```
-------------------------------------------------------------------------------
-----------------------------------
      log:  C:\dnb\schooling.log
  log type:  text
 opened on:   5 Jul 2006, 09:03:57

. /* schooling.log */
> use schooling;

. gen age2=age76^2;

. /* OLS (inconsistent) */
> reg lwage76 ed76 age76 age2 black smsa76 south76;

      Source |       SS       df       MS              Number of obs =    3010
-------------+------------------------------           F(  6,  3003) =  194.69
       Model |  165.973797     6  27.6622995           Prob > F      =  0.0000
    Residual |  426.667849  3003  .142080536           R-squared     =  0.2801
-------------+------------------------------           Adj R-squared =  0.2786
       Total |  592.641646  3009  .196956346           Root MSE      =  .37694

------------------------------------------------------------------------------
     lwage76 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        ed76 |   .0340887   .0027293    12.49   0.000     .0287371    .0394402
       age76 |   .1443718   .0452368     3.19   0.001     .0556734    .2330701
        age2 |  -.0018257   .0007852    -2.33   0.020    -.0033652   -.0002861
       black |  -.1887294   .0177561   -10.63   0.000    -.2235447   -.1539141
      smsa76 |   .1647065   .0156804    10.50   0.000     .1339611    .1954519
     south76 |  -.1298909   .0152216    -8.53   0.000    -.1597367    -.100045
       _cons |   3.190643   .6437037     4.96   0.000     1.928498    4.452787
------------------------------------------------------------------------------

. outreg2 using schooling, replace ctitle("ols");
seeout

. /* IV with 1 instrument */
> /* First stage regression */
> reg ed76 nearc4 age76 age2 black smsa76 south76;

      Source |       SS       df       MS              Number of obs =    3010
-------------+------------------------------           F(  6,  3003) =   67.29
       Model |  2555.48762     6  425.914603           Prob > F      =  0.0000
    Residual |  19006.5924  3003  6.32920161           R-squared     =  0.1185
-------------+------------------------------           Adj R-squared =  0.1168
       Total |  21562.0801  3009  7.16586243           Root MSE      =  2.5158

------------------------------------------------------------------------------
        ed76 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      nearc4 |    .347105   .1069972     3.24   0.001     .1373098    .5569002
       age76 |   1.061441   .3013985     3.52   0.000     .4704727     1.65241
        age2 |  -.0187598   .0052314    -3.59   0.000    -.0290173   -.0085024
       black |  -1.468367   .1154434   -12.72   0.000    -1.694723   -1.242011
      smsa76 |   .8354027   .1092524     7.65   0.000     .6211856     1.04962
     south76 |  -.4596997   .1024337    -4.49   0.000    -.6605469   -.2588524
       _cons |  -1.869524   4.298357    -0.43   0.664    -10.29755    6.558497
------------------------------------------------------------------------------

. /* instrument relevance test */
> testparm nearc4;

 ( 1)  nearc4 = 0

       F(  1,  3003) =   10.52
            Prob > F =    0.0012

. scalar frelev=r(F);
```

```
. /* exogeneity test */
> predict resed76,res;

. reg lwage76 ed76 age76 age2 black smsa76 south76 resed76;

      Source |       SS       df       MS              Number of obs =    3010
-------------+------------------------------           F(  7,  3002) =  167.16
       Model |  166.210579     7  23.7443684           Prob > F      =  0.0000
    Residual |  426.431067  3002   .14204899           R-squared     =  0.2805
-------------+------------------------------           Adj R-squared =  0.2788
       Total |  592.641646  3009  .196956346           Root MSE      =  .37689

------------------------------------------------------------------------------
     lwage76 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        ed76 |   .0936071   .0461802     2.03   0.043      .003059    .1841552
       age76 |   .0824397   .0659313     1.25   0.211    -.0468354    .2117149
        age2 |  -.0007331   .0011544    -0.64   0.525    -.0029965    .0015304
       black |  -.1011767   .0700988    -1.44   0.149    -.2386233    .0362699
      smsa76 |   .1080666   .0465875     2.32   0.020       .01672    .1994132
     south76 |  -.0994275   .0280781    -3.54   0.000    -.1544817   -.0443732
     resed76 |   -.059727   .0462611    -1.29   0.197    -.1504336    .0309796
       _cons |   3.275667   .6469925     5.06   0.000     2.007074    4.544261
------------------------------------------------------------------------------

. testparm resed76;

 ( 1)  resed76 = 0

       F(  1,  3002) =    1.67
            Prob > F =    0.1968

. scalar rexog=r(p);

. drop resed76;

. /* tsls */
> ivreg lwage76 (ed76=nearc4) age76 age2 black smsa76 south76;

Instrumental variables (2SLS) regression

      Source |       SS       df       MS              Number of obs =    3010
-------------+------------------------------           F(  6,  3003) =  146.22
       Model |  98.4080021     6  16.4013337           Prob > F      =  0.0000
    Residual |  494.233644  3003  .164579968           R-squared     =  0.1660
-------------+------------------------------           Adj R-squared =  0.1644
       Total |  592.641646  3009  .196956346           Root MSE      =  .40568

------------------------------------------------------------------------------
     lwage76 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        ed76 |   .0936071   .0497079     1.88   0.060    -.0038579    .1910722
       age76 |   .0824397   .0709678     1.16   0.245    -.0567107    .2215901
        age2 |  -.0007331   .0012426    -0.59   0.555    -.0031694    .0017033
       black |  -.1011767   .0754536    -1.34   0.180    -.2491227    .0467694
      smsa76 |   .1080666   .0501463     2.16   0.031     .0097421    .2063911
     south76 |  -.0994274    .030223    -3.29   0.001    -.1586873   -.0401676
       _cons |   3.275667   .6964159     4.70   0.000     1.910167    4.641168
------------------------------------------------------------------------------
Instrumented:  ed76
Instruments:   age76 age2 black smsa76 south76 nearc4
------------------------------------------------------------------------------

. outreg2 using schooling, append ctitle("iv1")
> addstat("F-value test intrument relevance",frelev,
> "p-value Hausman-Wu test exogeneity",rexog);
seeout
```

```
. /* IV with more than 1 instrument */
> /* First stage regression */
> reg ed76 nearc4 daded momed age76 age2 black smsa76 south76;

      Source |       SS       df       MS              Number of obs =    3010
-------------+------------------------------           F(  8,  3001) =  131.51
       Model |  5596.85573     8  699.606966           Prob > F      =  0.0000
    Residual |  15965.2243  3001  5.31996812           R-squared     =  0.2596
-------------+------------------------------           Adj R-squared =  0.2576
       Total |  21562.0801  3009  7.16586243           Root MSE      =  2.3065

------------------------------------------------------------------------------
        ed76 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      nearc4 |   .2652582   .0982436     2.70   0.007     .0726266    .4578897
       daded |    .179144   .0155571    11.52   0.000     .1486403    .2096477
       momed |    .214897   .0170983    12.57   0.000     .1813715    .2484225
       age76 |   .9874191   .2763478     3.57   0.000     .4455688    1.529269
        age2 |  -.0170751   .0047968    -3.56   0.000    -.0264804   -.0076698
       black |  -.7947936   .1095649    -7.25   0.000    -1.009624   -.5799637
      smsa76 |    .569724   .1007944     5.65   0.000     .3720908    .7673571
     south76 |  -.2234506   .0944376    -2.37   0.018    -.4086195   -.0382817
       _cons |  -5.154972   3.943185    -1.31   0.191    -12.88659    2.576647
------------------------------------------------------------------------------

. /* instrument relevance test */
> testparm nearc4 daded momed;

 ( 1)  nearc4 = 0
 ( 2)  daded = 0
 ( 3)  momed = 0

       F(  3,  3001) =  194.74
            Prob > F =    0.0000

. scalar frelev=r(F);

. /* exogeneity test */
> predict resed76,res;

. reg lwage76 ed76 age76 age2 black smsa76 south76 resed76;

      Source |       SS       df       MS              Number of obs =    3010
-------------+------------------------------           F(  7,  3002) =  167.18
       Model |  166.225364     7  23.7464806           Prob > F      =  0.0000
    Residual |  426.416282  3002  .142044065           R-squared     =  0.2805
-------------+------------------------------           Adj R-squared =  0.2788
       Total |  592.641646  3009  .196956346           Root MSE      =  .37689

------------------------------------------------------------------------------
     lwage76 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        ed76 |   .0423199   .0067604     6.26   0.000     .0290644    .0555754
       age76 |   .1358068   .0456866     2.97   0.003     .0462265     .225387
        age2 |  -.0016746   .0007933    -2.11   0.035    -.0032299   -.0001192
       black |  -.1766212   .0199494    -8.85   0.000     -.215737   -.1375053
      smsa76 |   .1568734   .0167468     9.37   0.000      .124037    .1897098
     south76 |  -.1256779   .0155454    -8.08   0.000    -.1561586   -.0951971
     resed76 |  -.0098336   .0073892    -1.33   0.183     -.024322    .0046548
       _cons |   3.202401   .6436817     4.98   0.000     1.940299    4.464503
------------------------------------------------------------------------------

. testparm resed76;

 ( 1)  resed76 = 0

       F(  1,  3002) =    1.77
```

```
            Prob > F =    0.1834

. scalar rexog=r(p);

. drop resed76;

. /* tsls */
> ivreg lwage76 (ed76=nearc4 daded momed) age76 age2 black smsa76 south76;

Instrumental variables (2SLS) regression

      Source |       SS       df       MS              Number of obs =    3010
-------------+------------------------------           F(  6,  3003) =  174.70
       Model |  164.681532     6  27.4469221           Prob > F      =  0.0000
    Residual |  427.960114  3003   .14251086           R-squared     =  0.2779
-------------+------------------------------           Adj R-squared =  0.2764
       Total |  592.641646  3009  .196956346           Root MSE      =  .37751

------------------------------------------------------------------------------
     lwage76 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        ed76 |   .0423199   .0067715     6.25   0.000     .0290426    .0555972
       age76 |   .1358068   .0457616     2.97   0.003     .0460794    .2255341
        age2 |  -.0016746   .0007946    -2.11   0.035    -.0032325   -.0001166
       black |  -.1766212   .0199822    -8.84   0.000    -.2158013    -.137441
      smsa76 |   .1568734   .0167743     9.35   0.000     .1239831    .1897637
     south76 |  -.1256779   .0155709    -8.07   0.000    -.1562087   -.0951471
       _cons |   3.202401   .6447385     4.97   0.000     1.938227    4.466575
------------------------------------------------------------------------------
Instrumented:  ed76
Instruments:   age76 age2 black smsa76 south76 nearc4 daded momed
------------------------------------------------------------------------------

. predict uu,res;

. reg uu nearc4 daded momed age76 age2 black smsa76 south76;

      Source |       SS       df       MS              Number of obs =    3010
-------------+------------------------------           F(  8,  3001) =    0.54
       Model |  .614522827     8  .076815353           Prob > F      =  0.8275
    Residual |   427.34559  3001  .142401063           R-squared     =  0.0014
-------------+------------------------------           Adj R-squared = -0.0012
       Total |  427.960113  3009  .142226691           Root MSE      =  .37736

------------------------------------------------------------------------------
          uu |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      nearc4 |   .0190807   .0160733     1.19   0.235    -.0124352    .0505966
       daded |   -.004102   .0025453    -1.61   0.107    -.0090927    .0008886
       momed |   .0039202   .0027974     1.40   0.161    -.0015648    .0094052
       age76 |   .0006869   .0452125     0.02   0.988    -.0879636    .0893375
        age2 |  -.0000158   .0007848    -0.02   0.984    -.0015545     .001523
       black |   .0002275   .0179256     0.01   0.990    -.0349202    .0353752
      smsa76 |  -.0051471   .0164907    -0.31   0.755    -.0374813    .0271871
     south76 |   .0027335   .0154507     0.18   0.860    -.0275615    .0330284
       _cons |  -.0167472   .6451331    -0.03   0.979    -1.281695    1.248201
------------------------------------------------------------------------------

. drop uu;

. outreg2  using schooling, append ctitle("aux. reg. sargan") bdec(4);
seeout

. scalar sargan=e(N)*e(r2);

. scalar rr=e(df_m)+1;

. ivreg lwage76 (ed76=nearc4 daded momed) age76 age2 black smsa76 south76;
```

```
Instrumental variables (2SLS) regression

      Source |       SS       df       MS              Number of obs =    3010
-------------+------------------------------           F(  6,  3003) =  174.70
       Model |  164.681532     6  27.4469221           Prob > F      =  0.0000
    Residual |  427.960114  3003   .14251086           R-squared     =  0.2779
-------------+------------------------------           Adj R-squared =  0.2764
       Total |  592.641646  3009  .196956346           Root MSE      =  .37751

------------------------------------------------------------------------------
     lwage76 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        ed76 |   .0423199   .0067715     6.25   0.000     .0290426    .0555972
       age76 |   .1358068   .0457616     2.97   0.003     .0460794    .2255341
        age2 |  -.0016746   .0007946    -2.11   0.035    -.0032325   -.0001166
       black |  -.1766212   .0199822    -8.84   0.000    -.2158013    -.137441
      smsa76 |   .1568734   .0167743     9.35   0.000     .1239831    .1897637
     south76 |  -.1256779   .0155709    -8.07   0.000    -.1562087   -.0951471
       _cons |   3.202401   .6447385     4.97   0.000     1.938227    4.466575
------------------------------------------------------------------------------
Instrumented:  ed76
Instruments:   age76 age2 black smsa76 south76 nearc4 daded momed
------------------------------------------------------------------------------

. scalar kk=e(df_m)+1;

. scalar df_sargan=rr-kk;

. scalar pvalue_sargan=chi2tail(df_sargan,sargan);

. outreg2 using schooling, append ctitle("iv2")
> addstat("F-value test intrument relevance",frelev,"p-value Hausman-Wu test
exogeneity",rexog,
> "Sargan statistic",sargan,"Degrees freedom Sargan statistic",df_sargan, "P
value Sargan statistic",pvalue_sarga
> n);
seeout

. /* gmm */
> ivreg2 lwage76 (ed76=nearc4 daded momed) age76 age2 black smsa76
south76,gmm;

GMM estimation
--------------

                                                      Number of obs =     3010
                                                      F(  6,  3003) =   191.93
                                                      Prob > F      =   0.0000
Total (centered) SS     =   592.641646                Centered R2   =   0.2777
Total (uncentered) SS   =  118616.3654                Uncentered R2 =   0.9964
Residual SS             =  428.0862589                Root MSE      =    .3771

------------------------------------------------------------------------------
             |               Robust
     lwage76 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        ed76 |   .0427006   .0070747     6.04   0.000     .0288344    .0565667
       age76 |   .1376785   .0461597     2.98   0.003     .0472071    .2281499
        age2 |  -.0017036   .0008009    -2.13   0.033    -.0032733    -.000134
       black |  -.1769194   .0198298    -8.92   0.000     -.215785   -.1380537
      smsa76 |   .1583036   .0162745     9.73   0.000     .1264062    .1902011
     south76 |  -.1246765   .0158253    -7.88   0.000    -.1556935   -.0936594
       _cons |    3.16688   .6485453     4.88   0.000     1.895755    4.438006
------------------------------------------------------------------------------
Anderson canon. corr. LR statistic (identification/IV relevance test): 535.393
                                                      Chi-sq(3) P-val =    0.0000
------------------------------------------------------------------------------
```

```
Hansen J statistic (overidentification test of all instruments):         4.347
                                                 Chi-sq(2) P-val =    0.1138
------------------------------------------------------------------------------
Instrumented:         ed76
Included instruments: age76 age2 black smsa76 south76
Excluded instruments: nearc4 daded momed
------------------------------------------------------------------------------

. scalar pvalue_sargan=e(jp);

. outreg2 using schooling, append ctitle("GMM")
> addstat("F-value test intrument relevance",e(idstat),
> "Sargan statistic",e(j),"Degrees freedom Sargan statistic",e(jdf), "P value
Sargan statistic",pvalue_sargan);
seeout

. stop;
unrecognized command:  stop
r(199);

end of do-file
r(199);

. exit, clear
```