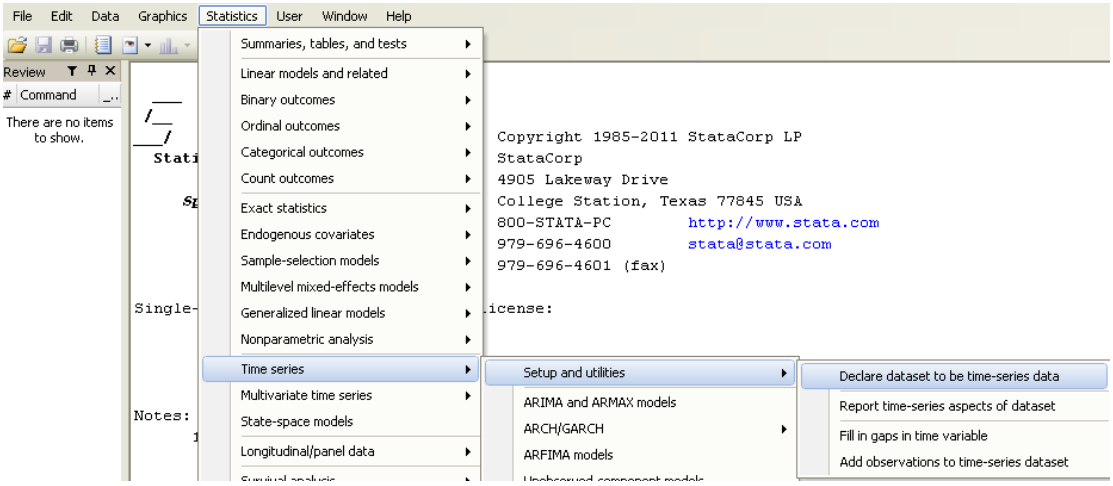
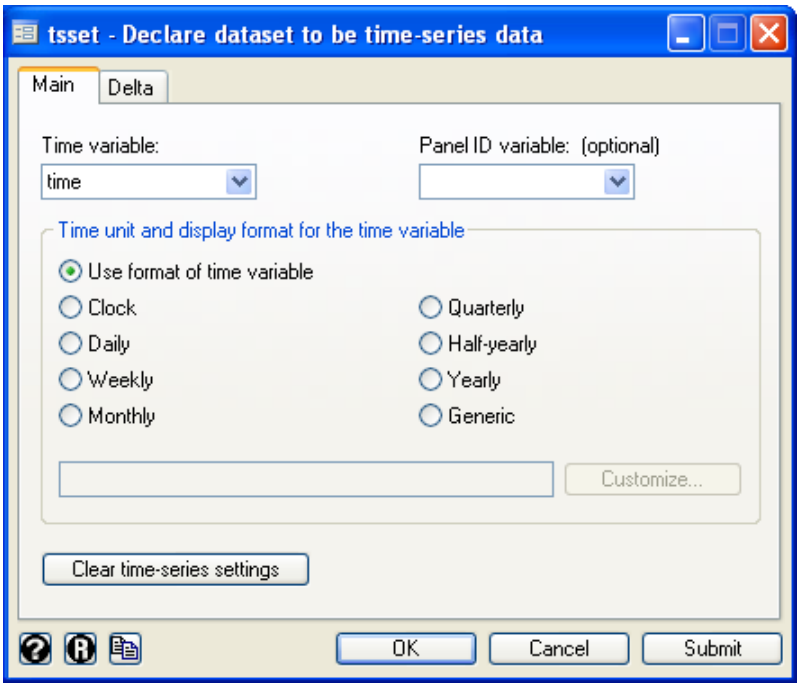
Autocorrelation Problem

Setting up data to be Time Series data

From menu bar, go to Statistics, choose Time series, select Setup & utilities, choose Declare dataset to be time-series data.



From tsset – Declare dataset to be time-series data window, specify variable determine time (in this case – time) in Time variable: box, and select time frequency in Display format for the time variable (in this case Monthly), then, click OK.




```
. tsset time, monthly
        time variable:  time, 1978m1 to 1987m12
```

Detecting Autocorrelation Problem

Model: $y_t = \beta_0 + \beta_1 x_t + u_t$

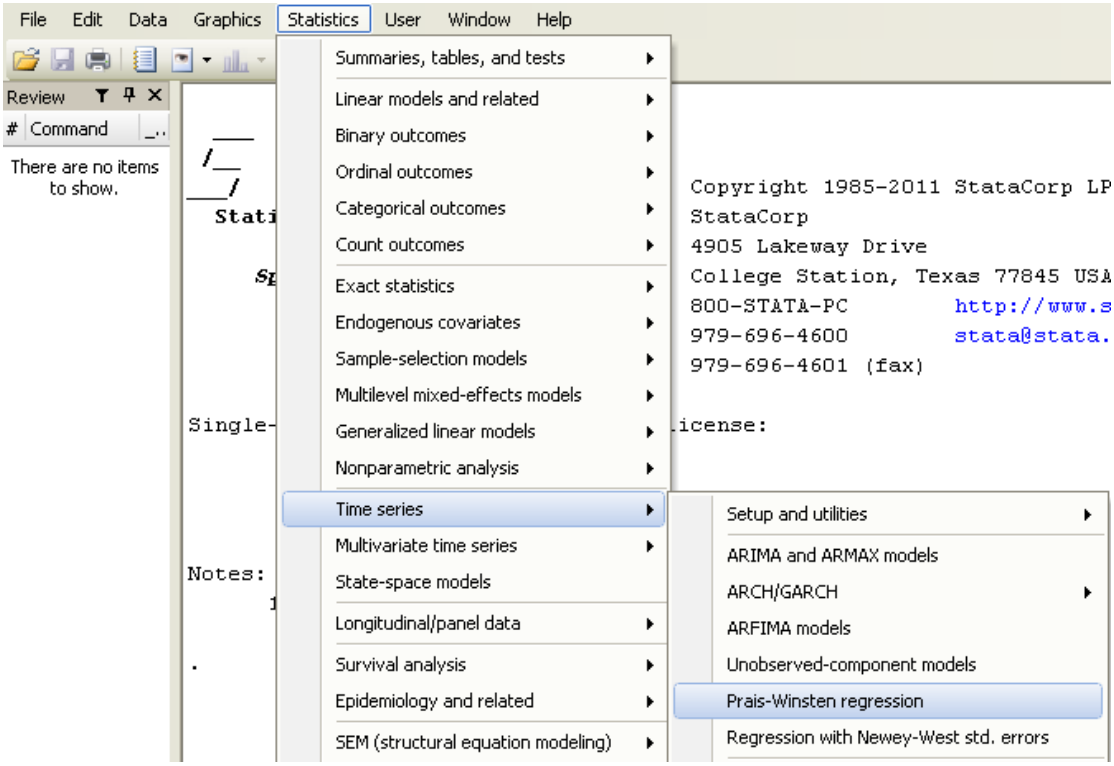
```
. reg y x
```

```
      Source |       SS       df       MS              Number of obs =     120
-------------+------------------------------           F(  1,   118) = 2609.35
       Model |  7284.31095     1  7284.31095           Prob > F      =  0.0000
    Residual |  329.411078   118  2.79161931           R-squared     =  0.9567
-------------+------------------------------           Adj R-squared =  0.9564
       Total |  7613.72203   119  63.9808574           Root MSE      =  1.6708

------------------------------------------------------------------------------
           y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           x |   .7370403   .0144286    51.08   0.000     .7084677    .7656129
       _cons |   4.542808   1.451023     3.13   0.002     1.669388    7.416228
------------------------------------------------------------------------------
```

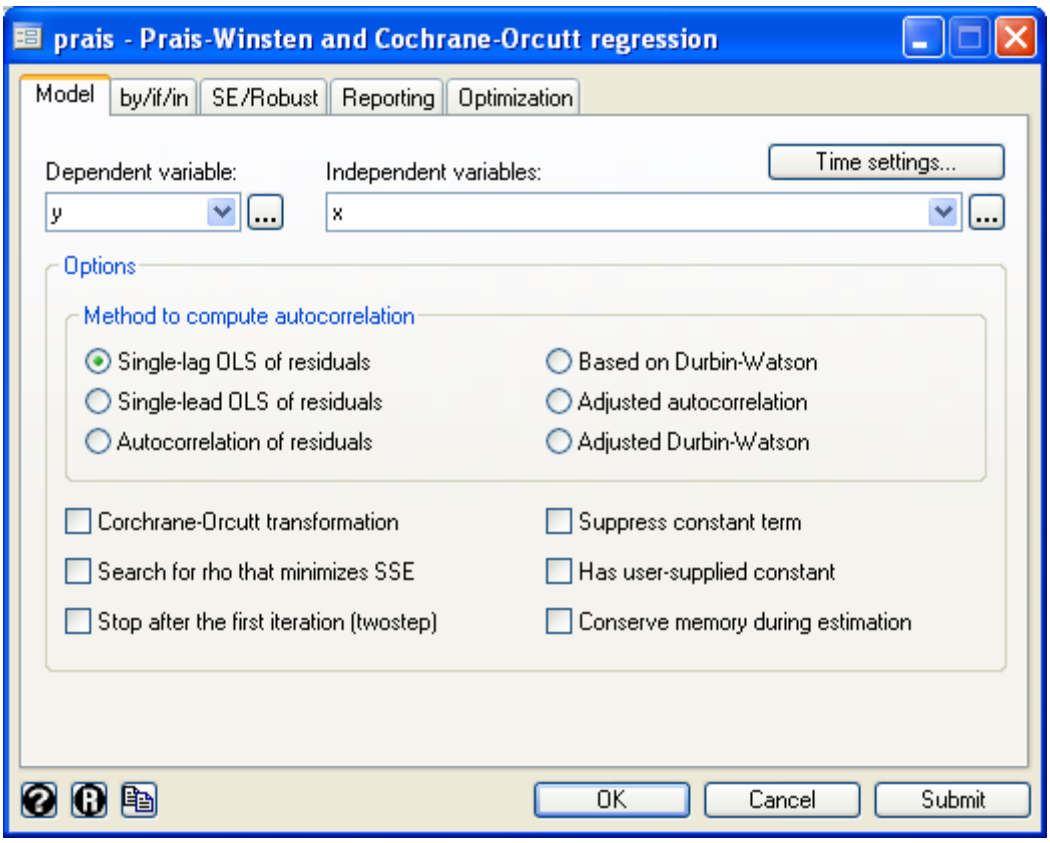
```
. estat dwatson

Durbin-Watson d-statistic(  2,   120) =  3.424407
```

Solving Problem using Cochrane-Orcutt Technique

To solve problem using Cochrane-Orcutt technique, from menu bar, go to Statistics, choose Time series, select Prais-Winsten regression.



From prais – Prais-Winsten and Cochrane-Orcutt regression window, specify dependent and independent variables in Dependent variable: and Independent variables: boxes, and check on Corchrane-Orcutt transformation box, then, click OK.




```
. prais y x, rhotype(reg) corc

Iteration 0:  rho = 0.0000
Iteration 1:  rho = -0.7568
Iteration 2:  rho = -0.7582
Iteration 3:  rho = -0.7582

Cochrane-Orcutt AR(1) regression -- iterated estimates

      Source |       SS       df       MS              Number of obs =     119
-------------+------------------------------           F(  1,   117) = 8265.39
       Model |  10297.8332     1  10297.8332           Prob > F      =  0.0000
    Residual |  145.769995   117  1.24589739           R-squared     =  0.9860
-------------+------------------------------           Adj R-squared =  0.9859
       Total |  10443.6032   118  88.5051115           Root MSE      =  1.1162

------------------------------------------------------------------------------
           y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           x |   .7415161   .0081562    90.91   0.000     .7253631     .757669
       _cons |   4.112478    .816992     5.03   0.000     2.494469    5.730488
-------------+----------------------------------------------------------------
         rho |  -.7582272
------------------------------------------------------------------------------
Durbin-Watson statistic (original)    3.424407
Durbin-Watson statistic (transformed) 2.061595
```

Cochrane-Orcutt Iterative Process

```
. reg y x

      Source |       SS       df       MS              Number of obs =     120
-------------+------------------------------           F(  1,   118) = 2609.35
       Model |  7284.31095     1  7284.31095           Prob > F      =  0.0000
    Residual |  329.411078   118  2.79161931           R-squared     =  0.9567
-------------+------------------------------           Adj R-squared =  0.9564
       Total |  7613.72203   119  63.9808574           Root MSE      =  1.6708

------------------------------------------------------------------------------
           y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           x |   .7370403   .0144286    51.08   0.000     .7084677    .7656129
       _cons |   4.542808   1.451023     3.13   0.002     1.669388    7.416228
------------------------------------------------------------------------------

. predict uhat1, resid

. reg uhat1 l.uhat1, noconst

      Source |       SS       df       MS              Number of obs =     119
-------------+------------------------------           F(  1,   118) =  147.01
       Model |  182.207794     1  182.207794           Prob > F      =  0.0000
    Residual |  146.249169   118  1.23939974           R-squared     =  0.5547
-------------+------------------------------           Adj R-squared =  0.5510
       Total |  328.456962   119  2.76014254           Root MSE      =  1.1133
------------------------------------------------------------------------------
       uhat1 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       uhat1 |
         L1. |  -.7568481    .062421   -12.12   0.000    -.8804588   -.6332375
------------------------------------------------------------------------------

. g ys_1=y-(-0.7568481)*l.y
(1 missing value generated)

. g xs_1=x-(-0.7568481)*l.x
(1 missing value generated)

. g x0_1=1-(-0.7568481)

. reg ys_1 xs_1 x0_1, noconst

      Source |       SS       df       MS              Number of obs =     119
-------------+------------------------------           F(  2,   117) =       .
       Model |  2256381.42     2  1128190.71           Prob > F      =  0.0000
    Residual |  145.770628   117  1.24590281           R-squared     =  0.9999
-------------+------------------------------           Adj R-squared =  0.9999
       Total |  2256527.19   119  18962.4133           Root MSE      =  1.1162
------------------------------------------------------------------------------
        ys_1 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        xs_1 |   .7415133   .0081615    90.86   0.000       .72535    .7576766
        x0_1 |   4.112747   .8175166     5.03   0.000     2.493698    5.731796
------------------------------------------------------------------------------

. g uhat2=y-(4.112747+0.7415133*x)

. reg uhat2 l.uhat2, noconst

      Source |       SS       df       MS              Number of obs =     119
-------------+------------------------------           F(  1,   118) =  148.00
       Model |  182.833426     1  182.833426           Prob > F      =  0.0000
    Residual |  145.769997   118  1.23533896           R-squared     =  0.5564
-------------+------------------------------           Adj R-squared =  0.5526
       Total |  328.603423   119   2.7613733           Root MSE      =  1.1115
------------------------------------------------------------------------------
       uhat2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       uhat2 |
         L1. |  -.7582268   .0623253   -12.17   0.000    -.8816478   -.6348057
------------------------------------------------------------------------------
```

```
. g ys_2=y-(-0.7582268)*l.y
(1 missing value generated)

. g xs_2=x-(-0.7582268)*l.x
(1 missing value generated)

. g x0_2=1-(-0.7582268)

. reg ys_2 xs_2 x0_2, noconst

      Source |       SS       df       MS              Number of obs =     119
-------------+------------------------------           F(  2,   117) =       .
       Model |  2259922.59     2   1129961.3           Prob > F      =  0.0000
    Residual |  145.770127   117  1.24589852           R-squared     =  0.9999
-------------+------------------------------           Adj R-squared =  0.9999
       Total |  2260068.36   119  18992.1711           Root MSE      =  1.1162

------------------------------------------------------------------------------
       ys_2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       xs_2 |    .741516   .0081562    90.91   0.000     .7253631     .757669
       x0_2 |   4.112483   .8169925     5.03   0.000     2.494472    5.730493
------------------------------------------------------------------------------

. g uhat3=y-(4.112483+0.741516*x)

. reg uhat3 l.uhat3, noconst

      Source |       SS       df       MS              Number of obs =     119
-------------+------------------------------           F(  1,   118) =  148.00
       Model |  182.833685     1  182.833685           Prob > F      =  0.0000
    Residual |  145.769993   118  1.23533892           R-squared     =  0.5564
-------------+------------------------------           Adj R-squared =  0.5526
       Total |  328.603678   119  2.76137545           Root MSE      =  1.1115

------------------------------------------------------------------------------
       uhat3 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       uhat3 |
         L1. |  -.7582271   .0623253   -12.17   0.000    -.8816482   -.6348061
------------------------------------------------------------------------------

. g ys_3=y-(-0.7582271)*l.y
(1 missing value generated)

. g xs_3=x-(-0.7582271)*l.x
(1 missing value generated)

. g x0_3=1-(-0.7582271)

. reg ys_3 xs_3 x0_3, noconst

      Source |       SS       df       MS              Number of obs =     119
-------------+------------------------------           F(  2,   117) =       .
       Model |   2259923.4     2   1129961.7           Prob > F      =  0.0000
    Residual |  145.770195   117   1.2458991           R-squared     =  0.9999
-------------+------------------------------           Adj R-squared =  0.9999
       Total |  2260069.17   119  18992.1779           Root MSE      =  1.1162

------------------------------------------------------------------------------
       ys_3 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       xs_3 |    .741516   .0081562    90.91   0.000     .7253631     .757669
       x0_3 |   4.112484   .8169926     5.03   0.000     2.494473    5.730495
------------------------------------------------------------------------------

. prais y x, rhotype(reg) corc

Iteration 0:  rho = 0.0000
Iteration 1:  rho = -0.7568
Iteration 2:  rho = -0.7582
Iteration 3:  rho = -0.7582
```

```
Cochrane-Orcutt AR(1) regression -- iterated estimates

      Source |       SS       df       MS              Number of obs =     119
-------------+------------------------------           F(  1,   117) = 8265.39
       Model |  10297.8332     1  10297.8332           Prob > F      =  0.0000
    Residual |  145.769995   117  1.24589739           R-squared     =  0.9860
-------------+------------------------------           Adj R-squared =  0.9859
       Total |  10443.6032   118  88.5051115           Root MSE      =  1.1162

------------------------------------------------------------------------------
           y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           x |   .7415161   .0081562    90.91   0.000     .7253631     .757669
       _cons |   4.112478    .816992     5.03   0.000     2.494469    5.730488
-------------+----------------------------------------------------------------
         rho |  -.7582272
------------------------------------------------------------------------------
Durbin-Watson statistic (original)    3.424407
Durbin-Watson statistic (transformed) 2.061595
```