Description Remarks and examples Also see

Description

sem can be used to produce correlations or covariances between exogenous variables. The advantages of using sem over Stata's correlate command are that you can perform statistical tests on the results and that you can handle missing values in a more elegant way.

To demonstrate these features, we use

```
. use https://www.stata-press.com/data/r19/census13
(1980 Census data by state)
. describe
Contains data from https://www.stata-press.com/data/r19/census13.dta
Observations:
                           50
                                                1980 Census data by state
                                                2 Dec 2024 14:01
    Variables:
                            9
Variable
              Storage
                         Display
                                     Value
    name
                  type
                          format
                                     label
                                                 Variable label
                byte
                         %13.0g
                                                State
state
                                     state1
brate
                int
                         %10.0g
                                                Birthrate
                         %12.0gc
                                                Population
рор
                long
medage
                float
                         %9.2f
                                                Median age
                                                Census division
division
                byte
                         %8.0g
                                     division
region
                byte
                         %-8.0g
                                     cenreg
                                                Census region
                float
                         %9.0g
                                                Marriage rate
mrgrate
                float
                                                Divorce rate
dvcrate
                         %9.0g
medagesq
                float
                         %9.0g
```

Sorted by:

See Correlations in [SEM] Intro 5 for background.

Remarks and examples

Remarks are presented under the following headings:

Using sem to obtain correlation matrices Fitting the model with the Builder Testing correlations with estat stdize and test

Using sem to obtain correlation matrices

We fit the following model:



Number of obs = 50

Prob > chi2 = .

This model does nothing more than estimate the covariances (correlations), something we could obtain from the correlate command by typing

. correlate mrgrate dvcrate medage (obs=50) mrgrate dvcrate medage 1.0000 mrgrate 0.7700 1.0000 dvcrate medage -0.0177 -0.2229 1.0000 . correlate mrgrate dvcrate medage, covariance (obs=50) mrgrate dvcrate medage mrgrate .000662 dvcrate .000063 1.0e-05 medage -.000769 -.001191 2.86775

As explained in *Correlations* in [SEM] **Intro 5**, to see results presented as correlations rather than as covariances, we specify sem's standardized option:

. sem (<- mrgrate dvcrate medage), standardized Exogenous variables Observed: mrgrate dvcrate medage Fitting target model: Iteration 0: Log likelihood = 258.58985 Iteration 1: Log likelihood = 258.58985 Structural equation model Estimation method: ml Log likelihood = 258.58985

Standardized	Coefficient	OIM std. err.	Z	P> z	[95% conf.	interval]
mean(mrgrate) mean(dvcrate)	.7332509 2.553791 17 62083	.1593002 .291922	4.60 8.75	0.000	.4210282 1.981634	1.045474 3.125947 21.08556
var(mrgrate) var(dvcrate) var(medage)	1 1 1	·			· .	
cov(mrgrate, dvcrate) cov(mrgrate, medage) cov(dvcrate,	.7699637 0176541	.0575805	13.37 -0.12	0.000	.6571079 2947485	.8828195 .2594403
medage)	222932	.1343929	-1.66	0.097	4863373	.0404732

LR test of model vs. saturated: chi2(0) = 0.00

Note:

1. The correlations reported are

	sem	correlate
mrgrate and dvcrate	0.7699637	0.7700
mrgrate and medage	-0.0176541	-0.0177
dvcrate and medage	-0.222932	-0.2229

Fitting the model with the Builder

Use the diagram above for reference.

1. Open the dataset.

In the Command window, type

- . use https://www.stata-press.com/data/r19/census13
- 2. Open a new Builder diagram.

Select menu item Statistics > SEM (structural equation modeling) > Model building and estimation.

3. Create the set of observed variables.

Select the Add observed variables set tool, "", and then click in the diagram about halfway down from the top and a quarter of the way in from the left.

In the resulting dialog box,

- a. select the Select variables radio button (it may already be selected);
- b. use the Variables control to select the variables in this order: mrgrate, dvcrate, and medage;
- c. select Horizontal in the Orientation control;
- d. select the **Distances** tab;
- e. select .5 (inch) in the Distance between variables control;
- f. click on OK.

If you wish, move the set of variables by clicking on any variable and dragging it.

Be sure you select the observed variables in the order indicated above; otherwise, the instructions below for creating covariances will not be correct.

- 4. Correlate each pair of variables.
 - a. Select the Add covariance tool, \frown .
 - b. Click in the top of the mrgrate rectangle, slightly to the right of the center (it will highlight when you hover over it), and drag a path to the top of the dvcrate rectangle, slightly to the left of the center (it will highlight when you can release to connect the covariance).
 - c. Click in the top of the dvcrate rectangle, slightly to the right of the center, and drag a path to the top of the medage rectangle, slightly to the left of the center.
 - d. Click in the top of the mrgrate rectangle, slightly to the left of the center, and drag a path to the top of the medage rectangle, slightly to the right of the center.

5. Clean up.

If you do not like where a covariance has been connected to its variable, use the Select tool, k, to click on the covariance, and then simply click on where it connects to an oval and drag the endpoint. You can also change the bow of the covariance by dragging the control point that extends from one end of the selected covariance.

6. Estimate.

Click on the **Estimate** button, \mathbb{P} , in the Standard Toolbar, and then click on **OK** in the resulting SEM estimation options dialog box.

7. Show standardized estimates.

From the SEM Builder menu, select View > Standardized estimates.

You can open a completed diagram in the Builder by typing

. webgetsem sem_corr

Testing correlations with estat stdize and test

We can test whether the correlations between median age and marriage and divorce rates are equal with test by typing

```
. estat stdize: ///
    test _b[/cov(medage,mrgrate)] = _b[/cov(medage,dvcrate)]
```

We must prefix test with estat stdize because otherwise we would be testing equality of covariances; see *Displaying other results, statistics, and tests (sem and gsem)* in [SEM] **Intro** 7 and see [SEM] estat stdize.

That we refer to the two correlations (covariances) by typing _b[/cov(medage,mrgrate)] and _b[/cov(medage,dvcrate)] is something nobody remembers and that we remind ourselves of by redisplaying sem results with the coeflegend option:

. sem, coefleg	gend		
Structural equ Estimation met	Number of obs = 50		
Log likelihood	d = 258.58985		
	Coefficient	Legend	
<pre>mean(mrgrate) mean(dvcrate) mean(medage)</pre>	.0186789 .0079769 29.54	_b[/mean(mrgrate)] _b[/mean(dvcrate)] _b[/mean(medage)]	
var(mrgrate) var(dvcrate) var(medage)	.0006489 9.76e-06 2.8104	_b[/var(mrgrate)] _b[/var(dvcrate)] _b[/var(medage)]	
cov(mrgrate, dvcrate) cov(mrgrate, medage) cov(dvcrate,	.0000613 0007539	_b[/cov(mrgrate,dvcrate)] _b[/cov(mrgrate,medage)]	
medage)	0011674	_b[/cov(dvcrate,medage)]	

We can now obtain the test:

Note:

1. We can reject the test at the 5% level.

Also see

- [SEM] estat stdize Test standardized parameters
- [SEM] test Wald test of linear hypotheses
- [R] correlate Correlations of variables

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