Logit/Probit Models using Panel Data

Pooled Logit Estimation

```
. logit union age grade not_smsa south southXt

Iteration 0:   log likelihood =  -13864.23
Iteration 1:   log likelihood = -13550.511
Iteration 2:   log likelihood =  -13545.74
Iteration 3:   log likelihood = -13545.736

Logistic regression                                     Number of obs   =      26200
                                                        LR chi2(5)      =     636.99
                                                        Prob > chi2     =     0.0000
Log likelihood = -13545.736                             Pseudo R2       =     0.0230

------------------------------------------------------------------------------
       union |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .0099931   .0026737     3.74   0.000     .0047527    .0152335
       grade |   .0483487   .0064259     7.52   0.000     .0357541    .0609432
    not_smsa |  -.2214908   .0355831    -6.22   0.000    -.2912324   -.1517493
       south |  -.7144461   .0612145   -11.67   0.000    -.8344244   -.5944678
     southXt |   .0068356   .0052258     1.31   0.191    -.0034067    .0170779
       _cons |  -1.888256    .113141   -16.69   0.000    -2.110009   -1.666504
------------------------------------------------------------------------------
```

Panel Logit Random-Effects Estimation

```
. xtlogit union age grade not_smsa south southXt

Fitting comparison model:

Iteration 0:   log likelihood =  -13864.23
Iteration 1:   log likelihood = -13550.511
Iteration 2:   log likelihood =  -13545.74
Iteration 3:   log likelihood = -13545.736

Fitting full model:

tau =  0.0     log likelihood = -13545.736
tau =  0.1     log likelihood = -12926.225
tau =  0.2     log likelihood = -12419.526
tau =  0.3     log likelihood = -12003.162
tau =  0.4     log likelihood = -11656.844
tau =  0.5     log likelihood =  -11367.53
tau =  0.6     log likelihood = -11129.716
tau =  0.7     log likelihood = -10947.266
tau =  0.8     log likelihood = -10845.532

Iteration 0:   log likelihood = -10947.312
Iteration 1:   log likelihood = -10557.296
Iteration 2:   log likelihood = -10540.582
Iteration 3:   log likelihood = -10540.367
Iteration 4:   log likelihood = -10540.367
Iteration 5:   log likelihood = -10540.366

Random-effects logistic regression              Number of obs      =     26200
Group variable: idcode                          Number of groups   =      4434

Random effects u_i ~ Gaussian                   Obs per group: min =         1
                                                               avg =       5.9
                                                               max =        12

                                                Wald chi2(5)       =    227.30
Log likelihood  = -10540.366                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
       union |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .0093936    .004454     2.11   0.035      .000664    .0181232
       grade |   .0867878   .0176345     4.92   0.000     .0522247    .1213508
    not_smsa |  -.2519379    .082334    -3.06   0.002    -.4133095   -.0905663
       south |  -1.163769   .1114164   -10.45   0.000    -1.382141    -.945397
     southXt |    .023245   .0078497     2.96   0.003     .0078599    .0386302
```

```
       _cons |  -3.360131   .2586306   -12.99   0.000    -3.867038   -2.853225
-------------+----------------------------------------------------------------
    /lnsig2u |   1.749534   .0469964                      1.657423    1.841645
-------------+----------------------------------------------------------------
     sigma_u |   2.398317   .0563561                      2.290366    2.511356
         rho |   .6361486   .0108779                      .6145729    .6571902
------------------------------------------------------------------------------
Likelihood-ratio test of rho=0: chibar2(01) =  6010.74 Prob >= chibar2 = 0.000

. mfx compute, predict(pu0)

Marginal effects after xtlogit
      y  = Pr(union=1 assuming u_i=0) (predict, pu0)
         =  .08116656
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
     age |   .0007006      .00033    2.10   0.036   .000046  .001356   30.4322
   grade |   .0064725      .00133    4.85   0.000   .003858  .009087   12.7615
not_smsa*|   -.017974      .00566   -3.17   0.002  -.029077 -.006871   .283702
   south*|  -.0822877      .00818  -10.05   0.000  -.098328 -.066247   .413015
 southXt |   .0017336      .00059    2.95   0.003   .000582  .002885   3.96874
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

Fixed-Effects Logit Estimation

```
. xtlogit union age grade not_smsa south southXt, fe
note: multiple positive outcomes within groups encountered.
note: 2744 groups (14165 obs) dropped because of all positive or
      all negative outcomes.

Iteration 0:   log likelihood = -4516.5769
Iteration 1:   log likelihood = -4511.1069
Iteration 2:   log likelihood = -4511.1042
Iteration 3:   log likelihood = -4511.1042

Conditional fixed-effects logistic regression   Number of obs      =     12035
Group variable: idcode                          Number of groups   =      1690

                                                Obs per group: min =         2
                                                               avg =       7.1
                                                               max =        12

                                                LR chi2(5)         =     78.16
Log likelihood  = -4511.1042                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
       union |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .0079706   .0050283     1.59   0.113    -.0018848    .0178259
       grade |   .0811808   .0419138     1.94   0.053    -.0009687    .1633303
    not_smsa |   .0210368   .1131542     0.19   0.853    -.2007414     .242815
       south |  -1.007318   .1500498    -6.71   0.000     -1.30141   -.7132256
     southXt |   .0263495   .0083244     3.17   0.002      .010034     .042665
------------------------------------------------------------------------------

. fitstat

Measures of Fit for clogit of union

(Multiple outcomes per group for clogit: Count R2 may not be valid)
Log-Lik Intercept Only:    -4550.186     Log-Lik Full Model:        -4511.104
D(1685):                    9022.208     LR(5):                       78.163
                                         Prob > LR:                    0.000
McFadden's R2:                 0.009     McFadden's Adj R2:            0.007
Maximum Likelihood R2:         0.045     Cragg & Uhler's R2:           0.045
Count R2:                      0.401
AIC:                           5.345     AIC*n:                     9032.208
BIC:                       -3501.527     BIC':                       -41.001

. mfx compute, predict(pu0)

Marginal effects after xtlogit
      y  = Pr(union|fixed effect is 0) (predict, pu0)
         =  .73128193
```

```
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.      z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
     age |   .0015663      .00106    1.47   0.141  -.000519  .003651    30.538
   grade |   .0159527      .00476    3.35   0.001   .006619  .025286   12.7934
not_smsa*|   .0041239      .02209    0.19   0.852  -.039178  .047425   .251516
   south*|  -.2064533      .05648   -3.66   0.000   -.31715 -.095756   .381388
 southXt |   .0051779      .00223    2.32   0.020     .0008  .009556   3.72065
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

Alternative Command

```
. clogit union age grade not_smsa south southXt, group(idcode)
note: multiple positive outcomes within groups encountered.
note: 2744 groups (14165 obs) dropped because of all positive or
      all negative outcomes.

Iteration 0:   log likelihood = -4516.5769
Iteration 1:   log likelihood = -4511.1069
Iteration 2:   log likelihood = -4511.1042
Iteration 3:   log likelihood = -4511.1042

Conditional (fixed-effects) logistic regression   Number of obs   =      12035
                                                  LR chi2(5)      =      78.16
                                                  Prob > chi2     =     0.0000
Log likelihood = -4511.1042                       Pseudo R2       =     0.0086

------------------------------------------------------------------------------
       union |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .0079706   .0050283     1.59   0.113    -.0018848    .0178259
       grade |   .0811808   .0419138     1.94   0.053    -.0009687    .1633303
    not_smsa |   .0210368   .1131542     0.19   0.853    -.2007414     .242815
       south |  -1.007318   .1500498    -6.71   0.000     -1.30141   -.7132256
     southXt |   .0263495   .0083244     3.17   0.002      .010034     .042665
------------------------------------------------------------------------------
```

Pooled Probit Estimation

```
. probit union age grade not_smsa south southXt

Iteration 0:   log likelihood =  -13864.23
Iteration 1:   log likelihood = -13548.436
Iteration 2:   log likelihood = -13547.308
Iteration 3:   log likelihood = -13547.308

Probit regression                                 Number of obs   =      26200
                                                  LR chi2(5)      =     633.84
                                                  Prob > chi2     =     0.0000
Log likelihood = -13547.308                       Pseudo R2       =     0.0229

------------------------------------------------------------------------------
       union |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .0059461   .0015798     3.76   0.000     .0028496    .0090425
       grade |     .02639   .0036651     7.20   0.000     .0192066    .0335735
    not_smsa |  -.1303911   .0202523    -6.44   0.000    -.1700848   -.0906975
       south |  -.4027254    .033989   -11.85   0.000    -.4693426   -.3361081
     southXt |   .0033088   .0029253     1.13   0.258    -.0024247    .0090423
       _cons |  -1.113091   .0657808   -16.92   0.000    -1.242019   -.9841628
------------------------------------------------------------------------------
```

Panel Probit Random-Effects Estimation

```
. xtprobit union age grade not_smsa south southXt

Fitting comparison model:

Iteration 0:   log likelihood =  -13864.23
...
Iteration 4:   log likelihood = -10552.327

Random-effects probit regression              Number of obs      =     26200
Group variable: idcode                        Number of groups   =      4434
```

```
Random effects u_i ~ Gaussian                   Obs per group: min =         1
                                                               avg =       5.9
                                                               max =        12

                                                Wald chi2(5)       =    220.73
Log likelihood  = -10552.327                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
       union |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .0046532   .0025134     1.85   0.064     -.000273    .0095795
       grade |   .0481056   .0099402     4.84   0.000     .0286232    .0675881
    not_smsa |  -.1401136   .0460446    -3.04   0.002    -.2303594   -.0498679
       south |  -.6428989   .0619944   -10.37   0.000    -.7644058    -.521392
     southXt |   .0130454   .0043914     2.97   0.003     .0044384    .0216525
       _cons |  -1.872166   .1455716   -12.86   0.000    -2.157481   -1.586851
-------------+----------------------------------------------------------------
    /lnsig2u |   .6105518   .0458732                      .5206419    .7004617
-------------+----------------------------------------------------------------
     sigma_u |   1.356999    .031125                      1.297346    1.419395
         rho |   .6480667   .0104626                      .6272979    .6682901
------------------------------------------------------------------------------
Likelihood-ratio test of rho=0: chibar2(01) =  5989.96 Prob >= chibar2 = 0.000
```