   0.027     .0949731    1.576794
           pop |  -.1754474   .0887446    -1.98   0.048    -.3493836   -.0015112
         _cons |   14.09579    1.66336     8.47   0.000     10.83567    17.35592
  -------------+----------------------------------------------------------------
       sigma_u |   3.250556
       sigma_e |  2.7540148
           rho |  .58213224   (fraction of variance due to u_i)
  ------------------------------------------------------------------------------

50. estimates store re_mur

51. xtreg mur shall year avginc density pop, fe

  Fixed-effects (within) regression               Number of obs     =      1,173
  Group variable: stateid                         Number of groups  =         51

  R-squared:                                      Obs per group:
       Within  = 0.2950                                         min =         23
       Between = 0.7563                                         avg =       23.0
       Overall = 0.5829                                         max =         23

                                                  F(5, 1117)        =      93.46
  corr(u_i, Xb) = -0.9876                         Prob > F          =     0.0000

  ------------------------------------------------------------------------------
           mur | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
  -------------+----------------------------------------------------------------
         shall |   -.084854   .3131224    -0.27   0.786    -.6992284    .5295204
          year |  -.1792772   .0276499    -6.48   0.000    -.2335287   -.1250256
        avginc |   .7569266   .1083151     6.99   0.000     .5444026    .9694506
       density |  -15.05388   .8509038   -17.69   0.000    -16.72343   -13.38433
           pop |  -.4527206   .1378383    -3.28   0.001    -.7231717   -.1822696
         _cons |   20.55347   1.363757    15.07   0.000     17.87766    23.22929
  -------------+----------------------------------------------------------------
       sigma_u |  26.008852
       sigma_e |  2.7540148
           rho |  .98891214   (fraction of variance due to u_i)
  ------------------------------------------------------------------------------
  F test that all u_i=0: F(50, 1117) = 47.81                   Prob > F = 0.0000
```

```
52. estimates store fe_mur

53. hausman fe_mur re_mur, sigmamore

  Note: the rank of the differenced variance matrix (4) does not equal the number of
        coefficients being tested (5); be sure this is what you expect, or there may
        be problems computing the test.  Examine the output of your estimators for
        anything unexpected and possibly consider scaling your variables so that the
        coefficients are on a similar scale.

                      ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |     fe_mur       re_mur       Difference       Std. err.
-------------+----------------------------------------------------------------
       shall |   -.084854    -.4895847        .4047307        .0721358
        year |  -.1792772    -.2306936        .0514164        .0131869
      avginc |   .7569266     1.059402       -.3024757        .0557182
     density |  -15.05388     .8358834       -15.88976           .9371
         pop |  -.4527206    -.1754474       -.2772732        .1375422
------------------------------------------------------------------------------
                          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(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
              = 342.31
  Prob > chi2 = 0.0000
  (V_b-V_B is not positive definite)

54.
55. *--------------------------------------------------
56. * Question Two: Seat Belt Usage: First-Difference or Fixed-Effects?
57. *--------------------------------------------------
58. use "C:\Users\jwvirene\Desktop\VirenePS4\SeatBelts.dta", clear // load in the new da
  > taset on seatbelt data

59. xtset fips year, yearly

  Panel variable: fips (strongly balanced)
   Time variable: year, 1983 to 1997
           Delta: 1 year

60. browse

61. // a) running the three different regression models
62. generate drk_speed = drinkage21*speed70 // interaction term

63. xtreg fatalityrate sb_useage drinkage21 drk_speed, fe vce(robust) // first regressio
  > n, no time or state effects

  Fixed-effects (within) regression               Number of obs     =        556
  Group variable: fips                            Number of groups  =         51

  R-squared:                                      Obs per group:
       Within  = 0.5758                                         min =          8
       Between = 0.0024                                         avg =       10.9
       Overall = 0.1573                                         max =         15

                                                  F(3, 50)          =     165.62
  corr(u_i, Xb) = -0.2170                         Prob > F          =     0.0000
```

(Std. err. adjusted for **51** clusters in **fips**)

fatalityrate	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
sb_useage	-.0173485	.0008312	-20.87	0.000	-.019018	-.015679
drinkage21	.000648	.0008175	0.79	0.432	-.0009939	.0022899
drk_speed	-.0002339	.0004745	-0.49	0.624	-.001187	.0007193
_cons	.0283424	.000768	36.91	0.000	.0267999	.029885
sigma_u	.00446959					
sigma_e	.00207147					
rho	.82318424	(fraction of variance due to u_i)				

```
64. xtreg fatalityrate sb_useage drinkage21 drk_speed i.year, fe vce(robust) // second r
  > egression, only time effect
```

Fixed-effects (within) regression		Number of obs =	556
Group variable: **fips**		Number of groups =	51
R-squared:		Obs per group:	
Within	= 0.7360	min =	8
Between	= 0.0095	avg =	10.9
Overall	= 0.2633	max =	15
		F(17, 50) =	49.31
corr(u_i, Xb)	= -0.0467	Prob > F =	0.0000

(Std. err. adjusted for **51** clusters in **fips**)

fatalityrate	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
sb_useage	-.0035785	.0014582	-2.45	0.018	-.0065074	-.0006497
drinkage21	-.000684	.0006614	-1.03	0.306	-.0020124	.0006444
drk_speed	.0004758	.0004919	0.97	0.338	-.0005122	.0014638
year						
1984	.0002749	.0010085	0.27	0.786	-.0017508	.0023006
1985	.000291	.0010622	0.27	0.785	-.0018425	.0024244
1986	.001197	.0010585	1.13	0.264	-.000929	.003323
1987	.0007536	.0010732	0.70	0.486	-.001402	.0029092
1988	.0002449	.0010508	0.23	0.817	-.0018657	.0023555
1989	-.0014578	.0011285	-1.29	0.202	-.0037245	.0008089
1990	-.0021375	.0011009	-1.94	0.058	-.0043486	.0000737
1991	-.0032841	.0011611	-2.83	0.007	-.0056164	-.0009519
1992	-.0046496	.001166	-3.99	0.000	-.0069916	-.0023076
1993	-.0047263	.0011849	-3.99	0.000	-.0071062	-.0023464
1994	-.0050606	.0012341	-4.10	0.000	-.0075394	-.0025818
1995	-.0050223	.0012157	-4.13	0.000	-.0074641	-.0025805
1996	-.0054638	.0012768	-4.28	0.000	-.0080283	-.0028992
1997	-.0056171	.0013015	-4.32	0.000	-.0082313	-.0030029
_cons	.0255237	.0009378	27.22	0.000	.02364	.0274074
sigma_u	.00418229					
sigma_e	.00165757					
rho	.86424605	(fraction of variance due to u_i)				

```
65. xtreg fatalityrate sb_useage drinkage21 drk_speed i.year c.year#fips, fe vce(robust)
  >  // third regression, time & state
  note: 56.fips#c.year omitted because of collinearity.

  Fixed-effects (within) regression               Number of obs     =        556
  Group variable: fips                            Number of groups  =         51

  R-squared:                                      Obs per group:
       Within  = 0.8397                                         min =          8
       Between = 0.1192                                         avg =       10.9
       Overall = 0.0629                                         max =         15

                                                  F(17, 50)         =          .
  corr(u_i, Xb) = -1.0000                         Prob > F          =          .

                                     (Std. err. adjusted for 51 clusters in fips)
```

fatalityrate	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
sb_useage	-.0028138	.0013163	-2.14	0.037	-.0054576	-.00017
drinkage21	-.0009654	.0005839	-1.65	0.105	-.0021382	.0002074
drk_speed	.0005785	.0004352	1.33	0.190	-.0002956	.0014526
year						
1984	.0005634	.0010526	0.54	0.595	-.0015508	.0026776
1985	.0001381	.000962	0.14	0.886	-.0017942	.0020705
1986	.0015611	.0009699	1.61	0.114	-.000387	.0035091
1987	.0015355	.0010528	1.46	0.151	-.000579	.0036501
1988	.0012885	.0010867	1.19	0.241	-.0008942	.0034713
1989	-.0000246	.0012241	-0.02	0.984	-.0024833	.0024341
1990	-.0003849	.0013466	-0.29	0.776	-.0030895	.0023198
1991	-.001193	.0014492	-0.82	0.414	-.0041039	.0017178
1992	-.0022017	.0014546	-1.51	0.136	-.0051232	.0007199
1993	-.0019137	.0015011	-1.27	0.208	-.0049287	.0011013
1994	-.001883	.0016121	-1.17	0.248	-.005121	.0013551
1995	-.0015047	.0017198	-0.87	0.386	-.0049589	.0019495
1996	-.0015598	.0018085	-0.86	0.393	-.0051922	.0020727
1997	-.0013389	.0019041	-0.70	0.485	-.0051634	.0024855
fips#c.year						
1	-.0002683	.000074	-3.62	0.001	-.000417	-.0001196
2	-.0011381	.0000882	-12.90	0.000	-.0013153	-.000961
4	-.0001054	.0000677	-1.56	0.126	-.0002414	.0000306
5	-.000713	.0000934	-7.63	0.000	-.0009006	-.0005253
6	-.0006715	.0000625	-10.75	0.000	-.000797	-.000546
8	-.0003354	.0000955	-3.51	0.001	-.0005271	-.0001436
9	-.0001873	.0001016	-1.84	0.071	-.0003915	.0000169
10	-.0003073	.0000949	-3.24	0.002	-.0004979	-.0001166
11	.0006239	.0000895	6.97	0.000	.0004443	.0008036
12	-.00077	.0000767	-10.03	0.000	-.0009241	-.0006159
13	-.0006043	.0000468	-12.92	0.000	-.0006983	-.0005104
15	.0001456	.0000973	1.50	0.141	-.0000499	.000341
16	-.0009295	.0000747	-12.44	0.000	-.0010796	-.0007793
17	-.0003296	.0000914	-3.61	0.001	-.0005131	-.000146
18	-.0005697	.0000893	-6.38	0.000	-.000749	-.0003903
19	-.0001666	.0000886	-1.88	0.066	-.0003446	.0000114
20	-.0003364	.0000704	-4.78	0.000	-.0004777	-.0001951
21	-.0003579	.0000953	-3.76	0.000	-.0005493	-.0001666
22	-.0000163	.0000833	-0.20	0.846	-.0001836	.0001511
23	-.0004575	.0000815	-5.61	0.000	-.0006213	-.0002938
24	-.0004837	.0000979	-4.94	0.000	-.0006804	-.0002871
25	-.0005919	.0000984	-6.01	0.000	-.0007896	-.0003942
26	-.0002916	.0000972	-3.00	0.004	-.0004869	-.0000964
27	-5.58e-06	.0000906	-0.06	0.951	-.0001876	.0001764
28	-.0003535	9.49e-06	-37.26	0.000	-.0003725	-.0003344
29	-.0005388	.0000461	-11.69	0.000	-.0006314	-.0004462
30	-.0001071	.0000897	-1.19	0.238	-.0002872	.0000729
31	-.0001242	.0000802	-1.55	0.128	-.0002852	.0000368
32	-.0005751	.0000518	-11.09	0.000	-.0006792	-.0004709
33	-.0005785	.0000931	-6.21	0.000	-.0007655	-.0003915
34	-.0002017	.0000984	-2.05	0.046	-.0003992	-4.08e-06

```
          35 |   -.001051   6.52e-06  -161.32   0.000    -.0010641   -.0010379
          36 |  -.0005158   .0000956    -5.40   0.000    -.0007078   -.0003239
          37 |  -.0007105   .0000908    -7.83   0.000    -.0008929   -.0005282
          38 |  -.0005012   .0000841    -5.96   0.000    -.0006701   -.0003323
          39 |  -.0003474   .0000969    -3.58   0.001    -.0005421   -.0001528
          40 |   .0001831   .0000676     2.71   0.009     .0000473    .0003189
          41 |  -.0005867   .0000831    -7.06   0.000    -.0007537   -.0004198
          42 |  -.0005641   .0000939    -6.01   0.000    -.0007527   -.0003755
          44 |  -.0000655   .0000768    -0.85   0.398    -.0002197    .0000887
          45 |  -.0007878   .0000884    -8.91   0.000    -.0009654   -.0006102
          46 |   -.000141   .0000346    -4.07   0.000    -.0002105   -.0000715
          47 |  -.0004338   .0000872    -4.98   0.000    -.0006089   -.0002588
          48 |  -.0001903   .0000472    -4.03   0.000    -.0002851   -.0000956
          49 |  -.0000215   .0000199    -1.08   0.287    -.0000615    .0000186
          50 |  -.0004339   .0000842    -5.15   0.000     -.000603   -.0002647
          51 |   -.000322   .0000895    -3.60   0.001    -.0005017   -.0001423
          53 |  -.0002992   .0000553    -5.41   0.000    -.0004103   -.0001882
          54 |  -.0012656   .0000836   -15.14   0.000    -.0014335   -.0010978
          55 |  -.0002597   .0000917    -2.83   0.007    -.0004438   -.0000755
          56 |          0  (omitted)
             |
       _cons |   .7800032   .1428037     5.46   0.000     .4931735    1.066833
-------------+----------------------------------------------------------------
     sigma_u |  .68173335
     sigma_e |  .00136312
         rho |    .999996   (fraction of variance due to u_i)
------------------------------------------------------------------------------

66.
67. // b) determining if lower speed limits reduce fatality risk of among young DUI (dri
  > vers under influence)
68. xtreg fatalityrate speed65#speed70 if ba08 == 0, fe vce(robust)
  note: 0b.speed65#1.speed70 identifies no observations in the sample.

  Fixed-effects (within) regression               Number of obs     =        676
  Group variable: fips                            Number of groups  =         49

  R-squared:                                      Obs per group:
       Within  = 0.4255                                         min =          5
       Between = 0.1091                                         avg =       13.8
       Overall = 0.0586                                         max =         15

                                                  F(2, 48)          =     119.16
  corr(u_i, Xb) = -0.2542                         Prob > F          =     0.0000

                                  (Std. err. adjusted for 49 clusters in fips)
  ------------------------------------------------------------------------------
               |               Robust
  fatalityrate | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
  -------------+----------------------------------------------------------------
       speed65#|
       speed70 |
          0 1  |          0  (empty)
          1 0  |  -.0056814   .0003791   -14.99   0.000    -.0064437   -.0049191
          1 1  |  -.0081663   .0006499   -12.57   0.000    -.0094731   -.0068596
               |
         _cons |    .025474   .0002357   108.08   0.000     .0250001    .0259479
  -------------+----------------------------------------------------------------
       sigma_u |  .00544825
       sigma_e |  .00314646
           rho |  .74989117   (fraction of variance due to u_i)
  ------------------------------------------------------------------------------
```

```
69. xtreg fatalityrate speed65#speed70 i.year if ba08 == 0, fe vce(robust)
  note: 0b.speed65#1.speed70 identifies no observations in the sample.

  Fixed-effects (within) regression               Number of obs     =        676
  Group variable: fips                            Number of groups  =         49

  R-squared:                                      Obs per group:
       Within  = 0.6973                                         min =          5
       Between = 0.0207                                         avg =       13.8
       Overall = 0.2879                                         max =         15

                                                  F(16, 48)         =      52.24
  corr(u_i, Xb) = -0.0069                         Prob > F          =     0.0000

                                      (Std. err. adjusted for 49 clusters in fips)
  ------------------------------------------------------------------------------
               |               Robust
  fatalityrate | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
  -------------+----------------------------------------------------------------
       speed65#|
       speed70 |
          0 1  |          0  (empty)
          1 0  |   -.000607   .0008978    -0.68   0.502    -.0024121    .0011981
          1 1  |  -.0002949   .0013102    -0.23   0.823    -.0029293    .0023395
               |
          year |
         1984  |  -.0008068   .0004296    -1.88   0.066    -.0016705    .0000569
         1985  |  -.0019435   .0005023    -3.87   0.000    -.0029535   -.0009335
         1986  |  -.0016366   .0006796    -2.41   0.020    -.0030031   -.0002702
         1987  |  -.0023637   .0012027    -1.97   0.055    -.0047818    .0000544
         1988  |  -.0029984   .0011337    -2.64   0.011    -.0052778   -.0007189
         1989  |  -.0047778    .001148    -4.16   0.000    -.0070859   -.0024697
         1990  |  -.0053478   .0010751    -4.97   0.000    -.0075095   -.0031861
         1991  |  -.0067688   .0010678    -6.34   0.000    -.0089159   -.0046218
         1992  |  -.0082656   .0009882    -8.36   0.000    -.0102524   -.0062787
         1993  |  -.0085193    .000959    -8.88   0.000    -.0104476    -.006591
         1994  |  -.0086258    .001135    -7.60   0.000    -.0109079   -.0063438
         1995  |  -.0085539   .0012778    -6.69   0.000    -.0111231   -.0059846
         1996  |  -.0089318   .0013263    -6.73   0.000    -.0115986    -.006265
         1997  |  -.0091196   .0013587    -6.71   0.000    -.0118514   -.0063878
               |
         _cons |   .0271999   .0004678    58.15   0.000     .0262594    .0281405
  -------------+----------------------------------------------------------------
       sigma_u |  .00482145
       sigma_e |  .00230983
           rho |    .813332   (fraction of variance due to u_i)
  ------------------------------------------------------------------------------

70. xtreg fatalityrate speed65#speed70 i.year c.year#fips if ba08 == 0, fe vce(robust)
  note: 0b.speed65#1.speed70 identifies no observations in the sample.
  note: 56.fips#c.year omitted because of collinearity.

  Fixed-effects (within) regression               Number of obs     =        676
  Group variable: fips                            Number of groups  =         49

  R-squared:                                      Obs per group:
       Within  = 0.7965                                         min =          5
       Between = 0.3407                                         avg =       13.8
       Overall = 0.2195                                         max =         15

                                                  F(16, 48)         =          .
  corr(u_i, Xb) = -1.0000                         Prob > F          =          .
```

(Std. err. adjusted for **49** clusters in **fips**)

fatalityrate	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
speed65# speed70						
0 1	0	(empty)				
1 0	.0003376	.0011295	0.30	0.766	-.0019336	.0026087
1 1	.0020622	.0015629	1.32	0.193	-.0010803	.0052047
year						
1984	-.0010538	.0004463	-2.36	0.022	-.0019512	-.0001565
1985	-.0024376	.0005393	-4.52	0.000	-.003522	-.0013532
1986	-.0023778	.0007321	-3.25	0.002	-.0038499	-.0009057
1987	-.0041037	.0014739	-2.78	0.008	-.0070673	-.0011401
1988	-.0050874	.0013962	-3.64	0.001	-.0078946	-.0022801
1989	-.0071358	.0014297	-4.99	0.000	-.0100104	-.0042611
1990	-.0079313	.0013345	-5.94	0.000	-.0106145	-.0052482
1991	-.0096525	.0013498	-7.15	0.000	-.0123665	-.0069385
1992	-.0114082	.0012599	-9.06	0.000	-.0139414	-.0088751
1993	-.0119699	.0012223	-9.79	0.000	-.0144275	-.0095122
1994	-.0126688	.0014243	-8.89	0.000	-.0155325	-.0098051
1995	-.0133987	.0016116	-8.31	0.000	-.0166391	-.0101584
1996	-.0140955	.0016827	-8.38	0.000	-.0174787	-.0107123
1997	-.0145992	.0017759	-8.22	0.000	-.0181699	-.0110285
fips#c.year						
1	.0004888	.0000461	10.59	0.000	.000396	.0005816
2	-.0000974	.0000502	-1.94	0.058	-.0001984	3.53e-06
4	-.0004344	5.81e-09	-7.5e+04	0.000	-.0004344	-.0004344
5	.0001982	.000052	3.81	0.000	.0000936	.0003027
6	.0004483	.0001114	4.02	0.000	.0002243	.0006722
8	.0004766	.000052	9.17	0.000	.0003721	.0005811
9	.0002729	.0001111	2.46	0.018	.0000494	.0004963
10	.0004672	.000052	8.99	0.000	.0003627	.0005718
11	.0010219	.000052	19.65	0.000	.0009174	.0011265
12	-.0001436	.0000556	-2.58	0.013	-.0002553	-.0000319
13	.0000736	.000019	3.87	0.000	.0000353	.0001119
15	.0007605	.000118	6.44	0.000	.0005232	.0009978
16	-.0001165	.0000111	-10.51	0.000	-.0001387	-.0000942
17	.0004927	.0000488	10.10	0.000	.0003947	.0005908
18	.000205	.000052	3.94	0.000	.0001005	.0003096
19	.000581	.000052	11.17	0.000	.0004765	.0006856
20	.0001429	.0000629	2.27	0.028	.0000164	.0002695
21	.0004036	.000052	7.76	0.000	.000299	.0005081
22	.0004705	.000052	9.05	0.000	.000366	.0005751
23	-.0008055	.0001726	-4.67	0.000	-.0011525	-.0004586
24	.0003903	.000052	7.51	0.000	.0002857	.0004948
25	.000263	.0000508	5.17	0.000	.0001608	.0003652
26	.0005155	.000052	9.91	0.000	.0004109	.00062
27	.0006765	.000052	13.01	0.000	.0005719	.000781
28	.0000624	5.81e-09	1.1e+04	0.000	.0000624	.0000624
29	.0003925	5.81e-09	6.8e+04	0.000	.0003925	.0003926
30	.0002853	.000052	5.49	0.000	.0001808	.0003899
31	.0005386	5.81e-09	9.3e+04	0.000	.0005385	.0005386
32	-.0000751	5.81e-09	-1.3e+04	0.000	-.0000752	-.0000751
33	-.0003943	.0000556	-7.10	0.000	-.000506	-.0002825
34	.000609	.0001148	5.31	0.000	.0003783	.0008398
35	-.0008738	.0000556	-15.73	0.000	-.0009855	-.0007621
36	.0002331	.0000586	3.98	0.000	.0001153	.000351
37	-.0000262	.0000629	-0.42	0.679	-.0001528	.0001004
38	.0005928	.000052	11.40	0.000	.0004882	.0006973
39	.0003487	.000052	6.71	0.000	.0002441	.0004532
40	.0004533	5.81e-09	7.8e+04	0.000	.0004533	.0004533
42	.0003201	.0000586	5.46	0.000	.0002023	.000438
44	.0003066	.0000586	5.23	0.000	.0001887	.0004244
45	-.0001128	.000052	-2.17	0.035	-.0002173	-8.21e-06
46	.0007095	5.81e-09	1.2e+05	0.000	.0007095	.0007096
47	.0003156	.000052	6.07	0.000	.0002111	.0004202
48	.0002328	5.81e-09	4.0e+04	0.000	.0002328	.0002329
50	.0005467	.0001114	4.91	0.000	.0003227	.0007707

```
          51 |   .0002904   .0000588     4.94   0.000     .0001722    .0004087
          53 |   .0003273   5.81e-09  5.6e+04   0.000     .0003273    .0003274
          54 |  -.0001617    .000052    -3.11   0.003    -.0002663   -.0000572
          55 |    .000433    .000052     8.33   0.000     .0003285    .0005376
          56 |          0  (omitted)
             |
       _cons |  -.5094092   .0781725    -6.52   0.000    -.6665855   -.3522329
-------------+----------------------------------------------------------------
     sigma_u |  .74083233
     sigma_e |  .00197315
         rho |  .99999291   (fraction of variance due to u_i)
------------------------------------------------------------------------------

71.
72. // comment on how these are interpreted: The model only runs if ba08 = 0, meaning th
  > at blood alcohol limit was not <= 0.08%, so we only run regression for those who dro
  > ve under the influence. The interaction term speed65#speed70 = 1 if 65 / higher & 70
  >  / higher speed limit, so these give the effect of a higher speed limit on fatality
  > rate
73.
74. // c)
75. // creating year dummies; we omitted 1983 because this is our base year, so we need
  > it for the first difference estimation between 1983 and 1984
76.
77. gen yy  = (drinkage21==1 & speed70==1)

78. gen yn  = (drinkage21==1 & speed70==0)

79. gen ny  = (drinkage21==0 & speed70==1)

80. gen nn  = (drinkage21==0 & speed70==0)

81.
82.
83. // case one model first difference
84. reg D.fatalityrate D.sb_useage D.drinkage21 D.yy D.yn D.ny D.nn, nocons vce(robust)
  note: D.yy omitted because of collinearity.
  note: D.ny omitted because of collinearity.
  note: D.nn omitted because of collinearity.

  Linear regression                               Number of obs     =        497
                                                  F(3, 494)         =      10.10
                                                  Prob > F          =     0.0000
                                                  R-squared         =     0.0588
                                                  Root MSE          =     .00189

------------------------------------------------------------------------------
D.           |               Robust
fatalityrate | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
   sb_useage |
         D1. |  -.0055101   .0011506    -4.79   0.000    -.0077707   -.0032494
             |
  drinkage21 |
         D1. |  -.0002309   .0005915    -0.39   0.696    -.0013931    .0009312
             |
          yy |
         D1. |          0  (omitted)
             |
          yn |
         D1. |  -.0001211   .0002937    -0.41   0.680    -.0006981    .0004559
             |
          ny |
         D1. |          0  (omitted)
             |
          nn |
         D1. |          0  (omitted)
------------------------------------------------------------------------------
```

```
85. xtreg fatalityrate sb_useage drinkage21 yy yn ny nn, fe vce(robust)
  note: yn omitted because of collinearity.
  note: ny omitted because of collinearity.
  note: nn omitted because of collinearity.

  Fixed-effects (within) regression               Number of obs     =        556
  Group variable: fips                            Number of groups  =         51

  R-squared:                                      Obs per group:
       Within  = 0.5758                                         min =          8
       Between = 0.0024                                         avg =       10.9
       Overall = 0.1573                                         max =         15

                                                  F(3, 50)          =     165.62
  corr(u_i, Xb) = -0.2170                         Prob > F          =     0.0000

                                    (Std. err. adjusted for 51 clusters in fips)
  ------------------------------------------------------------------------------
               |               Robust
  fatalityrate | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
  -------------+----------------------------------------------------------------
     sb_useage |  -.0173485   .0008312   -20.87   0.000     -.019018    -.015679
    drinkage21 |    .000648   .0008175     0.79   0.432    -.0009939    .0022899
            yy |  -.0002339   .0004745    -0.49   0.624     -.001187    .0007193
            yn |          0  (omitted)
            ny |          0  (omitted)
            nn |          0  (omitted)
         _cons |   .0283424    .000768    36.91   0.000     .0267999     .029885
  -------------+----------------------------------------------------------------
       sigma_u |  .00446959
       sigma_e |  .00207147
           rho |  .82318424   (fraction of variance due to u_i)
  ------------------------------------------------------------------------------

86.
87. // case two model first difference
88. reg D.fatalityrate D.sb_useage D.drinkage21 D.yy D.yn D.ny D.nn i.year, nocons vce(r
  > obust)
  note: D.yn omitted because of collinearity.
  note: D.ny omitted because of collinearity.
  note: D.nn omitted because of collinearity.

  Linear regression                               Number of obs     =        497
                                                  F(16, 481)        =       7.92
                                                  Prob > F          =     0.0000
                                                  R-squared         =     0.2222
                                                  Root MSE          =     .00175

  ------------------------------------------------------------------------------
  D.           |               Robust
  fatalityrate | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
  -------------+----------------------------------------------------------------
     sb_useage |
           D1. |  -.0024382   .0012557    -1.94   0.053    -.0049054    .0000291
               |
    drinkage21 |
           D1. |  -.0008808   .0005734    -1.54   0.125    -.0020076    .0002459
               |
            yy |
           D1. |   -.000101   .0003714    -0.27   0.786    -.0008307    .0006287
               |
            yn |
           D1. |          0  (omitted)
               |
            ny |
           D1. |          0  (omitted)
               |
            nn |
           D1. |          0  (omitted)
               |
          year |
          1985 |  -.0011357   .0005284    -2.15   0.032     -.002174   -.0000975
```

1986	.0009568	.000471	2.03	0.043	.0000313	.0018823
1987	-.0004326	.0003574	-1.21	0.227	-.0011349	.0002697
1988	-.0007349	.000328	-2.24	0.026	-.0013794	-.0000903
1989	-.0016834	.0003286	-5.12	0.000	-.0023291	-.0010377
1990	-.0007526	.0003684	-2.04	0.042	-.0014764	-.0000287
1991	-.0012167	.0002974	-4.09	0.000	-.001801	-.0006324
1992	-.0014083	.000254	-5.54	0.000	-.0019073	-.0009092
1993	-.0001077	.0002171	-0.50	0.620	-.0005343	.0003189
1994	-.0003648	.000295	-1.24	0.217	-.0009445	.0002149
1995	.0002281	.0002325	0.98	0.327	-.0002288	.000685
1996	-.0004402	.000221	-1.99	0.047	-.0008744	-5.90e-06
1997	-.0001702	.0002328	-0.73	0.465	-.0006277	.0002873

```
89. xtreg fatalityrate sb_useage drinkage21 yy yn ny nn i.year, fe vce(robust)
  note: yn omitted because of collinearity.
  note: ny omitted because of collinearity.
  note: nn omitted because of collinearity.

  Fixed-effects (within) regression               Number of obs     =        556
  Group variable: fips                            Number of groups  =         51

  R-squared:                                      Obs per group:
       Within  = 0.7360                                         min =          8
       Between = 0.0095                                         avg =       10.9
       Overall = 0.2633                                         max =         15

                                                  F(17, 50)         =      49.31
  corr(u_i, Xb) = -0.0467                         Prob > F          =     0.0000

                                     (Std. err. adjusted for 51 clusters in fips)
```

fatalityrate	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
sb_useage	-.0035785	.0014582	-2.45	0.018	-.0065074	-.0006497
drinkage21	-.000684	.0006614	-1.03	0.306	-.0020124	.0006444
yy	.0004758	.0004919	0.97	0.338	-.0005122	.0014638
yn	0	(omitted)				
ny	0	(omitted)				
nn	0	(omitted)				
year						
1984	.0002749	.0010085	0.27	0.786	-.0017508	.0023006
1985	.000291	.0010622	0.27	0.785	-.0018425	.0024244
1986	.001197	.0010585	1.13	0.264	-.000929	.003323
1987	.0007536	.0010732	0.70	0.486	-.001402	.0029092
1988	.0002449	.0010508	0.23	0.817	-.0018657	.0023555
1989	-.0014578	.0011285	-1.29	0.202	-.0037245	.0008089
1990	-.0021375	.0011009	-1.94	0.058	-.0043486	.0000737
1991	-.0032841	.0011611	-2.83	0.007	-.0056164	-.0009519
1992	-.0046496	.001166	-3.99	0.000	-.0069916	-.0023076
1993	-.0047263	.0011849	-3.99	0.000	-.0071062	-.0023464
1994	-.0050606	.0012341	-4.10	0.000	-.0075394	-.0025818
1995	-.0050223	.0012157	-4.13	0.000	-.0074641	-.0025805
1996	-.0054638	.0012768	-4.28	0.000	-.0080283	-.0028992
1997	-.0056171	.0013015	-4.32	0.000	-.0082313	-.0030029
_cons	.0255237	.0009378	27.22	0.000	.02364	.0274074
sigma_u	.00418229					
sigma_e	.00165757					
rho	.86424605	(fraction of variance due to u_i)				

```
90.
91. // case three model first difference
92. reg D.fatalityrate D.sb_useage D.drinkage21 D.yy D.yn D.ny D.nn c.year#fips, nocons
  > vce(robust)
  note: D.yn omitted because of collinearity.
  note: D.ny omitted because of collinearity.
  note: D.nn omitted because of collinearity.

  Linear regression                               Number of obs     =        497
                                                  F(54, 443)        =       2.42
                                                  Prob > F          =     0.0000
                                                  R-squared         =     0.1527
                                                  Root MSE          =      .0019
```

D. fatalityrate	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
sb_useage D1.	-.0024594	.0012874	-1.91	0.057	-.0049896	.0000709
drinkage21 D1.	-.0003367	.0006038	-0.56	0.577	-.0015233	.0008499
yy D1.	.000733	.0003629	2.02	0.044	.0000198	.0014462
yn D1.	0	(omitted)				
ny D1.	0	(omitted)				
nn D1.	0	(omitted)				
fips#c.year						
1	-2.09e-07	3.79e-07	-0.55	0.581	-9.54e-07	5.35e-07
2	-4.65e-07	7.91e-07	-0.59	0.556	-2.02e-06	1.09e-06
4	-2.28e-07	3.87e-07	-0.59	0.557	-9.89e-07	5.34e-07
5	-3.54e-07	2.17e-07	-1.64	0.102	-7.80e-07	7.10e-08
6	-4.29e-07	1.42e-07	-3.01	0.003	-7.09e-07	-1.49e-07
8	-2.55e-07	1.72e-07	-1.48	0.140	-5.93e-07	8.36e-08
9	-1.89e-07	2.68e-07	-0.70	0.482	-7.16e-07	3.38e-07
10	-2.05e-07	7.18e-07	-0.29	0.775	-1.62e-06	1.21e-06
11	3.13e-07	6.13e-07	0.51	0.610	-8.93e-07	1.52e-06
12	-4.68e-07	2.08e-07	-2.25	0.025	-8.77e-07	-5.90e-08
13	-4.60e-07	2.77e-07	-1.66	0.098	-1.00e-06	8.50e-08
15	-2.77e-08	3.19e-07	-0.09	0.931	-6.56e-07	6.00e-07
16	-5.33e-07	2.47e-07	-2.16	0.032	-1.02e-06	-4.69e-08
17	-2.68e-07	1.96e-07	-1.37	0.172	-6.53e-07	1.17e-07
18	-4.91e-07	2.69e-07	-1.83	0.068	-1.02e-06	3.74e-08
19	-2.10e-07	2.92e-07	-0.72	0.472	-7.83e-07	3.63e-07
20	-2.78e-07	2.04e-07	-1.36	0.175	-6.79e-07	1.24e-07
21	-2.13e-07	2.39e-07	-0.89	0.373	-6.82e-07	2.56e-07
22	-2.53e-07	2.88e-07	-0.88	0.381	-8.20e-07	3.14e-07
23	-2.01e-07	2.48e-07	-0.81	0.418	-6.88e-07	2.86e-07
24	-3.12e-07	1.39e-07	-2.25	0.025	-5.85e-07	-3.90e-08
25	-4.01e-07	1.54e-07	-2.61	0.009	-7.03e-07	-9.89e-08
26	-2.77e-07	1.60e-07	-1.73	0.085	-5.92e-07	3.82e-08
27	-1.99e-07	1.98e-07	-1.00	0.316	-5.87e-07	1.90e-07
28	-2.53e-07	3.15e-07	-0.80	0.422	-8.73e-07	3.67e-07
29	-2.27e-07	5.23e-07	-0.43	0.664	-1.25e-06	8.01e-07
30	-8.76e-08	4.13e-07	-0.21	0.832	-8.99e-07	7.24e-07
31	-1.27e-07	2.81e-07	-0.45	0.651	-6.79e-07	4.25e-07
32	-5.21e-07	4.58e-07	-1.14	0.255	-1.42e-06	3.78e-07
33	-4.47e-07	2.29e-07	-1.95	0.051	-8.97e-07	2.56e-09
34	-1.66e-07	1.54e-07	-1.08	0.281	-4.69e-07	1.36e-07
35	-6.36e-07	2.49e-07	-2.55	0.011	-1.13e-06	-1.46e-07
36	-3.16e-07	1.61e-07	-1.96	0.051	-6.32e-07	7.91e-10
37	-4.09e-07	2.27e-07	-1.81	0.072	-8.55e-07	3.61e-08
38	-2.64e-07	3.57e-07	-0.74	0.460	-9.65e-07	4.37e-07

39	-2.19e-07	1.53e-07	-1.44	0.152	-5.19e-07	8.09e-08
40	-1.07e-07	2.37e-07	-0.45	0.651	-5.73e-07	3.59e-07
41	-5.40e-07	3.10e-07	-1.74	0.082	-1.15e-06	6.95e-08
42	-3.84e-07	2.09e-07	-1.83	0.067	-7.94e-07	2.73e-08
44	-4.56e-08	1.94e-07	-0.23	0.815	-4.28e-07	3.37e-07
45	-4.54e-07	2.60e-07	-1.74	0.082	-9.65e-07	5.79e-08
46	-2.48e-07	3.90e-07	-0.64	0.526	-1.01e-06	5.19e-07
47	-3.24e-07	1.15e-07	-2.82	0.005	-5.50e-07	-9.79e-08
48	-2.09e-07	2.90e-07	-0.72	0.472	-7.78e-07	3.61e-07
49	-5.80e-08	2.74e-07	-0.21	0.833	-5.97e-07	4.81e-07
50	-4.35e-07	5.70e-07	-0.76	0.446	-1.55e-06	6.85e-07
51	-2.12e-07	2.46e-07	-0.86	0.390	-6.95e-07	2.72e-07
53	-2.71e-07	2.24e-07	-1.21	0.229	-7.12e-07	1.71e-07
54	-7.18e-07	4.97e-07	-1.44	0.149	-1.70e-06	2.59e-07
55	-2.44e-07	2.61e-07	-0.93	0.351	-7.57e-07	2.70e-07
56	-2.06e-07	5.15e-07	-0.40	0.689	-1.22e-06	8.06e-07

```
93. xtreg fatalityrate sb_useage drinkage21 yy yn ny nn c.year#fips, fe vce(robust)
  note: yn omitted because of collinearity.
  note: ny omitted because of collinearity.
  note: nn omitted because of collinearity.

  Fixed-effects (within) regression               Number of obs     =        556
  Group variable: fips                            Number of groups  =         51

  R-squared:                                      Obs per group:
       Within  = 0.7971                                         min =          8
       Between = 0.1963                                         avg =       10.9
       Overall = 0.1052                                         max =         15

                                                  F(4, 50)          =          .
  corr(u_i, Xb) = -1.0000                         Prob > F          =          .

                                     (Std. err. adjusted for 51 clusters in fips)
```

fatalityrate	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
sb_useage	-.0044294	.0014182	-3.12	0.003	-.007278	-.0015808
drinkage21	.0002634	.0006349	0.41	0.680	-.0010118	.0015385
yy	.0020038	.0003568	5.62	0.000	.001287	.0027205
yn	0	(omitted)				
ny	0	(omitted)				
nn	0	(omitted)				
fips#c.year						
1	-.0006116	.0000679	-9.00	0.000	-.0007481	-.0004752
2	-.0011773	.0000324	-36.32	0.000	-.0012424	-.0011122
4	-.0004438	.0000612	-7.26	0.000	-.0005667	-.000321
5	-.0009738	.0000374	-26.06	0.000	-.0010488	-.0008987
6	-.000998	.0000827	-12.07	0.000	-.0011642	-.0008319
8	-.0003909	.0000181	-21.64	0.000	-.0004272	-.0003546
9	-.0002549	7.43e-06	-34.31	0.000	-.0002698	-.00024
10	-.0003616	.0000191	-18.95	0.000	-.0003999	-.0003233
11	.0005817	.0000297	19.58	0.000	.000522	.0006414
12	-.0011329	.0000535	-21.16	0.000	-.0012404	-.0010253
13	-.001003	.0000815	-12.30	0.000	-.0011668	-.0008393
15	-.0001405	.0000412	-3.41	0.001	-.0002233	-.0000576
16	-.0013638	.0000709	-19.23	0.000	-.0015062	-.0012213
17	-.0005507	.0000555	-9.93	0.000	-.0006621	-.0004393
18	-.0008468	.0000458	-18.48	0.000	-.0009389	-.0007548
19	-.0004316	.000058	-7.45	0.000	-.000548	-.0003152
20	-.0006858	.000064	-10.71	0.000	-.0008144	-.0005572
21	-.0005057	.0000577	-8.76	0.000	-.0006216	-.0003898
22	-.0003316	.0000608	-5.46	0.000	-.0004536	-.0002095
23	-.0004771	.0000496	-9.61	0.000	-.0005768	-.0003774
24	-.0007231	.0000394	-18.34	0.000	-.0008023	-.0006439
25	-.0008142	.0000376	-21.64	0.000	-.0008898	-.0007387
26	-.0004984	.0000467	-10.68	0.000	-.0005922	-.0004047
27	-.0002759	.0000535	-5.15	0.000	-.0003835	-.0001684
28	-.0006204	.0001007	-6.16	0.000	-.0008227	-.0004181

29	-.0008507	.0000721	-11.80	0.000	-.0009956	-.0007059
30	-.0003884	.0000779	-4.99	0.000	-.0005448	-.000232
31	-.0004423	.0000701	-6.31	0.000	-.0005831	-.0003015
32	-.0009648	.0000879	-10.97	0.000	-.0011415	-.0007882
33	-.0008651	.0000375	-23.06	0.000	-.0009405	-.0007898
34	-.0004118	.0000437	-9.42	0.000	-.0004996	-.000324
35	-.0013143	.0001034	-12.71	0.000	-.001522	-.0011066
36	-.0007623	.0000476	-16.01	0.000	-.0008579	-.0006667
37	-.0009813	.0000532	-18.45	0.000	-.0010881	-.0008745
38	-.0005292	.0000422	-12.54	0.000	-.000614	-.0004444
39	-.0006081	.0000748	-8.13	0.000	-.0007583	-.0004578
40	-.0002427	.0000565	-4.29	0.000	-.0003562	-.0001292
41	-.0007626	.0000679	-11.23	0.000	-.0008989	-.0006262
42	-.0006817	.0000297	-22.94	0.000	-.0007414	-.000622
44	-.0000537	.0000772	-0.70	0.490	-.0002086	.0001013
45	-.0009567	.0000753	-12.70	0.000	-.001108	-.0008054
46	-.0004505	.0000863	-5.22	0.000	-.0006237	-.0002772
47	-.0004704	.0000347	-13.56	0.000	-.0005401	-.0004007
48	-.0005036	.0000714	-7.05	0.000	-.000647	-.0003602
49	-.0003013	.0000917	-3.28	0.002	-.0004855	-.000117
50	-.0006623	.000074	-8.96	0.000	-.0008108	-.0005137
51	-.0005893	.000056	-10.52	0.000	-.0007018	-.0004768
53	-.0006986	.0000771	-9.07	0.000	-.0008534	-.0005438
54	-.0012921	.0000436	-29.66	0.000	-.0013796	-.0012046
55	-.0005313	.0000356	-14.94	0.000	-.0006028	-.0004599
56	-.0002554	.0001092	-2.34	0.023	-.0004747	-.0000361
_cons	1.271754	.1074714	11.83	0.000	1.055891	1.487617
sigma_u	.70700164					
sigma_e	.00151157					
rho	.99999543	(fraction of variance due to u_i)				

94.
95.
96.
97. *--
98.
99. log close
name: **<unnamed>**
log: **C:\Users\jwvirene\Desktop\VirenePS4\ps4.smcl**
log type: **smcl**
closed on: **15 Mar 2024, 11:34:13**