Seemingly Unrelated Regression (SUR) Models

Example:

Study on trading value of three different groups of investors including individual, institution, and foreign investors. The models are as follows:

$$QLN_t = \beta_{10} + \beta_{11}SET_t + \beta_{12}PE_t + \beta_{13}DY_t + \beta_{14}DUM_t + \varepsilon_{1t}$$
$$QLI_t = \beta_{20} + \beta_{21}SET_t + \beta_{22}PE_t + \beta_{23}DY_t + \beta_{24}DUM_t + \beta_{25}DJ_t + \beta_{26}IB_t + \varepsilon_{2t}$$
$$QF_t = \beta_{30} + \beta_{31}SET_t + \beta_{32}PE_t + \beta_{33}DY_t + \beta_{34}DUM_t + \beta_{35}FX_t + \beta_{36}IB_t + \varepsilon_{3t}$$

The disturbance terms $\varepsilon_{1t}, \varepsilon_{2t},$ and ε_{3t} are assumed to be correlated.

OLS:

```
. reg3 (qln set pe dy dum) (qli set dj ib pe dy dum) (qf set fx ib pe dy dum), o

Multivariate regression
------------------------------------------------------------------------------
Equation           Obs  Parms        RMSE    "R-sq"     F-Stat        P
------------------------------------------------------------------------------
qln                 84      4    5047.675    0.4640      17.10   0.0000
qli                 84      6    1826.843    0.2180       3.58   0.0021
qf                  84      6    5802.913    0.4669      11.24   0.0000
------------------------------------------------------------------------------
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
qln          |
         set |  -345.1613   48.03645    -7.19   0.000    -439.8026     -250.52
          pe |  -534.6304    168.594    -3.17   0.002    -866.7938    -202.467
          dy |  -2115.715   539.4979    -3.92   0.000    -3178.632   -1052.797
         dum |  -3718.633   1984.562    -1.87   0.062    -7628.613    191.3469
       _cons |   12337.82   3805.531     3.24   0.001     4840.173    19835.47
-------------+----------------------------------------------------------------
qli          |
         set |  -48.97907    18.3963    -2.66   0.008    -85.22341   -12.73473
          dj |   135.2776   59.33954     2.28   0.024     18.36695    252.1882
          ib |   88.29653   67.38561     1.31   0.191    -44.46645    221.0595
          pe |  -182.7578   83.29688    -2.19   0.029    -346.8691   -18.64644
          dy |  -917.2405    392.641    -2.34   0.020    -1690.821   -143.6602
         dum |  -628.3281   860.6836    -0.73   0.466    -2324.045    1067.389
       _cons |   3089.883   1839.067     1.68   0.094    -533.4418    6713.207
-------------+----------------------------------------------------------------
qf           |
         set |   376.5217   55.84303     6.74   0.000     266.4999    486.5436
          fx |    102.815   218.4466     0.47   0.638    -327.5679    533.1979
          ib |  -98.88969   210.3643    -0.47   0.639    -513.3488    315.5695
          pe |   751.3749   273.1862     2.75   0.006     213.1441    1289.606
          dy |   3042.807   1235.314     2.46   0.014     608.9934     5476.62
         dum |   3324.652   3827.915     0.87   0.386    -4217.098     10866.4
       _cons |  -18891.85   8782.692    -2.15   0.033    -36195.49   -1588.212
------------------------------------------------------------------------------
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SUR:

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. reg3 (qln set pe dy dum) (qli set dj ib pe dy dum) (qf set fx ib pe dy dum), sur

Seemingly unrelated regression
------------------------------------------------------------------------------
Equation           Obs  Parms        RMSE    "R-sq"       chi2        P
------------------------------------------------------------------------------
qln                 84      4    4895.142    0.4640      72.72   0.0000
qli                 84      6     1797.71    0.1739      18.59   0.0049
qf                  84      6    5563.745    0.4653      76.49   0.0000
------------------------------------------------------------------------------
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------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
qln          |
         set |  -345.1613   46.58486    -7.41   0.000    -436.4659   -253.8566
          pe |  -534.6304   163.4993    -3.27   0.001    -855.0831   -214.1776
          dy |  -2115.715   523.1951    -4.04   0.000    -3141.158   -1090.271
         dum |  -3718.633   1924.592    -1.93   0.053    -7490.764    53.49775
       _cons |   12337.82   3690.534     3.34   0.001     5104.508    19571.13
-------------+----------------------------------------------------------------
qli          |
         set |   -36.4466   16.72057    -2.18   0.029    -69.21832   -3.674872
          dj |   11.63355   15.65562     0.74   0.457    -19.05089      42.318
          ib |   115.9576   61.82175     1.88   0.061    -5.210785     237.126
          pe |  -199.5312   78.51039    -2.54   0.011    -353.4088    -45.6537
          dy |  -1040.228    365.219    -2.85   0.004    -1756.044   -324.4121
         dum |  -1001.492   802.6055    -1.25   0.212     -2574.57    571.5858
       _cons |    3753.84   1719.156     2.18   0.029     384.3559    7123.324
-------------+----------------------------------------------------------------
qf           |
         set |    380.311   52.87754     7.19   0.000      276.673    483.9491
          fx |   3.099417   18.89913     0.16   0.870     -33.9422    40.14104
          ib |  -118.3508   64.30475    -1.84   0.066    -244.3858    7.684168
          pe |   736.5373   193.5326     3.81   0.000     357.2204    1115.854
          dy |   3165.703   677.6422     4.67   0.000     1837.549    4493.857
         dum |   4714.671   2238.532     2.11   0.035     327.2284    9102.113
       _cons |  -16243.51   4380.287    -3.71   0.000    -24828.71   -7658.301
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Alternative Command for SUR:

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. sureg (qln set pe dy dum) (qli set dj ib pe dy dum) (qf set fx ib pe dy dum)

Seemingly unrelated regression
------------------------------------------------------------------------------
Equation           Obs  Parms        RMSE    "R-sq"       chi2        P
------------------------------------------------------------------------------
qln                 84      4    4895.142    0.4640      72.72   0.0000
qli                 84      6     1797.71    0.1739      18.59   0.0049
qf                  84      6    5563.745    0.4653      76.49   0.0000
------------------------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
qln          |
         set |  -345.1613   46.58486    -7.41   0.000    -436.4659   -253.8566
          pe |  -534.6304   163.4993    -3.27   0.001    -855.0831   -214.1776
          dy |  -2115.715   523.1951    -4.04   0.000    -3141.158   -1090.271
         dum |  -3718.633   1924.592    -1.93   0.053    -7490.764    53.49775
       _cons |   12337.82   3690.534     3.34   0.001     5104.508    19571.13
-------------+----------------------------------------------------------------
qli          |
         set |   -36.4466   16.72057    -2.18   0.029    -69.21832   -3.674872
          dj |   11.63355   15.65562     0.74   0.457    -19.05089      42.318
          ib |   115.9576   61.82175     1.88   0.061    -5.210785     237.126
          pe |  -199.5312   78.51039    -2.54   0.011    -353.4088    -45.6537
          dy |  -1040.228    365.219    -2.85   0.004    -1756.044   -324.4121
         dum |  -1001.492   802.6055    -1.25   0.212     -2574.57    571.5858
       _cons |    3753.84   1719.156     2.18   0.029     384.3559    7123.324
-------------+----------------------------------------------------------------
qf           |
         set |    380.311   52.87754     7.19   0.000      276.673    483.9491
          fx |   3.099417   18.89913     0.16   0.870     -33.9422    40.14104
          ib |  -118.3508   64.30475    -1.84   0.066    -244.3858    7.684168
          pe |   736.5373   193.5326     3.81   0.000     357.2204    1115.854
          dy |   3165.703   677.6422     4.67   0.000     1837.549    4493.857
         dum |   4714.671   2238.532     2.11   0.035     327.2284    9102.113
       _cons |  -16243.51   4380.287    -3.71   0.000    -24828.71   -7658.301
------------------------------------------------------------------------------
```