Title

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sem and gsem option covstructure( ) — Specifying covariance restrictions

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Description

Option `covstructure()` provides a sometimes convenient way to constrain the covariances of your model.

Alternatively or in combination, you can place constraints on the covariances by using the standard path notation, such as

```
. sem  ..., ... cov(name1*name2@c1  name3*name4@c1) ...
. gsem ..., ... cov(name1*name2@c1  name3*name4@c1) ...
```

See [SEM] **sem and gsem path notation**.

Syntax

```
sem ... [, ... covstructure(variables, structure) ... ]

sem ... [, ... covstructure(groupid: variables, structure) ... ]

gsem ... [, ... covstructure(variables, structure) ... ]
```

where *variables* is one of

1. a list of (a subset of the) exogenous variables (`sem`) or latent exogenous variables (`gsem`) in your model, for instance,

   ```
   . sem  ..., ... covstruct(x1 x2, structure)
   . sem  ..., ... covstruct(L1 L2, structure)
   . gsem ..., ... covstruct(L1 L2, structure)
   ```

2. `_OEx`, meaning all observed exogenous variables in your model (`sem` only)
3. `_LEx`, meaning all latent exogenous variables in your model (including any multilevel latent exogenous variables in the case of `gsem`)
4. `_Ex`, meaning all exogenous variables in your model (`sem` only)

or where *variables* is one of

1. a list of (a subset of the) error variables in your model, for example,

   ```
   . sem ..., ... covstruct(e.y1 e.y2 e.Aspect, structure)
   ```

2. `e._OEn`, meaning all error variables associated with observed endogenous variables in your model
3. `e._LEn`, meaning all error variables associated with latent endogenous variables in your model
4. `e._En`, meaning all error variables in your model

and where *structure* is

structure	Description	Notes
diagonal	all variances unrestricted all covariances fixed at 0	
unstructured	all variances unrestricted all covariances unrestricted	
identity	all variances equal all covariances fixed at 0	
exchangeable	all variances equal all covariances equal	
zero	all variances fixed at 0 all covariances fixed at 0	
pattern(*matname*)	covariances (variances) unrestricted if *matname*$[i,j] \geq$. covariances (variances) equal if *matname*$[i,j] =$ *matname*$[k,l]$	(1)
fixed(*matname*)	covariances (variances) unrestricted if *matname*$[i,j] \geq$. covariances (variances) fixed at *matname*$[i,j]$ otherwise	(2)

Notes:

(1) Only elements in the lower triangle of *matname* are used. All values in *matname* are interpreted as the floor() of the value if noninteger values appear. Row and column stripes of *matname* are ignored.

(2) Only elements on the lower triangle of *matname* are used. Row and column stripes of *matname* are ignored.

groupid may be specified only when the group() option is also specified, and even then it is optional; see [SEM] **sem group options**.

Option

covstructure(*[groupid:] variables*, *structure*) is used either to modify the covariance structure among the exogenous variables of your model or to modify the covariance structure among the error variables of your model. Optional *groupid* is available only with sem with option group() specified; see [SEM] **sem group options**.

You may specify the covstructure() option multiple times.

The default covariance structure for exogenous variables is covstructure(_Ex, unstructured) for sem. There is no simple way in this notation to write the default for gsem.

The default covariance structure for error variables is covstructure(e._En, diagonal) for sem and gsem.

Remarks and examples

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See [SEM] **example 17**.

Standard linear structural equation modeling allows covariances among exogenous variables, both latent and observed, and allows covariances among the error variables. Covariances between exogenous variables and error variables are disallowed (assumed to be 0).

Some authors refer to the covariances among the exogenous variables in standard SEMs as matrix $\mathbf{\Phi}$ and to the covariances among the error variables as matrix $\mathbf{\Psi}$.

Also see

[SEM] **sem** — Structural equation model estimation command

[SEM] **gsem** — Generalized structural equation model estimation command

[SEM] **sem and gsem path notation** — Command syntax for path diagrams

[SEM] **example 17** — Correlated uniqueness model