

## 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](#).

If you are using `sem`, also see [\[SEM\] sem path notation extensions](#) for documentation on how the syntax of `covstructure()` is modified when the `group()` option is specified.

If you are using `gsem`, also see [\[SEM\] gsem path notation extensions](#) for documentation on how the syntax of `covstructure()` is modified when the `group()` option or the `lclass()` options are specified.

## Syntax

```
sem ... [ , ... covstructure(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. `_0Ex`, 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._0En`, 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

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

## Option

`covstructure(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.

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

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  $\Phi$  and to the covariances among the error variables as matrix  $\Psi$ .

## 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