```
------------------------------------------------------------------------------
------------------------------------------------------------------------------
------------
      name:  <unnamed>
       log:  C:\Users\nw\Documents\HILDA Project\Training\Melbourne Nov
2011\Exercises\ex6.log
  log type:  text
 opened on:   8 Nov 2011, 09:37:21

. 
. ************************************************************
. * Load the panel data and tell Stata it is panel data      *
. * then, only keep males to reduce the sample size and increase*
. * the speed of estimation.
* 
. ************************************************************
. use "`working'\panelex5.dta",replace

. tsset id wave
       panel variable:  id (unbalanced)
        time variable:  wave, 1 to 9, but with gaps
                delta:  1 unit

. 
. 
. ************************************************************
. * Continuing with the wage example, suppose we specifically  *
. * want to examine the determinants of low pay. Create a dummy*
. * variable to indicate an hourly wage of less than $14/hour. *
. * Examine the proportion of low paid workers, how it has     *
. * changed over time and low pay transitions.                 *
. ************************************************************
. 
. gen lopay=w_hr<14

. xttab lopay

                  Overall             Between             Within
    lopay |    Freq.  Percent      Freq.  Percent        Percent
----------+-----------------------------------------------------
        0 |   47428     79.43     11431     85.55          85.06
        1 |   12279     20.57      6420     48.05          56.68
----------+-----------------------------------------------------
    Total |   59707    100.00     17851    133.60          74.85
                            (n = 13362)

. xttrans lopay

           |         lopay
     lopay |         0          1 |     Total
-----------+----------------------+----------
         0 |     93.24       6.76 |    100.00
         1 |     50.59      49.41 |    100.00
-----------+----------------------+----------
     Total |     84.30      15.70 |    100.00


. bysort wave: su lopay
```

```
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
------------
-> wave = 1

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
       lopay |      6686    .3305414    .4704433          0          1

-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
------------
-> wave = 2

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
       lopay |      6382    .2919148    .4546789          0          1

-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
------------
-> wave = 3

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
       lopay |      6371    .2605556    .4389723          0          1

-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
------------
-> wave = 4

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
       lopay |      6258    .2245126    .4172943          0          1

-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
------------
-> wave = 5

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
       lopay |      6602    .1990306    .3993014          0          1

-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
------------
-> wave = 6

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
       lopay |      6787    .1753352    .3802816          0          1

-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
------------
```

```
-> wave = 7

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
       lopay |      6816     .149061    .3561748          0          1

-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
------------
-> wave = 8

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
       lopay |      6826    .1273074    .3333414          0          1

-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
------------
-> wave = 9

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
       lopay |      6979    .1077518    .3100889          0          1


. 
. ************************************************************
. * Estimate a linear probability model (LPM) to explain low   *
. * pay, using the same specification as the wage equation.    *
. * Estimate a RE model. How would you interpret the           *
. * coefficients? [Note they can be interpreted directly,      *
. * unlike in the probit and logit models below.]              *
. ************************************************************
. xtreg lopay hgage agesq cohort married female further degree ///
>         jbemp /*tucov*/ permanent nsw, re

Random-effects GLS regression                   Number of obs      =
59707
Group variable: id                              Number of groups   =
13362

R-sq:  within  = 0.1358                         Obs per group: min =
1
       between = 0.3021                                        avg =
4.5
       overall = 0.2308                                        max =
9

                                                Wald chi2(10)      =
13153.36
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =
0.0000

------------------------------------------------------------------------------
-----
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf.
Interval]
```

```
-------------+------------------------------------------------------------
-----
       hgage |  -.0948455   .0012392   -76.54   0.000    -.0972742   -
.0924168
       agesq |   .0755173   .0014075    53.65   0.000     .0727587
.0782759
      cohort |   -.030429   .0005342   -56.97   0.000    -.0314759   -
.0293821
     married |   .0111984   .0046622     2.40   0.016     .0020607
.0203361
      female |   .0418206   .0049686     8.42   0.000     .0320824
.0515588
     further |  -.0899933   .0053458   -16.83   0.000    -.1004708   -
.0795157
      degree |  -.0746616   .0063012   -11.85   0.000    -.0870116   -
.0623115
      jbempt |  -.0017646   .0003114    -5.67   0.000     -.002375   -
.0011542
   permanent |  -.0307871   .0035217    -8.74   0.000    -.0376896   -
.0238846
         nsw |  -.0210843   .0050871    -4.14   0.000    -.0310548   -
.0111139
       _cons |   62.53481   1.071321    58.37   0.000     60.43506
64.63456
-------------+------------------------------------------------------------
-----
     sigma_u |   .2298695
     sigma_e |  .30086992
         rho |  .36857557   (fraction of variance due to u_i)
------------------------------------------------------------------------------
-----

.
.
. ****************************************************************
. * Predict the probability of being low paid for each person.   *
. * Type help xtreg post-estimation for details of the predict   *
. * command. Examine the predictions. What do you notice?        *
. ****************************************************************
.
. predict reprob, xb

. predict reprob1, xbu //including predicted individual effect

. su lopay reprob reprob1, de

                            lopay
-------------------------------------------------------------
      Percentiles      Smallest
 1%            0              0
 5%            0              0
10%            0              0       Obs                59707
25%            0              0       Sum of Wgt.        59707

50%            0                      Mean           .2056543
                        Largest       Std. Dev.      .4041823
75%            0              1
90%            1              1       Variance       .1633633
```

```
95%            1              1       Skewness       1.456512
99%            1              1       Kurtosis       3.121427

                    Linear prediction
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -.1330489      -.2241488
 5%    -.0695236      -.2169429
10%    -.0247208       -.211746       Obs               59707
25%     .0621021      -.2044594       Sum of Wgt.       59707

50%     .1768914                      Mean           .2153759
                       Largest       Std. Dev.      .2102552
75%     .3292528       .8914966
90%     .5359221       .8915645       Variance       .0442072
95%     .6372729       .8917341       Skewness       .7376855
99%      .770086       .8918359       Kurtosis       3.054582

                        Xb + u[id]
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -.1494125      -.2884432
 5%    -.0887211      -.2728885
10%    -.0492079      -.2660058       Obs               59707
25%     .0224265      -.2659074       Sum of Wgt.       59707

50%     .1277282                      Mean           .2056543
                       Largest       Std. Dev.      .2517365
75%     .3411561       1.125741
90%     .6035851       1.138452       Variance       .0633712
95%     .7397249       1.150896       Skewness       1.009622
99%     .8936468       1.156993       Kurtosis       3.306962

.
. ************************************************************
. * Estimate an FE LPM and examine the predicted probabilities.*
. ************************************************************
. xtreg lopay hgage agesq cohort married female further degree ///
>         jbemp /*tucov*/ permanent nsw, fe
note: cohort omitted because of collinearity
note: female omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =
59707
Group variable: id                              Number of groups   =
13362

R-sq:  within  = 0.1406                         Obs per group: min =
1
       between = 0.1905                                        avg =
4.5
       overall = 0.1414                                        max =
9

                                                F(8,46337)         =
947.51
corr(u_i, Xb)  = -0.8384                        Prob > F           =
0.0000
```

```
------------------------------------------------------------------------------
       lopay |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       hgage |   -.120436   .0021204   -56.80   0.000    -.1245921   -.1162799
       agesq |    .105761   .0025844    40.92   0.000     .1006954    .1108265
      cohort |  (omitted)
     married |   .0388039   .0069033     5.62   0.000     .0252734    .0523344
      female |  (omitted)
     further |  -.1367623   .0102959   -13.28   0.000    -.1569423   -.1165822
      degree |   .0245604   .0146468     1.68   0.094    -.0041475    .0532684
      jbempt |   .0008392   .0004339     1.93   0.053    -.0000112    .0016897
   permanent |  -.0032936    .004081    -0.81   0.420    -.0112924    .0047051
         nsw |   .0020983   .0132384     0.16   0.874    -.0238492    .0280458
       _cons |    3.08184   .0400793    76.89   0.000     3.003284    3.160396
-------------+----------------------------------------------------------------
     sigma_u |  .55050481
     sigma_e |  .30086992
         rho |  .77000074   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(13361, 46337) =     2.71        Prob > F = 0.0000

.
. predict feprob, xb

. predict feprob1, xbu //including predicted individual effect

.
. su lopay feprob feprob1, de

                            lopay
-------------------------------------------------------------
      Percentiles      Smallest
 1%            0              0
 5%            0              0
10%            0              0       Obs                 59707
25%            0              0       Sum of Wgt.         59707

50%            0                      Mean           .2056543
                        Largest       Std. Dev.      .4041823
75%            0              1
90%            1              1       Variance       .1633633
95%            1              1       Skewness       1.456512
```

```
99%            1              1       Kurtosis       3.121427

                      Linear prediction
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -.4637284      -.4865073
 5%    -.4218718      -.4864751
10%    -.3901945      -.4863298       Obs               59707
25%    -.2765585      -.4861845       Sum of Wgt.       59707

50%     .0331033                      Mean           .2056543
                        Largest       Std. Dev.      .5589684
75%     .6036463       1.518717
90%     1.098327       1.519557       Variance       .3124456
95%     1.261273       1.520396       Skewness       .7271015
99%      1.51344       1.520396       Kurtosis       2.329063

                         Xb + u[id]
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -.1859578      -.3880788
 5%    -.1072756      -.3713734
10%     -.063895      -.3487845       Obs               59707
25%     -.005028      -.3476784       Sum of Wgt.       59707

50%     .0903401                      Mean           .2056543
                        Largest       Std. Dev.      .3051392
75%     .3457097       1.285256
90%     .6799397       1.292453       Variance       .0931099
95%     .9556987       1.311241       Skewness       1.255784
99%     1.042445       1.408116       Kurtosis        3.79189

. 
. ************************************************************
. * Estimate the model as a RE probit and examine the          *
. * predicted probabilities (type help xtprobit post-estimation*
. * for details of the predict command).                       *
. * What do you notice? How have the probabilities been        *
. * calculated?                                                *
. ************************************************************
. xtprobit lopay hgage agesq cohort married female further degree ///
>         jbemp /*tucov*/ permanent nsw, re

Fitting comparison model:

Iteration 0:   log likelihood = -30339.617
Iteration 1:   log likelihood = -23420.818
Iteration 2:   log likelihood = -23251.665
Iteration 3:   log likelihood = -23251.458
Iteration 4:   log likelihood = -23251.458

Fitting full model:

rho =  0.0     log likelihood = -23251.458
rho =  0.1     log likelihood = -22388.762
rho =  0.2     log likelihood = -21989.801
rho =  0.3     log likelihood = -21836.779
rho =  0.4     log likelihood = -21852.112
```

```
Iteration 0:   log likelihood =  -21836.77
Iteration 1:   log likelihood =  -21375.42
Iteration 2:   log likelihood = -21367.756
Iteration 3:   log likelihood = -21367.742
Iteration 4:   log likelihood = -21367.742

Random-effects probit regression                Number of obs      =
59707
Group variable: id                              Number of groups   =
13362

Random effects u_i ~ Gaussian                   Obs per group: min =
1
                                                               avg =
4.5
                                                               max =
9

                                                Wald chi2(10)      =
6592.26
Log likelihood  = -21367.742                    Prob > chi2        =
0.0000

------------------------------------------------------------------------------
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
       hgage |  -.4558991   .0078423   -58.13   0.000    -.4712697   -
.4405285
       agesq |   .3124385   .0079475    39.31   0.000     .2968617
.3280153
      cohort |  -.1906813   .0037131   -51.35   0.000    -.1979588   -
.1834037
     married |  -.0368732   .0273418    -1.35   0.177    -.0904622
.0167158
      female |    .251939   .0251412    10.02   0.000     .2026632
.3012148
     further |  -.3381665   .0274014   -12.34   0.000    -.3918722   -
.2844608
      degree |  -.6975005   .0371214   -18.79   0.000    -.7702571   -
.6247439
      jbempt |  -.0284252   .0020782   -13.68   0.000    -.0324984    -
.024352
   permanent |  -.1737852   .0200036    -8.69   0.000    -.2129916   -
.1345787
         nsw |  -.1308096   .0266997    -4.90   0.000      -.18314   -
.0784791
       _cons |   386.5501   7.463667    51.79   0.000     371.9216
401.1786
-------------+----------------------------------------------------------------
    /lnsig2u |  -.1204002   .0368845                     -.1926924   -
.0481079
-------------+----------------------------------------------------------------
------------------------------------------------------------------------------
```

```
     sigma_u |   .9415761   .0173648                      .9081496
.976233
         rho |   .4699363   .0091878                      .4519754
.4879753
------------------------------------------------------------------------------
-----
Likelihood-ratio test of rho=0: chibar2(01) =  3767.43 Prob >= chibar2 =
0.000

.
. predict repprob, pu0

. su lopay repprob, de

                           lopay
-------------------------------------------------------------
      Percentiles      Smallest
 1%            0             0
 5%            0             0
10%            0             0       Obs                59707
25%            0             0       Sum of Wgt.        59707

50%            0                     Mean           .2056543
                        Largest       Std. Dev.      .4041823
75%            0             1
90%            1             1       Variance       .1633633
95%            1             1       Skewness       1.456512
99%            1             1       Kurtosis       3.121427

                 Pr(lopay=1 assuming u_i=0)
-------------------------------------------------------------
      Percentiles      Smallest
 1%     .0002255       .0000104
 5%     .0012381       .0000139
10%      .003309       .0000154       Obs                59707
25%     .0150408       .0000181       Sum of Wgt.        59707

50%     .0678746                      Mean           .1749603
                        Largest       Std. Dev.      .2321324
75%      .238481       .9754409
90%     .5617821       .9755037       Variance       .0538855
95%     .7365823       .9756603       Skewness       1.662574
99%     .9089257       .9757539       Kurtosis       4.866044

.
. ************************************************************
. * Now estimate the model as a RE logit and examine the       *
. * predicted probabilities (type help xtlogit postestimation  *
. * for details of the predict command).                       *
. * What do you notice? How have the probabilities been        *
. * calculated?                                               *
. ************************************************************
. xtlogit lopay hgage agesq cohort married female further degree ///
>         jbemp /*tucov*/ permanent nsw, re

Fitting comparison model:

Iteration 0:   log likelihood = -30339.617
```

```
Iteration 1:   log likelihood = -23923.118
Iteration 2:   log likelihood = -23215.263
Iteration 3:   log likelihood = -23201.418
Iteration 4:   log likelihood = -23201.391
Iteration 5:   log likelihood = -23201.391

Fitting full model:

tau =  0.0     log likelihood = -23201.391
tau =  0.1     log likelihood = -22849.103
tau =  0.2     log likelihood =  -22527.05
tau =  0.3     log likelihood = -22247.356
tau =  0.4     log likelihood = -22021.286
tau =  0.5     log likelihood = -21862.207
tau =  0.6     log likelihood = -21792.251
tau =  0.7     log likelihood = -21856.716

Iteration 0:   log likelihood =  -21792.23
Iteration 1:   log likelihood = -21339.586
Iteration 2:   log likelihood = -21334.357
Iteration 3:   log likelihood = -21334.338
Iteration 4:   log likelihood = -21334.338

Random-effects logistic regression              Number of obs      =
59707
Group variable: id                              Number of groups   =
13362

Random effects u_i ~ Gaussian                   Obs per group: min =
1
                                                               avg =
4.5
                                                               max =
9

                                                Wald chi2(10)      =
5958.40
Log likelihood  = -21334.338                    Prob > chi2        =
0.0000

------------------------------------------------------------------------------
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
       hgage |  -.8252997   .0146057   -56.51   0.000    -.8539264   -
.7966731
       agesq |    .560641   .0145353    38.57   0.000     .5321522
.5891297
      cohort |  -.3497448   .0069135   -50.59   0.000    -.3632949   -
.3361947
     married |  -.0718777   .0500144    -1.44   0.151     -.169904
.0261487
      female |   .4493369   .0455548     9.86   0.000     .3600511
.5386227
     further |  -.6130987    .049666   -12.34   0.000    -.7104423    -
.515755
```

```
      degree |  -1.300175   .0693114   -18.76   0.000    -1.436023   -
1.164327
      jbempt |  -.0521376   .0038565   -13.52   0.000    -.0596961    -
.044579
   permanent |  -.2926862   .0359879    -8.13   0.000    -.3632212   -
.2221512
         nsw |  -.2433049   .0484902    -5.02   0.000     -.338344   -
.1482658
       _cons |   708.8378   13.90222    50.99   0.000     681.5899
736.0856
-------------+----------------------------------------------------------
-----
    /lnsig2u |   1.059181   .0375428                      .9855987
1.132764
-------------+----------------------------------------------------------
-----
     sigma_u |   1.698237   .0318783                      1.636892
1.761881
         rho |   .4671309   .0093451                      .4488672
.4854832
------------------------------------------------------------------------
-----
Likelihood-ratio test of rho=0: chibar2(01) =  3734.11 Prob >= chibar2 =
0.000

.
. predict relprob, pu0

. su lopay relprob, de

                          lopay
-------------------------------------------------------------
      Percentiles      Smallest
 1%            0              0
 5%            0              0
10%            0              0       Obs                59707
25%            0              0       Sum of Wgt.        59707

50%            0                      Mean           .2056543
                       Largest        Std. Dev.      .4041823
75%            0              1
90%            1              1       Variance       .1633633
95%            1              1       Skewness       1.456512
99%            1              1       Kurtosis       3.121427

                Pr(lopay=1 assuming u_i=0)
-------------------------------------------------------------
      Percentiles      Smallest
 1%     .0017309       .0004404
 5%     .0041413       .0004943
10%     .0073244       .0005156       Obs                59707
25%     .0196731       .0005494       Sum of Wgt.        59707

50%     .0646826                      Mean           .1740193
                       Largest        Std. Dev.      .2350365
75%      .221457       .9724768
90%     .5725967       .9725304       Variance       .0552421
95%     .7588834        .972664       Skewness       1.749767
```

```
99%     .9185546       .9727439       Kurtosis       5.099154

.
. ************************************************************
. * Do the linear probability model, logit model and probit    *
. * model produce similar predictions of Pr(y=1) for different *
. * types of individuals? Use scatter plots of predicted       *
. * probabilities from the different (random effects) models.  *
. ************************************************************
.
. *First plot logit and probit predicted probabilities *
.
. scatter relprob repprob in 1/100, ///
> title(Logit and Probit predicted probabilities) ///
> xtitle(Predicted probabilities from the probit) ///
> ytitle(Predicted probability from the logit) ///
> scheme(s1color) legend(on)

.
. graph save "`working'\Logit vs. Probit.gph", replace
(file C:\Users\nw\Documents\HILDA Project\Training\Melbourne Nov
2011\Exercises\Logit vs. Probit.gph saved)

.
. * Then plot LPM and logit predicted probabilities *
. scatter reprob relprob in 1/500, msize(small) ///
> title(LPM and Logit predicted probabilities) ///
> xtitle(Predicted probabilities from the logit) ///
> ytitle(Predicted probabilities from the LPM) scheme(s1color)

.
. graph save "`working'\Logit vs. LPM.gph", replace
(file C:\Users\nw\Documents\HILDA Project\Training\Melbourne Nov
2011\Exercises\Logit vs. LPM.gph saved)

.
. ************************************************************
. * Estimate the FE logit (recall there is no FE probit).      *
. * Why does Stata report that it has dropped (a lot of!)      *
. * observations? Why is there no constant reported?           *
. ************************************************************
. xtlogit lopay hgage agesq cohort married female further degree ///
>         jbemp /*tucov*/ permanent nsw, fe
note: multiple positive outcomes within groups encountered.
note: 8873 groups (33576 obs) dropped because of all positive or
      all negative outcomes.
note: cohort omitted because of no within-group variance.
note: female omitted because of no within-group variance.

Iteration 0:   log likelihood = -9334.0899
Iteration 1:   log likelihood = -7311.5943
Iteration 2:   log likelihood = -7291.5364
Iteration 3:   log likelihood = -7291.4151
Iteration 4:   log likelihood = -7291.4151

Conditional fixed-effects logistic regression   Number of obs      =
26131
```

```
Group variable: id                              Number of groups   =
4489

                                                Obs per group: min =
2
                                                               avg =
5.8
                                                               max =
9

                                                LR chi2(8)         =
5544.70
Log likelihood  = -7291.4151                    Prob > chi2        =
0.0000

------------------------------------------------------------------------------
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
       hgage |  -.8804523   .0268205   -32.83   0.000    -.9330195   -
.8278852
       agesq |   .5477122   .0333533    16.42   0.000      .482341
.6130834
      cohort |  (omitted)
     married |   .0764314   .0950317     0.80   0.421    -.1098272
.2626901
      female |  (omitted)
     further |  -.3836895    .113007    -3.40   0.001    -.6051792   -
.1621998
      degree |  -.1254846   .1781733    -0.70   0.481    -.4746978
.2237285
      jbempt |  -.0167859   .0065245    -2.57   0.010    -.0295737   -
.0039982
   permanent |   .1019658   .0446407     2.28   0.022     .0144716
.18946
         nsw |   .0584974   .1705381     0.34   0.732     -.275751
.3927458
------------------------------------------------------------------------------

.
.
. ****************************************************************
. * Predict the probabilites implied by the FE logit. What do  *
. * you notice? How are the probabilities calculated?          *
. ****************************************************************
. predict felprob, pu0

. su felprob, de

                Pr(lopay|fixed effect is 0)
-------------------------------------------------------------
      Percentiles      Smallest
 1%     1.85e-15       4.70e-16
 5%     5.47e-15       4.90e-16
10%     1.42e-14       5.42e-16       Obs               59707
```

```
25%     1.52e-13       5.68e-16       Sum of Wgt.       59707

50%     1.21e-11                      Mean           2.08e-07
                        Largest       Std. Dev.      8.61e-07
75%     4.77e-09       7.37e-06
90%     2.34e-07       7.38e-06       Variance       7.42e-13
95%     1.12e-06       7.38e-06       Skewness       5.727186
99%     6.22e-06       7.39e-06       Kurtosis       38.33599

.
.
. ************************************************************
. * We wish to test the RE assumption that the individual      *
. * effects are uncorrelated with the regressors. We compare   *
. * the RE and FE logit models. Re-estimate both models and    *
. * store the results.                                         *
. ************************************************************
. xtlogit lopay hgage agesq cohort married female further degree ///
>         jbemp /*tucov*/ permanent nsw, fe
note: multiple positive outcomes within groups encountered.
note: 8873 groups (33576 obs) dropped because of all positive or
      all negative outcomes.
note: cohort omitted because of no within-group variance.
note: female omitted because of no within-group variance.

Iteration 0:   log likelihood = -9334.0899
Iteration 1:   log likelihood = -7311.5943
Iteration 2:   log likelihood = -7291.5364
Iteration 3:   log likelihood = -7291.4151
Iteration 4:   log likelihood = -7291.4151

Conditional fixed-effects logistic regression   Number of obs      =
26131
Group variable: id                              Number of groups   =
4489

                                                Obs per group: min =
2
                                                               avg =
5.8
                                                               max =
9

                                                LR chi2(8)         =
5544.70
Log likelihood  = -7291.4151                    Prob > chi2        =
0.0000

------------------------------------------------------------------------------
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
       hgage |  -.8804523   .0268205   -32.83   0.000    -.9330195   -
.8278852
       agesq |   .5477122   .0333533    16.42   0.000      .482341
.6130834
```

```
      cohort |  (omitted)
     married |   .0764314   .0950317     0.80   0.421    -.1098272
.2626901
      female |  (omitted)
     further |  -.3836895    .113007    -3.40   0.001    -.6051792   -
.1621998
      degree |  -.1254846   .1781733    -0.70   0.481    -.4746978
.2237285
      jbempt |  -.0167859   .0065245    -2.57   0.010    -.0295737   -
.0039982
   permanent |   .1019658   .0446407     2.28   0.022     .0144716
.18946
         nsw |   .0584974   .1705381     0.34   0.732     -.275751
.3927458
------------------------------------------------------------------------
-----

. est store fixed

.
. xtlogit lopay hgage agesq cohort married female further degree ///
>         jbemp /*tucov*/ permanent nsw, re

Fitting comparison model:

Iteration 0:   log likelihood = -30339.617
Iteration 1:   log likelihood = -23923.118
Iteration 2:   log likelihood = -23215.263
Iteration 3:   log likelihood = -23201.418
Iteration 4:   log likelihood = -23201.391
Iteration 5:   log likelihood = -23201.391

Fitting full model:

tau =  0.0     log likelihood = -23201.391
tau =  0.1     log likelihood = -22849.103
tau =  0.2     log likelihood =  -22527.05
tau =  0.3     log likelihood = -22247.356
tau =  0.4     log likelihood = -22021.286
tau =  0.5     log likelihood = -21862.207
tau =  0.6     log likelihood = -21792.251
tau =  0.7     log likelihood = -21856.716

Iteration 0:   log likelihood =  -21792.23
Iteration 1:   log likelihood = -21339.586
Iteration 2:   log likelihood = -21334.357
Iteration 3:   log likelihood = -21334.338
Iteration 4:   log likelihood = -21334.338

Random-effects logistic regression              Number of obs      =
59707
Group variable: id                              Number of groups   =
13362

Random effects u_i ~ Gaussian                   Obs per group: min =
1
                                                               avg =
4.5
```

```
                                                              max =
9

                                                Wald chi2(10)      =
5958.40
Log likelihood  = -21334.338                    Prob > chi2        =
0.0000

------------------------------------------------------------------------------
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
       hgage |  -.8252997   .0146057   -56.51   0.000    -.8539264   -
.7966731
       agesq |    .560641   .0145353    38.57   0.000     .5321522
.5891297
      cohort |  -.3497448   .0069135   -50.59   0.000    -.3632949   -
.3361947
     married |  -.0718777   .0500144    -1.44   0.151     -.169904
.0261487
      female |   .4493369   .0455548     9.86   0.000     .3600511
.5386227
     further |  -.6130987    .049666   -12.34   0.000    -.7104423    -
.515755
      degree |  -1.300175   .0693114   -18.76   0.000    -1.436023   -
1.164327
      jbempt |  -.0521376   .0038565   -13.52   0.000    -.0596961    -
.044579
   permanent |  -.2926862   .0359879    -8.13   0.000    -.3632212   -
.2221512
         nsw |  -.2433049   .0484902    -5.02   0.000     -.338344   -
.1482658
       _cons |   708.8378   13.90222    50.99   0.000     681.5899
736.0856
-------------+----------------------------------------------------------------
    /lnsig2u |   1.059181   .0375428                      .9855987
1.132764
-------------+----------------------------------------------------------------
     sigma_u |   1.698237   .0318783                     1.636892
1.761881
         rho |   .4671309   .0093451                      .4488672
.4854832
------------------------------------------------------------------------------
Likelihood-ratio test of rho=0: chibar2(01) =  3734.11 Prob >= chibar2 =
0.000

. est store random

.
.
. ************************************************************
. * How do the FE coefficients differ from the RE model. Test  *
. * the FE against the RE model. Which model do you prefer?    *
```

```
. ************************************************************
. hausman fixed random

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-
V_B))
             |     fixed        random       Difference          S.E.
-------------+----------------------------------------------------------
-----
       hgage |   -.8804523    -.8252997       -.0551526        .0224947
       agesq |    .5477122     .560641       -.0129288        .0300194
     married |    .0764314    -.0718777        .1483091        .0808058
     further |   -.3836895    -.6130987        .2294092         .101508
      degree |   -.1254846    -1.300175         1.17469        .1641391
      jbempt |   -.0167859    -.0521376        .0353517        .0052628
   permanent |    .1019658    -.2926862         .394652        .0264133
         nsw |    .0584974    -.2433049        .3018023         .163499
------------------------------------------------------------------------
-----
                          b = consistent under Ho and Ha; obtained from
xtlogit
          B = inconsistent under Ha, efficient under Ho; obtained from
xtlogit

    Test:  Ho:  difference in coefficients not systematic

                  chi2(8) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =      402.83
                Prob>chi2 =      0.0000


.
.
. ************************************************************
. * Predicting the probability for a person with selected      *
. * characteristics.                                           *
. * The predict command predicts the probabilities             *
. * for each observation separately (given their               *
. * characteristics).                                          *
. * To make predictions for a specific type of person we need  *
. * to use the model formulae directly and plug in the chosen  *
. * values. Use command nlcom (which also gives standard       *
. * errors).                                                   *
. *                                                            *
. * Calculate the probability of being low paid for a reference*
. * male aged 40 and born in 1967 (i.e. current yr is 2007),   *
. * who is not married, has no further or higher education,        *
. * non-unionised permanent job, has been on his job for 1 year*
. * and does not live in nsw.
. * Calculate the probability for
*
. * 3 values  of individual effect, low (-1 sd), medium (0) and*
. * high (+1 sd). What impact do unobserved individual level   *
. * factors have on the probability of being low paid?         *
. ************************************************************
.
. * For convenience, use model just estimated (RE logit)
. * "replay" previous results for references
.
```

```
. xtlogit

Random-effects logistic regression              Number of obs      =
59707
Group variable: id                              Number of groups   =
13362

Random effects u_i ~ Gaussian                   Obs per group: min =
1
                                                               avg =
4.5
                                                               max =
9

                                                Wald chi2(10)      =
5958.40
Log likelihood  = -21334.338                    Prob > chi2        =
0.0000

------------------------------------------------------------------------------
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
       hgage |  -.8252997   .0146057   -56.51   0.000    -.8539264   -
.7966731
       agesq |    .560641   .0145353    38.57   0.000     .5321522
.5891297
      cohort |  -.3497448   .0069135   -50.59   0.000    -.3632949   -
.3361947
     married |  -.0718777   .0500144    -1.44   0.151     -.169904
.0261487
      female |   .4493369   .0455548     9.86   0.000     .3600511
.5386227
     further |  -.6130987    .049666   -12.34   0.000    -.7104423    -
.515755
      degree |  -1.300175   .0693114   -18.76   0.000    -1.436023   -
1.164327
      jbempt |  -.0521376   .0038565   -13.52   0.000    -.0596961    -
.044579
   permanent |  -.2926862   .0359879    -8.13   0.000    -.3632212   -
.2221512
         nsw |  -.2433049   .0484902    -5.02   0.000     -.338344   -
.1482658
       _cons |   708.8378   13.90222    50.99   0.000     681.5899
736.0856
-------------+----------------------------------------------------------------
    /lnsig2u |   1.059181   .0375428                      .9855987
1.132764
-------------+----------------------------------------------------------------
     sigma_u |   1.698237   .0318783                      1.636892
1.761881
         rho |   .4671309   .0093451                      .4488672
.4854832
```

```
------------------------------------------------------------------------------
Likelihood-ratio test of rho=0: chibar2(01) =  3734.11 Prob >= chibar2 =
0.000

.
. ************************************************************
. * write down xb for ref person using stored coefficients,
. * accessed using _b notation
. * use a local "macro" to store the text for future use
. ************************************************************
.
. local refxb _b[_cons] + _b[hgage]*40 + _b[agesq]*16 + ///
> _b[cohort]*1967 + _b[jbemp]*1 + _b[permanent]

.
. * use a macro to store the standard deviation of u(i) *
. local ui=e(sigma_u) //estimate of sd from model

.
. ************************************************************
. * NOTE: macro subtlety                                      *
. * A local statement without the = sign stores the           *
. * following text directly in the macro                      *
. * A local statement with the = sign evaluates the expression *
. * and stores the resulting number in the macro              *
. * You will see difference below when the macro contents are  *
. * displayed.                                                *
. ************************************************************
.
. * calculate probabilities using logit formula*
. *low individual effect -use -1 st dev of u(i)*
.
. /*
> nlcom ( prlo:exp(`refxb'-`ui')/(1+exp(`refxb'-`ui')) )
>           ( prmed: exp(`refxb') / (1+exp(`refxb')) )
>       ( prhi: exp(`refxb'+`ui') / (1+exp(`refxb'+`ui')) )
> */
.
. * Note single quotes used to access macro contents
. nlcom prlo:exp(`refxb'-`ui')/(1+exp(`refxb'-`ui'))

        prlo:  exp(_b[_cons] + _b[hgage]*40 + _b[agesq]*16 +
_b[cohort]*1967 + _b[jbemp]*1 + _b[permanent]-
1.698237010370481)/(1+exp(_b[_cons] + _b[hgage]*40
> + _b[agesq]*16 + _b[cohort]*1967 + _b[jbemp]*1 + _b[permanent]-
1.698237010370481))

------------------------------------------------------------------------------
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
        prlo |   .0055132   .0003912    14.09   0.000     .0047465
.0062799
------------------------------------------------------------------------------
```

```
.
. * medium individual efefct, u(o)=0
. nlcom prmed: exp(`refxb') / (1+exp(`refxb'))

       prmed:  exp(_b[_cons] + _b[hgage]*40 + _b[agesq]*16 +
_b[cohort]*1967 + _b[jbemp]*1 + _b[permanent]) / (1+exp(_b[_cons] +
_b[hgage]*40 + _b[agesq]*16 +
>  _b[cohort]*1967 + _b[jbemp]*1 + _b[permanent]))

------------------------------------------------------------------------
-----
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf.
Interval]
-------------+----------------------------------------------------------
-----
       prmed |   .0294021   .0020361    14.44   0.000     .0254115
.0333928
------------------------------------------------------------------------
-----


.
. * High individual effects - use +1 st dev of u(i)
. nlcom prhi: exp(`refxb'+`ui') / (1+exp(`refxb'+`ui'))

        prhi:  exp(_b[_cons] + _b[hgage]*40 + _b[agesq]*16 +
_b[cohort]*1967 + _b[jbemp]*1 + _b[permanent]+1.698237010370481) /
(1+exp(_b[_cons] + _b[hgage]*4
> 0 + _b[agesq]*16 + _b[cohort]*1967 + _b[jbemp]*1 +
_b[permanent]+1.698237010370481))

------------------------------------------------------------------------
-----
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf.
Interval]
-------------+----------------------------------------------------------
-----
        prhi |   .1420207   .0086936    16.34   0.000     .1249814
.1590599
------------------------------------------------------------------------
-----


.
. * calculate xb for ref person who has done further studies *
. local refxb1 _b[_cons] + _b[hgage]*40 + _b[agesq]*16 + ///
> _b[cohort]*1967 + _b[jbemp]*1 + _b[permanent]+_b[degree]

.
. local ui=e(sigma_u)

.
. * calculate probabilities *
. nlcom prlo: exp(`refxb1'-`ui') / (1+exp(`refxb1'-`ui'))

        prlo:  exp(_b[_cons] + _b[hgage]*40 + _b[agesq]*16 +
_b[cohort]*1967 + _b[jbemp]*1 + _b[permanent]+_b[degree]-
1.698237010370481) / (1+exp(_b[_cons] +
```

```
> _b[hgage]*40 + _b[agesq]*16 + _b[cohort]*1967 + _b[jbemp]*1 +
_b[permanent]+_b[degree]-1.698237010370481))

------------------------------------------------------------------------------
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
        prlo |   .0015083   .0001553     9.71   0.000      .001204
.0018126
------------------------------------------------------------------------------

. nlcom prmed: exp(`refxb1') / (1+exp(`refxb1'))

       prmed:  exp(_b[_cons] + _b[hgage]*40 + _b[agesq]*16 +
_b[cohort]*1967 + _b[jbemp]*1 + _b[permanent]+_b[degree]) /
(1+exp(_b[_cons] + _b[hgage]*40 + _b[
> agesq]*16 + _b[cohort]*1967 + _b[jbemp]*1 + _b[permanent]+_b[degree]))

------------------------------------------------------------------------------
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
       prmed |   .0081867   .0008371     9.78   0.000     .0065461
.0098274
------------------------------------------------------------------------------

. nlcom prhi: exp(`refxb1'+`ui') / (1+exp(`refxb1'+`ui'))

        prhi:  exp(_b[_cons] + _b[hgage]*40 + _b[agesq]*16 +
_b[cohort]*1967 + _b[jbemp]*1 +
_b[permanent]+_b[degree]+1.698237010370481) / (1+exp(_b[_cons] +
> _b[hgage]*40 + _b[agesq]*16 + _b[cohort]*1967 + _b[jbemp]*1 +
_b[permanent]+_b[degree]+1.698237010370481))

------------------------------------------------------------------------------
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
        prhi |   .0431575   .0042572    10.14   0.000     .0348136
.0515014
------------------------------------------------------------------------------

.
. ************************************************************
. *            ADDITIONAL EXERCISE                           *
. ************************************************************
. ************************************************************
. * Repeat probability predictions using RE probit           *
. ************************************************************
```

```
.
. xtprobit lopay hgage agesq cohort married female further degree ///
>         jbemp /*tucov*/ permanent nsw, re

Fitting comparison model:

Iteration 0:   log likelihood = -30339.617
Iteration 1:   log likelihood = -23420.818
Iteration 2:   log likelihood = -23251.665
Iteration 3:   log likelihood = -23251.458
Iteration 4:   log likelihood = -23251.458

Fitting full model:

rho =  0.0     log likelihood = -23251.458
rho =  0.1     log likelihood = -22388.762
rho =  0.2     log likelihood = -21989.801
rho =  0.3     log likelihood = -21836.779
rho =  0.4     log likelihood = -21852.112

Iteration 0:   log likelihood =  -21836.77
Iteration 1:   log likelihood =  -21375.42
Iteration 2:   log likelihood = -21367.756
Iteration 3:   log likelihood = -21367.742
Iteration 4:   log likelihood = -21367.742

Random-effects probit regression                Number of obs      =
59707
Group variable: id                              Number of groups   =
13362

Random effects u_i ~ Gaussian                   Obs per group: min =
1
                                                               avg =
4.5
                                                               max =
9

                                                Wald chi2(10)      =
6592.26
Log likelihood  = -21367.742                    Prob > chi2        =
0.0000

------------------------------------------------------------------------
-----
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf.
Interval]
-------------+----------------------------------------------------------
-----
       hgage |  -.4558991   .0078423   -58.13   0.000    -.4712697   -
.4405285
       agesq |   .3124385   .0079475    39.31   0.000     .2968617
.3280153
      cohort |  -.1906813   .0037131   -51.35   0.000    -.1979588   -
.1834037
     married |  -.0368732   .0273418    -1.35   0.177    -.0904622
.0167158
```

```
      female |    .251939   .0251412    10.02   0.000     .2026632
.3012148
     further |  -.3381665   .0274014   -12.34   0.000    -.3918722   -
.2844608
      degree |  -.6975005   .0371214   -18.79   0.000    -.7702571   -
.6247439
      jbempt |  -.0284252   .0020782   -13.68   0.000    -.0324984    -
.024352
   permanent |  -.1737852   .0200036    -8.69   0.000    -.2129916   -
.1345787
         nsw |  -.1308096   .0266997    -4.90   0.000      -.18314   -
.0784791
       _cons |   386.5501   7.463667    51.79   0.000     371.9216
401.1786
-------------+----------------------------------------------------------
-----
    /lnsig2u |  -.1204002   .0368845                     -.1926924   -
.0481079
-------------+----------------------------------------------------------
-----
     sigma_u |   .9415761   .0173648                      .9081496
.976233
         rho |   .4699363   .0091878                      .4519754
.4879753
------------------------------------------------------------------------
-----
Likelihood-ratio test of rho=0: chibar2(01) =  3767.43 Prob >= chibar2 =
0.000

.
. * use a macro to store the standard deviation of u(i) *
. local ui=e(sigma_u) //estimate of sd from model

.
.
. * calculate probabilities *
. nlcom prlo: norm(`refxb'-`ui')

        prlo:  norm(_b[_cons] + _b[hgage]*40 + _b[agesq]*16 +
_b[cohort]*1967 + _b[jbemp]*1 + _b[permanent]-.9415761176406886)

------------------------------------------------------------------------
-----
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf.
Interval]
-------------+----------------------------------------------------------
-----
        prlo |   .0018619   .0002295     8.11   0.000     .0014122
.0023116
------------------------------------------------------------------------
-----

. nlcom prmed: norm(`refxb')

       prmed:  norm(_b[_cons] + _b[hgage]*40 + _b[agesq]*16 +
_b[cohort]*1967 + _b[jbemp]*1 + _b[permanent])
```

```
------------------------------------------------------------------------------
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       prmed |   .0250518   .0022611    11.08   0.000     .0206202    .0294835
------------------------------------------------------------------------------

. nlcom prhi: norm(`refxb'+`ui')

        prhi:  norm(_b[_cons] + _b[hgage]*40 + _b[agesq]*16 + _b[cohort]*1967 + _b[jbemp]*1 + _b[permanent]+.9415761176406886)

------------------------------------------------------------------------------
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        prhi |   .1544575   .0091814    16.82   0.000     .1364622    .1724527
------------------------------------------------------------------------------

.
.
. * calculate xb for ref person with further studies *
. nlcom prlo: norm(`refxb1'-`ui')

        prlo:  norm(_b[_cons] + _b[hgage]*40 + _b[agesq]*16 + _b[cohort]*1967 + _b[jbemp]*1 + _b[permanent]+_b[degree]-.9415761176406886)

------------------------------------------------------------------------------
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        prlo |   .0001602   .0000341     4.70   0.000     .0000934    .0002271
------------------------------------------------------------------------------

. nlcom prmed: norm(`refxb1')

       prmed:  norm(_b[_cons] + _b[hgage]*40 + _b[agesq]*16 + _b[cohort]*1967 + _b[jbemp]*1 + _b[permanent]+_b[degree])

------------------------------------------------------------------------------
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
```

```
       prmed |   .0039469    .000648     6.09   0.000     .0026769
.005217
------------------------------------------------------------------------------
-----

. nlcom prhi: norm(`refxb1'+`ui')

        prhi:  norm(_b[_cons] + _b[hgage]*40 + _b[agesq]*16 +
_b[cohort]*1967 + _b[jbemp]*1 +
_b[permanent]+_b[degree]+.9415761176406886)

------------------------------------------------------------------------------
-----
       lopay |      Coef.   Std. Err.      z    P>|z|     [95% Conf.
Interval]
-------------+----------------------------------------------------------------
-----
        prhi |   .0431724   .0050745     8.51   0.000     .0332266
.0531183
------------------------------------------------------------------------------
-----

.
.
. ****************************************************************
. *             END OF ADDITIONAL EXERCISE                       *
. ****************************************************************
.
. set more on

. log c
      name:  <unnamed>
       log:  C:\Users\nw\Documents\HILDA Project\Training\Melbourne Nov
2011\Exercises\ex6.log
  log type:  text
 closed on:   8 Nov 2011, 09:38:07
------------------------------------------------------------------------------
------------------------------------------------------------------------------
------------
```