140.655 Longitudinal Data Analysis
Thomas Travison

Fitting Longitudinal Poisson Outcomes Models with Stata

If one is presented with a discrete data outcome which takes the form of a *count* of the number of incidents to occur per unit time, it is typical to construct models assuming a poisson distribution on the outcome. Stata uses the **xtpois** command to fit these models in a regression setting.

As an example, we will use the seizure data discussed in the text. The data are take on 59 individuals at 5 time points. The main analytic interest is in estimating the effect on the introduction of progabide to reduce the number of seizures per time period. Age is included as a covariate. All data points are per unit time; an offset is hence unnecessary.

Random Effects Models

The option **re** induces a random-effects model for the outcome. The random effect is assumed to follow a gamma distribution. The **eform** option forces reporting of rate ratios rather than their logorithms:

```
. xtpois seizures treat age time1 time2 time3 time4, i(id) re eform

Random-effects Poisson                          Number of obs      =       295
Group variable (i) : id                         Number of groups   =        59

Random effects u_i ~ Gamma                      Obs per group: min =         5
                                                               avg =       5.0
                                                               max =         5

                                                Wald chi2(6)       =   1678.94
Log likelihood  = -1012.9425                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
seizures |        IRR   Std. Err.       z     P>|z|       [95% Conf. Interval]
---------+--------------------------------------------------------------------
   treat |   .8881932   .1840046     -0.572   0.567       .5917882    1.333057
     age |   .9832704   .0135455     -1.225   0.221        .957077    1.010181
   time1 |   .2864894   .0141415    -25.325   0.000       .2600712    .3155913
   time2 |   .2674986   .0135635    -26.006   0.000       .2421929    .2954484
   time3 |   .2702116   .0136467    -25.910   0.000       .2447458    .2983272
   time4 |    .234943   .0125471    -27.121   0.000       .2115945     .260868
---------+--------------------------------------------------------------------
/lnalpha |  -.4974429    .173556                          -.8376064   -.1572793
---------+--------------------------------------------------------------------
   alpha |   .6080836   .1055366                           .4327451    .8544653
------------------------------------------------------------------------------
Likelihood ratio test of alpha=0:    chi2(1) =  2548.45   Prob > chi2 = 0.0000

.
```

Population Average (GEE) models:

The option **pa** induces a population average model; the model is estimated using an independence working assumption on the outcome. The default correlation structure for the residuals is exchangeable (= uniform).

```
. xtpois seizures treat age time1 time2 time3 time4, i(id) pa nolog eform
robust

Iteration 1: tolerance = .06103939
Iteration 2: tolerance = .00174119
Iteration 3: tolerance = .00001193
Iteration 4: tolerance = 8.464e-09

GEE population-averaged model                   Number of obs      =       295
Group variable:                           id    Number of groups   =        59
Link:                                    log    Obs per group: min =         5
Family:                              Poisson                   avg =       5.0
Correlation:                    exchangeable                   max =         5
                                               Wald chi2(6)       =    321.07
Scale parameter:                            1  Prob > chi2        =    0.0000

                              (standard errors adjusted for clustering on id)
------------------------------------------------------------------------------
             |             Semi-robust
seizures |        IRR   Std. Err.       z     P>|z|       [95% Conf. Interval]
---------+--------------------------------------------------------------------
   treat |   .9162349   .1847382     -0.434   0.664       .6171364    1.360293
     age |   .9734854   .0124003     -2.110   0.035       .9494821    .9980955
   time1 |   .2864894   .0412083     -8.691   0.000       .2161089    .3797908
   time2 |   .2674986   .0241799    -14.588   0.000       .2240677    .3193478
   time3 |   .2702116   .0446535     -7.918   0.000       .1954518    .3735668
   time4 |    .234943   .0229902    -14.802   0.000       .1939406     .284614
------------------------------------------------------------------------------

.
```