```
------------------------------------------------------------------------------------------------------------------------
      name:  <unnamed>
       log:  c:\temp\margins workshop 4.log
  log type:  text
 opened on:   3 Jun 2019, 11:47:11

.
. set more 1

.
.
. use http://www.stata-press.com/data/r14/margex, clear
(Artificial data for margins)

.
. sum y outcome sex age

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
           y |      3,000    69.73357    21.53986          0      146.3
     outcome |      3,000    .1696667    .3754023          0          1
         sex |      3,000    .5006667    .5000829          0          1
         age |      3,000      39.799    11.54174         20         60

.
. *********************************
. * 1. Continuous Dependent variables
. *********************************
.
. reg y i.sex##c.age

      Source |       SS           df       MS      Number of obs   =     3,000
-------------+----------------------------------   F(3, 2996)      =    139.91
       Model |  170983.675         3  56994.5583   Prob > F        =    0.0000
    Residual |  1220449.33     2,996   407.35959   R-squared       =    0.1229
-------------+----------------------------------   Adj R-squared   =    0.1220
       Total |  1391433.01     2,999  463.965657   Root MSE        =    20.183

------------------------------------------------------------------------------
           y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         sex |
     female  |   14.92308   2.789012     5.35   0.000     9.454508    20.39165
         age |  -.4929608   .0480944   -10.25   0.000    -.5872622   -.3986595
             |
   sex#c.age |
     female  |  -.0224116   .0674167    -0.33   0.740    -.1545994    .1097762
             |
       _cons |   82.36936   1.812958    45.43   0.000      78.8146    85.92413
------------------------------------------------------------------------------


.         *********************************************************
.         * 1.1 Average Adjusted Prediction and Average Marginal Effect
.         *********************************************************
.         margins  i.sex

Predictive margins                              Number of obs     =      3,000
Model VCE    : OLS

Expression   : Linear prediction, predict()

------------------------------------------------------------------------------
             |            Delta-method
             |     Margin   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         sex |
       male  |   62.75002   .5509414   113.90   0.000     61.66975    63.83028
     female  |   76.78114   .5491282   139.82   0.000     75.70443    77.85784
------------------------------------------------------------------------------

.         margins, dydx(i.sex)

Average marginal effects                        Number of obs     =      3,000
Model VCE    : OLS

Expression   : Linear prediction, predict()
dy/dx w.r.t. : 1.sex

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         sex |
```

```
     female  |   14.03112   .7778678    18.04   0.000     12.50591    15.55633
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.

.
.         ************************************************************************
.         * 1.2 Adjusted Predictions and Marginal Effects at the Means
.         ************************************************************************
.         margins  i.sex,      atmeans

Adjusted predictions                            Number of obs     =      3,000
Model VCE    : OLS

Expression   : Linear prediction, predict()
at           : 0.sex           =    .4993333 (mean)
               1.sex           =    .5006667 (mean)
               age             =      39.799 (mean)

------------------------------------------------------------------------------
             |            Delta-method
             |     Margin   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         sex |
        male |   62.75002   .5509414   113.90   0.000     61.66975    63.83028
     female  |   76.78114   .5491282   139.82   0.000     75.70443    77.85784
------------------------------------------------------------------------------

.         margins, dydx(i.sex) atmeans

Conditional marginal effects                    Number of obs     =      3,000
Model VCE    : OLS

Expression   : Linear prediction, predict()
dy/dx w.r.t. : 1.sex
at           : 0.sex           =    .4993333 (mean)
               1.sex           =    .5006667 (mean)
               age             =      39.799 (mean)

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         sex |
     female  |   14.03112   .7778678    18.04   0.000     12.50591    15.55633
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.

.
.         ************************************************************************
.         * 1.3 Adjusted Predictions and Marginal Effects at Representative values
.         ************************************************************************
.         margins  i.sex,      at(age=(20(10)60))

Adjusted predictions                            Number of obs     =      3,000
Model VCE    : OLS

Expression   : Linear prediction, predict()

1._at        : age             =          20

2._at        : age             =          30

3._at        : age             =          40

4._at        : age             =          50

5._at        : age             =          60

------------------------------------------------------------------------------
             |            Delta-method
             |     Margin   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     _at#sex |
     1#male  |   72.51015   .9336568    77.66   0.000     70.67947    74.34082
   1#female  |     86.985    1.22567    70.97   0.000     84.58175    89.38824
     2#male  |   67.58054   .5984013   112.94   0.000     66.40722    68.75386
   2#female  |   81.83127   .8228617    99.45   0.000     80.21784     83.4447
     3#male  |   62.65093   .5541361   113.06   0.000     61.56441    63.73746
   3#female  |   76.67755   .5461908   140.39   0.000      75.6066    77.74849
     4#male  |   57.72132   .8477402    68.09   0.000     56.05911    59.38353
   4#female  |   71.52382    .604927   118.24   0.000     70.33771    72.70994
     5#male  |   52.79171   1.262091    41.83   0.000     50.31706    55.26637
   5#female  |    66.3701   .9380502    70.75   0.000     64.53081    68.20939
------------------------------------------------------------------------------
```

```
.         margins, dydx(i.sex) at(age=(20(10)60))

Conditional marginal effects                    Number of obs     =      3,000
Model VCE    : OLS

Expression   : Linear prediction, predict()
dy/dx w.r.t. : 1.sex

1._at        : age             =          20

2._at        : age             =          30

3._at        : age             =          40

4._at        : age             =          50

5._at        : age             =          60

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
1.sex        |
         _at |
          1  |   14.47485   1.540773     9.39   0.000     11.45377    17.49593
          2  |   14.25073   1.017441    14.01   0.000     12.25578    16.24568
          3  |   14.02662   .7780689    18.03   0.000     12.50101    15.55222
          4  |    13.8025   1.041441    13.25   0.000     11.76049    15.84451
          5  |   13.57838   1.572518     8.63   0.000     10.49506    16.66171
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.

.
.
. **********************************
. * 2. Binary Dependent variables
. **********************************
.
. logit outcome i.sex##c.age

Iteration 0:   log likelihood = -1366.0718
Iteration 1:   log likelihood = -1130.6519
Iteration 2:   log likelihood = -1086.7145
Iteration 3:   log likelihood =   -1084.73
Iteration 4:   log likelihood = -1084.7241
Iteration 5:   log likelihood = -1084.7241

Logistic regression                             Number of obs     =      3,000
                                                LR chi2(3)        =     562.70
                                                Prob > chi2       =     0.0000
Log likelihood = -1084.7241                     Pseudo R2         =     0.2060

------------------------------------------------------------------------------
     outcome |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         sex |
      female |     1.3517    .622081     2.17   0.030     .1324438    2.570957
         age |    .110599    .010689    10.35   0.000      .089649     .131549
             |
   sex#c.age |
      female |  -.0104589   .0130144    -0.80   0.422    -.0359667    .0150489
             |
       _cons |  -7.030922   .5024759   -13.99   0.000    -8.015757   -6.046088
------------------------------------------------------------------------------

.
.         ***********************************************************
.         * 2.1 Average Adjusted Prediction and Average Marginal Effect
.         ***********************************************************
.         margins  i.sex

Predictive margins                              Number of obs     =      3,000
Model VCE    : OIM

Expression   : Pr(outcome), predict()

------------------------------------------------------------------------------
             |            Delta-method
             |     Margin   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         sex |
        male |   .1126685   .0093343    12.07   0.000     .0943737    .1309633
      female |    .208375   .0090897    22.92   0.000     .1905596    .2261905
```

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

.         margins, dydx(i.sex)

Average marginal effects                        Number of obs     =      3,000
Model VCE    : OIM

Expression   : Pr(outcome), predict()
dy/dx w.r.t. : 1.sex

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         sex |
      female |   .0957065   .0130288     7.35   0.000     .0701705    .1212426
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.

.
.         ********************************************************************
.         * 2.2 Adjusted Predictions and Marginal Effects at the Means
.         ********************************************************************
.         margins  i.sex,      atmeans

Adjusted predictions                            Number of obs     =      3,000
Model VCE    : OIM

Expression   : Pr(outcome), predict()
at           : 0.sex           =    .4993333 (mean)
               1.sex           =    .5006667 (mean)
               age             =      39.799 (mean)

------------------------------------------------------------------------------
             |            Delta-method
             |     Margin   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         sex |
        male |   .0672832   .0076099     8.84   0.000     .0523679    .0821984
      female |   .1552839   .0120209    12.92   0.000     .1317234    .1788445
------------------------------------------------------------------------------

.         margins, dydx(i.sex) atmeans

Conditional marginal effects                    Number of obs     =      3,000
Model VCE    : OIM

Expression   : Pr(outcome), predict()
dy/dx w.r.t. : 1.sex
at           : 0.sex           =    .4993333 (mean)
               1.sex           =    .5006667 (mean)
               age             =      39.799 (mean)

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         sex |
      female |   .0880008   .0142272     6.19   0.000      .060116    .1158856
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.

.
.         ********************************************************************
.         * 2.3 Adjusted Predictions and Marginal Effects at Representative values
.         ********************************************************************
.         margins  i.sex,      at(age=(20(10)60))

Adjusted predictions                            Number of obs     =      3,000
Model VCE    : OIM

Expression   : Pr(outcome), predict()

1._at        : age             =          20

2._at        : age             =          30

3._at        : age             =          40

4._at        : age             =          50

5._at        : age             =          60

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

```
             |            Delta-method
             |     Margin   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     _at#sex |
     1#male  |   .0080106    .002354     3.40   0.001      .003397    .0126243
   1#female  |   .0246885   .0053467     4.62   0.000     .0142092    .0351678
     2#male  |    .023824   .0046315     5.14   0.000     .0147463    .0329016
   2#female  |   .0644637   .0091944     7.01   0.000     .0464431    .0824843
     3#male  |   .0686917   .0076827     8.94   0.000     .0536339    .0837496
   3#female  |   .1579425   .0120468    13.11   0.000     .1343312    .1815539
     4#male  |   .1822807   .0163514    11.15   0.000     .1502325     .214329
   4#female  |   .3380009   .0144851    23.33   0.000     .3096107    .3663911
     5#male  |   .4025188   .0433544     9.28   0.000     .3175457     .487492
   5#female  |   .5815612   .0257546    22.58   0.000     .5310831    .6320392
------------------------------------------------------------------------------

.         margins, dydx(i.sex) at(age=(20(10)60))

Conditional marginal effects                    Number of obs     =      3,000
Model VCE    : OIM

Expression   : Pr(outcome), predict()
dy/dx w.r.t. : 1.sex

1._at        : age             =          20

2._at        : age             =          30

3._at        : age             =          40

4._at        : age             =          50

5._at        : age             =          60

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
1.sex        |
         _at |
          1  |   .0166779   .0058419     2.85   0.004     .0052279    .0281278
          2  |   .0406397    .010295     3.95   0.000     .0204619    .0608176
          3  |   .0892508   .0142881     6.25   0.000     .0612466     .117255
          4  |   .1557201   .0218446     7.13   0.000     .1129055    .1985348
          5  |   .1790423   .0504272     3.55   0.000     .0802068    .2778779
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.

.
.
.
. ******************************
. * 3. Nominal Dependent Variable
. ******************************
.
. mlogit group i.sex##c.age

Iteration 0:   log likelihood = -3213.9305
Iteration 1:   log likelihood = -2441.2113
Iteration 2:   log likelihood = -2339.4727
Iteration 3:   log likelihood = -2324.0574
Iteration 4:   log likelihood = -2323.1654
Iteration 5:   log likelihood = -2323.1628
Iteration 6:   log likelihood = -2323.1628

Multinomial logistic regression                 Number of obs     =      3,000
                                                LR chi2(6)        =    1781.54
                                                Prob > chi2       =     0.0000
Log likelihood = -2323.1628                     Pseudo R2         =     0.2772

------------------------------------------------------------------------------
       group |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
1            |  (base outcome)
-------------+----------------------------------------------------------------
2            |
         sex |
     female  |  -2.361453   .4732721    -4.99   0.000     -3.28905   -1.433857
         age |  -.0884692   .0088024   -10.05   0.000    -.1057215   -.0712169
             |
   sex#c.age |
     female  |   .0116919   .0105998     1.10   0.270    -.0090833    .0324671
             |
       _cons |   4.863548   .4000653    12.16   0.000     4.079434    5.647661
```

```
-------------+----------------------------------------------------------------
3            |
         sex |
      female |   -3.10343   .7024166    -4.42   0.000    -4.480142   -1.726719
         age |  -.1600698   .0099236   -16.13   0.000    -.1795197   -.1406199
             |
   sex#c.age |
      female |   -.023138   .0203289    -1.14   0.255    -.0629819    .0167058
             |
       _cons |   7.224298   .4232181    17.07   0.000     6.394806     8.05379
------------------------------------------------------------------------------

.
.         ************************************************************
.         * 3.1 Average Adjusted Prediction and Average Marginal Effect
.         ************************************************************
.         margins  i.sex

Predictive margins                              Number of obs     =      3,000
Model VCE    : OIM

1._predict   : Pr(group==1), predict(pr outcome(1))
2._predict   : Pr(group==2), predict(pr outcome(2))
3._predict   : Pr(group==3), predict(pr outcome(3))

------------------------------------------------------------------------------
             |            Delta-method
             |     Margin   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_predict#sex |
     1#male  |   .1963344   .0109191    17.98   0.000     .1749333    .2177355
   1#female  |   .5876871   .0122378    48.02   0.000     .5637015    .6116728
     2#male  |   .4564214   .0134995    33.81   0.000     .4299629    .4828799
   2#female  |   .3454528   .0127735    27.04   0.000     .3204172    .3704885
     3#male  |   .3472442   .0109808    31.62   0.000     .3257222    .3687663
   3#female  |     .06686   .0076335     8.76   0.000     .0518987    .0818213
------------------------------------------------------------------------------

.         margins, dydx(i.sex)

Average marginal effects                        Number of obs     =      3,000
Model VCE    : OIM

dy/dx w.r.t. : 1.sex
1._predict   : Pr(group==1), predict(pr outcome(1))
2._predict   : Pr(group==2), predict(pr outcome(2))
3._predict   : Pr(group==3), predict(pr outcome(3))

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
1.sex        |
    _predict |
          1  |   .3913528    .016401    23.86   0.000     .3592075     .423498
          2  |  -.1109686   .0185849    -5.97   0.000    -.1473943   -.0745428
          3  |  -.2803842   .0133734   -20.97   0.000    -.3065956   -.2541728
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.

.
.         ********************************************************************
.         * 3.2 Adjusted Predictions and Marginal Effects at the Means
.         ********************************************************************
.         margins  i.sex,      atmeans

Adjusted predictions                            Number of obs     =      3,000
Model VCE    : OIM

1._predict   : Pr(group==1), predict(pr outcome(1))
2._predict   : Pr(group==2), predict(pr outcome(2))
3._predict   : Pr(group==3), predict(pr outcome(3))
at           : 0.sex           =    .4993333 (mean)
               1.sex           =    .5006667 (mean)
               age             =      39.799 (mean)

------------------------------------------------------------------------------
             |            Delta-method
             |     Margin   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_predict#sex |
     1#male  |   .1393318   .0108882    12.80   0.000     .1179914    .1606723
   1#female  |   .6184776   .0144219    42.88   0.000     .5902113    .6467439
     2#male  |   .5334788   .0156358    34.12   0.000     .5028332    .5641243
```

```
   2#female  |   .3555603   .0141027    25.21   0.000     .3279194    .3832011
     3#male  |   .3271894   .0151745    21.56   0.000     .2974479     .356931
   3#female  |   .0259622   .0054847     4.73   0.000     .0152123     .036712
------------------------------------------------------------------------------

.         margins, dydx(i.sex) atmeans

Conditional marginal effects                    Number of obs     =      3,000
Model VCE    : OIM

dy/dx w.r.t. : 1.sex
1._predict   : Pr(group==1), predict(pr outcome(1))
2._predict   : Pr(group==2), predict(pr outcome(2))
3._predict   : Pr(group==3), predict(pr outcome(3))
at           : 0.sex           =    .4993333 (mean)
               1.sex           =    .5006667 (mean)
               age             =      39.799 (mean)

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
1.sex        |
    _predict |
           1 |   .4791458   .0180705    26.52   0.000     .4437283    .5145633
           2 |  -.1779185   .0210562    -8.45   0.000    -.2191879   -.1366491
           3 |  -.3012272   .0161353   -18.67   0.000    -.3328519   -.2696026
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.

.
.         ********************************************************************
.         * 3.3 Adjusted Predictions and Marginal Effects at Representative values
.         ********************************************************************
.         margins  i.sex,      at(age=(20(10)60))

Adjusted predictions                            Number of obs     =      3,000
Model VCE    : OIM

1._predict   : Pr(group==1), predict(pr outcome(1))
2._predict   : Pr(group==2), predict(pr outcome(2))
3._predict   : Pr(group==3), predict(pr outcome(3))

1._at        : age             =          20

2._at        : age             =          30

3._at        : age             =          40

4._at        : age             =          50

5._at        : age             =          60

------------------------------------------------------------------------------
                 |            Delta-method
                 |     Margin   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------+------------------------------------------------------------
_predict#_at#sex |
       1#1#male  |   .0126692   .0028692     4.42   0.000     .0070457    .0182927
     1#1#female  |   .1920224   .0228275     8.41   0.000     .1472813    .2367635
       1#2#male  |   .0467692   .0066373     7.05   0.000     .0337604     .059778
     1#2#female  |   .4044238    .021257    19.03   0.000     .3627608    .4460867
       1#3#male  |   .1421408   .0109796    12.95   0.000     .1206213    .1636604
     1#3#female  |   .6224511   .0143228    43.46   0.000      .594379    .6505232
       1#4#male  |   .3320474   .0208241    15.95   0.000     .2912329    .3728619
     1#4#female  |    .787917   .0130506    60.37   0.000     .7623382    .8134958
       1#5#male  |   .5768218   .0383867    15.03   0.000     .5015853    .6520583
     1#5#female  |   .8905212   .0121263    73.44   0.000     .8667539    .9142884
       2#1#male  |   .2795929   .0208103    13.44   0.000     .2388054    .3203804
     2#1#female  |   .5047988   .0395215    12.77   0.000      .427338    .5822596
       2#2#male  |   .4261096    .015173    28.08   0.000     .3963711    .4558481
     2#2#female  |   .4933594   .0211976    23.27   0.000      .451813    .5349059
       2#3#male  |   .5346418   .0157039    34.05   0.000     .5038627    .5654208
     2#3#female  |   .3523646   .0140078    25.15   0.000     .3249099    .3798194
       2#4#male  |   .5156169   .0212172    24.30   0.000      .474032    .5572017
     2#4#female  |   .2069798   .0129141    16.03   0.000     .1816685     .232291
       2#5#male  |   .3697871   .0352686    10.48   0.000     .3006619    .4389123
     2#5#female  |   .1085555    .012078     8.99   0.000      .084883    .1322281
       3#1#male  |   .7077379   .0212994    33.23   0.000     .6659919    .7494839
     3#1#female  |   .3031788   .0460007     6.59   0.000     .2130191    .3933386
       3#2#male  |   .5271211   .0154281    34.17   0.000     .4968825    .5573597
     3#2#female  |   .1022168   .0122213     8.36   0.000     .0782635      .12617
       3#3#male  |   .3232174   .0152249    21.23   0.000     .2933772    .3530576
     3#3#female  |   .0251843   .0053923     4.67   0.000     .0146155     .035753
```

```
       3#4#male  |   .1523357   .0149037    10.22   0.000      .123125    .1815464
     3#4#female  |   .0051032   .0018942     2.69   0.007     .0013906    .0088158
       3#5#male  |   .0533911    .009203     5.80   0.000     .0353536    .0714286
     3#5#female  |   .0009233   .0004988     1.85   0.064    -.0000544     .001901
-------------------------------------------------------------------------------

.         margins, dydx(i.sex) at(age=(20(10)60))

Conditional marginal effects                    Number of obs     =      3,000
Model VCE    : OIM

dy/dx w.r.t. : 1.sex
1._predict   : Pr(group==1), predict(pr outcome(1))
2._predict   : Pr(group==2), predict(pr outcome(2))
3._predict   : Pr(group==3), predict(pr outcome(3))

1._at        : age             =          20

2._at        : age             =          30

3._at        : age             =          40

4._at        : age             =          50

5._at        : age             =          60

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
1.sex        |
_predict#_at |
        1 1  |   .1793532   .0230071     7.80   0.000     .1342601    .2244463
        1 2  |   .3576545   .0222691    16.06   0.000     .3140079    .4013012
        1 3  |   .4803103    .018047    26.61   0.000     .4449389    .5156816
        1 4  |   .4558696   .0245757    18.55   0.000     .4077022     .504037
        1 5  |   .3136994   .0402565     7.79   0.000     .2347981    .3926006
        2 1  |   .2252059   .0446657     5.04   0.000     .1376628     .312749
        2 2  |   .0672498   .0260683     2.58   0.010     .0161569    .1183427
        2 3  |  -.1822771   .0210435    -8.66   0.000    -.2235217   -.1410325
        2 4  |  -.3086371   .0248383   -12.43   0.000    -.3573193   -.2599549
        2 5  |  -.2612315   .0372794    -7.01   0.000    -.3342978   -.1881652
        3 1  |  -.4045591   .0506925    -7.98   0.000    -.5039146   -.3052036
        3 2  |  -.4249043   .0196821   -21.59   0.000    -.4634806    -.386328
        3 3  |  -.2980331   .0161516   -18.45   0.000    -.3296896   -.2663766
        3 4  |  -.1472325   .0150236    -9.80   0.000    -.1766782   -.1177868
        3 5  |  -.0524678   .0092165    -5.69   0.000    -.0705318   -.0344038
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.

.
.
.
. *******************************************
. * 4. Data collected with complex survey design
. *******************************************
. use "c:\temp\margins.dta", clear

.
.
. svydes

Survey: Describing stage 1 sampling units

      pweight: finalwgt
          VCE: linearized
  Single unit: missing
     Strata 1: stratid
         SU 1: psuid
        FPC 1: <zero>

                                    #Obs per Unit
                              ----------------------------
Stratum    #Units     #Obs      min       mean      max
--------  --------  --------  --------  --------  --------
       1         2       380       165     190.0       215
       2         2       185        67      92.5       118
       3         2       348       149     174.0       199
       4         2       460       229     230.0       231
       5         2       252       105     126.0       147
       6         2       298       131     149.0       167
       7         2       476       206     238.0       270
       8         2       338       158     169.0       180
       9         2       244       100     122.0       144
```

```
      10          2        262        119      131.0        143
      11          2        275        120      137.5        155
      12          2        314        144      157.0        170
      13          2        342        154      171.0        188
      14          2        405        200      202.5        205
      15          2        380        189      190.0        191
      16          2        336        159      168.0        177
      17          2        393        180      196.5        213
      18          2        359        144      179.5        215
      20          2        285        125      142.5        160
      21          2        214        102      107.0        112
      22          2        301        128      150.5        173
      23          2        341        159      170.5        182
      24          2        438        205      219.0        233
      25          2        256        116      128.0        140
      26          2        261        129      130.5        132
      27          2        283        139      141.5        144
      28          2        299        136      149.5        163
      29          2        503        215      251.5        288
      30          2        365        166      182.5        199
      31          2        308        143      154.0        165
      32          2        450        211      225.0        239
--------  --------  ---------  --------  --------  --------
      31         62     10,351         67      167.0        288

.
. sum illness sex age

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
     illness |     10,351    1.871124    1.290174          0          7
         sex |     10,351    1.525167    .4993904          1          2
         age |     10,351    47.57965    17.21483         20         74

.
. svy: reg illness i.sex##c.age
(running regress on estimation sample)

Survey: Linear regression

Number of strata   =        31                Number of obs     =       10,351
Number of PSUs     =        62                Population size   =  117,157,513
                                              Design df         =           31
                                              F(   3,     29)   =       600.17
                                              Prob > F          =       0.0000
                                              R-squared         =       0.2472

------------------------------------------------------------------------------
             |             Linearized
     illness |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         sex |
      Female |   1.697105   .0714118    23.77   0.000      1.55146     1.84275
         age |     .01235   .0007846    15.74   0.000     .0107498    .0139501
             |
   sex#c.age |
      Female |  -.0108862   .0014354    -7.58   0.000    -.0138137   -.0079588
             |
       _cons |   .6259047   .0553246    11.31   0.000     .5130694    .7387399
------------------------------------------------------------------------------

.
.         ***********************************************************
.         * 4.1 Average Adjusted Prediction and Average Marginal Effect
.         ***********************************************************
.         margins  i.sex,      vce(unconditional)

Predictive margins                              Number of obs     =     10,351

Expression   : Linear prediction, predict()

------------------------------------------------------------------------------
             |             Linearized
             |     Margin   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         sex |
        Male |   1.147723   .0428523    26.78   0.000     1.060325    1.235121
      Female |   2.384857   .0480366    49.65   0.000     2.286885    2.482828
------------------------------------------------------------------------------

.         margins, dydx(i.sex) vce(unconditional)

Average marginal effects                        Number of obs     =     10,351
```

```
Expression   : Linear prediction, predict()
dy/dx w.r.t. : 2.sex

------------------------------------------------------------------------------
             |            Linearized
             |      dy/dx   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         sex |
     Female  |   1.237134   .0313338    39.48   0.000     1.173228    1.301039
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.

.
.         ***********************************************************************
.         * 4.2 Adjusted Predictions and Marginal Effects at the Means
.         ***********************************************************************
.         margins  i.sex,      atmeans vce(unconditional)

Adjusted predictions                            Number of obs     =     10,351

Expression   : Linear prediction, predict()
at           : 1.sex           =    .4793502 (mean)
               2.sex           =    .5206498 (mean)
               age             =    42.25264 (mean)

------------------------------------------------------------------------------
             |            Linearized
             |     Margin   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         sex |
       Male  |   1.147723   .0432126    26.56   0.000      1.05959    1.235856
     Female  |   2.384857   .0482069    49.47   0.000     2.286538    2.483175
------------------------------------------------------------------------------

.         margins, dydx(i.sex) atmeans vce(unconditional)

Conditional marginal effects                    Number of obs     =     10,351

Expression   : Linear prediction, predict()
dy/dx w.r.t. : 2.sex
at           : 1.sex           =    .4793502 (mean)
               2.sex           =    .5206498 (mean)
               age             =    42.25264 (mean)

------------------------------------------------------------------------------
             |            Linearized
             |      dy/dx   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         sex |
     Female  |   1.237134   .0297874    41.53   0.000     1.176382    1.297886
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.

.
.         ***********************************************************************
.         * 4.3 Adjusted Predictions and Marginal Effects at Representative values
.         ***********************************************************************
.         margins  i.sex,      at(age=(20(10)80)) vce(unconditional)

Adjusted predictions                            Number of obs     =     10,351

Expression   : Linear prediction, predict()

1._at        : age             =          20

2._at        : age             =          30

3._at        : age             =          40

4._at        : age             =          50

5._at        : age             =          60

6._at        : age             =          70

7._at        : age             =          80

------------------------------------------------------------------------------
             |            Linearized
             |     Margin   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     _at#sex |
     1#Male  |   .8729037   .0471375    18.52   0.000     .7767662    .9690413
   1#Female  |   2.352285    .066818    35.20   0.000     2.216008    2.488561
```

```
     2#Male  |   .9964032   .0445776    22.35   0.000     .9054865     1.08732
   2#Female  |   2.366922   .0567169    41.73   0.000     2.251247    2.482597
     3#Male  |   1.119903    .043307    25.86   0.000     1.031578    1.208228
   3#Female  |   2.381559   .0493509    48.26   0.000     2.280907    2.482211
     4#Male  |   1.243402   .0434388    28.62   0.000     1.154808    1.331996
   4#Female  |   2.396197   .0460517    52.03   0.000     2.302273     2.49012
     5#Male  |   1.366902   .0449608    30.40   0.000     1.275204      1.4586
   5#Female  |   2.410834   .0476713    50.57   0.000     2.313608     2.50806
     6#Male  |   1.490401   .0477402    31.22   0.000     1.393035    1.587768
   6#Female  |   2.425471   .0537669    45.11   0.000     2.315813     2.53513
     7#Male  |   1.613901    .051574    31.29   0.000     1.508715    1.719087
   7#Female  |   2.440109   .0630535    38.70   0.000      2.31151    2.568707
-------------------------------------------------------------------------------

. margins, dydx(i.sex) at(age=(20(10)80)) vce(unconditional)

Conditional marginal effects                    Number of obs     =     10,351

Expression   : Linear prediction, predict()
dy/dx w.r.t. : 2.sex

1._at        : age             =          20

2._at        : age             =          30

3._at        : age             =          40

4._at        : age             =          50

5._at        : age             =          60

6._at        : age             =          70

7._at        : age             =          80

------------------------------------------------------------------------------
             |            Linearized
             |      dy/dx   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
2.sex        |
         _at |
          1  |   1.479381   .0467848    31.62   0.000     1.383963    1.574799
          2  |   1.370519   .0367626    37.28   0.000     1.295541    1.445497
          3  |   1.261656   .0304339    41.46   0.000     1.199586    1.323727
          4  |   1.152794   .0302161    38.15   0.000     1.091168     1.21442
          5  |   1.043932   .0362196    28.82   0.000     .9700617    1.117802
          6  |   .9350699   .0460735    20.30   0.000     .8411024    1.029037
          7  |   .8262077   .0578423    14.28   0.000     .7082376    .9441778
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.

.
.
.
. ************************************
. * 5. Margins with the imputed data
. ************************************
.
. webuse mheart1s20, clear
(Fictional heart attack data; bmi missing)

. mi convert flong

. mi estimate , saving(c:\temp\miestfile.dta, replace) esample(esample) : logit attack smokes age bmi hsgrad female

Multiple-imputation estimates                   Imputations       =         20
Logistic regression                             Number of obs     =        154
                                                Average RVI       =     0.0312
                                                Largest FMI       =     0.1355
DF adjustment:   Large sample                   DF:     min       =   1,060.38
                                                        avg       = 223,362.56
                                                        max       = 493,335.88
Model F test:       Equal FMI                   F(   5,71379.3)   =       3.59
Within VCE type:          OIM                   Prob > F          =     0.0030

------------------------------------------------------------------------------
      attack |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      smokes |   1.198595   .3578195     3.35   0.001     .4972789    1.899911
         age |   .0360159   .0154399     2.33   0.020     .0057541    .0662776
         bmi |   .1039416   .0476136     2.18   0.029      .010514    .1973692
      hsgrad |   .1578992   .4049257     0.39   0.697    -.6357464    .9515449
      female |  -.1067433   .4164735    -0.26   0.798    -.9230191    .7095326
       _cons |  -5.478143   1.685075    -3.25   0.001    -8.782394   -2.173892
```

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

.
.         ****************************
.         * 5.1 Average Adjusted Prediction and Average Marginal Effect
.         ************************
.         mimrgns using c:\temp\miestfile.dta , esample(esample) predict(pr) dydx(*)

Multiple-imputation estimates                   Imputations       =         20
Average marginal effects                        Number of obs     =        154
                                                Average RVI       =     0.0364
                                                Largest FMI       =     0.1330
DF adjustment:   Large sample                   DF:     min       =   1,099.73
                                                        avg       = 311,279.09
Within VCE type: Delta-method                           max       = 625,539.79

Expression   : Pr(attack), predict(pr)
dy/dx w.r.t. : smokes age bmi hsgrad female

------------------------------------------------------------------------------
             |      dy/dx   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      smokes |   .2554116   .0650578     3.93   0.000     .1279003    .3829228
         age |   .0076757   .0030757     2.50   0.013     .0016474    .0137041
         bmi |   .0221116   .0094601     2.34   0.020     .0035496    .0406735
      hsgrad |   .0335879   .0861148     0.39   0.697    -.1351951    .2023709
      female |  -.0228004   .0886991    -0.26   0.797    -.1966481    .1510474
------------------------------------------------------------------------------

.         mimrgns using c:\temp\miestfile.dta , esample(esample) dydx(*)

Multiple-imputation estimates                   Imputations       =         20
Average marginal effects                        Number of obs     =        154
                                                Average RVI       =     0.0362
                                                Largest FMI       =     0.1355
DF adjustment:   Large sample                   DF:     min       =   1,060.38
                                                        avg       = 267,524.12
Within VCE type: Delta-method                           max       = 493,335.88

Expression   : Linear prediction (log odds), predict(xb)
dy/dx w.r.t. : smokes age bmi hsgrad female

------------------------------------------------------------------------------
             |      dy/dx   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      smokes |   1.198595   .3578195     3.35   0.001     .4972789    1.899911
         age |   .0360159   .0154399     2.33   0.020     .0057541    .0662776
         bmi |   .1039416   .0476136     2.18   0.029      .010514    .1973692
      hsgrad |   .1578992   .4049257     0.39   0.697    -.6357464    .9515449
      female |  -.1067433   .4164735    -0.26   0.798    -.9230191    .7095326
------------------------------------------------------------------------------

.
.
.
. ******************************************************
. * 6. Plotting the results from the -margins- command
. ******************************************************
.
. use http://www.stata-press.com/data/r14/margex, clear
(Artificial data for margins)

. mlogit group i.sex##c.age

Iteration 0:   log likelihood = -3213.9305
Iteration 1:   log likelihood = -2441.2113
Iteration 2:   log likelihood = -2339.4727
Iteration 3:   log likelihood = -2324.0574
Iteration 4:   log likelihood = -2323.1654
Iteration 5:   log likelihood = -2323.1628
Iteration 6:   log likelihood = -2323.1628

Multinomial logistic regression                 Number of obs     =      3,000
                                                LR chi2(6)        =    1781.54
                                                Prob > chi2       =     0.0000
Log likelihood = -2323.1628                     Pseudo R2         =     0.2772

------------------------------------------------------------------------------
       group |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
1            |  (base outcome)
-------------+----------------------------------------------------------------
2            |
         sex |
```

```
     female  |  -2.361453   .4732721    -4.99   0.000     -3.28905   -1.433857
        age  |  -.0884692   .0088024   -10.05   0.000    -.1057215   -.0712169
             |
   sex#c.age |
     female  |   .0116919   .0105998     1.10   0.270    -.0090833    .0324671
             |
       _cons |   4.863548   .4000653    12.16   0.000     4.079434    5.647661
-------------+----------------------------------------------------------------
3            |
         sex |
     female  |   -3.10343   .7024166    -4.42   0.000    -4.480142   -1.726719
        age  |  -.1600698   .0099236   -16.13   0.000    -.1795197   -.1406199
             |
   sex#c.age |
     female  |   -.023138   .0203289    -1.14   0.255    -.0629819    .0167058
             |
       _cons |   7.224298   .4232181    17.07   0.000     6.394806     8.05379
------------------------------------------------------------------------------

.
.
.         ***************************************
.         * Plotting the Adjusted Predictions
.         ***************************************
.         margins  i.sex,      at(age=(20(10)60))

Adjusted predictions                            Number of obs     =      3,000
Model VCE    : OIM

1._predict   : Pr(group==1), predict(pr outcome(1))
2._predict   : Pr(group==2), predict(pr outcome(2))
3._predict   : Pr(group==3), predict(pr outcome(3))

1._at        : age             =          20

2._at        : age             =          30

3._at        : age             =          40

4._at        : age             =          50

5._at        : age             =          60

------------------------------------------------------------------------------
                 |            Delta-method
                 |     Margin   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------+------------------------------------------------------------
_predict#_at#sex |
       1#1#male  |   .0126692   .0028692     4.42   0.000     .0070457    .0182927
     1#1#female  |   .1920224   .0228275     8.41   0.000     .1472813    .2367635
       1#2#male  |   .0467692   .0066373     7.05   0.000     .0337604     .059778
     1#2#female  |   .4044238    .021257    19.03   0.000     .3627608    .4460867
       1#3#male  |   .1421408   .0109796    12.95   0.000     .1206213    .1636604
     1#3#female  |   .6224511   .0143228    43.46   0.000      .594379    .6505232
       1#4#male  |   .3320474   .0208241    15.95   0.000     .2912329    .3728619
     1#4#female  |    .787917   .0130506    60.37   0.000     .7623382    .8134958
       1#5#male  |   .5768218   .0383867    15.03   0.000     .5015853    .6520583
     1#5#female  |   .8905212   .0121263    73.44   0.000     .8667539    .9142884
       2#1#male  |   .2795929   .0208103    13.44   0.000     .2388054    .3203804
     2#1#female  |   .5047988   .0395215    12.77   0.000      .427338    .5822596
       2#2#male  |   .4261096    .015173    28.08   0.000     .3963711    .4558481
     2#2#female  |   .4933594   .0211976    23.27   0.000      .451813    .5349059
       2#3#male  |   .5346418   .0157039    34.05   0.000     .5038627    .5654208
     2#3#female  |   .3523646   .0140078    25.15   0.000     .3249099    .3798194
       2#4#male  |   .5156169   .0212172    24.30   0.000      .474032    .5572017
     2#4#female  |   .2069798   .0129141    16.03   0.000     .1816685     .232291
       2#5#male  |   .3697871   .0352686    10.48   0.000     .3006619    .4389123
     2#5#female  |   .1085555    .012078     8.99   0.000      .084883    .1322281
       3#1#male  |   .7077379   .0212994    33.23   0.000     .6659919    .7494839
     3#1#female  |   .3031788   .0460007     6.59   0.000     .2130191    .3933386
       3#2#male  |   .5271211   .0154281    34.17   0.000     .4968825    .5573597
     3#2#female  |   .1022168   .0122213     8.36   0.000     .0782635      .12617
       3#3#male  |   .3232174   .0152249    21.23   0.000     .2933772    .3530576
     3#3#female  |   .0251843   .0053923     4.67   0.000     .0146155     .035753
       3#4#male  |   .1523357   .0149037    10.22   0.000      .123125    .1815464
     3#4#female  |   .0051032   .0018942     2.69   0.007     .0013906    .0088158
       3#5#male  |   .0533911    .009203     5.80   0.000     .0353536    .0714286
     3#5#female  |   .0009233   .0004988     1.85   0.064    -.0000544     .001901
------------------------------------------------------------------------------

.         marginsplot, yline(0)

  Variables that uniquely identify margins: age sex _outcome
```

```
.         marginsplot, by(sex) yline(0)

  Variables that uniquely identify margins: age sex _outcome

.
.         ************************************
.         * Plotting the marginal effect
.         ************************************
.         margins, dydx(i.sex) at(age=(20(10)60))

Conditional marginal effects                    Number of obs     =      3,000
Model VCE    : OIM

dy/dx w.r.t. : 1.sex
1._predict   : Pr(group==1), predict(pr outcome(1))
2._predict   : Pr(group==2), predict(pr outcome(2))
3._predict   : Pr(group==3), predict(pr outcome(3))

1._at        : age             =          20

2._at        : age             =          30

3._at        : age             =          40

4._at        : age             =          50

5._at        : age             =          60

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
1.sex        |
_predict#_at |
        1 1  |   .1793532   .0230071     7.80   0.000     .1342601    .2244463
        1 2  |   .3576545   .0222691    16.06   0.000     .3140079    .4013012
        1 3  |   .4803103    .018047    26.61   0.000     .4449389    .5156816
        1 4  |   .4558696   .0245757    18.55   0.000     .4077022     .504037
        1 5  |   .3136994   .0402565     7.79   0.000     .2347981    .3926006
        2 1  |   .2252059   .0446657     5.04   0.000     .1376628     .312749
        2 2  |   .0672498   .0260683     2.58   0.010     .0161569    .1183427
        2 3  |  -.1822771   .0210435    -8.66   0.000    -.2235217   -.1410325
        2 4  |  -.3086371   .0248383   -12.43   0.000    -.3573193   -.2599549
        2 5  |  -.2612315   .0372794    -7.01   0.000    -.3342978   -.1881652
        3 1  |  -.4045591   .0506925    -7.98   0.000    -.5039146   -.3052036
        3 2  |  -.4249043   .0196821   -21.59   0.000    -.4634806    -.386328
        3 3  |  -.2980331   .0161516   -18.45   0.000    -.3296896   -.2663766
        3 4  |  -.1472325   .0150236    -9.80   0.000    -.1766782   -.1177868
        3 5  |  -.0524678   .0092165    -5.69   0.000    -.0705318   -.0344038
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.

.         marginsplot, yline(0)

  Variables that uniquely identify margins: age _outcome

.
.
. log close
      name:  <unnamed>
       log:  c:\temp\margins workshop 4.log
  log type:  text
 closed on:   3 Jun 2019, 11:47:26
-------------------------------------------------------------------------------------------------------------------------------
```