Title

> **estat teffects —** Decomposition of effects into total, direct, and indirect

Syntax

> estat <u>teff</u>ects [, *options*]

options	Description
compact	do not display effects with no path
<u>standardized</u>	report standardized effects
<u>nolabel</u>	display group values, not labels
nodirect	do not display direct effects
noindirect	do not display indirect effects
nototal	do not display total effects
display_options	control column formats, row spacing, and display of omitted paths

Menu

Statistics > SEM (structural equation modeling) > Testing and CIs > Direct and indirect effects

Description

estat teffects is for use after sem but not gsem.

estat teffects reports direct, indirect, and total effects for each path (Sobel 1987), along with standard errors obtained by the delta method.

Options

compact is a popular option. Consider the following model:

    . sem (y1<-y2 x1) (y2<-x2)

x2 has no direct effect on y1 but does have an indirect effect. estat teffects formats all its effects tables the same way by default, so there will be a row for the direct effect of x2 on y1 just because there is a row for the indirect effect of x2 on y1. The value reported for the direct effect, of course, will be 0. compact says to omit these unnecessary rows.

standardized reports effects in standardized form, but standard errors of the standardized effects are not reported.

nolabel is relevant only if estimation was with sem's group() option and the group variable has a value label. Groups are identified by group value rather than label.

nodirect, noindirect, and nototal suppress the display of the indicated effect. The default is to display all effects.

display_options: <u>noomitted</u>, vsquish, cformat(*%fmt*), pformat(*%fmt*), sformat(*%fmt*), and nolstretch; see [R] **estimation options**. Although estat teffects is not an estimation command, it allows these options.

Remarks and examples

See [SEM] **example 7**.

Direct effects are the path coefficients in the model.

Indirect effects are all mediating effects. For instance, consider

```
. sem ... (y1<-y2) (y1<-x2) (y2<-x3) ..., ...
```

The direct effect of y2 on y1 is the path coefficient (y1<-y2).

In this example, changes in x3 affect y1, too. That is called the indirect effect and is the product of the path coefficients (y2<-x3) and (y1<-y2). If there were other paths in the model such that y1 changed when x3 changed, those effects would be added to the indirect effect as well. estat teffects reports total indirect effects.

The total effect is the sum of the direct and indirect effects.

When feedback loops are present in the model, such as

```
. sem ... (y1<-y2) (y1<-x2) (y2<-x3 y1) ..., ...
```

care must be taken when interpreting indirect effects. The feedback loop is when a variable indirectly affects itself, as y1 does in the example; y1 affects y2 and y2 affects y1. Thus in calculating the indirect effect, the sum has an infinite number of terms although the term values get smaller and smaller and thus usually converge to a finite result. It is important that you check nonrecursive models for stability; see Bollen (1989, 397) and see [SEM] **estat stable**. Caution: if the model is unstable, the calculation of the indirect effect can sometimes still converge to a finite result.

Stored results

estat teffects stores the following in r():

Scalars
    r(N_groups)   number of groups

Matrices
    r(nobs)   sample size for each group
    r(direct)   direct effects
    r(indirect)   indirect effects
    r(total)   total effects
    r(V_direct)   covariance matrix of the direct effects
    r(V_indirect)   covariance matrix of the indirect effects
    r(V_total)   covariance matrix of the total effects

estat teffects with the standardized option additionally stores the following in r():

Matrices
    r(direct_std)   standardized direct effects
    r(indirect_std)   standardized indirect effects
    r(total_std)   standardized total effects

References

Bollen, K. A. 1989. *Structural Equations with Latent Variables*. New York: Wiley.

Sobel, M. E. 1987. Direct and indirect effects in linear structural equation models. *Sociological Methods and Research* 16: 155–176.

Also see

[SEM] **estat stable** — Check stability of nonrecursive system

[SEM] **methods and formulas for sem** — Methods and formulas for sem

[SEM] **sem postestimation** — Postestimation tools for sem